ORIGINAL

NEW APPLICATION

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Attorneys for Arizona Public Service Company

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BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

JIM O'CONNOR, Chairman
LEA MÁRQUEZ PETERSON
ANNA TOVAR
NICK MYERS
KEVIN THOMPSON

Arizona Corporation Commission
DOCKETED
JUL 8 2024
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IN THE MATTER OF THE APPLICATION OF ARIZONA PUBLIC SERVICE COMPANY, IN CONFORMANCE WITH THE REQUIREMENTS OF ARIZONA REVISED STATUTES § 40-360, ET SEQ., FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AUTHORIZING THE REDHAWK POWER PLANT EXPANSION PROJECT, WHICH INCLUDES THE CONSTRUCTION OF NATURAL GAS TURBINES, A 500kV SWITCHYARD AND RELATED FACILITIES, ALL LOCATED TWO MILES SOUTHEAST OF THE INTERSECTION OF ELLIOT ROAD AND WINTERSBURG ROAD IN MARICOPA COUNTY, ARIZONA.	DOCKET NO. L-00000D-24-0156-00234 **NOTICE OF FILING APPLICATION FOR CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY**

Applicant, Arizona Public Service Company (APS or Applicant), through undersigned counsel, provides notice of filing its Application for a Certificate of Environmental Compatibility (Application) seeking authority to construct the above-captioned Redhawk Power Plant Expansion Project. Pursuant to Arizona Revised Statutes

(A.R.S.) §§ 40-360 through 40-360.13 and Arizona Administrative Code (A.A.C.) R14-3-201 through R14-3-219, enclosed are 25 copies of APS's Application. Applicant has paid the $5,000.00 filing fee pursuant to A.R.S. § 40-360.09 and A.A.C. R14-3-218.

Communications concerning the Application (including data requests) should be directed to:

Linda J. Benally
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Phoenix, Arizona 85004
Email: Linda.Benally@pinnaclewest.com

and

J. Matthew Derstine
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DATED this 8th day of July 2024.

By: /s/ Linda J. Benally
Linda J. Benally
Pinnacle West Capital Corporation
400 North 5th Street, MS 8695
Phoenix, Arizona 85004

AND

By: /s/ J. Matthew Derstine
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Attorneys for Arizona Public Service Company

CERTIFICATION OF MAILING

ORIGINAL and 25 copies filed
this 8th day of July 2024 with:

Utilities Division-Docket Control
ARIZONA CORPORATION COMMISSION
1200 West Washington St.
Phoenix, AZ 85007

COPIES of the foregoing hand-delivered this
8th day of July 2024 to:

Adam Stafford
Chairman, Arizona Power Plant and Transmission
Line Siting Committee
Office of the Arizona Attorney General Kris Mayes
2005 N. Central Ave.
Phoenix, AZ 85004-2926

COPIES of the foregoing e-mailed this 8th day of July to:

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By: ______________________

Redhawk Power Plant Expansion Project

Application for Certificate of Environmental Compatibility

Prepared for:

State of Arizona Corporation Commission Power Plant and Transmission Line Siting Committee

Prepared by: aps

JULY 2024

REDHAWK POWER PLANT EXPANSION PROJECT

APPLICATION FOR CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY

Prepared for:

State of Arizona Power Plant and Transmission Line Siting Committee

Arizona Corporation Commission

Submitted by:

Arizona Public Service Company

aps

EXECUTIVE SUMMARY

Arizona Public Service Company (APS) owns and operates the Redhawk Power Plant[1] (Redhawk or Existing Plant). Redhawk is a natural gas-fired electricity-generating facility located at 11600 South 363rd Avenue in Maricopa County, approximately five (5) miles northwest of Arlington, Arizona.

With this Application, APS seeks a Certificate of Environmental Compatibility (CEC) to construct eight (8) new simple-cycle natural gas-fired peaking units at Redhawk, which will add approximately 397 megawatts (MW) of fast-ramping generation that is needed to help ensure grid reliability (the Expansion Project).

Though exempt from mandatory jurisdiction to obtain a CEC, APS voluntarily seeks a CEC in accordance with prior practice of the Arizona Power Plant and Transmission Line Siting Committee (Line Siting Committee) and the Arizona Corporation Commission (Commission). The Company is aware that the Commission recently disclaimed jurisdiction over a CEC application,[2] but due to the specific facts and circumstances related to the Redhawk Expansion Project and out of an abundance of caution, APS seeks review from the Line Siting Committee pursuant to A.R.S. §40-360 *et seq.*

A. EXISTING REDHAWK POWER PLANT

Redhawk has been in operation since 2003. The Plant consists of two (2) combined-cycle natural gas-fired units that produce a total of 1,060 MW. In addition to the two (2) combined-cycle units, the Existing Plant includes an administration building, warehouse storage, inlet air cooling system, cooling towers, water treatment and storage facilities, gas conditioning equipment, and on-site access roads. The Existing Redhawk power plant facilities are situated on approximately 460 acres owned by APS.

B. EXPANSION PROJECT

1. PURPOSE

The Expansion Project ensures that APS has the reliable generation capacity to respond to fluctuations in load demand and intermittent resource output and can reliably supply power during periods of peak demand. Today, Arizona is experiencing a significant increase in demand for electrical generation to support residential, commercial, and industrial customer load growth. At the same time, summer energy supply is tightening in the Western United States, particularly during periods when solar resources are limited or unavailable, making it difficult to purchase needed MW from the energy market. The proposed new LM6000 units, along with solar, wind, battery energy storage, and customer-sided technologies that APS is adding to its resource portfolio, will help APS meet the nearly 40 percent load growth that is expected in the next eight (8) years. Having a variety of resources—including nuclear, solar, wind, battery energy storage, customer demand response programs, and natural gas resources—makes the system more resilient to supply chain disruptions, extreme weather, and changing market conditions.

The new natural gas-fired units will be able to ramp up quickly during periods of peak demand and provide reliable power when solar and wind resources come offline and battery energy

[1] *See* Decision No. 95 in Docket No. L-00000J-99-0095-000.

[2] *See* Docket No. L-00000F-24-0056-00230.

storage resources are depleted. Natural gas resources provide critical capacity during peak system demand and support reliability when customers need it most. The new units are also hydrogen capable.

Construction of the eight (8) new simple-cycle units at Redhawk will generate reliable energy for Arizona and maximize the use of the existing transmission and natural gas infrastructure that currently serves the Plant. Interconnecting the Expansion Project to the grid will require an addition to the existing Redhawk 500 kilovolt (kV) switchyard, and new interconnection facilities that include a generator tie line and breakers. New transmission lines will not be needed. The switchyard addition also creates the ability to connect future generation.

2. EXPANSION PROJECT DESCRIPTION

APS proposes to build eight (8) LM6000 combustion turbine generator units with emission control systems, including selective catalytic reduction and carbon monoxide catalysts. The supporting infrastructure includes balance-of-plant equipment including a plant air system, an ammonia system, a continuous emission monitoring system, a raw water tank, a water treatment system, a demineralized water tank, and wastewater tanks. Other systems include plant control systems, power distribution centers, low-voltage switchgear, low-voltage motor control centers, 230kV collector bus system, four 13.8/230kV generator step-up transformers, and a 230/500kV step-up transformer. The new generators will be arranged in pairs, with two (2) generators connected to a generator step-up transformer.

The eight (8) new generator units are air-cooled and contain oil lubrication systems that also are air cooled using air-type fin-fan coolers. Demineralized water will be used for inlet fogging and water spray power augmentation to reduce the turbine inlet air temperature to improve turbine performance. Each generator unit is also equipped with water injection in the combustor to reduce nitrogen oxide (NO_x) emissions.

Groundwater and natural gas for the Expansion Project will be provided using the existing water rights and infrastructure that currently serves Redhawk with minimal improvements required. The Expansion Project will pump approximately 300 acre-feet of groundwater per year using Redhawk's existing groundwater rights.

To accommodate the interconnection of the Expansion Project to the grid, APS plans to construct an addition to the Redhawk Switchyard within the Redhawk plant site owned by APS. The existing Redhawk Switchyard occupies approximately 11 acres. The switchyard addition will require approximately 20 additional acres located within the Redhawk Plant boundary.

The interconnection facilities required to connect the new units to the grid include an approximately 500-foot-long generator tie line from the 230/500kV transformer to the point of interconnect in the Redhawk switchyard addition.

C. ENVIRONMENTAL STUDIES

APS engaged consultants who conducted environmental studies and an impact evaluation for the Expansion Project. APS evaluated the potential environmental impacts on existing and future land use (Exhibit A), air and water quality (Exhibit B), biological resources (Exhibits C and D), visual and cultural resources (Exhibit E), recreation (Exhibit F), noise levels (Exhibit I), and existing plans (Exhibit H).

Generally, the environmental review analysis covered a one (1) mile area surrounding Redhawk. The land use and air quality studies and visual assessments used broader study areas to assess any potential environmental impacts, as shown in **Table 1**.

Table 1. Environmental Resource Study Area Boundaries

Environmental Resource	Study Area Boundary
Land Use	CEC guidance states a two-mile buffer around Expansion Project features.
Air Quality Permit—U.S. Environmental Protection Agency (EPA) Review	The EPA recommends a three-mile notification area around Expansion Project features as part of Air Quality Permit review with public involvement.
Water	Phoenix Active Management Area (AMA) groundwater model boundary.
Biology	One mile surrounding Expansion Project features. U.S. Fish and Wildlife Service and Arizona Game and Fish Department databases automatically provide information for a three-mile buffer around Expansion Project features.
Cultural Resources	One mile surrounding Expansion Project features.
Visual and Scenic Resources	One mile surrounding Expansion Project features. Visual simulations were created of resources within one mile of the Expansion Project. Analysis of visual and scenic resources may include discussions that go beyond one mile, as local topography and conditions merit further analysis areas being included due to the proximity of recreational or scenic-valued resources in the Expansion Project vicinity.
Noise Analysis	One mile surrounding Expansion Project features.
Public Outreach for CEC	Typically, one-mile buffer around Expansion Project features is required by the CEC for siting studies. However, if that boundary bisects an established community or neighborhood, analysis is extended to capture the remaining portions of that grouping. For the Expansion Project, a three-mile outreach boundary was utilized to mirror the EPA Air Quality Permit review boundary.

The environmental studies and impact conclusions in the attached exhibits demonstrate that constructing the eight new peaking units at the existing Redhawk Plant is environmentally compatible based on the factors that are to be considered in using a certificate of environmental compatibility as outlined below:

- Land use impacts are not expected because the existing site is already an operating power plant within its industrial land use designation. In addition, the Expansion Project is compatible with existing plans and future development in the vicinity of Redhawk.
- The area surrounding Redhawk consists of other power plants, solar fields, and other industrial uses. The closest residences to the Existing Plant are located 1.9 miles northeast.
- There will be no impacts on special-status species or unique habitats.
- The lower profile of the stack heights associated with the LM6000 units will not be as visually dominant as the Existing Plant. High-sensitivity viewers are found in the residential community east of 335th Avenue and from the Arlington Elementary School, which

contains community sports fields. Views from the residential neighborhoods are not hindered by the Existing Plant or the Expansion Project. Views towards the power plant will retain the same visual character with the addition of the Expansion Project. In addition, there are no designated scenic areas in the Expansion Project vicinity; therefore, there will be nominal impacts on visual resources will occur.

- There are no known historical sites and structures or archaeological sites in the Study Area. The Expansion Project is unlikely to have adverse impacts on cultural resources.
- Noise conditions associated with the Expansion Project operations are not expected to significantly change as compared to current operations. The Expansion Project will meet all applicable noise ordinances.
- The air quality impacts for all pollutants and averaging intervals are insignificant except for one hour nitrogen dioxide and 24-hour particulate matter less than 2.5 microns. For those two pollutants, the total impacts are below the National Ambient Air Quality Standards and Prevention of Significant Deterioration increments. In connection with preparing its Air Quality Permit application, APS conducted an environmental justice (EJ) analysis. Additional information regarding APS's EJ evaluation, conclusions, and corresponding outreach is in the Air Quality Permit application (Exhibit B-1).
- Approximately 300-acre feet of groundwater per year will be used to operate the Expansion Project. Water will be supplied from two existing on-site production wells, using existing groundwater rights. The additional 300-acre feet of groundwater use will not unreasonably impact the aquifer below the Plant or the active management area. Sufficient groundwater is available from the aquifers beneath the Redhawk Power Plant to support the additional 300-acre feet of groundwater use, and to continue all known existing current off-site water uses for the duration of the proposed 40-year operation of the Expansion Project. Water use restrictions set forth in the Phoenix AMA fourth management plan are specific to operation of cooling towers at combustion turbine power plants. The generation units will be air cooled. No new cooling towers are proposed; consequently, the Expansion Project complies with the Phoenix AMA fourth management plan.

D. PUBLIC OUTREACH AND ENGAGEMENT

APS used a robust public outreach and participation process to inform and gather input from the general public and government agencies about the Expansion Project. Public outreach methods included newsletters, customer emails, a virtual open house, an in-person open house meeting, reminder postcards for the in-person open house, social media advertisements, a local newspaper ad, and an Expansion Project website. The various outreach materials have been provided in English and Spanish to ensure effective communication with area residents and stakeholders. The public participation process included outreach to various state and local agencies, planning jurisdictions, landowners, and elected officials.

E. CONCLUSIONS

The addition of eight (8) natural gas turbines and associated infrastructure to the Redhawk Plant will have minimal environmental impacts on the factors identified in A.R.S. §40-40-360.06(A). In addition, the new turbines are subject to and will comply with all applicable air pollution standards and regulations as detailed in the Air Permit Application attached as Exhibit B-1. Finally, as outlined in the "Water Assessment for the Proposed Expansion Project" attached as Exhibit B-2, the addition of these turbines will not result in unreasonable impacts to the groundwater aquifer beneath Redhawk and will produce minimal impact to the management area. The new natural gas units will be within an existing utility right-of-way on private land that is designated by Maricopa County for industrial use.

The Expansion Project, once approved, will provide electric service reliability for APS customers. Accordingly, APS requests that the Arizona Power Plant and Transmission Line Siting Committee and the Arizona Corporation Commission grant a CEC for the Expansion Project.

TABLE OF CONTENTS

APPLICATION

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1. ***"Name and address of the applicant, or in the case of a joint project, the applicants."***

   Arizona Public Service Company (APS)
   400 North Fifth Street
   Phoenix, Arizona 85004

2. ***"Name, address and telephone number of a representative of an applicant who has access to technical knowledge and background information concerning the application in question and who will be available to answer questions or furnish additional information."'***

   Applicant: Mr. Peter Van Allen, PMP
   Project Manager, Generation Capital Projects
   Arizona Public Service Company
   400 North 5th Street, M.S. 9219
   Phoenix, Arizona 85004
   Telephone: 602-250-4651

3. ***"State each date on which applicant has filed a ten-year plan in compliance with A.R.S. 40-360.02 and designate each such filing in which the facilities for which this application is made were described. If they have not been previously described in a ten-year plan, state the reasons therefore."***

   APS filed the 90-day pre-application plan on April 5, 2024. The additional facilities will be entirely located within the Existing Plant boundary.

4. ***"Description of the proposed facility, including:"***

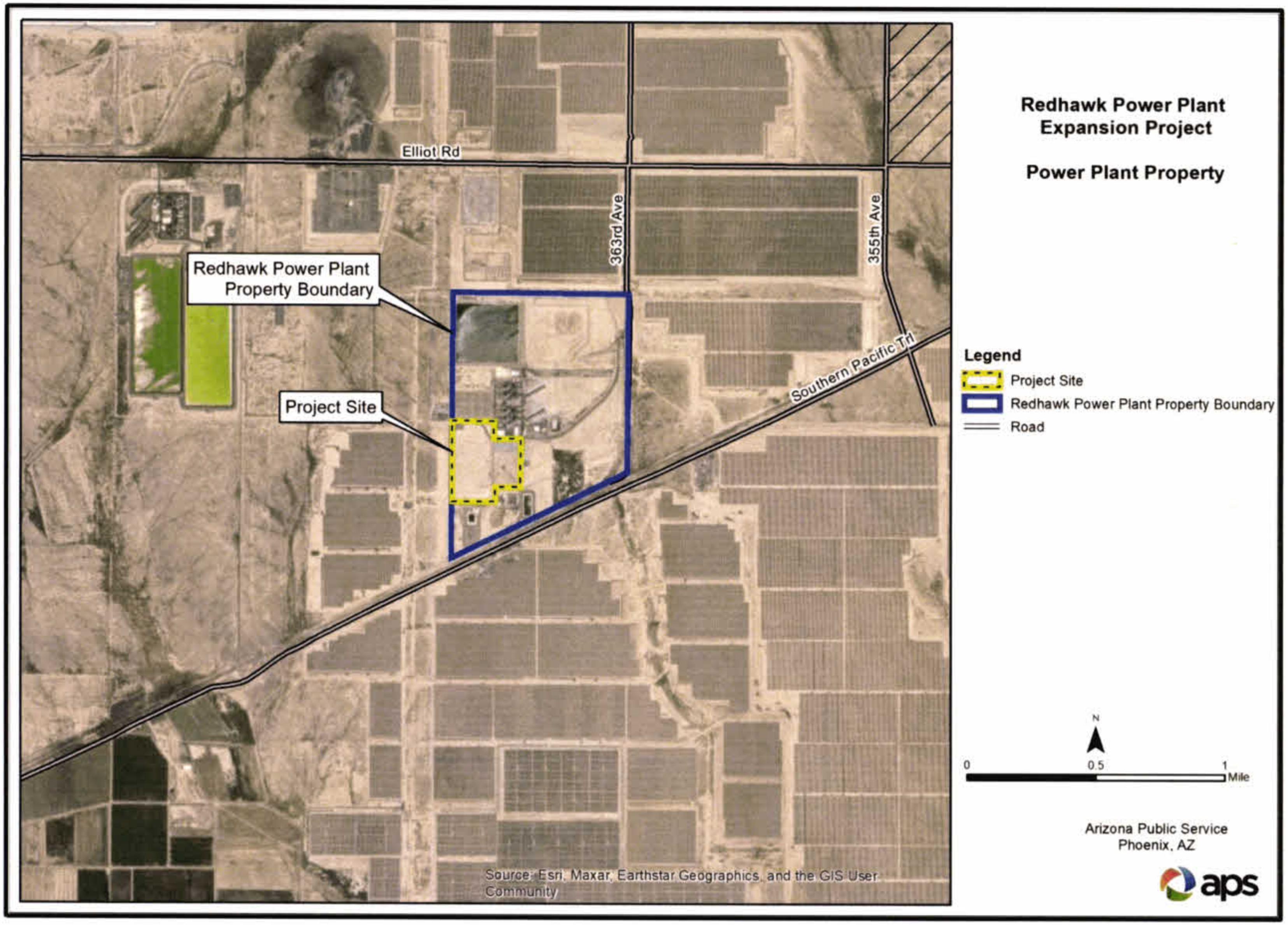
   4.a. "With respect to an electric generating plant:"

   4.a.i. "Type of generating facilities (nuclear, hydro, fossil-fueled, etc):"

The Redhawk Power Plant Expansion Project will involve the installation of eight (8) generating units at the existing Redhawk Power Plant. Redhawk is a natural gas-fired combined-cycle electricity-generating facility located at 11600 South 363rd Avenue in Maricopa County, approximately five (5) miles northwest of Arlington, Arizona.

APS plans to install eight (8) General Electric Model LM6000PC aeroderivative simple cycle combustion turbines (CTs) with Water Spray Power Augmentation (WSPA). These CT units will be identified as Units three through ten. Each CT will have a maximum nominal electric output of 49.6 megawatts (MW) and a maximum nominal natural gas fuel flow of 471 million British Thermal Units (MMBtu) per hour. These CTs will be equipped with state-of-the-art air quality control systems, including water injection and selective catalytic reduction (SCR) for nitrogen oxide (NO_X) control and oxidation catalysts for carbon monoxide (CO) and volatile organic compound control.

Figure 1. Redhawk Property



4.a.ii. "Number and size of the proposed units:"

APS plans to build eight (8) new 49.6 MW natural gas units adjacent to the Existing Plant. The new components include eight (8) LM6000 generator units with emission control systems installed, SCR/CO catalysts, and water tanks. The new generators will be arranged in four (4) pairs, with one generator connected to each low-voltage winding of a three-winding generator step-up transformer. To stay within short-circuit current ratings and continuous current ratings of the 13.8 kilovolt (kV) switchgear generator breakers, each generator will be connected to a separate low-voltage transformer winding.

Site Layout and Arrangement

The Expansion Project will be contained entirely within the Existing Plant site, including the new facility equipment, generation interconnections, natural gas source, well water supply, and wastewater discharge. The Existing Plant was selected for expansion due to the available physical space and existing supporting utilities, such as transmission line capacity out of the plant, natural gas fuel supply, raw well water supply, and other existing power generation facilities, as well as being a key location on the transmission system to support grid reliability.

The eight (8) new units will be located south of the existing Redhawk Units one and two. **Figure 2** shows the primary areas where construction activities will occur, and **Figure 3** depicts the proposed site layout and arrangement of the Expansion Project, including potential alignment for the generation interconnections (on an aerial photograph of existing conditions). The eight (8) new units will be aligned and numbered from north to south (identified as Units three through ten).

Gas Turbines: The LM6000 CTs are gas turbine engines derived from the core of the CF6-80C2 engine, which is General Electric Company's high-thrust, high-efficiency aircraft engine. The LM6000 CTs consist of Inlet Guide Vanes (IGV), a five-stage low pressure compressor, Variable Bleed Valve collector, a fourteen-stage high pressure compressor, a combustor, a two-stage high pressure turbine, and a five-stage low pressure turbine. The LM6000 CTs each generate approximately 49.6 MW and include WSPA systems, which enhance the efficiency and output of the LM6000 gas turbine engines by spraying microdroplets of atomized water into the interstage air stream between the low-pressure compressors and the high-pressure compressors. The water is atomized by eighth-stage bleed air and special nozzles to produce a droplet diameter of less than 20 microns. As the droplets evaporate, the air temperature is reduced, and the mass flow is increased, resulting in greater power output and better fuel efficiency. The turbines are housed in a metal enclosure to protect the units from the elements and for noise reduction.

Figure 2. Primary Construction Area

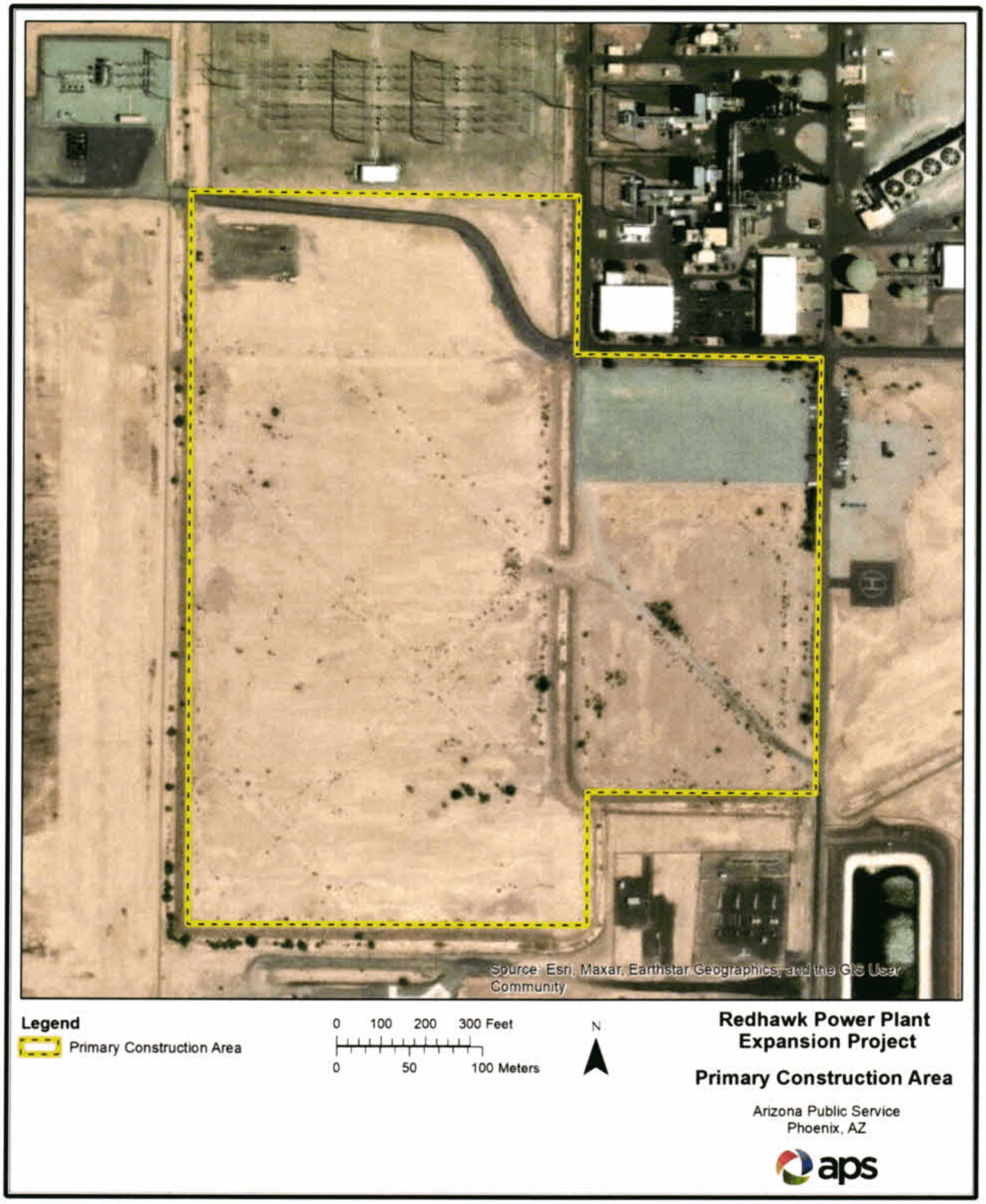
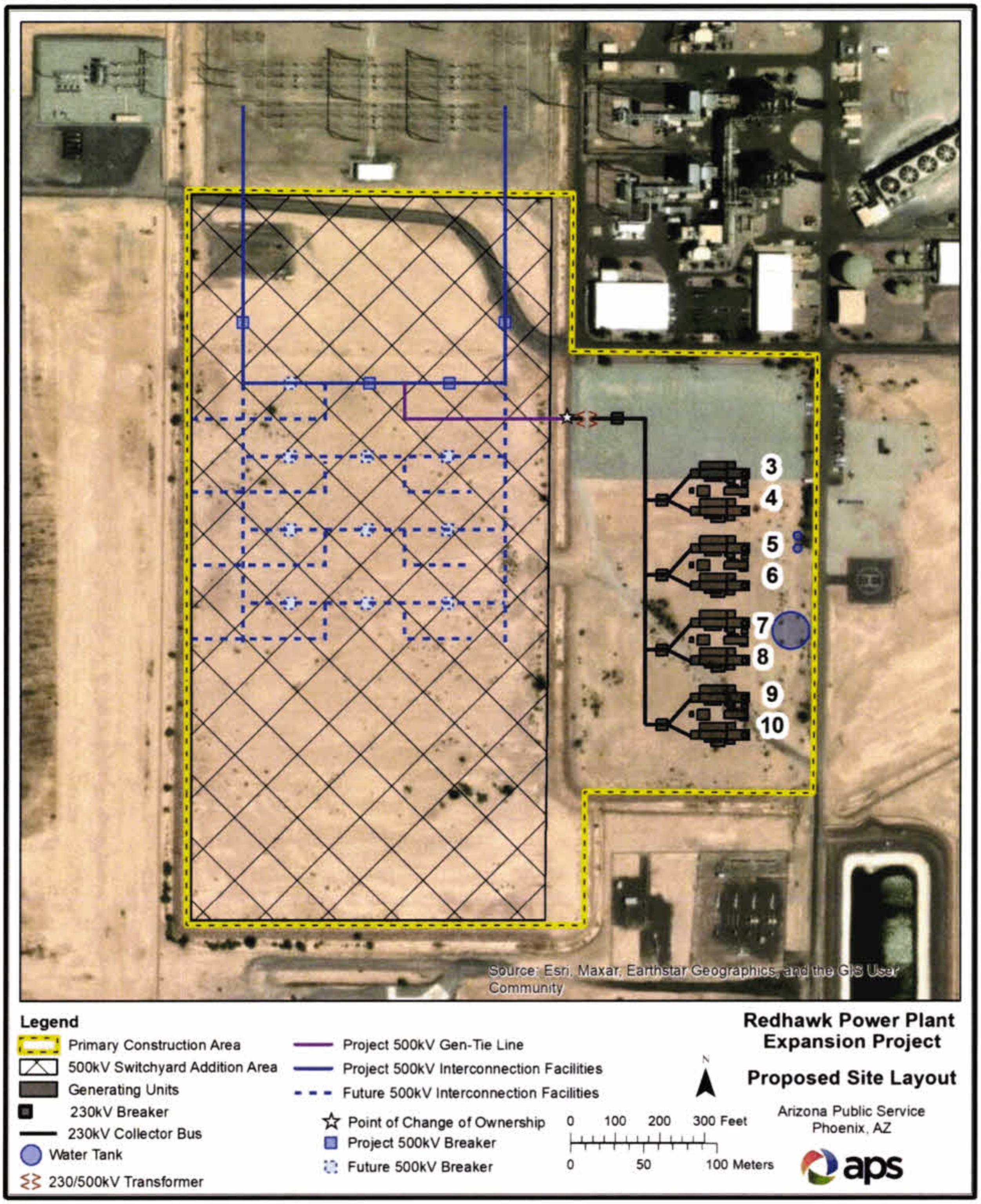


Figure 3. Proposed Site Layout



Air Intake System: The air intake system provides filtered air to the CT compressors. The intake system is mounted above the CT and is equipped with static prefilters and high-efficiency final filters to remove particulates from the air. An inlet air fogging system is used to enhance the gas turbine performance at the high local ambient air temperatures. The fogging system sprays a fine mist of water into the combustion air stream within the inlet air filter house. The fogging system is used to reduce the temperature of the inlet air and increase the mass flow to the CTs, resulting in increased electrical output and improved fuel efficiency for the units.

Exhaust Gas System: Each turbine is equipped with an exhaust gas system which includes silencers, SCR and CO catalysts, and an exhaust stack. Exhaust gases from the turbines discharge into the exhaust ducts where they pass through silencers for noise attenuation and through the SCR and CO catalyst to reduce NO_X and CO. Each exhaust stack features continuous emissions monitors and test connections for performance monitoring.

Generators for the Gas Turbines: The generators for the gas turbines are two-pole, totally enclosed, and open ventilated, with brushless excitation. The air used to cool the generators passes through unit-mounted air filters to remove particulates before entering the generator. The turbines and generators are on a horizontal axis with the cold ends of the turbines (compressor ends) attached to the generators.

Fire Protection System: The fire protection system will be designed and installed in accordance with codes and standards of the National Fire Protection Association and Maricopa County, as applicable.

230kV Collector Bus - Generation Asset: The LM6000 turbine generator units are output at a voltage level of 13.8kV and arranged in pairs, or power blocks, with two generators connected to one 230/13.8kV generator step-up transformer rated at 69/92/115 megavolt amps (MVA). The generator step-up transformers are connected to a 500/230kV transformer rated at 360/480/600 MVA via a 230kV collector bus. The 500/230kV transformer is connected to the high-voltage transmission system via the switchyard addition. Each generator has a 13.8kV generator breaker, which is used for synchronizing the unit. A 13.8kV auxiliary power switchgear bus distributes auxiliary power to the 13.8kV to 480 volt unit auxiliary transformers and balance of facility transformers. The 13.8kV auxiliary power switchgear has two sources of power and two main breakers. Each source is from a tap between the 13.8kV generator breaker and the generator step-up transformer connected to the two units. All facility auxiliaries can be supplied from either source.

500kV Switchyard Addition - Transmission Asset: The current Redhawk 500kV switchyard does not have any open bay positions to connect the Expansion Project. Therefore, an addition to the existing Redhawk 500kV switchyard will be constructed to the south by extending the east and west buses, creating room for additional termination bays. The existing 500kV switchyard is approximately 12 acres, and the switchyard addition will be approximately an additional 25 acres. The siting area for the switchyard addition is approximately 55 acres. The addition to the Redhawk switchyard will create the capability to connect future generators and new 500kV lines, including this Expansion

Project. The Redhawk 500kV switchyard is connected via two 500kV lines to the Hassayampa Switchyard, which is part of the Palo Verde Hub and connected into the larger 500kV transmission grid. The switchyard addition will be constructed as a breaker-and-a-half configuration, which is similar to the existing Redhawk 500kV switchyard and will look very similar.

4.a.iii. "The source and type of fuel to be utilized, including a proximate analysis of fossil fuels:"

The planned generating units will utilize pipeline quality natural gas supplied to the facility through pipelines from the El Paso Natural Gas Company and Transwestern Pipeline Company.

The planned generating units are also hydrogen capable, once that carbon-free fuel is commercially available and affordable.

4.a.iv. "Amount of fuel to be utilized daily, monthly, and yearly."

Within the Air Permit Application submitted to the Maricopa County Air Quality Department, APS proposed an annual fuel use limit of 6,271,200 MMBtu. Based on that annual limit, the following average monthly and daily utilization of fuel may be anticipated.

Annual: 6,271,200 MMBtu / 1,005.3 Btu/standard cubic feet = 6,238.1 million standard cubic feet (MMSCF)

Daily: 6,238.1 MMSCF / 365 days = 17.1 MMSCF*

Monthly: 6,238.1 MMSCF / 12 months = 519.8 MMSCF*

*The daily and monthly fuel utilization could vary significantly based on load demand influencing operations.

4.a.v. "Type of cooling to be utilized and source of any water to be utilized."

The eight (8) new LM6000 CTs require water for process cooling to maintain performance. The electrical generator for the LM6000 package is air-cooled using blowers and fin-fan coolers. Water for the new units will be provided using the Existing Plant infrastructure, with very little improvements required. Existing groundwater rights will be used to provide the necessary water supply for inlet fogging and WSPA for the new LM6000 units. These fogging systems will be used to cool air at the inlet, allowing for greater generation efficiency without the use of water cooling towers. Water use restrictions set forth in the Phoenix AMA fourth management plan are specific to operation and of cooling towers at combustion turbine power plants. The proposed expansion generation units to be installed at the Redhawk Power Plant will be air cooled. No new cooling towers are proposed; consequently, the proposed expansion complies with the Phoenix AMA fourth management plan.

Water Systems: These units require demineralized water for inlet air fogging, WSPA and NO_X water injection. Groundwater will be the main water supply for the eight (8) new units. Raw water is pretreated for Total Dissolved Solids removal by an on-site Reverse Osmosis/Electrodeionization (RO/EDI) water treatment system.

Water Treatment: The water treatment consists of an on-site RO/EDI system, the possibility of removable demineralizer bottles/trailers, a raw water tank, a demineralized water tank, and four wastewater tanks.

4.a.vi. "Proposed height of stacks and number of stacks, if any:"

The exhaust stack on each of the eight (8) LM6000 generator units will be approximately 85 feet tall. The eight (8) stacks will be aligned north to south.

4.a.vii. "Dates for scheduled start-up and firm operation of each unit and date of construction must commence in order to meet schedules:"

The first four (4) generating units are planned to be in operation during the fourth quarter of 2027, and the remaining four (4) units will be put into service before the second quarter of 2028.

Based on the anticipated construction schedule of 104 weeks, construction of these eight (8) units should commence no later than the first quarter of 2026.

4.a.viii. "To the extent available, the estimated costs of the proposed facilities and site, stated separately. (If application contains alternative sites, furnish an estimate for each site and a brief description of reasons for any variations in estimates.)"

The estimated cost of the Expansion Project is $443,000,000. APS owns the Project site, and there will be no additional cost to obtain land or easements for this Expansion Project.

4.a.ix. "Legal description of the proposed site. (If application contains alternative sites, list sites in order of applicant's preference with a summary of reasons for such order of preference and any changes such alternative sites would require in the plans reflected in (i) through (vii) hereof.)"

Redhawk and all components of the Expansion Project are within Section 14 and Section 23 of Township 1 South, Range 6 West, Gila-Salt River Baseline and Meridian, as depicted on the Arlington, Arizona, U.S. Geological Survey 7.5-minute topographic quadrangle.

4.b "With respect to a proposed transmission line." (4.b.i through 4.b.vi)

The Expansion Project does not require the construction of a new a transmission line. It only requires an addition to the existing switchyard as depicted on **Figure 3**.

5. ***"List the areas of jurisdiction [as defined in A.R.S. § 40-360(1)] affected by each alternative site or route and designate those proposed sites or routes, if any, which are contrary to the zoning ordinances or master plans of any of such areas of jurisdiction."***

The Expansion Project is in an unincorporated portion of Maricopa County within the communities of Arlington and Tonopah. Maricopa County is the jurisdictional authority within the Expansion Project area. The Expansion Project will be located within the Existing Plant site that is currently zoned for Industrial Use under Special Use Permit Z99-111. The Special Use Permit Z99-111 will be amended to include the Expansion Project and will be constructed in compliance with the permit requirements.

6. ***"Describe any environmental studies applicant has performed or caused to be performed in connection with this application or intends to perform or cause to be performed in such connection, including the contemplated date of completion."***

APS engaged consultants who conducted environmental studies and an impact evaluation for the Expansion Project. Specifically, APS conducted analyses to support APS's Air Pollution Control Permit Application, which was submitted to Maricopa County Air Quality Department. Those analyses are included in the Air Pollution Control Permit Application (see **B-1**).

APS engaged a water resource consultant to perform a water assessment (**see B-2**). This report describes analysis conducted to evaluate the effects of the proposed additional groundwater use and summarizes the findings.

APS conducted an evaluation of the existing environment and potential environmental effects of the implementation of the Expansion Project. APS performed an environmental analysis to address land use; water resources; biological resources; scenic, historic, and archaeological resources; recreational resources; and noise. Potential environmental effects from the construction and operation of the Expansion Project are discussed in Exhibits A through F and Exhibits H through J.

ARIZONA PUBLIC SERVICE COMPANY

/s/ Peter Van Allen

By Peter Van Allen,

Project Manager, Generation Capital Projects

Original and twenty-five (25) copies of this Application for a Certificate of Environmental Compatibility hand delivered and filed with the Arizona Corporation Commission on this 8th day of July 2024.

Exhibit A
Location and Land Use Information

In accordance with A.A.C. R14-3-220, Exhibit 1, the Applicant provides the following location maps and land use information:

1. "Where commercially available, a topographic map, 1:250,000 scale, showing the proposed plant site and the adjacent area within 20 miles thereof. If application is made for alternative plant sites, all sites may be shown on the same map, if practicable, designated by applicant's order of preference."

2. "Where commercially available, a topographic map, 1:62,500 scale, of each proposed plant site, showing the area within two (2) miles thereof. The general land use plan within this area shall be shown on the map, which shall also show the areas of jurisdiction affected and any boundaries between such areas of jurisdiction. If the general land use plan is uniform throughout the area depicted, it may be described in the legend in lieu of an overlay."

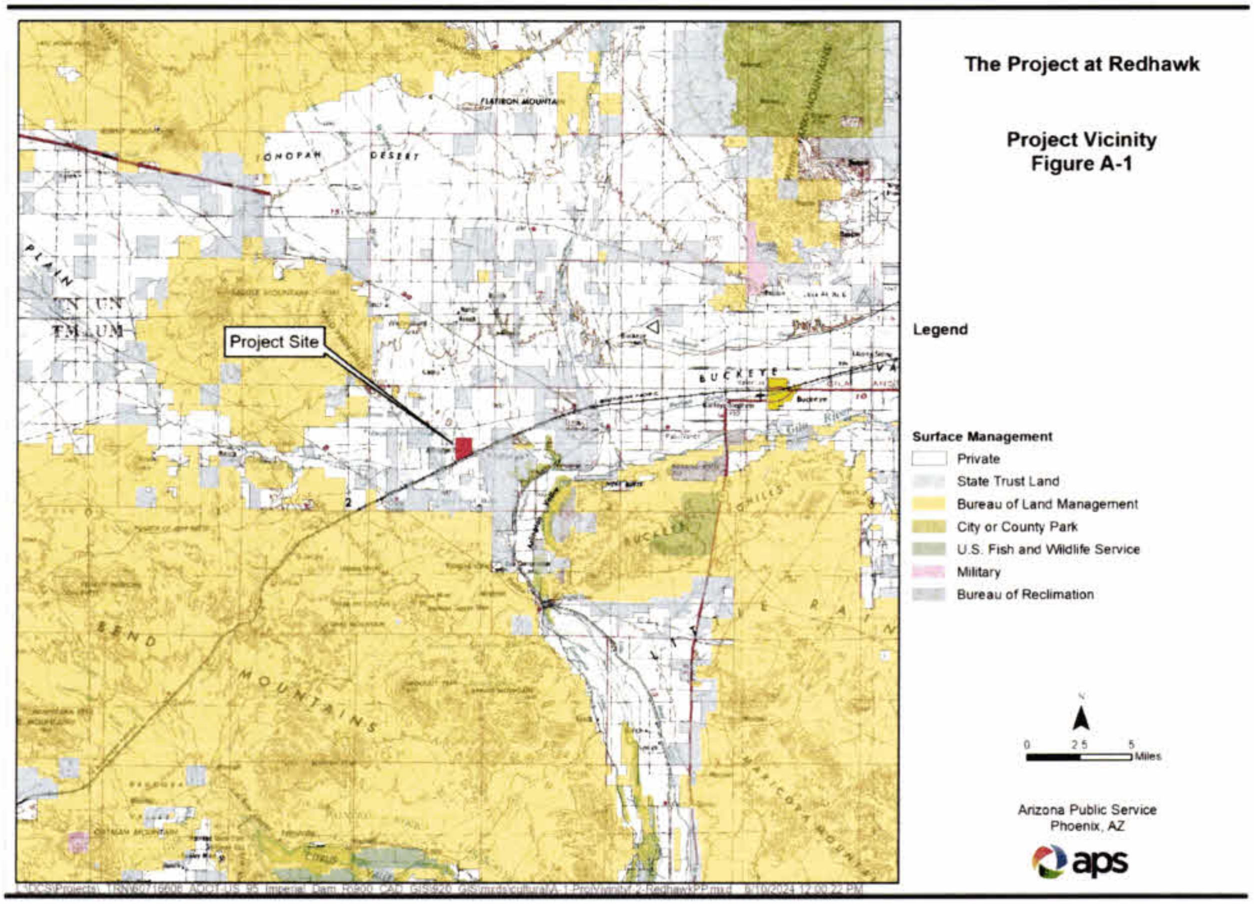
Land Use

The purpose of this land use assessment is to compile baseline data to determine potential land use impacts that may result from the construction, operation, and maintenance of the Redhawk Power Plant Expansion Project (Expansion Project). The land use analysis was completed using a 2-mile Study Area around the Expansion Project site. Much of the land within the 2-mile land use Study Area is privately owned or Arizona State Trust land managed by Arizona State Land Department. The Study Area is entirely within Maricopa County, Arizona (**Figure A-1**). The Expansion Project is located in Section 14 and 23 of Township 1 South, Range 6 West, Gila-Salt River Baseline and Meridian, U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle.

Land use information was obtained from general or comprehensive plans adopted by state and local governmental agencies. The following is a discussion of the land use considerations and an analysis of existing and future uses relevant to the Expansion Project. The analysis is based on the most recently available data from various local and regional plans relevant to the Study Area and GIS databases, including:

- Maricopa County Vision 2030 Comprehensive Plan (Maricopa County 2016)
- Tonopah/Arlington Area Plan (Maricopa County 2020)
- Maricopa County Zoning Ordinance (Maricopa County 2023)
- Maricopa County Planning and Development GIS Maps (Maricopa County 2024)
- State of Arizona Land Resource Information System (ASLD 2024)
- USGS National Land Cover Database (USGS 2019)

Figure A-1. Expansion Project Vicinity Map



Existing Land Usage

The Study Area is included in the Tonopah/Arlington Area Plan (2020). The land within the Study Area is owned by private entities or Arizona State Trust land managed by the Arizona State Land Department (**Figure A-2**).

The Maricopa County land use designation at the Redhawk Power Plant is Industrial use (Maricopa County 2024) (**Figures A-3** and **A-4**). The Expansion Project will be located within the Existing Plant site that is currently zoned for Industrial Use under Special Use Permit Z99-111. In December 2019, the approval of Special Use Permit rezoned the land use designation of the Redhawk Power Plant from Rural 190 to Industrial use. The Special Use Permit Z99-111 will be amended to include the Expansion Project and will be constructed in compliance with the permit requirements.

Maricopa County land currently zoned Agricultural, Transportation, Solar Generation, Industrial, Rural Residential, or vacant (**Figure A-4**) (Maricopa County 2016) exists within the Study Area. Land zoned Rural (Rural-43) residential surrounds the Study Area, but there are very few developed residential communities currently present. The most notable is the residential community located approximately 2 miles northeast of the Expansion Project. No large-scale subdivisions have been built nearby, as dwellings are limited to one per acre with Rural-43 zoning.

The remaining land within the 2-mile Study Area is split between state trust land and private land, with most of the land being private (ASLD 2024). Current land uses are split between barren land, cultivated crops, industrial land, herbaceous cover, open water, and shrub/scrubland (**Table A-1**). Between 2001 and 2021, 33.17 percent of the land uses within the Study Area has not changed, with just over a 1 percent increase in urbanization/land development (USGS 2019).

Figure A-2. Land Ownership

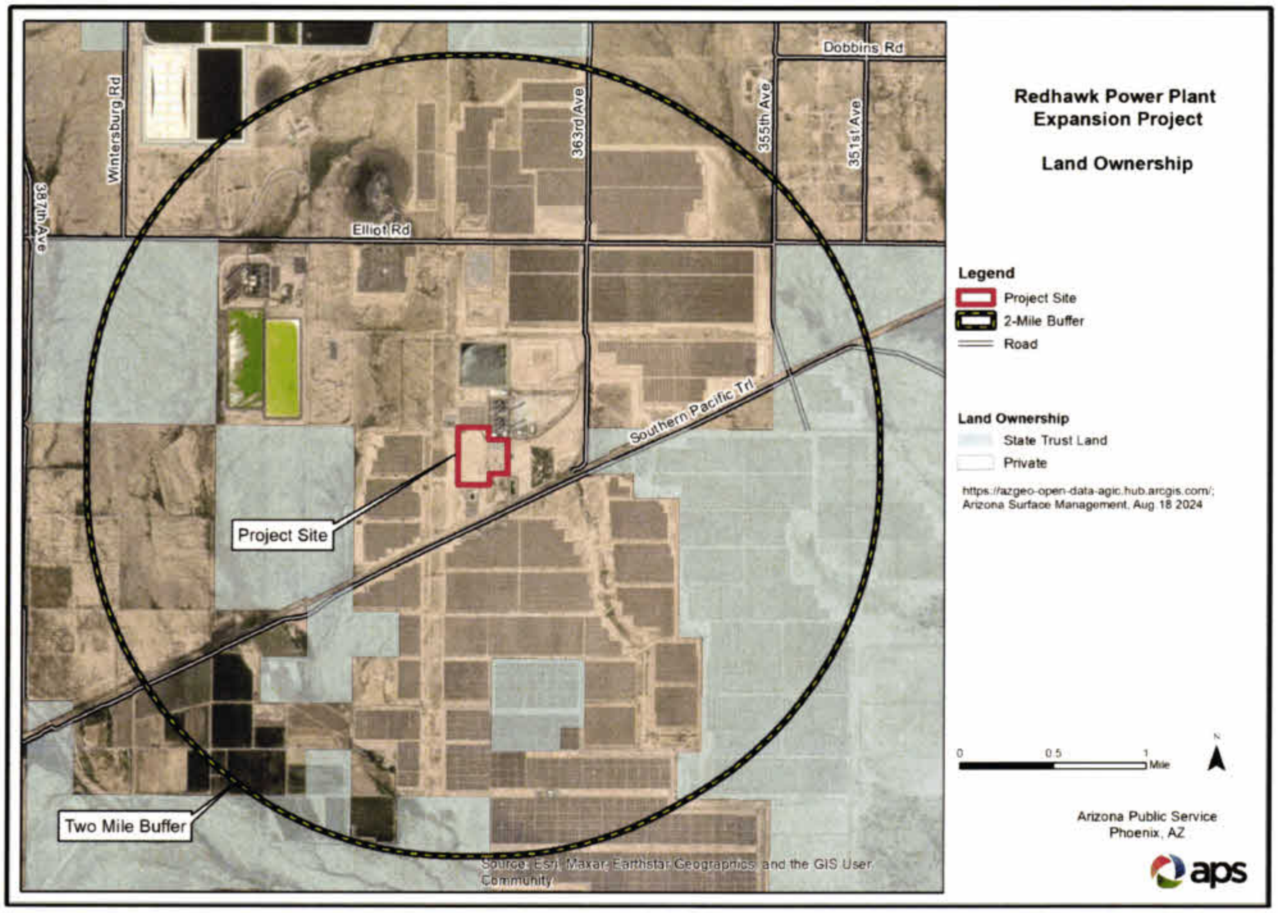


Figure A-3. Existing Land Use

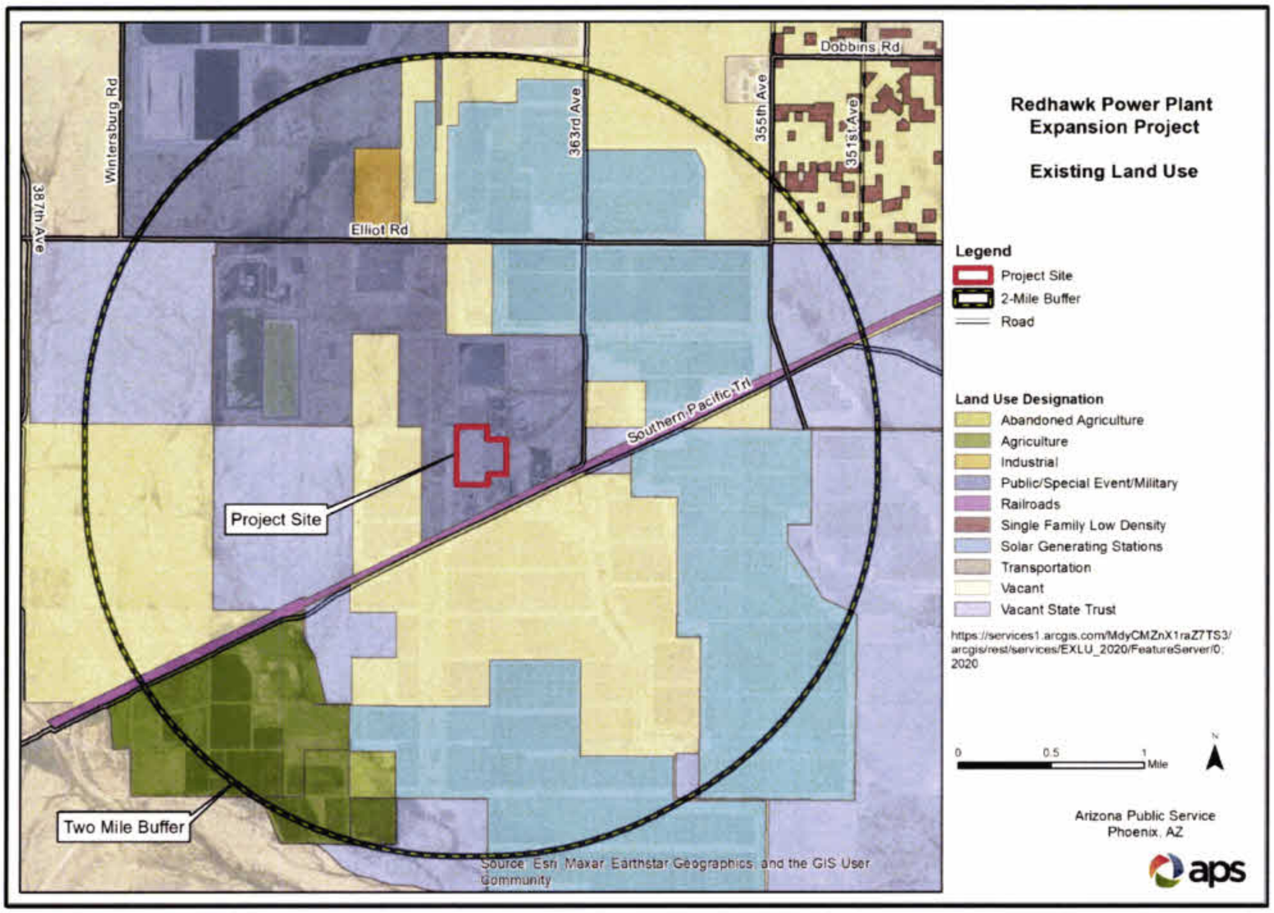


Figure A-4. Existing Zoning

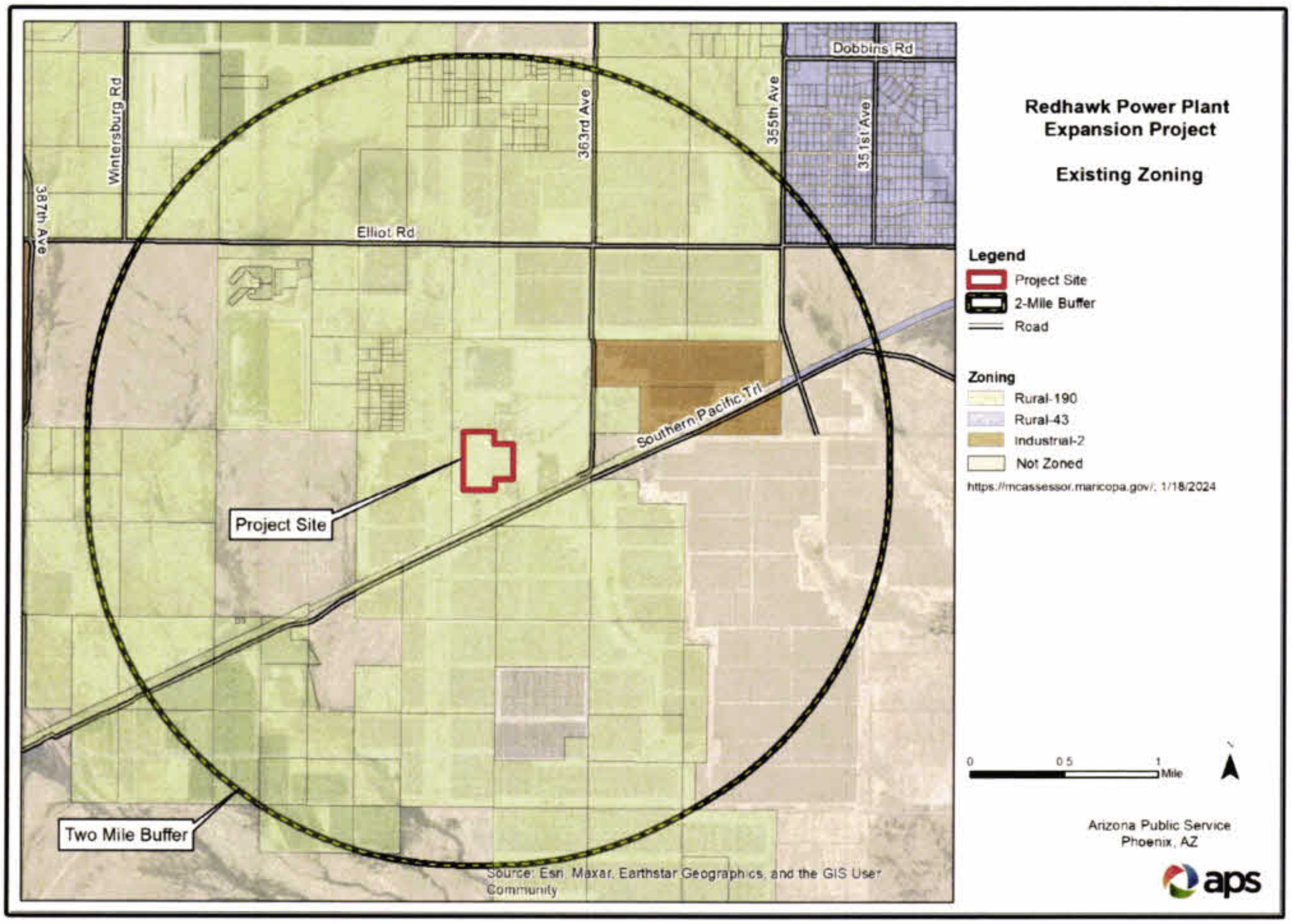


Table A-1. Land Cover and Ownership within Two-mile Study Area of the Expansion Project

Category	Percent within Study Area
Current Land Cover	
Agriculture Hay/Pasture	6.2%
Cultivated Crops	5.9%
Developed Land	6.9%
Open Space	10.0%
Grassland/Herbaceous	71.0%
Current Land Ownership	
Private Land	89.3%
State Trust Land	10.7%
Land Usage Changes (2001 to 2021)	
No Change	94.8%
Increases in Urban Cover (residences)	5.2%

Table Sources: ASLD 2024; USGS 2019

Future Land Use Compliance

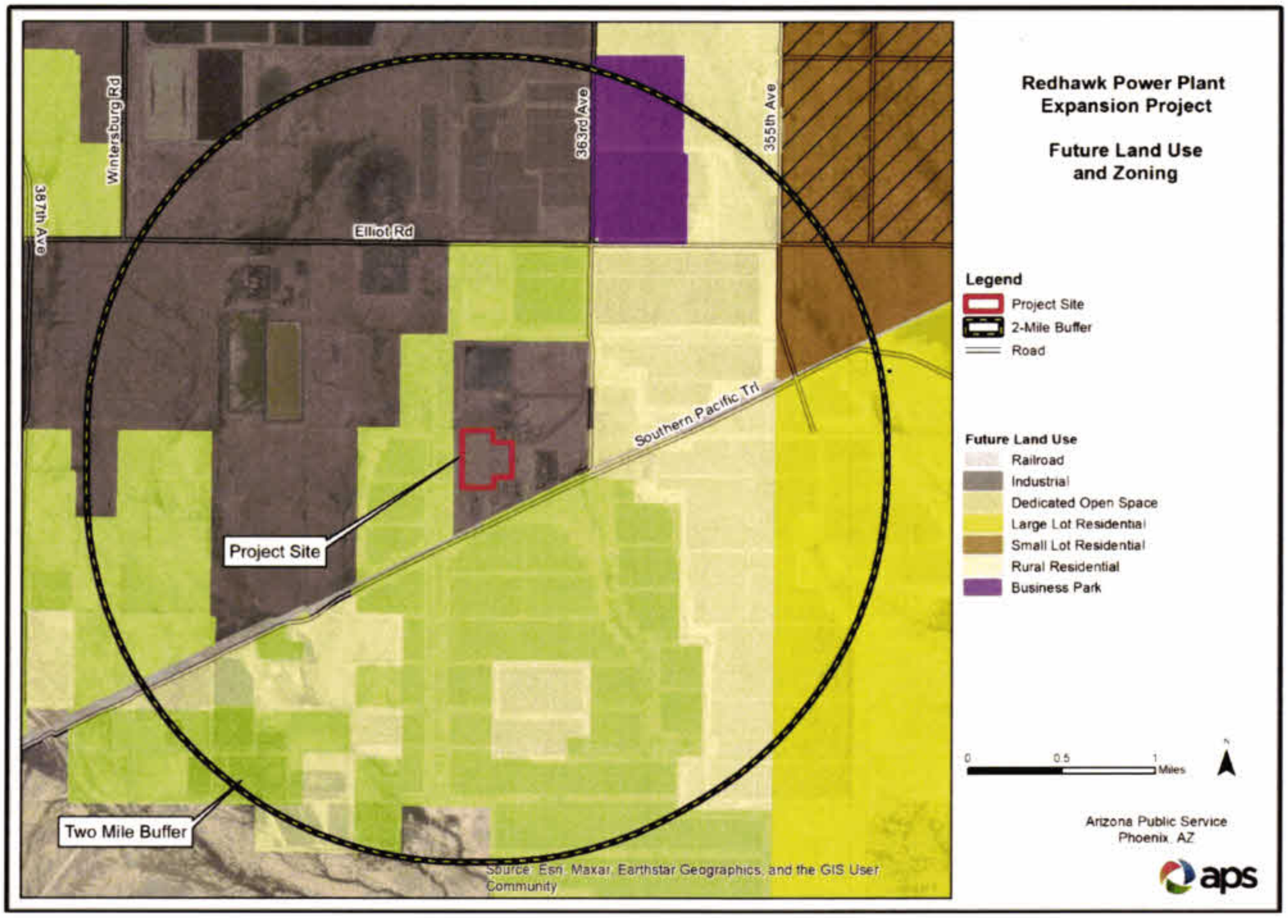
Identification of future land use within the Study Area included review of the land use policy plans within the Maricopa County Comprehensive Plan and the Tonopah/Arlington Area Plan. Maricopa County's future land use for the Study Area is to promote efficient land development that is compatible with adjacent land uses and to create orderly and functional development patterns (Maricopa County 2020).

The Industrial/Special Use zoning designation identifies locations for major employment centers. Uses permitted in this category include general warehousing, storage, distribution activities, and general manufacturing. The Expansion Project is consistent with designated future land uses. Compatibility with adjacent current and future land use is an important consideration, and developments within this category are subject to plan review and approval (Maricopa County 2023).

Conclusion

The Expansion Project is consistent with existing and future land use of the area, including the growth plans of Maricopa County (**Figure A-5**).

Figure A-5. Future Land Use



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U.S. Geological Survey (USGS). 2019. 2019 National Land Cover Database. Accessed at https:// www.usgs.gov/centers/eros/science/national-land-cover-database (Accessed December 19, 2023).

Exhibit B
Environmental Reports

As stated in Arizona Corporation Commission Rules of Practice and Procedure R14-3-220, Exhibit 1:

> "Attach any environmental studies which applicant has made or obtained in connection with the proposed site(s) or route(s). If an environmental report has been prepared for any federal agency or if a federal agency has prepared an environmental statement pursuant to Section 102 of the National Environmental Policy Act a copy shall be included as part of this exhibit."

Air Quality Permit Application

In April 2024, Arizona Public Service Company (APS) filed an application for a significant revision to Maricopa County Air Permit (No. P0009401) (Application) to allow the construction and operation of eight (8) new LM6000 units at the Redhawk Power Plant (Existing Plant). The Application, including detailed air modeling analysis and additional impacts analysis, was submitted to the Maricopa County Air Quality Department and U.S. Environmental Protection Agency in early April 2024 as part of the air permit process. The following paragraphs are a summary from the Application. The full Application is included as **Appendix B-1**.

As detailed in the Application, the proposed eight (8) new units will have state-of-the-art air quality control systems, including water injection and selective catalytic reduction for nitrogen oxides control and oxidation catalysts for carbon monoxide and volatile organic compound control. The air quality impacts for all pollutants and averaging intervals are insignificant except for 1-hour nitrogen dioxide and 24-hour particulate matter less than 2.5 micrometers in diameter impacts. For those two (2) pollutants, cumulative National Ambient Air Quality Standards (NAAQS) and prevention of significant deterioration (PSD) increment modeling analyses were performed and included the existing units and the other nearby sources. The results of the cumulative analyses demonstrate compliance with the NAAQS and PSD increments.

APS conducted an environmental justice (EJ) analysis as part of the Maricopa County Air Permit Application for this Expansion Project. Additional information regarding APS's EJ evaluation, conclusions, and corresponding outreach are contained in a copy of the Application in **Appendix B-1**.

Groundwater Report

A groundwater analysis was performed for the Expansion Project. The Expansion Project will rely upon existing groundwater rights and use less than 300 acre-feet a year. As detailed in the report, sufficient groundwater is available in the aquifers beneath the Existing Plant to support the water needs of the Expansion Project, and the increased water use does not result in an unreasonable impact to existing registered water wells owned by parties other than APS or to the Active Management Area. The full report is included in **Appendix B-2**.

Transmission System Study

A Transmission System Study was prepared for the Expansion Project. The report indicates that the Expansion Project will not adversely impact the bulk electric transmission system or create any reliability concerns. The full report is included in **Appendix B-3**.

Exhibit B-1.
Redhawk Power Plant Title V Permit Significant Revision Application Permit No. P0009401

Redhawk Power Plant

Construction and Title V Air Quality Operating Permit Significant Revision Application

Permit Number P0009401

Natural Gas-Fired Simple Cycle Combustion Turbine Expansion Project.

April 2024

Prepared for:

Arizona Public Service
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Prepared By:

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Chapter 1. Executive Summary.

Arizona Public Service (APS) is planning a new Natural Gas-Fired Simple Cycle Combustion Turbine Expansion Project at the existing Redhawk Power Plant (Redhawk) in Arlington, Maricopa County. Redhawk is located in an area that is classified as attainment for all criteria air pollutants except ozone. Redhawk is a major stationary source under the Title V permit program and operates under Permit Number P0009401. Redhawk is also a major stationary source under the Prevention of Significant Deterioration (PSD) and Nonattainment Area New Source Review (NANSR) construction permit programs.

The proposed Expansion Project will involve the construction and operation of eight (8) General Electric Model LM6000PC natural gas-fired simple cycle combustion turbine (CT) electric generating units and associated support equipment. Each CT will have a maximum nominal electric output of 49.6 megawatts (MW). These CTs will be equipped with state-of-the-art air quality control systems including water injection and selective catalytic reduction (SCR) for nitrogen oxides (NO_x) control and oxidation catalysts for carbon monoxide (CO) and volatile organic compound (VOC) control.

Maricopa County and the Redhawk Power Plant are classified as a marginal nonattainment area for ozone, and the regulated ozone nonattainment area pollutants are NO_x and VOC. Major modifications of a major stationary source are subject to review under the permit requirements for major modifications located in nonattainment areas in County Rule 240, Section 304. Major modifications under the NANSR program require the installation of the Lowest Achievable Emission Rate (LAER) control technology and emission offsets. LAER is the most stringent emission limitation derived from either: 1) the most stringent emission limitation contained in the implementation plan of any State for such class or category of source; or 2) the most stringent emission limitation achieved in practice by such class or category of source. Offsets are emission reductions obtained from existing sources located in the vicinity of the proposed source which offset the emissions increase from the modification and provide a net air quality benefit. The purpose for requiring offsets (or offsetting emissions decreases) is to allow an area to move towards attainment while still allowing growth.

For a marginal ozone nonattainment area, the significant threshold for both NO_x and VOC emissions is 40 tons per year. From the following table, the Project will result in significant emissions increase and a significant net emissions increase for NO_x emissions but not VOC emissions. Therefore, this Project is subject to NANSR review for NO_x emissions. This application includes a detailed LAER analysis for NO_x emissions in Chapter 7 and an emissions offset analysis in Chapter 10. Based on the LAER analysis, APS is proposing to limit NO_x emissions to the lowest emission rate for any identified similar source, equal to a NO_x emission rate of 2.3 ppmdv at 15% O_2. Note that if the area is reclassified as a serious nonattainment area, the significant threshold for both NO_x and VOC emissions is reduced to 25 tons per year, and the emission offset requirements increase from a ratio of 1.15 to 1 (i.e., a 15% reduction) to a ratio of 1.2 to 1 (i.e., a 20% reduction). APS will surrender NO_x Emission Reduction Credits (ERCs) to offset the proposed emission increases based on the nonattainment designation applicable to the area. These ERCs will result in an overall reduction in NO_x emissions in the nonattainment area and a net air quality benefit.

The PSD program in the Code of Federal Regulations, 40 CFR §52.21 and County Rule 240, Section 305 requires that a major modification of a major stationary source within an attainment area must undergo PSD review and obtain a construction permit prior to commencing construction. A major modification means any physical change or change in the method of operation of a major stationary source that would result in a significant emissions increase and a significant net emissions increase of a regulated pollutant. The following table is a summary of the potential emissions based on the proposed limits in this application. From this table, the Project will result in a significant emissions increase of NO_x, particulate matter (PM), PM_{10}, $PM_{2.5}$, and greenhouse gas (GHG) emissions. Therefore, this Project is subject to PSD review for these pollutants including the requirement to apply the Best Available Control Technology (BACT) to each pollutant.

Potential emissions for the new Project and PSD or NANSR applicability, tons per year.

Pollutant		Project Potential to Emit	PSD / NANSR Significant Threshold	OVER?
Carbon Monoxide	CO	95.0	100	**NO**
Nitrogen Oxides	NO_x	59.0	40	**YES**
Particulate Matter	PM	54.1	25	**YES**
Particulate Matter	PM_{10}	54.1	15	**YES**
Particulate Matter	$PM_{2.5}$	54.1	10	**YES**
Sulfur Dioxide	SO_2	1.9	40	**NO**
Volatile Organic Compounds	VOC	23.1	40	**NO**
Sulfuric Acid Mist	H_2SO_4	0.14	7	**NO**
Fluorides (F)	F	0.0000	3	**NO**
Lead	Pb	0.0016	0.6	**NO**
Carbon Dioxide	CO_2	366,790.2	n/a	**n/a**
Greenhouse Gases	CO_2e	367,169.0	75,000	**YES**

This application includes a detailed air quality modeling analysis as well as an additional impacts analysis as required under the PSD program. The results of this analysis demonstrate that the proposed Project and the Redhawk Power Plant will be in compliance with all applicable air quality standards for carbon monoxide (CO), nitrogen dioxide (NO_2), PM_{10}, $PM_{2.5}$, sulfur dioxide (SO_2), and lead (Pb).

This application also includes a detailed Environmental Justice (EJ) analysis of the 3-mile radius surrounding the Redhawk Power Plant. EJ is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This EJ analysis did not identify any potentially significant adverse or disproportionate impacts to the community within the study area. The study area has a low population of 217 individuals, equal to a population density of less than 8 individuals per square mile. The study area's population of all ethnic groups is lower as a percentage of the population than the County and State except for the total Hispanic population which is 35% as compared to the County at 31%, and none of the households in the study area have limited English proficiency or speak another language at home.

Chapter 2. Project Description.

2.1 Existing Plant Description.

Arizona Public Service (APS) owns and operates the Redhawk Power Plant which is located at 11600 South 363rd Avenue, Arlington, in Maricopa County. The Redhawk Power Plant operates under Title V Permit Number V99-013. Redhawk consists of two natural gas-fired combined cycle (CC) units and associated equipment and systems. Each combined cycle unit has a nominal rating of 550 megawatts (MW) of gross electrical output. Each unit has two (2) 191 MW General Electric (GE) Model 7FA CTs generators (CTGs) and one 180 MW steam turbine generator (STG). Each combined cycle unit is equipped with a heat recovery steam generator (HRSG) which provides steam to the STG common to that unit. Each HRSG is equipped with duct burners which allow for supplemental natural gas firing. Each HRSG is also equipped with a selective catalytic reduction (SCR) system for the control of nitrogen oxides (NO_x) emissions.

Figure 2-2 shows the site location of the Redhawk Power Plant in the State of Arizona and in Maricopa County. Figure 2-3 is an aerial image of the Redhawk Power Plant showing the proposed location of the Expansion Project. Figure 2-4 shows the layout of the proposed new CTs on the project site.

2.2 Expansion Project.

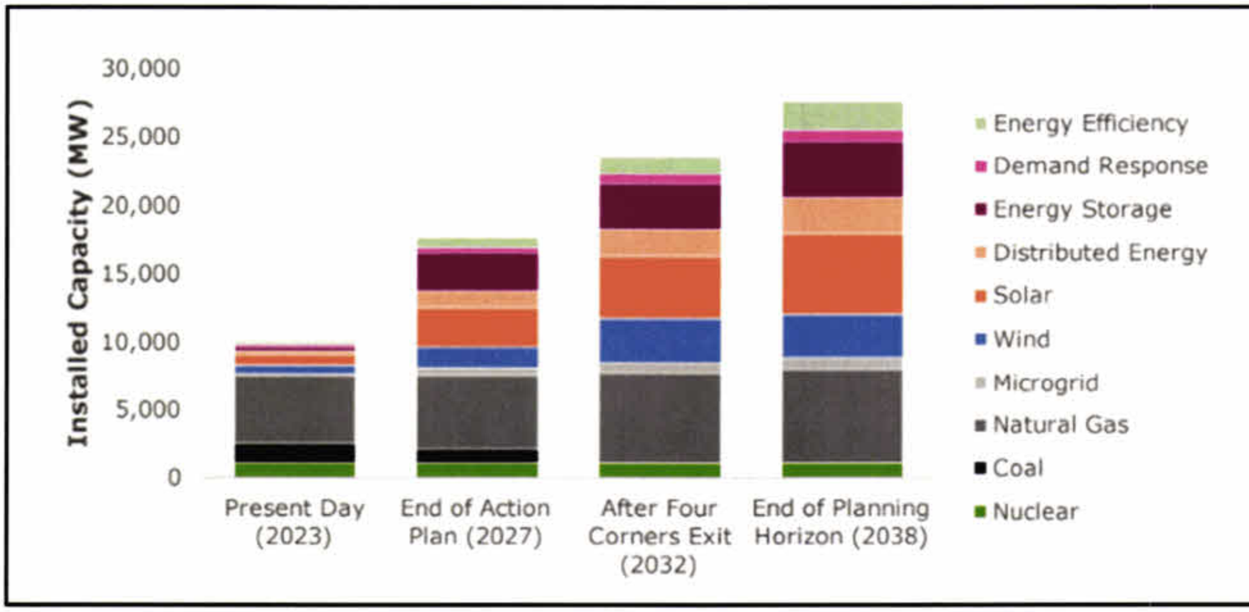
The Redhawk Power Plant Expansion Project will involve the installation of eight (8) General Electric Model LM6000PC aeroderivative simple cycle combustion turbines (CTs) with water spray power augmentation. These CT units will be identified as Units 3 - 10. Each CT will have a maximum nominal electric output of 49.6 MW and a maximum nominal natural gas fuel flow of 471mmBtu/hr (HHV). These CTs will be equipped with state-of-the-art air quality control systems including water injection and selective catalytic reduction (SCR) for nitrogen oxides (NO_x) control and oxidation catalysts for carbon monoxide (CO) and volatile organic compound (VOC) control.

2.3 Purpose and Need.

Today, Arizona is experiencing significant growth in demand for energy generation to support residential, commercial, and industrial customer load growth. At the same time, summer energy supply is tightening in the western United States, making it difficult to purchase the required energy from the energy market. These new LM6000PC simple cycle CTs, along with the solar and battery energy storage APS is adding to its resource portfolio, will help APS meet the nearly 40% load growth that is expected in the next eight years. Figure 2-1 shows the installed capacity for APS today and as projected for the next 15 years. This figure shows a wide diversity of energy resources. Having a variety of resources - including natural gas, nuclear, solar, energy storage, and customer demand response programs in APS's portfolio - makes the system more resilient to supply chain disruptions, extreme weather, and changing market conditions. Further, natural gas resources, including these new simple cycle CTs, provide critical capacity during peak system demand and support reliability when customers need it most.

Our Plan demonstrates that investment in additional renewable energy is a cost effective means to meeting customer needs. Capitalizing on opportunities for new renewable resources will require complementary investments in transmission infrastructure. Our Preferred Plan includes significant quantities of New Mexico wind, delivered to APS loads via a combination of new transmission and the repurposing of existing transmission after the exit from Four Corners. Utility-scale energy storage is an essential piece of our future resource mix and an area that we have invested heavily in, with over 2 gigawatts (GW) of planned battery additions during the Action Plan period. Storage technologies will help us use regional excess solar generation that is frequently available at low, zero, and even negative prices. We remain dedicated to a responsible adoption and integration of this nascent technology, and have committed to a maximum of 3 GW of battery energy storage through 2027. We will continually evaluate this cap as more industry experience with the technology is gained.

FIGURE 2-1. Total installed capacity across the planning horizon in the preferred plan.



The Redhawk Plant is a key component of Arizona's energy infrastructure. It currently produces 1,060 MW, enough energy to power nearly 170,000 Arizona homes. APS plans to have the additional eight units in service ahead of summer 2028 when APS's total load requirements are forecasted to be over 11,000 MW. APS needs flexible and firm generation resources like the proposed additional LM6000PC units at Redhawk to ensure sufficient reliability and resource adequacy in the face of significant customer load growth, increased reliance on renewables, extreme weather, and tightening western energy markets.

A critical component of this Project is that the proposed LM6000PC units are quick starting and fast ramping. These new CTs can be online in eight minutes and at full load in under 10 minutes - making them a critical resource to respond to fluctuations in renewable energy output throughout the day. Because these LM6000PC peaking units offer flexible, on-demand energy 24/7, they can provide much-needed energy during late afternoon and evening hours when customer demand is high, creating a strong complement to renewable energy resources such as solar. In short the new units will support reliable electrical service when APS customers need it most.

The proposed new LM6000PC CTs will also provide dynamic voltage control for the electric grid. Dynamic voltage control is the ability of a generating resource to maintain voltage levels within acceptable limits. This Project will also provide system electric inertia (kinetic energy stored during the units' operation) and frequency response (the ability of a generating resource to aid balance between generation and load on the grid) necessary for electric system stability. Batteries and renewable energy systems such as wind and solar cannot provide this necessary grid support. These attributes of the proposed CTs are critical when the electric supply resource portfolio includes more and more intermittent, renewable resources such as wind and solar.

FIGURE 2-2. Location of the Redhawk Power Plant in Arizona and Maricopa County.

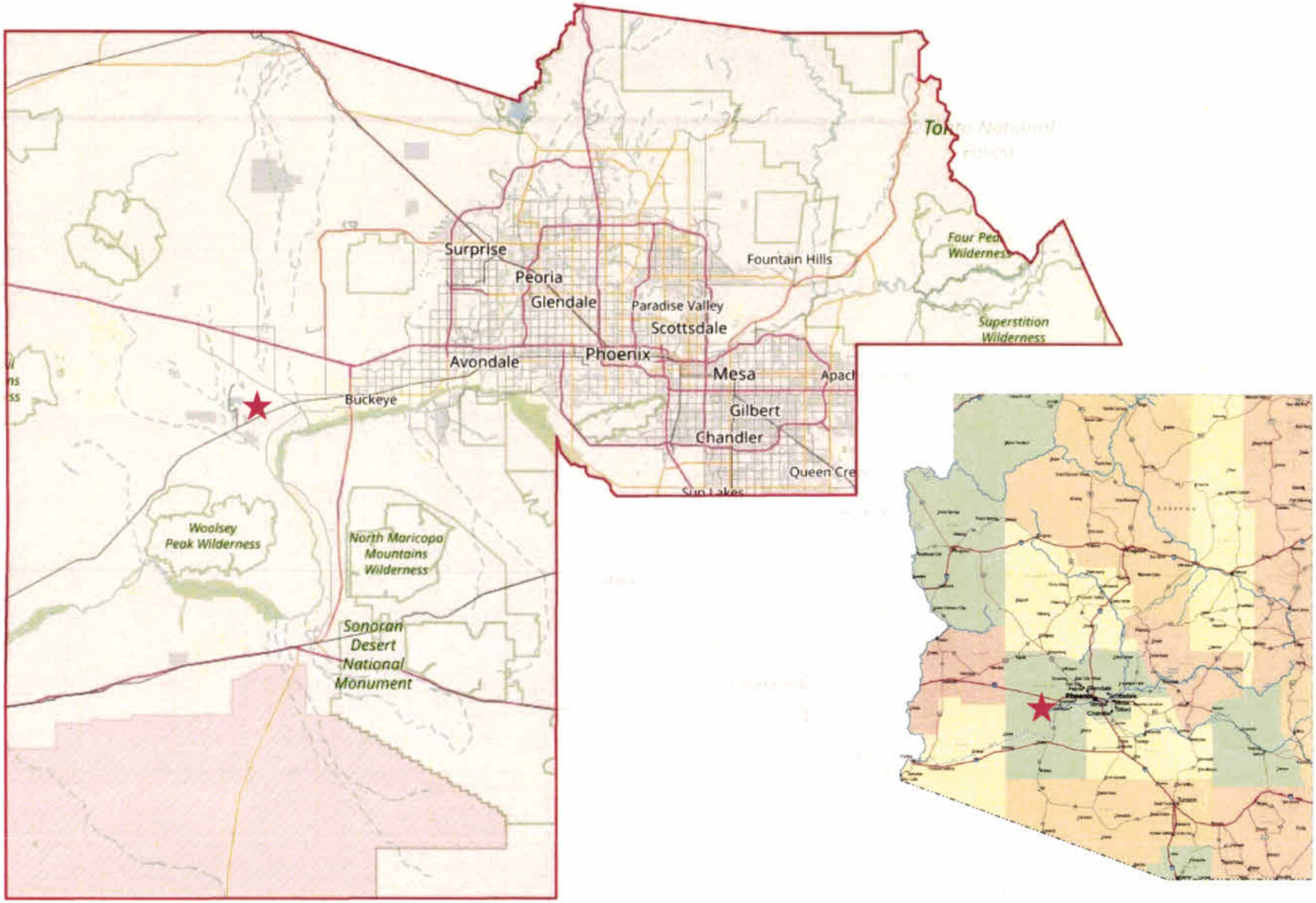
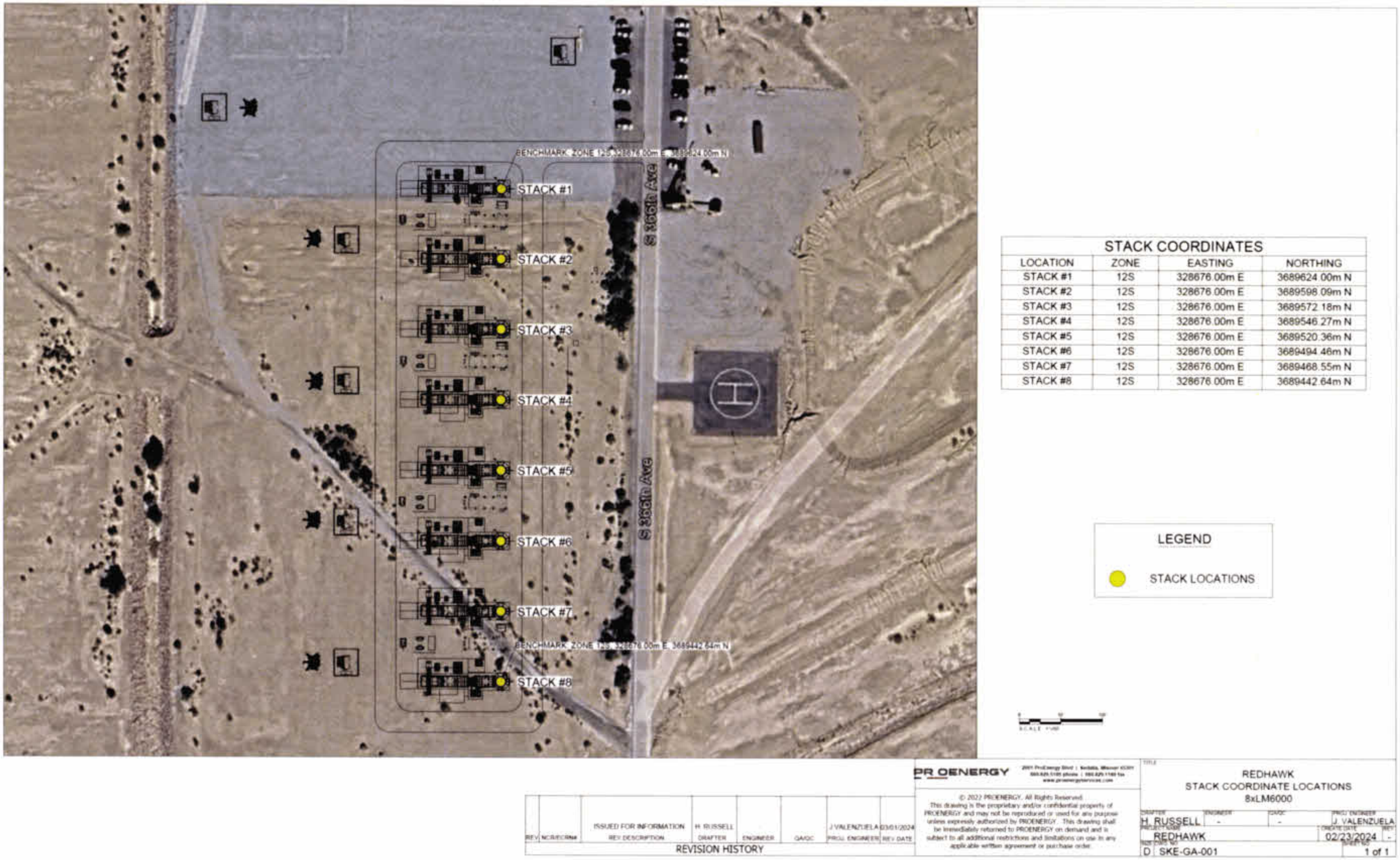


FIGURE 2-3. Redhawk Power Plant aerial image and location for the CT Expansion Project.

FIGURE 2-4. Layout of the proposed new CTs on the project site.



STACK COORDINATES			
LOCATION	ZONE	EASTING	NORTHING
STACK #1	12S	328676.00m E	3689624.00m N
STACK #2	12S	328676.00m E	3689598.09m N
STACK #3	12S	328676.00m E	3689572.18m N
STACK #4	12S	328676.00m E	3689546.27m N
STACK #5	12S	328676.00m E	3689520.36m N
STACK #6	12S	328676.00m E	3689494.46m N
STACK #7	12S	328676.00m E	3689468.55m N
STACK #8	12S	328676.00m E	3689442.64m N

2.4 General Electric Model LM6000PC Combustion Turbine Generators.

The General Electric (GE) Model LM6000PC simple cycle CTs or gas turbines are aeroderivative CTs coupled to an electric generator to produce electric power. A CT is an internal combustion system which uses air as a working fluid to produce mechanical power and consists of an air inlet system, a compressor section, a combustion section, and a power section. The compressor section includes an air filter, noise silencer, and a multistage axial compressor.

During operation, ambient air is drawn into the compressor section. The air is compressed and heated by the adiabatic compression of the inlet gas and also by the combustion of fuel in the combustor section. The expansion of the high pressure, high temperature gas expands through the turbine blades which rotate the turbine shaft in the power section of the turbine, and the rotating shaft powers an electric generator. The LM6000PC CTs are aeroderivative units based on turbine designs in the aviation industry. This aeroderivative design is capable of fast starts and fast ramping to full electric output capacity. Figure 2-5 is a process flow diagram for the LM6000 CTs. These CTs will be equipped with inlet air filters which remove dust and particulate matter from the inlet air. During hot weather, the filtered air may also be cooled utilizing water spray fogging systems. During cold weather, the filtered air may be mixed with warm air from the turbine compartment which is part of the anti-icing system. The filtered air is drawn into the compressor section of the gas turbine where the air is compressed. The air temperature rises adiabatically along with the increase in pressure. These CTs will also be equipped with Water Spray Power Augmentation (WSPA). This water flow increases the mass flow of gases through the turbines and results in higher electric power output.

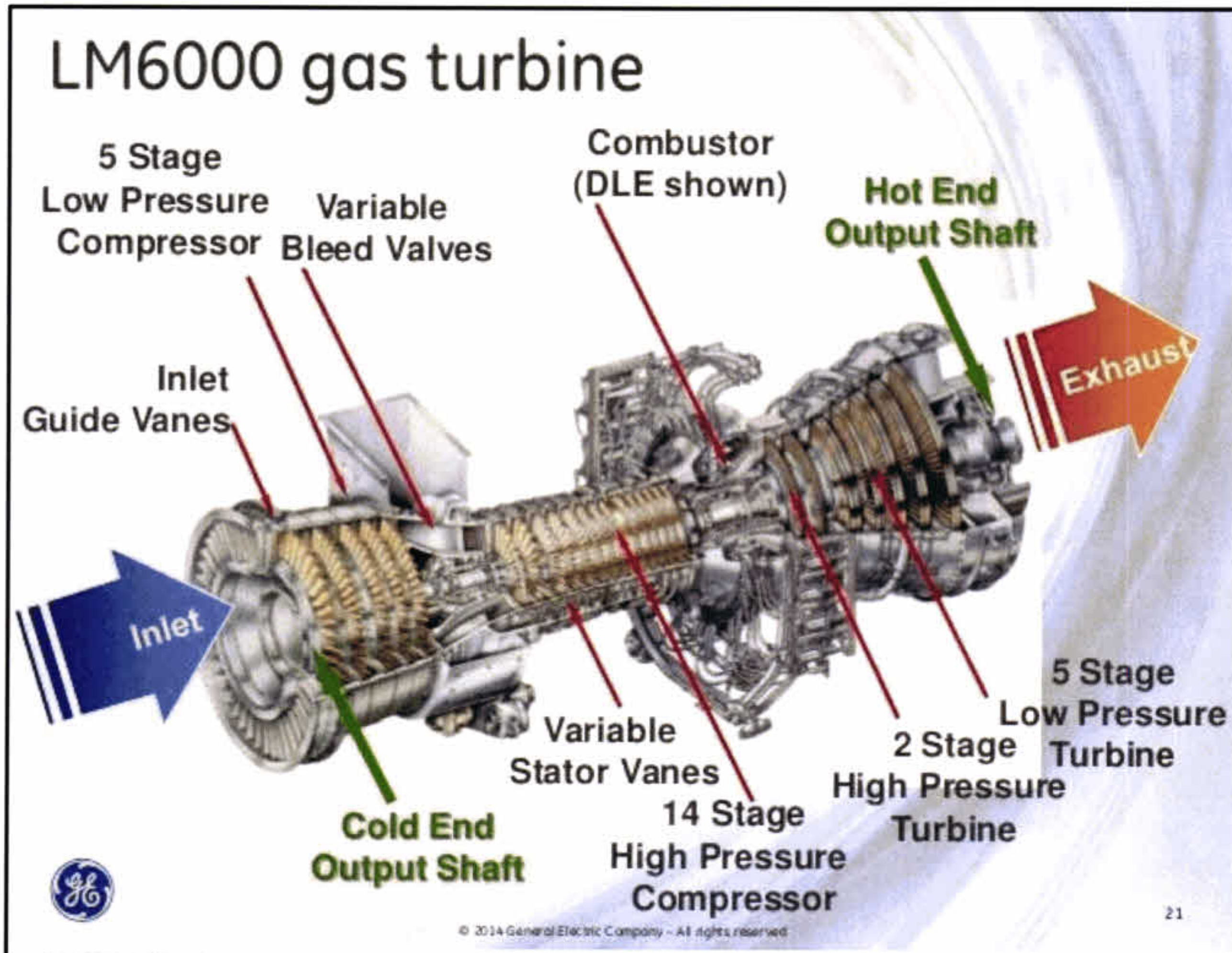
The hot, compressed air flows to the combustion section of the CT where high-pressure natural gas is injected into the turbine and the air/fuel mixture is ignited. Water is also injected into the combustion section of the CT which reduces flame temperatures and reduces thermal NO_x formation. The combustion gases pass through the power or expansion section of the turbine which consists of blades attached to a rotating shaft, and fixed blades or "buckets". The expanding gases cause the blades and shaft to rotate. The power section of the turbine extracts energy from the hot compressed gases which cools and reduces the pressure of the exhaust gases. The power section of the turbine produces the power to drive the electric generator.

Each CT and generator will be enclosed in a metal acoustical enclosure which will also contain accessory equipment. The CTs will be equipped with the following equipment:

- Inlet air filters
- Inlet air fogging
- Metal acoustical enclosure to reduce sound emissions
- Air cooled (fin fan) lube oil coolers for the turbine and generator
- Annular standard combustor combustion system
- Water injection system for NO_x control
- Compressor wash system to clean compressor blades

- Fire detection and protection system
- Hydraulic starting system
- Compressor variable bleed valve vent to prevent compressor surge in off-design operation

FIGURE 2-5. Process flow diagram of a GE Model LM6000 simple cycle CT (from GE Company).



NOTE: This diagram shows dry low NOx (DLE) combustors. The proposed CTs will have SAC combustors with water injection.

2.5 Post Combustion Air Quality Control Systems.

The combustion gases exit each CT at approximately 760 to 926 °F. The exhaust gases will then pass through two post combustion air quality control systems, including oxidation catalysts for the control of carbon monoxide (CO) and volatile organic compounds (VOC), and selective catalytic reduction (SCR) systems for the control of nitrogen oxides (NO_x) emissions. The units will utilize a high temperature catalyst formulation which has a continuous operating temperature of approximately 900 °F.

2.5.1 Selective Catalytic Reduction (SCR).

Selective Catalytic Reduction (SCR) is a post combustion flue gas treatment technique for the reduction of NO_x emissions which uses an aqueous ammonia (NH_3) or aqueous urea ($CO(NH_2)_2$) injection system and a catalytic reactor. The injection grid disperses urea or ammonia in the flue gas upstream of the catalyst. At the SCR operating temperature, urea decomposes to ammonia. Ammonia reacts with NO_x in the presence of the catalyst to form nitrogen (N_2) and water (H_2O) according to the following reaction equations:

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$$
$$4NH_3 + 2NO_2 + O_2 \rightarrow 3N_2 + 6H_2O$$

Catalysts are substances which evoke chemical reactions that would otherwise not take place, and act by providing a reaction mechanism that has a lower activation energy than the uncatalyzed mechanism. For SCR, the catalyst is usually a noble metal, a base metal (titanium or vanadium) oxide, or a zeolite-based material. Noble metal catalysts are not typically used in SCR because of their very high cost.

To achieve optimum long-term NO_x reductions, SCR systems must be properly designed for each application. In addition to critical temperature considerations, the NH_3 or urea injection rate must be carefully controlled to maintain an NH_3/NO_x molar ratio that effectively reduces NO_x. Excessive ammonia injection will result in NH_3 emissions, called ammonia slip. SCR has the capability to make substantial reductions in NO_x emissions from boilers, CTs, and engines. For these CTs, the use of SCR is expected to reduce NO_x emissions by approximately 90%.

2.5.2 Oxidation Catalyst System.

For natural gas-fired gas turbines applications, CO and VOC emissions may be controlled using oxidation catalysts installed as a post combustion control system. A typical oxidation catalyst is a rhodium or platinum (noble metal) catalyst on an alumina support material. The catalyst is typically installed in a reactor with flue gas inlet and outlet distribution plates. CO and VOC react with oxygen (O_2) in the presence of the catalyst to form carbon dioxide (CO_2) and water (H_2O) according to the following general equations:

$$2CO + O_2 \rightarrow 2CO_2$$
$$2C_nH_{2n+2} + (3n + 1)O_2 \rightarrow 2nCO_2 + (2n+2)H_2O$$

Oxidation catalysts have the potential to achieve a 90% reduction in uncontrolled CO emissions at steady state operation. VOC reduction capabilities are expected to be less.

2.6 Project Schedule.

The following is the expected schedule for the Redhawk Power Plant Natural Gas-Fired Simple Cycle Combustion Turbine Expansion Project.

Submit Air Quality Operating Permit Significant Revision Application	April 2024
Begin Detailed Engineering	January 2, 2025
Permit Issue Date	August 1, 2025
Contractor Mobilization	Feb 1, 2026
Major Foundations Complete	October 1, 2026
Major Equipment rough set on foundations	Feb 1, 2027
Begin Commissioning	August 1, 2027
Facility Commercial Operation	March 1, 2028

Chapter 3. Air Emissions Analysis.

Potential emissions for these new LM6000PC CTs are based on the use of water injection and selective catalytic reduction (SCR) for nitrogen oxides (NO_x) control and oxidation catalysts for CO and VOC control. This emissions analysis is based on a maximum design nominal fuel flow of 471 mmBtu/hr (HHV). In addition, the emissions in this analysis are based on the proposed Best Available Control technology (BACT) and Lowest Achievable Emission Rate (LAER) technology for NO_x emissions, the proposed BACT emission limits for particulate matter (PM), PM_{10}, $PM_{2.5}$, and greenhouse gas (GHG) emissions, and the proposed emissions and operational limits as detailed in Chapter 4 of this application.

3.1 Normal Operation.

The maximum PSD regulated pollutant emission rates for each LM6000PC CT during normal operation and with controls are summarized in Table 3-1.

3.2 Startup and Shutdown Emissions.

The CT air pollution control systems including the SCR and oxidation catalyst systems are not operational during periods of startup and shutdown (SU/SD) because the exhaust gas temperatures are too low for these systems to function as designed. In addition, water injection used to control NO_x emissions cannot be used during startup because injecting water too soon can impact the CT flame stability and combustion dynamics, and it may also increase CO emissions. As a result, CO, NO_x, and VOC emissions may be elevated during periods of startup and shutdown.

Table 3-2 is a summary of the startup and shutdown duration, the expected fuel consumption, expressed as mmBtu, and the PSD regulated air pollutant emissions. ***Note that the startup and shutdown durations, heat input, and emissions, expressed in pounds per event, are the maximum expected values.*** Under normal conditions, these CTs can startup in approximately 8 - 10 minutes which will result in lower heat input and emission rates. Furthermore, the emission rates for PM, PM_{10}, and $PM_{2.5}$ emissions, as well as SO_2, sulfuric acid mist, lead (Pb), CO_2, and GHG emissions, expressed in pounds per million Btu of heat input (lb/mmBtu), are NOT elevated during periods of startup and shutdown. Therefore, the highest mass emission rate for these pollutants, expressed in pounds per hour, occurs during normal operation at 100% of the rated capacity of the CTs. Further, the total mass emissions of PM, PM_{10}, $PM_{2.5}$, SO_2, sulfuric acid mist, lead (Pb), CO_2, and GHG emissions, expressed in tons per year, can be accumulated based only on heat input and the respective pollutant emission rate, expressed in lb/mmBtu.

3.3 Total Potential Emissions for Each CT.

Table 3-3 is a summary of the total potential emissions for each CT based on the proposed emission limits and operational limits detailed in Chapter 4 of this application.

TABLE 3-1. Maximum potential emission rates with controls for each LM6000PC CT during normal operation.

Pollutant		Heat Input	Emission Rate		
		mmBtu/hr	lb/mmBtu	ppm @ 15% O_2	lb/hr
Carbon Monoxide	CO	471	0.00894	4.0	4.21
Nitrogen Oxides	NO_x	471	0.00848	2.3	3.99
Particulate Matter	PM	471	0.015		7.00
Particulate Matter	PM_{10}	471	0.015		7.00
Particulate Matter	$PM_{2.5}$	471	0.015		7.00
Sulfur Dioxide	SO_2	471	0.0006		0.28
Vol. Org. Compounds	VOC	471	0.0055		2.60
Sulfuric Acid Mist	H_2SO_4	471	0.000046		0.022
Fluorides (F)	F	471	0.0000		0.000
Lead	Pb	471	0.0000005		0.0002
Carbon Dioxide	CO_2	471	116.98		55,095.7
Greenhouse Gases	CO_2e	471	117.10		55,152.6

Footnotes

1. CO and NO_x emissions during normal operation are calculated based on concentrations of 4 and 2.3 parts per million, dry volume basis (ppmdv) corrected to 15% excess oxygen according to the following equations from 40 CFR Part 60, Appendix A, Reference Method 19, Eq. 19-1 and 40 CFR Part 75, Appendix F, Eq. F-5:

$$E_{NOx} = K_{NOx}\, C_d\, F_d\, \frac{20.9}{20.9 - \%O_{2d}} \qquad E_{CO} = K_{CO}\, C_d\, F_d\, \frac{20.9}{20.9 - \%O_{2d}}$$

Where, E = Pollutant emission rate, lb/mmBtu
C_d = Pollutant concentration during unit operation, parts per million, dry volume basis
F_d = 8,710 dscf/mmBtu for natural gas
$\%O_2$ = Oxygen concentration, percent by volume, dry basis, = 15%
K_{CO} = 7.237×10^{-8} lb/dscf-ppm CO
K_{NOx} = 1.194×10^{-7} lb/dscf-ppm NO_x

2. PM emissions are based on a proposed BACT emission rate of 7.0 pounds per hour, equal to 0.015 lb/mmBtu at 100% load.
3. All filterable plus condensable PM_{10} emissions are also assumed to be $PM_{2.5}$ emissions.
4. Sulfur dioxide (SO_2) emissions are based on the emission factor for the combustion of pipeline natural gas from the Acid Rain Program in 40 CFR Part 75 of 0.0006 lb SO_2/mmBtu.
5. VOC emissions are based on a proposed emission limit of 0.005 lb/mmBtu.
6. Lead (Pb) emissions are based on the emission factor from the U.S. EPA's *AP-42*, Table 1.4-2.
7. The emission factors for greenhouse gases including CO_2, N_2O and CH_4 are from 40 CFR 98, Tables C-1 and C-2. The CO_2e factors are from 40 CFR 98, Subpart A, Table A-1.

TABLE 3-2. Maximum emission rates for each LM6000PC CT during startup and shutdown.

Pollutant		Startup			Shutdown			TOTAL SU/SD EMISSIONS	
		Duration	Heat Input	Emissions	Duration	Heat Input	Emissions		
		minutes	mmBtu	lb	minutes	mmBtu	lb	lb / mmBtu	lb / event
Carbon Monoxide	CO	30	199.6	15.7	9	33.7	16.6	0.138	32.3
Nitrogen Oxides	NO_x	30	199.6	15.4	9	33.7	3.0	0.064	18.4
Particulate Matter	PM	30	199.6	2.99	9	33.7	0.51	0.015	3.5
Particulate Matter	PM_{10}	30	199.6	2.99	9	33.7	0.51	0.015	3.5
Particulate Matter	$PM_{2.5}$	30	199.6	2.99	9	33.7	0.51	0.015	3.5
Sulfur Dioxide	SO_2	30	199.6	0.1	9	33.7	0.02	0.0006	0.1
Vol. Org. Compounds	VOC	30	199.6	1.8	9	33.7	0.9	0.012	2.7
Sulfuric Acid Mist	H_2SO_4	30	199.6	0.0	9	33.7	0.00	0.000	0.0
Fluorides (F)	F	30	199.6	0.0	9	33.7	0.00	0.000	0.0
Lead	Pb	30	199.6	0.0	9	33.7	0.00	0.000	0.0
Carbon Dioxide	CO_2	30	199.6	23,348.4	9	33.7	3,942.1	117.0	27,290.5
Greenhouse Gases	CO_2e	30	199.6	23,372.5	9	33.7	3,946.2	117.1	27,318.7

TABLE 3-3. Potential emissions for each new GE LM6000PC CT based on the proposed limits in this application.

Pollutant		Heat Input	Normal Operation					Startup / Shutdown Operation			Total Potential to Emit
		mmBtu/hr	lb/mmBtu	ppm @ 15% O_2	lb/hr	mmBtu/yr	ton/yr	lb/event	event/yr	ton/yr	ton/yr
Carbon Monoxide	CO	471	0.00894	4.0	4.21	783,900	3.50	32.30	540	8.72	12.23
Nitrogen Oxides	NO_x	471	0.00848	2.3	3.99	783,900	3.32	15.00	540	4.05	7.37
Particulate Matter	PM	471	0.015		7.00	783,900	5.83	3.47	540	0.94	6.76
Particulate Matter	PM_{10}	471	0.015		7.00	783,900	5.83	3.47	540	0.94	6.76
Particulate Matter	$PM_{2.5}$	471	0.015		7.00	783,900	5.83	3.47	540	0.94	6.76
Sulfur Dioxide	SO_2	471	0.0006		0.28	783,900	0.24	0.09	540	0.03	0.24
Vol. Org. Compounds	VOC	471	0.0055		2.60	783,900	2.16	2.70	540	0.73	2.88
Sulfuric Acid Mist	H_2SO_4	471	0.000046		0.022	783,900	0.02	0.0072	540	0.00	0.018
Fluorides (F)	F	471	0.0000		0.000	783,900	0.0000	0.0000	540	0.0000	0.0000
Lead	Pb	471	0.0000005		0.00024	783,900	0.00020	0.00008	540	0.00002	0.00020
Carbon Dioxide	CO_2	471	117.0		55,096	783,900	45,848.8	27,291	540	7,368.4	45,848.8
Greenhouse Gases	CO_2e	471	117.1		55,153	783,900	45,896.1	27,319	540	7,376.1	45,896.1

Footnotes

The emission rates for PM, PM_{10}, and $PM_{2.5}$, SO_2, sulfuric acid mist, lead (Pb), CO_2, and GHG emissions, expressed in pounds per million Btu of heat input (lb/mmBtu), are NOT elevated during periods of startup and shutdown. Therefore, the total mass emissions for these pollutants, expressed in tons per year, may be based only on heat input and the respective pollutant emission rate, expressed in lb/mmBtu.

3.4 Natural Gas Piping Systems.

Natural gas piping components including valves, connection points, pressure relief valves, pump seals, compressor seals, and sampling connections can leak and result in fugitive natural gas emissions. Since natural gas consists of from 70 to almost 100% methane, leaks in the natural gas piping can result in methane emissions, and methane is a regulated greenhouse gas.

The Mandatory Greenhouse Gas Reporting Rules in 40 CFR Part 98, Subpart W include methods for estimating GHG emissions from petroleum and natural gas systems. Table 3-4 summarizes the estimated fugitive methane emissions and the equivalent GHG emissions, expressed as CO_2e, which are expected to result from a properly operated and maintained natural gas piping system for new CTs.

Note that these fugitive methane emissions represent less than 0.8% of the total GHG emissions from the proposed Project.

TABLE 3-4. Potential fugitive emissions from the natural gas piping systems.

Component Type	Component Count	Emission Factor[1] scf / hour / component	Specific Volume[3] scf / lb CH_4	Natural Gas (Methane)[4] ton/year	CO_2e Factor[2]	Potential to Emit ton CO_2e / year
Connectors	70	0.017	19.8	0.26	25	6.6
Flanges	2,000	0.003	19.8	1.33	25	33.2
Valves	2,160	0.123	19.8	58.86	25	1,471.6
Open Ended Pipes	70	0.123	19.8	1.91	25	47.7
Pump/Compressor Seals	20	13.3	19.8	58.93	25	1,473.4
Relief Valves		0.193	19.8	0.00	25	0.0
TOTAL				**121.0**	**25**	**3,025.9**

Footnotes

1. The emission factors are default whole gas emission factors from 40 CFR Part 98, Table W-1A for onshore natural gas production, Western U.S. In accordance with Table W-1A Footnote 1, for multi-phase flow that includes gas, use the gas service emissions factors.
2. The specific volume of methane at 68 °F is based on a specific volume of 385.5 standard cubic feet per lb-mole of gas, and a methane molecular weight of 16.0 lb/lb-mole.
3. Methane emissions are based on the worst-case assumption that natural gas is 100% methane by volume.

3.5 Sulfur Hexafluoride (SF_6) Insulated Electrical Equipment

Under the Prevention of Significant Deterioration (PSD) program sulfur hexafluoride (SF_6), Chemical Abstract Service (CAS) No. 2551-62-4, is also listed as regulated GHG. The new Project will include circuit breakers and switch gear for the CTs which will be insulated with SF_6. SF_6 is a colorless, odorless, non-flammable, inert, and non-toxic gas. SF_6 has a very stable molecular structure and has a very high ionization energy which makes it an excellent electrical insulator. The gas is used for electrical insulation, arc suppression, and current interruption in high-voltage electrical equipment.

The electrical equipment containing SF_6 is designed not to leak, because if too much gas leaks out, the equipment may not operate correctly and could become unsafe. State-of-the-art circuit breakers are gas-tight and are designed to achieve a leak rate of less than or equal to 0.5% per year (by weight). This is the same leak rate from the U.S. EPA report, *SF_6 Leak Rates from High Voltage Circuit Breakers - EPA Investigates Potential Greenhouse Gas Emission Source*, J. Blackman, Program Manager, EPA, and M. Avery, ICF Consulting, and Z. Taylor, ICF Consulting. This is also the International Electrotechnical Commission (IEC) maximum leak rate standard.

Table 3-5 summarizes the potential SF_6 emissions for the planned equipment based on this leak rate. Note that these emissions represent less than 0.03% of the total GHG emissions from the proposed Project.

TABLE 3-5. Potential fugitive SF_6 emissions from high voltage electrical equipment and the equivalent GHG emissions.

Breaker Type	Breaker Count	Total SF_6 per Component pounds	Leak Rate % per year	SF_6 Emissions ton/year	CO_2e Factor[4]	Potential to Emit ton CO_2e /yr
230 kV	8	135	0.5%	0.0027	23,900	64.5
145 kV	8	90	0.5%	0.0018	23,900	43.0
13.8 kV		35	0.5%	0.0000	23,900	0.0
TOTAL FUGITIVE EMISSIONS				**0.0045**	**23,900**	**107.6**

Footnotes

Potential emissions are based on the International Electrotechnical Commission (IEC) maximum leak rate standard of 0.5% per year.

3.6 Total Project Potential PSD and NANSR Regulated Air Emissions.

Table 3-6 summarizes the potential emissions with controls for the new GE LM6000PC CTs, the natural gas piping systems, and the SF_6 insulated electrical equipment based on the proposed emission and operating limits in this application.

TABLE 3-6. Total potential PSD regulated air pollutants for the Redhawk Power Plant Natural Gas-Fired Simple Cycle Combustion Turbine Expansion Project.

Pollutant		Eight (8) CTs Combined ton/yr	Natural Gas Piping Systems ton/yr	SF_6 Insulated Equipment	Total Project ton/yr
Carbon Monoxide	CO	95.0			95.0
Nitrogen Oxides	NO_x	59.0			59.0
Particulate Matter	PM	54.1			54.1
Particulate Matter	PM_{10}	54.1			54.1
Particulate Matter	$PM_{2.5}$	54.1			54.1
Sulfur Dioxide	SO_2	1.9			1.9
Volatile Organic Compounds	VOC	23.1			23.1
Sulfuric Acid Mist	H_2SO_4	0.14			0.14
Fluorides (F)	F	0.0000			0.0000
Lead	Pb	0.0016			0.0016
Carbon Dioxide	CO_2	366,790.2			366,790.2
Greenhouse Gases	CO_2e	367,169.0	3,025.9	107.6	370,302.4

3.7 Potential Hazardous Air Pollutant (HAP) Emissions.

Table 3-7 is a summary of the potential hazardous air pollutant (HAP) emissions for each new CT, and for all eight (8) CTs combined. The emission factors for all HAPs except formaldehyde (CH_2O) emissions during normal operation are based on uncontrolled emission factors from the U.S. EPA's *Compilation of Air Pollutant Emission Factors, AP-42*, Volume 1: Section 3.1, Stationary Gas Turbines for Electricity Generation. Formaldehyde (CH_2O) emissions during normal operation are based on the emission limit of 91 parts per billion (ppbdv) or less at 15% O_2 for new, lean premix and diffusion-flame natural gas and oil-fired combustion turbines located at major sources of HAPs in accordance with the *National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines*, 40 CFR 63, Subpart YYYY. This emission concentration is equal to an emission rate of 0.000235 lb/mmBtu.

In the preamble to the proposed rules for Subpart YYYY, the U.S. EPA stated[1]:

> The only add-on HAP emission control technology identified in the original NESHAP rulemaking was an oxidation catalyst. No new or improved add-on control technologies that reduce HAP emissions from turbines were identified during the technology review. Our review also did not identify any new or improved operation and maintenance practices, process changes, pollution prevention approaches, or testing and monitoring techniques for stationary combustion turbines.

APS is proposing to install and operate oxidation catalyst systems on the proposed CTs in this application. The U.S. EPA's recent Information Collection Request (ICR), which was conducted recently in a reconsideration rulemaking for Subpart YYYY, has several test reports for General Electric (GE) LM6000PC units at the Middletown Power LLC Generating Plant in Middletown, Connecticut[2]. These tests were conducted in September 2022 on similar CTs also equipped with oxidation catalyst systems. The test results indicated average formaldehyde emission rates of 35.55 ppbdv at 15% O_2 on Unit 13, and 28.38 ppbdv at 15% O_2 on Unit 15. These emission rates are approximately one-third of the Subpart YYYY emission limit. Based on the U.S. EPA's evaluation of formaldehyde from similar CTs under Subpart YYYY, APS has concluded that the normal operation formaldehyde emission rate of 91 ppbdv at 15% O_2, except during turbine startup, equal to an emission rate of 0.000235 lb/mmBtu, is a conservative estimate of the maximum normal operation formaldehyde emissions from the proposed CTs in this application.

During periods of startup and shutdown, formaldehyde emissions may be elevated because the CTs are not operating in their full lean premix firing mode. During these periods, formaldehyde emissions in Table 3-7 are based on the uncontrolled emission factor of 0.000714 lb/mmBtu from AP-42, Section 3.1 noted above. The heat input rate during periods of startup and shutdown of 233.3 mmBtu per event is from Table 3-2.

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[1] Federal Register, Vol. 84, No. 71, Friday, April 12, 2019, page 15063.

[2] https://www.epa.gov/stationary-sources-air-pollution/stationary-combustion-turbines-national-emission-standards (see Survey Test Reports Part 2 (zip).

TABLE 3-7. Potential hazardous air pollutant (HAP) emissions for each new CT and for all eight (8) CTs combined based on the proposed emission limits in this application.

POLLUTANT	CAS No.	Normal Operation					Startup and Shutdown Operation					Total Potential to Emit
		Emission Factor	Each CT		Eight (8) CTs Combined		Emission Factor	Each CT		Eight (8) CTs Combined		
		lb/mmBtu	mmBtu/hr	lb/hr	mmBtu/yr	ton/yr	lb/mmBtu	mmBtu	lb/SUSD	SU/SD/yr	ton/yr	ton/yr
Acetaldehyde	75-07-0	0.000040	471	0.0188	6,271,200	0.125	0.000040	233.3	0.0093	4,320	0.020	0.146
Acrolein	107-02-8	0.000006	471	0.0030	6,271,200	0.020	0.000006	233.3	0.0015	4,320	0.003	0.023
Benzene	71-43-2	0.000012	471	0.0057	6,271,200	0.038	0.000012	233.3	0.0028	4,320	0.006	0.044
1,3-Butadiene	106-99-0	0.000000	471	0.0002	6,271,200	0.001	0.000000	233.3	0.0001	4,320	0.000	0.002
Ethylbenzene	100-41-4	0.000032	471	0.0151	6,271,200	0.100	0.000032	233.3	0.0075	4,320	0.016	0.116
Formaldehyde	50-00-0	0.000215	471	0.1015	6,271,200	0.676	0.000714	233.3	0.1666	4,320	0.360	1.035
Xylene	1330-20-7	0.000001	471	0.0006	6,271,200	0.004	0.000001	233.3	0.0003	4,320	0.001	0.005
Naphthalene	91-20-3	0.000002	471	0.0010	6,271,200	0.007	0.000002	233.3	0.0005	4,320	0.001	0.008
PAH		0.000029	471	0.0137	6,271,200	0.091	0.000029	233.3	0.0068	4,320	0.015	0.106
Propylene oxide	75-56-9	0.000130	471	0.0612	6,271,200	0.408	0.000130	233.3	0.0303	4,320	0.066	0.473
Toluene	108-88-3	0.000064	471	0.0301	6,271,200	0.201	0.000064	233.3	0.0149	4,320	0.032	0.233
TOTAL		**0.000533**		**0.25**	**6,271,200**	**1.67**	**0.001031**		**0.24**	**4,320**	**0.520**	**2.19**

Footnotes

1. The emission factors for all HAPs except formaldehyde emissions during normal operation are *uncontrolled* emission factors from the U.S. EPA's *Compilation of Air Pollutant Emission Factors, AP-42*, Volume 1: Stationary Point and Area Sources, Section 3.1, Stationary Gas Turbines for Electricity Generation. Formaldehyde emissions during startup and shutdown are based on the AP-42 emission factor.

2. Formaldehyde (CH_2O) emissions during normal operation are based on the emission limit of 91 parts per billion (ppbdv) or less at 15% O_2 for lean premix and diffusion-flame natural gas and oil-fired CTs located at major sources of HAPs in accordance with the *National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines*, 40 CFR 63, Subpart YYYY.

Chapter 4. Proposed Emission Limits.

With this application, APS requests the following emission limits be incorporated into the Redhawk Power Plant permit for the construction and operation of eight (8) new General Electric Model LM6000PC aeroderivative simple cycle combustion turbine (CT) electric generating units with water spray power augmentation, identified as Units 3 - 10.

4.1 Emission Limits for Each CT, Units 3 - 10.

4.1.1 Emission Limits

1. Excluding periods of startup and shutdown, the Permittee shall not cause to be discharged into the atmosphere from the simple cycle combustion turbines (CTs) Units 3 – 10 any gases which contain:
   a. Nitrogen oxides (NO_x) emissions in excess of 2.3 ppmvd corrected to 15 percent oxygen, based on a 1-hour average (limit is based on BACT/LAER).
   b. Carbon monoxide (CO) emissions in excess of 4.0 ppmvd corrected to 15 percent oxygen, based on a 24-hour average.
   c. Volatile organic compound (VOC) emissions in excess of 2.6 pounds per hour.
2. The Permittee shall not cause to be discharged into the atmosphere from the simple cycle combustion turbines (CTs) Units 3 – 10 any gases which contain:
   a. PM, PM_{10}, or $PM_{2.5}$ emissions in excess of 7.0 pounds per hour (limit is based on BACT).
   b. Visible emissions in excess of 20% opacity, as measured using U.S. EPA Reference Method 9.
   c. CO_2 emissions may not exceed 1,450 lb CO_2 per MWh of gross electric output for all periods of operation, including periods of startup and shutdown, based on a 12-operating month rolling average.

4.1.2 Startup and Shutdown (SU/SD).

1. "Startup" is defined as the period beginning with the ignition of fuel and ending 30 minutes later.
2. "Shutdown" is defined as the period beginning with the initiation of combustion turbine shutdown sequence and lasting until fuel combustion has ceased.
3. The total NO_x emissions during any hour, including periods of startup and shutdown, may not exceed 36.2 pounds per hour (BACT/LAER).

4.1.3 Operating Limits.

1. The total heat input to each combustion turbine, Units 3 – 10, may not exceed 783,900 mmBtu in any rolling 12-month period.

4.2 Emission Limits for All Eight CTs, Units 3 – 10 Combined.

1. Carbon monoxide (CO) emissions from the combustion turbine Units 3 – 10 combined may not exceed 95 tons in any rolling 12-month period for all periods of operation, including startup and shutdown. Compliance with this limit shall be demonstrated using a CO continuous emissions monitoring systems (CEMS).
2. Nitrogen oxides (NO_x) emissions from the combustion turbine Units 3 – 10 combined may not exceed 60 tons in any rolling 12-month period for all periods of operation, including periods of startup and shutdown. Compliance with this limit shall be demonstrated using a NO_x continuous emissions monitoring systems (CEMS).
3. Volatile organic compound (VOC) emissions from the combustion turbine Units 3 – 10 combined may not exceed 23 tons in any rolling 12-month period for all periods of operation, including periods of startup and shutdown. Compliance with this limit shall be demonstrated using records of fuel use data, startup/shutdown events, emission factors from stack tests, and an emission factor of 2.7 lbs per startup/shutdown event.

4.3 Initial Compliance Demonstration Requirements.

1. Within 60-days after achieving maximum production rate of each CT Units 3 - 10 but no later than 180 days after the initial start-up of each CT, the Permittee shall conduct performance tests using standard test methods as specified below or equivalent methods as approved by the MCAQD. These tests shall be performed at the maximum practical production rate of each unit. The performance tests shall include:

a. Carbon monoxide (CO) emissions:	40 CFR Part 60, App. A-4, Ref. Method 10.
b. Nitrogen oxides (NO_x) emissions:	40 CFR Part 60, App. A-4, Ref. Method 7E.
c. PM_{10}, $PM_{2.5}$ emissions:	40 CFR Part 60, App. A-3, Ref. Method 5 and 40 CFR Part 51 App. M, Ref. Method 202.

4.4 Monitoring and Compliance Demonstration Requirements.

1. The Permittee shall install, calibrate, maintain, and operate continuous emissions monitoring systems (CEMS) for the measurement of carbon monoxide (CO) emissions on Units 3 - 10. The CO CEMS shall be installed and operated in accordance with the requirements in 40 CFR Part 60, Appendix B, Performance Specification 4A or 4B.
2. The Permittee shall install, calibrate, maintain, and operate continuous emissions monitoring systems (CEMS) for the measurement of nitrogen oxides (NO_x) on Units 3 - 10. The NO_x CEMS shall be installed and operated in accordance with the requirements in 40 CFR Part 75.
3. The Permittee shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of fuel (natural gas) used in Units 3 - 10. The monitoring

systems shall be installed and operated in accordance with the requirements in 40 CFR Part 75, Appendix D.

4.5 Standards of Performance for Stationary Combustion Turbines, 40 CFR 60, Subpart KKKK.

1. Nitrogen oxides (NO_x) emissions may not exceed:

    a. 25 ppm at 15 percent O_2 or 1.2 lb/MWh based on a 4-hour rolling average when a valid NO_x emission rate is obtained for at least 3 of the 4 hours,

    b. 96 ppm at 15 percent O_2 or 4.7 lb/MWh when operating at less than 75 percent of peak load, or when operating at temperatures less than 0 °F.

2. Sulfur dioxide (SO_2) emissions may not exceed:

    a. 0.90 pounds of SO_2 per megawatt-hour of gross output or

    b. 0.060 lb SO_2/mmBtu heat input.

3. Install, certify, and operate a NO_x continuous emissions monitoring system (NO_x CEMS) in accordance with 40 CFR Part 75 Appendix A. (40 CFR §§ 60.4335(b) and 60.4345(a))

4.6 Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units, 40 CFR 60 Subpart TTTT.

1. Carbon dioxide (CO_2) emissions may not exceed 120 lb/MMBtu of heat input as determined by the procedures in 40 CFR § 60.5525.

Chapter 5. Applicable Requirements.

5.1 Minor New Source Review (NSR) Air Permitting Requirements.

In accordance with County Rule 241 §102.2, minor new source (NSR) review permitting requirements are applicable to a modification that would increase the source's potential to emit equal to or greater than the minor NSR modification thresholds. The minor NSR program requires the application of the Best Available Control Technology (BACT) or Reasonably Available Control Technology (RACT), as required by Rule 241, Sections 304 or 305, for each new emissions unit. The minor NSR threshold levels for any new or modified stationary source are summarized below. The proposed Project's potential to emit, the minor NSR BACT threshold levels, and the minor NSR applicability are summarized in Table 5-1. From Table 5-1, this Project will exceed the minor NSR BACT thresholds for NO_x, PM_{10}, and $PM_{2.5}$ emissions. However, in accordance with Rule 241, Section 103, the provisions of this rule shall not apply if the emissions are subject to major source requirements under Rule 240. Because this Project will be subject to Rule 240 for NO_x, PM_{10}, and $PM_{2.5}$ emissions, these pollutants are not subject to review under the minor NSR program.

TABLE 5-1. Total new stationary source potential emissions, the minor NSR threshold levels under Rule 241, and minor NSR applicability. All emissions are tons per year.

Pollutant		Total Potential to Emit	Minor NSR Threshold	OVER?	Minor NSR BACT Threshold	OVER?
Carbon Monoxide	CO	95.0	50	**YES**	100	**NO**
Nitrogen Oxides	NO_x	59.0	20	**YES**	40	**YES**
Particulate Matter	PM_{10}	54.1	7.5	**YES**	15	**YES**
Particulate Matter	$PM_{2.5}$	54.1	5	**YES**	10	**YES**
Sulfur Dioxide	SO_2	1.9	20	**NO**	40	**NO**
Volatile Organic Compounds	VOC	23.1	20	**YES**	40	**NO**

5.2 Major New Source Review (NSR) Air Permitting Requirements.

The Redhawk Power Plant in Maricopa County is classified as attainment for all criteria air pollutants except ozone. Maricopa County and the proposed site are classified as a marginal nonattainment area for the 8-hour ozone standard. However, the area may soon be reclassified as a serious nonattainment area.

5.2.1 Prevention of Significant Deterioration of Air Quality (PSD) Program.

The Prevention of Significant Deterioration of Air Quality (PSD) program in the Code of Federal Regulations, in 40 CFR §52.21 and County Rule 240, Section 305 requires that a major modification of a major stationary source within an attainment area must undergo PSD review and obtain a construction permit prior to commencing construction. In accordance with 40 CFR §52.21(b)(2)(i), a major modification means any physical change in or change in the method of operation of a major stationary source that would result in a significant emissions increase of a regulated NSR pollutant and a significant net emissions increase of that pollutant from the major stationary source.

Table 5-2 is a summary of the potential emissions for all PSD (and NANSR) regulated pollutants based on the proposed emissions and operating limits in this application. From Table 5-2, the Project will result in significant emissions increase and a significant net emissions increase of NO_x, PM, PM_{10}, $PM_{2.5}$, and greenhouse gas (GHG) emissions from the Redhawk Power Plant. Therefore, this Project is subject to PSD review for NO_x, PM, PM_{10}, $PM_{2.5}$, and GHG emissions, and the proposed Project will require the application of the Best Available Control Technology (BACT) for these pollutants. ***Note that NO_x emissions (as NO_2) are regulated both as a PSD pollutant as NO_2 and also as an ozone nonattainment area NANSR pollutant.***

TABLE 5-2. Potential emissions for the proposed new Project and PSD or NANSR applicability. All emissions are tons per year.

Pollutant		Total Project Potential to Emit	PSD / NANSR Significant Threshold	OVER?
Carbon Monoxide	CO	95.0	100	**NO**
Nitrogen Oxides	NO_x	59.0	40	**YES**
Particulate Matter	PM	54.1	25	**YES**
Particulate Matter	PM_{10}	54.1	15	**YES**
Particulate Matter	$PM_{2.5}$	54.1	10	**YES**
Sulfur Dioxide	SO_2	1.9	40	**NO**
Volatile Organic Compounds	VOC	23.1	40	**NO**
Sulfuric Acid Mist	H_2SO_4	0.14	7	**NO**
Fluorides (F)	F	0.0000	3	**NO**
Lead	Pb	0.0016	0.6	**NO**
Carbon Dioxide	CO_2	366,790.2	n/a	**n/a**
Greenhouse Gases	CO_2e	370,302.4	75,000	**YES**

5.2.2 Nonattainment Area New Source Review (NANSR) Program.

Maricopa County and the Redhawk Power Plant are classified as a marginal nonattainment area for the 8-hour ozone standard. The regulated ozone nonattainment area pollutants are NO_x and VOC. Major modifications of a major stationary source are also subject to review under the permit requirements for new major sources or major modifications located in nonattainment areas in County Rule 240, Section 304 which incorporates 40 CFR §51.165(a)(1). A major modification to a major stationary source in a marginal ozone nonattainment area is a significant emissions increase of a regulated NSR pollutant and a significant net emissions increase NO_x or VOC emissions.

For a marginal ozone nonattainment area, the significant threshold for both NO_x and VOC emissions is 40 tons per year. From Table 5-2, the proposed project will result in significant emissions increase and a significant net emissions increase for NO_x emissions. Therefore, this Project is subject to NANSR review for NO_x emissions, and the proposed Project will require the application of the Lowest Achievable Emission Rate (LAER) and emission offsets for NO_x emissions. This application includes a LAER analysis for NO_x emissions in Chapter 7 and an emissions offset analysis in Chapter 10. Note that if the area is reclassified as a serious nonattainment area, the significant threshold for both NO_x and VOC emissions is reduced to 25 tons per year.

5.3 Standards of Performance for Stationary Combustion Turbines, 40 CFR 60, Subpart KKKK.

In 2006, the U.S. EPA finalized the *Standards of Performance for Stationary Combustion Turbines* under 40 CFR 60, Subpart KKKK. In accordance with 40 CFR § 60.4300, combustion turbines which commenced construction, modification, or reconstruction after February 18, 2005 are subject to this subpart. The pollutants regulated under Subpart KKKK include NO_x and sulfur dioxide (SO_2). The proposed natural gas-fired simple cycle stationary CTs meet the affected facility definition under this standard. Therefore, the following NSPS requirements will apply to the proposed CTs.

5.3.1 Sulfur Dioxide (SO_2) Emissions.

The applicable new SO_2 emission standard for the proposed simple cycle CTs under Subpart KKKK are:

> **§ 60.4330 What emission limits must I meet for sulfur dioxide (SO_2)?**
>
> (a) If your turbine is located in a continental area, you must comply with either paragraph (a)(1), (a)(2), or (a)(3) of this section. If your turbine is located in Alaska, you do not have to comply with the requirements in paragraph (a) of this section until January 1, 2008.
>
> (1) You must not cause to be discharged into the atmosphere from the subject stationary combustion turbine any gases which contain SO_2 in excess of 110 nanograms per Joule (ng/J) (0.90 pounds per megawatt-hour (lb/MWh)) gross output;
>
> (2) You must not burn in the subject stationary combustion turbine any fuel which contains total potential sulfur emissions in excess of 26 ng SO_2/J (0.060 lb SO2/MMBtu) heat input. If your turbine simultaneously fires multiple fuels, each fuel must meet this requirement;

The applicable limits are 0.90 pounds of SO_2 per megawatt-hour of gross output or 0.060 lb SO_2/mmBtu heat input. The combustion of pipeline natural gas will meet this emission standard.

5.3.2 Nitrogen Oxides (NO_x) Emissions.

The NO_x emission standards under 40 CFR § 60.4320 are specified in Subpart KKKK, Table 1. The standards for new, modified, or reconstructed turbines firing natural gas and with a heat input greater than 50 mmBtu/hr and less than or equal to 850 mmBtu/hr is 25 ppm at 15 percent O_2 or 1.2 pounds per MWh of useful output. For these combustion turbines which use the mechanical and thermal energy output of the CTs only to produce electricity, the gross useful output is the gross electrical output from the turbine/generator set.

Excerpts from Table 1 to 40 C.F.R. Part 60, Subpart KKKK: NO_X emission limits for new stationary combustion turbines.

Combustion turbine type	Combustion turbine heat input at peak load (HHV)	NO_X emission standard
New turbine firing natural gas.	Greater than 50 mmBtu/hr and less than or equal to 850 mmBtu/hr	25 ppm at 15 percent O_2 or 1.2 lb/MWh
Turbines operating at less than 75% of peak load, … and turbine operating at less than 0 °F	> 30 MW output	96 ppm at 15 percent O_2 or 4.7 lb/MWh.

APS is proposing to install a NO_x continuous emissions monitoring system (NOx CEMS) in accordance with the requirements in the federal Acid Rain Program in 40 CFR Part 75. In accordance with the Subpart KKKK requirements in 40 CFR § 60.4380 **How are excess emissions and monitor downtime defined for NOx?**, subparagraph (b), an excess emission is defined as:

> **§ 60.4380 How are excess emissions and monitor downtime defined for NO_X?**
>
> (b) For turbines using continuous emission monitoring, as described in §§ 60.4335(b) and 60.4345:
>
> (1) An excess emissions is any unit operating period in which the 4-hour or 30-day rolling average NO_X emission rate exceeds the applicable emission limit in § 60.4320. For the purposes of this subpart, a "4-hour rolling average NO_X emission rate" is the arithmetic average of the average NO_X emission rate in ppm or ng/J (lb/MWh) measured by the continuous emission monitoring equipment for a given hour and the three unit operating hour average NO_X emission rates immediately preceding that unit operating hour. Calculate the rolling average if a valid NO_X emission rate is obtained for at least 3 of the 4 hours. For the purposes of this subpart, a "30-day rolling average NO_X emission rate" is the arithmetic average of all hourly NO_X emission data in ppm or ng/J (lb/MWh) measured by the continuous emission monitoring equipment for a given day and the twenty-nine unit operating days immediately preceding that unit operating day. A new 30-day average is calculated each unit operating day as the average of all hourly NO_X emissions rates for the preceding 30 unit operating days if a valid NO_X emission rate is obtained for at least 75 percent of all operating hours.

Therefore, the applicable NO_x emission limits under Subpart KKKK are:

1. 25 ppm at 15 percent O_2 or 1.2 lb/MWh based on a 4-hour rolling average when a valid NO_x emission rate is obtained for at least 3 of the 4 hours, and
2. 25 ppm at 15 percent O_2 or 1.2 lb/MWh based on a 30-operating day rolling average.
3. 96 ppm at 15 percent O_2 or 4.7 lb/MWh when operating at less than 75 percent of peak load, or when operating at temperatures less than 0 °F

The proposed BACT/LAER NO_x emission limit of 2.3 ppmdv at 15% excess oxygen based on a 1-hour average is more stringent than the NO_x emissions standards under Subpart KKKK.

5.3.3 General Compliance Requirement under 40 CFR § 60.4333.

Under 40 CFR § 60.4333, the CTs, the SCR, and the oxidation catalyst air pollution control equipment and monitoring equipment must be operated and maintained in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction.

5.3.4 NO_x Monitoring Requirements under 40 CFR § 60.4335.

The compliance monitoring requirements of Subpart KKKK allows the use of NO_x monitoring methods that are required under the federal Acid Rain Program in 40 CFR Part 75. APS proposes to install and certify a NO_x continuous emission monitoring systems (NO_x CEMS) consisting of a NO_x monitor and a diluent gas oxygen (O_2) monitor to determine the hourly NO_x emission rate in ppm corrected to 15% O_2 in accordance with the requirements of 40 CFR Part 75.

5.3.5 SO_2 Monitoring Requirements under 40 CFR § 60.4360 and § 60.4365.

Subpart KKKK also allows for several acceptable monitoring methods to demonstrate compliance with the SO_2 emission limits. To be exempted from fuel sulfur monitoring requirements, APS must demonstrate that the potential sulfur emissions expressed as SO_2 are less than 0.060 lb/mmBtu for continental US areas. The demonstration can be made by providing information from a current, valid purchase contract, tariff sheet or transportation contract for the fuel, specifying that the total sulfur content for natural gas use is 20 grains of sulfur or less per 100 standard cubic feet. The demonstration can also be made using representative fuel sampling data which show that the sulfur content does not exceed 0.060 lb SO_2/mmBtu. The fuel sampling data specified in 40 CFR Part 75, Appendix D, section 2.3.1.4 or 2.3.2.4 may be used to make this demonstration under Subpart KKKK.

5.3.6 Performance Tests under 40 CFR § 60.4400.

Initial performance testing is required in accordance with 40 CFR §60.8. Subsequent performance tests must be conducted on an annual basis. As described in §60.4405, the NO_x CEMS RATA tests may be used as the initial NO_x performance test. The SO_2 performance test may be a fuel analysis of the natural gas, performed by the operator, fuel vendor, or other qualified agency. The required test methods are detailed in 40 CFR §60.4415.

5.3.7 Reporting Requirements under 40 CFR § 60.4375.

For each affected unit required to continuously monitor parameters or emissions, or to periodically determine the fuel sulfur content under this subpart, reports of excess emissions and monitor downtime must be submitted in accordance with 40 CFR § 60.7(c). Excess emissions must be reported for all periods of unit operation, including start-up, shutdown, and malfunction. Paragraphs § 60.4380 and § 60.4385 describe how excess emissions are defined for Subpart KKKK.

For each affected unit that conducts annual performance tests in accordance with § 60.4340(a), a written report of the results of each performance test must be submitted before the close of business on the 60th day following the completion of the performance test.

5.4 Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units, 40 CFR 60 Subpart TTTT.

These CTs may also be subject to the *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units*, 40 CFR 60 Subpart TTTT. The applicable carbon dioxide (CO_2) requirement in Subpart TTTT, Table 2 are summarized below.

Affected EGU	CO_2 Emission standard
Newly constructed or reconstructed stationary combustion turbine that supplies its design efficiency or 50 percent, whichever is less, times its potential electric output or less as net-electric sales on either a 12-operating month or a 3-year rolling average basis and combusts more than 90% natural gas on a heat input basis on a 12-operating-month rolling average basis	50 kg CO_2 per gigajoule (GJ) of heat input (120 lb CO_2/MMBtu).
Newly constructed and reconstructed stationary combustion turbine that combusts 90% or less natural gas on a heat input basis on a 12-operating-month rolling average basis	50 kg CO_2/GJ of heat input (120 lb/MMBtu) to 69 kg CO_2/GJ of heat input (160 lb/MMBtu) as determined by the procedures in § 60.5525.

However, the CO_2 emissions standards in 40 CFR 60.5520(d)(1) states:

> (1) Stationary combustion turbines that are only permitted to burn fuels with a consistent chemical composition (i.e., uniform fuels) that result in a consistent emission rate of 160 lb CO_2/MMBtu or less are not subject to any monitoring or reporting requirements under this subpart. **These fuels include, but are not limited to, natural gas, methane, butane, butylene, ethane, ethylene, propane, naphtha, propylene, jet fuel kerosene, No. 1 fuel oil, No. 2 fuel oil, and biodiesel.** Stationary combustion turbines qualifying under this paragraph are only required to maintain purchase records for permitted fuels.

Therefore, while these CTs are subject to the standards in 40 CFR 60 Subpart TTTT, in accordance with 40 CFR 60.5520(d)(1), there would be no monitoring or reporting requirements for either natural gas or diesel fuel oil-fired CTs under Subpart TTTT.

5.5 Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units, 40 CFR 60 Subpart TTTTa *(proposed)*.

In May 2023, the U.S. EPA proposed revised new source performance standards (NSPS) for GHG emissions from new fossil fuel-fired stationary combustion turbine EGUs. Upon promulgation of 40 CFR part 60, subpart TTTTa, stationary combustion turbines that commence construction or reconstruction after May 23, 2023 and meet the relevant applicability criteria will be subject to 40 CFR part 60, subpart TTTTa. For new and reconstructed fossil fuel-fired combustion turbines, EPA is proposing to create three subcategories based on the function the combustion turbine serves:

1. Low load ("peaking units") subcategory that consists of combustion turbines with a capacity factor of less than 20 percent;
2. Intermediate load subcategory for combustion turbines with a capacity factor that ranges between 20 percent and a source-specific upper bound that is based on the design efficiency of the combustion turbine;
3. Base load subcategory for combustion turbines that operate above the upper-bound threshold for intermediate load turbines.

For the low load subcategory, EPA is proposing that the best system of emissions reduction (BSER) is the use of lower emitting fuels (e.g., natural gas and distillate oil) with standards of performance ranging from 120 lb CO_2/MMBtu to 160 lb CO_2/MMBtu, depending on the type of fuel combusted.

With this application, APS is proposing to limit the heat input to each CT to a capacity factor of 19.4% which will make these CTs low load or peaking units under Subpart TTTTa[3].

5.6 Acid Rain Program.

In accordance with the applicability requirements of the Acid Rain Program in 40 CFR § 72.6(a)(3)(i), a *utility unit* that is a *new unit* shall be an affected unit:

> **§ 72.6 Applicability.**
>
> (a) Each of the following units shall be an affected unit, and any source that includes such a unit shall be an affected source, subject to the requirements of the Acid Rain Program:
>
> (3) A utility unit, except a unit under paragraph (b) of this section, that:
>
> (i) Is a new unit;

Under 40 CFR § 72.2, "utility unit" and "new unit" mean:

> *Utility unit means a unit owned or operated by a utility:*
>
> *(1) That serves a generator in any State that produces electricity for sale, or*
>
> *(2) That during 1985, served a generator in any State that produced electricity for sale.*
>
> *New unit* means a unit that commences commercial operation on or after November 15, 1990, including any such unit that serves a generator with a nameplate capacity of 25 MWe or less or that is a simple combustion turbine.

Since these CTs would produce electricity for sale, they are "utility units." The definition of "new unit" includes a unit that commences commercial operation on or after November 15, 1990, including a simple combustion turbine. "Simple combustion turbines" and "Unit" are subsequently defined as:

> *Simple combustion turbine* means a unit that is a rotary engine driven by a gas under pressure that is created by the combustion of any fuel. This term includes combined cycle units without auxiliary firing. This term excludes combined cycle units with auxiliary firing, unless the unit did not use the auxiliary firing from 1985 through 1987 and does not use auxiliary firing at any time after November 15, 1990.
>
> *Unit* means a fossil fuel-fired combustion device.

These CTs would be fossil fuel-fired combustion devices that commenced commercial operation on or after November 15, 1990. These new CTs would also be simple combustion turbine devices, and they are also utility units. Therefore, these new CTs will be affected units under the Acid Rain Program. APS will submit an Acid Rain Permit application to EPA and provide a copy to Maricopa County Air Quality Department (MCAQD).

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[3] APS reserves the right to request a different limit should the subcategories promulgated in the final rule differ materially from the proposed subcategories.

5.7 National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines 40 CFR Part 63, Subpart YYYY.

The *National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines*, 40 CFR Part 63, Subpart YYYY apply to new sources located at a major source of hazardous air pollutants (HAPs). A major stationary source of HAPs is any stationary source with potential emissions of any individual HAP of more than 10 tons per year, or any stationary source with total potential HAP emissions of more than 25 tons per year. The Redhawk Power Plant is currently a minor or area source of HAPs.

In accordance with 40 CFR §63.6090(b)(4), existing CTs which commenced construction or reconstruction on or before January 14, 2003 do not have to meet the requirements of this subpart. No initial notification is necessary for any existing CT. In accordance with 40 CFR § 63.6090(a)(2), a stationary combustion turbine is new if you commenced construction of the stationary combustion turbine after January 14, 2003.

Table 5-3 is a summary of the total potential HAP emissions for the Redhawk Power Plant after the addition of the new simple cycle CT Units 3 – 10. From Table 5-3, the total potential HAP emissions after the installation of the new CTs are less than 10 tons per year for each individual HAP, and less than 25 tons per year for all HAPs combined. Therefore, the Redhawk Power Plant will remain a minor or area source after this Project, and the standards under 40 CFR Part 63 Subpart YYYY do not apply to the new (or existing) units.

TABLE 5-3. Total potential hazardous air pollutant emissions for the Redhawk Power Plant with the addition of the new simple cycle CT Units 3 - 8. All emissions are tons per year.

Hazardous Air Pollutant	CAS No.	Unit CC1	Unit CC2	New CT Units 3 - 10	Fire Pump	Cooling Towers	Total Potential to Emit
Acetaldehyde	75-07-0	0.042	0.042	0.146	0.00028		0.23
Acrolein	107-02-8	0.080	0.080	0.023	0.00003		0.18
Benzene	71-43-2	0.090	0.090	0.044	0.00034		0.22
1,3-Butadiene	106-99-0	0.005	0.005	0.002	0.00001		0.01
Ethylbenzene	100-41-4	0.090	0.090	0.116			0.30
Formaldehyde	50-00-0	0.444	0.444	1.035	0.00043		1.92
Hexane		0.305	0.305				0.61
Naphthalene	91-20-3	0.016	0.016	0.005			0.04
PAH		0.028	0.028	0.008	0.00006		0.06
Propylene	115-07-1				0.00103		0.00
Propylene Oxide	75-56-9	0.364	0.364	0.106			0.83
Toluene	108-88-3	1.630	1.630	0.473	0.00015		3.73
Xylene	1330-20-7	0.180	0.180	0.233	0.00010		0.59
TOTAL		**3.275**	**3.275**	**2.190**	**0.00243**	**0.000**	**8.74**

5.8 40 CFR 64 – Compliance Assurance Monitoring.

The Compliance Assurance Monitoring (CAM) program is codified in 40 CFR Part 64. CAM plan requirements apply to any pollutant specific emissions unit with uncontrolled potential emissions above the major source threshold of 100 tons per year that uses a control device to achieve compliance with an emission limitation or standard. Uncontrolled NO_x and CO emissions for the eight (8) simple cycle CTs exceed this threshold.

With respect to NO_x emissions, the new CTs will be subject to 40 CFR 60 Subpart KKKK and are also affected units under the Acid Rain Program in 40 CFR Part 72 – 75. In accordance with the CAM applicability requirements in 40 CFR § 64.2(b)(1)(i) and (iii), the CAM plan requirements do not apply to emission units subject to these programs.

There are no specific applicable requirements for CO emissions from these CTs under a New Source Performance Standard (NSPS) or under any National Emission Standard for Hazardous Air Pollutants (NESHAP). APS is proposing to use CEMS for monitoring CO emissions from the proposed units. In accordance with 40 CFR § 64.3(d)(2)(ii), the use of a CO CEMS that is installed and operated in accordance with 40 CFR Part 60 and Appendix B of Part 60 shall be deemed to satisfy the general design criteria CAM plans.

Chapter 6. Control Technology Review Methodology.

6.1 Best Available Control Technology (BACT).

The Clean Air Act defines "best available control technology" (BACT) as:

> "...an emission limitation based on the maximum degree of reduction for each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of 'best available control technology' result in emissions of any pollutants which will exceed the emissions allowed by any applicable standard established pursuant to section 111 or 112 of this Act. Emissions from any source utilizing clean fuels, or any other means, to comply with this paragraph shall not be allowed to increase above levels that would have been required under this paragraph as it existed prior to November 15, 1990."

Under the Maricopa County Air Pollution Control Regulations, Rule 100, Section 200.25, "best available control technology" (BACT) means:

200.25 BEST AVAILABLE CONTROL TECHNOLOGY (BACT): An emissions limitation, based on the maximum degree of reduction for each pollutant, subject to regulation under the Act, which would be emitted from any proposed stationary source or modification, which the Control Officer, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of such pollutant. Under no circumstances shall BACT be determined to be less stringent than the emission control required by an applicable provision of these rules or of any State or Federal laws ("Federal laws" include the EPA approved State Implementation Plan (SIP)). If the Control Officer determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.

The BACT requirement applies for a given pollutant to each individual new or modified emission unit when the project, on a facility-wide basis, has a significant net emissions increase for that pollutant. Individual BACT determinations are performed on a unit-by-unit, pollutant-by-pollutant basis.

6.2 Top Down BACT Methodology.

The United States Environmental Protection Agency (U.S. EPA) recommends a "top-down" approach in conducting a BACT or Lowest Available Emission Rate (LAER) analysis. This method evaluates progressively less stringent control technologies until a level of control considered BACT is reached, based on the environmental, energy, and economic impacts. The five steps of a top-down BACT analysis are:

1. Identify all available control technologies with practical potential for application to the emission unit and regulated pollutant under evaluation;
2. Eliminate all technically infeasible control technologies;
3. Rank remaining control technologies by effectiveness and tabulate a control hierarchy;
4. Evaluate most effective controls and document results; and
5. Select BACT, which will be the most effective practical option not rejected, based on economic, environmental, and/or energy impacts.

The impact analysis of any BACT review includes an evaluation of environmental, energy, technical, and economic impacts. The net environmental impact associated with a control alternative may be considered if dispersion modeling analyses are performed. The energy impact analysis estimates the direct energy impacts of the control alternatives in units of energy consumption. If possible, the energy requirements for each control option are assessed in terms of total annual energy consumption. The economic impact of a control option is assessed in terms of cost effectiveness and ultimately, whether the option is economically reasonable. The economic impacts are reviewed on a cost per ton controlled basis, as directed by the U.S. EPA's Office of Air Quality Planning and Standards (OAQPS) Cost Control Manual, Fifth Edition.

The EPA has consistently interpreted the statutory and regulatory BACT definitions as containing two core requirements, which EPA believes must be met by any BACT determination, irrespective of whether it is conducted in a "top-down" manner. First, the BACT analysis must include consideration of the most stringent available technologies: i.e., those that provide the "maximum degree of emissions reduction." Second, any decision to require a lesser degree of emissions reduction must be justified by an objective analysis of "energy, environmental, and economic impacts" contained in the record of the permit decisions.

6.3 Technical Feasibility.

Step 2 of the BACT analysis involves the evaluation of all of the identified available control technologies from Step 1 to determine their technical feasibility. A control technology is technically feasible if it has been previously installed and operated successfully at a similar emission source, or there is technical agreement that the technology can be applied to the emission source. Technical infeasibility is demonstrated through clear physical, chemical, or other engineering principles that demonstrate that technical difficulties preclude the successful use of the control option.

The technology must be commercially available for it to be considered as a candidate for BACT. EPA's New Source Review Workshop Manual, page B.12 states, "Technologies which have not yet been applied to (or permitted for) full scale operations need not be considered available; an applicant should be able to purchase or construct a process or control device that has already been demonstrated in practice."

In general, if a control technology has been "demonstrated" successfully for the type of emission source under review, then it would normally be considered technically feasible. For an undemonstrated technology, "availability" and "applicability" determine technical feasibility. Page B.17 of the New Source Review Workshop Manual states:

> Two key concepts are important in determining whether an undemonstrated technology is feasible: "availability" and "applicability." As explained in more detail below, a technology is considered "available" if it can be obtained by the applicant through commercial channels or is otherwise available within the common sense meaning of the term. An available technology is "applicable" if it can reasonably be installed and operated on the source type under consideration. A technology that is available and applicable is technically feasible.
>
> Availability in this context is further explained using the following process commonly used for bringing a control technology concept to reality as a commercial product:
>
> - concept stage;
> - research and patenting;
> - bench scale or laboratory testing;
> - pilot scale testing;
> - licensing and commercial demonstration; and
> - commercial sales.

Applicability involves not only commercial availability (as evidenced by past or expected near-term deployment on the same or similar type of emission source), but also involves consideration of the physical and chemical characteristics of the gas stream to be controlled. A control method applicable to one emission source may not be applicable to a similar source depending on differences in gas stream characteristics.

6.4 Economic Feasibility.

Economic feasibility is normally evaluated according to the average and incremental cost effectiveness of the control option. From the U.S. EPA's New Source Review Manual, page B.31, average cost effectiveness is the dollars per ton of pollutant reduced. The incremental cost effectiveness is the cost per ton reduced from the technology being evaluated as compared to the next lower technology. The EPA NSR Review Manual states that, "where a control technology has been successfully applied to similar sources in a source category, an applicant should concentrate on documenting significant cost differences, if any, between the application of the control technology on those sources and the particular source under review".

In addition to the average and incremental cost effectiveness analysis, EPA has also used direct comparisons of control technology costs to overall project costs as part of recent GHG BACT determinations. Regarding economic impacts, in its PSD GHG BACT guidance EPA states[4]:

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[4] EPA, EPA-457/B-11-001, *PSD and Title V Permitting Guidance for Greenhouse Gases,* (Mar. 2011), page 42.

> EPA recognizes that at present CCS is an expensive technology, largely because of the costs associated with CO_2 capture and compression, and these costs will generally make the price of electricity from power plants with CCS uncompetitive compared to electricity from plants with other GHG controls. Even if not eliminated in Step 2 of the BACT analysis, on the basis of the current costs of CCS, we expect that CCS will often be eliminated from consideration in Step 4 of the BACT analysis, even in some cases where underground storage of the captured CO_2 near the power plant is feasible.

The U.S. EPA evaluated the costs of CCS in its Response to Public Comments (October, 2011) for the Palmdale Hybrid Power Project, a 570 MW power plant based on approximately 520 MW of natural gas-fired combined cycle units and 50 MW of solar photovoltaic systems. In the EPA's analysis, the estimated capital costs for the Project are \$615-\$715 million, equal to an annualized cost of about \$35 million over the 20 year lifetime of the facility. In comparison, the estimated annual cost for CCS for this Project is about \$78 million, ***or more than twice the value of the facility's annual capital costs***. Based on these very high costs, EPA eliminated CCS as an economically infeasible control option. The EPA's decision to reject CCS based on these very high annual costs was upheld on appeal by the U.S. EPA's Environmental Appeals Board (EAB), PSD Appeal No. 11 -07, decided September 17, 2012.

The EAB also rejected a challenge to a PSD permit for the construction of a new ethylene production unit in Baytown, Texas. The EAB upheld the determination that the installation of CCS was too expensive, on a total cost basis, to be selected as BACT for limiting GHG emissions from the proposed unit.

6.4.1 Average Cost Effectiveness.

In the EPA's New Source Review Manual, page B.37, average cost effectiveness is calculated as:

$$\text{Average Cost Effectiveness (\$ per ton removed)} = \frac{\text{Control option annualized cost}}{\text{Baseline emission rate} - \text{Control option emissions rate}}$$

The average cost effectiveness is based on the overall reduction in the air pollutant from the baseline emission rate. In the draft Workshop Manual, the EPA states that the baseline emission rate represents uncontrolled emissions for the source. However, the manual also states that when calculating the cost effectiveness of adding controls to inherently lower emitting processes, baseline emissions may be assumed to be the emissions from the lower emitting process itself.

6.4.2 Incremental Cost Effectiveness.

In addition to determining the average cost effectiveness of a control option, the U.S. EPA's New Source Review Manual states that the incremental cost effectiveness between dominant control options should also be calculated. The incremental cost effectiveness compares the costs and emissions performance level of a control option to those of the next most stringent control option:

$$\text{Incremental Cost (\$ per incremental ton removed)} = \frac{\text{Control option annualized cost} - \text{Next control option annualized cost}}{\text{Next control option emission rate} - \text{Control option emissions rate}}$$

6.5 Alternative to Top-Down BACT Analysis

In the Maricopa County Air Quality Permitting Handbook, August 2023, MCAQD states that to streamline the BACT selection process, MCAQD will accept BACT for the same or similar source category as listed by the South Coast Air Quality Management District (SCAQMD), San Joaquin Valley Air Pollution Control District (SJVAPCD), the Bay Area Air Quality Management District (BAAQMD), or another regulatory agency accepted by MCAQD as a viable alternative.

If an owner or operator of a source opts to select control technology for the same or similar source category accepted by the air quality management districts in California, the owner or operator may forego conducting the top-down BACT analysis.

6.6 Scope of the Control Technology Review.

The U.S. EPA has a longstanding policy regarding the scope of control technology options which the review agency may consider in a control technology review or BACT analysis. The scope of potential options relates directly to a proposed project's basic purpose or design. In short, the list of options should not include processes or options that would fundamentally redefine the source proposed by the applicant.

In the U.S. EPA EAB decision on the Prairie State Generating Station, PSD Appeal No. 05-05, the EAB explained (pages 27-28) that the facility's "basic purpose" or basic design," as defined by the applicant, is the fundamental touchstone of EPA's policy on "redefining the source":

> ...Congress intended the permit applicant to have the prerogative to define certain aspects of the proposed facility that may not be redesigned through application of BACT and that other aspects must remain open to redesign through the application of BACT. The parties' arguments, properly framed in light of their agreement on this central proposition, thus concern the proper demarcation between those aspects of a proposed facility that are subject to modification through the application of BACT and those that are not.
>
> We see no fundamental conflict in looking to a facility's basic "purpose" or to its "basic design" in determining the proper scope of BACT review, nor do we believe that either approach is at odds with past Board precedent.

This EAB decision was upheld by the United States Court of Appeals, 7th Circuit.[5]

When EPA issued guidance in 2011 for conducting control technology reviews for greenhouse gas (GHG) emissions, EPA confirmed that a BACT analysis should not redefine the source's purpose:[6]

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[5] *Sierra Club v. EPA*, 499 F.3d 653 (7th Cir. 2007).

[6] U.S. EPA, EPA-457/B-11-001, *PSD and Title V Permitting Guidance for Greenhouse Gases* 26 (Mar. 2011) (citing *Prairie State*, 13 E.A.D. at 23).

> While Step 1 [of a BACT process] is intended to capture a broad array of potential options for pollution control, this step of the process is not without limits. EPA has recognized that a Step 1 list of options need not necessarily include lower pollution processes that would fundamentally redefine the nature of the source proposed by the permit applicant. BACT should generally not be applied to regulate the applicant's purpose or objective for the proposed facility.

The EAB has analyzed the redefinition of the source concept in the context of a past permitting proceeding similar to the proposed Project. In their challenges to a PSD permit issued for the Pio Pico Energy Center, petitioners asserted before the EAB that EPA had erred in eliminating combined-cycle gas turbines in Step 2 of its BACT analysis for GHG emissions. Like the proposed project, Pio Pico is a simple cycle gas-fired facility designed to back up renewable generation by providing peaking and load-shaping capability. As the EAB recognized in its Pio Pico decision and consistent with EPA guidance, a permitting authority can consider peaking facilities, intermediate load facilities and base load facilities to be different electricity generation source types. The EAB explained how "plants operating in 'peaking mode' typically remain idle much of the time but can be started up when power demand increases … and, unlike base load plants, typically use simple-cycle rather than combined-cycle units as well as smaller turbines."[7]

The U.S. EPA has also addressed the issue of whether a peaking facility must consider energy storage such as batteries in the control technology review. In the U.S. EPA's Environmental Appeals Board (EAB) decision for the APS Ocotillo Power Plant[8], the EAB stated that "Maricopa County did not abuse its discretion when it determined that pairing energy storage at this facility would "redefine the source", making the following statements and conclusions.

> But Step 1's broad look is "not without limits." *Id.* Consideration of fundamentally different facility types than those proposed by permit applicants generally is not required. Indeed, EPA guidance and Board precedent, affirmed by the U.S. Court of Appeals for the Seventh Circuit, give permitting authorities the discretion to exclude a proposed control alternative from consideration in the BACT analysis, if that proposed alternative would "redefine the design of the source."

The EAB went on to state (page 336):

> As explained in *La Paloma*, to determine whether an emissions control option would fundamentally redefine a proposed source, permit issuers should begin by examining how the permit applicant defines the proposed facility's "end, object, aim, or purpose," i.e., its "basic design." That "basic design" typically is set forth in the permit application and supporting materials in the administrative record. *Id.* at 286; *accord Palmdale*, 15 E.A.D. at 731; *Desert Rock*, 14 E.A.D. at 530; *Prairie State*, 13 E.A.D. at 21-23. The permit issuer should then take a "hard look" at the applicant's "basic design," identifying design elements that are "inherent" to the applicant's purpose and design elements that possibly could be altered to achieve pollutant emissions reductions without disrupting that purpose.

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[7] *In re Pio Pico Energy Center*, PSD Appeal Nos. 12-04 through 12-06, slip op. at 63 (EAB Aug. 2, 2013).

[8] In Arizona Public Services Company, PSD Appeal No. 16-01, Order Denying Review, September 1, 2016 page 328.

The EAB concluded this issue stating:

> The administrative record in this case supports Maricopa County's conclusion that integrating energy storage into the Ocotillo project would interfere with Arizona Public Service's ability to meet its customers' needs for "rapid, reliable power," as that option likely would not allow Arizona Public Service to meet "short peak demand[s]," "several short peak demands in a row," or "extended peak demand[s]" on an "immediate basis." *See* RTC at 8-9. For example, Sierra Club concedes on appeal that the paired energy storage option it advocates would not allow Arizona Public Service to fire the turbines to maximum capacity in 2 minutes. Pet. at 16 & n.12. As such, the option would not fulfill Arizona Public Service's project purpose. Maricopa County reasonably determined that energy storage would not be adequate to stabilize the electrical grid, as necessary in a situation with a large and growing proportion of intermittent power sources such as solar and wind. *See* RTC at 11-12. The record supports a determination that these aspects of the facility's design are inherent ones, central to Arizona Public Service's business purpose in proposing the Ocotillo Modernization Project, and Maricopa County appropriately identified them as such. *Id.* at 8-9, 11-12.

In the U.S. EPA's Response to Comments on the Red Gate PSD Permit for GHG Emissions, PSD-TX-1322-GHG, February 2015,[9] issued for a peaking facility to be comprised of reciprocating internal combustion engines (RICE), EPA determined that "energy storage cannot be required in the Step 1 BACT analysis as a matter of law." *Id.* at 1 (explaining that "'incorporating energy storage' in Step 1 of the BACT analysis for a [RICE] resource would constitute the consideration of an alternative means of power production in violation of long-established principles for what can occur in Step 1 of the BACT analysis") (citing *Sierra Club v. EPA*, 499 F.3d 653, 655 (7th Cir. 2007)). EPA concluded that energy storage, either "to replace all or part of the proposed . . . project," would fundamentally redefine the source. *Id.* at 2.

Like this Project, the purpose of the Red Gate project was to provide reliable, rapidly dispatchable power to support renewables and the transmission grid. Because "energy storage first requires separate generation and the transfer of the energy to storage to be effective . . . [it] is a fundamentally different design than a RICE resource that does not depend upon any other generation source to put energy on the grid." *Id.* Energy storage could not meet that production purpose for the duration or scale needed. *Id.* at 2-3. As EPA correctly observed, "[t]he nature of energy storage and the requirement to replenish that storage with another resource goes against the fundamental purpose of the facility." *Id.* at 3.

Similarly, in another PSD permit for a peaking facility for the Shady Hills Generating Station (Jan 2014), this time with natural gas-fired simple cycle units, EPA also concluded that energy storage would not meet the business purpose of the facility and therefore should not be considered in the BACT analysis.[10]

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[9] *Response to Public Comments* for the South Texas Electric Cooperative, Inc. – Red Gate Power Plant PSD Permit for Greenhouse Gas Emissions, PSD-TX-1322-GHG (Nov. 2014), http://www.epa.gov/region6/6pd/air/pd-r/ghg/stec-redgate-resp2sierra-club.pdfNov%2014 .

[10] Responses to Public Comments, Draft Greenhouse Gas PSD Air Permit for the Shady Hills Generating Station at 10-11 (Jan 2014), http://www.epa.gov/region04/air/permits/ghgpermits/shadyhills/ShadyHillsRTC%20_011314.pdf.

Chapter 7. Nitrogen Oxides (NO_x) Control Technology Review.

Nitrogen oxides (NO_x) consist of both nitrogen oxide (NO), and nitrogen dioxide (NO_2). During combustion, NO usually accounts for about 90% of the total NO_x emissions. However, since NO is converted to NO_2 in the atmosphere, the mass emission rate of NO_x is usually reported as NO_2.

NO_x is formed during combustion by two major mechanisms; thermal formation (Thermal NO_x), and fuel formation (Fuel NO_x). Thermal NO_x results from the high temperature oxidation of nitrogen (N_2) and oxygen (O_2). In this mechanism, N_2 is supplied from air, which is 78% N_2 by volume. Thermal NO_x formation increases exponentially with temperature, becoming significant at temperatures above 2800 °F. Fuel NO_x results from the oxidation of organic nitrogen compounds in the fuel. Because fuel bound nitrogen is more easily converted to NO_x during combustion, nitrogen levels in fuel have a significant impact on NO_x formation. However, since natural gas has only trace organic nitrogen compounds, thermal NO_x is the primary source of NO_x emissions from natural gas-fired gas turbines.

7.1 BACT Baseline.

The standards of performance for stationary gas turbines under 40 CFR Part 60, Subpart KKKK regulate emissions from these CTs. The applicable standards are described in Chapter 4 and are summarized below.

1. 25 ppm at 15 percent O_2 or 1.2 lb/MWh based on a 4-hour rolling average when a valid NO_x emission rate is obtained for at least 3 of the 4 hours,
2. 25 ppm at 15 percent O_2 or 1.2 lb/MWh based on a 30-operating day rolling average, and
3. 96 ppm at 15 percent O_2 or 4.7 lb/MWh when operating at less than 75 percent of peak load, or when operating at temperatures less than 0 °F.

7.2 BACT Control Technology Determinations.

The following BACT / LAER determinations are for simple cycle CTs. As discussed in detail in the greenhouse gas BACT analysis in Chapter 9, section 9.5.3 of this application, combined cycle CTs are not included in this control technology analysis because combined cycle CTs do not meet the purpose and need of this project, and because the high temperature selective catalytic reduction (SCR) systems required for simple cycle CTs cannot achieve the NO_x emission rates that low temperature SCR systems can achieve on combined cycle CTs.

Table 7-1 is a summary of the BACT/LAER determinations from the South Coast Air Quality Management District (SCAQMD) and the Bay Area Air Quality Management District (BAAQMD). The lowest determination has a BACT emission limit of 2.3 ppmdv at 15% O_2.

Table 7-2 is a summary of BACT determinations from the U.S. EPA's RACT/BACT/LAER Clearinghouse. Also included in Table 7-2 is the Ocotillo Power Plant. From both Tables 7-1 and 7-2, the most stringent NO_x emission limit for similar simple cycle CTs is 2.3 ppmdv at 15% O_2, based on a 1-hour average.

TABLE 7-1. NO_x LAER / BACT determinations for natural gas-fired simple cycle CTs.

Agency	Emission Unit Description	NOx Limit ppmdv at 15% O_2	Averaging Period
SCAQMD	General Electric LM6000PC 49.8 MW simple cycle CT equipped with SCR.	2.3	1-Hour
SCAQMD	General Electric LMS100PA 100 MW simple cycle CTs equipped with SCR.	2.5	1-Hour
BAAQMD 89.1.3	Simple cycle CTs greater than 40 MW with water injection and SCR.	2.5	

TABLE 7-2. NO_x BACT limits for simple-cycle, natural gas-fired gas turbines.

Facility	State	Permit Date	NOx Limit, ppmdv at 15% O_2	Averaging Period
Bayonnne Energy Center	NJ	2018	2.5	3-hour
Troutdale Energy Center, LLC	OR	2016	2.5	3-hour
Perryman Generating Station	MD	2016	2.5	3-hour
Ocotillo Power Plant	AZ	2015	2.5	1-hour
Pio Pico Energy Center	CA	2012	2.5	1-hour
Walnut Creek Energy Park	CA	2011	2.5	1-hour

Footnotes

WI means water injection; SCR means selective catalytic reduction.

7.3 STEP 1. Identify All Available Control Technologies.

Recent BACT determinations from the U.S. EPA's RACT/BACT/LAER Clearinghouse and the review of literature indicates four major control technologies used to control NO_x emissions:

1. Water Injection (WI),
2. Dry low NO_x (DLN) combustion,
3. Selective Catalytic Reduction (SCR), including hot SCR
4. EMx™ Catalytic Absorption process (EMx or SCONOx™)
5. Selective non-catalytic reduction (SNCR).

7.3.1 Water Injection (WI).

The proposed GE LM6000PC CTs will be equipped with water injection which is designed to reduce turbine exhaust NO_x levels prior to the inlet to the SCR systems to 25 ppmdv at 15% O_2.

7.3.2 Dry low NO_x (DLN) Combustion.

Dry Low NO_x (DLN) combustion is available for the LM6000 CTs, but the proposed CTs use water injection and also utilize water spray power augmentation which injects water into the CT to increase mass flow and increase the CT power output. As a result, DLN equipped LM6000 CTs have a lower peak electric generating capacity than the water injected units. This reduction in peak generating capacity directly affects the ability of the project to meet its basic design requirements. Furthermore, DLN combustion has a significantly lower turndown capability for these CTs. Therefore, DLN combustion is not technically feasible for these peaking units. And in any case, the same level of NO_x control is expected with both water injection and DLN combustion.

7.3.3 Selective Catalytic Reduction (SCR).

Selective Catalytic Reduction (SCR) is a flue gas treatment technique for the reduction of NO_x emissions which uses an ammonia (NH_3) injection system and a catalytic reactor. An SCR system utilizes an injection grid which disperses NH_3 in the flue gas upstream of the catalyst. NH_3 reacts with NO_x in the presence of the catalyst to form nitrogen (gas) and water according to the following general equations:

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$$

$$4NH_3 + 2NO_2 + O_2 \rightarrow 3N_2 + 6H_2O$$

Catalysts are substances which evoke chemical reactions that would otherwise not take place, and act by providing a reaction mechanism that has a lower activation energy than the uncatalyzed mechanism. For SCR, the catalyst is usually a noble metal, a base metal (titanium or vanadium) oxide, or a zeolite-based material. Noble metal catalysts are not typically used in SCR because of their very high cost. To achieve optimum long-term NO_x reductions, SCR systems must be properly designed for each application. In addition to critical temperature considerations, the NH_3 injection rate must be carefully controlled to maintain an NH_3/NO_x molar ratio that effectively reduces NO_x. Excessive ammonia injection will result in NH_3 emissions, called ammonia slip.

SCR has the capability to make substantial reductions in NO_x emissions. For these simple cycle CTs, the use of SCR is expected to reduce NO_x emissions by more than 90%.

7.3.4 Selective Non-Catalytic Reduction (SNCR).

In a selective non-catalytic reduction (SNCR) control system, urea or ammonia is injected into boilers where the flue gas temperature is approximately 1,600 °F to 2,100 °F. At these temperatures, urea [$CO(NH_2)_2$] or ammonia [NH_3], reacts with NO_x, forming elemental nitrogen [N_2] and water without the need for a catalyst. The overall NO_x reduction reactions are similar to those for SCR. Multiple injection points are required to thoroughly mix the reagent into the boiler furnace. The limiting factor for an SNCR system is the ability to contact NO_x with the reagent without resulting in excessive ammonia slip, and without excessive ammonia decomposition before the NO_x emissions can be reduced.

SNCR has been widely used in circulating fluidized bed (CFB) boilers where the high alkaline ash loading of the CFB boilers makes 'high dust' loading SCR systems technically infeasible. However, the time and temperature range for SNCR is not compatible with CTs. We are not aware of the application of SNCR to any gas turbine either in the U.S. or worldwide. Therefore, SNCR is not a technically feasible control technology for the Paris gas turbines.

7.3.5 EMx™ Catalytic Absorption/Oxidation (formerly SCONOx™).

EMx™ Catalytic Absorption/Oxidation (the second-generation of the SCONOx™ NOx Absorber technology) is based on a proprietary catalytic oxidation and absorption technology. EMx™ uses a potassium carbonate (K_2CO_3) coated catalyst to reduce NO_x and CO emissions from natural gas fired gas turbines. The catalyst oxidizes carbon monoxide (CO) to carbon dioxide (CO_2), and nitric oxide (NO) to nitrogen dioxide (NO_2). The NO_2 absorbs onto the catalyst to form potassium nitrite (KNO_2) and potassium nitrate (KNO_3). Dilute hydrogen gas is periodically passed across the surface of the catalyst to regenerate the K_2CO_3 catalyst coating. The regeneration cycle converts KNO_2 and KNO_3 to K_2CO_3, water (H_2O), and elemental nitrogen (N_2). This makes the K_2CO_3 available for further absorption and the water and nitrogen are exhausted.

ABB Alstom Power purchased a proprietary technology called SCONOx™ from Goal Line Environmental Technologies. A SCONOx™ system has been in operation since December of 1996 on the 30 MW Sun Law Energy Federal cogeneration plant in Vernon, California. Since August of 1999, SCONOx has been in operation on a 5 MW cogeneration plant at Genetics Institute in Andover, Massachusetts. The Redding Electric Utility in Redding, California installed a SCONOx™ system on a 43 MW combined cycle plant in 2002. ABB Alstom Power subsequently completed design of a scaled-up SCONOx™ system for 100 MW and greater combined cycle gas turbines.

A significant advantage of SCONOx™ is that it does not require ammonia or urea as a reagent. However, SCONOx™ is designed for operation at temperatures of 300 °F to 700 °F. Therefore, SCONOx™ has potential application to combined cycle and cogeneration gas turbines which have lower exhaust gas temperatures than simple cycle CTs. This operating range is too low for the exhaust gas temperatures from the proposed LM6000 CTs. Therefore, EMx™ Catalytic Absorption/Oxidation is not a technically feasible control option for these CTs.

7.4 STEP 2. Identify Technically Feasible Control Technologies.

The following NO_x control technologies were identified for natural gas-fired CTs. Based on the discussion in Step 1, Water Injection, Selective Catalytic Reduction, and EMx™ Catalytic Absorption process are technically feasible control options.

Control Technology	Technical Feasibility	Basis
1. Water Injection (WI).	Feasible	Proposed Technology
2. Dry low NO_x (DLN) combustion.	Infeasible	Lower peak generating capacity and reduced turndown capability cannot meet the Project's Purpose and Need.
3. Selective Catalytic Reduction (SCR).	Feasible	Proposed Technology
4. EMx™ Catalytic Absorption process (EMx or SCONOx™).	Feasible	Cannot reduce emissions below SCR rates.
5. Selective non-catalytic reduction (SNCR).	Infeasible	Time and temperature range required for SNCR is not compatible with CTs.

7.5 STEP 3. Rank the Technically Feasible Technologies.

Water injection combined with hot SCR is expected to achieve a NO_x emission rate of 2.3 ppmdv at 15% O_2. Limited data is available on the EMx™ Catalytic Absorption process, but the available data indicate that this technology cannot reliably reduce NO_x emissions below 3.0 ppmdv at 15% O_2.

7.6 STEP 4. Evaluate the Most Effective Controls.

APS proposes to utilize water injection combined with hot SCR which is the lowest emission rate technology. Therefore, further evaluation is unnecessary.

7.7 STEP 5. Proposed NO_x BACT/LAER Determination.

APS has concluded that the use of water injection in combination with the use of selective catalytic reduction (SCR) represents the best available control technology (BACT) and the Lowest Achievable Emission Rate (LAER) for the control of NO_x emissions from the proposed GE LM6000PC simple-cycle CTs. This BACT determination is the same as BACT determinations that have been approved by the South Coast Air Quality Management District (SCAQMD) and the and the Bay Area Air Quality Management District (BAAQMD). This BACT determination is also the lowest identified emission limit for similar simple cycle CTs in the U.S. EPA's RACT/BACT/LAER Clearinghouse.

7.7.1 Proposed BACT /LAER for Normal Operation.

Based on this analysis, APS proposes the following limits as the Best Available Control technology (BACT) and the Lowest Achievable Emission Rate (LAER) for the control of NO_x emissions from the new GE LM6000PC CTs:

1. Nitrogen oxide (NO_x) emissions may not exceed 2.3 parts per million, on a dry, volume basis (ppmdv) corrected to 15% O_2, based on a 1-hour average. This limit shall not apply during turbine commissioning, start-up, shutdown, and equipment tuning.

7.7.2 Proposed BACT/LAER Determination for Periods of Startup and Shutdown.

The CT air pollution control systems including the SCR and water injection systems are not operational during periods of startup and shutdown (SU/SD) because the exhaust gas temperatures are too low for these systems to function as designed. In addition, water injection used to control NO_x emissions cannot be used during startup because injecting water too soon can impact the CT flame stability and combustion dynamics, and it may also increase CO emissions. As a result, NO_x emissions may be elevated during periods of startup and shutdown. For periods of startup and shutdown, APS proposes the use of good combustion practices designed to expeditiously startup and shutdown the CTs to minimize NO_x emissions.

Water injection is used to reduce NO_x emissions from these CTs before the SCR systems. The earlier that water injection can be initiated during the startup process, the lower NO_x emissions will be during startup. However, if injection is initiated at very low loads, it can impact flame stability and combustion dynamics, and it may increase CO emissions. These concerns must be carefully balanced when determining when to initiate water injection. Oxidation catalysts and SCR pollution control systems are not functional during periods of startup and shutdown because the exhaust gas temperatures are too low for these systems to function as designed.

For simple cycle CTs, the time required for startup is much shorter than gas turbines used in combined cycle applications. The quick startup times for simple cycle CTs help minimize emissions during startup and shutdown events. For the proposed LM6000PC simple cycle CTs, the length of time for a normal startup, i.e., the time from initial fuel firing to the time that the unit goes on-line and water injection begins, is normally about 8 to 10 minutes. However, the SCR and oxidation catalyst pollution control systems are not fully operational until the temperature of the catalysts and exhaust gases in these systems is at the normal operating temperature. The time to achieve this temperature can be as long as 30 minutes from initial fuel firing. The length of time for a normal shutdown, i.e., the time from the cessation of water injection to the time when the flame is out, can be as long as 9 minutes. Therefore, the longest duration for a startup and shut down cycle or "event" is 39 minutes

Based on this analysis, APS proposes the following limits as BACT and LAER for the control of NO_x emissions from the new GE LM6000PC CTs during periods of startup and shutdown.

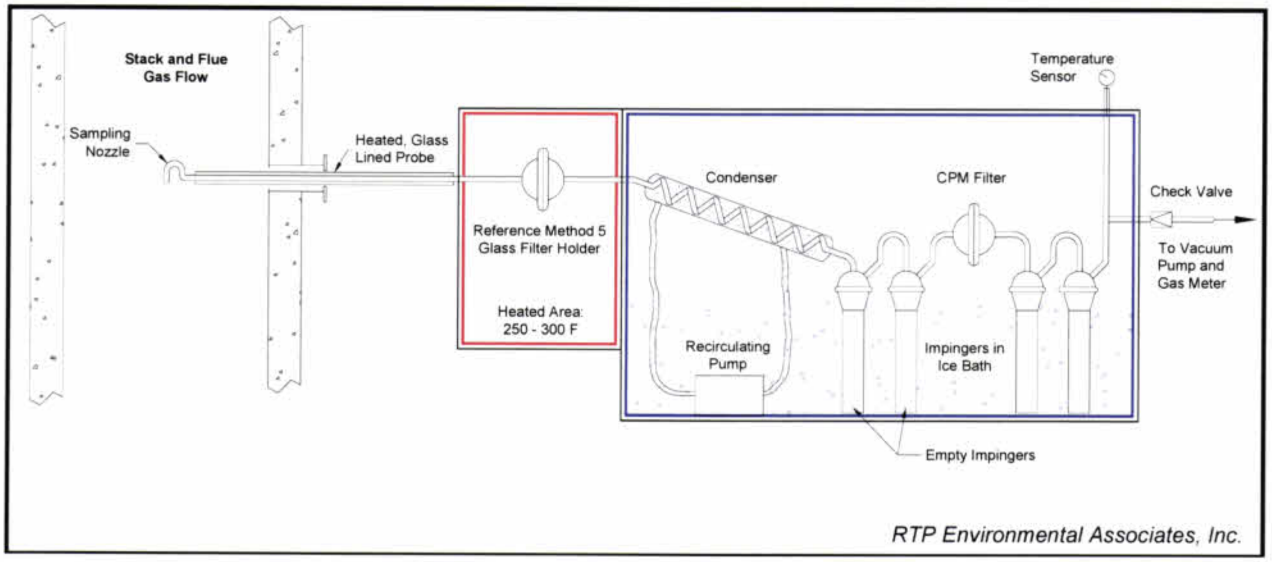
1. "Startup" is defined as the period beginning with the ignition of fuel and ending 30 minutes later.
2. "Shutdown" is defined as the period beginning with the initiation of gas turbine shutdown sequence and lasting until fuel combustion has ceased.
3. The total NO_x emissions during any hour, including periods of startup and shutdown, may not exceed 36.2 pounds per hour.

Chapter 8. Particulate Matter, PM_{10}, and $PM_{2.5}$ Control Technology Review.

Emissions of particulate matter (PM), PM with particle sizes less than 10 microns (PM_{10}), and PM with particle sizes less than 2.5 microns ($PM_{2.5}$) from CTs result from PM in the combustion air, from ash in the fuel and injected water, and from products of incomplete combustion. For this analysis, all PM emissions from the CTs are also assumed to be PM_{10} and $PM_{2.5}$ emissions. Since natural gas has virtually no inorganic ash, fuel ash is not a significant source of PM emissions. As a result, the primary sources of PM emissions from these CTs are expected to result from products of incomplete combustion, from solids in the water used for water injection, turbine wear, and particulate matter in the ambient air.

PM which exists as a solid or liquid at temperatures of approximately 250 °F are measured using U.S. EPA's Reference Method 5 or 17 and are commonly referred to as "front half" emissions. PM which exists as a solid or liquid at the lower temperature of 32 °F are measured using U.S. EPA's Reference Method 202, and is commonly referred to as "back half" or "condensable" PM. Condensable PM may include acid gases such as sulfuric acid mist, volatile organic compounds (VOC) and other materials, but does not include condensed water vapor.

FIGURE 8-1. Reference Method 5 and Reference Method 202 sample train.



8.1 BACT Baseline.

There are currently no emission standards for combustion or gas turbines under the New Source Performance Standards.

8.2 BACT Control Technology Determinations.

In accordance with the *Maricopa County Air Quality Permitting Handbook*, August 2023, MCAQD will accept BACT for the same or similar source category as listed by the South Coast Air Quality Management District (SCAQMD), San Joaquin Valley Air Pollution Control District (SJVAPCD), the Bay Area Air Quality Management District (BAAQMD), or another regulatory agency accepted by MCAQD as a viable alternative. We were only able to identify one BACT determination for PM_{10} emissions from the BAAQMD for simple cycle CTs larger than 40 MW. That determination, Document No. 89.1.3, identified "Exclusive use of CPUC-regulated grade natural gas" as the control technology.

Table 8-1 is a summary of PM emission limits for natural gas-fired simple cycle gas turbines from the U.S. EPA's RACT/BACT/LAER database. Note that a number of the emission limits from the U.S. EPA's RBLC database are stated as a mass emission rate, expressed in pounds of PM per hour. The emission limits range from 0.0019 lb/mmBtu to 0.0171 lb/mmBtu.

TABLE 8-1. Recent PM BACT limits for simple-cycle, natural gas-fired gas turbines.

Facility	State	Permit Date	Throughput		Permit Limit, as Stated		Equivalent Calculated lb/mmBtu
Pio Pico Energy Center	CA	Feb-14	300	MW	0.0053	lb/mmBtu	0.0053
Westar Energy Emporia EC	KS	Mar-23	1780	mmBtu/hr	18	lb/hour	0.0101
Westar Energy Emporia EC	KS	Mar-23	405.3	mmBtu/hr	6	lb/hour	0.0148
Colbert Combustion Turbine Plant	AL	Mar-22	229	MW	0.008	lb/mmBtu	0.0080
LBWL Erickson Station	MI	Sep-21	667	mmBtu/hr	4.5	lb/hour	0.0067
Washington Parish Energy Center	LA	Jun-21	2201	mmBtu/hr	6.3	lb/hour	0.0029
Doswell Energy Center	VA	Jun-19	1961	mmBtu/hr	12	lb/hour	0.0061
Calcasieu Pass LNG Project	LA	Jun-19	927	mmBtu/hr	8	lb/hour	0.0086
Calcasieu Pass LNG Project	LA	Jun-19	263	mmBtu/hr	4.5	lb/hour	0.0171
Cove Point LNG Terminal	MD	May-18	130	MW	0.0033	lb/mmBtu	0.0033
Cove Point LNG Terminal	MD	May-18	130	MW	0.007	lb/mmBtu	0.0070
Waverly Facility	WV	May-18	1571	mmBtu/hr	15	lb/hour	0.0095
Montpelier Generating Station	IN	Nov-17	270.9	mmBtu/hr	0.0066	lb/mmBtu	0.0066
Lonesome Creek Gen. Station	ND	Jun-17	412	mmBtu/hr	5	lb/hour	0.0121
Invenergy Nelson Expansion LLC	IL	Apr-17	190	MW	0.005	lb/mmBtu	0.0050
R.M. Heskett Station	ND	Apr-17	986	mmBtu/hr	7.3	lb/hour	0.0074
Pioneer Generating Station	ND	Nov-16	451	mmBtu/hr	5.4	lb/hour	0.0120
Troutdale Energy Center, LLC	OR	May-16	1690	mmBtu/hr	9.1	lb/hour	0.0054
Midwest Fertilizer Corporation	IN	May-16	283	mmBtu/hr	0.0019	lb/mmBtu	0.0019

8.3 STEP 1. Identify All Available Control Technologies.

The following PM, PM_{10}, and $PM_{2.5}$ control technologies were identified for natural gas-fired CTs:

1. Water Injection,
2. Dry Low NO_x (DLN) Combustion,
3. Low Ash / Low Sulfur Fuel (i.e., natural gas and/or distillate fuel oil).
4. Post combustion control systems including fabric filter baghouses, electrostatic precipitators (ESP), wet scrubbers, cyclones, and multiclones.

The proposed LM6000PC CTs will be equipped with inlet air filters which remove dust and particulate matter from the inlet air. These CTs will also utilize water injection in which demineralized water is injected into the combustion section of the CT which reduces flame temperatures and reduces thermal NO_x formation. These CTs are also equipped with water spray power augmentation which injects demineralized water into the low-pressure compressor. This water flow increases the mass flow of gases through the turbines and results in higher electric power output. Both the inlet air and the demineralized water have the potential to result in PM emissions from these CTs.

Dry Low NO_x (DLN) combustion is available for the LM6000 CTs, but the proposed CTs use water spray power augmentation to increase mass flow and increase the CT power output. As a result, DLN equipped LM6000 CTs have a lower peak electric generating capacity than the water injected units. This reduction in peak generating capacity directly affects the ability of the project to meet its basic design requirements. Furthermore, DLN combustion has a significantly lower turndown capability for these CTs. Therefore, DLN combustion is not technically feasible for these peaking units. And in any case, it is unclear if any reduction in PM could be achieved through the use of DLN as compared to water injection.

The proposed CTs are internal combustion engines. Numerous other PM control systems are available for solid fuel-fired *external* combustion sources such as boilers and process heaters, including fabric filter baghouses, electrostatic precipitators (ESP), wet scrubbers, and mechanical systems such as cyclones and multiclones. However, we are not aware of any examples where these control systems have been applied to natural gas-fired CTs. This is because natural gas-fired CTs already have very low PM emission rates similar to or even less than the *controlled* emission rates from solid fuel-fired boilers after the use of these post combustion control systems. In addition, the high exhaust gas flowrates and high exhaust gas temperatures from simple cycle CTs are not compatible with these PM control technologies intended primarily for solid fuel-fired boilers.

8.4 STEP 2. Identify Technically Feasible Control Technologies.

The following PM, PM_{10}, and $PM_{2.5}$ control technologies were identified for natural gas-fired gas turbines:

1. Low Ash / Low Sulfur Fuel (i.e., natural gas)
2. Post combustion control systems including fabric filter baghouses, electrostatic precipitators (ESP), wet scrubbers, cyclones, and multiclones.

8.4.1 Low Ash / Low Sulfur Fuel.

PM, PM_{10}, and $PM_{2.5}$ emissions from CTs can be affected by ash and inorganic sediments in the fuel, and by the level of sulfur compounds in the fuel. While the inorganic ash and sediments may be emitted directly as particulate matter, sulfur compounds are emitted primarily as sulfur dioxide (SO_2). However, because of the high excess oxygen levels and high temperatures in the exhaust gas of CTs, SO_2 may be further oxidized to sulfur trioxide (SO_3). While SO_3 is a gas, SO_3 will spontaneously react with water when temperatures drop below the acid dew point to form sulfuric acid (H_2SO_4). Sulfuric acid mist is condensable PM, and, by definition, it is also a part of the $PM_{2.5}$ emissions.

Regardless of the reaction mechanisms, natural gas is a very low ash and a very low sulfur fuel. In fact, natural gas has the lowest ash and sulfur content of the available fossil fuels.

8.4.2 Post Combustion PM Control Systems.

As noted in Step 1, CTs are internal combustion engines. While numerous other PM control systems are available for solid fuel-fired *external* combustion sources such as boilers and process heaters, including fabric filter baghouses, electrostatic precipitators (ESP), wet scrubbers, and mechanical systems such as cyclones and multiclones, we are not aware of any examples where these control systems have been applied to natural gas-fired CTs. This is because natural gas-fired gas turbines already have very low PM emission rates similar to or even less than the *controlled* emission rates from solid fuel-fired boilers after the use of these post combustion control systems. In addition, the high exhaust gas flowrates and high exhaust gas temperatures from simple cycle gas turbines are not compatible with these PM control technologies intended for solid fuel-fired boilers.

Because there is no evidence that the use of post combustion PM control systems such as fabric filter baghouses could actually reduce the already very low PM emission rates from CTs, and because the exhaust gas temperatures from simple cycle CTs are much higher than the maximum design temperatures for these PM control systems, fabric filter baghouses, electrostatic precipitators (ESP), wet scrubbers, and mechanical systems such as cyclones and multiclones are not technically feasible control technologies for the control of PM emissions from the proposed CTs.

8.5 STEP 3. Rank the Technically Feasible Technologies.

Based on the above analysis, the use of low ash and low sulfur containing fuels including natural gas is a technically feasible control option for these gas turbines. From Table 7-1, the use of this control is expected to achieve a PM, PM_{10}, and $PM_{2.5}$ emission rate in the range of 0.0019 lb/mmBtu to 0.0171 lb/mmBtu.

8.6 STEP 4. Evaluate the Most Effective Controls.

APS proposes to utilize the use of low ash and low sulfur fuel (natural gas) as the best available control technology. Other control options, including post combustion PM control systems, are not available and are technically infeasible control options. Therefore, further evaluation is unnecessary.

8.7 STEP 5. Proposed Particulate Matter (PM), and $PM_{2.5}$ BACT Determination.

APS has concluded that the use of low sulfur fuel (natural gas) represents the best available control technology (BACT) for the control of particulate matter (PM), PM_{10}, and $PM_{2.5}$ emissions from the proposed GE LM6000PC simple-cycle CTs. From the U.S. EPA's RACT/BACT/LAER database, the emission limits for similar natural gas-fired CTs range from 0.0019 lb/mmBtu to 0.0171 lb/mmBtu. Based on the full load heat input rate for the proposed CTs of 471 mmBtu/hr, these reported emission limits range from 0.9 to 8.0 lb/hr.

The U.S. EPA Region 9 originally established the PM_{10} and $PM_{2.5}$ Pio Pico Energy Center (PPEC) BACT limit at 0.0065 lb/mmBtu. In response to an Environmental Appeals Board decision, EPA revised their BACT analysis by reviewing the lowest permitted emission limits and recent stack test data for similar sized natural gas-fired CTs. Region 9 considered a number of technical factors with the potential to impact the reliability and usefulness of the stack test data in projecting achievable emissions. EPA noted that there was significant variability in the test data from the three facilities analyzed. In addition, data for two of the three facilities reviewed was from the initial compliance tests on new units, while for the third facility the emission units were only four years old. EPA noted in its analysis that CTs are expected to last more than 20 to 30 years. It is unclear how much PM emissions may vary as the equipment ages and therefore it would be inappropriate to rely only on this emissions data to set a limit that is achievable on an ongoing basis over the life of the equipment. Setting a BACT limit based on limited testing of new units may not address long-term achievable emissions.

EPA's review focused on three facilities that were all located in the same region and stated that because fuel sulfur content is one of the main contributors to PM emissions from gas turbines, and because the sulfur content in natural gas varies by region, that it was appropriate to use data from the same region in California as the PPEC for setting the PM emission limit. Sulfur in the natural gas will be oxidized to form sulfur dioxide (SO_2), and it may also be oxidized to form sulfur trioxide (SO_3). When the exhaust gas temperature reaches the acid dew point (which will only occur in the atmosphere or in a stack testing reference method sample train), SO_3 will react spontaneously with water to form sulfuric acid (H_2SO_4, $H_2SO_4 \cdot H_2O$, or $H_2SO_4 \cdot 2H_2O$). Sulfuric acid is "condensable" particulate matter which is measured using Reference Method 202 used for determining PM_{10} and $PM_{2.5}$ emissions. In addition, some of the sulfur dioxide in the sample flue gas may dissolve in the Method 202 sample train and eventually react with water to form sulfuric acid mist. This unintended reaction of SO_2 to form condensable particulate matter creates particulate matter which is an artifact of the reference method. In this context "artifact" means something observed (i.e., condensable particulate matter) in a scientific investigation or experiment (i.e., the reference method test) that is not naturally present but occurs as a result of the investigative procedure.

APS has reviewed information available for similar GE LM6000 CTs which are operated by APS at the Sundance Power Plant. These CTs are in the same region for purposes of representative natural gas. Table 8-2 is a summary of four (4) compliance emission tests for units at the Sundance Power Plant. From Table 8-2, compliance emission tests indicate total PM, PM_{10}, and $PM_{2.5}$ emission rates ranging from 0.004 to 0.013 lb/mmBtu.

TABLE 8-2. Compliance emission test results for particulate matter emissions from similar combustion turbines.

Unit	Date	PM_{10} Emission Rate, lb/mmBtu			
		Filterable	Condensable	Total	Total of Test
7	7/19/2018	0.002	0.002	0.004	
		0.001	0.001	0.003	
		0.002	0.002	0.004	0.004
6	7/18/2018	0.002	0.001	0.003	
		0.001	0.003	0.004	
		0.001	0.014	0.016	0.008
8	7/19/2012			0.008	
				0.015	
				0.015	0.013
4	7/17/2012			0.017	
				0.009	
				0.008	0.011
Average		**0.002**	**0.004**	**0.009**	**0.009**
Maximum		**0.002**	**0.014**	**0.017**	**0.013**
125% of Maximum					**0.015**

Because the proposed CTs have high excess oxygen levels, and because the CTs will be equipped with oxidation catalysts, relatively high percentages of SO_2 may be converted to SO_3. And based on compliance emission tests for similar CTs in the region which indicate total filterable plus condensable PM emission rates as high as 0.013 lb/mmBtu, APS has concluded that the achievable long term emission rate for the proposed CTs is 0.015 lb/mmBtu. At the full rated heat input capacity for the proposed CTs of 471 mmBtu per hour, this emission rate is equal to 7.0 pounds per hour.

Based on this analysis, APS proposes the following limits as the Best Available Control technology (BACT) for the control of particulate matter (PM), PM_{10}, and $PM_{2.5}$ emissions from the new GE LM6000PC CTs.

1. Particulate matter (PM), PM_{10}, and $PM_{2.5}$ emissions may not exceed 7.0 pounds per hour, based on a 3-hour average.

Chapter 9. Greenhouse Gas (GHG) Emissions Control Technology Review.

On May 13, 2010, the U.S. EPA issued a final "tailoring" rule that establishes requirements for greenhouse gas (GHG) emissions from stationary sources under the Prevention of Significant Deterioration (PSD) program in 40 CFR §52.21. This rule sets thresholds for GHG emissions that establish when permits are required for new stationary sources under the PSD program. The final rule "tailors" the requirements of the PSD program to limit which facilities will be required to obtain PSD permits and meet substantive PSD program requirements for GHG emissions. After January 2, 2011, new major stationary sources that are subject to the PSD permitting program due to potential emissions of a pollutant other than GHGs would be subject to the PSD requirements for GHG emissions. GHG emission increases of 75,000 tons per year or more of total GHG, on a total CO_2 equivalent basis (CO_2e), will need to determine the Best Available Control Technology (BACT) for GHG emissions.

The final rule includes the following regulated GHG emissions:

1. Carbon dioxide (CO_2)
2. Methane (CH_4)
3. Nitrous oxide (N_2O)
4. Hydrofluorocarbons (HFCs)
5. Perfluorocarbons (PFCs)
6. Sulfur hexafluoride (SF_6)

From 40 CFR §98, Table A-1, the global warming potential for these pollutants are:

Name	Global Warming Potential (100 yr.)
1. Carbon dioxide (CO_2)	1
2. Methane (CH_4)	25
3. Nitrous oxide (N_2O)	298

The potential emission rate for each individual greenhouse gas is then multiplied by its global warming potential and summed to determine the total CO_2 equivalent emissions (CO_2e) for the source.

9.1 Project Operational Requirements.

As noted in the Purpose and Need in section 2.3 of this application, Arizona is experiencing significant growth in demand for energy generation to support residential, commercial, and industrial customer load growth. At the same time, summer energy supply is tightening in the western United States, making it difficult to purchase the required energy from the energy market. These new LM6000PC units, along with the solar and battery energy storage APS is adding to its resource portfolio, will help APS meet the more than 40% load growth that is expected in the next eight years. Having a variety of resources - including natural gas, nuclear, solar, energy storage, and customer demand response programs in APS's portfolio - makes the system more resilient to supply chain disruptions, extreme weather, and changing market conditions. Further, natural gas resources provide critical capacity during peak system demand and support reliability when customers need it most.

A critical component of this Project is that the proposed LM6000PC units are quick starting and fast ramping. These new CTs can be online in eight minutes and at full load in under 10 minutes - making them a critical resource to respond to fluctuations in renewable energy output throughout the day. Because these LM6000PC peaking units offer flexible, on-demand energy 24/7, they can provide much-needed energy during late afternoon and evening hours when customer demand is high, creating a strong complement to renewable energy resources such as solar. In short. the new units will support reliable electrical service when APS customers need it most.

APS is continuing to add renewable energy, especially solar energy, to the electric power grid. However, because renewable energy is an intermittent source of electricity, a balanced resource mix is essential to maintain reliable electric service. One of the major impediments to grid integration of solar generation is the variable nature of the power provided and how that variability impacts the electric grid. According to the Electric Power Research Institute (EPRI) study on the variability of solar power generation capacity, the total plant output for three large PV plants in Arizona have ramping events of up to 40% to 60% of the rated output power over 1-minute to 1-hour time intervals[11]. Considering only the solar capacity in Maricopa County, the required electric generating capacity ramp rate required to back up these types of solar systems is in the range of 165 to 310 MW per minute.

To back up the current and future renewable energy resources, the Project design requires quick start and power ramping capability to meet changing power demands and mitigate grid instability caused by the intermittency of renewable energy generation. To achieve these requirements, the project design is based on eight (8) General Electric (GE) LM6000PC natural gas-fired simple cycle CTs. The proposed CTs can provide an electric power ramp rate equal to 50 MW per minute per CT which is critical for the project to meet its purpose and need. When all 8 proposed CTs are operating at 50% load, the entire project can provide approximately 190 MW of ramping capacity in less than 2 minutes.

The proposed new LM6000PC units will also provide dynamic voltage control for the electric grid. Dynamic voltage control is the ability of a generating resource to maintain voltage levels within acceptable limits. This Project will also provide system electric inertia (kinetic energy stored during the units' operation) and frequency response (the ability of a generating resource to aid balance between generation and load on the grid) necessary for electric system stability. Batteries and renewable energy systems such as wind and solar cannot provide this necessary grid support. These attributes of the proposed CTs are critical when the electric supply resource portfolio includes more and more intermittent, renewable resources such as wind and solar.

[11] Electric Power Research Institute (EPRI) report, *Monitoring and Assessment of PV Plant Performance and Variability Large PV Systems*, 3002001387, Technical Update, December 2013, conclusion, page 6-1.

9.2 Potential Greenhouse Gas (GHG) Emissions.

GHG emissions from natural gas-fired CTs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The federal *Mandatory Greenhouse Gas Reporting Requirements* under 40 CFR Part 98 requires reporting of greenhouse gas (GHG) emissions from large stationary sources. Under 40 CFR Part 98, facilities that emit 25,000 metric tons or more per year of GHG emissions are required to submit annual reports to EPA. Table C-1 of this rule includes default emission factors for CO_2. The CO_2 emission factor for natural gas combustion is 53.06 kg per mmBtu, equal to 116.98 pounds per million Btu, based on the higher heating value (HHV) of natural gas.

Methane (CH_4) emissions result from incomplete combustion of natural gas. The federal *Mandatory Greenhouse Gas Reporting rule*, 40 CFR Part 98, Table C-2 lists a methane emission factor for natural gas combustion of 0.001 kg/mmBtu (0.0022 lb/mmBtu). The potential emission rate for methane is then multiplied by its global warming potential of 25 to determine the total CO_2e emissions, equal to 0.055 lb CO_2e per mmBtu of heat input.

Nitrous oxide (N_2O) emissions from gas turbines result primarily from low temperature combustion. The federal *Mandatory Greenhouse Gas Reporting rule*, 40 CFR Part 98, Table C-2 lists a default N_2O emission factor for natural gas combustion of 0.0001 kg/mmBtu (0.00022 lb/mmBtu). The potential emission rate for N_2O is then multiplied by its global warming potential of 298 to determine the total CO_2e emissions, equal to 0.066 lb CO_2e per mmBtu of heat input.

Potential GHG emissions for each CT based on the proposed operating limits in this permit application are summarized in Table 9-1. It is important to note that the emission rates for CO_2 and GHG emissions, expressed in pounds per million Btu of heat input (lb/mmBtu), are NOT elevated during periods of startup and shutdown. Therefore, total emissions may simply be based on the heat input of the CTs.

Because CO_2 emissions account for 99.9% of the GHG emissions from these CTs, this control technology review for GHG emissions will focus on CO_2 emissions.

TABLE 9-1. Potential GHG emissions for each CT based on the proposed emission limits in this application.

Pollutant		Emission Factor	Total GHG Emission Factor		Heat Input		Total GHG Emissions	
		lb / mmBtu	CO_2e Factor[4]	lb / mmBtu	mmBtu / hour	mmBtu / year	lb / hour	ton / year
Carbon Dioxide	CO_2	116.976	1	116.976	471	783,900	55,095.7	45,848.8
Methane	CH_4	0.0022	25	0.055	471	783,900	26.0	21.6
Nitrous Oxide	N_2O	0.00022	298	0.066	471	783,900	30.9	25.7
Total GHG Emissions	CO_2e	116.98		117.10	471	783,900	55,152.6	45,896.1

9.3 BACT Baseline.

9.3.1 Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units, 40 CFR 60 Subpart TTTT.

These CTs are subject to the *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units*, 40 CFR 60 Subpart TTTT. The applicable carbon dioxide (CO_2) requirement in Subpart TTTT, Table 2 are summarized below.

Affected EGU	CO_2 Emission standard
Newly constructed or reconstructed stationary combustion turbine that supplies its design efficiency or 50 percent, whichever is less, times its potential electric output or less as net-electric sales on either a 12-operating month or a 3-year rolling average basis and combusts more than 90% natural gas on a heat input basis on a 12-operating-month rolling average basis	50 kg CO_2 per gigajoule (GJ) of heat input (120 lb CO_2/MMBtu).
Newly constructed and reconstructed stationary combustion turbine that combusts 90% or less natural gas on a heat input basis on a 12-operating-month rolling average basis	50 kg CO_2/GJ of heat input (120 lb/MMBtu) to 69 kg CO_2/GJ of heat input (160 lb/MMBtu) as determined by the procedures in § 60.5525.

However, the CO_2 emissions standards in 40 CFR 60.5520(d)(1) states:

> (1) Stationary combustion turbines that are only permitted to burn fuels with a consistent chemical composition (i.e., uniform fuels) that result in a consistent emission rate of 160 lb CO_2/MMBtu or less are not subject to any monitoring or reporting requirements under this subpart. **These fuels include, but are not limited to, natural gas, methane, butane, butylene, ethane, ethylene, propane, naphtha, propylene, jet fuel kerosene, No. 1 fuel oil, No. 2 fuel oil, and biodiesel.** Stationary combustion turbines qualifying under this paragraph are only required to maintain purchase records for permitted fuels.

Therefore, while these CTs are subject to the standards in 40 CFR 60 Subpart TTTT, there would be no monitoring or reporting requirements for natural gas or diesel fuel oil-fired CTs under Subpart TTTT.

9.3.2 Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units, 40 CFR 60 Subpart TTTTa *(proposed)*.

In May 2023, the U.S. EPA proposed revised new source performance standards (NSPS) for GHG emissions from new fossil fuel-fired stationary CT EGUs. Upon promulgation of 40 CFR part 60, subpart TTTTa, stationary CTs that commence construction or reconstruction after May 23, 2023 and meet the relevant applicability criteria will be subject to 40 CFR part 60, subpart TTTTa. For new and reconstructed fossil fuel-fired CTs, EPA is proposing to create three subcategories based on the function the CT serves:

1. Low load (peaking units) subcategory that consists of CTs with a capacity factor less than 20%;
2. Intermediate load subcategory for CTs with a capacity factor that ranges between 20 percent

and a source-specific upper bound that is based on the design efficiency of the CT;

3. Base load subcategory for CTs that operate above the upper-bound threshold for intermediate load turbines.

For the low load subcategory, EPA is proposing that the best system of emissions reduction (BSER) is the use of lower emitting fuels (e.g., natural gas and distillate oil) with standards of performance ranging from 120 lb CO_2/MMBtu to 160 lb CO_2/MMBtu, depending on the type of fuel combusted. With this application, APS is proposing to limit the heat input to each CT to less than 20% capacity factor.[12]

9.4 BACT Control Technology Determinations.

Table 9-2 is a summary of BACT determinations from the U.S. EPA's RACT/BACT/LAER Clearinghouse. Also included in Table 9-2 is the Ocotillo Power Plant. Emission limits range from 1,260 to 1,707 lb/MWh, and also include limits of 117 and 120 lb/mmBtu, reflecting natural gas as the fuel.

TABLE 9-2. Recent GHG BACT limits for natural gas-fired simple-cycle gas turbines.

Facility	State	Permit Date	Limit	Units	Averaging Period
TVA - Johnsonville CT	TN	Mar-23	120	lb/mmBtu	
Colbert CT Plant	AL	Mar-22	120	lb/mmBtu	
Ector County Energy	TX	Sep-21	1,514	lb CO_2/MWhr	
Washington Parish Energy	LA	Jun-21	120	lb/mmBtu	Annual Ave
Cove Point LNG Terminal	MD	May-18	117	lb/mmBtu	
Mustang Station	TX	Apr-18	120	lb/mmBtu	
Gaines County Power Plant	TX	Jun-17	1,300	lb CO_2/MWhr	
Neches Station	TX	Jul-16	1,341	lb CO_2/MWhr	
Lauderdale Plant	FL	Jul-16	1,372	lb CO_2/MWhr	12-month
Fort Myers Plant	FL	Jul-16	1,374	lb CO_2/MWhr	365 day
Perryman Generating Station	MD	Jul-16	1,394	lb CO_2/MWhr	12-month
Hill County Gen. Facility	TX	Jul-16	1,434	lb CO_2/MWhr	
Troutdale Energy Center	OR	May-16	1,707	lb CO_2/MWhr(g)	12-month
Ocotillo Power Plant	AZ	Mar-16	1,460	lb CO_2/MWhr(g)	12-month
LADWP Scattergood Station	CA	Jan-13	1,260	lb CO_2e/MWhr(n)	12-month
Pio Pico Energy Center	CA	Nov-12	1,328	lb CO_2/MWhr(g)	720 hours

[12] APS reserves the right to request a different limit should the subcategories promulgated in the final rule differ materially from the proposed subcategories.

9.5 STEP 1. Identify All Potential Control Technologies.

The first step in a top-down BACT analysis is to identify all "available" control options. Available control options are those control technologies or techniques with a practical potential for application to the emissions unit and pollutant being evaluated. Air pollution control technologies and techniques include the application of production process or available methods, systems, controls, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for the affected pollutant.

Recent BACT emission limits have been expressed on a pound per MWh of electric output basis (either gross or net output) and/or a fuel composition (pounds of GHG emissions per million Btu of heat input) basis. The averaging periods for these emission limits are typically long term, 12-month limits. The available technologies for the control of CO_2 emissions from recently permitted simple cycle natural gas-fired gas turbines identified in this database includes the use of low carbon containing fuels and the use of energy efficient processes.

CO_2 emissions result from the oxidation of carbon in the fuel. When combusting natural gas, this reaction is responsible for much of the heat released in the combustion turbine and is therefore unavoidable. Broadly, there are four potential control options for reducing CO_2 emissions from these CTs:

1. **The use of low carbon containing or lower emitting primary fuels,**
2. **Good combustion, operating, and maintenance practices, including,**
   a. Steam injection,
   b. Water injection,
   c. Dry Low NO_x combustion.
3. **The use of energy efficient processes and technologies, including,**
   a. Efficient simple cycle CTs,
   b. Combined cycle CTs,
   c. Reciprocating internal combustion engine (RICE) generators,
   d. Energy storage option.
4. **Carbon capture and sequestration (CCS) as a post combustion control system.**

With respect to the use of energy efficient processes and technologies, as stated by the Bay Area Air Quality Management District in the Statement of Basis for the Russell City Energy Center, "The only effective means to reduce the amount of CO_2 generated by (a) fuel-burning power plant is to generate as much electric power as possible from the combustion, thereby reducing the amount of fuel needed to meet the plant's required power output." Energy efficient processes and technologies include reciprocating internal combustion engines (RICE), as well as efficient simple cycle gas (combustion) turbines (CT) and combined-cycle CTs. And there are also various energy storage systems, including battery storage, liquid air energy storage (LAES), flywheel energy storage (FES), compressed air energy storage (CAES), and pumped hydroelectric storage. However, APS is proposing to install natural gas-fired simple cycle CTs to meet the specific purpose and need of the Project. The use of combined cycle CTs or other energy storage options would change the project in such a fundamental way that the requirement to use these technologies would redefine the design of the Project. As EPA noted in its guidance, *U.S. EPA, EPA-457/B-11-001, PSD and Title V Permitting Guidance for Greenhouse Gases 26 (Mar. 2011)*, page 26:

> While Step 1 is intended to capture a broad array of potential options for pollution control, this step of the process is not without limits. EPA has recognized that a Step 1 list of options need not necessarily include inherently lower polluting processes that would fundamentally redefine the nature of the source proposed by the permit applicant. BACT should generally not be applied to regulate the applicant's purpose or objective for the proposed facility.

9.5.1 Use of Low Carbon Containing or Lower Emitting Primary Fuels.

EPA's guidance document "*PSD and Title V Permitting Guidance for Greenhouse Gases*" notes that because the CAA includes "clean fuels" in the definition of BACT, clean fuels which would reduce GHG emissions but do not result in the use of a different primary fuel type or a redesign of the source should be considered in the BACT analysis. Table 9-3 is a summary of the CO_2 emission rate for coal, distillate fuel oil, and natural gas. With respect to the use of lower emitting or low carbon containing "clean" fuels, APS is proposing the use of natural gas as the primary fuel for these CTs. Because natural gas is the lowest CO_2 emitting fossil fuel available for this Project, further evaluation of clean fuels is not necessary.

TABLE 9-3. Potential CO_2 emissions for various fossil fuels.

Fuel	CO_2 Emission Rate, lb/mmBtu
Bituminous Coal	205.9
Subbituminous Coal	213.9
Distillate Fuel Oil	162.7
Natural Gas	116.9

Footnotes

The CO_2 emission rates are from *Mandatory Greenhouse Gas Reporting Requirements* 40 CFR Part 98.

9.5.1.1 Hydrogen Fuel.

In the preamble to the U.S. EPA's proposed *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units*, 40 CFR 60 Subpart TTTTa, the EPA noted that the combustion of hydrogen (H_2) as a fuel in CTs would produce essentially zero direct CO_2 emissions, and EPA evaluated a number of cofiring scenarios for baseload electric generating units in the proposed rule. However, EPA also noted in the preamble that the manufacture of hydrogen can generate GHG emissions. And EPA did not propose cofiring of hydrogen for low load peaking units such as these proposed CTs.

There are a number of complications to firing hydrogen in combustion turbines. As EPA stated in the Technical Support Document (TSD) *Hydrogen in Combustion Turbine Electric Generating Units*[13] "Perhaps the most significant challenge is that the flame speed of hydrogen gas is an order of magnitude higher than that of methane; at hydrogen blends of 70 percent or greater, the flame speed is essentially tripled compared to pure natural gas. A higher flame speed can lead to localized higher temperatures, which can increase thermal stress on the turbine's components as well as increase thermal NO_x emissions."

Hydrogen production methods include gasification of coal, steam methane reforming, methane pyrolysis, and electrolysis of water, as well as hydrogen derived from biomass or refuse. Without carbon capture and sequestration, producing hydrogen from coal and natural gas will itself produce GHG emissions. Production by electrolysis would have essentially zero GHG emissions, but it requires electricity to electrolyze water into hydrogen and oxygen. According to the same EPA TSD, "Specific to the electricity source, electrolysis production prices are estimated to be $5.58/kg, $5.96/kg, and approximately $9.00/kg for nuclear, wind, and solar electrolysis, respectively." At a higher heating value of 61,100 Btu/lb, this is equal to costs of $42 to $67 per million Btu of heat input. This is more than 10 times the current cost of natural gas.

While the proposed GE LM6000PC CTs are capable of cofiring up to 35% hydrogen, there is no source of hydrogen currently available for use in these CTs. The use of hydrogen as a fuel in these CTs would fundamentally change the proposed project. As EPA notes in its GHG BACT guidance, *U.S. EPA, EPA-457/B-11-001, PSD and Title V Permitting Guidance for Greenhouse Gases 26 (Mar. 2011)*, page 26:

> While Step 1 is intended to capture a broad array of potential options for pollution control, this step of the process is not without limits. EPA has recognized that a Step 1 list of options need not necessarily include inherently lower polluting processes that would fundamentally redefine the nature of the source proposed by the permit applicant. BACT should generally not be applied to regulate the applicant's purpose or objective for the proposed facility.
>
> In assessing whether an option would fundamentally redefine a proposed source, EPA recommends that permitting authorities apply the analytical framework recently articulated by the Environmental Appeals Board. Under this framework, a permitting authority should look first at the administrative record to see how the applicant defined its goal, objectives, purpose or basic design for the proposed facility in its application. The underlying record will be an essential component of a supportable BACT determination that a proposed control technology redefines the source.

Because the use of hydrogen as a fuel would fundamentally redefine the nature of the Project as stated in this application, hydrogen fuel may be eliminated in Step 1 because the required use of hydrogen as a fuel which is not available at the Redhawk Power Plant would constitute a redefinition of the source.

[13] *Hydrogen in Combustion Turbine Electric Generating Units*, Technical Support Document, Docket ID No. EPA-HQ-OAR-2023-0072, U.S. EPA Office of Air and Radiation, May 23, 2023.

9.5.2 Good Combustion, Operating, and Maintenance Practices.

Combustion turbines may use different combustion technologies to enhance performance or reduce emissions. Combustion technologies for CTs include diffusion flame combustion with water injection, diffusion flame combustion with steam injection, and lean premix combustion using dry low NO_x combustion.

9.5.2.1 Steam Injection.

GE does not offer the proposed LM6000PC CTs with steam injection. Therefore, steam injection is not an available control option for the proposed CTs and is therefore eliminated as a control technology option.

9.5.2.2 Water Injection.

Good combustion practices including the use of water injection is an effective method for controlling NO_x emissions from these CTs. Water injection is the most widely used combustion control technology for aero derivative CTs and CTs with capacities less than 100 MW. The injection of water directly into the turbine combustor lowers the peak flame temperature and reduces thermal NO_x formation.

A significant advantage of water injection for these simple cycle CTs is the ability to achieve higher peak power output levels with water injection. The use of water injection increases the mass flow through the turbine which increases power output, especially at high ambient temperatures when peak power is often needed from these CTs. This is especially important for these CTs because the Redhawk Power Plant is located in Arizona, a region with high ambient temperatures.

9.5.2.3 Dry Low NO_x Combustion.

Dry Low NO_x (DLN) combustion is available for the LM6000PC CTs and under certain operating conditions can achieve the same NO_x emission rate as water injection, equal to a CT exhaust prior to the SCR systems of 25 ppmdv at 15% O_2. However, DLN equipped LM6000PC CTs have a lower peak electric generating capacity than the water injected units. This reduction in peak generating and ramping capacity directly affects the ability of the project to meet its basic design requirements, another reason to eliminate DLN combustion in Step 1.

In addition the DLE 1.5 technology can only achieve CT exhaust NOx emission rates of less than 25 ppm NOx emissions at 75% to 100% load. Therefore, while water injected LM6000PC CTs can achieve the NO_x emission rate of 25 ppm continuously down to 50% of load, the DLN equipped units cannot achieve this NO_x emission rate at loads below 75% of load. Because a CT turndown to 50% load is a major design criterion for the Project, utilizing DLN would require changing the basic purpose and design of the facility, and is therefore properly eliminated in Step 1 as redefining the source. In addition, the lack of turndown capability for the DLN equipped CTs makes the DLN equipped CTs technically infeasible for these peaking units.

9.5.3 Use of Energy Efficient Processes and Technologies.

The following section discusses combined cycle CTs, reciprocating internal combustion engine (RICE) electric generating units, and various energy storage technologies. However, these technologies are not control technologies. The use of combined cycle CTs, RICE electric generating units, and energy storage options would change the project in such a fundamental way that the requirement to use these technologies would redefine the design of the Project.

9.5.3.1 Combined Cycle CTs.

The use of combined cycle CTs would change the project in such a fundamental way that the plant could not meet its stated purpose of a peaking power plant. As noted above, EPA states in its GHG BACT guidance, *U.S. EPA, EPA-457/B-11-001, PSD and Title V Permitting Guidance for Greenhouse Gases (Mar. 2011)* that while Step 1 is intended to capture a broad array of potential options for pollution control, this step of the process is not without limits. EPA has recognized that a Step 1 list of options need not necessarily include inherently lower polluting processes that would fundamentally redefine the nature of the source proposed by the permit applicant. BACT should generally not be applied to regulate the applicant's purpose or objective for the proposed facility.

The Redhawk CT Expansion Project is being proposed to provide quick start and power ramping capability to meet changing and peak power demands and mitigate grid instability caused in part by the intermittency of renewable energy generation. Electric utilities primarily use simple-cycle CTs as peaking units, while combined cycle CTs are installed to provide baseload capacity. The proposed CTs can provide an electric power ramp rate equal to 50 MW per minute per CT which is critical for the project to meet its purpose and need. When all eight (8) CTs are operating at 50% load, the entire project can provide approximately 190 MW of capacity in about one (1) minute. Combined cycle units cannot provide this very fast response time which is a critical design requirement of this Project.

Combined cycle CTs are also unable to respond rapidly to the large swings in generation which can be caused by a sudden drop in generation from renewable energy sources. The long startup time for combined cycle CTs is incompatible with the purpose of the Project which is to provide quick response to changes in the supply and demand of electricity. And of critical importance is the fact that these simple cycle CTs may be required to startup and shutdown multiple times per day. These design requirements make combined cycle CTs technically infeasible for the Project. This conclusion is consistent with the U.S. EPA Region 9 evaluation and conclusion regarding the technical feasibility of combined cycle CTs for the Ocotillo Power Plant and also for the Pio Pico Energy Center. This conclusion is also consistent with the U.S. EPA Region 4 conclusion regarding the use of combined cycle units at the EFS Shady Hills Project in which EPA stated, "Based on the short startup and shutdown periods the simple cycle combustion turbines (SCCTs) offer, along with the purpose of the Project, CCCTs were considered a redefinition of the source and therefore, not considered in the BACT analysis."

Combined cycle CTs have other technical problems which also make them infeasible for this Project. When a combined cycle CT is started from a full stop as is typical for a peaking unit, the CT is simply operating in the simple cycle mode. The large frame CTs often used in combined cycle applications do not have the high turndown ratio that can be achieved with aero-derivative CTs like the LM6000PC CTs. Large frame

CTs also have longer startup times. Therefore, constructing a combined cycle CT and then operating the combined cycle unit as a peaking unit to meet the fast load response required for this Project would mean that the combined cycle CTs would operate primarily in the simple cycle mode and would result in more GHG emissions than properly constructing the plant using the proposed simple cycle CTs.

Even a fast-start combined cycle CT is only capable of achieving startup within 30 minutes if the unit is already hot. If the unit is not hot, the combined cycle CT may require more than 3 hours to achieve full load under some conditions. These longer startup times are incompatible with the purpose and need of the proposed Project which is to provide a rapid electric power response to changes in the supply and demand of electricity. To keep the heat recovery steam generator (HRSG) and the steam turbine at a sufficiently high temperature to allow for quick startup, the facility would either have to operate continuously (and therefore it would no longer be a peaking facility) or it would have to operate an auxiliary boiler. The auxiliary boiler would need to be operated even when the peaking unit is not in service to keep the unit in hot standby, resulting in additional emissions of GHGs and other pollutants.

For the above reasons, combined cycle CTs may be eliminated in Step 1 because, as EPA stated in the EFS Shady Hills Project, combined cycle CTs would not meet the basic purpose and need of the Redhawk Generating Station Combustion Turbine Expansion Project and would therefore constitute a redefinition of the source.

9.5.3.2 Reciprocating Internal Combustion Engine (RICE) Generators.

If the largest available RICE electric generating units of approximately 19 MW were used for this project, this power plant would need to construct and operate at least twenty one (21) RICE engines. This would be a more complex power plant to construct and operate. While RICE electric generating units are not a control technology, RICE are further evaluated in Step 2 of the BACT analysis.

9.5.3.3 Energy Storage Options.

A number of energy storage technologies may be available including batteries, compressed air energy storage (CAES), liquid air energy storage (LAES), pumped hydro, and flywheels. When considering energy storage options as a GHG emissions control technology in Step 1 of this analysis, it is important to point out that energy *storage* options are fundamentally different than the energy *generation* project being proposed by APS. In short, incorporating energy storage into the proposed Project is not an available control option because these options would fundamentally redefine the source.

In the U.S. EPA's Response to Comments on the Red Gate PSD Permit for GHG Emissions, PSD-TX-1322-GHG, February 2015,[14] issued for a peaking facility to be comprised of reciprocating internal combustion engines (RICE), EPA determined that "energy storage cannot be required in the Step 1 BACT analysis as a matter of law." And in the U.S. EPA Environmental Appeals Board (EAB) decision regarding the APS Ocotillo Power Plant in 2016, the EAB concluded that replacing part or all of the proposed electric

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[14] *Response to Public Comments* for the South Texas Electric Cooperative, Inc. – Red Gate Power Plant PSD Permit for Greenhouse Gas Emissions, PSD-TX-1322-GHG (Nov. 2014), http://www.epa.gov/region6/6pd/air/pd-r/ghg/stec-redgate-resp2sierra-club.pdfNov%2014 .

power generation with energy storage fundamentally changed the project design and therefore the permitting authority did not err in not considering energy storage as an available technology, stating[15]:

> In sum, Maricopa County's characterization of Ocotillo's project purpose and inherent design is consistent with the record materials, and its BACT analysis incorporated a "hard look" at Arizona Public Service's business purpose. Accordingly, Maricopa County did not abuse its discretion in concluding that pairing energy storage with the proposed combustion turbines at the Ocotillo facility would "redefine the source."

Like the purpose of the Redhawk Expansion Project, the purpose of the Ocotillo Modernization Project and the Red Gate Project were to provide power for renewables and transmission grid support. EPA determined that "energy storage first requires separate generation and the transfer of the energy to storage to be effective . . . [it] is a fundamentally different design than a RICE resource that does not depend upon any other generation source to put energy on the grid." *Id.* Energy storage could not meet that production purpose for the duration or scale needed. *Id.* at 2-3. As EPA correctly observed, "[t]he nature of energy storage and the requirement to replenish that storage with another resource goes against the fundamental purpose of the facility." *Id.* at 3.

Similarly, in another PSD permit for a peaking facility for the Shady Hills Generating Station consisting of natural gas-fired simple cycle CTs (Jan 2014), EPA also concluded that energy storage would not meet the business purpose of the facility and therefore should not be considered in the BACT analysis. [16]

It is also important to note that energy storage technologies are not "zero emissions" technologies. The "round trip" energy efficiency of battery energy storage systems (BESS) is typically 80 to 90%. Other types of energy storage systems are even less. Therefore, while storage technologies may have near zero emissions at the site, the technology simply stores energy produced elsewhere, and then delivers it back to the grid, but at a net loss.

9.5.3.4 Battery Storage.

The Moss Landing Battery Storage Project is one of the largest grid connected battery energy storage facilities in the U.S. Installed at the retired Moss Landing power plant site in California, the facility has a 400 MW power output and 1,600 MWh of total energy capacity. The Redhawk Expansion Project will have a similar electric power output of almost 400 MW, and a ***continuous energy generation*** of 400 MW per hour. This means that the Moss Landing facility could provide the total energy output of the proposed Redhawk Project for a maximum of 4 hours. Thus, one of the largest battery storage facilities in the U.S. could not meet the basic purpose and need of the proposed project because this storage facility cannot provide the sustained, continuous electric generating capacity required. Therefore, the battery storage option may be eliminated at Step 1 of this BACT analysis because it would not meet the business purpose

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[15] U.S. EPA EAB PSD Appeal No. 16-01, ORDER DENYING REVIEW, September 1, 2016, page 346.

[16] Responses to Public Comments, Draft Greenhouse Gas PSD Air Permit for the Shady Hills Generating Station at 10-11 (Jan 2014), http://www.epa.gov/region04/air/permits/ghgpermits/shadyhills/ShadyHillsRTC%20_011314.pdf.

of the Project – to provide between 25 MW to 500 MW of electrical energy as needed[17] on an immediate basis, thereby redefining the source, and under Step 2 because it is not technically feasible at this time to produce up to 500 MW of electrical energy using this method.

On April 21, 2022, the U.S. EPA issued for public input a draft technical white paper on control techniques and measures that could reduce greenhouse gas (GHG) emissions from new stationary CTs entitled *Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Combustion Turbine Electric Generating Units*, April 21, 2022. This emerging technologies document discusses the successful integration of short-term storage with natural gas-fired CTs at two 50-MW peaking plants operated by Southern California Edison (SCE). In 2017, the Norwalk and Rancho Cucamonga Generating Stations began operating the world's first "Hybrid Enhanced Gas Turbine systems". The energy storage comes from co-located 10-MW/4.3-MWh lithium-ion batteries that pull excess renewable energy from the grid and then provide energy during peak demand. Note that these batteries would be capable of providing the full 10 MW of capacity for less than 26 minutes. It is also important to note that these batteries are not required under the facilities' permits for BACT.

This document states that "energy storage allows combustion turbines to minimize starts and stops and operate more continuously at optimal efficiency, both of which reduce GHG emissions." The battery storage at the two California facilities is charged by excess renewable power pulled from the grid as opposed to being charged by turbines on site. APS already has battery energy storage systems (BESS) co-located at solar energy installations. Co-locating batteries at the Redhawk facility to be charged by the CTs would increase GHG emissions from the units as compared to operation of the CTs alone because of the inherent round-trip efficiency losses for BESS.

9.5.3.5 Liquid Air Energy Storage (LAES).

Liquid air energy storage (LAES), also called cryogenic energy storage (CES), uses low temperature (cryogenic) liquids such as liquid air to store energy. This technology is being developed by Highview Power Storage in the United Kingdom. According to their website, work is now underway at Carrington; a 50MW / 300MWh plant at Trafford Energy Park near Manchester, UK. We are not aware of any commercially operating LAES facilities on the electric power output scale of the proposed Project. The "round trip" energy efficiency of LAES is expected to be 50 – 60%[18]. Therefore, like batteries, the LAES

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[17] See the U.S. EPA's *Response to Public Comments* for the South Texas Electric Cooperative, Inc. – Red Gate Power Plant PSD Permit for Greenhouse Gas Emissions PSD-TX-1322-GHG, page 7. http://www.epa.gov/region6/6pd/air/pd-r/ghg/stec-redgate-final-rtc.pdf. EPA states with respect to the use of batteries as a BACT control option, "Thus, the option may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the project – to provide up 225MW of energy for necessary time periods – and it may also be eliminated at Step 2 of the BACT analysis because it does not meet the technical requirements of the project – to provide such power for multiple days."

[18] For example, the document *Liquid Air Energy Storage (LAES): Pilot Plant to Multi MW Demonstration Plant, Highview Power Storage*, LAES technology benefits include "60% efficiency in stand alone mode. Integrates well with other industrial process plant (utilizing waste heat/cold) to enhance performance e.g. 70%+" Note that the Ocotillo Power Plant does not have waste heat/cold available to achieve the higher potential efficiency.

option may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the Project, which is to generate and provide to the grid 25 to 400 MW of electricity as needed.

9.5.3.6 Flywheel Energy Storage (FES).

Flywheel energy storage (FES) uses electric energy input to spin a flywheel and store energy in the form of rotating kinetic energy. An electric motor-generator uses electric energy to accelerate the flywheel to speed. When needed, the energy is discharged by drawing down the kinetic energy using the same motor-generator. Because FES incurs limited wear even when used repeatedly, FES are best used for low energy applications that require many cycles such as for uninterruptible power supply (UPS) applications. We are not aware of large FES systems installed to date that have the power output or energy storage comparable to the Redhawk Expansion Project. Therefore, like batteries and LAES, the flywheel energy storage option has not been developed on a scale similar to the Project and may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the Project.

9.5.3.7 Compressed Air Energy Storage (CAES).

Compressed air energy storage (CAES) stores compressed air in suitable underground geologic structures when off-peak power is available, and the stored high-pressure air is returned to the surface to produce power when generation is needed during peak demand periods. The round trip energy efficiency of CAES is also expected to be approximately 50 – 60%.

There are two operating CAES plants in the world; a 110 MW plant in McIntosh, Alabama (1991) and a 290 MW plant in Huntorf, Germany (1978). Both plants store air underground in excavated salt caverns produced by solution mining. Other geological structures such as basalt flows may also be feasible CAES geologic formations. However, the Redhawk Power Plant does not have any suitable geological structures in the vicinity of the plant. Like the other energy storage options, the CAES option may be eliminated at Step 1 of the BACT analysis because it would not meet the business purpose of the Project, and it can also be eliminated at Step 2 of the BACT analysis as technically infeasible.

9.5.3.8 Pumped Hydroelectric Storage.

Pumped hydroelectric storage projects move water between two reservoirs located at different elevations to store energy and generate electricity. When electricity demand is low, excess electric generating capacity is used to pump water from a lower reservoir to an upper reservoir. When electricity demand is high, the stored water is released from the upper reservoir to the lower reservoir through a turbine to generate electricity. Pumped storage projects have relatively high round trip efficiencies of 70 to 80%. However, there are no available water reservoirs at or near the Redhawk Power Plant, and water resources in the Phoenix area are scarce. Therefore, this technology is not an "available control option" at the Redhawk Power Plant and may be eliminated as a BACT option in Step 1 of the BACT analysis.

9.6 STEP 2. Identify Technically Feasible Control Technologies.

Step 2 of the BACT analysis involves the evaluation of the identified available control technologies to determine their technical feasibility. Generally, a control technology is technically feasible if it has been previously installed and operated successfully at a similar emission source. In addition, the technology must be commercially available for it to be considered as a candidate for BACT.

Potential CO_2 controls for these CTs include the use of low carbon containing fuels, energy efficient processes and technologies including efficient simple cycle CTs, combined cycle CTs, reciprocating internal combustion engines (RICE), and the use of post combustion control systems, including carbon capture and sequestration (CCS).

9.6.1 Lower Emitting Primary Fuels.

EPA's guidance document "*PSD and Title V Permitting Guidance for Greenhouse Gases*" notes that because the CAA includes "clean fuels" in the definition of BACT, clean fuels which would reduce GHG emissions but do not result in the use of a different primary fuel type or a redesign of the source should be considered in the BACT analysis. Table 9-3 is a summary of the CO_2 emission rate for coal, distillate fuel oil, and natural gas. With respect to the use of lower emitting or low carbon containing "clean" fuels, APS is proposing the use of natural gas as the primary fuel for these CTs. Because natural gas is the lowest CO_2 emitting fossil fuel available for this Project, further evaluation of clean fuels is not necessary.

As noted in Step 1, because the use of hydrogen as a fuel would fundamentally redefine the nature of the Project as stated in this application, hydrogen fuel may be eliminated in Step 1 because the required use of hydrogen as a fuel which is not available at the Redhawk Power Plant would constitute a redefinition of the source.

9.6.2 Energy Efficient Processes and Technologies.

The use of energy efficient processes and technologies is a technically feasible CO_2 control option. As stated by the Bay Area Air Quality Management District in the Statement of Basis for the Russell City Energy Center, "The only effective means to reduce the amount of CO_2 generated by (a) fuel-burning power plant is to generate as much electric power as possible from the combustion, thereby reducing the amount of fuel needed to meet the plant's required power output." Energy efficient processes and technologies include efficient simple cycle gas turbines, as well as reciprocating internal combustion engines (RICE), and combined-cycle gas turbines.

9.6.2.1 High Efficiency Simple Cycle Combustion Turbines.

APS is proposing to install eight (8) GE LM6000PC natural gas-fired simple cycle CTs for this Project. The LM6000PC CTs are efficient, fast start CTs which are well suited for the proposed project. The LM6000PC CTs utilize an aero derivative CT coupled to an electric generator to produce electric energy. A CT is an internal combustion engine which uses air as a working fluid to produce mechanical power and consists of an air inlet system, a compressor section, a combustion section, and a power section. The compressor section includes an air filter, noise silencer, and a multistage axial compressor. During operation, ambient air is drawn into the compressor section where it is compressed and discharged to the combustion section of the turbine where natural gas is injected into the turbine and the air/fuel mixture is ignited. Water is also injected into the combustion section of the turbine which reduces flame temperatures and reduces thermal NO_x formation. The heated air, water, and combustion gases pass through the power or expansion section of the turbine which consists of blades attached to a rotating shaft, and fixed blades or buckets. The expanding gases cause the blades and shaft to rotate. The power section of the turbine extracts energy from the hot gases. The power section of the turbine produces the power to drive both the compressor and the electric generator.

The LM6000PC CTs achieve a simple cycle thermal efficiency of approximately 40% based on the lower heating value (LHV) of natural gas.

9.6.2.2 Combined-Cycle CTs.

Combined cycle CTs are highly efficient power plants typically designed for baseload electric power generation. However, the purpose of this Project is to construct peaking power capacity. The Redhawk Expansion Project is being proposed to provide quick start and power ramping capability over the range of 25 MW to 400 MW to meet changing and peak power demands and mitigate grid instability caused in part by the intermittency of renewable energy generation. To satisfy the basic purpose of this plant, the peaking units must be able to start quickly even under "cold" start conditions, the units must be able to repeatedly start and stop as needed, and the units must be able to operate at low loads to provide power ramping capacity. The proposed LM6000PC CTs have a startup time of 10 minutes from dispatch to baseload, and also have a 5-minute fast start capability. This fast startup time is critical to the Project's purpose and need.

These requirements for this peaking capacity make combined-cycle CTs technically infeasible for this Project because combined cycle CTs cannot meet the rapid startup and shutdown requirements for this peak power capacity. The start-up of a combined-cycle CT is normally conducted in three steps:

1. Purging of the heat recovery steam generator (HRSG),
2. Gas turbine startup, synchronization, and loading, and
3. Steam turbine speed-up, synchronization, and loading.

The third step of the startup process is dependent on the amount of time that the unit has been shut down prior to being restarted. As a result, the startup of a combined cycle CT are often classified as "cold" starts, "warm" starts, and "hot" starts. The HRSG and steam turbine must be started carefully to avoid severe thermal stress which can cause damage to the equipment and unsafe operating conditions for plant personnel. For this reason, the startup time for a combined cycle CT is normally much longer than that of a similarly-sized simple cycle CT. Even with fast-start technology, new combined-cycle units may require more than 3 hours to achieve full load, as compared to approximately 30 minutes to full electric output for the proposed GE Model LMS100 simple cycle gas turbines.

"Fast start" combined cycle CTs are available but require significant changes in design, including the need for auxiliary boilers to keep the heat recovery steam generator (HRSG) hot, and/or provisions to decouple the CT exhaust from the HRSG for fast start operation. But even fast start capable combined cycle CTs have longer startup times than the proposed simple cycle CTs. Because the long startup time and reduced ramp rate capacity for combined cycle CTs is incompatible with the purpose of the Project, the use of combined cycle CTs is technically infeasible for the Project. This conclusion is consistent with the EPA

Region 9 determination for the Pio Pico Energy Center and the EPA Region 4 determination for the EFS Shady Hills Project peaking projects.

9.6.2.3 Reciprocating Internal Combustion Engines.

Reciprocating internal combustion engines (RICE) are well-suited for peaking applications and are technically feasible for the proposed Project. RICE are further evaluated in this control technology review.

9.6.3 Good Combustion, Operating, and Maintenance Practices.

Good combustion and operating practices are a potential control option by improving the efficiency of any combustion related generating technology, including simple cycle CTs and RICE generators. Good combustion practices include the proper maintenance and tune-up of the CTs or RICE on an annual basis, or more frequent basis, in accordance with the manufacturer's specifications.

9.6.4 Carbon Capture and Sequestration (CCS).

There are three approaches for Carbon Capture and Sequestration (CCS), including pre-combustion capture, post-combustion capture, and oxy-fuel combustion[19]. Pre-combustion capture is applicable primarily to fuel gasification plants, where solid fuel such as coal is converted into gaseous fuels. The conversion process could allow for the separation of the carbon containing gases for sequestration. Pre-combustion capture is not technically feasible for this proposed project which is based on natural gas combustion that does not require gas conversion.

Oxy-combustion is the combustion of fuels with nearly pure oxygen and recycled flue gas instead of air. The resultant flue gas is primarily carbon dioxide (CO_2) which facilitates the capture of high-purity CO_2 without the need for a post-combustion scrubber. However, oxy-fuel combustion is not commercially available for gas turbine applications.

Post-combustion CCS is theoretically applicable for CT power plants. However, in contrast to readily-available high-efficiency simple cycle CT technologies, emerging CCS technologies are not available or applicable to simple cycle CTs. Under the final *Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units* in 40 CFR 60, Subpart TTTT, EPA established standards for newly constructed "base load" and "non-base load" fossil fuel-fired stationary CTs. In setting these standards, EPA stated that there is not sufficient information to determine that CCS is adequately demonstrated for base load natural-gas fired combustion turbines.[20] Further, in setting the fuel-based standard for non-base load CTs, the EPA concluded that the low capacity factors and irregular operating patterns (i.e., frequent starting and stopping and operating at part load) of non-base load units make the technical challenges associated with CCS even greater than those associated with base load units.

[19] Intergovernmental Panel on Climate Change (IPCC), 2005.

[20] Pre-publication version of the Clean Power Plan *Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units*, page 527 of 768.

A post combustion CCS system involves three steps: 1) Capturing CO_2 from the emissions unit, 2) Transporting the CO_2 to a permanent geological storage site, and 3) Permanently storing the CO_2.

Before CO_2 emitted from these CTs can be sequestered, it must be captured as a relatively pure gas. CO_2 may be captured from the CT exhaust gas using adsorption, physical absorption, chemical absorption, cryogenic separation, gas membrane separation, and mineralization. Many of these methods are either still in development or are not suitable for treating CT flue gas due to the characteristics of the exhaust stream. The low concentration of CO_2 in natural gas-fired CTs adds to the challenge of CO_2 capture over coal-fired power plants. The CTs proposed for this Project are expected to contain approximately 5 to 6% CO_2 by volume in the flue gas exhaust. This concentration is much lower than coal-fired power plants, where the CO_2 concentration is typically 12 to 15%. As a result, there are a number of serious operational challenges and additional equipment which would be required for these natural gas-fired simple cycle CTs used for peaking load operation because of the highly variable exhaust gas flow and low CO_2 concentration. These challenges and additional equipment would have significant impacts on the operation of these CTs and the ability of these CTs to meet the basic project design requirements to provide peak power capacity and high ramp rates. CCS would also significantly affect the power output, efficiency, and cost of this Project.

Post-combustion carbon capture has been demonstrated on a slipstream from a combined cycle CT exhaust at NextEra Energy's (formerly owned and operated by Florida Power and Light) natural gas power plant in Bellingham, MA. This plant captures a 40 MW slipstream from a combined cycle CT, equal to about 365 short tons per day of CO_2. However, each of the proposed CTs could produce more than 650 tons of CO_2 per day, or more than 5,000 tons per day for eight (8) CTs combined. This is 14 times the size of the CO_2 capture system at the Bellingham Energy Center.

As noted in the POWER article, *Commercially Available CO_2 Capture Technology*, Dennis Johnson; Satish Reddy, PhD; and James Brown, PE, (available at www.powermag.com/coal/2064.html), Fluor Corporation has developed an amine-based post-combustion CO_2 capture technology called Econamine FG Plus (EFG+). There are more than 25 licensed plants worldwide that employ the EFG+ technology — from steam-methane reformers to CT power plants.

Of the potentially applicable technologies, post-combustion capture with an amine solvent such as monoethanolamine (MEA) is currently the preferred option because it is the most mature and well-documented technology, and because it offers high capture efficiency, high selectivity, and the lowest energy use compared to the other existing processes. Post-combustion capture using MEA is also the only process known to have been previously demonstrated in practice on gas turbines. Therefore, MEA is the only carbon capture technology considered in this analysis.

In 2003, Fluor and British Petroleum (BP) completed a joint feasibility study that examined capturing CO_2 from eleven simple cycle CTs at BP's Central Gas Facility (CGF) gas processing plant in Alaska (Hurst & Walker, 2005; Simmonds et al., 2003). This project was not actually implemented. The absorption of CO_2 by MEA is a reversible exothermic reaction. To actually capture CO_2 using MEA, the turbine exhaust gas must be cooled to about 50 °C (122 °F) to improve absorption and minimize solvent loss due to evaporation. In the feasibility study for the CGF, the CT flue gas was to be cooled by a heat recovery steam generator (HRSG) to complete most of the cooling, followed by a direct contact cooler (DCC). Hurst & Walker (2005) found that the DCC alone would be insufficient for the CTs due to the high exhaust gas temperature of 480 - 500 °C (900 – 930 °F). Note that the LM6000PC CTs have exhaust gas temperatures of 750 to 840 °F. Therefore, to be able to actually capture CO_2 emissions, the exhaust gas would need to be reduced by 630 to 720 °F. The only feasible way to achieve this significant temperature reduction is to use a HRSG.

In a carbon capture system, after the MEA is loaded with CO_2 in the absorber, it would be sent to a stripper where it is heated to reverse the reaction and liberate the CO_2. In the CGF facility study, heat for this regeneration stage was to have come from the steam generated in the HRSG, with excess steam to be used to generate electricity. Unfortunately, the integration of a HRSG to the simple cycle CTs would convert the turbines from simple-cycle to combined-cycle operation. As noted above, combined cycle CTs are not technically feasible for the proposed project because of the fast startup times required for the Project. Therefore, while carbon capture with an MEA absorption process may be technically feasible for base load combined-cycle gas turbines, it is not feasible for simple-cycle non-base load CTs. Because combined-cycle CTs are not technically feasible for this Project, CCS is also not technically feasible for this Project.

As noted above, a post combustion CCS system involves three steps: 1) Capturing CO_2 from the emissions unit, 2) Transporting the CO_2 to a permanent geological storage site, and 3) Permanently storing the CO_2. With respect to the second and third steps, the Redhawk Power Plant does not have any nearby carbon sequestration sites available. According to the U.S. Geologic Survey (USGS) *Geologic Carbon Dioxide Sequestration Interactive Map*, the closest possible sites are the Eastern Great Basin north and west of the Colorado River in Nevada and in the northwest corner of Arizona, and the San Juan Basin in northwest New Mexico. The closest of these areas is more than 200 miles from the Redhawk Power Plant. And these closest areas are not necessarily available or feasible to be used for sequestration. These distances present severe technical feasibility problems to transporting and permanently sequestering more than 300,000 tons of CO_2 annually.

9.6.5 Conclusions regarding the technically feasible control options.

Table 9-4 identifies the technically feasible and technically infeasible control technologies for the control of GHG emissions from the proposed CTs based on the above analysis.

TABLE 9-4. Summary of the technical feasibility of GHG control technologies.

Control Technology	Technical Feasibility
1. The use of low carbon containing or lower emitting primary fuels.	Feasible
2. The use of energy efficient processes and technologies, including:	
a. Efficient Simple Cycle CTs	Feasible
b. Combined Cycle CTs	Infeasible
c. Reciprocating Internal Combustion Engines (RICE)	Feasible*
3. Good combustion and operating practices.	Feasible
4. Carbon Capture and Sequestration (CCS).	Infeasible

9.7 STEP 3. Rank The Technically Feasible Control Technologies.

Based on the above analysis, the following are technically feasible control technologies for the control of GHG emissions from this proposed new peak electric generating capacity:

1. The use of natural gas, an inherently low carbon fuel,
2. Efficient simple cycle CT electric generating units,
3. Good combustion and operating practices,
4. Reciprocating internal combustion engine (RICE) electric generating units.

With respect to the use of lower emitting primary fuels, both CT and RICE electric generating units may use the lowest commercially available carbon containing fuel – natural gas. Therefore, the lowest CO_2 and GHG emitting generating technology will be based on the efficiency of the technology and the applicability of the technology to the Project's Purpose and Need.

Table 9-6 includes detailed performance data for the proposed GE LM6000PC CTs. The lowest design heat rate (i.e., the highest efficiency) for these CTs at 100% load and an ambient temperature of 20 °F is 9,397 Btu per kWh of gross electric energy output (Btu/kWh_g). One Btu is equal to 3,413 kWh; therefore, a gross heat rate of 9,397 Btu/kWh_g is equal to an electric generating efficiency of 36% and 1,105 lb CO_2/MWh_g. Please note that this efficiency is based on the *higher heating value* (HHV) of natural gas. For natural gas, the HHV is 1.109 times the LHV, or approximately 11% higher.

One large natural gas-fired lean burn RICE engine has a design heat rate as low as approximately 8,190 Btu/kWhg based on the HHV of natural gas. This heat rate is equal to an efficiency of approximately 42% (HHV) and a CO_2 emission rate of 947 lb CO_2/MWh_g. The largest natural gas-fired engine currently manufactured has a maximum continuous rating of up to 18.3 MW. However, only one manufacturer currently makes this engine – the Wärtsilä 18V50SG. Other manufacturers make smaller natural gas engines of up to approximately 10 MW in size. Therefore, to achieve the same gross electric output, the Project would require from 20 to 40 RICE electric generating units. This would be a much more complex installation and the existing Redhawk Power Plant may not have sufficient space for this many RICE generators.

Table 9-5 is a ranking of the technically feasible GHG control technologies based on the above stated ***best case design efficiencies, heat rates, and CO_2 emission rates*** for the RICE and CT electric generating units.

TABLE 9-5. Ranking of the technically feasible GHG control technologies for the turbines.

Technology	Minimum Heat Rate Btu/kWh_g	Best Case CO_2 Emission Rate lb/MWh_g
Natural Gas-Fired RICE Engines	8,190	947
Natural Gas-Fired GE LM6000PC CTs	9,397	1,105

TABLE 9-6. Performance data for the General Electric Model LM6000PC simple cycle CTs at various load and ambient air conditions.

CASE #	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ambient Dry Bulb Temperature	°F	20	20	20	41	41	41	73	73	73	105	105	105	115	115	115
Relative Humidity	%	60	60	60	51	51	51	37	37	37	19	19	19	9.5	9.5	9.5
CT Load, %		100%	75%	50%	100%	75%	50%	100%	75%	50%	100%	75%	50%	100%	70%	50%
Inlet Conditioning Fogging		OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
Performance																
Generator Output, Gross	MW	48.75	36.58	24.37	49.58	36.89	24.79	47.36	35.51	23.68	43.86	32.90	21.76	43.45	30.41	21.72
Generator Output, Gross	kW	48,749	36,584	24,375	49,575	36,890	24,788	47,357	35,511	23,679	43,860	32,899	21,758	43,445	30,412	21,723
Heat Rate, Gross (HHV)	Btu/kWh	9,397	9,994	11,339	9,506	10,027	11,310	9,587	10,138	11,507	9,689	10,425	12,011	9,703	10,642	12,071
Estimated Auxiliary Load	kW	729	643	594	736	647	594	726	635	573	729	609	539	757	632	560
Power, Net	kW	48,020	35,941	23,781	48,839	36,243	24,194	46,631	34,876	23,106	43,131	32,290	21,219	42,688	29,779	21,163
Fuel and Water Flow																
Total Heat Input, HHV	MMBtu/hr	458.1	365.6	276.4	471.3	369.9	280.3	454.0	360.0	272.5	424.9	343.0	261.3	421.6	323.6	262.2
Total Heat Input, LHV	MMBtu/hr	413.5	330.0	249.5	425.4	333.9	253.1	409.8	325.0	245.9	383.6	309.6	235.9	380.5	292.1	236.7
Fuel Flow	lb/hr	19,872	15,862	11,990	20,444	16,049	12,162	19,696	15,617	11,820	18,436	14,879	11,338	18,288	14,040	11,375
NOx Water Injection Flowrate	lb/hr	23,450	17,590	14,069	23,472	17,604	14,083	19,721	14,069	10,782	17,050	9,742	6,444	16,740	19,721	19,721
Fogging Water Flowrate	lb/hr							9,200			9,200			9,200		
Exhaust Parameters																
Exhaust Temperature	°F	788	730	675	840	767	718	850	806	782	863	857	826	864	861	850
Exhaust Flow	lb/hr	1,093,320	997,200	872,280	1,058,760	973,080	844,200	1,017,000	913,680	777,960	965,880	847,800	722,520	961,560	815,760	710,280
Exhaust Volume Flow	ACFM	590,467	511,484	425,823	598,206	517,009	428,337	581,980	502,846	416,620	559,427	484,982	402,776	556,988	470,813	406,459
Exhaust Volume Flow	SCFM	231,279	209,901	183,503	224,792	206,297	177,864	216,866	194,167	163,708	206,422	180,037	153,114	205,368	174,118	152,271
Stack Emissions																
Carbon Dioxide (CO_2)	lb/MMBtu	117.6	118.7	118.2	118.1	118.8	118.0	117.9	118.5	117.7	117.8	118.2	118.0	117.7	117.7	117.9
	lb/hr	53,883	43,390	32,655	55,652	43,928	33,072	53,541	42,662	32,075	50,073	40,533	30,835	49,621	38,107	30,914
	lb/MWhr(g)	1,105	1,186	1,340	1,123	1,191	1,334	1,131	1,201	1,355	1,142	1,232	1,417	1,142	1,253	1,423

Footnotes

1. Performance data is for the General Electric LM6000PC CTs, Power Factor 1.0, altitude 880 feet, and barometric pressure of 14.24 PSIA.
2. Performance data are based on the following natural gas fuel values: 23,051 Btu/lb, Higher Heating Value (HHV) and 1,005.3 Btu per standard cubic foot, HHV.
3. CO_2 emissions are for new CTs and do not represent degradation in engine efficiency due to normal operation of the engine.

9.8 STEP 4. Evaluate the Most Effective Controls.

9.8.1 Natural Gas-Fired RICE Engines.

From Table 9-5, the use of RICE electric generating units would have the lowest potential CO_2 emission rate of the technically feasible control options. At the CO_2 emission rates in Table 9-5, the use of these RICE engines may reduce CO_2 emissions by approximately 17% during normal operation. Note that this is an estimate of the potential reduction in CO_2 emissions. The use of from 20 to 40 RICE engines rather than 8 CTs may have other issues which could impact the overall efficiency of the power plant and the total CO_2 emissions.

However, while RICE engines may have a relatively small improvement in CO_2 emissions, the use of RICE engines would have other significant environmental impacts. The U.S. EPA has a long standing policy that the use of a control technology may be eliminated if the use of that technology would lead to increases in other pollutants, and that those increases would have significant adverse effects that may outweigh the benefits from the use of that technology. In the U.S. EPA's *New Source Review Workshop Manual*, page B.49, EPA states:

> One environmental impact is the trade-off between emissions of the various pollutants resulting from the application of a specific control technology. The use of certain control technologies may lead to increases in emissions of pollutants other than those the technology was designed to control. For example, the use of certain volatile organic compound (VOC) control technologies can increase nitrogen oxides (NOx) emissions. In this instance, the reviewing authority may want to give consideration to any relevant local air quality concern relative to the secondary pollutant (in this case NOx) in the region of the proposed source. For example, if the region in the example were nonattainment for NOx, a premium could be placed on the potential NOx impact. This could lead to elimination of the most stringent VOC technology (assuming it generated high quantities of NOx) in favor of one having less of an impact on ambient NOx concentrations.

The U.S. EPA's guidance document *PSD and Title V Permitting Guidance For Greenhouse Gases*, November, 2010 recommends that the environmental impact analysis of Step 4 of a GHG BACT analysis should concentrate on impacts other than the direct impacts due to emissions of the regulated pollutant in question. EPA has recognized that consideration of a wide variety of collateral environmental impacts is appropriate in Step 4, such as solid or hazardous waste generation, discharges of polluted water from a control device, visibility impacts, demand on local water resources, and emissions of other pollutants subject to NSR or pollutants not regulated under NSR such as air toxics. Where GHG control strategies affect emissions of other regulated pollutants, permitting authorities should consider the potential trade-offs of selecting particular GHG control strategies. Permitting authorities have flexibility when evaluating the trade-offs associated with decreasing one pollutant while increasing another, and the specific considerations made will depend on the facts of the specific permit at issue.

In this case, while the use of RICE engines may result in a reduction in CO_2 emissions, the use of RICE engines may result in an increase in other regulated PSD pollutants, especially VOC emissions. With respect to VOC emissions, RICE electric generating units have substantially higher VOC emission rates than CTs. Three different PSD permits for new natural gas-fired Wärtsilä 18V50SG RICE electric generating units equipped with oxidation catalysts for CO and VOC control have VOC BACT limits of 4.49 pounds per hour. These units have a rated heat input capacity of 154 mmBtu per hour and a rated capacity of 18.8 MW. The BACT emission limit for VOC emissions for these units of 4.49 lb/hr is equal to a VOC emission rate of 0.029 lb/mmBtu. On a heat input basis, this emission rate is more than 5 times as high as the proposed VOC emission limit for the CTs in this application.

The Redhawk Power Plant is located in Maricopa County which is currently designated as a moderate nonattainment area for ozone. Based on the ozone nonattainment status of the area, it is appropriate to favor the technology that reduces NO_x and VOC emissions over relatively small and potentially uncertain reductions in GHG emissions, especially when the difference in both NO_x and VOC emissions between the two technologies is significant. EPA Region 9 considered these same types of collateral environmental impacts from RICE generators in Step 4 of the Pio Pico GHG BACT analysis and concluded that it was appropriate to eliminate RICE engines because of these adverse collateral environmental impacts.

9.8.2 Carbon Capture and Sequestration.

As stated above in Step 2, CCS is not a technically feasible control option for these simple cycle CTs. However, even if the severe technical feasibility issues could somehow be resolved, CCS is not an economically feasible control technology for these CTs. In the preamble to the proposed standards of performance for GHG emissions for electric generating units, 40 CFR 60 Subpart TTTTa, the EPA stated[21]:

> The EPA is not proposing the use of CCS or hydrogen co-firing as the BSER (or as a component of the BSER) for low load combustion turbines. As described in the section discussing the second component of BSER for the intermediate load subcategory, the EPA is not proposing that CCS is the BSER for simple cycle combustion turbines based on the Agency's assessment that CCS may not be cost-effective for such combustion turbines when operated at intermediate load. This rationale applies with even greater force for low load combustion turbines. In addition, currently available post-combustion amine-based carbon capture systems require that the exhaust from a combustion turbine be cooled prior to entering the carbon capture equipment. The most energy efficient way to do this is to use a HSRG, which is an integral component of a combined cycle turbine system but is not incorporated in a simple cycle unit. For these reasons, the Agency is not proposing that CCS qualifies as the BSER for this subcategory of sources.

Regarding economic impacts, in its PSD BACT guidance EPA states[22]:

> EPA recognizes that at present CCS is an expensive technology, largely because of the costs associated with CO_2 capture and compression, and these costs will generally make the price of electricity from power

[21] Federal Register, Vol. 88, No. 99, Tuesday, May 23, 2023, page 33286.

[22] U.S. EPA, EPA-457/B-11-001, *PSD and Title V Permitting Guidance for Greenhouse Gases,* (Mar. 2011), page 42.

> plants with CCS uncompetitive compared to electricity from plants with other GHG controls. Even if not eliminated in Step 2 of the BACT analysis, on the basis of the current costs of CCS, we expect that CCS will often be eliminated from consideration in Step 4 of the BACT analysis, even in some cases where underground storage of the captured CO_2 near the power plant is feasible.

For example, even though the U.S. EPA rejected CCS as a technically infeasible GHG emissions control technology option for the Palmdale Hybrid Power Project, the EPA evaluated the costs of CCS in its Response to Public Comments (October, 2011). (Please note that while EPA approved the permit for this facility, the project was never constructed.) The proposed Palmdale Hybrid Power Project included 520 MW natural gas-fired combined cycle units and 50 MW of solar photovoltaic systems. In the EPA's analysis, the estimated capital costs for the Project were \$615 - \$715 million, equal to an annualized cost of about \$35 million. In comparison, the estimated annual cost for CCS for this Project is about \$78 million, ***or more than twice the value of the facility's annual capital costs***. Based on these very high costs, EPA eliminated CCS as an economically infeasible control option. The EPA's decision to reject CCS based on these very high annual costs was upheld on appeal by the U.S. EPA's Environmental Appeals Board, PSD Appeal No. 11-07, decided September 17, 2012.

Like the Palmdale Project, the Redhawk Power Plant does not have any nearby carbon sequestration sites available. As noted in section 9.6.4, the closest of these areas is more than 200 miles from the Redhawk Power Plant. Therefore, even if the severe technical feasibility issues for the application of CCS to these simple cycle CTs could somehow be resolved, the use of CCS for this Project is not an economically feasible control technology option for these simple cycle CTs.

9.9 STEP 5. Proposed Greenhouse Gas BACT Determination.

Based on this control technology review, the use of efficient, natural gas-fired simple-cycle CTs combined with good combustion and maintenance practices represents BACT for the control of GHG emissions from the proposed CTs. Therefore, BACT will be achieved by the CT design and by the proper operation and maintenance of the CTs.

9.9.1 Combustion Turbine Design.

The proposed natural gas-fired General Electric Model LM6000PC aeroderivative simple cycle CTs are efficient, low CO_2 emitting CTs. The lowest design heat rate (i.e., the highest efficiency) for these CTs at 100% load and an ambient temperature of 20 °F is 9,397 Btu per kWh_g, equal to an electric efficiency of 36% and 1,105 lb CO_2/MWh_g.

9.9.2 Emission Limit.

9.9.2.1 Emission Limit Based on the Worst-Case Operation.

The BACT emission limit must be achievable at all times and across all load ranges for which these CTs are designed to operate. As stated in the Project Description, the new units need the ability to start quickly, change load quickly, and idle at low load. The latter requirement will allow the CTs to ramp very quickly when needed to respond to demand requirements which can occur for many reasons, including simply cloud cover reducing solar output. To provide this capability, the CTs will be designed to meet the BACT emission limits for NO_x, PM, PM_{10}, and $PM_{2.5}$ emissions at steady state loads as low as 25% of the maximum output capability of the CTs.

The CT efficiency decreases and the CO_2 emission rate increases as the load is decreased. In addition, the CO_2 emission rate may vary between CTs due to normal variation in the manufacturing process, and even with proper operation and maintenance, the CO_2 emission rate may increase over time due to the normal operation and wear of the CT components. Variation in turbines is expected to be about 3%, and degradation in performance due to normal wear is expected to be an additional 3%[23]. This variation and degradation in performance can result in a 6% increase above the design values in Table 9-6. From Table 9-6, these CTs have a design CO_2 emission rate of 1,423 lb/MWh_g at 50% load and an ambient condition of 115 °F. Therefore, this CO_2 emission rate may degrade to 1,510 lb/MWh_g over time. Furthermore, this rate does not consider startup and shutdown emissions when no energy is produced.

9.9.2.2 Emission Limit Based on the Expected Operation.

The operation of these CTs may vary substantially from day to day. The U.S. EPA Region 9 provided a framework for addressing the variation of turbine efficiency and resulting GHG emission rate as a function of load in their "*Responses to Public Comments on the Proposed Prevention of Significant Deterioration Permit for the Pio Pico Energy Center*", November 2012. EPA stated that it is not possible to predict the extent of part load operation during every year for the life of the generating facility and that facilities are designed to meet a range of operating levels. Therefore, EPA stated it is inappropriate to establish a GHG

[23] U.S. EPA Region IX, *Fact Sheet and Ambient Air Quality Impact Report for a Clean Air Act Prevention of Significant Deterioration Permit, Pio Pico Energy Center*, PSD Permit Number SD 11-01, June 2012.

permit limit that prevents the facility from generating electricity as intended. For the Pio Pico PSD permit, EPA determined that the appropriate methodology for setting the GHG BACT emission limit was to set the final BACT limit at a level achievable during the lowest load, "worst-case" normal operating conditions. This methodology was also used to develop the GHG BACT limit for the APS Ocotillo CTs.

Table 9-7 is a summary of a typical anticipated run time operating scenario for these CTs. The run time scenario includes the heat input for up to 540 startup/shutdown events per year, and a projection of low, mid, and high CT load operation at five (5) ambient temperature conditions. The annual average CO_2 emission rate for the CTs based on this expected operation and including all periods of operation, including startup and shutdown, is 1,370 lb/MWh_g.

Note that the analysis in Table 9-7 is based on the design values for a new GE LM6000PC CT and does not represent the variation in CTs and the degradation in performance due to normal wear which can result in a 6% increase above the design values. Therefore, based on this analysis, the long term achievable CO_2 emission rate for these CTs is 1,450 lb CO_2/MWh_g.

TABLE 9-7. Expected operation and CO_2 emission rate for the GE LM6000PC CTs based on the non-degraded design heat rates.

Operation	Ambient Condition	% of Total	Heat Input	Heat Rate	Generation	CO_2 Emissions	
	°F	%	mmBtu/yr	Btu/kWh_g	MWh	ton/yr	lb/MWh_g
Startup / Shutdown			125,980			7,368	
Low Load: 50 - 74%	20	0.0%	70	11,339	6	4	1,326
Mid Load: 75 - 99%		0.0%	70	9,994	7	4	1,169
High Load: 100%		0.1%	699	9,397	74	41	1,099
Low Load: 50 - 74%	41	0.1%	699	11,310	62	41	1,323
Mid Load: 75 - 99%		1%	6,992	10,027	697	409	1,173
High Load: 100%		8%	55,937	9,506	5,884	3,272	1,112
Low Load: 50 - 74%	73	1%	6,992	11,507	608	409	1,346
Mid Load: 75 - 99%		14%	97,889	10,138	9,655	5,725	1,186
High Load: 100%		24%	167,810	9,587	17,505	9,815	1,121
Low Load: 50 - 74%	105	1%	6,992	12,011	582	409	1,405
Mid Load: 75 - 99%		23%	160,818	10,425	15,426	9,406	1,219
High Load: 100%		18%	125,858	9,689	12,990	7,361	1,133
Low Load: 50 - 74%	115	1%	5,454	12,071	452	319	1,412
Mid Load: 75 - 99%		2%	13,984	10,642	1,314	818	1,245
High Load: 100%		7%	48,945	9,703	5,044	2,863	1,135
Total, All Operation		**100%**	**825,190**		**70,307**	**48,263.7**	**1,370**

Because the GHG emission rate varies with ambient air temperatures, and because the operating load will vary not only with the time of day but also the time of year, the averaging period for the GHG BACT limit must be long enough to encompass this variability in operation. A 12-month rolling average basis is consistent with the majority of the CO_2 BACT emission limits and is also consistent with the final CO_2 emission standard under 40 CFR 60 Subpart TTTT. In the preamble to this proposed rule, EPA stated[24] "This 12-operating-month period is important due the inherent variability in power plant GHG emissions rates." EPA went on to say, "a 12-operating month rolling average explicitly accounts for variable operating conditions, allows for a more protective standard and decreased compliance burden, allows EGUs to have and use a consistent basis for calculating compliance (i.e., ensuring that 12 operating months of data would be used to calculate compliance irrespective of the number of long-term outages), and simplifies compliance for state permitting authorities". EPA Region 9 also stated in the Pio Pico response to comments that "EPA believes that annual averaging periods are appropriate for GHG limits in PSD permits because climate change occurs over a period of decades or longer, and because such averaging periods allow facilities some degree of flexibility while still being practically enforceable". For these reasons, APS believes that the operational limit should be based on a 12-month rolling average.

9.9.3 Gas Turbine Maintenance Requirements.

To achieve the proposed BACT emission limits, these CTs must be maintained properly to ensure peak performance of the turbines and ensure that good combustion and operating practices are maintained. Therefore, BACT also includes a requirement to prepare and follow a maintenance plan for each CT. Good CT maintenance practices normally include annual boroscopic inspections of the turbine, generator testing, control system inspections, and periodic fuel sampling and analysis. Good CT maintenance practices also includes major overhauls conducted as recommended by the manufacturer.

9.9.4 Proposed GHG BACT Requirements.

Because the GHG emission rate varies with ambient air temperatures, and because the operating load of the CTs will vary not only with the time of day but also the time of year, the averaging period for the GHG BACT limit must be long enough to encompass this variability. A 12-month rolling average basis is consistent with the majority of the CO_2 BACT emission limits and is also consistent with the final CO_2 emission standard under 40 CFR 60 Subpart TTTT. In the preamble to this proposed rule, EPA stated[25] "This 12-operating-month period is important due the inherent variability in power plant GHG emissions rates." EPA went on to say "a 12-operating month rolling average explicitly accounts for variable operating conditions, allows for a more protective standard and decreased compliance burden, allows EGUs to have and use a consistent basis for calculating compliance (i.e., ensuring that 12 operating months of data would be used to calculate compliance irrespective of the number of long-term outages), and simplifies compliance for state permitting authorities". For these reasons, APS believes that the GHG BACT emission limit should be based on a 12-month rolling average.

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[24] Federal Register, Vol. 79, No. 5, January 8, 2014, page 1,481.

[25] Federal Register, Vol. 79, No. 5, January 8, 2014, page 1,481.

Based on this analysis, APS has concluded that the use of efficient simple cycle combustion turbines and the use of good combustion practices in combination with low carbon containing fuel (natural gas) represents the best available control technology (BACT) for the control of GHG emissions from the proposed GE LM6000PC simple-cycle combustion turbines. Based on this analysis, APS proposes the following limits as BACT for the control of GHG emissions from the new CTs:

1. CO_2 emissions may not exceed 1,450 lb CO_2 per MWh of gross electric output for all periods of operation, including periods of startup and shutdown, based on a 12-operating month rolling average.
2. The total heat input to each combustion turbine may not exceed 783,900 mmBtu based on a 12-operating month rolling average.
3. The permittee shall prepare and follow a Maintenance Plan for each CT.

9.10 Natural Gas Piping Systems GHG Control Technology Review.

The Prevention of Significant Deterioration (PSD) program in 40 CFR §52.21 includes methane (CH_4) as a regulated GHG substance or pollutant. Natural gas piping components including valves, connection points, pressure relief valves, pump seals, compressor seals, and sampling connections can leak and result in fugitive natural gas emissions. Since natural gas consists of from 70 to almost 100% methane, leaks in the natural gas piping can result in methane emissions, and methane is a regulated greenhouse gas.

The Mandatory Greenhouse Gas Reporting Rules in 40 CFR Part 98, Subpart W include methods for estimating GHG emissions from petroleum and natural gas systems. Table 3-4 summarizes the estimated fugitive methane emissions and the equivalent GHG emissions, expressed as CO_2e, which are expected to result from a properly operated and maintained natural gas piping system for new CTs.

9.10.1 STEP 1. Identify All Potential Control Technologies.

The following technologies are available to control fugitive methane emissions from natural gas piping systems.

1. Leakless technology components,
2. Leak detection and repair (LDAR) program,
3. Alternative monitoring using remote sensing technology, and
4. Audio/visual/olfactory (AVO) monitoring program.

9.10.2 STEP 2. Identify Technically Feasible Control Technologies.

"Leakless" technologies such as bellows or seal valves can reduce fugitive natural gas emissions by eliminating valve gasket and flange leak paths. Other leak paths nevertheless do exist so that this technology does not eliminate fugitive emissions. Leakless technology components are used for highly toxic and hazardous materials but are not normally used in natural gas piping systems because of the high cost for these components and the difficulty in maintaining and repairing these components. For example, if a welded or threaded and seal welded bonnet joint valve fails, the failed component cannot be repaired without a unit shutdown, and the repair may result in additional maintenance related natural gas venting which can reduce its overall control effectiveness. Seal valves have other limitations which limit their use, including cycle life, pressure retention capability, and size limitations. Because these components are not a standard used in natural gas piping systems, the use of leakless valves is not considered a technically feasible control option for the CT Project natural gas piping systems.

Leak detection and repair (LDAR) programs, alternative monitoring using remote sensing technology, and audio/visual/olfactory (AVO) monitoring programs are technically feasible control options.

9.10.3 STEP 3. Rank the Technically Feasible Control Technologies.

Leak detection and repair (LDAR) programs using instrument monitoring are effective for identifying leaking components and is an accepted practice for limiting VOC emissions from gas processing and chemical plants. Quarterly monitoring with an instrument and a leak definition of 500 ppm is considered to have a control efficiency of 97% for valves, flanges, and connectors. Remote sensing using infrared imaging is also effective in detecting leaks, especially for components in difficult to monitor areas and is considered to be equivalent to LDAR.

Audio/visual/olfactory (AVO) monitoring is also an effective monitoring method for odorous and low vapor pressure compounds such as natural gas, especially because the observations can be substantially more frequent than for LDAR. Pipeline natural gas is purposely odorized with mercaptan for safety. As a result, natural gas leaks have a discernible odor. Larger leaks can be detected by sound and sight, either directly or as a secondary indicator such as condensation around a leaking source due to the adiabatic cooling effect of the expanding gas as it leaves the leaking component. Thus, observations for leaking valves or components can be made when plant personnel make routine walk-downs of the plant. As a result, AVO observation is an effective method for identifying and correcting leaks in natural gas systems, especially larger leaks that can result in increased emissions and potentially hazardous conditions. The Texas Commission on Environmental Quality (TCEQ) also assigns a 97% control effectiveness for AVO for odorous and low vapor pressure compounds such as natural gas.

9.10.4 STEP 4. Evaluate the Most Effective Controls.

The use of audio/visual/olfactory (AVO) monitoring is an effective monitoring method for the control of fugitive methane emissions from the natural gas piping systems. The proposed project will also utilize high quality components and materials of construction that are compatible with the service in which they are employed. This is the highest level of control available for the control of methane emissions from the piping systems. Therefore, no further evaluation is necessary.

9.10.5 STEP 5. Proposed GHG BACT Determination.

Based on this analysis, APS has concluded that the use of audio/visual/olfactory (AVO) monitoring represents the Best Available Control Technology (BACT) for the control of fugitive methane emissions from the natural gas piping systems. APS proposes the following conditions as BACT:

1. The permittee shall implement an auditory/visual/olfactory (AVO) monitoring program for detecting leaks in the Project natural gas piping components.
2. AVO monitoring shall be performed in accordance with a written monitoring program.

9.11 SF_6 Insulated Electrical Equipment GHG Control Technology Review.

Under the Prevention of Significant Deterioration (PSD) program in 40 CFR §52.21, sulfur hexafluoride (SF_6), Chemical Abstract Service (CAS) No. 2551-62-4, is also listed as regulated GHG. The new Project will include circuit breakers and switch gear for the CTs which will be insulated with SF_6. SF_6 is a colorless, odorless, non-flammable, inert, and non-toxic gas. SF_6 has a very stable molecular structure and has a very high ionization energy which makes it an excellent electrical insulator. The gas is used for electrical insulation, arc suppression, and current interruption in high-voltage electrical equipment.

The electrical equipment containing SF_6 is designed not to leak, because if too much gas leaks out, the equipment may not operate correctly and could become unsafe. State-of-the-art circuit breakers are gas-tight and are designed to achieve a leak rate of less than or equal to 0.5% per year (by weight). This is the same leak rate from the U.S. EPA report, *SF_6 Leak Rates from High Voltage Circuit Breakers - EPA Investigates Potential Greenhouse Gas Emission Source*, J. Blackman, Program Manager, EPA, and M. Avery, ICF Consulting, and Z. Taylor, ICF Consulting. This is also the International Electrotechnical Commission (IEC) maximum leak rate standard.

Table 3-5 summarizes the potential SF_6 emissions for the planned equipment based on this leak rate. Note that these emissions represent less than 0.03% of the total GHG emissions from the proposed Project.

9.12 STEP 1. Identify All Potential Control Technologies.

The following technologies are available to control fugitive SF_6 emissions from electrical equipment:

1. State-of-the-art enclosed-pressure SF_6 technology with leak detection.
2. Use of a non-GHG emission dielectric material in the breakers.

9.13 STEP 2. Identify Technically Feasible Control Technologies.

State-of-the-art enclosed-pressure SF_6 technology with leak detection is an available technology used to limit fugitive SF_6 emissions.

There are no available alternative insulating material or substances as available alternatives. In the report *SF_6 Emission Reduction Partnership for Electric Power Systems, 2014 Annual Report*, U.S. EPA, March 2015, (http://www.epa.gov/electricpower-sf6/documents/SF6_AnnRep_2015_v9.pdf), EPA states "Because there is no clear alternative to SF_6, Partners reduce their greenhouse gas emissions through implementing emission reduction strategies such as detecting, repairing, and/or replacing problem equipment, as well as educating gas handlers on proper handling techniques of SF6 gas during equipment installation, servicing, and disposal." Therefore, the use of alternative substances as dielectric materials is not considered a technically feasible control option for these circuit breakers.

9.14 STEP 3. Rank the Technically Feasible Control Technologies.

The use of state-of-the-art enclosed SF_6 technology with leak detection is the highest ranked technically feasible control technology to limit fugitive SF_6 emissions from the proposed electrical equipment.

9.15 STEP 4. Evaluate the Most Effective Controls.

The use of state-of-the-art enclosed SF_6 technology with leak detection for the control of SF_6 emissions from the proposed electrical equipment is the highest level of control available for the control of SF_6 emissions. Therefore, further evaluation is unnecessary.

9.16 STEP 5. Proposed GHG BACT Determination.

Based on this analysis, APS has concluded that the use of state-of-the-art enclosed SF_6 technology with leak detection represents the Best Available Control technology (BACT) for the control of fugitive SF_6 emissions from the proposed electrical equipment. APS proposes the following conditions as BACT:

1. The Permittee shall install, operate, and maintain enclosed-pressure SF_6 circuit breakers with a maximum annual leakage rate of 0.5% by weight.

Chapter 10. Emission Offset Requirements.

Maricopa County and the Redhawk Power Plant are classified as a marginal nonattainment area for the 8-hour ozone standard. The regulated ozone nonattainment area pollutants are NO_x and VOC. Major modifications of a major stationary source are subject to review under the permit requirements for new major sources or major modifications located in nonattainment areas in County Rule 240, Section 304 which incorporates 40 CFR §51.165(a)(1).

A major modification to a major stationary source in an ozone nonattainment area is defined as modification with a significant emissions increase and a significant net emissions increase in NO_x or VOC emissions. In accordance with 40 CFR §51.165(a)(1)(x)(A), for a marginal ozone nonattainment area, the significant threshold for both NO_x and VOC emissions is 40 tons per year. From Table 5-2, and in accordance with the proposed emission limits in Chapter 4 of this application, the proposed Project will result in significant emissions increase and a significant net emissions increase for NO_x emissions. This project is not subject to review under the NANSR program for VOC emissions.

Maricopa County may be reclassified as a serious nonattainment area in the near future. In accordance with 40 CFR §51.165(a)(1)(x)(B) and (C), for a serious ozone nonattainment area, the significant threshold for both NO_x and VOC emissions is 25 tons per year. If Maricopa County is reclassified as a serious ozone nonattainment area, this Project will still be subject to review under the NANSR program for NO_x emissions and not subject to NANSR review for VOC emissions.

10.1 Nonattainment Area Offset Requirements.

The total tonnage of increased emissions, in tons per year, resulting from a major modification that must be offset in accordance with section 173(a)(1)(A) of the Clean Air Act shall be determined by summing the difference between the allowable emissions after the modification and the actual emissions before the modification for each emissions unit. Because the actual emissions for the emissions units in this application are zero, the offset requirements are based on the potential to emit after the Project, or 60.4 tons per year.

In accordance with 40 CFR §51.165(a)(9)(ii)(B), for a marginal ozone nonattainment area, the ratio of total actual emissions reductions of VOC (and/or NO_x) to the emissions increase of VOC (and/or NO_x) shall be at least 1.15:1. In accordance with 40 CFR §51.165(a)(9)(ii)(C), for a serious ozone nonattainment area, the offset ratio is 1.2:1. Based on the proposed potential NO_x emissions limit of 59.0 tons per year for this Project, the NO_x emission offset or Emission Reduction Credit (ERC) requirements for this Project are:

Moderate Nonattainment Area:	(59.0 ton NOx/year)(1.15)	=	68 tons per year
Serious Nonattainment Area:	(59.0 ton NOx/year)(1.20)	=	71 tons per year

Section 173 of the Clean Air Act requires that any emission reductions required as a precondition of the issuance of a permit under paragraph (1) shall be federally enforceable before such permit may be issued. APS will surrender the necessary NO_x Emission Reduction Credits for this Project prior to issuance of the permit authorizing this Project.

Chapter 11. Ambient Air Quality Assessment.

A PSD air quality impact analysis has been performed for the pollutants NOx, PM_{10}, and $PM_{2.5}$. A minor-NSR modeling analysis has been performed for CO. The analyses follow all relevant EPA, Arizona Department of Environmental Quality (ADEQ), and Maricopa County air modeling guidance. Appendix B of this application presents the ambient air quality assessment modeling protocol and report.

The air quality impacts from the Project are insignificant for all pollutants and averaging intervals except for 1-hr NO_2 and 24-hr $PM_{2.5}$ impacts. For those two pollutants, cumulative NAAQS and PSD increment modeling analyses were performed that included the existing Redhawk emission units and other nearby sources. The results of the cumulative analyses demonstrate compliance with the NAAQS and PSD increments.

Additional PSD impact analyses were performed for soils and vegetation, Class II visibility, and associated growth. No adverse impacts were identified.

Class I area screening analyses were performed, which demonstrate that the Project impacts at the nearest Class I area (Superstition Wilderness area) are below the Class I Significant Impact Levels, and do not trigger Air Quality Relative Values (AQRV) analysis requirements.

Chapter 12. Compliance Statement.

Section 173(3) of the Clean Air Act requires the following permit requirement:

> (a) IN GENERAL.—The permit program required by section 172(b)(6) 70 shall provide that permits to construct and operate may be issued if—
>
> (3) the owner or operator of the proposed new or modified source has demonstrated that all major stationary sources owned or operated by such person (or by any entity controlling, controlled by, or under common control with such person) in such State are subject to emission limitations and are in compliance, or on a schedule for compliance, with all applicable emission limitations and standards under this Act;

With this application, APS certifies that all major stationary sources owned or operated by Arizona Public Service in the State of Arizona are in compliance, or on a schedule for compliance, with all applicable emission limitations and standards under the Clean Air Act and as required by Maricopa County. The general certification of truth and accuracy for this permit application contained in the Maricopa County Air Quality Department's form *TITLE V PERMIT APPLICATION* and included in Appendix A of this application applies to this compliance statement.

Chapter 13. Alternatives Analysis.

Section 173(3) of the Clean Air Act requires the following permit requirement:

> (5) an analysis of alternative sites, sizes, production processes,
> and environmental control techniques for such proposed
> source demonstrates that benefits of the proposed source significantly
> outweigh the environmental and social costs imposed
> as a result of its location, construction, or modification.

This Project will result in significant emissions increase and a significant net emissions increase for NO_x emissions (but not VOC emissions). Therefore, this Project is subject to NANSR review for NO_x emissions. The following information and analysis of alternative sites, sizes, production processes, and environmental control techniques is being provided to demonstrate that benefits of the proposed Project significantly outweigh the environmental and social costs imposed as a result of the proposed location and modification of the Redhawk Power Plant.

13.1 Alternative Sites.

The Redhawk Power Plant is an existing electric power generating station which has already been constructed and has been in service for more than 20 years. This site is in a rural area and already has the necessary natural gas pipelines and electric transmission system infrastructure necessary for this Project. If this Project were constructed at a different site outside of the Maricopa County nonattainment area, the new site would require the installation of natural gas pipelines and electric transmission lines which would increase the environmental impact and social costs of this new electric power generation.

13.2 Alternate Sizes.

To avoid the applicability of the nonattainment new source review requirements for this Project at the Redhawk Power Plant, the installed capacity would need to be less than one-half of the proposed capacity. This much smaller installed capacity would not meet the electric power demands of the customers of APS and may lead to significant electric power reliability concerns in the region.

13.3 Alternative Production Processes.

A detailed analysis of the technically feasible electric power production techniques and an evaluation of the technically feasible options is included in the greenhouse gas emissions control technology review in Chapter 9 of this application. As detailed in that analysis, battery energy storage systems (BESS) and combined cycle combustion turbine electric generating units are not technically feasible alternative production processes for this proposed project. The only technically feasible alternative production process is the use of reciprocating internal combustion engine (RICE)-based electric generating units.

While the use of RICE electric generating units is a technically feasible alternative production process, the use of RICE may result in an increase in other regulated PSD pollutants, including NO_x, PM_{10}, and VOC emissions. With respect to VOC emissions, RICE electric generating units have substantially higher VOC emission rates than CTs. The Tucson Electric's Sundt Generating Station was permitted in 2018 to construct and operate ten (10) new natural gas-fired Wärtsilä 18V50SG RICE electric generating units equipped with oxidation catalysts for CO and VOC control. These units have a rated heat input capacity of 154 mmBtu per hour and a rated capacity of 18.8 MW. The BACT emission limit for VOC emissions for these units is 4.49 lb/hr, equal to a VOC emission rate of 0.029 lb/mmBtu. This emission rate is more than 5 times higher than the proposed VOC emission limit for the CTs in this application of 0.005 lb VOC/mmBtu.

The NO_x emission rate representing BACT for RICE engines equipped with selective catalytic reduction (SCR) is typically 5 to 6 ppm. For example, the air permit for Pacific Gas & Electric Company's Humboldt Bay Power Plant in Eureka, California authorized the use of 10 new Wärtsilä 18V50DF 16.3 MW lean-burn RICE generators equipped with SCR and oxidation catalysts. This permit was issued in 2009 and limits NO_x emissions to 6.0 ppmdv at 15% O_2, more than twice the emission concentration for the proposed CTs. Tucson Electric's Sundt Generating Station was permitted in 2018 and while not subject to NOx BACT requirements, the facility was permitted for 10 RICE units at a total capacity of 180 MW and a NOx emission increase of 170 tons per year. This is equal to a NO_x emission rate of 1,800 pounds per MW of capacity. Based on the emission limitations proposed in this application, these CTs will have a NO_x emission rate of 314 lb NOx per MW of installed capacity. And the City of Tallahassee - Arvah B. Hopkins Generating Station in Florida was permitted in 2020 to construct and operate 18.8 MW Wärtsilä 18V50SG RICE units. These units have NO_x emission limits of 2.55 lb/hr and 5 ppm at 15% O_2.

This Project is subject to the NANSR program because the Redhawk Power Plant is located in Maricopa County which is currently designated as a moderate nonattainment area for ozone. Even if RICE-based electric generating units could achieve the same NO_x emission rate as the proposed CTs, the significantly higher VOC emissions from RICE-based units would result in even greater environmental impacts to the ozone nonattainment area. These adverse collateral environmental impacts from the use of RICE generators eliminates this option as an alternative production process. After the elimination of RICE generators from this analysis, the proposed high efficiency simple-cycle CTs represent the only feasible production process.

13.4 Alternative Environmental Control Techniques.

A detailed NO_x control technology review is included in Chapter 7 of this application. Based on that control technology review, APS is proposing the lowest emission rate identified for any similar simple cycle combustion turbine. There are no alternative environmental control techniques available that can reduce NOx emissions below the proposed NOx emission limit which represents LAER for these proposed simple cycle combustion turbines.

13.5 Emission Offsets.

Based on the offsets analysis in Chapter 10 of this application, APS will surrender NOx emission reduction credits (ERCs) or emissions offsets at a ratio of 1.15 to 1 or 1.2 to 1 depending on the nonattainment classification of Maricopa County at the time of issuance of this permit. Offsets are emission reductions obtained from existing sources located in the vicinity of the Redhawk Power Plant which offset the emissions increase from the proposed modification and provide a net air quality benefit. The purpose for requiring offsets (or offsetting emissions decreases) is to allow an area to move towards attainment while still allowing growth.

Chapter 14. Environmental Justice.

14.1 Purpose.

The purpose of this Environmental Justice (EJ) evaluation is to identify any "*potential EJ concerns*," defined by United States Environmental Protection Agency (EPA) as "the actual or potential lack of fair treatment or meaningful involvement of minority populations, low-income populations, tribes, and indigenous peoples…[including] disproportionate impacts on minority populations, low-income populations, and/or indigenous peoples that may exist prior to or that may be created by the proposed" Redhawk Expansion Project.[26]

14.2 EPA's Definition of Environmental Justice.

The EPA defines EJ as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. An environmental justice analysis accomplishes two important policy objectives: (1) it addresses the principle of fair treatment by further evaluating adverse and disproportionate impacts and identifying ways to prevent or mitigate such impacts; and (2) it addresses the principle of meaningful involvement by fostering enhanced community engagement in the permitting decision.

14.3 Overview of EPA's Environmental Justice Guidance.

APS's evaluation and actions are generally consistent with EPA and other federal agency guidance on EJ, including:

- EPA, Environmental Justice Website (https://www.epa.gov/environmentaljustice)
- EPA, EJ in Air Permitting - Principles for Addressing Environmental Justice Concerns in Air Permitting (Dec. 22, 2022, https://www.epa.gov/caa-permitting/ej-air-permitting-principles-addressing-environmental-justice-concerns-air)
- EPA, Clean Air Power Sector Programs, Power Plants and Neighboring Communities (https://www.epa.gov/power-sector/power-plants-and-neighboring-communities)
- EPA, EJ Screen: Environmental Justice Screening and Mapping Tool, How to Interpret EJScreen Data (https://www.epa.gov/ejscreen/how-interpret-ejscreen-data#:~:text=For%20early%20applications%20of%20EJScreen,potential%20candidate%20for%20further%20review)

- Federal Interagency Working Group on Environmental Justice & NEPA Committee, Promising Practices for EJ Methodologies in NEPA Reviews (March 2016, https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf)
- EPA, EPA Activities To Promote Environmental Justice in the Permit Application Process, 78 Fed. Reg. 27220, 27227 (May 9, 2013, https://www.federalregister.gov/documents/2013/05/09/2013-10945/epa-activities-to-promote-environmental-justice-in-the-permit-application-process)
- EPA, Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (June 2016, https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf)

Apart from recent guidance issued in December 2022, EPA has issued little guidance or methodologies for air permit *applicants* to follow in conducting EJ evaluations; rather, EPA's EJ guidance is largely focused on actions the *agency* must undertake to ensure a robust consideration of "potential EJ concerns." Nonetheless, EPA's suite of guidance documents provides a general framework for how air permit applicants could approach EJ analyses.

14.3.1 Step One: Define the Study Area.

EPA's guidance suggests that applicants should define a "study area" that comprises a three (3) mile radius around the project site, for EJ evaluation purposes. EJ Screening Report for the Clean Power Plan."[27]

14.3.2 Step Two: Evaluate the Study Area Utilizing EPA's EJScreen Tool.

EPA's guidance emphasizes the utilization of EPA's EJScreen tool (EJScreen).[28] EJScreen is "EPA's environmental justice mapping and screening tool that provides EPA with a nationally consistent dataset and approach for combining environmental and demographic socioeconomic indicators."[29] Users identify a defined study area within the tool and the tool then provides demographic, socioeconomic and environmental information for that area.

EJScreen provides four sets of data for the study area, including:

- Thirteen (13) Environmental Indicators;
- Thirteen (13) Environmental Index scores that combine each Environmental Indicator with two (2) demographic factors (income and people of color);
- Seven (7) Socioeconomic Indicators designed to identify disadvantaged communities; and

[27] EPA, Power Plants and Neighboring Communities (epa.gov)

[28] EPA, EJ Screening Tool (epa.gov)

[29] EPA, What Is EJScreen? (epa.gov)

- Supplemental Index score that averages five (5) Socioeconomic Indicators with the Environmental Indicator to quantify community-level vulnerabilities.

14.3.3 Step Three: Identify Potentially Adverse or Disproportionate Impacts within the Study Area.

EPA defines "disproportionate impacts" as differences in impacts or risks that are "extensive enough that they may merit Agency action." EPA further states that the higher the average differences between the potentially affected study area communities and the comparison groups (in our case, the county and state populations) the greater the potential for a disproportionate adverse impact.

EPAs guidance provides that a study area with any of the 13 EJ Index Scores at or above the 80th percentile nationally should be considered as a potential candidate for further EJ review due to potential adverse or disproportionate impacts[30]. It is important to note that exceeding this screening level does not automatically confer EJ status for a community, but rather is a starting point that identifies potential areas of concern.

14.3.4 Step Four: Ensure Meaningful Involvement of Potentially Impacted Community Members.

If a community is identified as adversely and disproportionately impacted in steps one through three, EPA's guidance instructs that these communities be afforded the opportunity for "meaningful involvement" in agency decision-making. EPA defines "meaningful involvement" as comprising four elements:

1. Potentially affected populations have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health;
2. The population's contribution can influence EPA's decisions;
3. The concerns of all participants involved are considered in the decision-making process; and
4. EPA will seek out and facilitate the involvement of populations potentially affected by EPA's decisions.[31]

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[30] EPA, How To Interpret EJScreen Data (epa.gov)

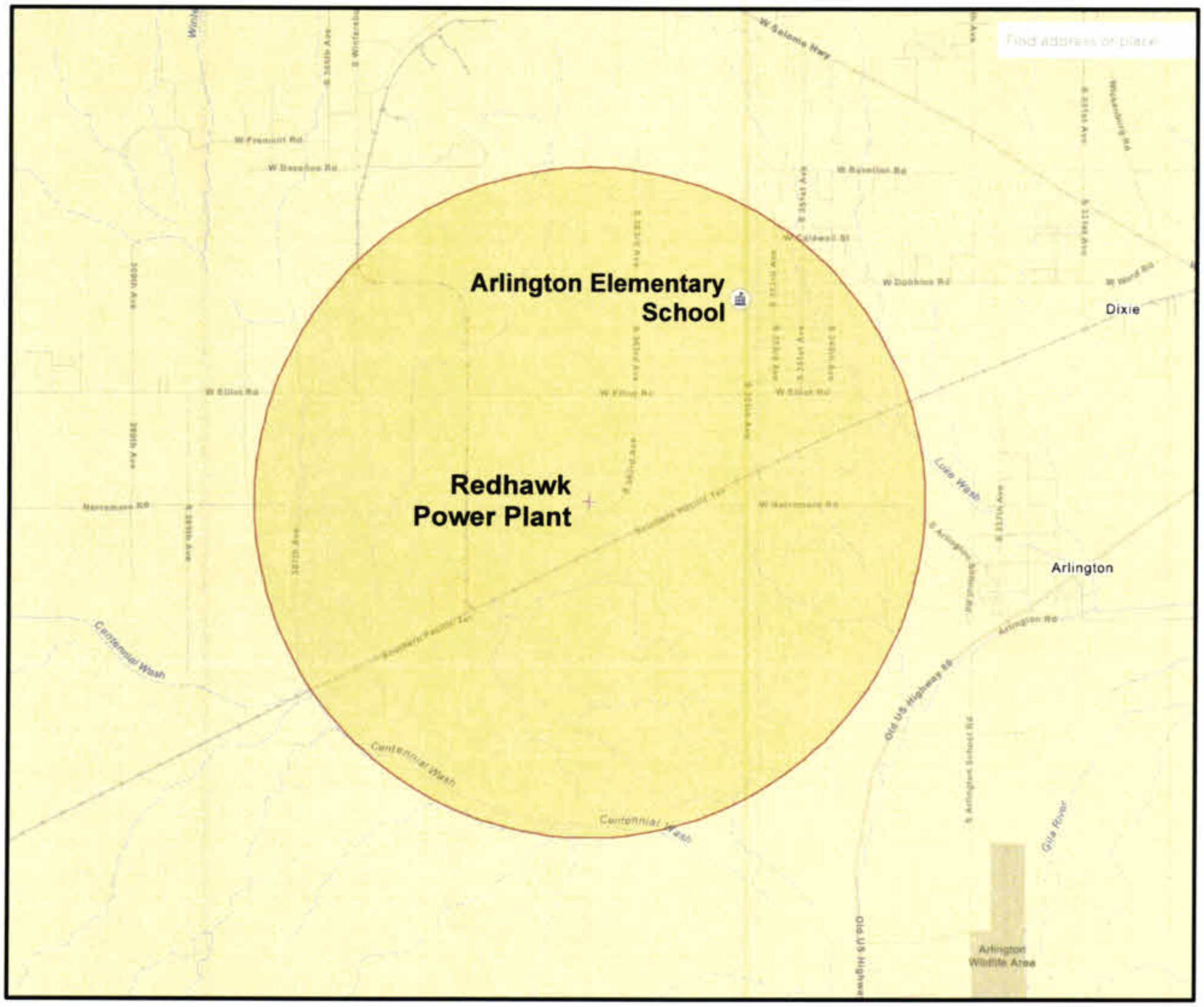
[31] EPA, Technical Guidance for Assessing Environmental Justice in Regulatory Actions (June 2016)

14.4 EJ Analysis Step One: Define the Study Area

The Redhawk Power Plant (SPP) is located at 11600 South 363rd Avenue, Arlington, Arizona, in Maricopa County. The site is located in an area designated as attainment or maintenance for all criteria air pollutants, except for the 8-hour ozone standard. The area is classified as a marginal nonattainment area for the ozone standard.

This EJ analysis utilized the U.S. EPA's recommended three-mile radius in considering the potential for adverse and disproportionate impacts. Figure 14-1 shows the study area from EJScreen.

FIGURE 14-1. Environmental Justice "Study Area" for the Redhawk Power Plant.



14.5 EJ Analysis Step Two: Evaluate the Study Area Utilizing EPA's EJScreen Tool.

It is important to note the following limitations to the data and evaluation in the following analysis. The census data used has inherent measurement of error (MOE) and in some cases may be outdated because the most recent data comes from 2021 and community profiles have likely evolved over the past two years.

14.5.1 Demographics.

There is little guidance around how to assess or value differences between the study area and the broader communities, state and nation — there are no defined thresholds for what constitutes a meaningful difference. The Federal Interagency Working Group on Environmental Justice and NEPA Committee's guidance document *Promising Practices for EJ Methodologies in NEPA Reviews* provides some insights into how to define "minority communities" and when differentials may be significant:

- A population is identified as "minority" if the minority population exceeds 50 percent of the study area; and
- A difference between the study area and the broader reference community is "meaningfully greater" if it is "ten or twenty percent greater than the reference community."[32]

In accordance with EJ guidance, this analysis will identify the study area as a "minority community" if the population is 50% or greater minority; and we flag any parameters in which the study area's demographics differ from Maricopa County or the State of Arizona by a factor of 10% or more.

For example, if a census tract classifies 35% of the population as low income but the county consists of 30% low income, the census tract would exceed the county average by 16.7% and thus be flagged as a potential area of concern. For this report, census data from the 2020 Census, American Community Survey, were used. The U.S. Census Bureau standard for the margin of error (MOE) is at the 90% confidence level. On the other hand, if a census tract indicates that 25% of the area is made up of people of color, but the county average is 35%, this element would not be flagged as a potential concern.

Table 12-1 is a summary of the EJ screening socioeconomic factors from EPA's EJScreen mapping tool. In this analysis, the **bolded and blue** data for the area within a three-mile radius of the proposed site—referred to as the "study area"—indicate a difference greater than 10% and a potential concern for the study area when compared to Maricopa County. The **bolded and orange** data indicate a difference greater than 10% and a potential concern for the study area when compared to the State of Arizona. Bolded data indicates a difference of greater than 10% but not a potential concern for the study area.

From Table 14-1, the study area has a lower percentage of individuals in all selected variables except "Less Than High School Education" and "Low Life Expectancy" as compared to both Maricopa County and the

[32]Federal Interagency Working Group on Environmental Justice and NEPA Committee, Promising Practices for EJ Methodologies in NEPA Reviews (Mar. 2016).

State of Arizona. The study area has a higher population with less than a high school education than both Maricopa County and the State of Arizona. With respect to "Low Life Expectancy", the study area has a slightly higher low life expectancy (20%) than the state as a whole (19%).

TABLE 14-1. Summary of the environmental justice screening socioeconomic factors from EJScreen.

Selected Variable	Study Area	Maricopa County	State Average	Percentile in State
Demographic Index	26%	**38%**	**38%**	37
People of Color	37%	**45%**	**44%**	47
Low Income	16%	**30%**	**32%**	28
Unemployment Rate	2%	**5%**	**6%**	35
Limited English Speaking	0%	**3%**	**4%**	0
Less Than High School Education	31%	**12%**	**12%**	90
Population under Age 5	4%	**6%**	**5%**	47
Population over Age 64	11%	**15%**	**20%**	38
Low Life Expectancy	20%		19%	59

Footnotes

Source: U.S. EPA EJScreen.

Bolded and orange data indicate a difference greater than 10% and a potential concern when compared to the state.

Bolded and blue data indicate a difference greater than 10% and a potential concern when compared to the county.

All bolded data indicate a difference greater than 10% compared to the county or state.

14.5.2 Ethnicity and Race.

14.5.2.1 Regional Setting.

Table 14-2 is a summary of the 2021 U.S. Census Bureau data for Maricopa County, the State of Arizona, and the 3-mile radius study area around the proposed site. Note that the study area has a very low population of only 217 individuals in an area of 28.27 square miles, equal to a population density of less than 8 individuals per square mile.

From Table 14-2, Arizona's population totals 7,276,316 individuals. The three most populous racial groups across the state are: White 77.6%; Hispanic or Latino (of any race) 32.3%; and Two or More Races 20.1%. Maricopa County has a total population of 4,412,779 individuals. Similar to the state as a whole, the three most common racial groups within the county are: White (73.8%); Hispanic or Latino (of any race) (31.1%); and two or more races (7.1%). In the composition of the three most populous racial groups, Maricopa County and the State of Arizona are similar.

In Table 14-2, the **bolded and orange** data indicate a difference greater than 10% and a potential concern when comparing the study area to the State of Arizona. The populations of all ethnic groups are lower as a percentage than the state as a whole except for the total Hispanic population which is 35% as compared to the state as a whole of 32.3%.

14.5.2.2 Local Setting.

The total population within the study area of the proposed site is 217 individuals. Within this area, the largest population is White at 63% and 137 individuals, followed by Hispanic of any race at 35% and 76 individuals.

In Table 14-2, the **bolded and blue** data for the study area indicate a difference greater than 10% and a potential concern when compared to Maricopa County. Like the comparison to the state as a whole, the populations of all ethnic groups are lower as a percentage than the state as a whole except for the total Hispanic population which is 35% as compared to Maricopa County at 31.1%.

TABLE 14-2. Summary of the U.S. Census Bureau data by race for Maricopa County, the State of Arizona, and the study area around the Redhawk Power Plant.

Race and Ethnicity	Study Area		Maricopa County		Arizona	
	Number	Percent	Number	Percent	Number	Percent
Total Population	217	100.0%	4,412,779	100.0%	7,276,316	100.0%
White	137	63.0%	3,256,087	**73.8%**	5,645,464	**77.6%**
Black or African American	0	0.0%	249,691	**5.7%**	326,638	**4.5%**
American Indian or Alaska Native	0	0.0%	85,061	**1.9%**	294,658	**4.0%**
Asian	0	0.0%	187,298	**4.2%**	245,285	**3.4%**
Native Hawaiian and Other Pacific Islander	0	0.0%	9696	**0.2%**	12,432	**0.2%**
Some other Race	0	0.0%	313,146	**7.1%**	693,486	**9.5%**
Two or More Races	2	1.0%	311,800	**7.1%**	1,462,148	**20.1%**
Total Hispanic Population (of any race)	76	35.0%	1,374,312	**31.1%**	2,351,124	32.3%

Footnotes

Source: U.S. EPA EJScreen.

Bolded and orange data indicate a difference greater than 10% and a potential concern when compared to the state.

Bolded and blue data indicate a difference greater than 10% and a potential concern when compared to the county.

All bolded data indicate a difference greater than 10% compared to the county or state.

14.5.3 Age and Sex.

14.5.3.1 Regional Setting.

According to the U.S. Census Bureau data summarized in Table 14-3, Arizona has a total population of 7,276,316 individuals, with almost 79% of the population older than 18 years of age, and almost 20% of the population 65 years and older. Maricopa County has a total population of 4,412,779 individuals, with 76% of the population older than 18 years of age and 15% of the population 65 years and older. Maricopa County's population is similar in age to the state as a whole, except that Maricopa County has a slightly larger percentage of the population 0 to 4 years old, and a smaller percentage of the population 65 years and older. The composition of both Maricopa County and the study area are similar to the state as a whole with respect to sex.

14.5.3.2 Local Setting.

From Table 14-3, the study area has an age distribution which is more than 10% different than both the county and the state for all age ranges. The study area is generally older than either Maricopa County or the State of Arizona, with smaller percentages of individuals 0 – 4 and 0 – 17 years of age, and more individuals greater than 18 years of age and greater than 65 years of age. With respect to sex, while the local population percentages do not vary by more than 10% from state or local populations, the local area does have a higher male population than both Maricopa County and the State of Arizona.

TABLE 14-3. Summary of the U.S. Census Bureau data by age and sex for Maricopa County, the State of Arizona, and the study area around the Redhawk Power Plant.

Age and Sex	Study Area		Maricopa County		Arizona	
	Number	Percent	Number	Percent	Number	Percent
Total Population	217	100.0%	4,412,779	100.0%	7,276,316	100.0%
Male	117	54.0%	2,181,967	49.4%	3,629,620	49.9%
Female	100	46.0%	2,230,812	50.6%	3,646,696	50.1%
Population Age 0-4	9	4.0%	277,315	**6.3%**	402,255	**5.5%**
Population Age 0-17	24	11.0%	1,051,018	**23.8%**	1,614,284	**22.2%**
Population Age 18+	193	89.0%	3,361,761	**76.2%**	5,662,032	**77.8%**
Population Age 65+	24	11.0%	671,096	**15.2%**	1,333,985	**18.3%**

Footnotes

Source: U.S. Census Bureau, American Community Survey (ACS) 2017 – 2021 (EJScreen).

Bolded and orange data indicate a difference greater than 10% and a potential concern when compared to the state.

Bolded and blue data indicate a difference greater than 10% and a potential concern when compared to the county.

All bolded data indicate a difference greater than 10% compared to the county or state.

14.5.4 Household Income and Poverty.

14.5.4.1 Regional Setting.

From the U.S. Census Bureau data in Table 14-4, the State of Arizona has an average per capita income of $38,334, with 12.8% of the total population being low income. Maricopa County has an average per capita income of $37,570, with 29% of the total population being low income.

14.5.4.2 Local Setting.

From Table 14-4, the study area has a total population of 217 individuals and 75 households. The data indicate an average of 2.9 persons per household, which is similar to both the state and county averages. The percentage of the population with low income in the study area is more than 10% less than Maricopa County and the State of Arizona. The per capita income in the study area is also less than both Maricopa County and the State of Arizona by more than 10%, indicating that the local population is in general poorer than the county or state averages.

TABLE 14-4. Summary of the U.S. Census Bureau household income data for the State of Arizona, Maricopa County, and the study area around the proposed site.

Income Levels	Study Area		Maricopa County		Arizona	
	Number	Percent	Number	Percent	Number	Percent
Total Population	217	100.0%	4,412,779	100.0%	7,276,316	100.0%
Low Income		16.0%		**29.0%**		**12.8%**
Unemployment Rate		2.0%		**5.0%**		**32.0%**
Number of Households	75		1,632,151		2,739,136	
Persons per Household	2.9		2.7		2.7	
Owner Occupied Housing		87.0%		**64.0%**		**66.3%**
Per Capita Income	$33,108		**$37,570**		**$38,334**	

Footnotes

Source: U.S. EPA EJScreen.

Bolded and orange data indicate a difference greater than 10% and a potential concern when compared to the state.

Bolded and blue data indicate a difference greater than 10% and a potential concern when compared to the county.

All bolded data indicate a difference greater than 10% compared to the county or state.

14.5.5 Limited English Proficiency.

14.5.5.1 Regional Setting.

From Table 14-5, 74% of the households in Maricopa County speak English at home, and 3% of the households had limited English proficiency. For the State of Arizona, 74% of the households speak English at home, and a slightly higher percentage of 4% of the households had limited English proficiency. For both Maricopa County and the State of Arizona, 20% of the households have Spanish spoken at home.

14.5.5.2 Local Setting.

As set forth in Table 14-5, of the 217 individuals and 75 households in the study area, none of the households have limited English proficiency or speak another language at home. Thus, the study area appears to have a very high English proficiency.

TABLE 14-5. Summary of the U.S. Census Bureau English proficiency data for Maricopa County and the study area.

English Proficiency Levels	Study Area		Maricopa County		Arizona	
	Number	Percent	Number	Percent	Number	Percent
Number of Households	75		1,632,151		2,739,136	
Limited English Households		0.0%		**3.0%**		**4.0%**
English Spoken at Home				**74.0%**		**73.8%**
Spanish Spoken at Home		0.0%		**20.0%**		**19.8%**
Other Asian and Pacific Island		0.0%		**1.0%**		**2.2%**
Other Indo-European		0.0%		**1.0%**		**1.9%**
Other and Unspecified		0.0%		**1.0%**		**2.3%**
Total Non-English		0.0%		**26.0%**		**26.0%**

Footnotes

Source: U.S. EPA EJScreen.

Bolded and orange data indicate a difference greater than 10% and a potential concern when compared to the state.

Bolded and blue data indicate a difference greater than 10% and a potential concern when compared to the county.

All bolded data indicate a difference greater than 10% compared to the county or state.

14.5.6 Health.

The University of Wisconsin Population Health Institute, in collaboration with the Robert Wood Johnson Foundation, maintains a County Health Rankings system for all states in the United States. These rankings measures two elements: "Health Outcomes" and "Health Factors."[33]

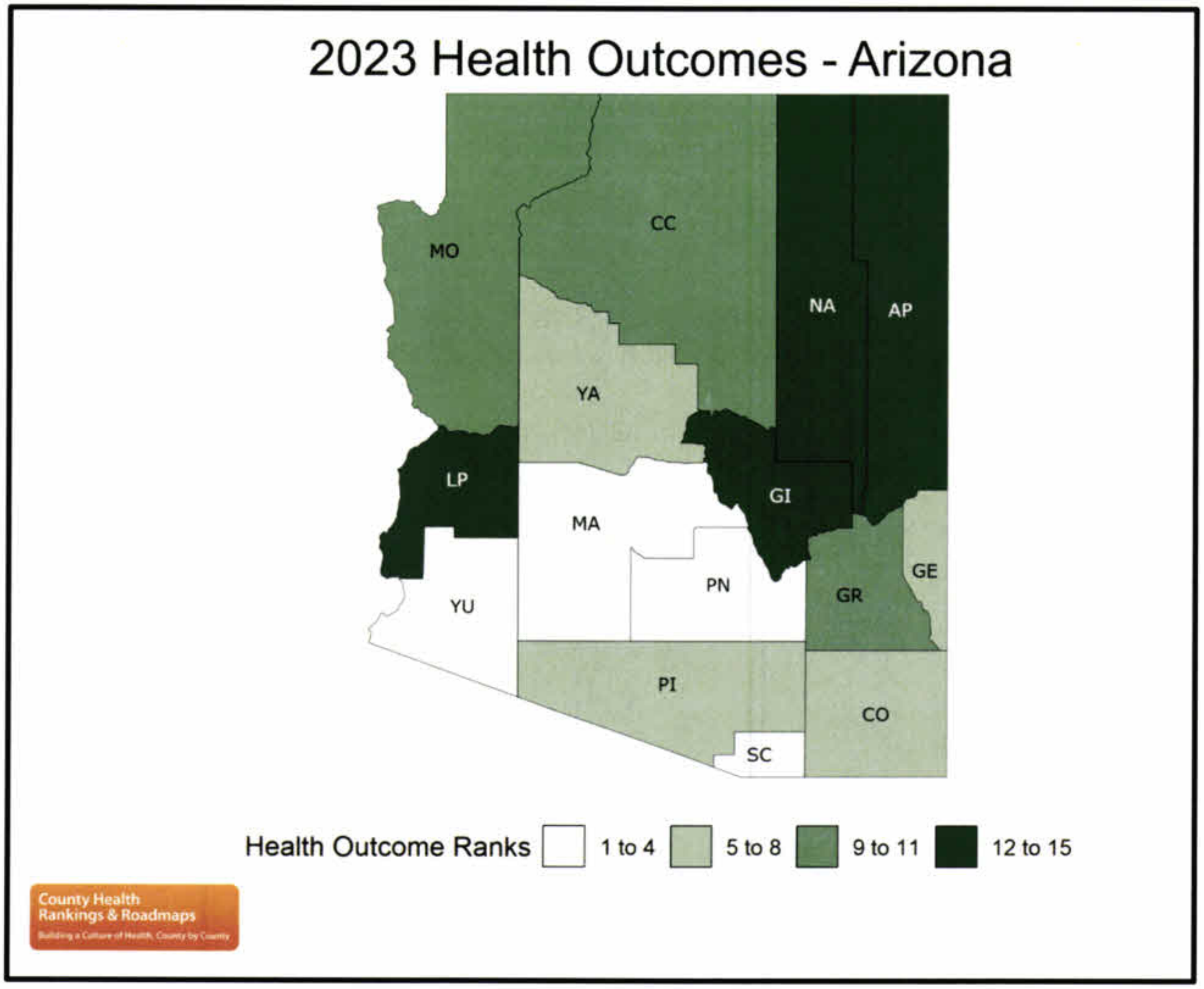
The "Health Outcomes" data represent the *current* health of a county's residents, in terms of length and quality of life. They reflect the physical and mental well-being of residents through measures representing the length and quality of life typically experienced in the community. Maricopa County ranks 1st out of 15 Arizona counties for Health Outcomes. Figure 14-2 shows the 2023 Health Outcomes ranks for the counties in Arizona.

The "Health Factors" data represent those things that can be modified to improve the length and quality of life for residents; they are predictors of how healthy a community may become in the future. The four Health Factors considered in the model include Health Behaviors, Clinical Care, Social & Economic Factors, and Physical Environment. Maricopa County ranks 3rd out of 15 Arizona counties for Health Factors. Figure 14-3 shows the 2023 Health Factors ranks for the counties in Arizona.

These data indicate that residents in Maricopa County enjoy better Health Outcomes than residents in other Arizona counties and have good opportunities to continue to improve Health Factors that can extend and enhance the quality of life.

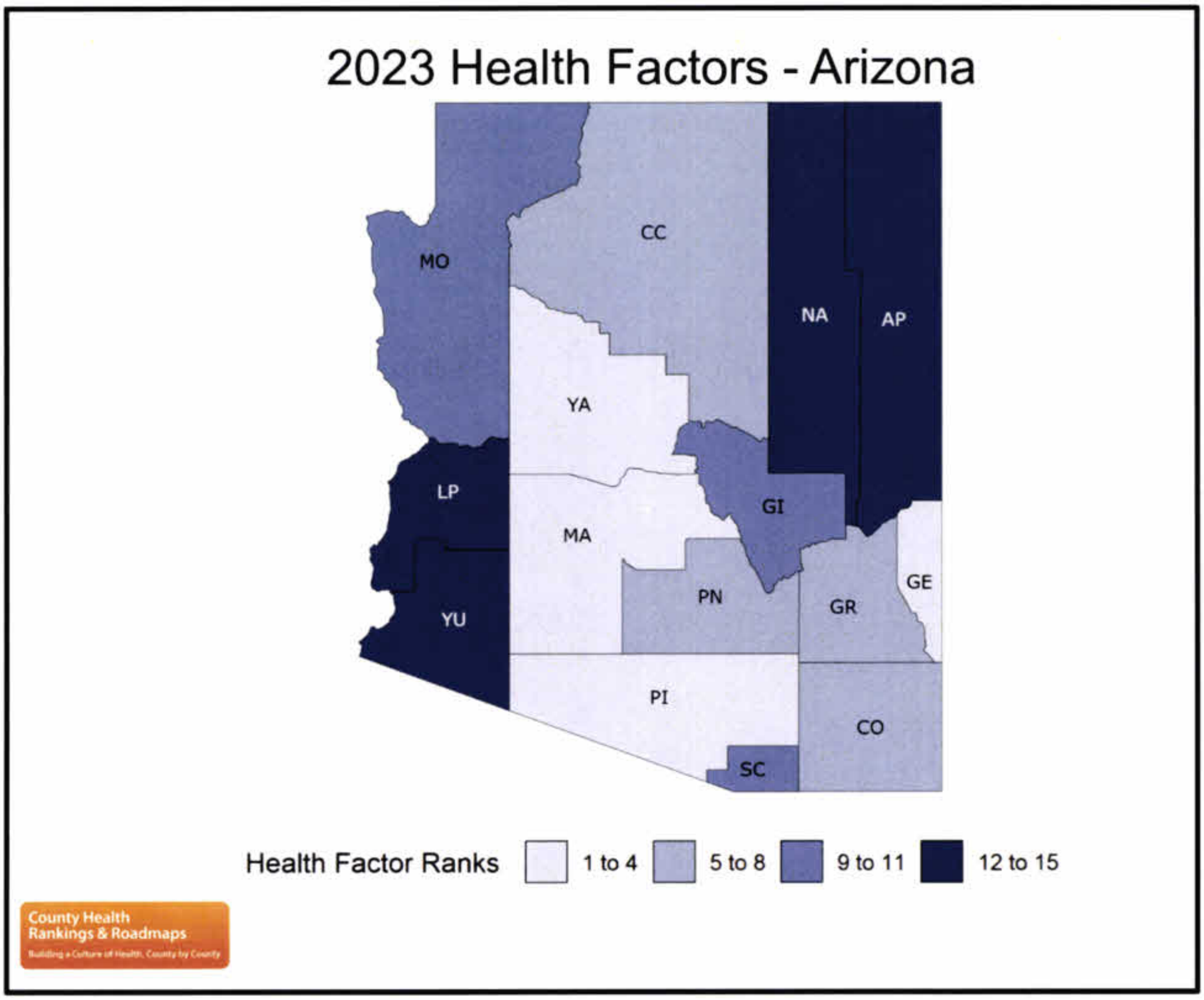
[33] University of Wisconsin Population Health Institute | County Health Rankings

FIGURE 14-2. Year 2023 Health Outcome ranks for Arizona counties.



Source: University of Wisconsin Population Health Institute and the Robert Wood Johnson Foundation, available at https://www.countyhealthrankings.org/explore-health-rankings/arizona/data-and-resources.

FIGURE 14-3. Year 2023 Health Factors ranks Arizona counties.



Source: University of Wisconsin Population Health Institute and the Robert Wood Johnson Foundation, available at https://www.countyhealthrankings.org/explore-health-rankings/arizona/data-and-resources.

14.5.7 Environmental Indicators.

The EPA EJScreen tool was used to evaluate the Environmental Indicators and the Environmental Indices for the study area. The Environmental Indicators quantify proximity to and the numbers of certain types of potential sources of exposure to environmental pollutants. EJScreen calculates the Environmental Index by using the Environmental Indicator percentile for a block group, as defined by the U.S. Census Bureau, multiplied by the Demographic Index for the block group. The EPA EJScreen Demographic Index refers to people within the socioeconomic groups outlined in Table 14-1. Per the screening guidance[34], any Environmental Indicator over the 80th percentile is a candidate for further review. The following EJ indicators were evaluated for the study area:

- Particulate Matter 2.5
- Ozone
- Diesel Particulate Matter
- Air Toxics Cancer Risks
- Air Toxics Respiratory Hazard Index
- Toxic Releases to Air
- Traffic Proximity
- Lead Paint
- Superfund Proximity
- RMP Facility Proximity
- Hazardous Waste Proximity
- Underground Storage Tanks
- Wastewater Discharge

Table 14-6 summarizes the EJ indicators from EJScreen which were evaluated for the study area. From Table 14-6, only Superfund Proximity, i.e., the site count/km distance, exceeded the 80th percentile.

[34] U.S. EPA, EJScreen Tool | US EPA

TABLE 14-6. Pollution and Sources Environmental Indicators from EJScreen.

Selected Variable	Study Area	State Average	Percentile in State	National Average	Percentile in Nation
Particulate Matter < 2.5µm (µg/m^3)	5.83	5.87	42%	8.08	7%
Ozone (ppb)	59.2	66.1	3%	61.6	33%
Diesel Particulate Matter (µg/m^3)	0.0813	0.278	16%	0.261	<50th
Air Toxics Cancer Risk* (lifetime risk per million)	20	25	13%	25	<50th
Air Toxics Respiratory Hazard Index*	0.23	0.31	10%	0.31	<50th
Toxic Releases to Air	140	2800	24%	4600	27%
Traffic Proximity (daily traffic count/distance to road)	2.7	190	3%	210	8%
Lead Paint (% Pre-1960 Housing)	0.0016	0.089	0%	0.3	0%
Superfund Proximity (site count/km distance)	0.11	0.077	**84%**	0.13	69%
RMP Facility Proximity (facility count/km distance)	0.15	0.38	50%	0.43	44%
Hazardous Waste Proximity (facility count/km distance)	0.021	0.71	5%	1.9	2%
Underground Storage Tanks (count/km^2)	0.018	1.7	31%	3.9	23%
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.27	5.8	66%	22	**87%**

Footnotes

Source: EPA, EJ Screening Tool 2.2

All bolded data indicate a potential concern.

Particulate Matter 2.5 ($PM_{2.5}$). EPA defines particulate matter as solid particles and liquid droplets found in the air.[35] Particulate matter 2.5 ($PM_{2.5}$) comprises inhalable particles with a diameter less than 2.5 micrometers. According to EPA's EJScreen tool, $PM_{2.5}$ measures 5.83 $\mu g/m^3$ within the study area around the plant. In comparison, the average $PM_{2.5}$ value for the State of Arizona is 5.87 $\mu g/m^3$; the average $PM_{2.5}$ value across the nation is 8.08 $\mu g/m^3$. The study area is at the 42nd percentile for the state (slightly better than average) and the 7th percentile for the nation (significantly better). For the $PM_{2.5}$ EJ Index, the study area is at the 45th percentile for the state and the 12th percentile for the nation, meaning the $PM_{2.5}$ air quality for people within the study area is slightly better compared to the rest of the state and much better (i.e., lower) than the average compared to the nation.

Ozone. The ozone (O_3) variable refers to the average annual top 10 daily maximum 8-hour concentrations of ozone in the air. The study area has a value of 59.2 parts per billion (ppb) for ozone. In comparison, the average value for the state is 66.1 ppb, and the average value nationally is 61.6 ppb. The study area is at the 42nd percentile for the state and 33rd percentile for the nation, meaning the ozone exposure in the study area is lower than the average in the state and also lower than the average in the country. For the ozone EJ Index, the study area is at the 5th percentile for the state and the 43rd percentile for the nation, meaning that the ozone exposure to people within the study area much lower than the rest of the state and slightly lower than the rest of the country.

Diesel Particulate Matter (PM). The Diesel PM variable describes the amount of diesel particulate matter in the air. The study area has a value of 0.0813 $\mu g/m^3$; the average value for the state is 0.278 $\mu g/m^3$; and the average value for the nation is 0.261 $\mu g/m^3$. The study area is in the 16th percentile for the state and is less than the 50th percentile for the nation, meaning there is less diesel PM in the air compared to both the state and the country. For the Diesel Particulate Matter EJ Index, the study area is at the 21st percentile for both the state and the nation, meaning that exposure to diesel particulate matter is below both the state and national averages.

Air Toxics Cancer Risk. The Air Toxics Cancer Risk variable refers to the lifetime cancer risk from inhaling toxic air contaminants. The study area has a value of 20 for the Air Toxics Cancer Risk variable, measured as a lifetime risk per one million population. In comparison, the average state value is 25, and the average national value is also 25. The study area is in the 13th percentile for the state and less than the 50th percentile for the nation, meaning that the risk for getting cancer from inhaling toxic air contaminants is lower in the study area than in both the state and the country. For the Air Toxics Cancer Risk EJ Index, the study area is at the 25th percentile for the state and the 30th percentile for the nation. This also indicates that the risk of getting cancer from inhaling toxic air contaminants by people within the study area is lower than the rest of the state and is also less than the average of the country.

Air Toxics Respiratory Hazard Index. The Air Toxics Respiratory Hazard Index (HI) measures the ratio of exposure concentrations of toxics in the air to the health-based reference concentrations set by EPA. The study area has a value of 0.23 (unitless index) for the Air Toxics HI variable. In comparison, the average

[35] Environmental Protection Agency | EPA Particulate Matter PM Basics

value for the state is 0.31, and the average value nationally is also 0.31. The study area is at the 10th percentile for the state and less than the 50th percentile nationally, meaning that exposure to high concentrations of air toxins is lower in the study area compared to the state and nation. For the Air Toxics Respiratory HI EJ Index, the study area is at the 30th percentile for the state and the 37th percentile for the nation, indicating that air toxics exposure is less than the state and national averages.

Toxic Releases to Air. The Toxics Releases to Air indicator quantifies relative potential human health impacts of certain chemicals included on the list of toxic chemicals from the Emergency Planning and Community Right-to-Know Act (EPCRA), based on the amount released by facilities. The study area has a value of 140 (unitless score) for the Toxic Releases to Air score. In comparison, the average score for the state is 2,800, and the average score nationally is 4,600. The study area is at the 24th percentile for the state and the 27th percentile nationally, meaning there are significantly fewer toxic releases to the ambient air in the study area than in both the state and the nation. For the Toxic Releases to Air EJ Index, the study area is at the 30th percentile for the State and the 29th percentile nationally, meaning toxic chemical releases are lower in the study area than both the state and national averages.

Traffic Proximity. The Traffic Proximity indicator quantifies the volume of vehicles at major roads within 500 meters divided by the distance to the road. The study area has a value of 2.7 (unitless score) for Traffic Proximity. In comparison, the average score for the state is 190, and the average score nationally is 210. The study area is at the 3rd percentile for the state and the 8th percentile nationally, meaning there are significantly fewer vehicles within 500 meters in the study area than both the state and the nation. For the Traffic Proximity EJ Index, the study area is at the 5th percentile for the state and the 12th percentile nationally, meaning the exposure within the EPA EJScreen demographic index to traffic is much lower than the average for both state and the country.

Lead Paint (% Pre-1960 Housing). The lead paint indicator is simply the percentage of occupied housing units built before 1960. This is a surrogate for the potential prevalence of lead paint. The study area has a value of 0.0016% Lead Paint %. In comparison the average score for the state is 0.089% which puts the study area value in the zero percentile for the state. The national average lead paint indicator value is 0.3% for nation, also placing the study area in the zero percentile nationally. The study area has a significantly less potential lead paint exposure than both the state and nation. The study area also has an EJ Index for Lead Paint in the zero percentile as compared to the state and nation.

Superfund Proximity. The Superfund proximity indicator is reflective of the total count of sites proposed and listed (final) on the National Priorities List (NPL). This is calculated by assigning distance-weighted scores for those NPL sites within 5 km. The value for the study area is 0.11 sites/km distance. The state average score is 0.077 which places the study area in the 84th percentile for the state. The national Superfund proximity indicator score is 0.13 which places the study area in the 69th percentile nationally, meaning that the study area is well above the state and national levels.

The Superfund proximity indicator is the only EJ environmental indicator which is more than 80 percent above the state average. This means that the proposed site is closer than the state and national averages to a Superfund site. The Hassayampa Landfill is located approximately six miles northeast of the proposed site. According to the Arizona Department of Environmental Quality[36], the Hassayampa Landfill (site) is located about 10 miles west of Buckeye, Arizona, and approximately six miles east of the Palo Verde Nuclear Generating Station. The site consists of about 10 acres formerly used for hazardous waste disposal which lies adjacent to the 47-acre former sanitary landfill. The contaminants of concern in groundwater include various volatile organic compounds (VOCs) such as 1,1-dichloroethene (DCE), trichlorotrifluoroethane (Freon 113), 1,1,1-trichloroethane (TCA); 1,1-dichloroethane (DCA), trichloroethene (TCE), tetrachloroethene (PCE), trichlorofluoromethane (Freon 11); 1,2-dichloroethene (DCE), 1,2-dichloropropane, and toluene. Soils beneath the waste pits contain VOCs, heavy metals, pesticides, and lime wastes. Contaminants of concern at the site may change as new data becomes available.

Risk assessment results indicate that potential health risks may exist for individuals who might ingest the contaminated groundwater or come into direct contact with hazardous wastes present. The landfill is capped and enclosed by a perimeter fence; therefore, there is no potential for adverse health effects due to inhalation of VOCs in the air or direct contact with the hazardous wastes present below the ground surface. Contamination in the groundwater is contained within the site boundaries. The groundwater contamination is restricted to the shallow aquifer which is not used as a potable water source.

RMP Facility Proximity. The RMP (Risk Management Plan) facility proximity reflects the total count of active RMP facilities within 5 km. This is calculated by assigning distance weighted scores from active sites in EPA's Facility Registry Services (FRS) website. The study area value is 0.15 sites/km distance. The state value is 0.38 which puts the study area in the 50th percentile for the state. On a national level, the RMP facility proximity value is 0.43, putting the study area at the 44th percentile nationally. Therefore, the study area is at or slightly below the median for both the state and nation for proximity to facilities that have risk management plans.

Hazardous Waste Proximity. The Hazardous Waste Proximity indicator reflects the total count of hazardous waste facilities in each block group within 5 km of the average resident. This is calculated by assigning distance-weighted scores of hazardous waste facilities (Resource Conservation and Recovery Act handlers that are either operating Treatment, Storage, and Disposal Facilities (TSDFs) or hazardous waste Large Quantity Generator (LGQs)). The study area value for hazardous waste proximity is 0.021 facilities/km distance. When compared to the state value of 0.71, the study area is in the 5th percentile. The national Hazardous Waste Proximity indicator value is 1.9, putting the Study Area in the 2nd percentile. This means that the study area has a much lower proximity to hazardous waste facilities than either the state or national averages.

Underground Storage Tanks. The Underground Storage Tanks (UST) indicator quantifies the relative risk of being affected by a leaking underground storage tank (LUST). This is calculated by adding the number of LUSTs (multiplied by 7.7) and the number of USTs within 1500 ft of a block group. The value of the study area is 0.018 UST/km^2. This value is much less than the average value for the state of 1.7 and far below the national average of 3.9. This puts the study area in the 31st and 23rd percentile for the state

[36] https://azdeq.gov/node/3840

and national average, respectively. Therefore, the study area is much less likely to have leaking underground storage tanks nearby than in the state or nation.

Wastewater Discharge. The wastewater discharge indicator quantifies a block group's relative risk of exposure to pollutants in downstream water bodies. This is calculated from the Discharge Monitoring Report and RSEI model using a toxicity-weighted concentration in stream reach segments within 500 meters. The study area value of 0.27 is in the 66th percentile for the state which has an average value of 5.8. From a national perspective, it is in the 87th percentile where the national average is 22. This means that the study area has an elevated potential for exposure to pollutants from wastewater discharge as compared to both the state and nation.

14.5.8 Local Sensitive Receptors.

EPA's EJ guidance suggests that sensitive receptors include, but are not limited to, hospitals, schools, daycare facilities, elderly housing and convalescent facilities[37]. These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other pollutants. For instance, children and the elderly may have a higher risk of developing asthma from elevated levels of certain air pollutants than healthy individuals between the ages of 18 and 64. Extra care must be taken when dealing with pollutants in close proximity to areas recognized as sensitive receptors.

The only sensitive public receptor identified within the study area is the Arlington Elementary School:

Arlington Elementary School
9410 S 355th Avenue
Arlington, AZ 85322
School ID: 040084000044
School district ID: 0400840

14.5.9 Step Three: Identify Potentially Adverse or Disproportionate Impacts within the Study Area.

Figure 14-4 depicts EPA's EJScreen "EJ Index" results for the study area. As previously noted, the EJ Index is an amalgam of the specific Environmental Indicator and two Demographic Indicators (low income and people of color).

From Figure 14-4, all of the thirteen (13) EJ Indexes for the study area are below EPA's 80th percentile flag for further scrutiny. However, from the EJ report, the Superfund proximity indicator for the study area was at the 84th percentile for the state which is the only EJ environmental indicator more than 80 percent above the state average. The Hassayampa Landfill is located approximately 6 miles northeast of the proposed site. Risk assessment results indicate that potential health risks may exist for individuals who might ingest the

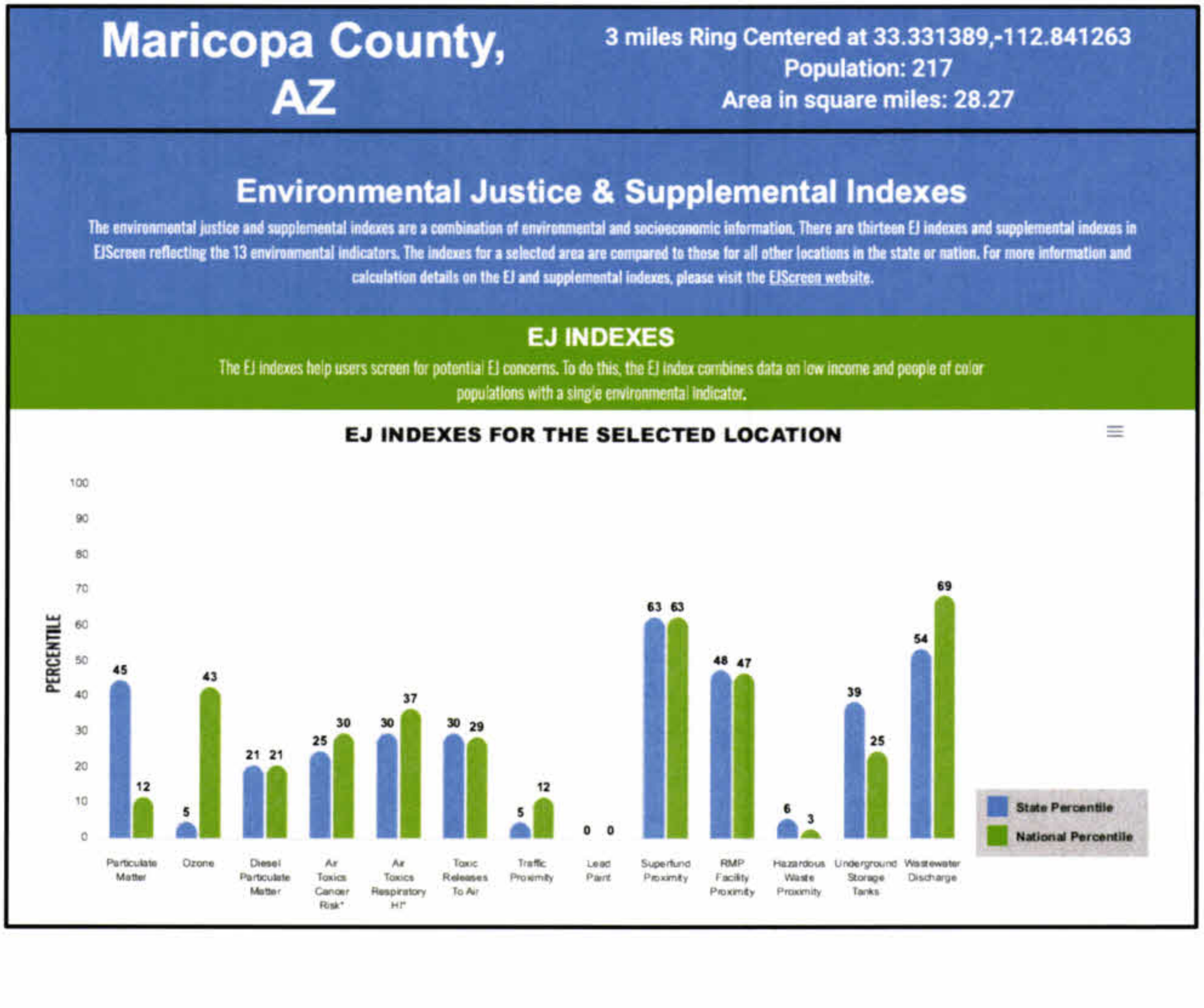
[37] Environmental Protection Agency | Environmental Issues of Concern for Urban Communities: Resources

contaminated groundwater or come into direct contact with hazardous wastes present. The landfill is capped and enclosed by a perimeter fence; therefore, there is no potential for adverse health effects due to inhalation of VOCs in the air or direct contact with the hazardous wastes present below the ground surface. Contamination in the groundwater is contained within the site boundaries.

The present application is for an air permit amendment and is unrelated to and has no potential to impact the Hassayampa Landfill. Indeed, there are no relevant applicable requirements that could be inserted into this air permit that would mitigate or address concerns related to superfund sites which would be outside the purview of this application.

Based upon a review of all of the information in Steps one through three, this EJ analysis did not identify a community that is adversely or disproportionately impacted by the project.

FIGURE 14-4. EJ Index results for the Power Plant Study Area.



14.5.10 Step Four: Ensure Meaningful Involvement of Potentially Impacted Community Members.

Although APS did not identify a community with potentially adverse or disproportionate impacts, the spirit of environmental justice is to ensure the fair treatment and meaningful involvement of all communities. APS is working to ensure potentially affected populations have an appropriate opportunity to participate in decisions about our proposed activity and has listened to the concerns of all participants involved.

The following is a brief overview of the Communications Outreach that has been conducted to date.

14.5.11 Communication and Public Outreach.

The Redhawk Power Plant is a Title V major source and operates under Title V permit No. P0009401. APS is seeking a significant revision and major modification to this Permit to construct and operate eight additional combustion turbines with selective catalytic reduction (SCR) and oxidation catalyst air quality control systems. Maricopa County Rule 210 § 408.2 requires the Maricopa County control Officer to provide public notice of receipt of a complete application for major modifications by publishing a notice in a newspaper of general circulation in Maricopa County. Maricopa County Rule 210 § 408.1(b) also requires the Maricopa County Control Officer to provide public notice, an opportunity for public comment, and an opportunity for a hearing before issuing or denying a significant permit revision. This requirement to provide public notice, an opportunity for public comment, and an opportunity for a hearing will help to facilitate meaningful community engagement before a final decision on this permit revision application is made.

APS will conduct community outreach for this permit application, to ensure that potentially impacted community members and businesses have an opportunity to better understand the project and its anticipated impacts, to ask questions, and to voice any concerns. Residents within three miles of the RHPPEP have a high proficiency with the English language. Regardless, 20% of homes in the Maricopa County area primarily speak Spanish. As part of its public outreach, APS will ensure that materials are published in both English and Spanish.

To provide information about the project and ample opportunity for the community to provide comment, APS will provide a variety of engagement opportunities and an in-person open house event as follows:

- On or around April 12, 2024, mail newsletters to homes and businesses within the study area, informing community members about the project and inviting them to the in-person and virtual open houses. The newsletter will be in both English and Spanish.
- On or around June 6, 2024, hold an in-person open house for community members. The timing of the event will be chosen to provide a long enough window to accommodate varying work and family schedules.
- A virtual open house (www.apsredhawkproject.com) will be made available to the public, commencing on 04/10/24 and will include informational materials in English and Spanish, and an opportunity to leave comments, concerns, or questions. This provides an opportunity for those

who cannot attend the in-person open house an alterative option for learning more and engaging with comments or questions.

- All project materials contain an e-mail address (apsredhawkproject@aps.com), a phone number (800-484-1358), and a project web address (www.apsredhawkproject.com) for community members who wish to engage and communicate with project staff. These channels of communication will be monitored, and responses will be provided in a timely manner.

- On or around May 7 through May 21, 2024, geotargeted social media ads will be placed to inform community members and businesses about the project and the virtual and in-person open house options.

APS will continue to monitor input from community members, and as additional community input is gathered, APS will supplement the permit record for this application.

14.6 Conclusions.

Environmental Justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This EJ evaluation examined the demographic and environmental conditions within the three-mile radius, known as the "study area," centered around the existing Redhawk Power Plant in Maricopa County, and compared those demographic and environmental conditions to the County, the State of Arizona, and to the nation as a whole. This analysis did not identify any potentially significant adverse or disproportionate impacts to the community within the study area. The following are the major findings for the study area in this analysis.

1. The study area has a low population of only 217 individuals in an area of 28.27 square miles, equal to a population density of less than 8 individuals per square mile.
2. The EJ screening socioeconomic factors for the study area have a lower percentage of individuals in all selected EJ screening variables except "Less Than High School Education" and "Low Life Expectancy" as compared to both the County and the State.
    a. The study area has a higher percentage of the population (31%) with less than a high school education than both the County (12%) and the State (12%).
    b. The study area has a slightly higher low life expectancy (20%) than the state as a whole (19%).
3. The study area's population of all ethnic groups is lower as a percentage than the County and State except for the total Hispanic population (35%) which is 10% greater than the County (31.1%).

4. The per capita income in the study area ($33,108) is also more than 10% less than both Maricopa County ($37,570) and the State of Arizona ($38,334), indicating that the local population has a lower income than the county or state averages.

5. None of the households have limited English proficiency or speak another language at home. Thus, the study area appears to have a very high English proficiency.

6. The Superfund proximity indicator for the study area was the only EJ environmental indicator which is more than 80 percent above the state average. However, the landfill is capped. There is no potential for adverse health effects due to inhalation of VOCs in the air or direct contact with the hazardous wastes present below the ground surface.

Even though APS did not find adverse or disproportionate impacts to the community, APS will work to ensure that there was and will continue to be meaningful involvement, engagement and dialogue with the community around the proposed new power plant.

Appendix A.

Maricopa County Air Quality Department Forms.

Maricopa County AIR QUALITY DEPARTMENT

Maricopa County Air Quality Department
Phone: 602-506-6010
Email: AQPermits@maricopa.gov

Maricopa.gov/AQ
CleanAirMakeMore.com

MARICOPA COUNTY ARIZONA

SECTION 1 STANDARD PERMIT APPLICATION FORM

TITLE V PERMIT APPLICATION

As required by A.R.S. § 49-480 and Rule 210 (Title V Permit Provisions)

ALL APPLICANTS MUST COMPLETE THE ENTIRE APPLICATION

Important: Please note that as the engineer reviews your application and prepares your permit, email will be the **primary** means for communication with you, unless you do not have an email address. Please ensure your email address is correct.

1. Permit to be issued to (Business license name of organization that is to receive permit):
Arizona Public Service Company (APS)

2. Mailing Address: **400 N. 5th Street, Mail Station 9303**

City: **Phoenix** | State: **Arizona** | Zip Code: **85004**

3. Plant Name (if different from item #1 above): Redhawk Generating Station

4. Name (or names) of Owner or Operator:
Arizona Public Service Company
Phone: ______ Email: ______

5. Name of Owner's Agent: **Mark Hajduk**
Phone: 602-**250-3394**

6. Plant/Site Manager or Contact Person: **Andre Bodrog**
Phone: **(602) 407-7801**

7. Proposed Equipment/Plant Location Address:
11600 South 363rd Avenue

City: **Arlington** | County: **MARICOPA** | Zip Code: **85322**

Section/Township/Range: ______

Latitude: **33.3332** | Longitude: **-112.8412** | Zip Code:

8. General Nature of Business: **Electrical Power Generation**

Standard Industrial Classification Code: **4911**

9. Type of Organization: ■ Corporation ☐ Individual Owner ☐ Partnership ☐ Govt. Entity
Government Facility Code: ______

10. Permit Application Basis (Check all that apply.): ☐ New Source ☐ Renewal of Existing Permit ■ Revision P0009401 ☐ Portable Source

For renewal or modification, include existing permit number and Date of Commencement of Construction or Modification:
04/01/2023

Is **any** of the equipment to be leased to another individual or entity? ☐ Yes ■ No

11. Signature of Responsible Official: Andre G Bodrog
Official Title of Signer: Redhawk Plant Manager

12. Typed or Printed Name of Signer: Andre Bodrog

Date: 04-10-2024 Phone: (602) 407-7801

For Office Use Only | Date Received: | Log Number:

Maricopa County Air Quality Department
Phone: 602-506-6010
Email: AQPermits@maricopa.gov

Maricopa.gov/AQ
CleanAirMakeMore.com

Facility name and location: **Arizona Public Service – Redhawk Generating Station** Date: **04/05/2024**

EMISSION SOURCES

Supplying all necessary information in the table below will allow for a more efficient review of the permit application and issuance of the permit. Estimate Potential to Emit (PTE) as defined in Rule 100 (General Provisions and Definitions). MCAQD Standard Conditions are 293K and 101.3 kilopascals per Rule 100 (General Provisions and Definitions).

REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
Emission Point (1)		Chemical Composition of Total Stream	Air Pollutant Emission Rate		UTM Coordinates of Emissions Point (5)			Stack Sources (6)					Nonpoint Sources (7)	
										Exit Data				
Number	Name	Regulated Air Pollutant Name (2)	#/hr (3)	tons/year (4)	Zone	East (m)	North (m)	Height above Ground (ft)	Height above Structure (ft)	diam. (ft)	velocity (fps)	temp. (°F)	Length (ft)	Width (ft)
Simple Cycle Combustion Turbine Units 3 - 10. Please refer to the permit application for detailed emissions and stack data.														

Ground Elevation of Facility above Mean Sea Level (ft): 885

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point numbers to eight digits. For each emission point, use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, and fugitive. Abbreviations are acceptable. Attach additional pages if needed.
2. List components, which include regulated air pollutants as defined in Rule 100 (General Provisions and Definitions). Examples of typical component names are: carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), volatile organic compounds (VOC), particulate matter (PM), and particulate matter less than 10 microns (PM10). Abbreviations are acceptable.
3. List pounds per hour (#/hr), which is the maximum potential emission rate expected.
4. List tons per year, which is the annual maximum potential emission expected and takes into account process operating schedule.
5. Provide a facility plot plan as described in the filing instructions. UTM coordinates are required only if the source is a major source or is required to perform refined modeling for the purposes of demonstrating compliance with ambient air quality guidelines.
6. Supply additional information as follows if appropriate:
   a. Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge.
   b. Stack's height above supporting or adjacent structures if structure is within 3 "stack heights above the ground" of the stack.
7. Dimensions of nonpoint sources as defined in R18-2-101.

SECTION 2 DESCRIPTION

Arizona Public Service (APS) owns and operates the Redhawk Power Plant (Title V Permit # V99-013) located in Maricopa County. Redhawk Power Plant (Redhawk) consists of two natural gas fired combined cycle (CC) units and associated equipment and systems. Each CC unit has a nominal rating of 530 megawatts (MW) gross electrical output. The CC units include two 175 MW combustion turbine generators (CTGs) and one 180 MW steam turbine generator (STG). Each combined cycle unit is equipped with a heat recovery steam generator (HRSG) which provides steam to the STG common to that unit. Each HRSG is equipped with duct burners which allow for supplemental natural gas firing. Each HRSG is also equipped with a selective catalytic reduction (SCR) system for the control of nitrogen oxides (NOx) emissions.

SECTION 3 EMISSION CALCULATIONS

APS voluntarily requests a reduction of the facility VOC Potential To Emit (PTE) from 121 tons/yr to 95 tons/yr, as detailed in Title V Air Permit P0009401, Item 18(a)(i) Table 1.

18. ALLOWABLE EMISSION LIMITATIONS:

Unless otherwise stated. the PM10 emission limits include both solid (filterable) and condensable particulate matter.

The allowable emission limits of these Permit Conditions are based upon the facility as currently permitted. They do not provide for facility changes or changes in the method of operation that would otherwise trigger applicable requirements including New Source Review. Prevention of Significant Deterioration or Best Available Control Technology.

a. FACILITY-WIDE REQUIREMENTS:

i. Facility Emission Limits:

In addition to emission limits expressed elsewhere in this Permit. the Permittee shall not cause. allow. or permit emissions to exceed the hourly and rolling average limits shown in Tables 1. 2. and 3

Table 1
Rolling 12-month Average Limits

	Rolling 12-month Average Emission Limits (tons per year)					
Parameter	NOx	CO	SO2	VOC	PM10	PM2.5
Annual Emission Limits	700	1900	20	121	367	367

This permit modification is solely a reduction of the VOC PTE and does not involve any changes to equipment or operation. A review of the historical actual annual VOC emissions are as follows:

Year	Actual VOC Emissions tons/yr
2017	4.917
2018	16.659
2019	16.447
2020	19.832
2021	15.881

Based upon the historical actual VOC emissions APS is willing to accept a lower VOC PTE emission rate of 95 tons per year and requests that such modification be made to the current Title V Air Permit P0009401, Revision Date 11/15/2022. The attached Tables 1 – 6 summarize the potential air emissions for each significant emissions unit at the Redhawk Power Plant. Table 7 summarizes the total facility potential emissions based on this revision application.

SECTION 4 APPLICABLE REQUIREMENTS

Since this is a reduction to the VOC PTE and there are no equipment or operation changes, there are no new applicable requirements, all current applicable requirements in Title V Air Permit P0009401, Revision Date 11/15/2022 remain enforceable.

SECTION 5 COMPLIANCE CERTIFICATION

I, Andre Bodrog, as Responsible Official for the Redhawk Generating Facility, hereby certify that:

- The applicable requirements for the Redhawk Generating Facility that are the basis of the certification are set forth in Sections 4 of the permit application.
- The Redhawk Generating Facility will comply with all applicable requirements listing Section 4 of the permit application and with additional requirements, if any, that become applicable during the permit term.
- The methods to be used to determine compliance with the listed applicable requirements are set forth in the existing Title V Air Quality Operating Permit V99-013 and the applicable requirements identified in Section 4 of the permit application, including a description of monitoring, recordkeeping and reporting requirements, and test methods.
- The Redhawk Generating Facility will submit semi-annual compliance certifications no later than April 30, for operations between October 1 and March 31, and the second report will be submitted no later than October 31, for operations between April 1 and September 30. There are currently no enhanced monitoring or compliance certification requirements applicable to the Redhawk Generating Station.
- Based on information and belief formed after reasonable inquiry, the statement and information in the permit application are true, accurate and complete.
- All major stationary sources owned or operated by Arizona Public Service in the State of Arizona and subject to emission limitations under the Clean Air Act are in compliance, or on a schedule for compliance, with all applicable emission limitations and standards under the Clean Air Act.

Andre G Bodrog　　　　　　　　　　04-10-2024

Andre Bodrog　　　　　　　　　　Date

Plant Manager
Redhawk Generating Facility

Appendix B.

Air Quality Modeling Protocol and Report.

Appendix B

Redhawk Power Plant
Title V Air Quality Operating Permit
Significant Revision Application
Permit Number P0009401

Air Modeling Protocol and Report

Prepared for:

Arizona Public Service
400 North 5th Street
Phoenix, Arizona 85004
www.aps.com

Prepared By:

RTP ENVIRONMENTAL ASSOCIATES INC.
1591 Tamarack Ave
Boulder, CO 80304

March 2024

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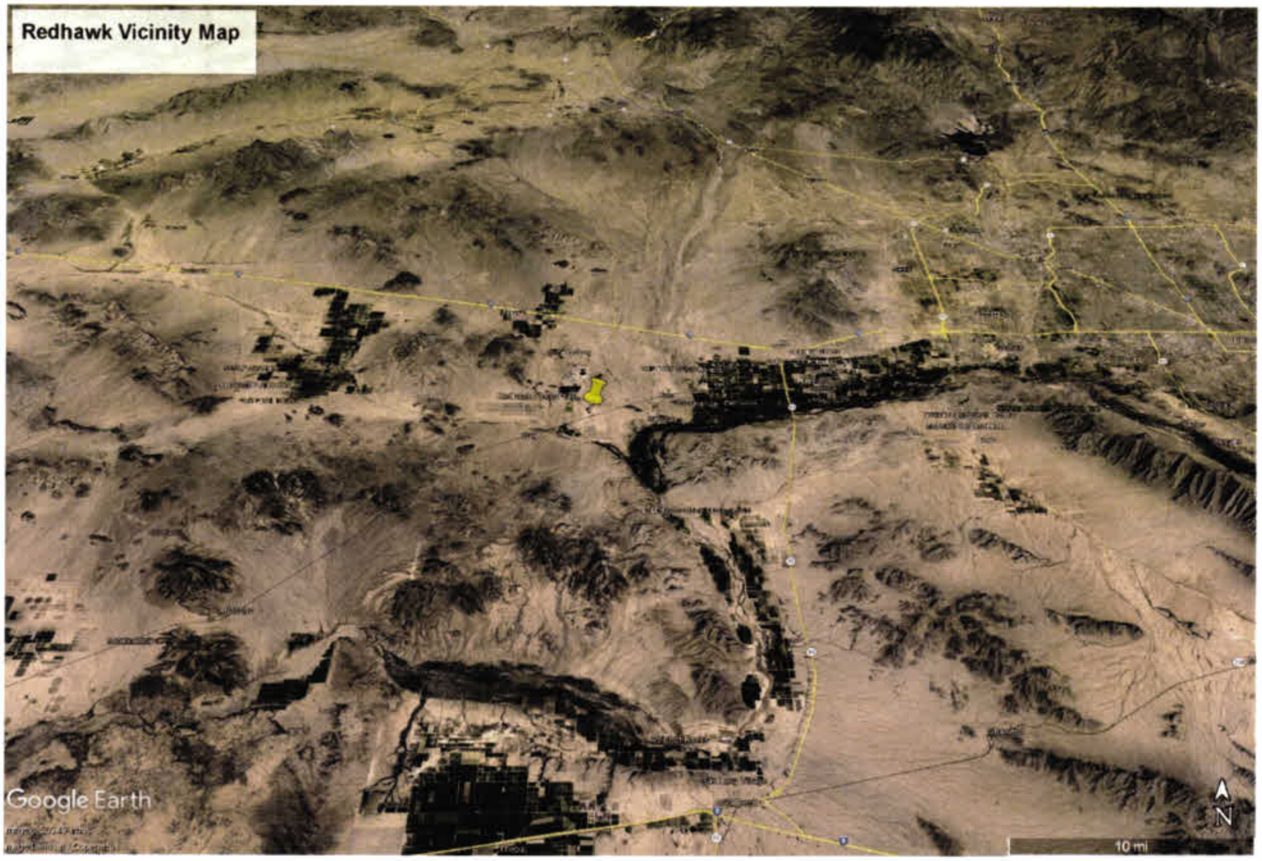
1.0 Introduction and Project Background

Arizona Public Service (APS) owns and operates the Redhawk Power Plant (Redhawk) located in Maricopa County. Redhawk consists of two natural gas fired combined cycle (CC) combustion turbine units and associated equipment. The plant address is 11600 South 363rd Ave, Arlington, AZ, 85922. The plant latitude is 33.2630N and longitude is 112.0930W. A project vicinity map is shown in Figure 1. The surrounding area is classified as an attainment area for all criteria air pollutants except ozone.

APS is proposing an expansion project at Redhawk (the Project). The proposed new power plant will consist of eight (8) General Electric Model LM6000PC simple cycle combustion turbine generators (CTs). As described in the *Redhawk Power Plant Title V Air Quality Operating Permit - Significant Revision Application - Permit Number P0009401*, dated April 1, 2024, (herein referred to as the Permit Application), the proposed Project emissions will trigger major New Source Review (NSR), including Prevention of Significant Deterioration (PSD) review for the pollutants NO_X, PM_{10}, and $PM_{2.5}$, and Non-Attainment Area (NAA) review for the pollutant NO_X.

This document is a combined air quality modeling protocol and report for the Project. The air quality modeling procedures conform with applicable requirements in the U.S. Environmental Protection Agency's (EPA) *Guideline on Air Quality Models*, 40 CFR Part 51 Appendix W (herein referred to as "EPA GAQM"), the Arizona Department of Environmental Quality (ADEQ) *Air Dispersion Modeling Guidelines for Arizona Air Quality Permits*, November 2019 (herein referred to as the "ADEQ Guidelines") and the *Maricopa County Air Quality Permitting Handbook* (August 2023).

Figure 1 - Location of the Redhawk Power Plant



1.1 Project Description

The proposed Project will consist of eight (8) General Electric Model LM6000PC aeroderivative simple cycle combustion turbines (CTs). These CT units will be identified as Units 3 through 10. These CTs will be equipped with air quality control systems including water injection and selective catalytic reduction (SCR) for nitrogen oxides (NO_X) control and oxidation catalysts for carbon monoxide (CO) and volatile organic compound (VOC) control.

1.2 Site Description

The Project site is in a sparsely populated area approximately 50 miles west of downtown Phoenix, at an elevation of approximately 880 ft above mean sea level (amsl). The site is in the northern reaches of the Sonoran Desert, with nearby agricultural land uses. Scattered, low mountain ranges surround the site, including the White Tank Mountains to the north and the Sierra Estrella to the east, and the highest peaks are on the order of 2,000 to 4,000 feet amsl. Other than the mountains, the topography at the Project area is generally flat at an elevation of approximately 800 to 900 feet amsl. The Gila River is located approximately 5 miles to the east, and this river runs generally westward through the Project area although it turns southward for approximately 20 miles just east of the Project location.

1.3 Regional Climatology

Most of the following discussion is taken from a climate summary compiled by the National Weather Service Forecast Office in Phoenix, Arizona found at the following internet link: http://www.public.asu.edu/~aunjs/ClimateofPhoenix/phxwx.htm .

The climate in the Phoenix area is of a desert type with low annual rainfall and low relative humidity. Daytime temperatures are high throughout the summer months. The winters are mild. Most deserts undergo drastic fluctuations between day and nighttime temperatures, but not the Phoenix metropolitan area due to the urban heat island effect. As the city has expanded, average summer low temps have been rising steadily. The daily heat of the sun is stored in pavement, sidewalks, and buildings, and is radiated back out at night. During the summer, overnight lows greater than 80 °F are commonplace.

There are two separate rainfall seasons. The first occurs during the winter months from November through March when the area is subjected to occasional storms from the Pacific Ocean. While this is classified as a rainfall season, there can be periods of a month or more in this or any other season when practically no precipitation occurs. Snowfall occurs very rarely in the Salt River Valley, while light snow occasionally falls in the higher mountains surrounding the valley. The second rainfall period occurs during July and August when Arizona is subjected to widespread thunderstorm activity whose moisture supply originates in the Gulf of Mexico, in the Pacific Ocean off the west coast of Mexico and in the Gulf of California. The spring and fall months are generally dry, although precipitation in substantial amounts has fallen occasionally during every month of the year.

The valley floor, in general, is rather free of strong wind. During the spring months southwest and west winds predominate and are associated with the passage of low-pressure troughs. During the thunderstorm season in July and August, there are often local, strong, gusty winds with considerable blowing dust. These winds generally come from a northeasterly to southeasterly direction. Throughout the year there are periods, often several days in length, in which winds remain under 10 miles per hour.

Sunshine in Phoenix area averages 86 percent of possible, ranging from a minimum monthly average of around 78 percent in January and December to a maximum of 94 percent in June. During the winter, skies are sometimes cloudy, but sunny skies predominate, and the temperatures are mild. During the spring, skies are also predominately sunny with warm temperatures during the day and mild pleasant evenings. Beginning in June, daytime weather is hot. During July and August, there is an increase in humidity, and there is often considerable afternoon and evening cloudiness associated with cumulus clouds building up over the nearby mountains. Summer thunder-showers seldom occur in the valley before evening.

The autumn season, beginning during the latter part of September, is characterized by sudden changes in temperature. The change from the heat of summer to the mild winter temperatures usually occurs during October. The normal temperature change from the beginning to the end of this month is the greatest of any of the twelve months in central Arizona. By November, the mild winter season is established in the Salt River Valley region.

2.0 Regulatory Status

The Redhawk Power Plant is in Arlington, Maricopa County, Arizona. The air permitting authority is the Maricopa County Air Quality Department (MCAQD). Maricopa County has issued a Title V Permit # V99-013 for operations at Redhawk.

2.1 Source Designation

The existing Redhawk Power Plant is major source under both Maricopa County Rule 240 (implementing the PSD Program) and Rule 210 (implementing Title V requirements). As described in the Permit Application, the proposed Project emissions will trigger major New Source Review (NSR) review, including Prevention of Significant Deterioration (PSD) review for the pollutants NO_X, PM_{10}, and $PM_{2.5}$, and Non-Attainment Area (NAA) review for the pollutant NO_X. The Project also trigger minor-NSR review for the pollutant CO.

2.2 Area Classifications

The Project location is classified as attainment for all criteria air pollutants except ozone. Maricopa County and the proposed site is classified as a marginal nonattainment area for the 8-hour ozone standard, although redesignation to serious status is imminent.

2.3 Baseline Dates and Area

A PSD increment is the maximum increase in concentration allowed above an established baseline concentration. The baseline concentration represents the actual ambient concentration existing at the baseline date, defined as the time of the first complete PSD permit application in each area, referred to as the "baseline area" or "air quality control region" (AQCR). There are two baseline dates that are defined: major source baseline dates and minor source baseline dates. The major source baseline date identifies the point in time after which major sources affect available increment, while the minor source baseline date identifies the point in time after which actual emission changes from all sources (both major and minor) affect available increment. The amount of PSD increment that has been consumed within an area is determined from the actual emission increases and decreases that have occurred since the applicable baseline date.

The applicable major source baseline dates for the Maricopa Intrastate AQCR are January 6, 1975, for SO_2 and PM_{10}; February 8, 1988, for NO_2; and October 20, 2010, for $PM_{2.5}$. The minor source baseline dates are March 3, 1980, for SO_2 and PM_{10}; January 20, 1993, for NO_2, and May 10, 2015, for $PM_{2.5}$.

3.0 Ambient Data Requirements

Preconstruction and post-construction monitoring requirements are discussed below.

3.1 Preconstruction Air Quality Monitoring

The collection of ambient air quality data for criteria pollutants that trigger PSD review and for which the Project requires a cumulative NAAQS analysis (as will be shown later, for this Project those pollutants are 24-hr average $PM_{2.5}$ and 1-hr average NO_2) is required prior to construction of a new major source, unless representative data from an existing monitor are available. This section contains an analysis of the representativeness of nearby existing ambient monitoring data for use in lieu of preconstruction monitoring data collection.

EPA's *Ambient Monitoring Guidelines for Prevention of Significant Deterioration*, 1987, discusses three criteria that help determine the representativeness of existing monitoring data for fulfilling the preconstruction monitoring requirement: the quality of the data, the currentness of the data, and the monitor location. The existing monitoring data must meet quality assurance procedures that are required for the operation of PSD and State and Local Air Monitoring Stations (SLAMS) air monitoring stations. The existing data should have been collected in the recent 3-year period preceding the permit application.

MCAQD collects accurate and timely ambient air quality monitoring data within Maricopa County. In cooperation with the EPA and other governmental agencies, the Division operates numerous SLAMS air quality sites which measure for several criteria pollutants and regularly reports on the monitoring station objectives and data results in periodic Network Plans and Network Assessments. These stations are operated in compliance with SLAMS quality assurance procedures. MCAQD has analyzed the air quality data from all stations in accordance with recommendations in the ADEQ Guidelines and has made available data tables with approved background air quality concentration values. These data generally meet the criteria for use as pre-construction air monitoring data. The following paragraphs further analyze the representativeness of the two stations that were used for background 1-hr NO_2 and 24-hr $PM_{2.5}$ data.

MCAQD operates the Buckeye monitoring station (AQS # 04-013-4011), located approximately 20 km to the east of Redhawk. The Buckeye site began operating in August 2004 and monitors for CO, NO_2, and PM_{10}. The station is located in a rural, agricultural setting, similar to Redhawk, and is the closest monitoring station to Redhawk. The monitoring spatial scales of this station are neighborhood for CO and PM_{10}, and urban for NO_2, which are appropriate for use as pre-construction monitoring data.

The two closest $PM_{2.5}$ monitoring stations operated by MCAQD are the Glendale station (located 66 km from Redhawk) and the West Phoenix station (located 67 km from Redhawk). The Glendale station (AQS # 04-013-2001) is in a residential neighborhood, while the West Phoenix station is in a high-density residential neighborhood with nearby industrial districts. The general setting and source environment of the Glendale station more closely matches the Redhawk project site than does the West Phoenix station. The Glendale station spatial scale is neighborhood, which is appropriate for use as pre-construction monitoring data.

Given the similar characteristics of the Buckeye and Glendale stations to the Redhawk area, the air quality data from these stations fulfill the PSD pre-construction air quality monitoring requirements. Section 3.4 presents the background concentration values that will be used in the air quality analyses.

3.2 Post-Construction Air Quality Monitoring

Post-construction air quality monitoring is not proposed for the Project.

3.3 Meteorological Monitoring

ADEQ has acquired and processed meteorological data from numerous meteorological monitoring stations using AERMET version 23132, AERMINUTE version 15272, and AERSURFACE version 20060. Data is available for the five-year period of 2017 to 2021 for 11 stations across Arizona and one station in California. One of the stations is the Sky Harbor National Weather Service station, located approximately 75 km to the east of Redhawk. This meteorological data is typically used as representative data in dispersion modeling for project in the Phoenix area.

Surface meteorological data is also collected by APS at the nearby Palo Verde Generating Station (PVGS), located approximately 7 km north of Redhawk. A 60-meter meteorological monitoring tower collects wind speed and wind direction data at 10-meter and 60-meter levels. The tower is operated and calibrated in accordance with *Meteorological Monitoring Programs for Nuclear Power Plants Regulatory Guide No. 1.23*, Revision 1, United States Nuclear Regulatory Commission (NRC), March 2007. The NRC meteorological monitoring requirements for instrument specifications, siting, data collection, and data validation meet or exceed the EPA requirements for onsite meteorological monitoring described in *Meteorological Monitoring Guidance for Regulatory Modeling Applications*, EPA-454/R-99-005, February 2000. Therefore, the PVGS onsite meteorological data is suitable for regulatory AERMOD modeling.

Given the proximity of the PVGS meteorological tower and the similarity of surface conditions and land use at PVGS and Redhawk, the PVGS data set is the more representative meteorological data set for the near-field modeling analyses. Therefore, it was used for the Project Class II modeling analyses. The data processing performed on the PVGS data is described in Section 5.2 of this protocol/report.

3.4 Background Concentrations

The impacts of non-nearby background sources and other sources not explicitly modeled are accounted for by using monitored air quality data (i.e., background concentrations). EPA's GAQM discusses requirements for background air quality concentrations that are "an essential part of the total air quality concentration to be considered in determining source impacts." Appendix W states that typically "air quality data should be used to establish background concentrations in the vicinity of the source(s) under consideration." ADEQ discusses the data processing requirements and methods to determine the background concentration values in the ADEQ Guidelines.

As will be shown later in this report, the only pollutants for which background data is required are 24-hr average PM2.5 and 1-hr average NO2. MCAQD has analyzed the air quality data from the Buckeye and Glendale stations in accordance with recommendations in the ADEQ Guidelines and has made available data tables with approved background concentration values. The background concentration data that will be used in the Project air quality impact analyses are presented in Table 1.

Table 1 - Background Air Quality Concentration Data

Pollutant	Avg Period	Background Concentration (µg/m3)
NO_2	1-hr	63.9
$PM_{2.5}$	24-hr	18.5

4.0 Project Emission Sources

The proposed Project will consist of eight (8) General Electric Model LM6000PC aeroderivative simple cycle combustion turbines (CTs). These CT units will be identified as Units 3 through 10. The turbines will exhaust through 85 ft tall stacks with a 10 ft diameter opening. The stacks exhaust vertically and do not have rain caps. Therefore, the stacks were modeled as default point sources in AERMOD. All source locations are based upon a NAD83, UTM Zone 12 projection. The Project emission sources, and proposed emission rates, are described in detail in Chapters 2 through 4 of the Permit Application.

5.0 Class II Area Analyses

5.1 Scope and Model Selection

Based on the regulatory analysis in the Permit Application, PSD air quality analyses are required for NO_X, PM_{10}, and $PM_{2.5}$ emissions. In addition, under Maricopa's minor-NSR permitting program, minor-NSR modeling analyses are required for CO emissions.

The primary guidance for performing PSD air quality analyses is EPA's GAQM, the *AERMOD Users Guide* and related addendums, and EPA's *AERMOD Implementation Guide*. In addition, EPA has also developed $PM_{2.5}$ permit modeling guidance and 1-hr NO_2 and SO_2 NAAQS modeling guidance. All procedures used for the Project's air quality impact analyses are consistent with these guidance documents.

Air modeling analyses are typically conducted in two steps: a "project-only" significant impact analysis, and if required a cumulative impact or "full" analysis. The significant impact analysis first estimates ambient impacts resulting from emissions from only the proposed Project. When the maximum ambient concentrations of a pollutant are below the Significant Impact Level ("SIL"), the emissions from the proposed source are not expected to have a significant impact on ambient air concentrations and further air quality analysis is not required for that pollutant and averaging interval. The use of the SILs is further discussed in Section 5.7 of this protocol.

If the Project's ambient impacts exceed the SIL for any pollutant and averaging interval, a cumulative NAAQS and PSD increment analysis is performed for those pollutants and averaging intervals. The cumulative analysis includes other nearby sources in addition to the Project emission sources.

The AERMOD model was used for the air quality analyses, with the regulatory default option set. AERMOD is a steady-state plume dispersion model that simulates transport and dispersion from multiple point, area, or volume sources based on an up-to-date characterization of the atmospheric boundary layer. AERMOD uses Gaussian distributions in the vertical and horizontal for stable conditions, and in the horizontal for convective conditions; the vertical distribution for convective conditions is based on a bi-Gaussian probability density function of the vertical velocity. For elevated terrain AERMOD incorporates the concept of the critical dividing streamline height, in which flow below this height remains horizontal, and flow above this height rises over terrain. AERMOD also uses the advanced PRIME algorithm to account for building wake effects.

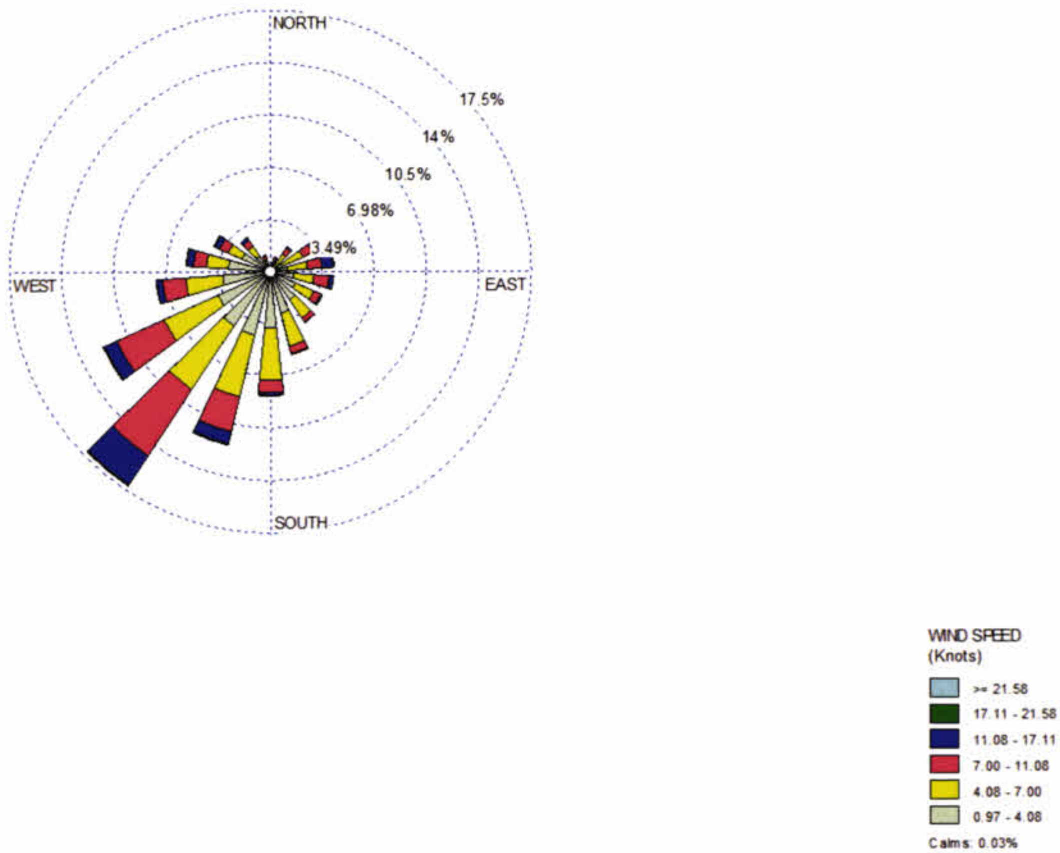
5.2 Meteorological Data and AERMET Processing

Meteorological data from the PVGS tower was processed using EPA's AERMET program, following procedures and guidance in EPA's GAQM and the AERMET manual. The meteorological data set for the period 2018-2022 consisted of 10-meter and 60-meter wind speed and direction data from the PVGS 60-meter meteorological tower, surface meteorological data from the nearest representative ASOS station (Sky Harbor airport station with IDs of WBAN-23183 and WMO-722780), and upper air data from the Tucson station (WBAN 23160 and WMO-722740).

The stage 1 AERMET processing extracted the onsite, surface, and upper air data sets and performed the standard Quality Assessment reviews. The threshold wind speed used for the onsite data set was 0.5 m/s. EPA's AERSURFACE program was then used to derive surface characteristics for the stage 2 AERMET processing. Two surface characteristic sectors were utilized, one from 61 to 147 degrees (to address the land surface characteristics around the adjacent PVGS plant), and the remaining sector to address the remaining bare land surfaces in the area. Monthly primary surface characteristics were processed.

To address issues with underprediction of the surface friction velocity (u*) during light wind, the ADJ_U* option was used in the stage 2 processing. The final valid AERMET meteorological data set has approximately 3% missing data which meets EPA requirements. Figure 2 presents the 10-meter wind rose for the PVGS data set.

Figure 2 - Wind Rose for PVGS Meteorological Data



Note: Data is for the 10-meter level wind data.

5.3 AERMOD Receptors

A receptor grid, or network, defines the locations of predicted air concentrations that are used to assess compliance with the relevant standards or guidelines. All coordinates used in the modeling are referenced to North American Datum 1983 (NAD83), Zone 12. The latest version of the AERMAP program was used to develop the model receptor grids. USGS National Elevation Data (NED) was used as the elevation data source for the AERMAP processing. The ADEQ Guidance for receptor grid placement is shown in Table 2.

Table 2– ADEQ Recommended Receptor Grid Coverage

Type of Receptors	Suggested Receptor Spacing (meters)	Receptor Coverage Area
Tight	25	Along ambient air boundary (AAB)
Fine	100	From AAB to 1 km
Medium	200 - 500	From 1 km to 5 km away from AAB
Coarse	500 - 1,000	From 5 km to 20 km away from AAB
Very Coarse	1,000-2,500	From 20 km to 50 km away from AAB
Discrete	Not Applicable	Place at areas of concern such as nearby residences, schools, worksites or daycare centers

The main receptor network used for the air modeling consisted of the following grids:

- 25-meter spaced grid on the facility boundary,
- 100-meter spaced grid out to a distance of 1 km in all directions,
- 300-meter spaced grid from 1 km out to a distance of 5 km in all directions,
- 750-meter spaced grid from 5 km out to a distance of 20 km in all directions,
- 2000-meter spaced grid from 20 km out to a distance of 50 km in all directions.

These grids were supplemented with a 200-meter spaced grid at elevated terrain features in the area. No other discrete receptors were used in the analysis.

Figures 3 and 4 present views of the receptor data sets.

Figure 3- Main AERMAP Receptor Grid

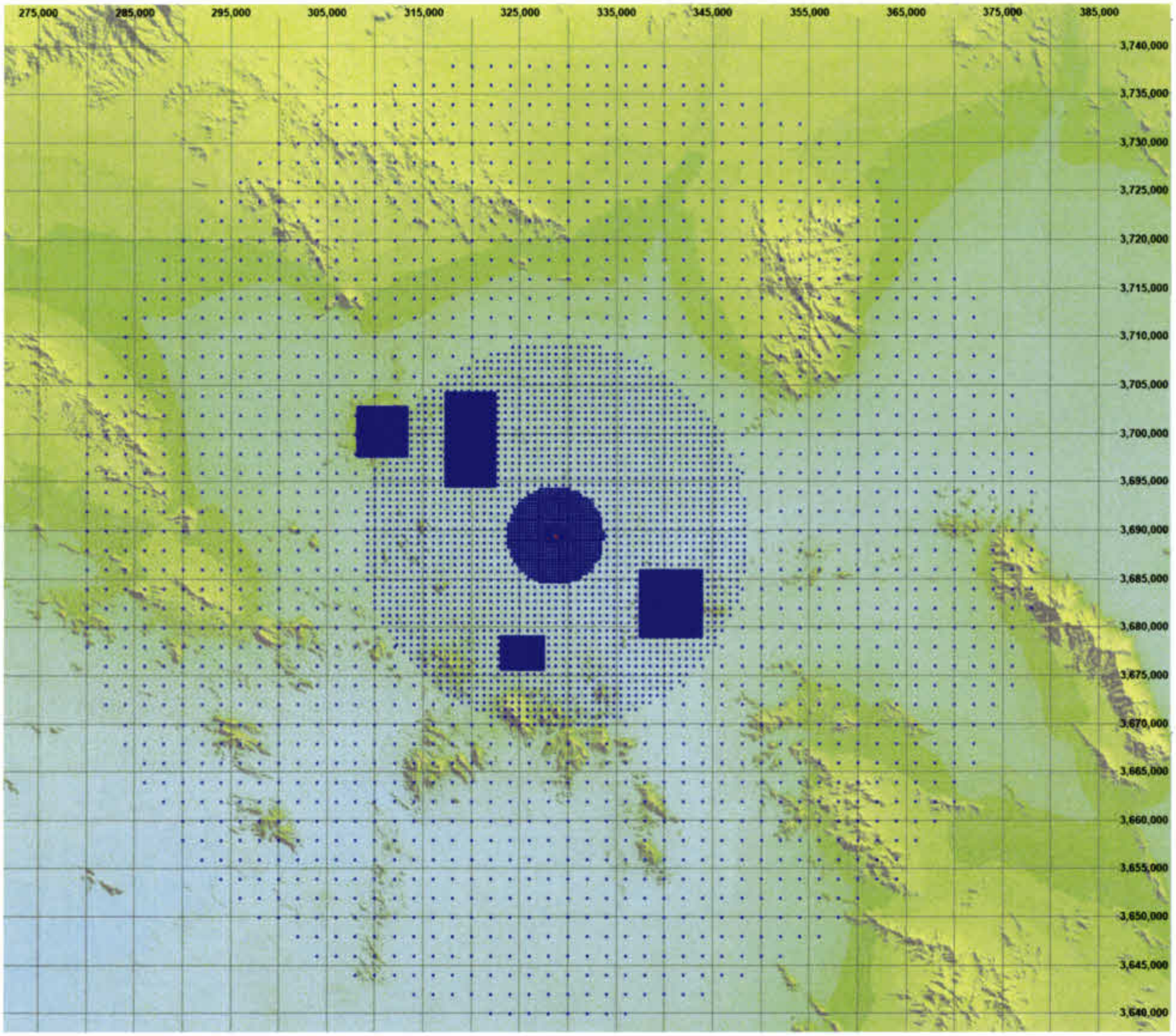


Figure 4- Close-in AERMAP Receptor Grid

Coordinates are UTM NAD 83 Zone 12. Blue dots are receptors. Stacks are red dots.

5.4 Urban versus Rural Dispersion Coefficients

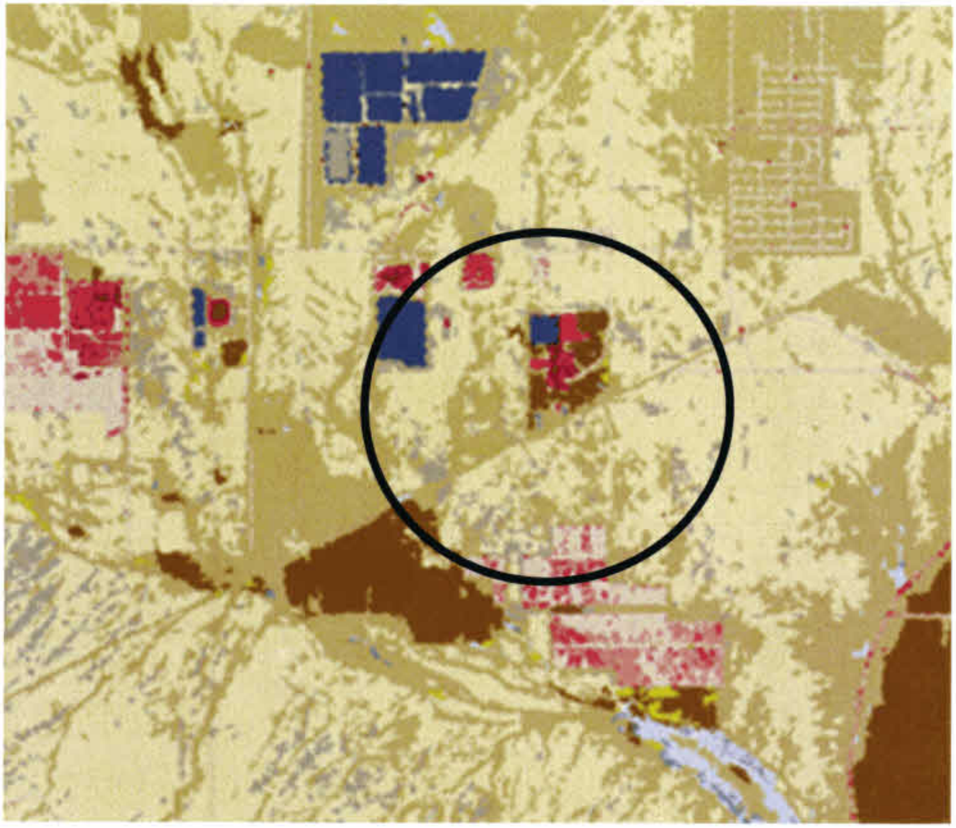
The AERMOD model allows the user to incorporate the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions. The selection of either rural or urban dispersion coefficients follows the procedures listed in Appendix W. The preferred Land Use Procedure classifies the land use within a 3km radius circle about the source using the meteorological land use typing scheme. If land use types I1, I2, C1, R2, and R3 account for 50 percent or more of the circle area, urban dispersion coefficients should be used. Sources located in areas defined as rural should be modeled using the rural dispersion parameters.

The land use typing scheme was used to determine the proper land use classification and AERMOD dispersion option for the Project. The USGS NLCD for 2016 for a 3 km radius centered on the plant presented in Figure 5 was reviewed. In accordance with Appendix W, an urban dispersion classification is to be used if the Auer land use types I1 (heavy industrial), I2 (light-moderate industrial), C1 (commercial), R2 (compact residential) and R3 (compact residential) account for 50% or more of the area within the 3 km radius around the site. The Auer land use classifications I1, I2, C1, R2 and R3 are no longer used by USGS, and these Auer classes correspond to the post-1992 NLCD land cover classes 23 (developed, medium intensity) and 24 (developed, high intensity), as shown in Table 3. Land cover classes 23 and 24 are shown as bright red and dark red areas in Figure 7.

Table 3- Land Cover Class Cross-Referencing

Auer – "Urban" Classes			NLCD 2011 Equivalent Classes		
Type	Use	Vegetation	Pervious	Use	No.
I1	Heavy Industrial	<5 %	0-20 %	Developed, high intensity	24
I2	Light Industrial	<5 %			
C1	Comm.	<15 %			
R2	Compact Residential	<30 %	20-50 %	Developed, medium intensity	23
R3	Compact Residential	<35 %			

Figure 5 – NLCD 2016 Land Use Categories near Redhawk



The estimated total area for land cover classes 23 and 24 (bright and dark red areas) within the 3km circle in Figure 7 is a small fraction of the total area within the 3km circle. Therefore, the area is designated as "rural" and the AERMOD RURAL modeling option was used.

5.5 GEP and Building Downwash

AERMOD can account for building downwash effects. The stack locations, stack heights, and structure locations and dimensions at the Project were input to EPA's "Building Profile Input Program – PRIME" (BPIP-PRIME) computer program. BPIP-PRIME processes this data in two steps. The first step determines and reports on whether a stack meets Good Engineering Practice (GEP) requirements and is subject to wake effects from a structure or structures. The second step calculated the "equivalent building dimensions" if a stack is influenced by structure wake effects in a format that is accepted by AERMOD. Since some stacks at the Project are influenced by wake effects, the BPIP-PRIME output for those stacks was input to the AERMOD model input file. Given the 85-foot height of the proposed stacks and the de-minimus GEP height of 65 meters, the proposed stacks do meet GEP requirements.

5.6 Modeling of NO_2 Impacts

The majority of NO_X emissions from combustion sources are in the form of nitric oxide (NO), whereas EPA has established air quality standards for NO_2. Therefore, a methodology must be used to convert model estimates of ambient NO concentrations into equivalent ambient NO_2 concentrations. The ARM2 ratio method option in AERMOD was used to account for the ambient conversion of emitted NO_X to ambient NO_2. In accordance with the EPA's GAQM, the minimum ARM2 ratio was set to 0.5 and the maximum ratio was set to 0.9 to result in a conservative analysis.

5.7 $PM_{2.5}$ Secondary Impact Analysis

The Project triggers PSD-review for $PM_{2.5}$, and the $PM_{2.5}$ air quality analysis followed the procedures described in EPA's "*Guidance for Ozone and Fine Particulate Matter Permit Modeling*", July 29, 2022 (herein referred to as the "Final Ozone and PM Guidance"). Because the Project emission increases of both direct $PM_{2.5}$ emissions and NO_X precursor emissions are above the PSD Significant Emission Rates, the $PM_{2.5}$ analysis for the Project is a "Case 2" analysis as described in the EPA Final Guidance. Case 2 analyses require the Project direct $PM_{2.5}$ emissions to be modeled using AEREMOD, and the Project secondary emissions of NO_X and SO_2 (i.e., the "holistic" approach) to be evaluated using the Tier 1 methodology (Modeled Emission Rates of Precursor or "MERPs" methodology) to determine the Project's $PM_{2.5}$ total impacts.

The MERPs methodology uses empirical relationships between precursors and secondary $PM_{2.5}$ formation derived from photochemical grid modeling studies; it provides a simple way to calculate the secondary $PM_{2.5}$ impacts from the NO_X and SO_2 precursor emission rates. MERPs have been derived by EPA for various areas of the country. The MERPs used for this secondary $PM_{2.5}$ impacts analysis were taken from EPA's "MERPs VIEW Qlik" webpage that provides access to EPA's hypothetical single source modeled impacts of $PM_{2.5}$ to support PSD permit modeling analyses. MERPs are provided for La Paz County, Arizona, which is located near the Project location, and the lowest MERPs (which results in the highest predicted impact) for either 10 or 90 meter stack heights and 500 tpy emissions or less were used in the analysis. The daily $PM_{2.5}$ MERP NO_X value is 15,260 and for SO_2 the value is 1,918. The Project emission increases of the $PM_{2.5}$ precursors are 60.4 tpy of NO_X and 2.0 tpy of SO_2. Therefore, the calculated 24-hr secondary $PM_{2.5}$ impact is 0.006 µg/m3. The annual $PM_{2.5}$ MERP NO_X value is 243,487 and for SO_2 the value is 31,245. Given the Project emissions, the calculated annual secondary $PM_{2.5}$ impact is 0.0003 µg/m3. These value was considered in the Project's modeling analyses for $PM_{2.5}$, although both secondary formation concentrations are so low that they are within the rounding error of the primary $PM_{2.5}$ modeled concentrations.

5.8 $PM_{2.5}$ SILs Verification

In EPA's 2018 "Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program" (herein referred to as the SILs Guidance), EPA discusses developments regarding the use of $PM_{2.5}$ SILs after the January 22, 2013, the U.S. Court of Appeals for the District of Columbia Circuit decision. EPA does not interpret the court's decision to preclude the use of SILs for $PM_{2.5}$ as part of a demonstration that a source will not cause or contribute to a violation of the $PM_{2.5}$ NAAQS. However, to ensure that PSD permitting decisions meet the requirements of the CAA, permitting authorities that use SILs for $PM_{2.5}$ must ensure that they apply the SILs on a case-by-case basis and in a manner that is consistent with the court's decision and the SILs Guidance.

The SILs are used both to define when a cumulative air quality analysis is required, and in a cumulative analysis of multiple sources to determine which sources are culpable for any NAAQS or PSD increment violations (i.e., a "culpability analysis"). For this air quality analysis, the $PM_{2.5}$ SILs are used only to determine when a cumulative analysis is required. EPA's SILs Guidance states "(p)ermitting authorities may elect to use the SIL values reflected in this guidance in a preliminary (single-source) analysis that considers only the impact of the proposed source in the permit application on air quality to determine whether a full (or cumulative) impact analysis is necessary". Based on this guidance, the $PM_{2.5}$ SILs are acceptable for use in this air quality analysis.

ADEQ modeling guidance recommends that the Permit applicant should determine whether a substantial portion of the NAAQS has already been consumed by evaluating background concentrations against the respective $PM_{2.5}$ NAAQS. If the source impact is below the applicable SIL and the difference between the NAAQS and the measured $PM_{2.5}$ background in the area is greater than the SIL, a full (cumulative) impact analysis can be exempted.

Background $PM_{2.5}$ monitoring data have been identified in Section 3.4 of this report, and the data is summarized along with the NAAQS and SILs in Table 4. This data indicates that the difference between the NAAQS and existing $PM_{2.5}$ air quality concentrations is greater than the $PM_{2.5}$ SILs. Therefore, there is adequate headroom between the existing air quality and the NAAQS to permit the use of the SILs for the modeling analyses.

Table 4– $PM_{2.5}$ Background Concentrations, NAAQS, and SILs

	NAAQS	Existing Air Quality	Difference between NAAAQS and Existing	SIL
$PM_{2.5}$ 24-hr	35	18.5	16.5	1.2
$PM_{2.5}$ Annual	9	6.9	2.1	0.2

Note: All values are expressed in units of μg/m³.

5.9 Ozone Impact Assessment

Based on EPA's Final Ozone and PM Guidance, a proposed Project in an ozone attainment areas with an increase of NO_X and/or VOC emissions of more than 40 tpy triggers a PSD ozone air impact analysis. The proposed Project does have NO_X emissions greater than 40 tpy, but the area is designated as a non-attainment area for ozone. Therefore, the Project must meet nonattainment NSR requirements for ozone, and the Project does not trigger the requirement for a single-source ozone impact assessment. However, to demonstrate that the Project will have an insignificant ozone air quality impact even without considering the benefits of the nonattainment NO_X emission offsets, a single-source PSD ozone impact assessment was performed. EPA recommends the MERPs methodology for calculating single-source ozone impacts. The MERPs used for the ozone impacts analysis were again taken from EPA's "MERPs VIEW Qlik" webpage for the La Paz County, Arizona, location. The lowest MERP for either 10 or 90 meter stack heights and 500 tpy emissions or less were used. The 8-hr ozone MERP NO_X value is 214 and the VOC value is 24,021. The Project emission increases of the ozone precursors are 60.4 tpy of NO_X and 22.3 tpy of VOC. Therefore, the calculated 8-hr ozone impact is 0.28 ppb. This value is less than the ozone SIL of 1 ppb, therefore the Project is not expected to cause or contribute to ozone NAAQS violations.

5.10 Source Characteristics

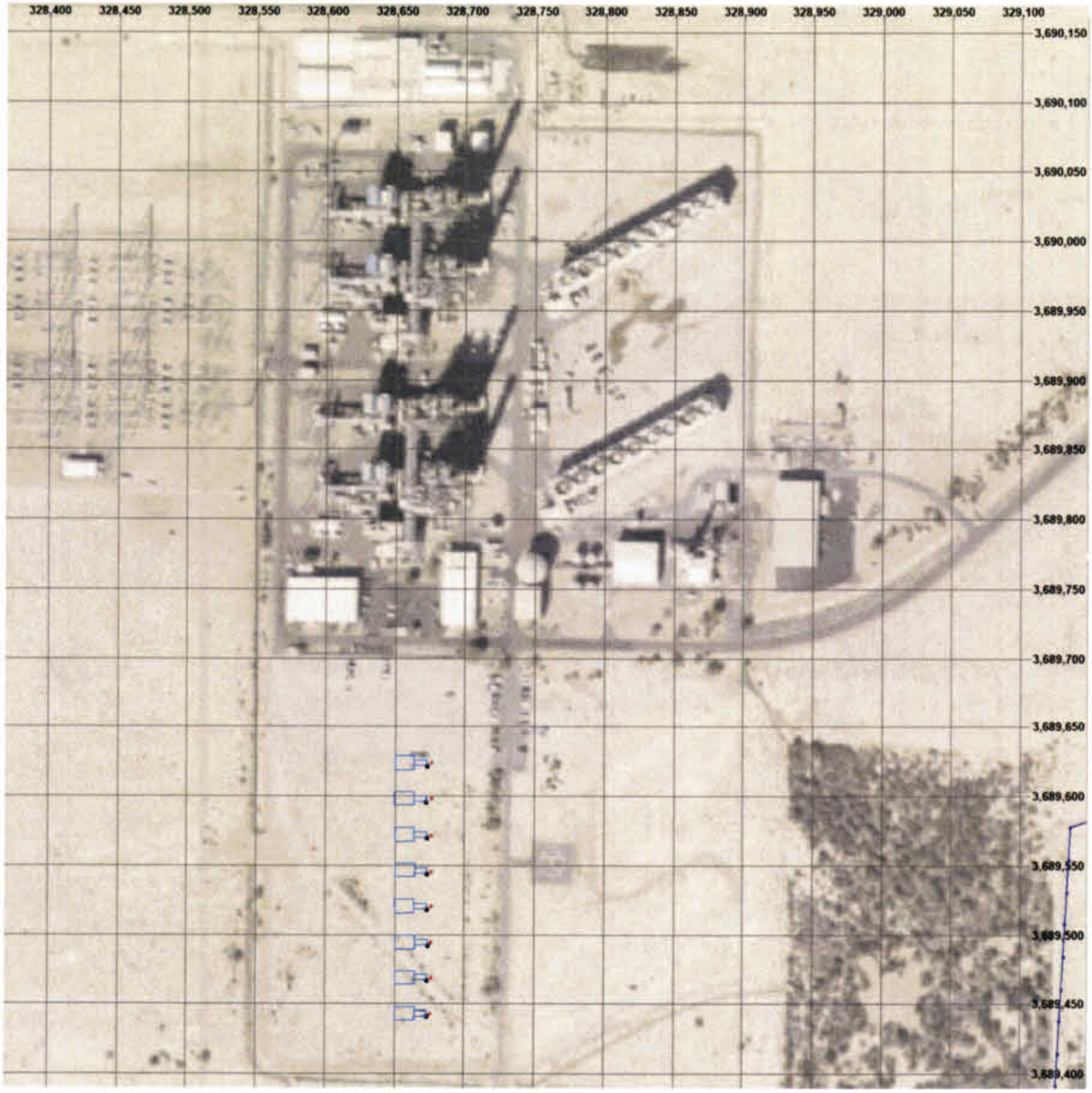
This section describes how the Project emission sources were characterized for modeling. The Project emission sources were modeled as POINT sources in AERMOD, as each emission unit exhausts vertically through separate 85-foot tall, 10-foot diameter stacks without any obstructions. Figure 10 presents a plot plan of the layout of the new emission sources and structures at the facility as input into the AERMOD model.

Chapter 3 of the Permit Application contains detailed information on the Project hourly and annual emissions. Emissions from the new turbines considered both normal operation and startup/shutdown emissions. The normal emissions are based on the maximum rated heat input, the proposed BACT emission limits, and the fuel use limits. The range of operating emissions and stack parameters are presented in Attachment A.

Because emission rates and stack parameters can vary over a range of operating conditions, the modeling analysis must consider various operating load scenarios. The modeling analysis considered various operating load scenarios for the new turbines based on the performance data presented in the main permit application. The turbine performance data is given for over a dozen combinations of operating load, inlet conditioning, and ambient temperature. Data is provided for 100%, 75%, and 50% operating loads. The stack exhaust flow and temperature data at a given load do vary over the ambient temperature and inlet conditioning values, but in a relatively small range. Therefore, for each of the three operating load scenarios that were evaluated (i.e., 100%, 75%, and 50% loads), the minimum stack flow and exhaust temperature across all ambient temperatures at that load were modeled with the maximum mass emission rate at that load. This results in a conservative load screening analysis. In addition to these three scenarios, a fourth startup/shutdown (SU/SD) operating scenario was modeled for NOx and CO (the two modeled pollutants that have increased emissions during startup/shutdown operations). The SU/SD emission rates for NOx are the proposed SU/SD emission rate of 36.2 lb/hr for each turbine, and the CO startup emission rate was conservatively set to 100 lb/hr for each turbine. The SU/SD scenario used stack parameters based on the 50% load stack flow rate and exhaust temperature.

Each of these four load scenarios was modeled, and the load scenario with the highest ambient impact was used for the Project SIL modeling.

Figure 6- Plot Plan of Project



New project stacks are shown as red dots, new turbine structures are shown with blue outline. All coordinates are UTM Zone 12 NAD83 projection values.

5.11 Load Screening Results

Attachment A presents the stack parameters and emission rates that were used in the load screening analysis. Table 5 summarizes the model predicted "highest first high" concentrations for a single turbine across the complete 5-year meteorological data set for each load screening scenario. The results indicate that the SU/SD load condition results in the maximum impacts for CO and NOx. For PM_{10} and $PM_{2.5}$ analyses, the worst case scenario was the 75% load scenario, and for SO_2 impacts the worst-case scenario was the 100% load scenario. The applicable worst-case scenario was used for all subsequent modeling analyses for each of the pollutants.

5.12 PSD Class II SIL Modeling Results

The first step in the PSD modeling analysis is the significant impact analysis, which estimates ambient concentrations resulting from the Project emission increases. The Project-only impacts are summarized in Table 6. Note that the secondary $PM_{2.5}$ impact has been added to the direct primary $PM_{2.5}$ impacts, but the secondary impact of 0.006 μg/m3 is so small that it is within rounding error for the primary impacts.

All Project impacts are below the SILs except for the 1-hr NO_2 and 24-hr $PM_{2.5}$ impacts. Therefore, a cumulative NAAQS analysis is required for the 1-hr NO_2 and 24-hr $PM_{2.5}$ pollutants/averaging intervals, and a cumulative PSD increment analysis for the 24-hr $PM_{2.5}$ pollutants/averaging interval (there are no 1-hr NO_2 PSD increments that have been established).

Table 5 - Load Screening Modeling Results

Scenario	NO2 1-hr	NO2 Annual	CO 1-hr	CO 8-hr	PM10 24hr	PM10 Annual	PM2.5 24hr	PM2.5 Annual	SO2 1-hr	So2 3-hr	SO2 24-hr	SO2 Annual
100% Load	1.0	0.025	1.1	0.6	0.366	0.044	0.259	0.044	**0.071**	**0.041**	**0.014**	**0.0017**
75% Load	0.9	0.024	1.0	0.5	**0.371**	**0.048**	**0.294**	**0.048**	0.064	0.039	0.013	0.0016
50% Load	0.7	0.020	0.8	0.4	0.349	0.045	0.286	0.045	0.053	0.035	0.011	0.0014
Startup/shutdown	**10.8**	**0.299**	**31.5**	**15.8**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 6 – Significant Impact Modeling Results

Pollutant	Avg Period	Maximum Modeled Impact (µg/m³)	Significant Impact Level (µg/m³)	Exceeds SIL?
NO_2	1-hr	82.6	7.5	Yes
	Annual	0.11	1	No
$PM_{2.5}$	24-hr	2.1	1.2	Yes
	Annual	0.09	0.2	No
PM_{10}	24-hr	2.9	5	No
	Annual	0.11	1	No
CO	1-hr	270	2000	No
	8-hr	124	500	No
SO_2	1-hr	0.5	7.8	No
	3-hr	0.3	25	No
	24-hr	0.1	5	No
	Annual	0.01	1	No

5.13 PSD Class II NAAQS Modeling and Results

A cumulative NAAQS analysis is required for the 1-hr NO_2 and 24-hr $PM_{2.5}$ pollutants/averaging intervals. The cumulative analysis expands the Project-only modeling by adding other nearby sources (including the existing combustion turbine and cooling tower emission units at Redhawk) to the Project emission sources. The impacts of non-nearby background sources and other sources not explicitly modeled are accounted for by adding monitored air quality data (i.e., background concentrations) to the model predicted concentrations. The resultant total concentrations are then compared to the NAAQS.

In Section 8.3.3 of EPA's GAQM, EPA provides guidance on the nearby sources to include in the cumulative NAAQS analysis. EPA states:

> *The number of nearby sources to be explicitly modeled in the air quality analysis is expected to be few except in unusual situations. In most cases, the few nearby sources will be located within the first 10 to 20 km from the source(s) under consideration. Owing to both the uniqueness of each modeling situation and the large number of variables involved in identifying nearby sources, no attempt is made here to comprehensively define a "significant concentration gradient." Rather, identification of nearby sources calls for the exercise of professional judgment by the appropriate reviewing authority.*

Another consideration for the development of the nearby source inventory is the size of the Project significant impact area. The significant impact areas are 12.3 km for the 24-hr $PM_{2.5}$ impact and 50 km for the 1-hr NO_2 impact (the larger 1-hr NO_2 significant impact area is a result of the low SIL value and use of the highest 1-hr concentration over 5 years of meteorological data). While the historical approach for deterministic NAAQS has been to evaluate all sources within the significant impact area for possible explicit modeling, EPA has noted in the probabilistic 1-hr NO_2 NAAQS modeling guidance that "inclusion of all sources within 50 kilometers of the project location, the nominal distance for which

AERMOD is applicable, is likely to produce an overly conservative result in most cases", and that "the emphasis on determining which nearby sources to include in the modeling analysis should focus on the area within about 10 kilometers of the project location in most cases".

Given the above EPA guidance, the nearby sources within 20 km of Redhawk were identified. The sources include the Mesquite Generating station and the Harquahala Generating station (now owned by Capital Power and known as the Arlington Valley station). The NO_X and $PM_{2.5}$ emissions from the combustion sources at these two nearby power plants were estimated from available permits and emission inventory data (note that the estimated $PM_{2.5}$ emission from the cooling towers at these two plants, and at the Palo Verde Generating station, are small relative to the combustion stack $PM_{2.5}$ emissions, and therefore were not included in the cumulative modeling). While the SR 85 Landfill and the Southwest Regional Landfill are also within 20 km of Redhawk, the $PM_{2.5}$ emissions from those facilities are small and do not need to be considered in the cumulative modeling. The stack parameters and emission rates modeled for these cumulative nearby sources are presented in Appendix A.

Table 7 presents the results from cumulative NAAQS analysis which demonstrates that the Project impacts, in combination with other nearby sources, are below the NAAQS.

5.14 PSD Class II PSD Increment Modeling and Results

With respect to the $PM_{2.5}$ PSD increments, the nearby emission sources, including the existing Redhawk emission units, began operation before the minor-source baseline date in Maricopa County. Therefore, these sources are part of the baseline and do not consume $PM_{2.5}$ PSD increment, and the $PM_{2.5}$ impacts of the Project can be compared directly to the $PM_{2.5}$ increments. Table 8 presents the results from cumulative PSD increment analysis which demonstrates that the Project impact is below the 24-hr $PM_{2.5}$ PSD Increment.

Table 7 – NAAQS Modeling Results

Pollutant	Maximum Modeled Impact (µg/m3)	Background Concentration (µg/m3)	Total Concentration (µg/m3)	NAAQS	Percentage of NAAQS
NO_2 1-hr	98	34	132	188	70%
$PM_{2.5}$ 24-hr	4.5	18.5	23.0	35.0	66%

Table 8 – Class II PSD Increment Modeling Results

Pollutant	Maximum Modeled Impact (µg/m3)	PSD Increment (µg/m3)	Percentage of Increment
$PM_{2.5}$ 24hr	2.7	9	30%

5.15 Maricopa Minor-NSR Modeling Results

In addition to the PSD required modeling, the Maricopa rules require a minor-NSR modeling analysis for those pollutants that do not trigger major-NSR review but are not exempted from minor-NSR because their emissions are below the minor modification threshold. For this Project, the only pollutant that requires a minor-NSR modeling analysis is CO. As shown in Table 5, the Project CO impacts are below the CO SILs. Therefore, no additional modeling is required to fulfill the minor-NSR modeling requirements.

6.0 Additional Impacts Analysis

An additional impact analysis is required for pollutants that trigger PSD review. The purpose of this analysis is to assess the potential impact the proposed project will have on visibility, soils, and vegetation, as well as the impact of general commercial, residential, and industrial growth associated with the proposed project.

6.1 Analysis on Vegetation and Soils

The analysis of NO_X, CO, PM_{10}, and $PM_{2.5}$ impacts on vegetation and soils of commercial or recreational value was based on an inventory of vegetation and soils in the Project area, and a comparison of AERMOD predicted air quality impacts of the Project to various effects thresholds.

An inventory of the nearby soils and vegetation was compiled and is presented in Attachment B. Native vegetation is limited in the surrounding area. The Lower Colorado River Valley Subdivision of Sonoran Desert scrub is the most arid portion of the Sonoran Desert. Native vegetation in the study area is typically dominated by low, open stands of creosote bush and white bursage. Cacti including saguaro and fishhook barrel cactus, though present in the Project vicinity, are less abundant than in regions with upland desert scrub areas. In undisturbed areas of this vegetation community, trees and taller vegetation are largely confined to washes and other drainages. Within the Project vicinity, small areas of low, undrained, and salt-affected soils are commonly found.

The air quality impacts from the Project were compared to vegetation and soils threshold impact criteria in EPA's *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals*, December 12, 1980, EPA 450/2-81-078. This document contains screening levels for NO_2 and CO impacts. The CO screening threshold for sensitive vegetation is listed as 1000 ppm (1,200,000 µg/m3) for a 1-week exposure. The NO_2 screening threshold for sensitive vegetation is listed as 2 ppm (3,760 µg/m3) for a 4-hour exposure. The Project CO and NO_2 impacts are orders of magnitude lower than these thresholds. In addition, because the Project combusts only natural gas, there are no appreciable emissions of metals and the Project metals impacts are far below any listed screening thresholds for soils and vegetation.

Information on the sensitivities of vegetation to NO_2 ambient concentrations is also found in EPA's "Air Quality Criteria for Oxides of Nitrogen, Summary of Vegetation Impacts" Volume II, August 1993 (EPA 600/8-91/049bF). For susceptible plant species, 1-hr NO_2 exposures to approximately 7,500 µg/m3 can cause 5% foliar injury. Once again, the Project NO_2 impacts are orders of magnitude lower than this threshold.

In summary, based on a comparison of Project air quality impacts to various screening thresholds, it can be concluded that the Project will not have an adverse impact on soils and vegetation.

6.2 Analysis on Visibility

A Class II area visibility analysis was performed for two nearby parks, the Estrella Mountain Regional Park, and the White Tank Mountain Regional Park. VISCREEN was used to assess visibility impacts at these locations. Note that there are no established adverse effects thresholds for Class II visibility analyses.

The VISCREEN model is a screening technique used to estimate the mass of pollutants in the atmosphere and its ability to scatter or absorb light and, therefore, to affect visibility. The VISCREEN model calculates rudimentary scattering and absorption coefficients and these values are compared to screening threshold levels to determine the potential magnitude and type of coherent plume visibility impairment. Two measures of potential plume effects are used. One is a measure of plume contrast, which is the change in light extinction coefficient between views against a background feature (either sky or terrain) and views against the plume. The other measure is delta E, the total color contrast, which takes into account plume intensity, color, and brightness. If the plume is brighter than its background, it will have a positive contrast. If the plume is darker than its background, it will have a negative contrast. VISCREEN assumes that a terrain object is black, which maximizes the contrast. VISCREEN was run with simple "worst-case" meteorology, referred to as a "Level 1" analysis.

The emissions used for the VISCREEN analysis are based on all 8 turbines operating at 100% load concurrently. Other VISCREEN inputs include the default particle characteristics and plume-source-observer angle, and an estimated existing background visual range in the Phoenix area of 90 km. Table 10 presents the VISCREEN Class II analysis results for "Inside the Class II area". There are no specific impact thresholds to compare against these Class II visibility modeling results.

Table 9 - VISCREEN Class II Visibility Analysis Results

Parameter	White Mtn Park	Estrella Mtn Park
Distance to Park Boundary (km)	37	45
Maximum Delta E	4.2	3.1
Maximum Contrast	0.04	0.02

6.3 Associated Growth and Secondary Emissions Analysis

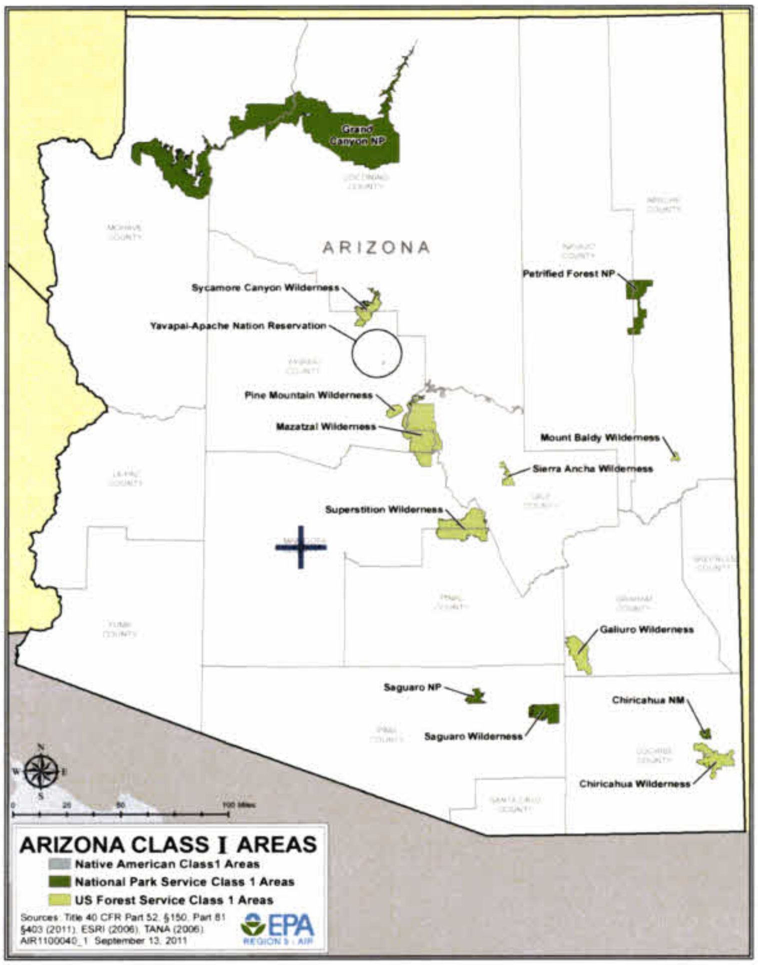
The emissions resulting from residential, commercial, and industrial growth associated with, but not directly a part of the project, must also be considered when conducting the air quality analysis. Given the limited construction related activities associated with this Project, the construction associated with the Project will not have a significant impact to the local population. Further, since the Redhawk Power Plant is an existing power plant, the employees required to operate the Project emission units are already largely hired and available, so that further impacts to the local area will be small. In addition, local municipal services will not be adversely impacted by this Project. Therefore, the Project is not expected to have a measurable effect on the residential, commercial, or industrial growth of the area.

7.0 Class I Area Analyses

The PSD regulations require that sources which may affect a Class I area (i.e., are generally located within 100 km of a Class I area) must notify the Federal Land Managers (FLMs) of the project. The permit applicant may be required to perform a Class I PSD Increment analysis and an Air Quality Related Values (AQRVs) analysis. The FLM's *Air Quality Related Values Work Group (FLAG) Phase I Report – Revised* (FLAG 2010) provides guidance on methodologies for conducting Class I air quality impact analyses.

Figure 7 presents a map showing the locations of Class I areas within Arizona relative to the Project location (shown as a blue cross). None of these Class I areas are within 100 km of the Project location. The closest Class I area is the Superstition Wilderness area located 129 km distant.

Figure 7 – Locations of Class I Areas relative to the Project



7.1 Class I AQRV Analysis Requirements

The FLAG 2010 guidance has developed an initial screening method that exempts a project from AQRV impact analysis and review based on its annual emissions and distance from a Class I area. The FLMs will consider a source locating greater than 50 km from a Class I area to have negligible impacts with respect to Class I AQRVs if the total SO_2, NO_X, PM_{10}, and H_2SO_4 annual emissions (in tpy, based on 24-

hour maximum allowable emissions), divided by the distance (in km) from the Class I, area (Q/D) is 10 or less. The Agencies would not request any Class I AQRV impact analyses from such sources.

The tpy emission rates for the Project are as follows: 59 tpy of NO_X, 2 tpy of SO_2, 54.1 tpy of PM_{10}, and 0.14 tpy of sulfuric acid mist. The total combined emission rate is 115 tpy, and the distance to the nearest Class I area is 129 km. The calculated Q/D value is 0.9, which is significantly less than the FLAG AQRV analysis threshold of 10. Therefore, AQRV analyses will not be required for the Project.

7.2 Class I SIL Analyses

The Project triggers PSD review for the criteria pollutants NO_2, CO, PM_{10}, and $PM_{2.5}$. Class I PSD increments and SILs have been established for NO_2, PM_{10}, and $PM_{2.5}$, as shown in Table 10. Therefore, an initial screening Class I significant impact analysis was performed for these pollutants and averaging intervals.

Table 10 – Class I SILs and PSD Increments

Pollutant	Avg Period	PSD Class I Increment (µg/m3)	Class I Significant Impact Level (µg/m3)
NO_2	Annual	2.5	0.1
$PM_{2.5}$	24-hr	2.0	0.27
	Annual	1.0	0.06
PM_{10}	24-hr	8	0.3
	Annual	4	0.2

When performing a Class I increment analysis for Class I areas located more than 50 km from the source, EPA's GAQM recommends that AERMOD be used to determine the Project-only significant impacts at or about 50 km from the source. Given the locations of Class I areas in Arizona, the 50 km receptor ring was limited to the directions of 315 degrees clockwise to 135 degrees, to capture the directions of all the Class I areas. If this initial screening analysis at 50 km indicates there are not significant ambient impacts at that distance, then further assessment of the Class I PSD increments is not necessary. Given the fact that transport of Project emissions to the nearest Class I area, the Superstition Wilderness area, travels across the central Phoenix Valley, the Sky Harbor meteorological data set is a representative meteorological data set for the long-range plume transport from the Project site to the Class I area. Therefore, the ADEQ Sky Harbor data was used for the Class I screening modeling.

Table 11 presents the results from the Class I screening analysis. All predicted impacts are below the Class I SILs; therefore, no additional long-range modeling is necessary.

Table 11 – Class I Screening Modeling Results

Pollutant	Avg Period	Maximum Predicted Impacts (µg/m3)	Class I Significant Impact Level (µg/m3)
NO_2	Annual	0.003	0.1
$PM_{2.5}$	24-hr	0.16	0.27
	Annual	0.01	0.06
PM_{10}	24-hr	0.19	0.3
	Annual	0.01	0.2

Attachment A – Emission and Stack Information

Emission and Stack Data used in Load Screening Analyses

Scenario ID	Scenario Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (fps)	Stack Diameter (ft)	PM10 (lb/hr)	PM25 (lb/hr)	NO2 (lb/hr)	CO (lb/hr)	SO2 (lb/hr)
100	100% Load	328676	3689546	882	85	788	118	10	7.00	7.00	4.00	4.21	0.25
75	75% Load	328676	3689546	882	85	712	92	10	6.37	6.37	3.17	3.36	0.22
50	50% Load	328676	3689546	882	85	656	81	10	5.48	5.48	2.36	2.51	0.17
SUSD	SUSD	328676	3689546	882	85	656	81	10	N/A	N/A	36.20	100.00	N/A

Project Emission and Stack Data used in SIL, NAAQS, and PSD Increment Analyses

Source ID	Description	Easting (X) (m)	Northing (Y) (m)	Base Eleva-tion (m)	Stack Height (ft)	Temp-erature (°F)	Exit Velocity (fps)	Stack Diameter (ft)	PM_{10} (lb/hr)	PM25 (lb/hr)	NO_2 (lb/hr)	CO (lb/hr)	SO_2 (lb/hr)
U3	SU/SD Case	328676	3689624	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25
U4	SU/SD Case	328676	3689599	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25
U5	SU/SD Case	328676	3689572	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25
U6	SU/SD Case	328676	3689546	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25
U7	SU/SD Case	328676	3689521	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25
U8	SU/SD Case	328676	3689495	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25
U9	SU/SD Case	328676	3689469	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25
U10	SU/SD Case	328676	3689443	268.8	85	656	81	10	6.37	6.37	36.2	100	0.25

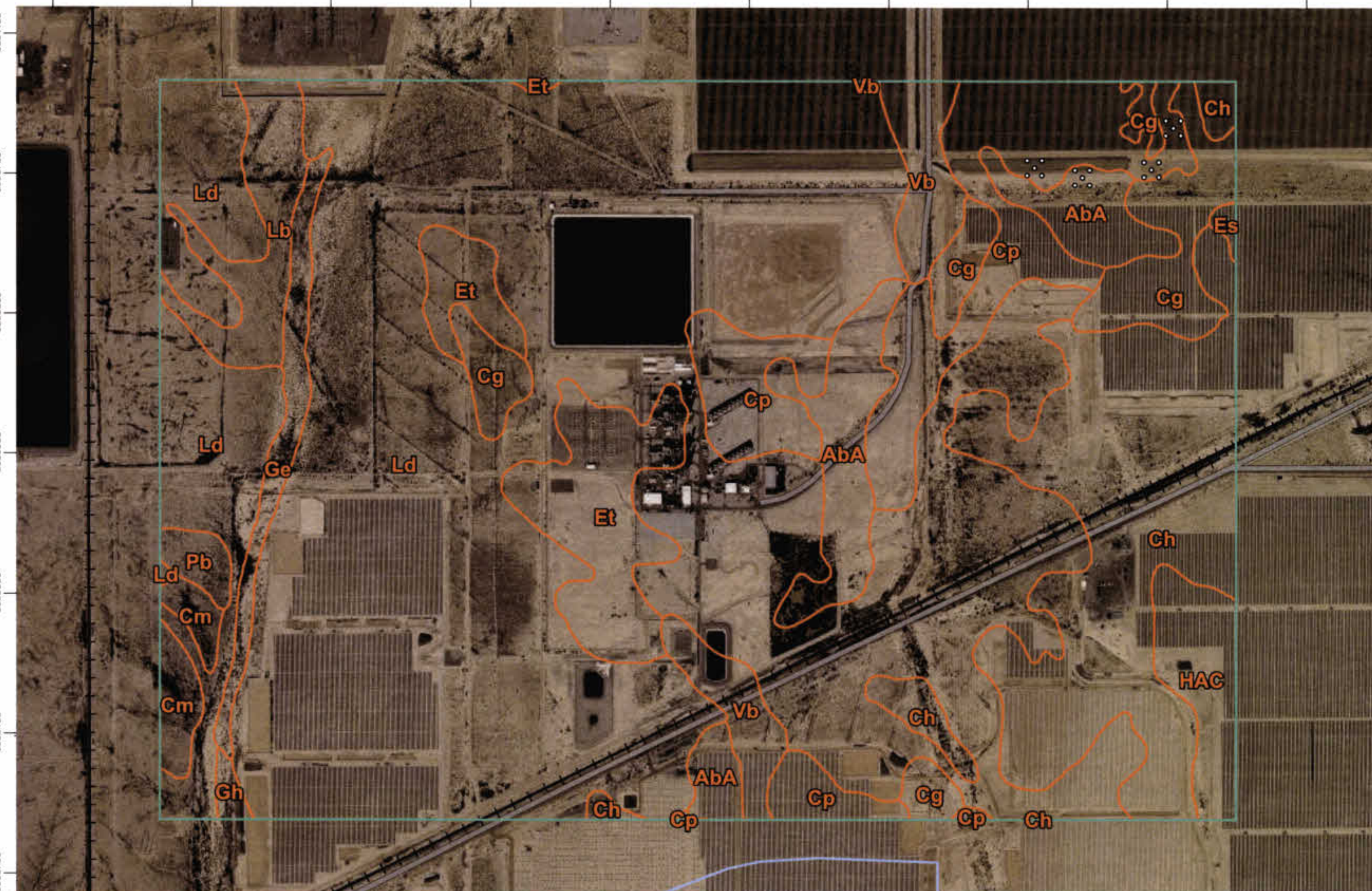
Notes: The stack parameters are for the worst-case SU/SD scenario, which was used for the NO_2 and CO modeling. For PM10 and PM2.5 analyses, the stack parameters were from the worst-case 75% load scenario, and for SO2 impacts the stack parameters were from the worst-case 100% load scenario.

Emission and Stack Data for Nearby Sources used in cumulative NAAQS Analyses

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)	PM25 (g/s)	NO2 (g/s)
U1A	Redhawk U1A	328709	3690028	268.2	53.34	349.7	19.9	5.5	2.65	2.39
U1B	Redhawk U1B	328710	3689979	268.2	53.34	349.7	19.9	5.5	2.65	2.39
U2A	Redhawk U2A	328705	3689875	268.2	53.34	349.7	19.9	5.5	2.65	2.39
U2B	Redhawk U2B	328708	3689828	268.2	53.34	349.7	19.9	5.5	2.65	2.39
Har1	Harquahala	324282	3690470	268.5	48.80	371.0	20.5	5.5	4.00	3.15
Har2	Harquahala	324330	3690470	268.5	48.80	371.0	20.5	5.5	4.00	3.15
Mes1A	Mesquite	328509	3690028	268.2	53.34	349.7	19.9	5.5	3.83	2.80
Mes1B	Mesquite	328510	3689979	268.2	53.34	349.7	19.9	5.5	3.83	2.80
Mes2A	Mesquite	328505	3689875	268.2	53.34	349.7	19.9	5.5	3.83	2.80
Mes2B	Mesquite	328508	3689828	268.2	53.34	349.7	19.9	5.5	3.83	2.80
U1TWR1	Redhawk Cool Twr	328774	3689974	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR2	Redhawk Cool Twr	328787	3689979	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR3	Redhawk Cool Twr	328798	3689989	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR4	Redhawk Cool Twr	328811	3689995	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR5	Redhawk Cool Twr	328825	3690001	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR6	Redhawk Cool Twr	328837	3690007	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR7	Redhawk Cool Twr	328849	3690017	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR8	Redhawk Cool Twr	328862	3690023	269.0	13.72	312.6	6.9	10.7	0.038	
U1TWR9	Redhawk Cool Twr	328875	3690030	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR1	Redhawk Cool Twr	328770	3689823	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR2	Redhawk Cool Twr	328783	3689831	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR3	Redhawk Cool Twr	328797	3689839	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR4	Redhawk Cool Twr	328808	3689845	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR5	Redhawk Cool Twr	328821	3689852	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR6	Redhawk Cool Twr	328834	3689861	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR7	Redhawk Cool Twr	328849	3689867	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR8	Redhawk Cool Twr	328861	3689874	269.0	13.72	312.6	6.9	10.7	0.038	
U2TWR9	Redhawk Cool Twr	328873	3689881	269.0	13.72	312.6	6.9	10.7	0.038	

Attachment B – Soils and Vegetation Inventory Data

Soil Map—Maricopa County, Arizona, Central Part



Map Scale: 1:17,900 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Maricopa County, Arizona, Central Part
Survey Area Data: Version 18, Sep 8, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 29, 2022—Nov 15, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AbA	Antho sandy loam, 0 to 1 percent slopes	67.5	4.2%
Cg	Casa Grande sandy loam	65.0	4.0%
Ch	Casa Grande loam	187.6	11.6%
Cm	Casa Grande-Laveen complex, alkali	16.1	1.0%
Cp	Coolidge sandy loam	123.9	7.6%
Es	Estrella loam	1.8	0.1%
Et	Estrella loam, saline-alkali	73.4	4.5%
Ge	Gilman fine sandy loam, 0 to 2 percent slopes	23.5	1.5%
Gh	Gilman loam, saline-alkali	3.3	0.2%
HAC	Harqua complex, 3 to 8 percent slopes	29.3	1.8%
Lb	Laveen sandy loam	36.4	2.2%
Ld	Laveen loam, saline-alkali	943.7	58.3%
Pb	Perryville loam, saline-alkali	7.6	0.5%
Vb	Valencia sandy loam, saline-alkali	40.7	2.5%
Totals for Area of Interest		**1,619.8**	**100.0%**

Appendix C.

Environmental Justice EJScreen Data for the Redhawk Power Plant Project.

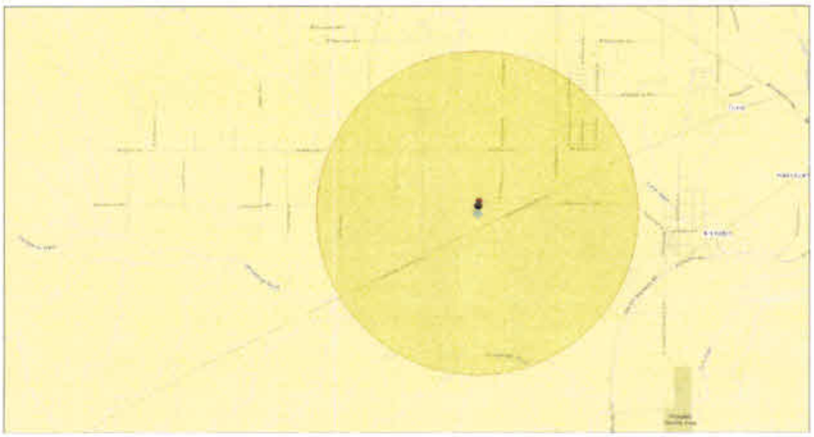
EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Maricopa County, AZ

3 miles Ring Centered at 33.331389,-112.841263
Population: 217
Area in square miles: 28.27

A3 Landscape



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
No language data available.	

COMMUNITY INFORMATION

Low income: 16 percent	People of color: 37 percent	Less than high school education: 31 percent	Limited English households: 0 percent
Unemployment: 2 percent	Persons with disabilities: 25 percent	Male: 54 percent	Female: 46 percent
76 years Average life expectancy	$33,108 Per capita income	Number of households: 75	Owner occupied: 87 percent

BREAKDOWN BY RACE

White: 63%	Black: 0%	American Indian: 0%	Asian: 0%
Hawaiian/Pacific Islander: 0%	Other race: 0%	Two or more races: 1%	Hispanic: 35%

BREAKDOWN BY AGE

From Ages 1 to 4	4%
From Ages 1 to 18	11%
From Ages 18 and up	89%
From Ages 65 and up	11%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	0%
Speak Other Indo-European Languages	0%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race. Source: U.S. Census Bureau, American Community Survey (ACS) 2017-2021. Life expectancy data comes from the Centers for Disease Control.

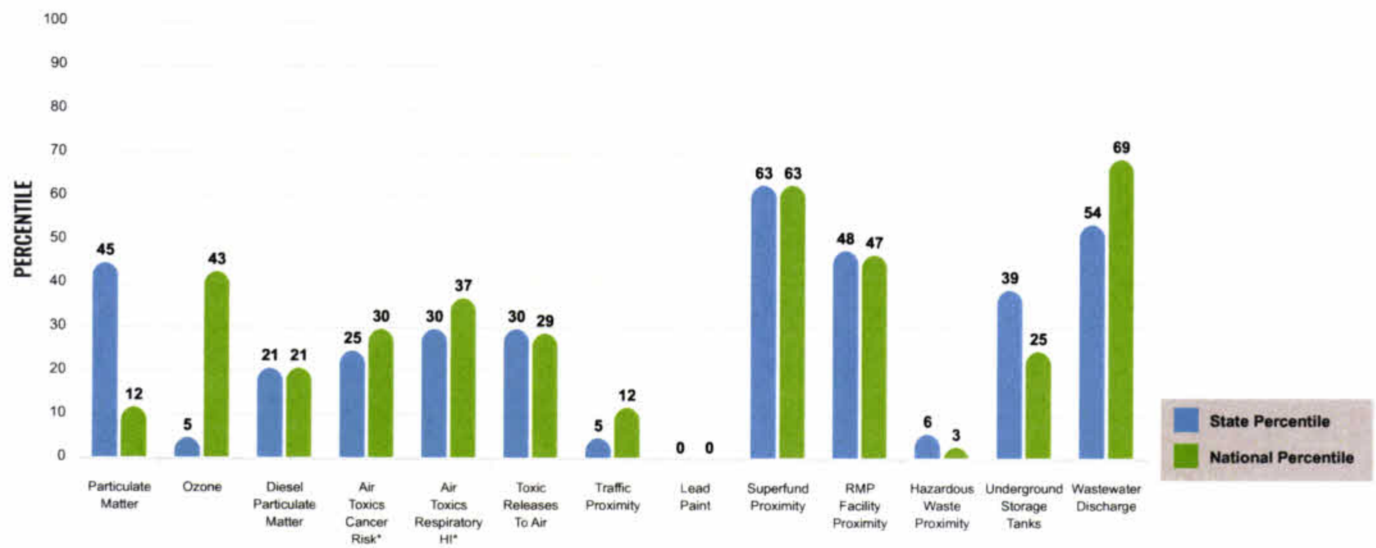
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

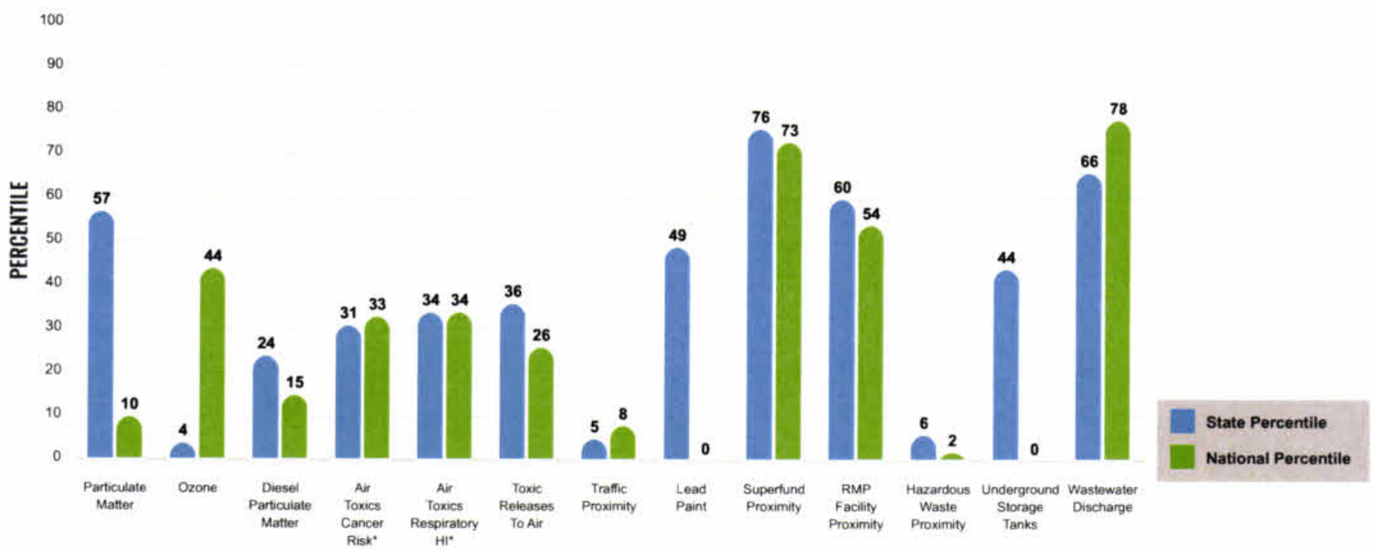
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 3 miles Ring Centered at 33.331389,-112.841263

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter ($\mu g/m^3$)	5.83	5.87	42	8.08	7
Ozone (ppb)	59.2	66.1	3	61.6	33
Diesel Particulate Matter ($\mu g/m^3$)	0.0813	0.278	16	0.261	10
Air Toxics Cancer Risk* (lifetime risk per million)	20	25	13	25	5
Air Toxics Respiratory HI*	0.23	0.31	10	0.31	4
Toxic Releases to Air	140	2,800	24	4,600	27
Traffic Proximity (daily traffic count/distance to road)	2.7	190	3	210	8
Lead Paint (% Pre-1960 Housing)	0.0016	0.089	0	0.3	0
Superfund Proximity (site count/km distance)	0.11	0.077	84	0.13	69
RMP Facility Proximity (facility count/km distance)	0.15	0.38	50	0.43	44
Hazardous Waste Proximity (facility count/km distance)	0.021	0.71	5	1.9	2
Underground Storage Tanks (count/km^2)	0.018	1.7	31	3.9	23
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.27	5.8	66	22	87
SOCIOECONOMIC INDICATORS					
Demographic Index	26%	38%	37	35%	44
Supplemental Demographic Index	14%	14%	56	14%	56
People of Color	37%	44%	47	39%	56
Low Income	16%	32%	28	31%	29
Unemployment Rate	2%	6%	34	6%	35
Limited English Speaking Households	0%	4%	0	5%	0
Less Than High School Education	31%	12%	90	12%	92
Under Age 5	4%	5%	47	6%	45
Over Age 64	11%	20%	38	17%	30
Low Life Expectancy	20%	19%	59	20%	59

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 0
Water Dischargers 9
Air Pollution 2
Brownfields 0
Toxic Release Inventory 0

Other community features within defined area:

Schools 1
Hospitals 0
Places of Worship 0

Other environmental data:

Air Non-attainment .... Yes
Impaired Waters .... No

Selected location contains American Indian Reservation Lands* .... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community .... Yes
Selected location contains an EPA IRA disadvantaged community .... Yes

Report for 3 miles Ring Centered at 33.331389,-112.841263

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	20%	19%	59	20%	59
Heart Disease	6.1	6	61	6.1	52
Asthma	10.8	10.6	64	10	75
Cancer	5.4	6.1	49	6.1	33
Persons with Disabilities	20.4%	13.9%	83	13.4%	87

CLIMATE INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	10%	6%	80	12%	66
Wildfire Risk	31%	48%	48	14%	84

CRITICAL SERVICE GAPS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	15%	13%	67	14%	61
Lack of Health Insurance	19%	10%	87	9%	91
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Report for 3 miles Ring Centered at 33.331389,-112.841263

Exhibit B-2.
Water Report

HALEY ALDRICH

www.haleyaldrich.com

WATER ASSESSMENT FOR PROPOSED EXPANSION REDHAWK POWER PLANT ARLINGTON, ARIZONA

Prepared by
Haley & Aldrich, Inc.
Phoenix, Arizona

REGISTERED GEOLOGIST
CERTIFICATE NO.
29889
MARK D. NICHOLLS
Date Signed 6/11/24
ARIZONA, U.S.A.
Exp. 9/30/24

for
Arizona Public Service Company
Phoenix, Arizona

File No. 0210763-000
June 2024

Table of Contents

REGISTERED GEOLOGIST
CERTIFICATE NO.
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MARK D.
NICHOLLS
Date Signed 6/11/24
ARIZONA U.S.A.

Exp. 9/30/24

List of Figures

1. Introduction

Arizona Public Service Company (APS) proposes to expand its Redhawk Power Plant with the addition of eight new GE LM6000 simple cycle natural gas generating units with water augmentation.[1] The proposed expansion will add up to 397 megawatts (MW) to the energy grid by 2028, and will require additional groundwater to support power generation. The anticipated water demand for the proposed new generating units will be up to 300 acre-feet per year (AFY) of groundwater sourced from two existing on-site wells for a period of approximately 40 years. The total planned groundwater use to support existing and proposed new plant operations is within the total withdrawal authority presently held by APS in the form of a Type 1 Non-Irrigation Grandfathered Water Right (Type 1 Right).[2] This report describes analyses conducted to evaluate the effects of the proposed additional groundwater pumping, and summarizes the results of the water use analyses.

Haley & Aldrich, Inc. (Haley & Aldrich) used an existing groundwater model developed by the Arizona Department of Water Resources (ADWR) to evaluate water availability and both immediate and future effects of the proposed increased groundwater pumping at the Redhawk Power Plant. The groundwater model used for these analyses is the most recent version of the Phoenix Active Management Area (AMA) groundwater model, which was published in June 2023 (ADWR, 2023). The Phoenix AMA groundwater model was developed to support decision making and regulatory initiatives that protect groundwater resources in the Phoenix AMA. The recently published model was used for this evaluation without modification of the model grid, boundaries, or other parameters to ensure consistency with current ADWR analyses.

The availability of groundwater was evaluated based on the effects of the proposed increased groundwater pumping on aquifer water levels and the continued availability of groundwater for use by the plant and others. The criteria used to quantify effects of the proposed groundwater use included:

1. The horizontal and vertical extent of the cone of depression resulting from the increased groundwater pumping associated with the proposed Redhawk Power Plant expansion; and
2. The contribution to regional groundwater elevation change during the planned operational period of the generating units expansion.

To assess potential impacts to the AMA's current management plan and groundwater levels, Haley & Aldrich modeled the effects of the proposed water use on groundwater levels, evaluated whether effects of the proposed use would unduly burden neighboring groundwater users, and whether the proposed expansion complies with the AMA's current management plan requirements for combustion turbine power plants.

The methodology and results of these analyses are described in the following sections.

---

[1] Water augmentation is a process whereby water is used to cool the air drawn into the turbine to increase power generation efficiency.

[2] APS has 3,356 AFY of Type 1 water rights, and up to 7,644 AFY of Type 2 water rights which may be applied at the Redhawk Power Plant property.

2. Regional Physiographic Setting

The Redhawk Power Plant is located in the southern portion of the Hassayampa groundwater sub-basin, near the western edge of the Phoenix AMA boundary (project site, Figure 1). The Hassayampa sub-basin is drained by the ephemeral Hassayampa River that enters the sub-basin in the northeast and flows to the south to its confluence with the Gila River near the town of Arlington in the southern part of the sub-basin. The Gila River is a perennial river that flows southeast until turning south near the town of Arlington before exiting the Hassayampa sub-basin at its southern boundary. Two major ephemeral tributaries are found in the Hassayampa sub-basin; Jackrabbit Wash, a tributary to the ephemeral Hassayampa River, and Centennial Wash, a tributary to the perennial Gila River.

Groundwater enters the Hassayampa sub-basin from the northeast and flows south toward the Gila River (ADWR, 2010). Some groundwater from the Hassayampa sub-basin historically flowed towards the West Salt River Valley sub-basin but has subsequently been redirected due to a change in the groundwater gradient in response to groundwater withdrawal in the sub-basin. Groundwater is the main source of water supply for irrigation in the Hassayampa sub-basin and is pumped from aquifers comprised of the basin-fill deposits.

The Hassayampa sub-basin includes the Hassayampa Plain, north of the Belmont Mountains, and the Lower Hassayampa Area, generally south of the Belmont Mountains. The Hassayampa sub-basin consists largely of undeveloped desert and agricultural land. The Hassayampa sub-basin lies within the Basin and Range physiographic province, which is characterized by northwest trending fault-block mountains separated by wide alluvial plains. The ground surface of the Hassayampa sub-basin is a gently sloping alluvial plain bounded on the north by the Vulture and Wickenburg mountains, on the east by the White Tank Mountains, on the south by the Buckeye Hills and the Gila Bend Mountains, and on the west by the Big Horn and Belmont mountains and the Palo Verde Hills (ADWR, 1994).

2.1 REGIONAL GEOLOGY

The Lower Hassayampa Area is separated from the Hassayampa Plain by the Belmont Mountains and a shallow subsurface bedrock ridge extending to the southeast (ADWR, 1994). Depth to bedrock in the Hassayampa sub-basin is a few tens of feet near the basin margins to over 1,200 feet near the center of the basin (ADWR, 1994). Precambrian granite, gneiss, and schist, Cretaceous andesite, and Quaternary basalt make up most of the mountain ranges surrounding the basin, with the Quaternary basalt of the Palo Verde Hills being the closest outcrop to the site (Wilson et al., 1957).

The Hassayampa sub-basin is filled with alluvial material derived from weathering and transportation of rock material from adjacent highlands. The basin fill in the Lower Hassayampa Area, and beneath the Redhawk Power Plant, consists of three hydrogeologic units designated as the Upper, Middle, and Lower Alluvial Units. The Upper Alluvial Unit is generally 30 to 60 feet thick, consisting of unconsolidated silty sands, gravelly sands with clay, and clay lenses. The Middle Alluvial Unit is approximately 230 to 300 feet thick and is primarily clay, consisting of silty clay, clayey silt, clayey sand, and silty sand lenses. The Lower Alluvial Unit ranges in thickness from 100 feet to more than 1,000 feet thick and consists of unconsolidated silty sand, sand, and gravelly sand, as well as moderately- to well-consolidated alluvial fan deposits.

2.2 REGIONAL HYDROGEOLOGY

Groundwater in the Hassayampa sub-basin generally occurs under unconfined conditions; however, there are local areas of confined (artesian) or perched aquifer conditions in the Lower Hassayampa Area (ADWR, 2010). Groundwater recharge sources include infiltration from the Hassayampa and Gila rivers, infiltration from mountain front recharge, and incidental recharge from irrigation and canal seepage (ADWR, 1994). Predevelopment groundwater generally flowed towards the Gila River but has been artificially modified by historic groundwater withdrawal (ADWR, 2010). Groundwater in the Lower Hassayampa Area flows toward the pumping centers in the Tonopah Desert and Centennial Wash areas (ADWR, 2010).

2.3 SITE GROUNDWATER LEVEL CONDITIONS

Groundwater occurs naturally beneath the Redhawk Power Plant site in the Lower Alluvial Unit at depths that are attainable for conventional pumping equipment. APS currently has two water supply wells that are consistently[3] pumped to support power generation at the project site. The static water level at the two active production wells was 233.7 feet below land surface (bls)[4] and 235.6 feet bls[5] in August 2019 and July 2020, respectively. Available water level data indicate that groundwater elevation has declined by approximately 3 feet per year[6] at an ADWR Groundwater Site Inventory (GWSI) well located approximately 1 mile northeast of the project site. Regional measured groundwater levels and water level changes over time were incorporated in the 2023 ADWR Phoenix AMA groundwater model. The measured groundwater levels were used to calibrate the groundwater model, ensuring that the model reasonably reflects observed groundwater conditions.

[3] APS has five active wells at the Redhawk Power Plant: two wells support power generation, one well for domestic water supply at the plant, and two wells are used for construction water supply and dust control.

[4] Well 55-230361.

[5] Well 55-231818.

[6] Groundwater Site Inventory Well 332054112494901, Registry No. 55-608004.

3. Project Area Setting

The Redhawk Power Plant is situated on basin fill and the closest surface bedrock exposure is Quaternary basalt of the Palo Verde Hills, northwest of the project site. The total thickness of alluvial fill is greater than 1,050 feet bls[7] at the project site, based on wells installed in 2019 and 2020. A depth to bedrock map developed by the Arizona Geological Survey (Richard, et al., 2007) based on gravity, well log data, and well depth data shows a depth to bedrock at the project site of approximately 1,200 feet bls. Several wells located on or near the project site have depths ranging from 950 to 1,150 feet bls and are constructed to produce from the Lower Alluvial Unit. Groundwater flow in the vicinity of the site is to the south-southwest, toward the Centennial Wash (ADWR, 2010).

3.1 GROUNDWATER AVAILABILITY

The availability of groundwater to meet the planned water requirements of the proposed expansion and known existing uses was evaluated as part of this analysis using the Phoenix AMA groundwater model (ADWR, 2023). Although not the primary water source, groundwater is currently used at the Redhawk Power Plant for power generation and other site water needs. Groundwater has previously been demonstrated to be available to support the current Redhawk Power Plant generation configuration. The Phoenix AMA groundwater model was used to evaluate groundwater availability for the proposed expansion and known existing groundwater uses by both APS and other groundwater users. This analysis assumes that current groundwater uses will continue for the planned operational life of the Redhawk Power Plant expansion. The results of the model analyses are described in Section 5.2, Model Results.

3.1.1 Groundwater Withdrawal Authority

Within the Phoenix AMA (and other AMAs), each groundwater user must have authority to withdraw groundwater, in the form of either established water rights or a permit from ADWR. Existing groundwater withdrawals at the Redhawk Power Plant project site are made pursuant to a Type 1 Non-Irrigation Groundwater Right of 3,356 AFY that are appurtenant to the 1,749 acres of APS land on which the Redhawk Power Plant was built. This Type 1 Right was obtained by APS by retiring 1,749 acres of designated agricultural land and converting the former irrigation rights to industrial use. By doing so, APS converted 5,604 acre-feet of Grandfathered Irrigation Groundwater Rights to 3,356 acre-feet of Type 1 Non-Irrigation Groundwater Rights for industrial purposes. The remaining 2,248 AFY (40 percent) of the agricultural water right was extinguished, meaning that this water would now remain in the aquifer to benefit all groundwater users.

The Redhawk Power Plant currently uses only approximately 500 AFY (approximately 15 percent) of groundwater under the remaining Type 1 Right. The proposed expansion would increase groundwater pumping at the Redhawk Power Plant to approximately 24 percent of the current Type 1 Right.

3.1.2 Groundwater Quality

Groundwater from the Lower Alluvial Unit beneath the Redhawk Power Plant is currently used for power generation, construction, dust control, and domestic water uses. The quality of groundwater obtained from the existing on-site water wells is suitable for each of these uses. Production of an additional 300 AFY from the existing on-site water wells is not anticipated to change groundwater quality.

[7] Well completion reports for APS water supply wells 55-230316 and 55-231818.

4. Effect of Expansion on the Phoenix AMA Fourth Management Plan

The proposed Redhawk Power Plant expansion consists of the addition of eight new GE LM6000 simple cycle natural gas generating units to the existing plant. Water use restrictions at new combustion turbine power plants are set forth in Sections 6.3.4.2, and 6-908 of the Phoenix AMA fourth management plan.[8] The water use restrictions set forth in the management plan include water quality criteria specific to operation and blow down of cooling towers at combustion turbine power plants. The proposed expansion generation units to be installed at the Redhawk Power Plant will be air cooled. No cooling towers are proposed in conjunction with the proposed expansion; consequently, the proposed expansion complies with the Phoenix AMA fourth management plan.

[8] The Phoenix AMA fourth management plan remains in effect until 31 December 2024. The fifth management plan will become effective on 1 January 2025. The water use restrictions for combustion turbine power plants set forth in Section 6.3.4.2 of the Pheonix AMA fourth management plan pertaining to cooling towers have been carried forward to the fifth management plan. Conservation requirements for cooling towers at combustion turbine power plants were updated in the fourth and fifth management plans. Water use restrictions for combustion turbine power plants included in both the fourth and fifth management plans pertain only to plants that use cooling towers.

5. Groundwater Assessment

5.1 METHODOLOGY

The ADWR developed and published a regional groundwater flow model of the Phoenix AMA (ADWR, 2023). The Phoenix AMA model replaced the older Salt River Valley model and the Lower Hassayampa sub-basin groundwater model. The Phoenix AMA model is a three-layer transient MODFLOW-NWT flow model with uniform horizontal grid cells of dimensions 0.5-mile by 0.5-mile.

From the ground surface, vertically downward, the three model layers represent the Upper Alluvial Unit, the Middle Alluvial Unit, and the Lower Alluvial Unit, respectively. The model simulates the timeframe 1900 through 2021 using transient stress periods of varying length. For the period 1921 to 2021, annual stress periods are used. Within each stress period, model boundary conditions representing stream stage, recharge, evapotranspiration, groundwater pumping, and specified head boundaries are held constant. Groundwater production wells are assigned total annual pumping based on reported groundwater production. Comprehensive model documentation is provided in the Phoenix AMA model report (ADWR, 2023).

Haley & Aldrich used the Phoenix AMA groundwater model to simulate groundwater withdrawal at the APS Redhawk Power Plant wells and calculated the associated drawdown. No changes were made to the model grid or layering discretization, and no changes were made to the published model parameterization. The simulated groundwater pumping was held constant for each model scenario (except APS Redhawk Power Plant) at 2021 levels for each groundwater user represented in the 2023 Phoenix AMA model. Groundwater pumping at the APS Redhawk Power Plant was adjusted for each model scenario to reflect different conditions as described below. Groundwater pumping trends, groundwater management practices, and groundwater elevation changes resulting from those practices outside of the Redhawk Power Plant property, as reflected in the 2023 Phoenix AMA model (ADWR, 2023), are assumed to continue for the simulation periods. The only change made to the published ADWR model was adjustment of the locations of the two on-site production wells at the Redhawk Power Plant to reflect actual well locations.

In the vicinity of the APS Redhawk facility, the published Phoenix AMA model includes eight APS wells. Figure 2 shows the six active APS wells and other registered wells located within 0.5 miles of the project site. Data from the model show that only the two APS production wells on the Redhawk Power Plant site were used for power production in year 2021.[9] The remaining six production wells were either turned off during 2021 or had production totals of less than 20 acre-feet in 2021.

To calculate drawdown associated with the planned plant expansion, a "baseline" scenario was set up to simulate groundwater levels through year 2060 by "turning off" production at the APS Redhawk facility wells. The boundary conditions and parameters were held constant at the 2021 specified values.

[9] Wells 55-623232 and 55-230361 were used to supply water to plant operations in 2021. Well 55-623232 has since been replaced for operations purposes by well 55-231818. Well 55-230361 remains active but is used only for small incidental water supply needs.

Three forecast scenarios representing the period 2021 through 2060 were used to simulate total production at the APS Redhawk facility, and calculate the respective drawdown values:

- Scenario 1 – current conditions, total production of 500 AFY;
- Scenario 2 – proposed expansion, total production of 800 AFY; and
- Scenario 3 – groundwater elevation change contribution after 40 years of groundwater use with proposed expansion, total production of 800 AFY.

For each of the forecast scenarios, groundwater withdrawal was simulated at the two APS wells shown on Figure 3 (55-231818 and 55-230361[10]). The total specified production for the respective scenarios is divided evenly between the two wells. The horizontal and vertical extent of the cone of depression is quantified in terms of potential drawdown impacts to wells owned by parties other than APS. Drawdown due to production at these two APS wells for each scenario is calculated as the difference of simulated water levels in the baseline scenario and the respective scenario at the end of a five-year pumping period. The five-year pumping period was used because it is consistent with the standard applied by ADWR[11] to determine if unreasonable increasing damage will occur at wells not owned by the applicant. Unreasonable increasing damage is defined as 10 feet or more of additional drawdown at wells not owned by the applicant at the end of a five-year pumping period. Calculated drawdown due to production at the APS Redhawk facility under each scenario at the end of the five-year pumping period is presented in Figures 4 and 5, respectively.

5.2 MODEL RESULTS

Key observations regarding each model scenario are described below.

5.2.1 Scenario 1 (Current Conditions, 500 AFY)

This model scenario represents groundwater pumping under current plant operating conditions. The Redhawk Power Plant currently uses approximately 500 AFY for power generation water supply. This scenario was run so that it can be used to compare additional off-site groundwater drawdown that will occur if the proposed expansion is authorized to the existing simulated drawdown conditions. Under this scenario, a maximum drawdown of 2.2 feet occurs at the two APS production wells at the end of the five-year pumping period (Figure 4). No off-site wells experience 10 feet or greater drawdown at the end of the five-year pumping period, and therefore do not experience unreasonable impact as a result of the current groundwater use.

5.2.2 Scenario 2 (Proposed Expansion, 800 AFY)

This model scenario represents groundwater pumping with the proposed plant expansion. The proposed expansion is estimated to use up to 300 AFY of additional groundwater pumped from the two existing water supply wells. This pumping scenario assumes 800 AFY of groundwater pumping; the current

[10] Wells 55-623232 and 55-230361 were used to supply water to plant operations in 2021. Well 55-623232 has since been replaced for operations purposes by well 55-231818. Well 55-230361 remains active but is used only for small incidental water supply needs.

[11] Arizona Administrative Code R12-15-1302 defines unreasonably increasing damage to an existing well as more than 10 feet of additional drawdown within the first five years of operation of a new extraction well. Although the proposed Redhawk expansion relies on two existing production wells, this criterion was applied to conservatively evaluate the potential effects of the increased groundwater pumping associated with the expansion.

500 AFY of groundwater use plus an additional 300 AFY of groundwater for the proposed new units. This scenario was run to examine the total simulated off-site groundwater drawdown that will occur if the proposed expansion is authorized. Under this scenario, a maximum drawdown of 3.4 feet occurs at the two APS production wells at the end of the five-year pumping period (Figure 5). The maximum drawdown simulated at any off-site water wells owned by parties other than APS is 2.6 feet at well 55-608003 at the end of the simulated five-year pumping period. No off-site wells experience 10 feet or greater drawdown at the end of the five-year pumping period, and therefore do not experience unreasonable impact as a result of increased groundwater pumping to support generation from the proposed expansion.

5.2.3 Scenario 3 (Differential Water Level Change Between 500 AFY and 800 AFY, After 40 Years)

This model scenario represents groundwater pumping under the proposed plant expansion operating conditions for a period of 40 years. The plant expansion would include a total groundwater use of approximately 800 AFY. This scenario was run to examine the total projected contribution to groundwater elevation change after 40 years of plant operations. Groundwater elevation conditions were evaluated after 40 years of pumping at rates of 500 AFY and 800 AFY to examine the change in groundwater elevations attributable to the proposed expansion. At the end of the 40-year simulation period, the 800 AFY of groundwater pumping associated with the proposed expansion resulted in a total of approximately 2.0 feet of additional groundwater elevation decline at the Redhawk Power Plant site over 40 years of pumping at the APS production wells over the current 500 AFY of groundwater pumping over the same period of time. This amount of groundwater elevation decline equates to approximately 0.6 inches (or 0.05 feet) of additional groundwater decline per year from operation of the Redhawk expansion. A groundwater elevation decline of 0.05 feet per year is very small in comparison to the overall groundwater elevation decline resulting from the combined pumping of all wells incorporated in the ADWR model.

The total groundwater elevation change over the 40-year simulation period with the proposed expansion groundwater use and *all* reported groundwater production from *all* other well owners registered as of 2021 is approximately 2.36 feet per year combined. This value represents the simulated groundwater elevation change over the 40-year simulation period resulting from all combined groundwater pumping included in the published Phoenix AMA (ADWR, 2023) groundwater model, and groundwater pumping associated with the proposed expansion.

6. Findings

Haley & Aldrich evaluated future additional groundwater pumping associated with the proposed expansion of the Redhawk Power Plant, located in Arlington, Arizona. The purpose of the evaluation was to quantify potential effects of the increased groundwater pumping that would occur from the two existing water supply wells should the proposed expansion be authorized. Current groundwater use at the Redhawk Power Plant is approximately 500 AFY, and the proposed expansion would increase groundwater use to a total of approximately 800 AFY. Haley & Aldrich used a recent groundwater model published by ADWR (2023) to quantify the potential effects of increased groundwater pumping in terms of impacts to off-site wells owned by parties other than APS, and the total contribution to groundwater elevation change over the 40-year operational period of the proposed expansion generating units. The key findings resulting from this evaluation are listed below.

1. Sufficient groundwater is available from the aquifers beneath the Redhawk Power Plant site to support the proposed expansion, and to continue all known existing current off-site water uses for the duration of the proposed 40-year operation of the expansion generating units.
2. The horizontal and vertical extent of the cone of depression resulting from the increased groundwater use (800 AFY total groundwater use) associated with the proposed Redhawk Power Plant expansion does not result in unreasonable impact to existing registered water wells owned by parties other than APS based on criteria established by ADWR (10 feet or more of additional drawdown over a period of five years of pumping).
    a. The maximum groundwater drawdown resulting from the current and proposed expansion groundwater pumping (800 AFY total groundwater use) is 3.43 feet at the APS production wells on the Redhawk Power Plant site, at the end of the simulated five-year pumping period.
    b. All off-site water wells owned by parties other than APS experience drawdown less than that simulated at the APS production wells on the Redhawk Power Plant site at the end of the simulated five-year pumping period.
    c. The maximum drawdown simulated at off-site water wells owned by parties other than APS is 2.6 feet at well 55-608003 at the end of the simulated five-year pumping period. No water wells owned by others experience drawdown of 10 feet or more during the five-year simulated pumping period.
3. Groundwater elevation change resulting from all current APS and non-APS groundwater pumping accounted for in the Phoenix AMA groundwater model, including the current 500 AFY of groundwater use at the Redhawk Power Plant, was projected for the planned 40-year operational period of the expansion generating units. This groundwater elevation change was compared to the projection of all current groundwater pumping, Redhawk Power Plant groundwater use, *plus* the 300 AFY of groundwater use associated with the proposed expansion, to determine the relative change in groundwater elevation attributable to the expansion related groundwater use. This comparison showed that the proposed additional 300 AFY of groundwater pumping for the expansion will result in approximately 2 feet of additional groundwater elevation drawdown over the planned 40-year operational period of the expansion generating units. This small amount of groundwater elevation change equates to approximately 0.05 feet per year of additional drawdown resulting from the proposed expansion.

References

1. Arizona Department of Water Resources (ADWR), 1994. Arizona Water Resources Assessment – Volume II Hydrologic Summary. August.

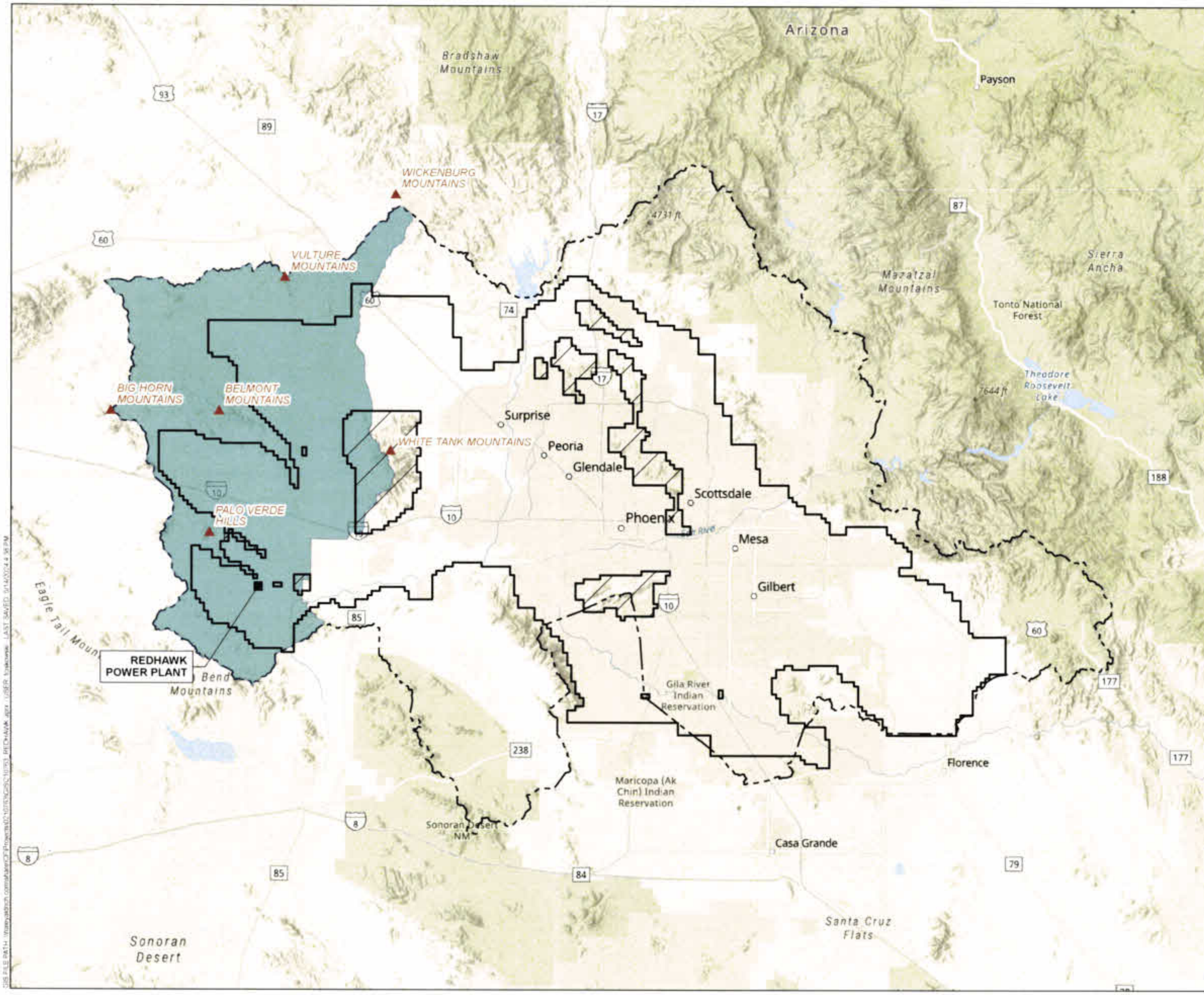
2. ADWR, 2010. Arizona Water Atlas, Volume 8 Active Management Area Planning Area. April.

3. ADWR, 2023. Phoenix Active Management Area Groundwater Model.

4. Richard, S.M., Shipman, T.C., Greene, L.C., and Harris, R.C., 2007. Estimated Depth to Bedrock in Arizona, v 1.0. Arizona Geology Survey Document Repository.

5. Wilson, E.D., Moore, R.T., and Peirce, W.H., 1957. Geologic Map of Maricopa County, Arizona. Prepared by the Arizona Bureau of Mines and University of Arizona.

FIGURES



LEGEND

- MOUNTAIN
- REDHAWK POWER PLANT SITE
- HASSAYAMPA SUBBASIN
- PHOENIX AMA MODEL NO-FLOW (INACTIVE) AREA
- PHOENIX AMA BOUNDARY
- EDGE OF PHOENIX AMA MODEL DOMAIN

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. AMA = ACTIVE MANAGEMENT AREA
3. SUBBASIN DATA SOURCE: PHOENIX AMA, 2023
4. BASE MAP SOURCE: ESRI

0 12 24
SCALE IN MILES

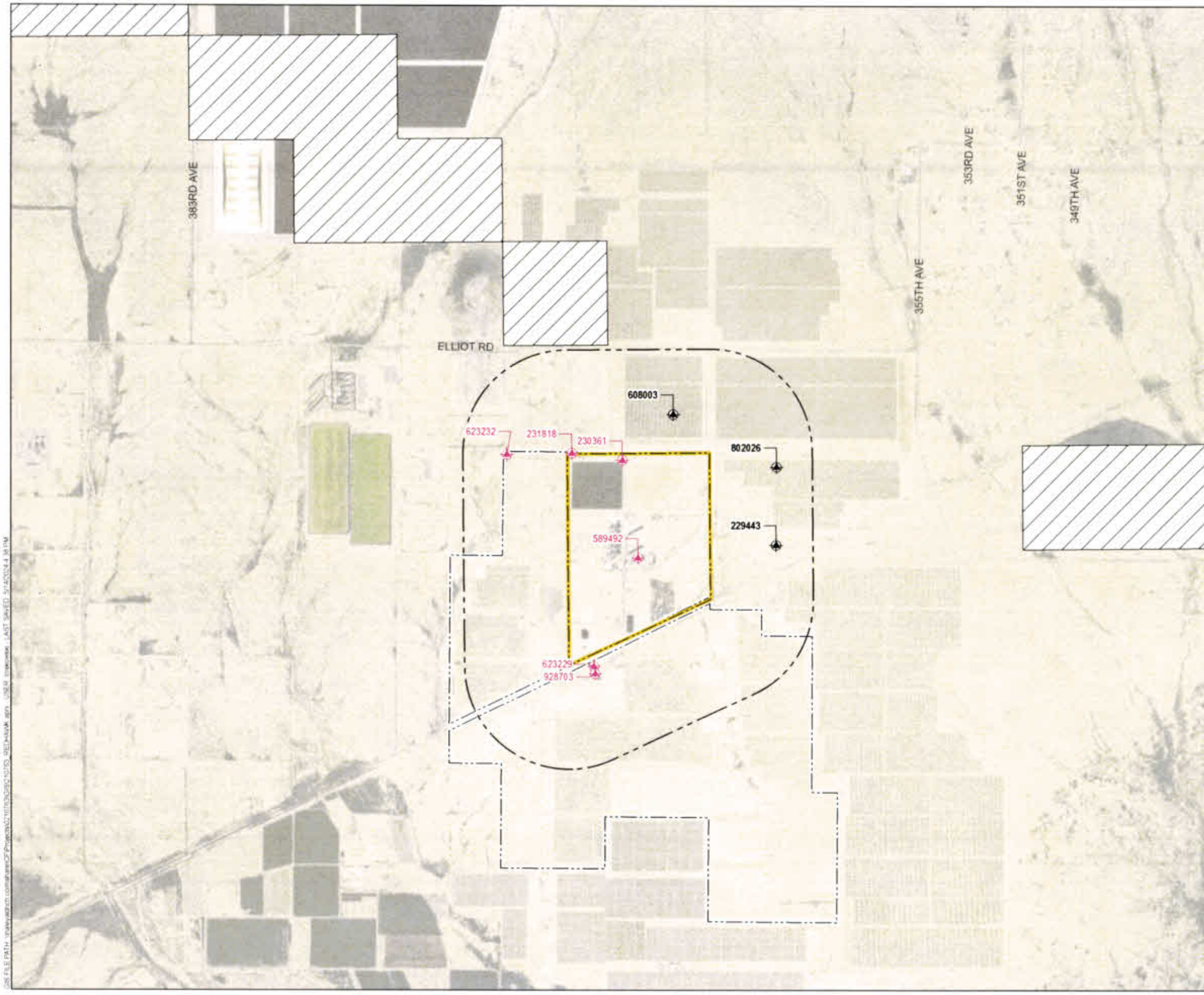
HALEY ALDRICH

APS REDHAWK FACILITY
ARLINGTON, ARIZONA

REDHAWK POWER PLANT
PROJECT LOCATION

JUNE 2024

FIGURE 1



LEGEND

- APS WATER SUPPLY WELL
- WELL, OTHER OWNER
- PHOENIX AMA MODEL NO-FLOW (INACTIVE) AREAS, HILLS OR SUBSURFACE BEDROCK
- REDHAWK POWER PLANT BOUNDARY
- APS PROPERTY BOUNDARY
- HALF MILE BUFFER AROUND REDHAWK POWER PLANT BOUNDARY

NOTES

1. SOME LOCATIONS WITHIN THE ARIZONA DEPARTMENT OF WATER RESOURCES (ADWR) WELL REGISTRY ARE CADASTRAL AND MAY NOT REPRESENT THE TRUE WELL LOCATION
2. WELL DATA SOURCE: ADWR WELL REGISTRY
3. DEFINITIONS
APS = ARIZONA PUBLIC SERVICE
AMA = ACTIVE MANAGEMENT AREA
4. AERIAL IMAGERY SOURCE: GOOGLE, 2024

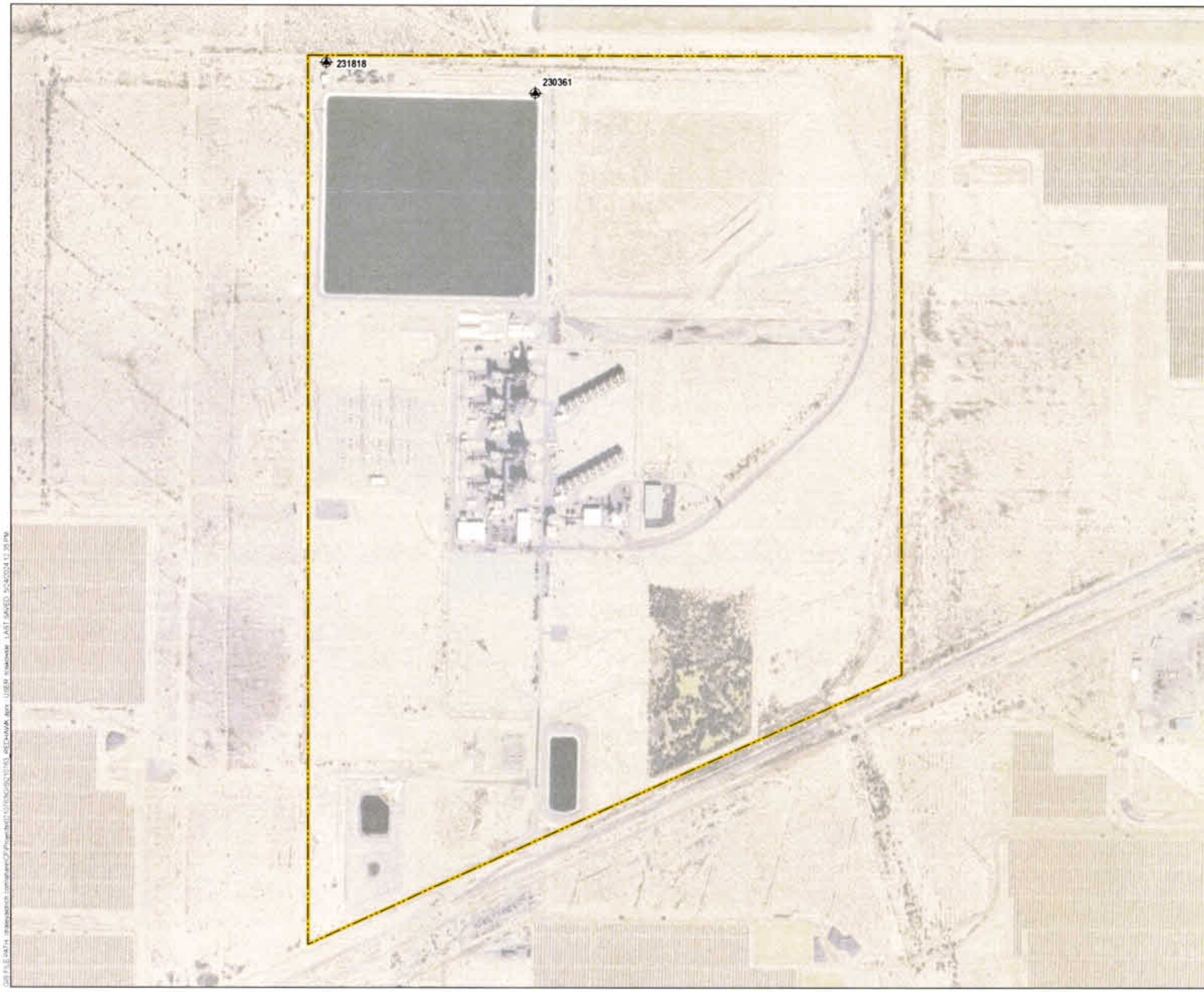
HALEY ALDRICH

APS REDHAWK FACILITY
ARLINGTON, ARIZONA

REGISTERED WELLS LOCATED WITHIN ONE HALF-MILE OF PROJECT SITE

JUNE 2024

FIGURE 2



LEGEND

APS GENERATION WATER SUPLLY WELL

REDHAWK POWER PLANT BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

2. WELL DATA SOURCE: ARIZONA DEPARTMENT OF WATER RESOURCES (ADWR) WELL REGISTRY

3. AERIAL IMAGERY SOURCE: GOOGLE, 2024

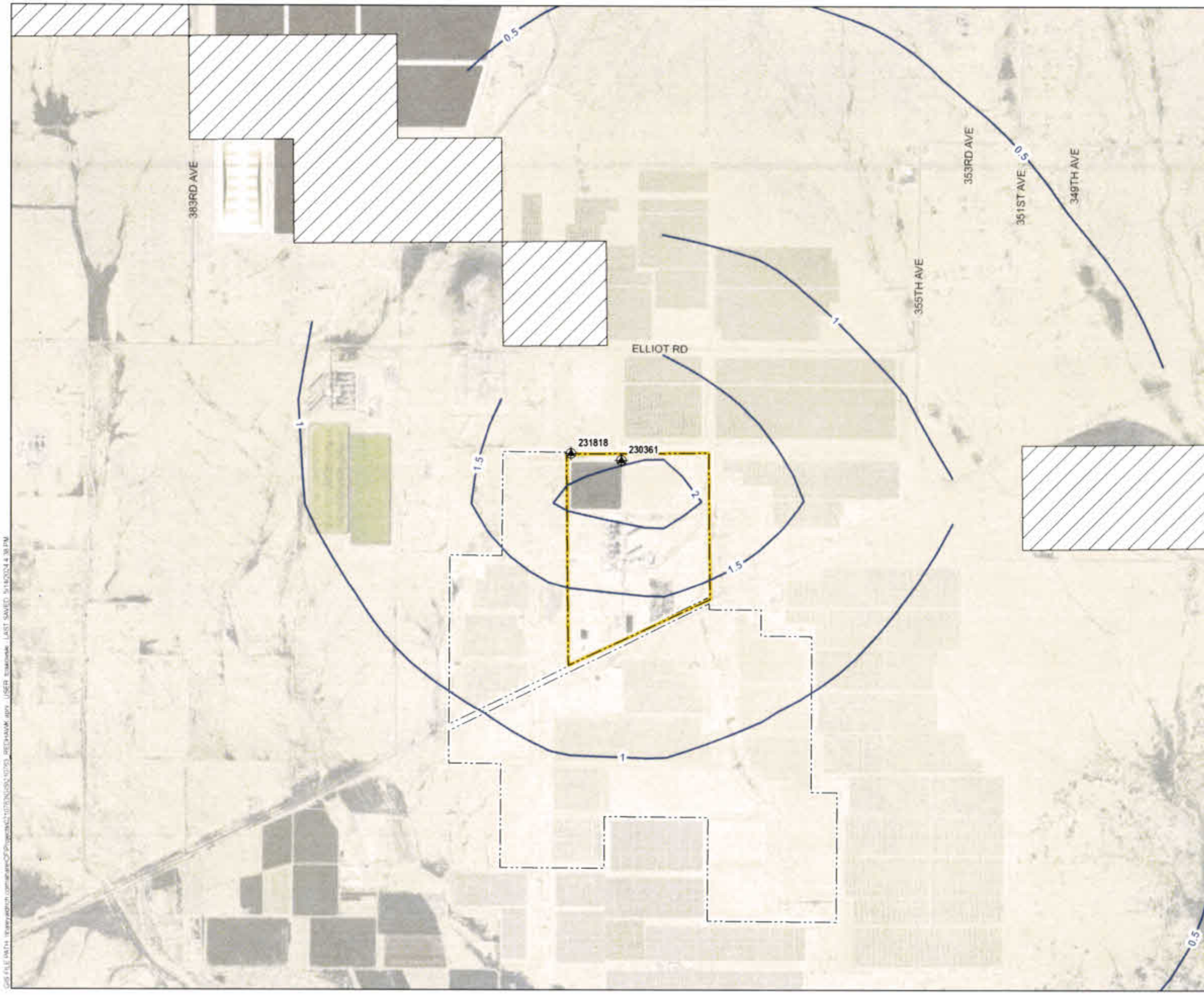
HALEY ALDRICH

APS REDHAWK FACILITY
ARLINGTON, ARIZONA

REDHAWK POWER PLANT
GENERATION WATER
SUPPLY WELL LOCATIONS

JUNE 2024

FIGURE 3



LEGEND

- APS GENERATION WATER SUPPLY WELL
- MODELED DRAWDOWN CONTOUR (IN FEET), 500 ACRE FT/YR
- PHOENIX AMA MODEL NO-FLOW (INACTIVE) AREAS, HILLS OR SUBSURFACE BEDROCK
- REDHAWK POWER PLANT BOUNDARY
- APS PROPERTY BOUNDARY

NOTES

1. SOME LOCATIONS WITHIN THE ARIZONA DEPARTMENT OF WATER RESOURCES (ADWR) WELL REGISTRY ARE CADASTRAL AND MAY NOT REPRESENT THE TRUE WELL LOCATION
2. WELL DATA SOURCE: ADWR WELL REGISTRY
3. SIMULATED APS PUMPING WELL RATES:
   230361: 250 ACRE FT/YR (154.8 GPM)
   623232: 250 ACRE FT/YR (154.8 GPM)
4. DEFINITIONS:
   APS = ARIZONA PUBLIC SERVICE
   FT = FEET
   YR = YEAR
   GPM = GALLONS PER MINUTE
   AMA = ACTIVE MANAGEMENT AREA
5. AERIAL IMAGERY SOURCE: GOOGLE, 2024

0 2,500 5,000
SCALE IN FEET

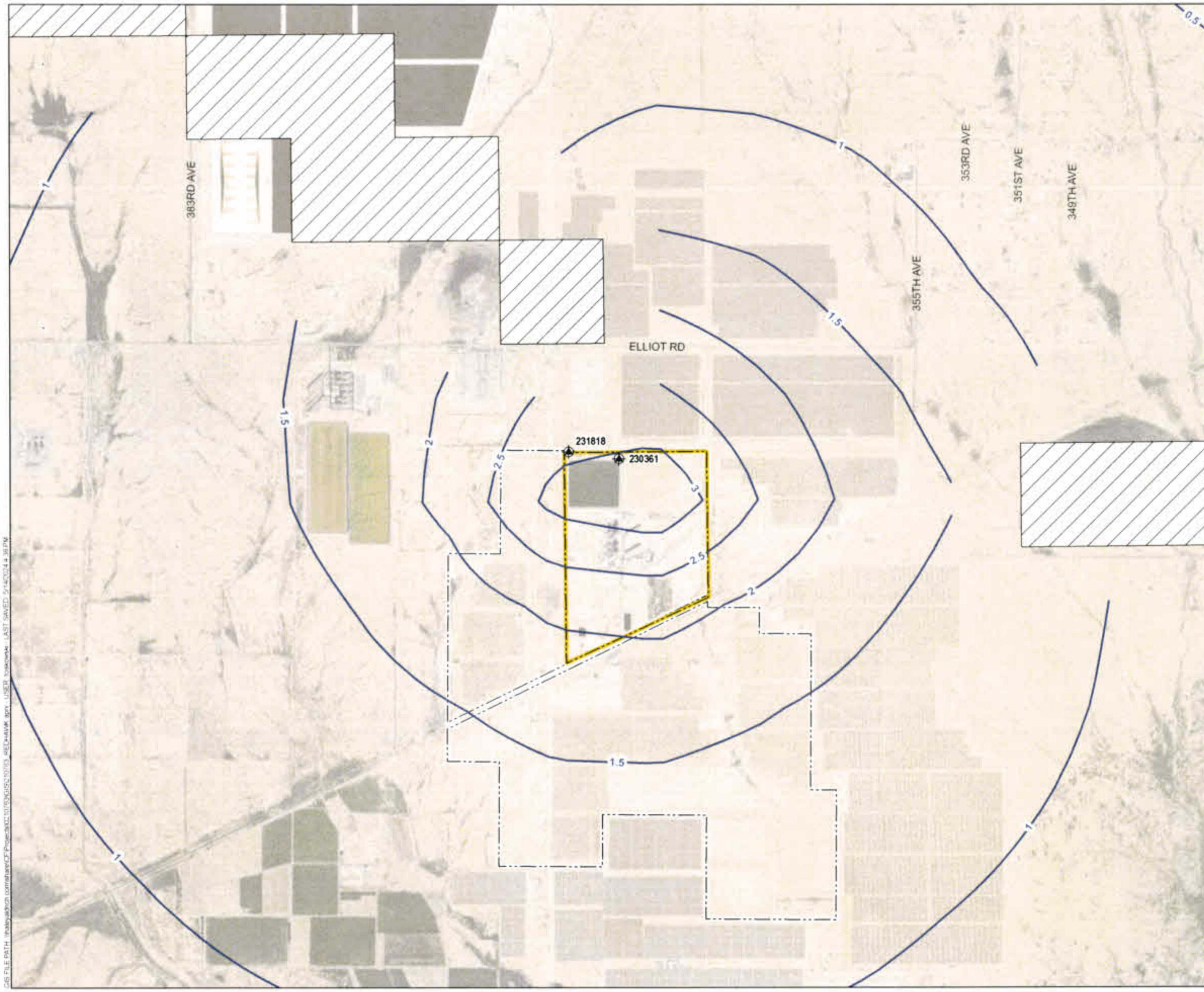
HALEY ALDRICH

APS REDHAWK FACILITY
ARLINGTON, ARIZONA

APS PUMPING
MODELED DRAWDOWN CONTOURS
(500 ACRE FT/YEAR)

JUNE 2024

FIGURE 4



LEGEND

- APS GENERATION WATER SUPPLY WELL
- MODELED DRAWDOWN CONTOUR (IN FEET), 800 ACRE FT/YR
- PHOENIX AMA MODEL NO-FLOW (INACTIVE) AREAS, HILLS OR SUBSURFACE BEDROCK
- REDHAWK POWER PLANT BOUNDARY
- APS PROPERTY BOUNDARY

NOTES

1. SOME LOCATIONS WITHIN THE ARIZONA DEPARTMENT OF WATER RESOURCES (ADWR) WELL REGISTRY ARE CADASTRAL AND MAY NOT REPRESENT THE TRUE WELL LOCATION.
2. WELL DATA SOURCE: ADWR WELL REGISTRY
3. SIMULATED APS PUMPING WELL RATES:
   230361: 400 ACRE FT/YR (247.8 GPM)
   623232: 400 ACRE FT/YR (247.8 GPM)
4. DEFINITIONS
   APS = ARIZONA PUBLIC SERVICE
   FT = FEET
   YR = YEAR
   GPM = GALLONS PER MINUTE
   AMA = ACTIVE MANAGEMENT AREA
5. AERIAL IMAGERY SOURCE: GOOGLE, 2024

0 2,500 5,000
SCALE IN FEET

HALEY ALDRICH

APS REDHAWK FACILITY
ARLINGTON, ARIZONA

APS PUMPING
MODELED DRAWDOWN CONTOURS
(800 ACRE FT/YEAR)

JUNE 2024

FIGURE 5

Exhibit B-3.
Gas Generation Addition—Reliability Analysis

1898 & CO.

PART OF BURNS & McDONNELL

REDHAWK GENERATING FACILITY PRELIMINARY STUDY

ARIZONA PUBLIC SERVICE COMPANY

393.04 MW REDHAWK GAS FACILITY

PROJECT NO. 170132

REVISION 1

April 4, 2024

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CONTENTS

TABLES

1.0 Executive Summary

Burns & McDonnell was retained by Arizona Public Service Company (APS) to perform a preliminary study of steady state and transient stability analyses to determine system impacts from the proposed Redhawk generating facility (the "Study"). The generating facility consists of eight (8) LM6000 gas turbines for a maximum of 393.04 MW at the proposed point of interconnection at the APS owned Redhawk 500 kV station (the "Project").

1.1 Steady State Analysis

Steady state analysis was performed to identify thermal and voltage impacts resulting from the interconnection of the Project under a variety of system conditions.

Steady state analysis was performed on pre-Project and post-Project models. Any event resulting in either a thermal overload or voltage violation in the post-Project model was compared to the same event in the pre-Project model.

Two facilities showed thermal overloads in the post-Project model. In both instances, the overload was observed in the pre-Project model, indicating no adverse impact resulting from the interconnection of the Project.

Zero facilities showed voltage violations in the post-Project model, indicating no adverse impact resulting from the interconnection of the Project.

1.2 Transient Stability Analysis

Transient stability analysis was performed to identify system stability impacts resulting from the interconnection of the Project under a variety of system events.

Transient stability analysis was performed on pre-Project and post-Project models. Any event resulting in either a reliability violation or system instability in the post-Project model was compared to the same event in the pre-Project model. All event simulations were visually inspected for a damped real power stable response, which indicates the Project, and the surrounding system were stable for events analyzed.

There were no observed adverse impacts to system stability resulting from the interconnection of the Project.

2.0 Introduction

2.1 Overview

Burns & McDonnell was retained by Arizona Public Service Company (APS) to perform a preliminary study of steady state and transient stability analyses to determine system impacts from the proposed Redhawk generating facility (the "Study"). The generating facility consists of eight (8) LM6000 gas turbines for a maximum of 393.04 MW at the proposed point of interconnection at the APS owned Redhawk 500 kV station (the "Project"). The preliminary power flow and stability analyses are needed in support of the Project's CEC filling. The Project has positions in both the APS generator interconnection queue and the Salt River Project generator interconnection queue due to the location of APS Redhawk 500 kV station.

3.0 Inputs and Assumptions

3.1 Steady State Inputs and Assumptions

3.1.1 Model Assumptions

The steady state analysis was performed using the 2028 Summer Peak load Arizona coordinated case provided by APS as the base model. Table 3.1-1 shows the base model used in the steady state analysis. All units in the Study area online in the case were assumed to be online in the analysis.

Table 3.1-1 : Steady State Study Model

Case Filename	Case Description	Unit Outage
28HS_AZCC_12-6-23.sav	2028 Summer Peak	None

3.1.2 Generation Assumptions

The post-Project model was modified to offset the 393.04 MW from the Project against the interchange of all areas two areas away from APS, excluding any area within the state of Arizona or located East of APS service territory. Each area's participation was determined as a percentage of its load over the aggregated load of participating areas. Each area was then scaled down by MVA weight while observing baseload status and individual machine limits.

3.1.3 Load Assumptions

No modifications were made to the load forecasts for the Study model detailed in Section 3.1.1.

3.1.4 Project Assumptions

The Project, generator step-up transformer, collector substation transformers and generation tie line were modeled using an EPC file provided by APS.

3.2 Transient Stability Inputs and Assumptions

3.2.1 Model Assumptions

The transient stability analysis was performed using the 2028 Summer Peak load Arizona coordinated case provided by APS as the base model. Table 3.2-1 shows the base model used in the transient stability analysis. All units in the Study area online in the case were assumed to be online in the analysis.

Table 3.2-1 : Transient Stability Study Model

Case Filename	Case Description	Unit Outage
28HS_AZCC_12-6-23.sav	2028 Summer Peak	None

3.2.2 Generation Assumptions

The post-Project model for the transient stability analysis was modified to offset the 393.04 MW from the Project against the interchange of all areas two areas away from APS, excluding any area within the state of Arizona or located East of APS service territory. Each area's participation was determined as a percentage of its load over the aggregated load of participating areas. Each area was then scaled down by MVA weight while observing baseload status and individual machine limits.

3.2.3 Load Assumptions

No modifications were made to the load forecasts for the Study model detailed in Section 3.2.1.

3.2.4 Dynamic Model Assumptions

The transient stability analysis utilized the accompanying base dynamics file, 28HS_AZCC_12-6-23.dyd.

3.2.5 Project Assumptions

The Project, generator step-up transformer, collector substation transformers and generation tie line were modeled using an EPC file provided by APS. The Project's dynamic model was provided by APS.

4.0 Study Methodology

4.1 Steady State Analysis Methodology

Steady state analysis was performed with and without the Project to determine thermal and voltage impacts to the surrounding system. The following limits were used for performance criteria, shown in Table 4.1-1:

Table 4.1-1 : Steady State Performance Criteria

Category	Thermal Loading Limit	Voltage Range (pu)	Voltage Deviation
P0	Normal Rating	0.95 - 1.05*	N/A
P1	Emergency Rating	0.9 - 1.1*	8%
P2-P7	Emergency Rating	0.9 - 1.1*	N/A

*500 kV buses were monitored at 1.0 - 1.1 pu for P0, and 0.945 - 1.155 pu for P1-P7 events

Voltages and flows were monitored with the above performance criteria for the system surrounding the Project. In steady state simulations the following solution settings were used, shown in Table 4.1-2:

Table 4.1-2 : Steady State Solution Settings

Control	Pre-Contingency	Post-Contingency
SVD Adjustment	Enabled	Disabled
DC Tap Adjustment	Enabled	Disabled
Area Interchange	Enabled	Disabled
Phase Shifter Adjustment	Enabled	Disabled
Transformer Tap Adjustment	Enabled	Disabled

Steady state analysis was performed on pre-Project and post-Project models. Any event resulting in either a thermal overload or voltage violation in the post-Project model was compared to the same event in the pre-Project model.

4.1.1 Fault Development

P1 and P3 three-phase faults per NERC TPL-001-5, within three (3) stations away from the APS Redhawk 500 kV bus were simulated. These included line faults and bus faults clearing either a load, shunt or transformer.

4.2 Transient Stability Analysis Methodology

Transient stability analysis was performed with and without the Project to assess the dynamic performance of the surrounding system. Generator and system stability were assessed for the studied case. The following parameters were monitored and plotted during the stability simulations:

- ANGLE: Machine Relative Rotor Angle
- POWR: Machine Electrical Power
- VOLT: Bus Voltage
- FREQ: Bus Frequency

Local generators in proximity to the Project were monitored for all parameters. Appropriate bus voltages and frequencies were monitored in proximity to the Project.

The stability of the system was assessed based on the response of the parameters above against NERC TPL-001-5 and WECC CRT3.2 Planning Criterion. The system parameters were observed for up to ten (10) seconds, which included the application and clearing of the defined faults. If any single machine was unstable during the simulation, the unstable machine was reported. If there were cascading events and multiple units were unstable, the system was assessed as unstable.

4.2.1 Fault Development

P1 and P3 three-phase faults per NERC TPL-001-5, within three (3) buses away from the APS Redhawk 500 kV bus were simulated. These included line faults and bus faults clearing either a load, shunt or transformer. Buses 69 kV and above are assumed to have breakers capable of interrupting any fault. The breaker clearing times used in the stability analysis are shown in Table 4.2-1 below.

Table 4.2-1 : Breaker Clearing Times

Breaker Voltage Level	Normal Clearing Time
69 kV	7 cycles
115/161 kV	5 cycles
230 kV	5 cycles
345 kV	4 cycles
500 kV	4 cycles

5.0 Steady State Analysis Results

Steady state analysis was performed on pre-Project and post-Project models. Any event resulting in either a thermal overload or voltage violation in the post-Project model was compared to the same event in the pre-Project model. The results of the steady state analysis are summarized below.

5.1 Thermal Loading Results

Two facilities showed thermal overloads in the post-Project model. These facilities and their pre and post Project thermal loading are shown in Table 5.1-1:

Table 5.1-1 : Thermal Loading Results

Monitored Facility	Contingency	Pre-Project Loading %	Post-Project Loading %
Panda - Freedom 230 kV	Base (P0)	104.56	106.87
Watson/West Park Tap - West Park 69 kV	Buckeye - Liberty 230 kV	119.34	119.08%

Both facilities are observed with a thermal loading violation in the pre-Project model, indicating no adverse impact resulting from the interconnection of the project.

5.2 Voltage Results

Zero facilities showed either voltage range or voltage deviation violations, indicating no adverse impact resulting from the interconnection of the Project.

6.0 Transient Stability Analysis Results

Transient stability analysis was performed on pre-Project and post-Project models. Any event resulting in either a reliability violation or system instability in the post-Project model was compared to the same event in the pre-Project model. All event simulations were visually inspected for a damped real power stable response, which indicates the Project, and the surrounding system were stable for events analyzed.

6.1 Stability Analysis Results

Review of the stability simulations show the events studied were all observed to have a damped and stable response, with the exception of events including a three-phase fault of the North Gila 500 kV bus. For these events including a three-phase fault on the North Gila 500 kV bus, both the pre-Project and post-Project simulations observed network divergence at the time the fault was applied. This result is found to be a numerical issue in simulation relating to the dynamic solution parameters and base case model. As such, it is concluded that there are no adverse system stability impacts due to the interconnection of the Project.

All fault simulations were visually inspected for a damped stable response. Transient bus voltages were visually inspected as well as numerically calculated during simulations to monitor voltage performance against WECC CRT3.2 voltage criteria. No buses were observed having transient voltage violation in any simulation.

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Exhibit C
Areas of Biological Wealth

As stated in Arizona Corporation Commission Rules of Practice and Procedure R-14-3-220, Exhibit 1:

"Describe any areas in the vicinity of the proposed site or route which are unique because of biological wealth or because they are habitats for rare or endangered species. Describe the biological wealth or species involved and state effects, if any, the proposed facilities will have thereon."

Overview

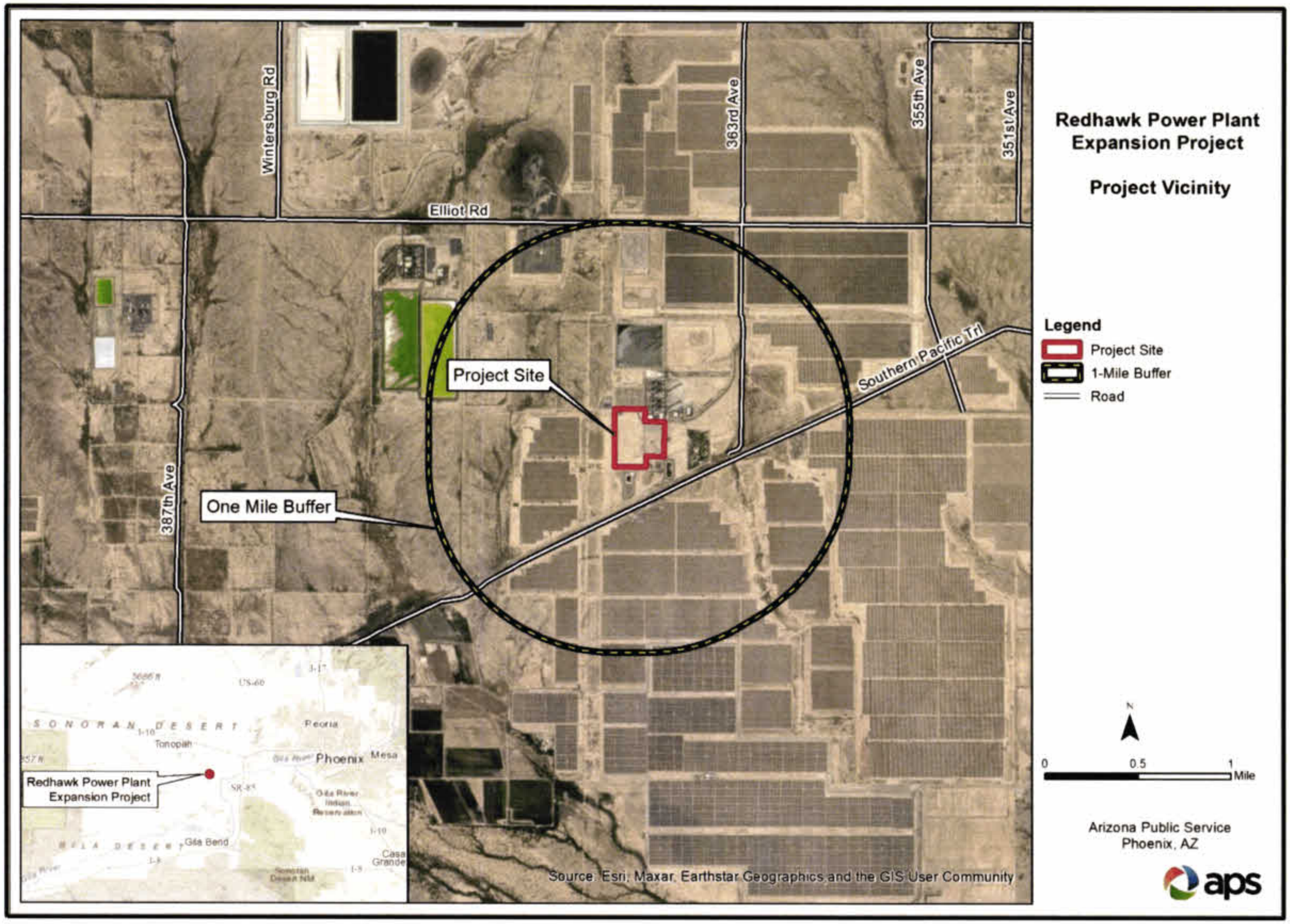
Exhibit C analyzes biological wealth resources and impacts related to the construction and operation of the Project. This report addresses species protected by federal and state laws and policies (i.e., endangered and threatened species) because of their conservation status. This report also addresses whether any areas protected (i.e., wildlife movement corridors) for conservation purposes are present in the study area. Federal and state databases used to review the Project do not return results based strictly on a 1-mile radius; therefore, this report addresses the results of those database queries for a 3-mile buffer around the Project site and discusses whether identified species or their habitat or other protected areas may be present or affected by the Project.

The elevation at the Project area is approximately 850 feet above mean sea level (amsl). The topography of the surrounding area is flat ground with the prominent land cover classes being agricultural fields and open desert. The City of Buckeye is located approximately 14.5 miles east, Arlington Mountain is located approximately 2 miles east, and the Gila River flows approximately 4.5 miles southeast of the Project. The study area can be found on the Gila-Salt River Principal Meridian, Arizona, U.S. Geological Survey 7.5-minute topographic quadrangle. The study area is within Section 14 and 23 of Township 1 South, Range 6 West.

The study area is in the Lower Colorado River Valley subdivision of the Sonoran Desertscrub biome (Brown 1994). The Lower Colorado River Valley subdivision is characterized by high temperatures and low precipitation and is the most arid subdivision of the Sonoran Desert. All Project features and ground disturbances are located within the existing footprint of the Project, meaning the area is highly developed with little native desert components remaining.

Special-status plant and wildlife species are subject to regulations under the authority of federal and state government agencies. Special-status species include those species that are listed by the U.S. Fish and Wildlife Service (USFWS) as federal endangered, threatened, proposed, or candidate species under the Endangered Species Act of 1973 (ESA), Section 4, as amended; protected under the Migratory Bird Treaty Act of 1918 (MBTA); protected as Birds of Conservation Concern (BCC); listed as Species of Greatest Conservation Need (SGCN) by the Arizona Game and Fish Department (AZGFD); or are protected under the Arizona Native Plant Law (ANPL) administered by the Arizona Department of Agriculture (AZDA). Descriptions of special-status species are listed below:

Figure C-1: Project Vicinity Map



- Endangered species (federal) are those species in danger of extinction throughout all or a significant portion of their range.
- Threatened species (federal) are those species likely to become endangered in the foreseeable future.
- Proposed species (federal) are those species recommended for listing under Section 4 of the ESA.
- Candidate species (federal) are those species for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Candidate species are not protected under the ESA, but for the purposes of this report will be discussed in the same manner as threatened or endangered species.
- USFWS Species of Concern is an informal term that refers to those species that the USFWS believes may need concentrated conservation actions. Conservation actions, such as monitoring, vary depending on the health of the populations and degree and types of threats. USFWS Species of Concern receive no legal protection under the ESA, and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species.
- AZGFD SGCN are species determined to be vulnerable in at least one of the following eight criteria: extirpated from Arizona, federal or state status, declining status, disjunct status, demographic status, concentration status, fragmentation status, and distribution status, as described by the AZGFD's listing of SGCN in the State Wildlife Action Plan.
- Certain bird species are protected under the MBTA (1918), the Bald and Golden Eagle Protection Act (1940), 50 C.F.R Sec. 10.12 and 16 U.S.C. Sec. 668(a). Any person or organization who plans to conduct activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implanting appropriate conservation measures. The USFWS lists the BCC and provides a list of their breeding seasons and probability of presence for a defined study area in the Information for Planning and Consultation (IPaC) report.
- The ANPL (ARS § 3-901 to 3-916) is administered by the AZDA, which manages native plant resources and impacts to protected native plant species. ANPL-listed plants include four protection categories: Highly Safeguarded, Salvage Restricted, Salvage Assessed, and Harvest Restricted. Landowners have the right to destroy or remove native plants growing on their land, but at least 60 days prior to the destruction of any protected native plants, landowners are required to notify the AZDA. At the time of the notification the landowner can state if they would allow salvage companies an opportunity to salvage the plants or if they intend to destroy the plants. Removal of protected native plants from the site would require tags/permits from the AZDA. The landowner is allowed to transplant healthy native trees within the site without a permit or notification.

Biological Resources Information

Data was gathered from the USFWS IPaC tool (USFWS 2024) and the AZGFD online Environmental Review Tool (ERT) (AZGFD 2024) to develop a list of special-status species that could occur within the study area (Appendix A). In summary, the USFWS IPaC identified seven (7) federally listed and protected species that may have the potential to occur in the Project area (**Table C-1**). Four (4) BCC were also identified in the study area (**Table C-2**). The federal IPaC did not list any critical habitat, National Wildlife Refuge Lands, or fish hatcheries in the study area, but it did identify possible freshwater pond (PUBF), lake (L2UBH), and riverine (R5UBFx, R4SBC) National Wetlands Inventory (NWI) wetlands at the Project site. The pond and lake potential wetland areas described on NWI maps were constructed as part of the Project site and are not regulated under the Clean Water Act (CWA). The riverine potential wetlands pass through the Project site but will not be impacted by the Project. The AZGFD ERT identified forty (40) special-status species that may have the potential to occur in within the study area (**Table C-3**). No field surveys were performed to validate desktop analysis.

Table C-1: ESA Species Potentially Occurring in the Study Area

Species	Status	Habitat Requirements	Habitat Suitability
BIRDS			
California least tern *Sternula antillarum browni*	ESA-LE	Found on coastal edges and beaches, typically near river mouths, estuaries, and coastal embayments. Spend most of their time on open, sandy beaches near the ocean with sparse vegetation (USFWS 2020).	**No suitable habitat.** No large bodies or coastal areas are present.
Cactus Ferruginous Pygmy Owl *Glaucidium brasilianum cactorum*	ESA-LT	Found in mesquite thickets, desert riverine woods and saguaros in desertscrub and semi-desert grasslands in southern Arizona; historic range continued into central Arizona. Found below 4,000 feet in elevation (USFWS 2021).	**No suitable habitat.** Suitable habitat for this species is not present in the study area. Although the USFWS lists this species the AZGFD does not include this species on their list as occurring within five (5) miles of the study area.
Yellow-billed cuckoo *Coccyzus americanus*	ESA-LT	This bird utilizes large contiguous patches of multi layered riparian habitat, such as cottonwood-willow gallery forests along rivers and streams below 6,600 feet (AZGFD 2021).	**No suitable habitat.** Suitable habitat for this species is not present in the study area. While water can be present at the site, the highly modified evaporation ponds do not provide the necessary riparian vegetation.
Yuma Ridgway's rail *Rallus obsoletus yumanensis*	ESA-LE	Found along freshwater marshes, brackish marshes, and side waters. They prefer tall, dense cattails and bulrushes along the edges of marshes. During the winter, they can be found in heavily overgrown sloughs and backwaters with a greater diversity of vegetation (AZGFD 2023a).	**No suitable habitat**. No marshes with the necessary dense vegetation are found within the Project.
Fish			
Gila topminnow *Poeciliopsis occidentalis*	ESA-LE	Small, perennial streams, springs and cienegas in upland desertscrub, semidesert grasslands and interior chaparral communities below 5,000 feet.[1]	**No suitable habitat**. No perennial streams, springs and cienegas are found within the study area.

[1] https://awcs.azgfd.com/species/fish/poeciliopsis-occidentalis-occidentalis

Species	Status	Habitat Requirements	Habitat Suitability
INSECTS			
Monarch butterfly *Danaus plexippus*	ESA-C	Breeding and migratory monarch butterfly populations occur throughout Arizona habitats, which include riparian areas, native desert habitats, and urban habitats concentrated on parks. Abundance of milkweed is critical for this species. Additional plant species monarchs are known to utilize include dogbane, alfalfa, thistles, seep willow, sunflowers, groundsel, and clovers (Morris et al. 2015).	**No suitable habitat**. Although the evaporation ponds could provide the necessary water during the summer months, suitable plant species most commonly associated with monarch butterfly are not prevalent in the study area.
MAMMALS			
Sonoran pronghorn *Antilocapra americana sonoriensis*	ESA-XN	Found within alluvial valleys separated by block-fault mountain ranges. The valleys are typically level with sandy soil and sparse vegetation at elevations of 400 to 1,600 feet amsl (AZGFD 2023b).	**No suitable habitat**. The urbanized power plant does not provide the open desert habitat required for the pronghorn. The desert surrounding the Project site could provide habitat, but that area will not be impacted by the Project.

NOTES: Agency or Law: ESA = Endangered Species Act; Status Definitions: **ESA:** LE = listed endangered; LT = listed threatened; C = candidate; XN = experimental population, non-essential

Table C-2. BCC Potentially Occurring in the Study Area

Species	Breeding Season	Habitat Requirements	Habitat Suitability
Bendire's thrasher *Toxostoma bendirei*	March 15 – July 31	This bird utilizes a variety of desert habitats with large shrubs, cacti and open ground. In lower elevations, occurs in desert grasslands and shrubland (NatureServe 2024a).	**No suitable habitat.** There is no native vegetation present large enough to serve as suitable habitat. There is Sonoran desertscrub community nearby that provides marginal habitat qualities for transient individuals.
Costa's hummingbird *Calypte costae*	January 15 – June 10	Occurs in washes and arid brushy foothills and chaparral. Nests in trees, shrubs, or cactus, often far from water (NatureServe 2024f).	**No suitable nesting or foraging habitat.** Vegetation in nearby ephemeral washes may be used by transient individuals.
Leconte's Thrasher *Toxostoma lecontei*	February 15- June 20	Lives in open habitats such as dry flats with scattered shrubs. Most often found in saltbush and creosote dominated communities NatureServe 2024g).	**No suitable habitat.** There is no native vegetation present large enough to serve as suitable habitat.

Table C-3. Species of Concern and SGCN Potentially Occurring in the Study Area*

Species	Common Name	FWS SC[1]	AZGFD SGCN[2 3]	Potential to Occur
Amphibians				
Incilius alvarius	Sonoran desert toad		2	Yes. While unlikely, they can be found near agricultural fields and open desert during monsoon season.
Birds				
Anthus spragueii	Sprague's pipit	SC	2	Yes. Known to be found in agricultural fields and flat desert areas during winter.
Artemisiospiza nevadensis	Sagebrush sparrow		2	No. Found in foothills with dense sagebrush or chaparral vegetation.
Athene cunicularia hypugaea	Western burrowing owl	SC	2	Yes. Known to be found near agriculture fields and along the edges of urban development.
Auriparus flaviceps	Verdin		2	Yes. Requires mesquite and creosote bush with branches higher than 0.5 meter (NatureServe 2024e), which is supported in the surrounding desert.
Botaurus lentiginosus	American bittern		2	No. Requires marshlands and meadows with significant surface water.
Buteo regalis	Ferruginous hawk	SC	2	Yes. While they nest in scrublands and woodlands, they have the potential to hunt across agricultural fields and open desert.
Buteo swainsoni	Swainson's hawk		2	Yes. Known to nest along agricultural fields and developed areas.
Calcarius ornatus	Chestnut-collared longspur		2	No. Found in dense shortgrass and long grass prairies.
Calypte costae	Costa's hummingbird		2	Yes. Requires native vegetation such as Sonoran desertscrub communities found in the surrounding area.
Campylorhynchus brunneicapillus	Cactus wren		2	No. Requires tall native vegetation for nesting such as saguaro cactus and mesquite trees.
Coccyzus americanus	Yellow-billed cuckoo (Western DPS)		2	No. Requires dense riparian vegetation.
Colaptes chrysoides	Gilded flicker		2	No. Found in tall vegetation (cottonwood, willow, ironwood, saguaro) stands (NatureServe 2024c).
Columbina inca	Inca dove		2	Yes. Found in urbanized areas near man-made structures.
Empidonax wrightii	Gray flycatcher		2	No. Require sagebrush or pinyon-juniper communities.

Species	**Common Name**	**FWS SC**[1]	**AZGFD SGCN**[2 3]	**Potential to Occur**
Falco mexicanus	Prairie falcon		2	Yes. They winter and hunt across agricultural fields and open desert.
Falco peregrinus anatum	American peregrine falcon		2	No. They require cliff faces or tall urban structures for nesting.
Falco sparverius	American kestrel		2	Yes. Often found in open agricultural fields.
Icterus bullockii	Bullock's oriole		2	No. Prefer woodland and riparian habitats. Rarely found away from tall, woody vegetation.
Lanius ludovicianus	Loggerhead shrike	SC	2	Yes. Can hunt in agricultural fields.
Megascops kennicottii	Western screech-owl		2	No. Found in tall, wooded areas or xeric landscapes with tall vegetation.
Melanerpes uropygialis	Gila woodpecker		2	No. Require saguaro cactus/other tall vegetation nearby for nesting.
Melospiza lincolnii	Lincoln's sparrow		2	No. Require dense vegetation for foraging.
Parabuteo unicinctus	Harris's hawk		2	No. Found in vegetated mesquite and cactus deserts or riparian woodlands.
Passerculus sandwichensis	Savannah sparrow		2	Yes. Can be found in open areas and agricultural fields.
Pooecetes gramineus	Vesper sparrow		2	Yes. Can be found in open areas and agricultural fields.
Spizella breweri	Brewer's sparrow		2	Yes. Can be found in open areas and agricultural fields during the winter.
Toxostoma bendirei	Bendire's thrasher		2	Yes. Found near agricultural fields where it can forage along the ground.
Toxostoma lecontei	LeConte's thrasher		2	Yes. Found in open deserts with sparse vegetation and sandy soils.
Mammals				
Antilocapra americana sonoriensis	Sonoran pronghorn	LE, XN	1	No. Experimental population is nearby but does not typically travel as far northeast as the Project.
Chaetodipus baileyi	Bailey's pocket mouse		2	Yes. Found in open desert where they forage underneath shrubs.
Eumops perotis californicus	Greater western bonneted bat		2	No. Require nearby cliff edges for roosting.
Lasiurus blossevillii	Western red bat		2	Not likely to occur. Although could forage around lights near the Project site, often avoids buildings and developed areas.

Species	Common Name	FWS SC[1]	AZGFD SGCN[2 3]	Potential to Occur
Lasiurus xanthinus	Western yellow bat		2	No. Typically roost in tall vegetation usually associated with upland woodlands and riparian areas.
Macrotus californicus	California leaf-nosed bat	SC	2	Yes. Will roost and forage in desert scrubland.
Myotis velifer	Cave myotis	SC	2	Yes. Will roost in caves/mines/crevices within desertscrub communities.
Myotis yumanensis	Yuma myotis	SC	2	No. Associated with cliff edges and areas where large colonies can roost.
Nyctinomops femorosaccus	Pocketed free-tailed bat		2	No. Roost high on cliff faces and in rocky crevices.
Tadarida brasiliensis	Brazilian free-tailed bat		2	Yes. Can roost in abandoned buildings in rural areas and hunt insects along agricultural fields and desert edges.
Reptiles				
Gopherus morafkai	Sonoran desert tortoise	CCA	1	Not likely to occur. Prefers upland habitats of the Sonoran desert scrub.

1 BGA= Bald and Golden Eagle Protection Act, SC= species of concern, CCA= Candidate Conservation Agreement, LE= listed endangered, XN= experimental population, non-essential

2 SGCN= Species of Greatest Conservation Need

3 AZGFD vulnerability categories= Extirpated from Arizona: Federal or State status: Declining status; Disjunct status; Demographic status, Concentration status; and Distribution Status

1=Vulnerability in at least one of the seven categories and matches one of the following: federally listed endangered or threatened under ESA; recently delisted from ESA and requires monitoring; covered under conservation agreement/CCA/CCAA/Conservation Strategy and Assessment; or closed season species under AZGFD Commission Orders 40, 41, 42, or 43

2=Vulnerability in at least of the seven categories, but no additional criteria from Tier 1

3=Unknown status species in at least one of seven categories

*Habitat requirements were reviewed using AZGFD's *Arizona's Natural Heritage Program* species abstracts. https://www.azgfd.com/wildlife-conservation/on-the-ground-conservation/cooperative-programs/az-natural-heritage-program/. January 5, 2024. Additional references were found for species not available within those abstracts.

Analysis

The Project Study Area

Land cover in the Project study area is comprised of an existing urbanized power plant surrounded by agricultural fields and open desert. The Project footprint is within the existing power plant developed property that retains minimal natural vegetation and would be unlikely to attract or support special-status species. Potential impacts to special-status species would not occur or are anticipated to be low and short-term in duration and would be mostly limited to effects from construction activities such as noise and light. Construction and operation of the Project is not expected to result in a measurable decline to special-status species or in a change to the species' management status.

Conclusion

Construction of the Project will occur on pre-disturbed lands that provide minimal habitat for special-status species. Special-status species would not experience long-term detrimental impacts related to the loss or alteration of vegetative cover within the power plant based on a lack of suitable habitat in areas that may be impacted by the Project. While there are some other suitable and unaffected habitats in the open desert areas in the vicinity of the Project, the construction of the Project is not anticipated to impact those surrounding areas; thus, not impacting the species that use them.

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Appendix A. USFWS IPaC and AZGFD OERT Species Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Arizona Ecological Services Field Office
9828 North 31st Ave
#c3
Phoenix, AZ 85051-2517
Phone: (602) 242-0210 Fax: (602) 242-2513

In Reply Refer To: 06/25/2024 14:43:41 UTC
Project Code: 2024-0108338
Project Name: APS Redhawk Power Plant Expansion Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The Fish and Wildlife Service (Service) is providing this list under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The list you have generated identifies threatened, endangered, proposed, and candidate species, and designated and proposed critical habitat, that *may* occur within the One-Range that has been delineated for the species (candidate, proposed, or listed) and it's critical habitat (designated or proposed) with which your project polygon intersects. These range delineations are based on biological metrics, and do not necessarily represent exactly where the species is located. Please refer to the species information found on ECOS to determine if suitable habitat for the species on your list occurs in your project area.

The purpose of the Act is to provide a means whereby threatened and endangered species and the habitats upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of Federal trust resources and to determine whether projects may affect federally listed species and/or designated critical habitat. A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.
If the Federal action agency determines that listed species or critical habitat *may be affected* by a federally funded, permitted or authorized activity, the agency must consult with us pursuant to 50 CFR 402. Note that a "may affect" determination includes effects that may not be adverse and that may be beneficial, insignificant, or discountable. An effect exists even if only one individual

or habitat segment may be affected. The effects analysis should include the entire action area, which often extends well outside the project boundary or "footprint." For example, projects that involve streams and river systems should consider downstream affects. If the Federal action agency determines that the action may jeopardize a *proposed* species or may adversely modify *proposed* critical habitat, the agency must enter into a section 7 conference. The agency may choose to confer with us on an action that may affect proposed species or critical habitat.

Candidate species are those for which there is sufficient information to support a proposal for listing. Although candidate species have no legal protection under the Act, we recommend that they be considered in the planning process in the event they become proposed or listed prior to project completion. More information on the regulations (50 CFR 402) and procedures for section 7 consultation, including the role of permit or license applicants, can be found in our Endangered Species Consultation Handbook at: https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf.

We also advise you to consider species protected under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712) and the Bald and Golden Eagle Protection Act (Eagle Act) (16 U.S.C. 668 *et seq.*). The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when authorized by the Service. The Eagle Act prohibits anyone, without a permit, from taking (including disturbing) eagles, and their parts, nests, or eggs. Currently 1,026 species of birds are protected by the MBTA, including the western burrowing owl (*Athene cunicularia hypugaea*). Protected western burrowing owls can be found in urban areas and may use their nest/burrows year-round; destruction of the burrow may result in the unpermitted take of the owl or their eggs.

If a bald eagle or golden eagle nest occurs in or near the proposed project area, our office should be contacted for Technical Assistance. An evaluation must be performed to determine whether the project is likely to disturb or harm eagles. The National Bald Eagle Management Guidelines provide recommendations to minimize potential project impacts to bald eagles (see https://www.fws.gov/law/bald-and-golden-eagle-protection-act and https://www.fws.gov/program/eagle-management).

The Division of Migratory Birds (505/248-7882) administers and issues permits under the MBTA and Eagle Act, while our office can provide guidance and Technical Assistance. For more information regarding the MBTA, BGEPA, and permitting processes, please visit the following web site: https://www.fws.gov/program/migratory-bird-permit. Guidance for minimizing impacts to migratory birds for communication tower projects (e.g. cellular, digital television, radio, and emergency broadcast) can be found at https://www.fws.gov/media/recommended-best-practices-communication-tower-design-siting-construction-operation.

The U.S. Army Corps of Engineers (Corps) may regulate activities that involve streams (including some intermittent streams) and/or wetlands. We recommend that you contact the Corps to determine their interest in proposed projects in these areas. For activities within a National Wildlife Refuge, we recommend that you contact refuge staff for specific information about refuge resources, please visit this link or visit https://www.fws.gov/program/national-wildlife-refuge-system to locate the refuge you would be working in or around.

If your action is on tribal land or has implications for off-reservation tribal interests, we encourage you to contact the tribe(s) and the Bureau of Indian Affairs (BIA) to discuss potential tribal concerns, and to invite any affected tribe and the BIA to participate in the section 7 consultation. In keeping with our tribal trust responsibility, we will notify tribes that may be affected by proposed actions when section 7 consultation is initiated. For more information, please contact our Tribal Coordinator, John Nystedt, at 928/556-2160 or John_Nystedt@fws.gov.

We also recommend you seek additional information and coordinate your project with the Arizona Game and Fish Department. Information on known species detections, special status species, and Arizona species of greatest conservation need, such as the western burrowing owl and the Sonoran desert tortoise (*Gopherus morafkai*) can be found by using their Online Environmental Review Tool, administered through the Heritage Data Management System and Project Evaluation Program (https://www.azgfd.com/wildlife-conservation/planning-for-wildlife/project-evaluation-program/).

We appreciate your concern for threatened and endangered species. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. If we may be of further assistance, please contact our Flagstaff office at 928/556-2118 for projects in northern Arizona, our general Phoenix number 602/242-0210 for central Arizona, or 520/670-6144 for projects in southern Arizona.

Sincerely,
/s/

Heather Whitlaw
Field Supervisor
Attachment

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

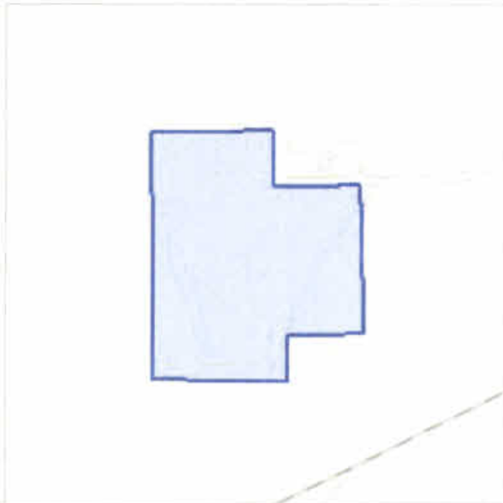
This species list is provided by:

Arizona Ecological Services Field Office
9828 North 31st Ave
#c3
Phoenix, AZ 85051-2517
(602) 242-0210

PROJECT SUMMARY

Project Code: 2024-0108338
Project Name: APS Redhawk Power Plant Expansion Project
Project Type: Power Gen - Natural Gas
Project Description: Add 8 new gas turbines at the existing Redhawk Power Plant.
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@33.331545649999995,-112.84254809925227,14z



Counties: Maricopa County, Arizona

ENDANGERED SPECIES ACT SPECIES

There is a total of 7 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Sonoran Pronghorn *Antilocapra americana sonoriensis* Population: U.S.A. (AZ), Mexico No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4750	Experimental Population, Non-Essential

BIRDS

NAME	STATUS
Cactus Ferruginous Pygmy-owl *Glaucidium brasilianum cactorum* There is **final** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/1225	Threatened
California Least Tern *Sternula antillarum browni* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8104	Endangered
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened
Yuma Ridgway's Rail *Rallus obsoletus yumanensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3505	Endangered

FISHES

NAME	STATUS
Gila Topminnow (incl. Yaqui) *Poeciliopsis occidentalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1116	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

THERE ARE NO BALD AND GOLDEN EAGLES WITHIN THE VICINITY OF YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE

SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bendire's Thrasher *Toxostoma bendirei* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9435	Breeds Mar 15 to Jul 31
Costa's Hummingbird *Calypte costae* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9470	Breeds Jan 15 to Jun 10
Gila Woodpecker *Melanerpes uropygialis* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/5960	Breeds Apr 1 to Aug 31
Leconte"s Thrasher *Toxostoma lecontei* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8969	Breeds Feb 15 to Jun 20

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)

Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)

Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

■ probability of presence ■ breeding season | survey effort – no data

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

RIVERINE

- R5UBFx

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Mark Turner
Address: 7720 N. 16th Street
City: Phoenix
State: AZ
Zip: 85020
Email mark.turner@aecom.com
Phone: 4806255533

Arizona Environmental Online Review Tool Report

Arizona Game and Fish Department Mission
To conserve Arizona's diverse wildlife resources and manage for safe, compatible outdoor recreation opportunities for current and future generations.

Project Name:

Addition of 8 gas fired turbines at the existing Redhawk Power Plant

Project Description:

The addition of 8 gas-fired turbines at the existing Redhawk Power Plant. Increase production to meet peaking energy demands.

Project Type:

Energy Production/Storage/Transfer, Energy Production (generation), gas power plant (new/expansion)

Contact Person:

Mark Turner

Organization:

AECOM

On Behalf Of:

APS

Project ID:

HGIS-22327

Please review the entire report for project type and/or species recommendations for the location information entered. Please retain a copy for future reference.

Disclaimer:

1. This Environmental Review is based on the project study area that was entered. The report must be updated if the project study area, location, or the type of project changes.
2. This is a preliminary environmental screening tool. It is not a substitute for the potential knowledge gained by having a biologist conduct a field survey of the project area. This review is also not intended to replace environmental consultation (including federal consultation under the Endangered Species Act), land use permitting, or the Departments review of site-specific projects.
3. The Departments Heritage Data Management System (HDMS) data is not intended to include potential distribution of special status species. Arizona is large and diverse with plants, animals, and environmental conditions that are ever changing. Consequently, many areas may contain species that biologists do not know about or species previously noted in a particular area may no longer occur there. HDMS data contains information about species occurrences that have actually been reported to the Department. Not all of Arizona has been surveyed for special status species, and surveys that have been conducted have varied greatly in scope and intensity. Such surveys may reveal previously undocumented population of species of special concern.
4. Arizona Wildlife Conservation Strategy (AWCS), specifically Species of Greatest Conservation Need (SGCN), represent potential species distribution models for the State of Arizona which are subject to ongoing change, modification and refinement. The status of a wildlife resource can change quickly, and the availability of new data will necessitate a refined assessment.

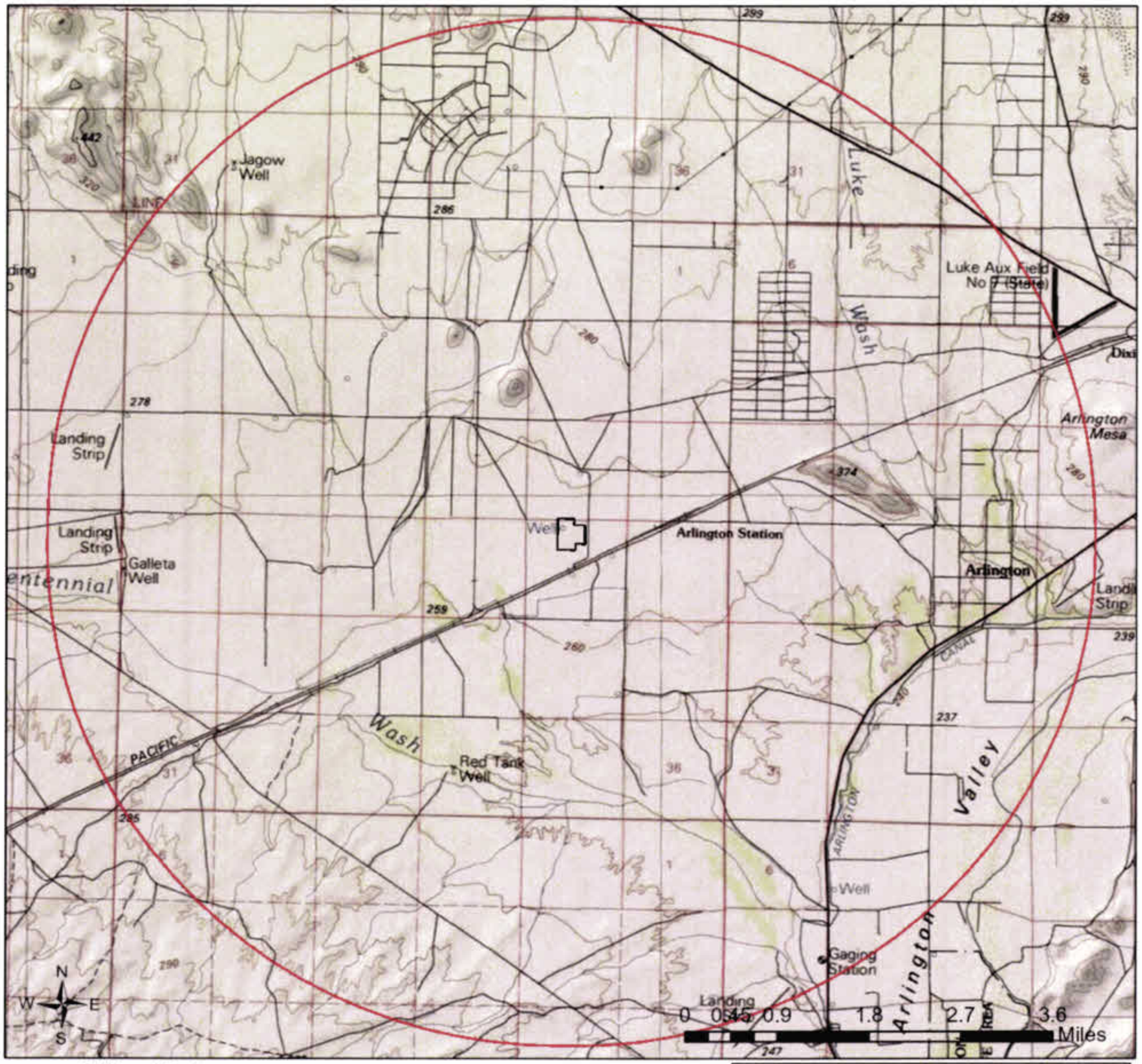
Locations Accuracy Disclaimer:
Project locations are assumed to be both precise and accurate for the purposes of environmental review. The creator/owner of the Project Review Report is solely responsible for the project location and thus the correctness of the Project Review Report content.

Recommendations Disclaimer:

1. The Department is interested in the conservation of all fish and wildlife resources, including those species listed in this report and those that may have not been documented within the project vicinity as well as other game and nongame wildlife.
2. Recommendations have been made by the Department, under authority of Arizona Revised Statutes Title 5 (Amusements and Sports), 17 (Game and Fish), and 28 (Transportation).
3. Potential impacts to fish and wildlife resources may be minimized or avoided by the recommendations generated from information submitted for your proposed project. These recommendations are preliminary in scope, designed to provide early considerations on all species of wildlife.
4. Making this information directly available does not substitute for the Department's review of project proposals, and should not decrease our opportunity to review and evaluate additional project information and/or new project proposals.
5. Further coordination with the Department requires the submittal of this Environmental Review Report with a cover letter and project plans or documentation that includes project narrative, acreage to be impacted, how construction or project activity(s) are to be accomplished, and project locality information (including site map). Once AGFD had received the information, please allow 30 days for completion of project reviews. Send requests to:
   Project Evaluation Program, Habitat Branch
   Arizona Game and Fish Department
   5000 West Carefree Highway
   Phoenix, Arizona 85086-5000
   Phone Number: (623) 236-7600
   Fax Number: (623) 236-7366
   Or
   PEP@azgfd.gov
6. Coordination may also be necessary under the National Environmental Policy Act (NEPA) and/or Endangered Species Act (ESA). Site specific recommendations may be proposed during further NEPA/ESA analysis or through coordination with affected agencies.

Addition of 8 gas fired turbines at the existing Redhawk Power Plant

USA Topo Basemap With Locator Map



Buffered Project Boundary

Project Boundary

Project Size (acres): 45.80

Lat/Long (DD): 33.3315 / -112.8428

County(s): Maricopa

AGFD Region(s): Yuma

Township/Range(s): T1S, R6W

USGS Quad(s): ARLINGTON

County of Yavapai, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS
Copyright © 2013 National Geographic Society, i-cubed
Esri, USGS

Addition of 8 gas fired turbines at the existing Redhawk Power Plant

Web Map As Submitted By User

Buffered Project Boundary

Project Boundary

Project Size (acres): 45.80

Lat/Long (DD): 33.3315 / -112.8428

County(s): Maricopa

AGFD Region(s): Yuma

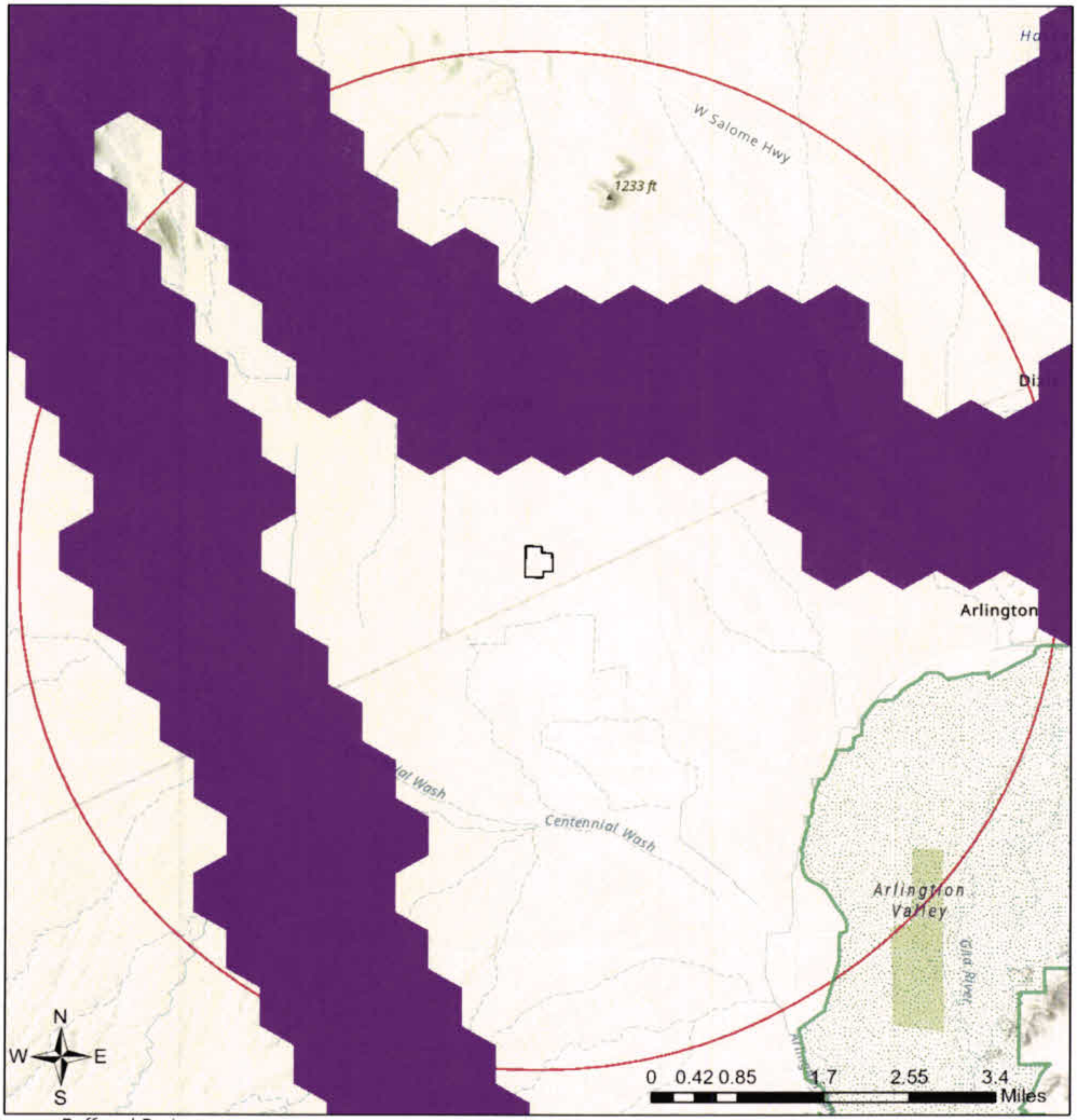
Township/Range(s): T1S, R6W

USGS Quad(s): ARLINGTON

Earthstar Geographics

Addition of 8 gas fired turbines at the existing Redhawk Power Plant

Important Areas



Buffered Project Boundary
Project Boundary
Important Bird Areas
Critical Habitat
Pinal County Riparian
Important Connectivity Zones
Wildlife Connectivity

Project Size (acres): 45.80

Lat/Long (DD): 33.3315 / -112.8428

County(s): Maricopa

AGFD Region(s): Yuma

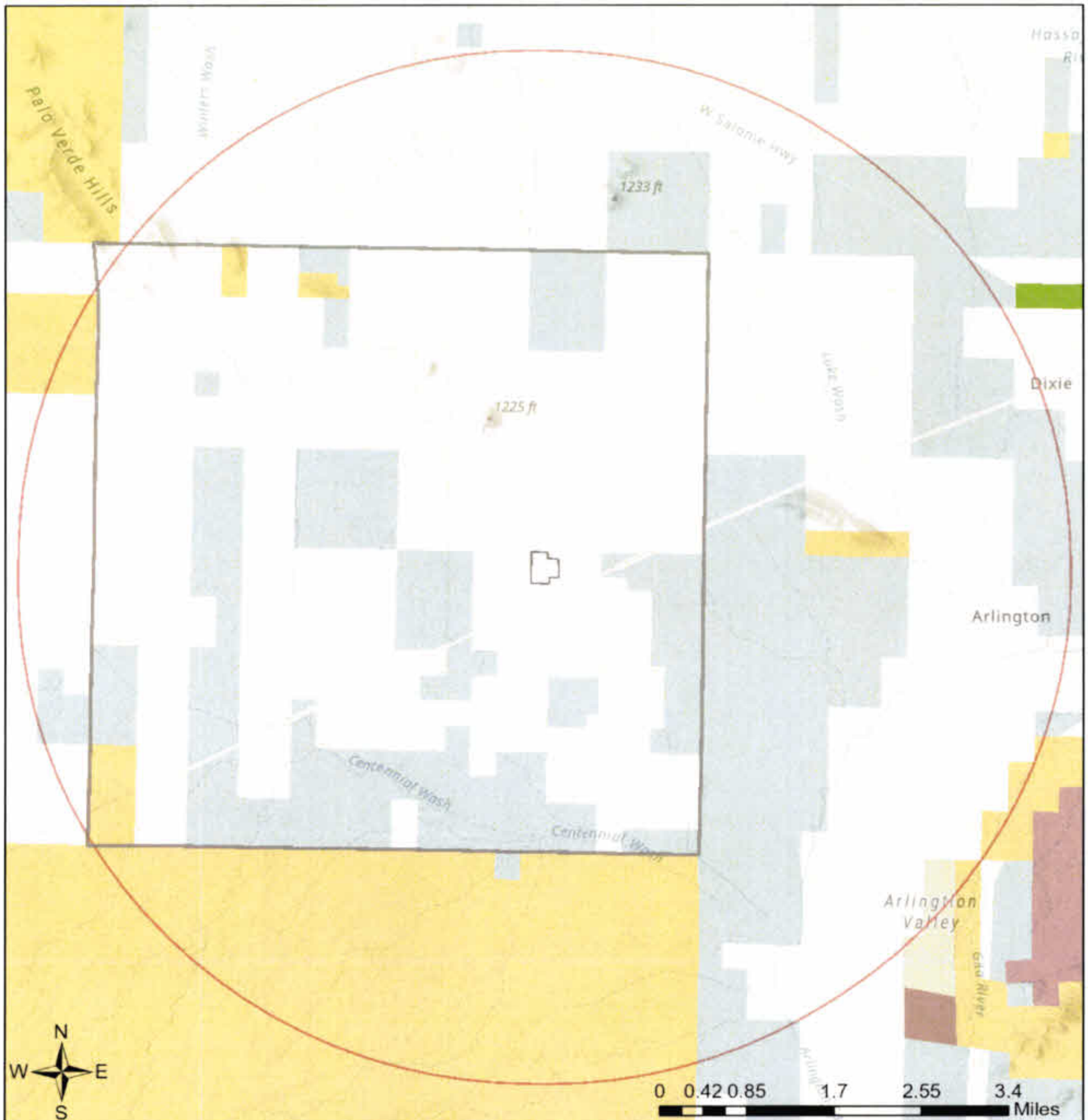
Township/Range(s): T1S, R6W

USGS Quad(s): ARLINGTON

Esri, NASA, NGA, USGS
City of Buckeye, Arizona, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

Addition of 8 gas fired turbines at the existing Redhawk Power Plant

Township/Ranges and Land Ownership



Buffered Project Boundary
Project Boundary
AZ Game & Fish Dept.
BLM
BOR
Indian Res.
Military
Mixed/Other
National Park/Mon.
Private
State & Regional Parks
State Trust
US Forest Service
Wildlife Area/Refuge
Township/Ranges

Project Size (acres): 45.80
Lat/Long (DD): 33.3315 / -112.8428
County(s): Maricopa
AGFD Region(s): Yuma
Township/Range(s): T1S, R6W
USGS Quad(s): ARLINGTON

Esri, NASA, NGA, USGS
City of Buckeye, Arizona, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

Special Status Species Documented within 5 Miles of Project Vicinity

Scientific Name	Common Name	FWS	USFS	BLM	NPL	SGCN
Amphispiza bilineata	Black-throated Sparrow					2
Antilocapra americana sonoriensis	Sonoran Pronghorn	LE,XN		S		1
Athene cunicularia hypugaea	Western Burrowing Owl	SC	S	S		2
Cylindropuntia echinocarpa	Golden Cholla				SR	
Incilius alvarius	Sonoran Desert Toad					2
Melozone aberti	Abert's Towhee		S			2
Rallus obsoletus yumanensis	Yuma Ridgway's Rail	LE		S		1
Spizella breweri	Brewer's Sparrow					2
Toxostoma lecontei	LeConte's Thrasher			S		2

Note: Status code definitions can be found at https://www.azgfd.com/wildlife-conservation/on-the-ground-conservation/state-wildlife-action-plan/state-wildlife-action-plan-status-definitions/.

No Special Areas Detected
No special areas were detected within the project vicinity.

Species of Greatest Conservation Need Predicted that Intersect with Project Footprint as Drawn, based on Predicted Range Models

Scientific Name	Common Name	FWS	USFS	BLM	NPL	SGCN
Anthus spragueii	Sprague's Pipit	SC				2
Antilocapra americana sonoriensis	Sonoran Pronghorn	LE,XN		S		1
Artemisiospiza nevadensis	Sagebrush Sparrow					
Athene cunicularia hypugaea	Western Burrowing Owl	SC	S	S		2
Auriparus flaviceps	Verdin					2
Botaurus lentiginosus	American Bittern					2
Buteo regalis	Ferruginous Hawk	SC		S		2
Buteo swainsoni	Swainson's Hawk					2
Calcarius ornatus	Chestnut-collared Longspur					2
Calypte costae	Costa's Hummingbird					2
Campylorhynchus brunneicapillus	Cactus Wren					2
Chaetodipus baileyi	Bailey's Pocket Mouse					2
Coccyzus americanus	Yellow-billed Cuckoo (Western DPS)					
Colaptes chrysoides	Gilded Flicker			S		2
Columbina inca	Inca Dove					2
Empidonax wrightii	Gray Flycatcher					2
Eumops perotis californicus	Greater Western Bonneted Bat					
Falco mexicanus	Prairie Falcon					2
Falco peregrinus anatum	American Peregrine Falcon					
Falco sparverius	American Kestrel					2
Gopherus morafkai	Sonoran Desert Tortoise	CCA	S	S		1
Icterus bullockii	Bullock's Oriole					2

Species of Greatest Conservation Need Predicted that Intersect with Project Footprint as Drawn, based on Predicted Range Models

Scientific Name	Common Name	FWS	USFS	BLM	NPL	SGCN
Incilius alvarius	Sonoran Desert Toad					2
Lanius ludovicianus	Loggerhead Shrike	SC				2
Lasiurus blossevillii	Western Red Bat		S			2
Lasiurus xanthinus	Western Yellow Bat		S			2
Macrotus californicus	California Leaf-nosed Bat	SC		S		2
Megascops kennicottii	Western Screech-owl					
Melanerpes uropygialis	Gila Woodpecker					2
Melospiza lincolnii	Lincoln's Sparrow					2
Myotis velifer	Cave Myotis	SC		S		2
Myotis yumanensis	Yuma Myotis	SC				2
Nyctinomops femorosaccus	Pocketed Free-tailed Bat					2
Parabuteo unicinctus	Harris's Hawk					2
Passerculus sandwichensis	Savannah Sparrow					2
Pooecetes gramineus	Vesper Sparrow					2
Spizella breweri	Brewer's Sparrow					2
Tadarida brasiliensis	Brazilian Free-tailed Bat					
Toxostoma bendirei	Bendire's Thrasher					2
Toxostoma lecontei	LeConte's Thrasher			S		2

Species of Economic and Recreation Importance Predicted that Intersect with Project Footprint as Drawn

Scientific Name	Common Name	FWS	USFS	BLM	NPL	SGCN
Callipepla gambelii	Gambel's Quail					
Pecari tajacu	Javelina					
Puma concolor	Mountain Lion					
Zenaida asiatica	White-winged Dove					
Zenaida macroura	Mourning Dove					

Project Type: Energy Production/Storage/Transfer, Energy Production (generation), gas power plant (new/expansion)

Project Type Recommendations:
During the planning stages of your project, please consider the local or regional needs of wildlife in regards to movement, connectivity, and access to habitat needs. Loss of this permeability prevents wildlife from accessing resources, finding mates, reduces gene flow, prevents wildlife from re-colonizing areas where local extirpations may have occurred, and ultimately prevents wildlife from contributing to ecosystem functions, such as pollination, seed dispersal, control of prey numbers, and resistance to invasive species. In many cases, streams and washes provide natural movement corridors for wildlife and should be maintained in their natural state. Uplands also support a large diversity of species, and should be contained within important wildlife movement corridors. In addition, maintaining biodiversity and ecosystem functions can be facilitated through improving designs of structures, fences, roadways, and culverts to promote passage for a variety of wildlife. Guidelines for many of these can be found at: https://www.azgfd.com/wildlife-conservation/planning-for-wildlife/planning-for-wildlife-wildlife-friendly-guidelines/.

Consider impacts of outdoor lighting on wildlife and develop measures or alternatives that can be taken to increase human safety while minimizing potential impacts to wildlife. Conduct wildlife surveys to determine species within project area, and evaluate proposed activities based on species biology and natural history to determine if artificial lighting may disrupt behavior patterns or habitat use. Use only the minimum amount of light needed for safety. Narrow spectrum bulbs should be used as often as possible to lower the range of species affected by lighting. All lighting should be shielded, canted, or cut to ensure that light reaches only areas needing illumination.

Minimize the potential introduction or spread of exotic invasive species, including aquatic and terrestrial plants, animals, insects and pathogens. Precautions should be taken to wash and/or decontaminate all equipment utilized in the project activities before entering and leaving the site. See the Arizona Department of Agriculture website for a list of prohibited and restricted noxious weeds at https://www.invasivespeciesinfo.gov/unitedstates/az.shtml and the Arizona Native Plant Society https://aznps.com/invas for recommendations on how to control. To view a list of documented invasive species or to report invasive species in or near your project area visit iMapInvasives - a national cloud-based application for tracking and managing invasive species at https://imap.natureserve.org/imap/services/page/map.html.

- To build a list: zoom to your area of interest, use the identify/measure tool to draw a polygon around your area of interest, and select "See What's Here" for a list of reported species. To export the list, you must have an account and be logged in. You can then use the export tool to draw a boundary and export the records in a csv file.

Minimization and mitigation of impacts to wildlife and fish species due to changes in water quality, quantity, chemistry, temperature, and alteration to flow regimes (timing, magnitude, duration, and frequency of floods) should be evaluated. Minimize impacts to springs, in-stream flow, and consider irrigation improvements to decrease water use. If dredging is a project component, consider timing of the project in order to minimize impacts to spawning fish and other aquatic species (include spawning seasons), and to reduce spread of exotic invasive species. We recommend early direct coordination with Project Evaluation Program for projects that could impact water resources, wetlands, streams, springs, and/or riparian habitats.

The Department recommends that wildlife surveys are conducted to determine if noise-sensitive species occur within the project area. Avoidance or minimization measures could include conducting project activities outside of breeding seasons.

Based on the project type entered, coordination with the Environmental Protection Agency may be required (http://www.epa.gov/).

For any powerlines built, proper design and construction of the transmission line is necessary to prevent or minimize risk of electrocution of raptors, owls, vultures, and golden or bald eagles, which are protected under state and federal laws. Limit project activities during the breeding season for birds, generally March through late August, depending on species in the local area (raptors breed in early February through May). Conduct avian surveys to determine bird species that may be utilizing the area and develop a plan to avoid disturbance during the nesting season. For underground powerlines, trenches should be covered or back-filled as soon as possible. Incorporate escape ramps in ditches or fencing along the perimeter to deter small mammals and herpetofauna (snakes, lizards, tortoise) from entering ditches. In addition, indirect affects to wildlife due to construction (timing of activity, clearing of rights-of-way, associated bridges and culverts, affects to wetlands, fences) should also be considered and mitigated.

Based on the project type entered, coordination with State Historic Preservation Office may be required (https://azstateparks.com/).

Based on the project type entered, coordination with Arizona Department of Environmental Quality may be required (http://www.azdeq.gov/).

Based on the project type entered, coordination with Arizona Department of Water Resources may be required (https://new.azwater.gov/).

Vegetation restoration projects (including treatments of invasive or exotic species) should have a completed site-evaluation plan (identifying environmental conditions necessary to re-establish native vegetation), a revegetation plan (species, density, method of establishment), a short and long-term monitoring plan, including adaptive management guidelines to address needs for replacement vegetation.

The Department requests further coordination to provide project/species specific recommendations, please contact Project Evaluation Program directly at PEP@azgfd.gov.

Avoid/minimize wildlife impacts related to contacting hazardous and other human-made substances in facility water collection/storage basins, evaporation or settling ponds and/or facility storage yards. Design slopes to discourage wading birds and use fencing, netting, hazing or other measures to exclude wildlife.

The Department encourages the use of technology that requires minimal amounts of water, preferably dry cooling. In the desert, water is very scarce and reducing consumption will lessen impacts on wildlife as well as the public.

Project Location and/or Species Recommendations:
HDMS records indicate that one or more native plants listed on the **Arizona Native Plant Law and Antiquities Act** have been documented within the vicinity of your project area. Please contact:
Arizona Department of Agriculture
1688 W Adams St.
Phoenix, AZ 85007
Phone: 602.542.4373
https://agriculture.az.gov/sites/default/files/Native%20Plant%20Rules%20-%20AZ%20Dept%20of%20Ag.pdf starts on page 44

HDMS records indicate that one or more **Listed, Proposed, or Candidate** species or **Critical Habitat** (Designated or Proposed) have been documented in the vicinity of your project. The Endangered Species Act (ESA) gives the US Fish and Wildlife Service (USFWS) regulatory authority over all federally listed species. Please contact USFWS Ecological Services Offices at https://www.fws.gov/office/arizona-ecological-services or:

Phoenix Main Office
9828 North 31st Avenue #C3
Phoenix, AZ 85051-2517
Phone: 602-242-0210
Fax: 602-242-2513

Tucson Sub-Office
201 N. Bonita Suite 141
Tucson, AZ 85745
Phone: 520-670-6144
Fax: 520-670-6155

Flagstaff Sub-Office
SW Forest Science Complex
2500 S. Pine Knoll Dr.
Flagstaff, AZ 86001
Phone: 928-556-2157
Fax: 928-556-2121

Exhibit D
Biological Resources

As stated in Arizona Corporation Commission Rules of Practice and Procedure R-14-3-220, Exhibit 1:

> "List the fish, wildlife, plant life, and associated forms of life in the vicinity of the proposed site or route and describe the effects, if any, other proposed facilities will have thereon."

Overview

For the purposes of the application for a Certificate of Environmental Compatibility (CEC), this exhibit analyzes biological resources and impacts related to the construction and operation of the Redhawk Power Plant Expansion Project (Expansion Project). Biological resources were studied within one (1) mile of the Expansion Project site, creating the Study Area shown in **Figure D-1**.

The elevation at the Expansion Project area is approximately 850 feet above mean sea level. The topography of the surrounding area is flat ground, with the prominent land cover classes being agricultural fields and open desert. The City of Buckeye is located approximately 14.5 miles east, Arlington Mountain is located approximately 2 miles east, and the Gila River is approximately 4.5 miles southeast of the Expansion Project. The Study Area is within Section 14 and 23 of Township 1 South, Range 6 West, Gila-Salt River Baseline and Meridian, Arizona, U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle.

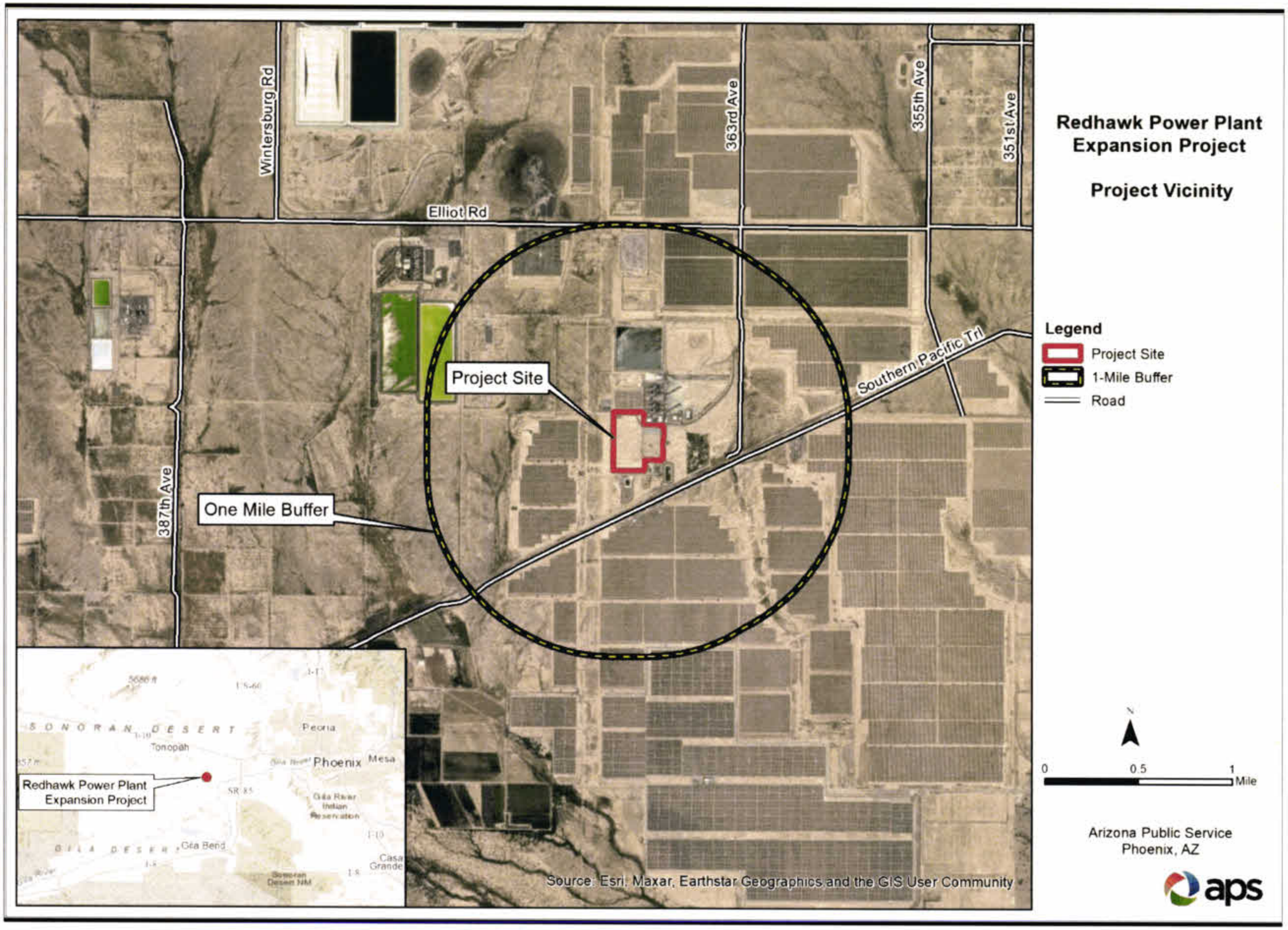
The Study Area is in the Lower Colorado River Valley subdivision of the Sonoran Desertscrub biome (Brown 1994). The Lower Colorado River Valley subdivision is characterized by high temperatures and low precipitation and is the most arid subdivision of the Sonoran Desert. All Expansion Project features and ground disturbances are located within the ownership boundaries of the existing Arizona Public Service Company (APS) Redhawk Power Plant, meaning the area is highly developed with little native desert components remaining. Overall, the biotic environment is heavily disturbed throughout the Study Area. Land use consists of the existing Redhawk Power Plant, which is highly industrialized and modified from the original desert landscape, while the rest of the Study Area is a mix of agriculture and open desert.

Biological Resources Information

Desktop-level review of the Study Area included general wildlife, sensitive habitats, soils, streams, wetlands, and irrigation canals. Prior CEC application data was reviewed to the extent relevant. The below publicly available data was also reviewed:

- Aerial photography (Google Earth, Esri online imagery)
- USGS 7.5-minute topographic maps for the Gila-Salt River quadrangle
- Wetlands data from the U.S. Fish and Wildlife Service National Wetland Inventory (NWI) (USFWS 2024)
- Surface water features data from the U.S. Environmental Protection Agency Waters Mapper (EPA 2024)
- Floodplain data from the Federal Emergency Management Agency (FEMA) Flood Map Service Center (FEMA 2024)
- Soil data from the National Resources Conservation Service Web Soil Survey (USDA 2024)

Figure D-1. Expansion Project Vicinity Map



- Arizona Game and Fish Department (AZGFD) Online Environmental Review Tool (AZGFD 2024)
- Land cover data from the Southwest Regional Gap Analysis Project (USGS 2024)

The data was used to develop a characterization of the biological resources in the Study Area. The impact analysis focused on vegetation communities, existing human disturbance, the presence of riparian or wetland habitats, and other habitats for special-status species and species of concern. No field surveys were performed to validate desktop analysis.

The native vegetation communities in the Study Area includes the Lower Colorado River Valley subdivision of the Sonoran Desertscrub biotic community. Two freshwater ponds that are classified as potential PUBF (palustrine, unconsolidated bottom, semi-permanently flooded) wetlands and one water feature that is classified as a potential L2UBH (lacustrine, littoral, unconsolidated bottom, permanently flooded) wetland are in the Study Area based on NWI data (USFWS 2024). These water features were constructed by the power plant and used as part of plant operations. Two drainages, a R4SBC (riverine, intermittent, streambed, seasonally flooded) drainage and a R5UBFx (riverine, unknown perennial, unconsolidated bottom, semi-permanently flooded) drainage, are associated with the Study Area but will not be disturbed by the Expansion Project. Most of the Expansion Project and surrounding area are classified by FEMA as areas of minimal flood hazard (*Zone X*), with a small percentage of the eastern edges of the Study Area classified as a Special Flood Hazard Area (*Zone A*) (FEMA 2024). A summary of the vegetation community and a list of the representative wildlife species found within the Expansion Project Area can be found below (**Table D-1**). The representative wildlife species were derived from the AZGFD Online Environmental Review Tool, which used prior wildlife observations and potential range maps to predict species that could possibly utilize this area.

Lower Colorado River Valley Subdivision/Sonoran Desertscrub Community

Native vegetation is limited in the Study Area, as the land has been industrialized into the existing power plant and with some open desert in the surrounding area. The Lower Colorado River Valley Subdivision of Sonoran Desertscrub is the most arid portion of the Sonoran Desert. Native vegetation in the Study Area is typically dominated by low, open stands of creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Cacti including saguaro (*Carnegiea gigantea*) and fishhook barrel cactus (*Ferocactus wislizenii*), though present in the Expansion Project vicinity, are less abundant than in regions with upland desertscrub areas. In undisturbed areas of this vegetation community, trees and taller vegetation are largely confined to washes and other drainages. However, the drainages within the Study Area pass through highly industrialized areas of the power plant and do not retain the typical larger vegetation. Within the Expansion Project vicinity, smaller areas of low, undrained, and salt-affected soils are commonly dominated by four-wing saltbush (*Atriplex canescens*), catclaw acacia (*Acacia greggii*), and velvet mesquite (*Prosopis velutina*). Other conspicuous species in a typical Sonoran Desertscrub community include desertbroom (*Baccharis sarothroides*), chuparosa (*Justicia californica*), jumping cholla (*Cylindropuntia fulgida*), ironwood (*Olneya tesota*), and blue paloverde (*Parkinsonia florida*) (Brown 1994; USGS 2005, 2024).

Table D-1. Representative Wildlife Species Associated within the CEC Expansion Project Area

Species	Habitat Requirements	Habitat Suitability
REPTILES		
• Variable sandsnake (Chilomeniscus stramineus) • Sonoran desert tortoise (*Gopherus morafkai*)	Variable sandsnakes can be found throughout the desertscrub, shrubland, thornscrub and sandy washes of the Sonoran Desert (Brennan and Holycross 2009).	Not likely to occur. Some Sonoran scrub vegetation occurs on the within the Study Area, with larger patches throughout the Expansion Project vicinity.

Species	Habitat Requirements	Habitat Suitability
	Sonoran desert tortoises often prefer upland habitats (Brown et al. 1979).	
BIRDS		
• American bittern (*Botaurus lentiginosus)* • Brewer's sparrow (*Spizella breweri*) • Ferruginous hawk (*Buteo regalis*) • Gila woodpecker (*Melanerpes uropygialis*) • Gilded flicker (*Colaptes chrysoides*) • Lincoln's sparrow (*Melospiza lincolnii)* • Loggerhead shrike (*Lanius ludovicianus*) • Prairie falcon (*Falco mexicanus*) • Savannah sparrow (*Passerculus sandwichensis*) • Vesper sparrow (*Pooecetes gramineus*) • Western burrowing owl (*Athene cunicularia hypugaea*)	Birds such as American bittern, Gila woodpecker, and Lincoln's sparrow prefer denser, larger riparian vegetation near streams and rivers (NatureServe 2024a, 2024b). Western burrowing owl are known to inhabit the perimeter of agricultural fields (AZGFD 2022). Savannah and vesper sparrows are often found in agricultural fields, where they can move across the ground to find food (AOU 1983; Wheelwright and Rising 1993)	A lack of distinct riparian habitat makes it unlikely that many of the species will be present. Some sparrow species that utilize agricultural fields and open desert may be present seasonally. Suitable habitat for western burrowing owl is found in the agriculture fields and along the edges of the power plant.
MAMMALS		
• Western red bat (*Lasiurus blossevillii*) • Western yellow bat (*Lasiurus xanthinus*) • Cave myotis (*Myotis velifer*) • Yuma myotis (*Myotis yumanensis*) • Brazilian free-tailed bat (*Tadarida brasiliensis*) • Bailey's pocket mouse (*Chaetodipus baileyi*) • Sonoran pronghorn (*Antilocapra americana sonoriensis*)	Bat species occupy diverse habitats in the southwestern U.S., including coniferous woodlands, dense riparian trees, and desert habitats (Ammerman et al. 2012; Davidai et al. 2015; Genoways and Jones 1968). Bailey's pocket mice are found in open desert areas with sparse shrub coverage (Hoffmeister 1986). Sonoran pronghorn are found in open desert valleys with open sight lines and space to move around to avoid predation (AZGFD 2023).	Not likely to occur. Some bat species could be foraging across agricultural fields and the freshwater ponds within the power plant, but the likelihood of residence in the Expansion Project area is low. Bailey's pocket mice could be found around the edges of the power plant where they can travel between the native vegetation of the surrounding area. Sonoran pronghorn are an experimental population of limited size and are highly unlikely to be found near the Expansion Project.
AMPHIBIANS		
• Sonoran desert toad (*Incilius alvarius*)	Sonoran desert toads are often found in Sonoran desertscrub but also in semidesert grasslands and Madrean woodlands. Strongly associated with ephemeral waterways where pooling occurs during the monsoon season (Brennan and Holycross 2009).	Not likely to occur. Flooding during monsoon rains could potentially create temporary suitable habitat, but unlikely.

Native Plants

The Arizona Native Plant Law (ANPL) (A.R.S. §§ 3-901 to 3-916) is administered by the Arizona Department of Agriculture (AZDA), who manages native plant resources and impacts to protected native plant species. ANPL-listed plants include four protection categories: Highly Safeguarded, Salvage Restricted, Salvage Assessed, and Harvest Restricted. Landowners have the right to destroy or remove native plants growing on their land, but they are required to notify the AZDA at least 60 days prior to the destruction of any protected native plants. At the time of the notification, the landowner can state if they will allow salvage companies an opportunity to salvage the plants or if they intend to destroy them. Removal of protected native plants from the site will require tags/permits from the AZDA. The landowner is allowed to transplant healthy native trees within the site without a permit or notification. It is anticipated that no native trees or cacti will be removed as part of this Expansion Project.

Analysis

The Expansion Project

The Expansion Project Study Area is comprised of the existing APS Redhawk Power Plant and the proposed expansion site located within APS ownership boundaries. The Expansion Project is surrounded by agricultural fields with some patches of native vegetation in open desert. The Study Area retains minimal natural vegetation and will be unlikely to attract or support native wildlife. Potential impacts to wildlife are anticipated to be low, short-term in duration, and mostly limited to effects from construction activities such as noise. Tall power lines, towers, and other support structures may pose a risk of collision for birds and other flying species.

Conclusion

Construction of the Expansion Project will occur on already disturbed lands that provide minimal wildlife habitat values. Wildlife species are not expected to experience long-term detrimental impacts from the loss or alteration of vegetative cover within the Study Area given the already disturbed nature of the lands proposed for use by the Expansion Project and on the availability of other suitable and unaffected habitats in the vicinity of the Expansion Project.

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Exhibit E
Scenic Areas, Historic Sites and Structures, and Archaeological Sites

As stated in Arizona Corporation Commission Rules of Practice and Procedure R-14-3-220, Exhibit 1:

> "Describe any existing scenic areas, historic sites and structures, or archaeological sites in the vicinity of the proposed facilities and state the effects, if any, the proposed facilities will have thereon."

Overview

For the purposes of the application for a Certificate of Environmental Compatibility (CEC), this exhibit analyzes the inventory and potential effects associated with scenic or visual resources as well as with existing historic sites and structures, or archaeological sites, related to the construction and operation of the Redhawk Power Plant Expansion Project (Expansion Project). Potential impacts will be related to the construction and operation of the eight (8) new GE LM6000 turbines, with each turbine having a nameplate capacity of 49.6 megawatts. The Study Area boundaries for the environmental review of the proposed Expansion Project include areas within 1 mile of the Expansion Project site (**Figure E-1**).

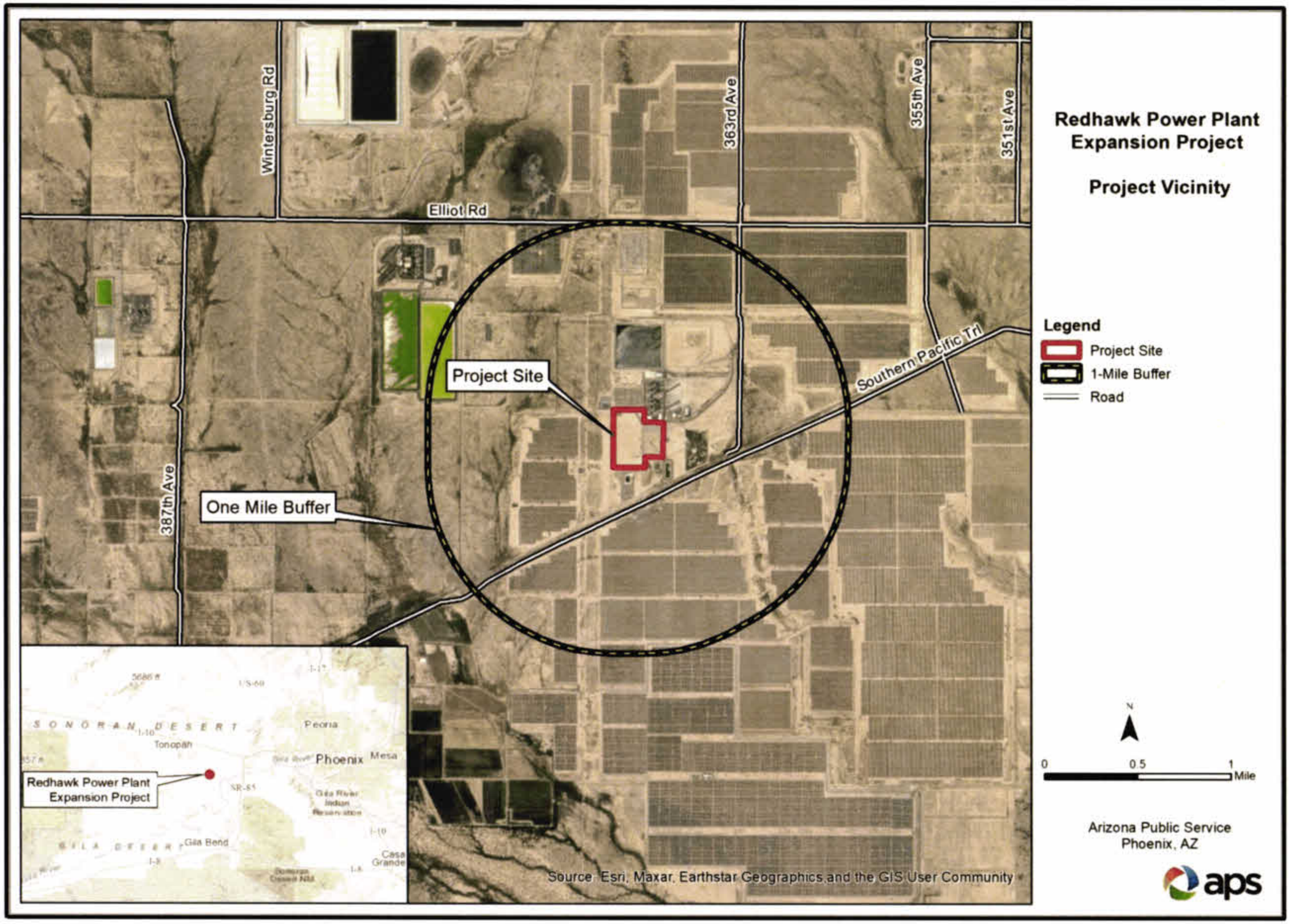
The elevation in the Expansion Project site is approximately 850 feet above mean sea level. The topography of the surrounding area is flat ground, with the prominent land cover classes being agricultural fields and open desert. The City of Buckeye is located approximately 14.5 miles east, Arlington Mountain is located approximately two (2) miles east, and the Gila River flows approximately 4.5 miles southeast of the Expansion Project. The Study Area can be found on the Gila-Salt River Baseline and Meridian, Arizona, U.S. Geological Survey 7.5-minute topographic quadrangle. The Study Area is within Section 14 and 23 of Township 1 South, Range 6 West.

Scenic Areas

The methodology for this assessment is provided below and includes separate discussions for scenery and sensitive viewers. The methodology is followed by the results of the inventory and impact assessment, both of which also include separate discussions for scenery (e.g., scenic quality) and sensitive viewers. The Expansion Project does not involve lands managed by the Bureau of Land Management, U.S. Forest Service, or any other federal, state, or county agencies that require conformance with visual resource management objectives or management guidelines. A discussion of the existing historic sites and structures and archaeological sites and associated impacts follows the discussion on scenic areas.

The purpose of the scenic area impact assessment is to identify and characterize the level of visual modification in the landscape that will result from the construction and operation of the Expansion Project. Modification of the landscape is described in levels of visual contrast, which can potentially affect both scenic quality and sensitive viewers. A 1-mile area (Study Area) was used to identify scenic areas around the Expansion Project at the existing Redhawk Power Plant.

Exhibit E-1. Expansion Project Study Area



The Expansion Project is located west of Buckeye, south of Wintersburg, and approximately 3.5 miles northwest of Arlington Valley along the Gila River. There are very few paved roads within the Study Area, with Elliot Road providing east-west access through the Study Area and South 363rd Avenue providing north-south access. The South 363rd Avenue corridor in the southern part of the Study Area turns into Narramore Road and connects southeast into Arlington Valley along the Gila River. Salome Highway, located approximately five (5) miles north of the Expansion Project, is a two-lane east-west county roadway connecting local communities in western Maricopa County. Interstate Highway 10 is located approximately nine (9) miles north of the Expansion Project.

The landscape surrounding the Expansion Project site can be characterized as flat with expansive views (see **Figure E-6**). Generally, the Study Area consists of power generation facilities such as Palo Verde Generating Station, Mesquite Power Plant, several solar generation facilities, agricultural lands along Centennial Wash, a rural residential neighborhood located mainly east of South 355th Avenue, and the Arlington Elementary School located along the west side of South 355th Avenue and south of Dobbins Road.

Inventory data for visual resources within the Study Area were collected from aerial photography and field review. The inventory focused on landscape character, determination of scenic quality, identification of sensitive viewers, and viewing conditions (e.g., distance zones, viewer orientation, and screening). Expansive views within the Study Area allow for the surrounding mountain ranges to be seen during normal conditions. The Palo Verde Mountains are approximately five (5) to eight (8) miles northwest, Saddle Mountain is approximately 13 miles northwest, Power Butte Recreational Area is located approximately six (6) miles southeast, and the Gila Bend Mountains are located approximately 12 miles south.

In consideration of the sensitivity of viewers, existing residential neighborhoods are typically considered to be of high sensitivity. Within three (3) miles and mostly northeast of the Expansion Project site, there are approximately 200 single-family homes. These residences are mainly concentrated east of South 355th Avenue, south of Dobbins Road, and north of Elliot Road. The existing power plants and associated electrical infrastructure are visible from the residential neighborhoods but do not significantly hinder the expansive views of the surrounding mountains.

The most visible components of the Expansion Project from all viewpoints will be the exhaust stacks, which are approximately 85 feet in height. A new water tank approximately 50 feet in height will also be visible from numerous viewpoints. Sensitive viewpoints consist of locations from which a significant number of people who have a concern for scenic resources will view a landscape or be exposed to Expansion Project activities. Sensitive viewpoints are generally located on transportation routes, residential areas, and recreational use areas. Visual simulations showing the power plant features from key observation points are included as **Figures E-2** through **E-15**. Both daytime and nighttime simulations have been prepared.

Analysis

Inventory of Scenic and Recreational Resources

There were no scenic or recreational resources identified within the Study Area. The landscape character of the area is flat and expansive with little natural vegetation. The surrounding mountain ranges are approximately five (5) to more than 13 miles away from the Expansion Project location. These mountains can be seen during clear conditions from throughout the Study Area. Existing electrical power lines and solar panels may briefly hinder views directly in their line of sight from the traveling public but do not significantly block views from a distance.

Figure E-2. KOP 1 Existing Conditions: Looking West Along Narramore Road

The Project
Figure E-2

KOP 1
Existing Conditions
Looking West along Narramore Road

Project Location Map

Photograph Information

Time of photograph:	11:37 am
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	West
Latitude:	33°19'49.416" N
Longitude:	112°49'58.458" W
Distance to project:	0.5 mile

February 2024

Figure E-3. KOP 1 Simulated Conditions: Looking West Along Narramore Road

The Project
Figure E-3

KOP 1
Simulated Conditions
Looking West along Narramore Road

Project Location Map

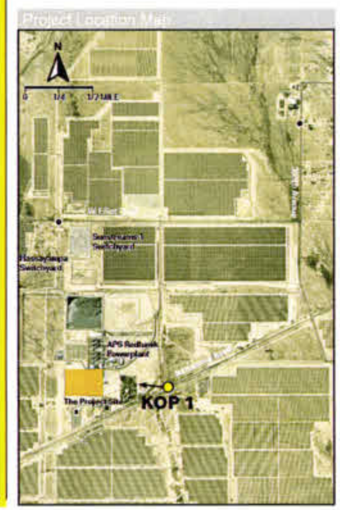
Photograph Information

Time of photograph:	11:37 am
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	West
Latitude:	33°19'49.416" N
Longitude:	112°49'58.458" W
Distance to project:	0.5 mile

Figure E-4. KOP 1 Existing Conditions – Night: Looking West Along Narramore Road

The Project
Figure E-4

KOP 1
Existing Conditions - Night
Looking West along Narramore Road



Photograph Information

Time of photograph:	9:25 pm
Date of photograph:	1-29-2024
Weather condition:	Clear, full moon
Viewing direction:	West
Latitude:	33°19'49.416" N
Longitude:	112°49'58.458" W
Distance to project:	0.5 mile

February 2024

Figure E-5. KOP 1 Simulated Conditions – Night: Looking West Along Narramore Road

The Project
Figure E-5

KOP 1
Simulated Conditions - Night
Looking West along Narramore Road

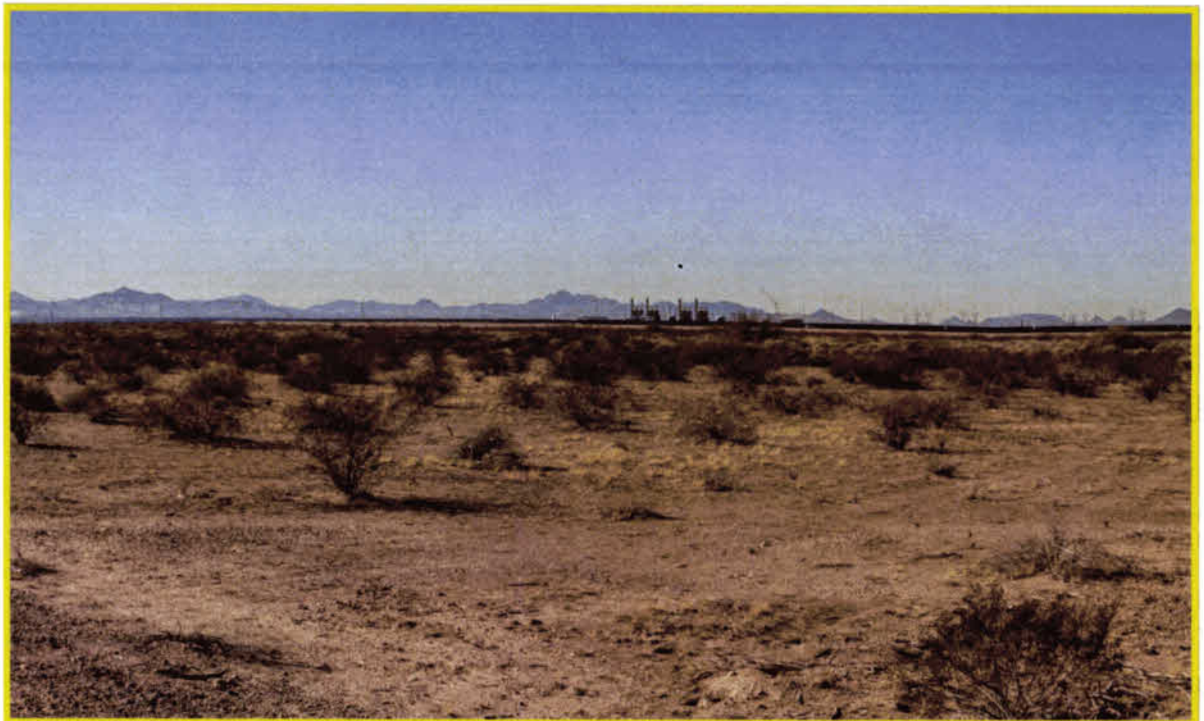
Project Location Map

Photograph Information

Time of photograph:	9:25 pm
Date of photograph:	1-29-2024
Weather condition:	Clear, full moon
Viewing direction:	West
Latitude:	33°19'49.416" N
Longitude:	112°49'58.458" W
Distance to project:	0.5 mile

February 2024

Figure E-6. KOP 2 Existing Conditions: Looking South Along 355th Avenue Near Residences and Arlington Elementary School



The Project
Figure E-6

KOP 2
Existing Conditions
Looking South along 355th Avenue
near residences and
Arlington Elementary School

Project Location Map

Photograph Information

Time of photograph:	11:05 am
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	South
Latitude:	33°21'31.236" N
Longitude:	112°48'57.36" W
Distance to project:	2.3 miles

February 2024

Figure E-7. KOP 2 Simulated Conditions: Looking South Along 355th Avenue Near Residences and Arlington Elementary School

The Project
Figure E-7

KOP 2
Simulated Conditions
Looking South along 355th Avenue
near residences and
Arlington Elementary School

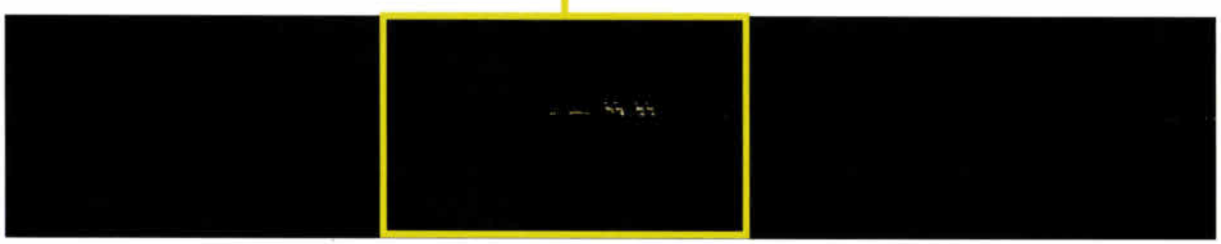
Project Location Map

Photograph Information

Time of photograph:	11:05 am
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	South
Latitude:	33°21'31.236" N
Longitude:	112°48'57.36" W
Distance to project:	2.3 miles

February 2024

Figure E-8. KOP 2 Existing Conditions – Night: Looking South Along 355th Avenue Near Residences and Arlington Elementary School



The Project
Figure E-8

KOP 2
Existing Conditions - Night
Looking South along 355th Avenue
near residences and
Arlington Elementary School

Project Location Map

Photograph Information

Time of photograph:	9:00 pm
Date of photograph:	1-29-2024
Weather condition:	Clear, full moon
Viewing direction:	South
Latitude:	33°21'31.236" N
Longitude:	112°48'57.36" W
Distance to project:	2.3 miles

February 2024

Figure E-9. KOP 2 Simulated Conditions – Night: Looking South Along 355th Avenue Near Residences and Arlington Elementary School

The Project
Figure E-9

KOP 2
Simulated Conditions - Night
Looking South along 355th Avenue
near residences and
Arlington Elementary School

Project Location Map

Photograph Information

Time of photograph:	9:00 pm
Date of photograph:	1-29-2024
Weather condition:	Clear, full moon
Viewing direction:	South
Latitude:	33°21'31.236" N
Longitude:	112°48'57.36" W
Distance to project:	2.3 miles

February 2024

Figure E-10. KOP 3 Existing Conditions: Looking Southeast Along West Elliot Road

The Project
Figure E-10

KOP 3
Existing Conditions
Looking Southeast along West Elliot Road

Project Location Map

Photograph Information

Time of photograph:	12:11 pm
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	Southeast
Latitude:	33°20'53.868" N
Longitude:	112°51'30.966" W
Distance to project:	1.5 miles

February 2024

Figure E-11. KOP 3 Simulated Conditions: Looking Southeast Along West Elliot Road

The Project
Figure E-11

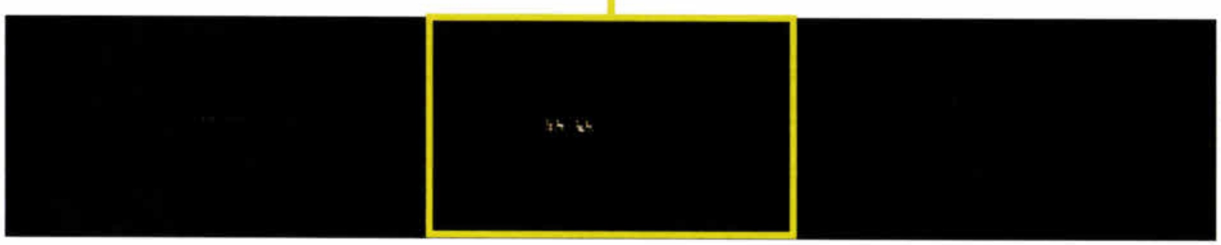
KOP 3
Simulated Conditions
Looking Southeast along West Elliot Road

Photograph Information

Time of photograph:	12:11
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	Southeast
Latitude:	33°20'53.868" N
Longitude:	112°51'30.966" W
Distance to project:	1.5 miles

February 2024

Figure E-12. KOP 3 Existing Conditions – Night: Looking Southeast Along West Elliot Road



The Project
Figure E-12

KOP 3
Existing Conditions - Night
Looking Southeast along West Elliot Road

Project Location Map

Photograph Information

Time of photograph:	9:11 pm
Date of photograph:	1-29-2024
Weather condition:	Clear-full moon
Viewing direction:	Southeast
Latitude:	33°20'53.868" N
Longitude:	112°51'30.966" W
Distance to project:	1.5 miles

February 2024

Figure E-13 KOP 3 Simulated Conditions – Night: Looking Southeast Along West Elliot Road

The Project
Figure E-13

KOP 3
Simulated Conditions - Night
Looking Southeast along West Elliot Road

Project Location Map

Photograph Information

Time of photograph:	9:11 pm
Date of photograph:	1-29-2024
Weather condition:	Clear-full moon
Viewing direction:	Southeast
Latitude:	33°20'53.868" N
Longitude:	112°51'30.966" W
Distance to project:	1.5 miles

February 2024

Figure E-14. KOP 4 Existing Conditions – Day: Looking Southwest from West Elliot Road and 355th Avenue Intersection

The Project
Figure E-14

KOP 4
Existing Conditions
Looking Southwest from residences near West Elliot Road and 355th Avenue

Project Location Map

Photograph Information

Time of photograph:	11:45 am
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	Southwest
Latitude:	33°20'54.438" N
Longitude:	112°48'57.438" W
Distance to project:	1.8 miles

June 2024

Figure E-15. KOP 4 Simulated Conditions – Day: Looking Southwest from West Elliot Road and 355th Avenue Intersection

The Project
Figure E-15

KOP 4
Simulated Conditions
Looking Southwest from residences near West Elliot Road and 355th Avenue

Project Location Map

Photograph Information

Time of photograph:	11:45 am
Date of photograph:	1-9-2024
Weather condition:	Hazy
Viewing direction:	Southwest
Latitude:	33°20'54.438" N
Longitude:	112°48'57.438" W
Distance to project:	1.8 miles

June 2024

Figure E-16. KOP 4 Existing Conditions – Night: Looking Southwest from Residences Near West Elliot Road and 355th Avenue Intersection

The Project
Figure E-16

KOP 4
Existing Conditions - Night
Looking Southwest from residences near West Elliot Road and 355th Avenue

Project Location Map

Photograph Information

Time of photograph:	9:21 pm
Date of photograph:	6-26-2024
Weather condition:	Hazy
Viewing direction:	Southwest
Latitude:	33°20'54.438" N
Longitude:	112°48'57.438" W
Distance to project:	1.8 miles

June 2024

Figure E-17. KOP 4 Simulated Conditions – Night: Looking Southwest from Residences Near West Elliot Road and 355th Avenue Intersection

The Project
Figure E-17

KOP 4
Simulated Conditions - Night
Looking Southwest from residences near West Elliot Road and 355th Avenue

Project Location Map

Photograph Information

Time of photograph:	9:21 pm
Date of photograph:	6-26-2024
Weather condition:	Hazy
Viewing direction:	Southwest
Latitude:	33°20'54.438" N
Longitude:	112°48'57.438" W
Distance to project:	1.8 miles

June 2024

Sensitive Viewers

High-sensitivity viewers are found in the residential community east of South 355th Avenue and from the Arlington Elementary School, which contains community sports fields. Views from the residential neighborhoods are not significantly hindered by the existing power plant or the new Expansion Project (see **Figures E-4** and **E-5**). Views from the nearest residence (Intersection of West Elliot Road and 355th Avenue) is not significantly hindered by the new Expansion Project (see **Figures E-14** and **E-15**). Views towards the Expansion Project will not be blocked or altered by the addition of eight (8) gas-fired turbines.

Expansion Project Boundaries

Construction of the Expansion Project will be conducted within the existing property boundary of the Redhawk Power Plant. The power plant is visible from the surrounding area but does not significantly hinder views of the surrounding mountains. The addition of the Expansion Project will not substantially block or alter the views within the Study Area.

Scenic Area Conclusion

Existing conditions within the Study Area generally include expansive views of flat native desert with dispersed residences and power-producing facilities and with distant mountains visible in the background (see **Figure E-6**). Transmission lines follow most of the major roadways (see **Figures E-6** and **E-10**). The Palo Verde Generating Station is visible from throughout the Study Area. The Expansion Project at the Redhawk Power Plant will add new power plant stacks visible from a few miles surrounding the plant but does not significantly hinder the expansive views of the surrounding mountain ranges (see **Figures E-3, E-7,** and **E-11**).

Construction and operation of the Expansion Project is not anticipated to impact general views in the area or views of the high-sensitivity viewers from the school (2.3 miles away) or residential neighborhoods (closest residences are 1.8 miles away [see **Figure E-7**]). The lines, forms, colors, textures, and scale of the Expansion Project features will repeat those of the existing infrastructure development.

Historic Sites and Structures and Archaeological Sites

The assessment of potential effects on historic sites and structures and archaeological sites relied on existing information about prior cultural resource studies within a review area that included the Expansion Project site and a buffer 1 mile wide, which is consistent with State Historic Preservation Office (SHPO) guidelines. Reviewed sources of information included:

- Arizona Register of Historic Places (ARHP)
- National Register of Historic Places
- AZSITE Cultural Resources Inventory, a geospatial database that includes records of the AZSITE Consortium members (Arizona State Museum [ASM], Arizona State University, Museum of Northern Arizona, and SHPO)
- Records on file at the ASM Archaeological Records Office for information not incorporated in the AZSITE database
- Historic maps and aerial photos
- Selected reports of prior cultural resource studies

The review identified 29 prior cultural resource studies conducted within or overlapping the review area between 1955 and 2023. The studies covered about two-thirds of the review area (approximately 1,764 acres of 2,611 acres). The available information was considered adequate for identifying historic sites and structures and archaeological sites within and in the vicinity of the Expansion Project site, and no cultural resource field survey was conducted.

Only two prior surveys overlapped the Expansion Project site. The most relevant was a survey conducted in 2000 to support the CEC application for the Redhawk Power Plant. That survey covered 1,103 acres, including the entire Expansion Project site, and discovered three archaeological sites. All the sites were outside the current Expansion Project site, and SHPO determined none were eligible for the ARHP. Another survey for the Palo Verde to North Gila 500-Kilovolt Transmission Line covered a narrow corridor at the western edge of the Expansion Project site and recorded no cultural resources in the review area. The survey was conducted by walking transects spaced at intervals of 20 meters, which meets current ASM standards for complete, intensive survey, and it is unlikely any cultural resources were missed. The results of numerous subsequent surveys in the vicinity suggest that agricultural facilities (such as canals) might have become of historic age (50 or more years old) since 2000, but review of recent aerials show the Expansion Project site is virtually cleared of vegetation, indicating the area has been graded, and a drainage channel appears to have been constructed through the Expansion Project site. The extent of disturbance from construction of the drainage channel probably will have destroyed any unrecorded cultural resources that might have been present in the Expansion Project site.

The record research identified 19 cultural resources recorded in the review area. None are in the Expansion Project site. All the recorded cultural resources are archaeological sites or abandoned or in-use structures that date to the Historic period or are modern. None relate to the Indigenous occupation of the region. Prior consultations formally determined one of the resources is eligible for the ARHP—the Southern Pacific Railroad Phoenix Main Line, which was constructed between 1923 and 1926. The railroad is eligible for the ARHP under Criterion A for its association with the development of railroad transportation in Arizona. The Union Pacific Railroad continues to use the line, now designated as the Roll Industrial Lead, for hauling freight. The railroad passes within approximately 800 feet south of the Expansion Project site.

The Arlington Siding archaeological site, AZ T:9:116(ASM), is associated with the Phoenix Main Line and adjacent to the tracks, approximately 0.75 mile east of the Expansion Project site. Cultural resource surveyors evaluated that site as eligible for the ARHP under Criterion D for its potential to yield important information, but SHPO has not formally determined the site's eligibility.

SHPO determined that ten of the cultural resources recorded in the review area lack historical significance and are not eligible for the ARHP. Cultural resource surveyors evaluated six (6) other cultural resources as ineligible for the ARHP, but SHPO has not formally determined their significance. The ARHP eligibility of the other cultural resource (an archaeological site with two scatters of 1930s to 1960 trash) remains unevaluated. Review of historic maps and aerial photos indicated a well and irrigation canals were present in the Expansion Project site by the early 1960s but are no longer present. (For details of the inventory, see the Cultural Resource Assessment included in Exhibit J).

Historic Site and Structures and Archaeological Sites Analysis and Conclusion

The cultural resource assessment indicated there are no known historical sites and structures or archaeological sites in the Expansion Project site. The proposed Expansion Project is unlikely to have adverse proximity impacts on cultural resources within 1 mile of the Expansion Project site due to factors such as visual changes of the landscape or increased noise. The setting of the one nearby resource determined to be eligible for the ARHP, the Southern Pacific Railroad Phoenix

Main Line, has been substantially altered by prior construction of electrical-generating facilities. The proposed Expansion Project will not substantially diminish the historical integrity of the railroad. Most of the other cultural resources recorded within a mile of the Expansion Project site have been determined ineligible for inclusion in the ARHP or have been recommended not eligible. If the one archaeological site recommended eligible and the one unevaluated archaeological site were determined to be eligible for the ARHP, it will likely be for their potential to yield important information about the history of the region, which will not be degraded by any proximity impacts.

In summary, the proposed Expansion Project will be constructed on a site that was intensively surveyed for cultural resources in 2000 in conjunction with planning and permitting the adjacent Redhawk Power Plant. The survey found no cultural resources in the Expansion Project site, which had been intensively farmed for several decades. The area appears to have been graded around 2002, apparently in conjunction with construction of the Redhawk Power Plant. The available cultural resource survey information is considered an adequate basis for concluding the proposed Expansion Project will not substantially alter or demolish any properties listed in or eligible for the ARHP.

Exhibit F
Recreational Resources

As stated in Arizona Corporation Commission Rules of Practice and Procedure R14-3-220, Exhibit 1:

> "State the extent, if any, the proposed site or route will be available to the public for recreational purposes, consistent with safety considerations and regulations, and attach any plans the applicant may have concerning the development of the recreational aspects of the proposed site or route."

Recreational Purposes and Aspects

The Redhawk Power Plant Expansion Project (Expansion Project) does not include the conversion or preservation of any publicly owned park, recreation area, or wildlife and waterfowl refuge. The Expansion Project is bordered by several mountains, including Saddle Mountain approximately 13 miles west, Palo Verde Hills eight (8) miles north, Buckeye Hills 11 miles southeast, and the Belmont Mountains 27 miles north. The Expansion Project activities will be entirely confined to the Expansion Project site and will not extend within recreation lands.

The Expansion Project is located within approximately 13 miles of Buckeye Hills Regional Recreation Park, approximately six (6) miles from Arlington Wildlife Area, and approximately six (6) miles from Powers Butte Wildlife Area located along Buckeye Hills (**Figure F-1**). The development of the Expansion Project would not affect recreation access to these areas, but it could have minor effects to the landscape that can be viewed by recreational users within some proximity to the Expansion Project. Therefore, the Expansion Project will not have a significant effect on parks or recreational facilities within the Expansion Project area.

Figure F-1. Recreational Areas

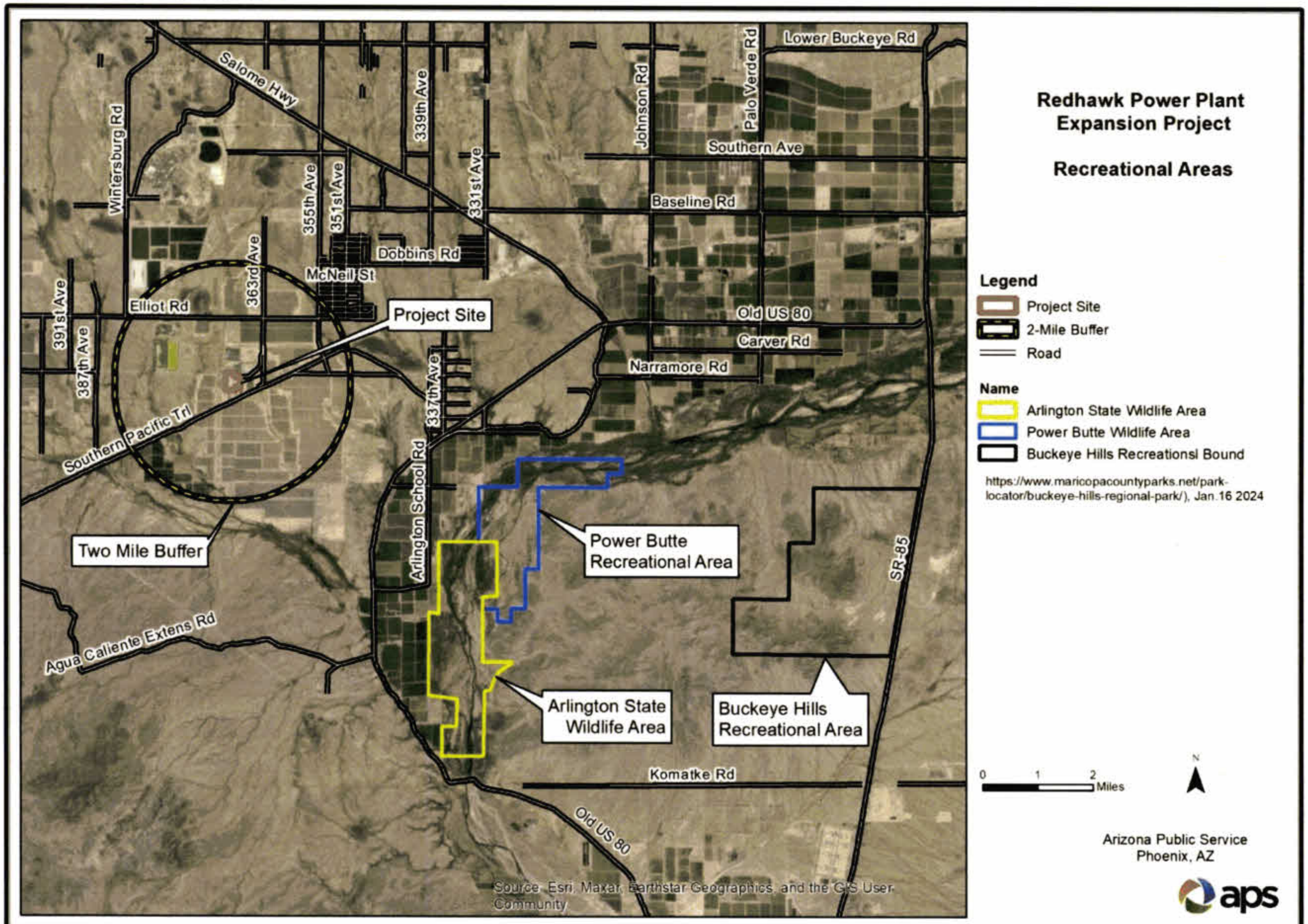


Exhibit G
Conceptual Drawings of Facilities

As stated in Arizona Corporation Commission Rules of Practice and Procedures R14-3-220, Exhibit 1:

> "Attach any artist's or architect's conception of the proposed plant or transmission line structures and switchyards, which applicant believes may be informative to the Committee."

The illustrations on the following page represent conceptual design information for the generating units and switchyard addition.

Figure G-1. Proposed Site Layout

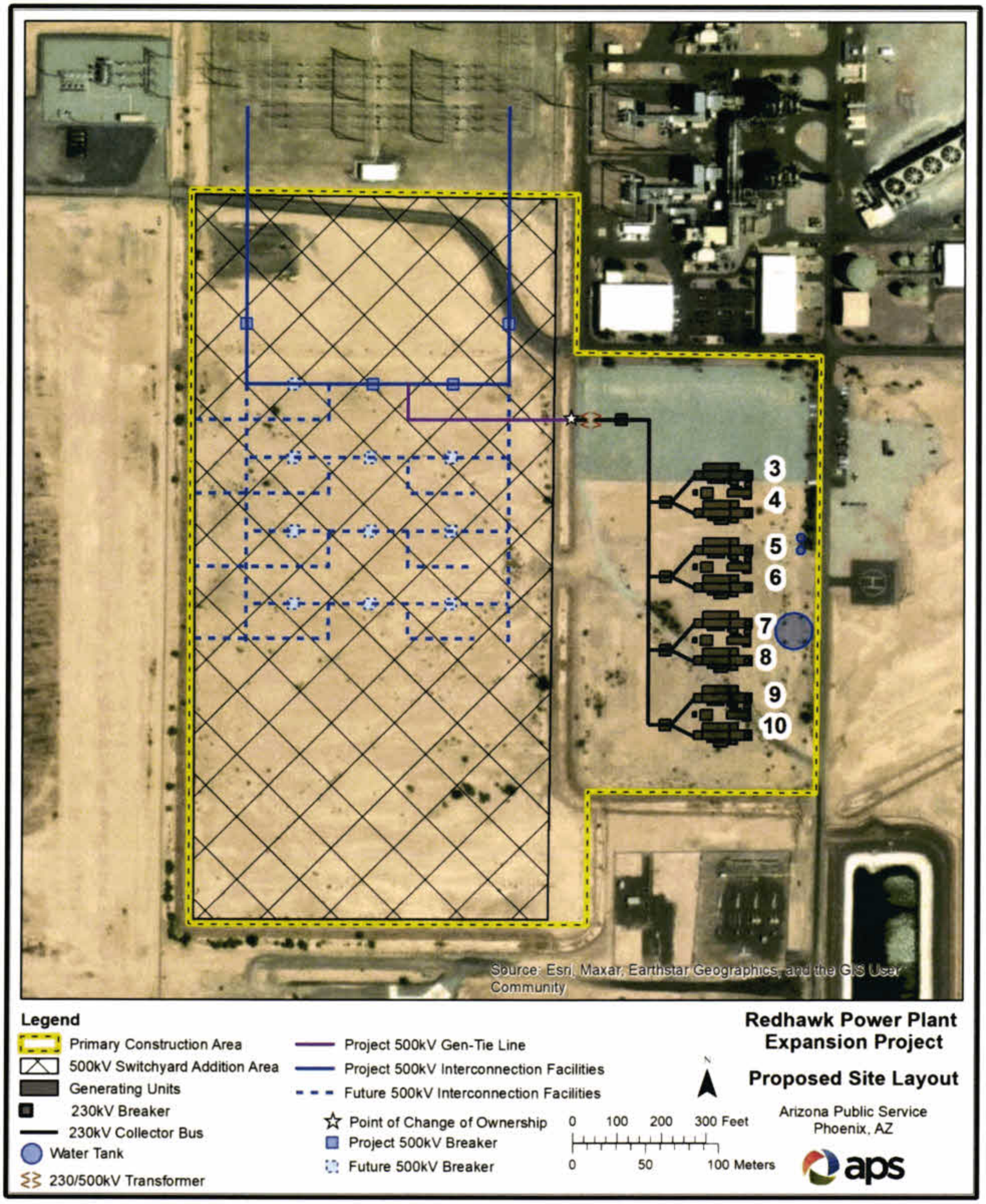
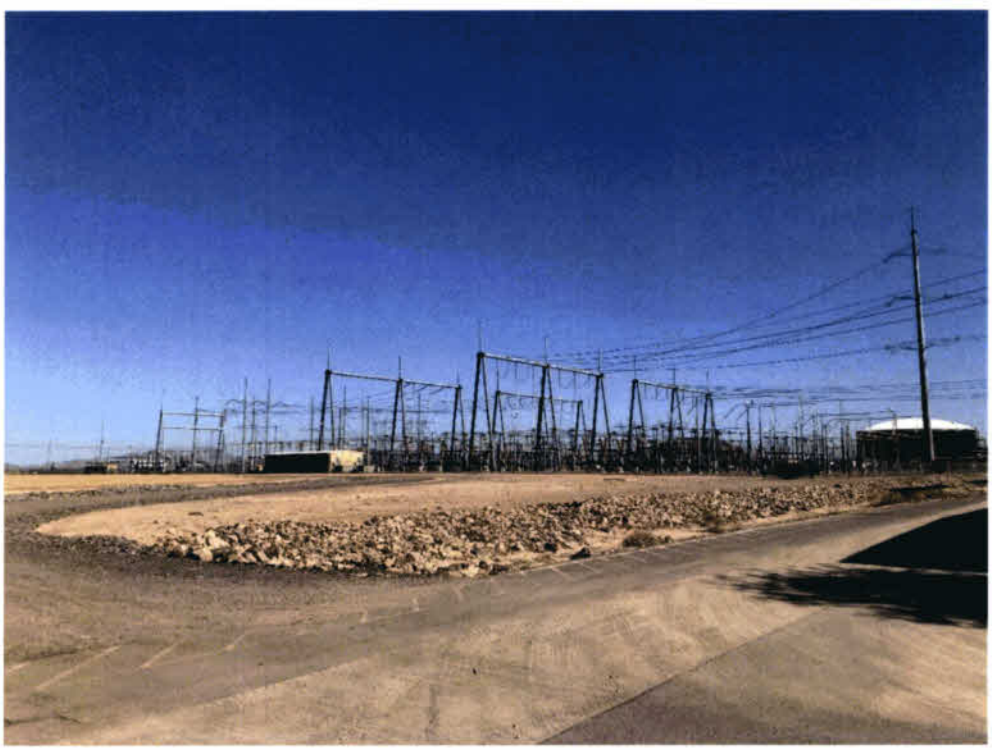


Figure G-2. Redhawk Switchyard

View of existing Redhawk Power Plant and Switchyard looking north from southern boundary near railroad.



View of existing Redhawk Switchyard looking northwest.

Figure G-3. Example LM6000 Pro Energy Units

Exhibit H
Existing Plans

As stated in Arizona Corporation Commission Rules of Practice and Procedures R14-3-220, Exhibit 1:

> "To the extent applicant is able to determine, state the existing plans of the state, local governments and private entities for other developments at or in the vicinity of the proposed site or route."

Overview

As part of the land use study (discussed in detail in **Exhibit A—Location and Land Use Information**), general and site-specific plans were obtained from the respective jurisdictions, landowners, and developers. Furthermore, Arizona Public Service Company (APS) invited representatives from jurisdictional planning departments, local agencies, and developers to provide relevant planning information throughout the siting study process.

The Redhawk Power Plant Expansion Project (Expansion Project) Study Area includes only the unincorporated community of Arlington within Maricopa County, Arizona. Throughout the siting process, APS met with Maricopa County representatives. Jurisdictional general plans, agency management plans, site plans from specific developers, and aerial photography were reviewed to identify development plans, constraints, and opportunities near the Redhawk Power Plant. All Expansion Project components are within the existing boundary of the Existing Plant site.

Jurisdictional and Agency General Plans

Existing and future land use information was reviewed for the Expansion Project Study Area. The analysis is based on the most recently available data from various local and regional plans relevant to the Expansion Project vicinity and GIS databases, including:

- Maricopa County Vision 2030 Comprehensive Plan (Maricopa County 2016)
- Tonopah/Arlington Area Plan (Maricopa County 2020)
- Maricopa County Zoning Ordinance (Maricopa County 2023)
- Maricopa County Planning and Development GIS Maps (Maricopa County 2024)
- State of Arizona Land Resource Information System (ASLD 2024)
- U.S. Geological Survey National Land Cover Database (USGS 2019)

In April 2024, APS scheduled one-on-one meetings and sent letters to the jurisdictions (listed in **Table H-1**) to provide Expansion Project information and request new or additional information or plans or planning development. Stakeholder letters are included in **Appendix A**. No responses to letters sent were received, however, during one-on-one meetings with stakeholders, support for the Expansion Project was received.

Table H-1. Jurisdiction/Agencies Contacted

Contact Name	Title	Jurisdiction/Agency
Tom Ellsworth	Director	Maricopa County Planning and Development Department

References

Arizona State Land Department (ASLD). 2023. Arizona State Land Department Resources Information System. Accessed at https://land.az.gov/ (Accessed December 20, 2023)

Maricopa County. 2016. Vision 2030 Maricopa County Comprehensive Plan (MCCP). Maricopa County Planning and Development. Accessed at https://www.maricopa.gov/DocumentCenter/View/3786/Vision-2030-Maricopa-County-Comprehensive-Plan-PDF (Accessed December 15, 2023).

_______. 2020. Maricopa County Tonopah/Arlington Area Plan (TAAP). Maricopa County Planning and Development. Accessed at https://www.maricopa.gov/DocumentCenter/View/6625/Tonopah-Arlington-Area-Plan-PDF (Accessed December 4, 2023).

_______. 2023. Maricopa County Zoning Ordinance (MCZO). Maricopa County Planning and Development. Accessed at https://www.maricopa.gov/DocumentCenter/View/4785/Maricopa-County-Zoning-Ordinance-PDF (Accessed December 7, 2023).

_______. 2024. Maricopa County Planning and Development GIS Maps (MCPD). Maricopa County Planning and Development. Accessed at https://maricopa.maps.arcgis.com/apps/webappviewer (Accessed January 5, 2024).

U.S. Geological Survey (USGS). 2019. 2019 National Land Cover Database. Accessed at https://www.usgs.gov/centers/eros/science/national-land-cover-database (Accessed December 19, 2023).

Appendix A. Stakeholder Letters

AECOM

AECOM
7720 North 16th Street
Phoenix, AZ 85020
aecom.com

June 10, 2024

Mr. Tom Ellsworth, Director
Maricopa County Planning and
Development Department
301 West Jefferson Street
Phoenix, Arizona 85003

Dear Mr. Ellsworth:

Arizona Public Service Company (APS) plans to file an application with the Arizona Corporation Commission (ACC) for a new Certificate of Environmental Compatibility (CEC) to construct eight (8) new simple-cycle peaking natural gas-fired units (Expansion Project) at the APS Redhawk Power Plant located at 11600 South 363rd Avenue in unincorporated Maricopa County (see attached Expansion Project Vicinity map).

The Expansion Project ensures that APS has the generation capacity to respond to significant anticipated growth in demand along with fluctuations in intermittent resource output and reliably supply power during periods of peak demand. The new natural gas-fired units along with the large quantities of solar and battery energy storage APS is adding, will help APS reliably meet the nearly 40% load growth that is expected by 2031. Importantly, because these peaking units offer flexible, on-demand energy 24/7, they can provide much-needed energy during late-afternoon and evening hours when customers use it most.

APS and its consultant, AECOM, implemented a comprehensive planning process, including environmental studies, to evaluate the impacts of the Expansion Project. You can find more information on the results of the environmental studies and public outreach process at the project's website (www.apsredhawkproject.com). The CEC application will be brought before the ACC Power Plant and Line Siting Committee (Committee). APS will request Committee approval for the CEC for the proposed generation facilities.

Arizona Administrative Code Rule R14-3-220 directs an applicant to include in its CEC application an Exhibit H addressing the following: "To the extent the applicant is able to determine, state the existing plans of the state, local government, and private entities for other developments at or in the vicinity of the proposed site or route."

AECOM

Maricopa County is invited to provide information or written comments regarding development plans in the vicinity of the proposed Project (as depicted on the attached map). APS requests your comments be submitted in writing, specifically including Maricopa County's existing or future development plans that you have identified or are known to you at this time.

To allow your comments to be included in APS's CEC application, please forward your written comments by June 30, 2024, via email at mark.turner@aecom.com or by physical mail addressed to Attn: Mark Turner, AECOM, 7720 North 16th Street, Suite 100, Phoenix, Arizona 85020.

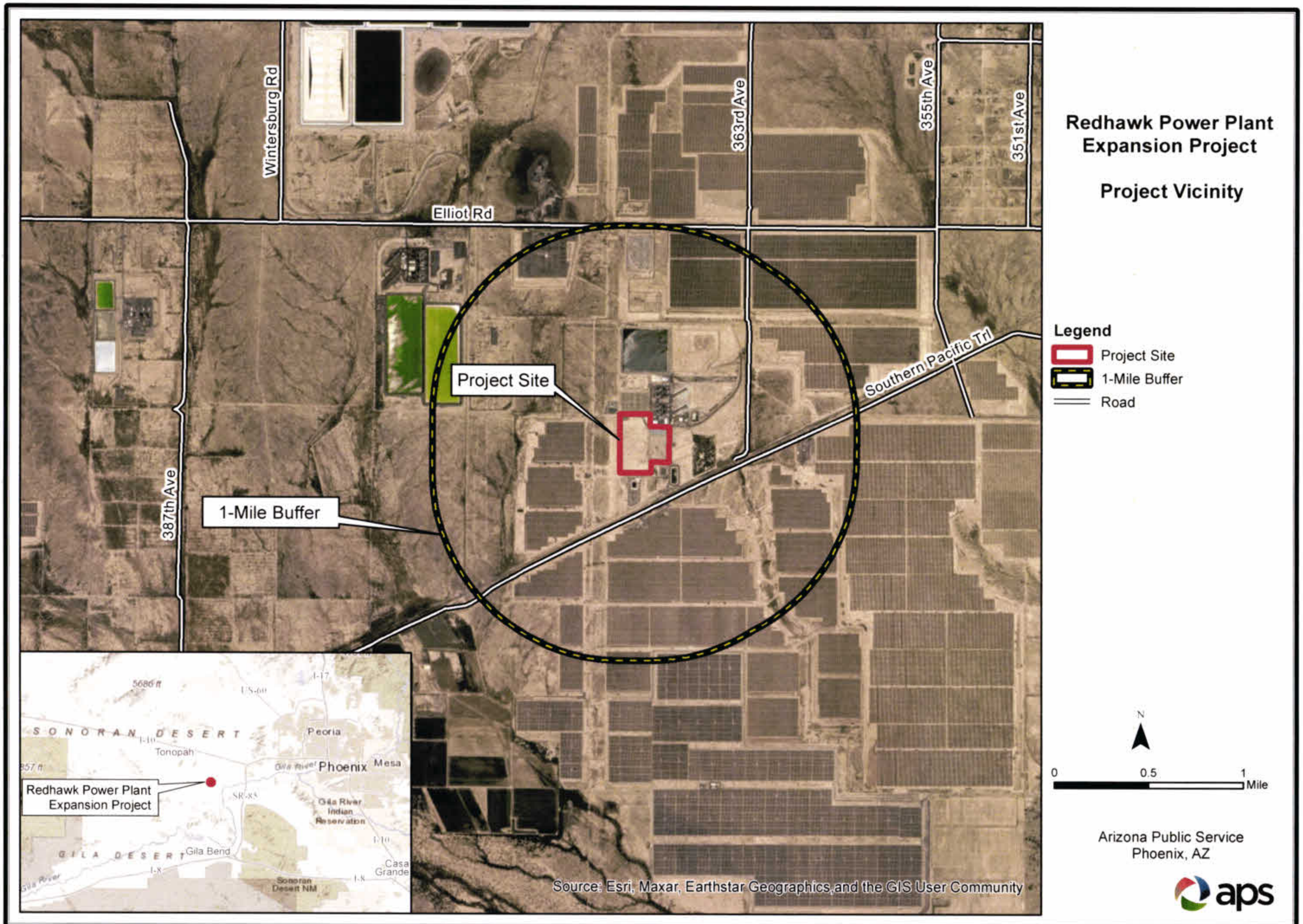
Thank you for your consideration.

Yours sincerely,

Mark Turner

Mark Turner, Environmental Project Manager
AECOM, Technical Services Inc.
Cc: Kevin Duncan, APS Senior Siting Consultant

Attachment: Project Vicinity Map


Wintersburg Rd
Elliot Rd
363rd Ave
355th Ave
351st Ave
387th Ave
Southern Pacific Trl
Project Site
1-Mile Buffer
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
SONORAN DESERT
Tonopah
Peoria
Phoenix
Mesa
Redhawk Power Plant
Expansion Project
Gila River Indian Reservation
GILA DESERT
Gila Bend
Casa Grande
Sonoran Desert NM
Redhawk Power Plant
Expansion Project
Project Vicinity
Legend
Project Site
1-Mile Buffer
Road
N
0
0.5
1
Mile
Arizona Public Service
Phoenix, AZ
aps

AECOM

APS Redhawk Power Plant Expansion Project Noise Assessment

Prepared for:
Arizona Public Service Company

Prepared by:
AECOM

June 2024

Delivering a better world

Prepared for:

Arizona Public Service Company

Prepared by:

George Hitterman
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Table of Contents

Figures

Tables

Exhibit I
Anticipated Noise/Interference with Communication Signals

In accordance with A.A.C. R14-3-220, Exhibit I describes the anticipated noise emission levels and any interference with communication signals which will emanate from the proposed facilities.

1. Introduction

1.1 Expansion Project Description

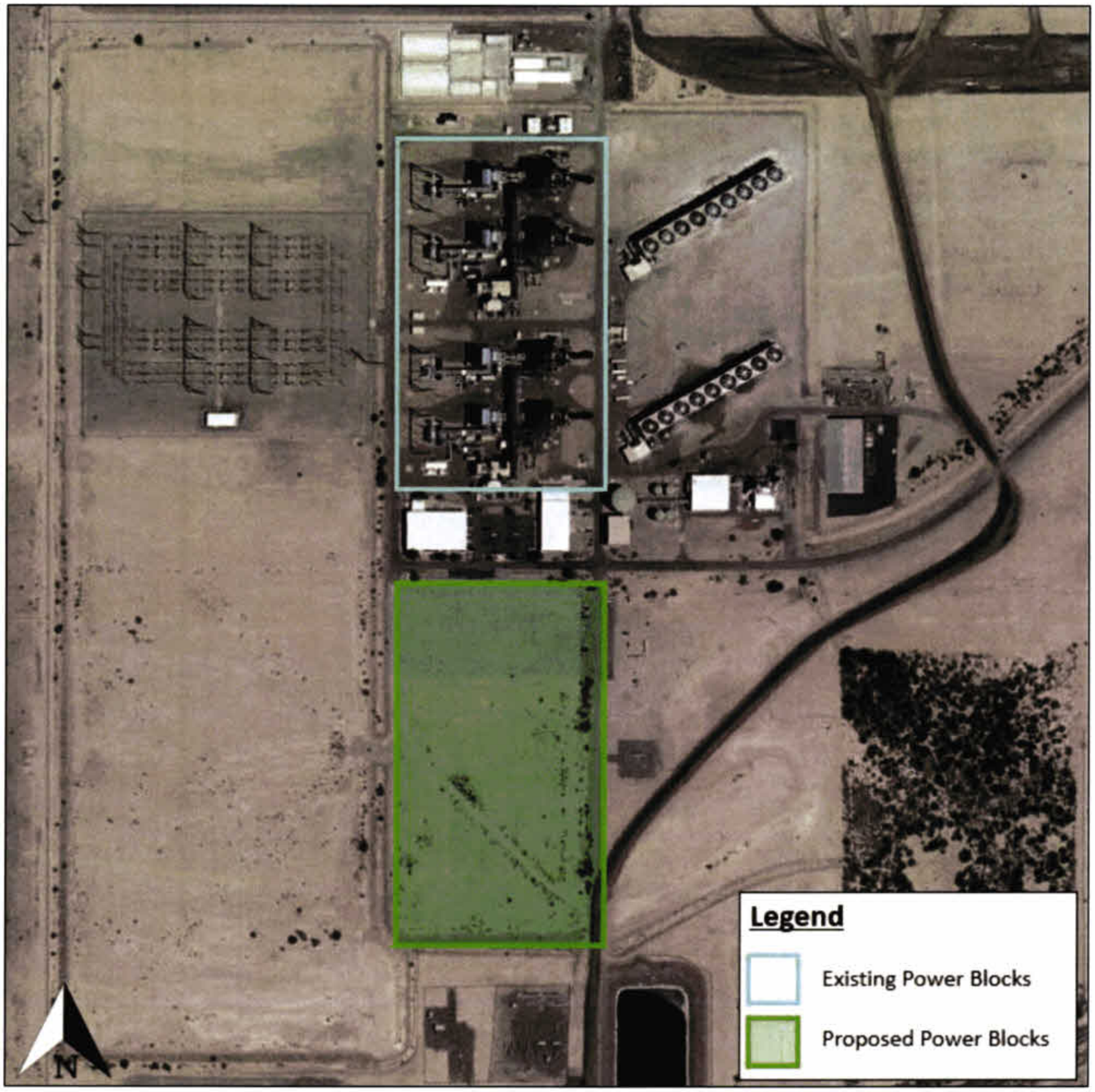
For the purposes of the application for a Certificate of Environmental Compatibility, this exhibit includes a noise study for the Redhawk Power Plant Expansion Project (Expansion Project). The gas-fired turbine power plant is in the center of a large, rural-zoned parcel located south of Elliot Road and north of Southern Pacific Railroad, accessed by 363rd Avenue on the eastern side of the parcel. The surrounding land uses include solar energy-generating stations to the south, east, and north and power-generating stations and unoccupied lands to the west.

The Expansion Project will include four power blocks, each with two turbines for a total of eight turbines. The current design of the Redhawk Power Plant includes two power blocks with four total turbines. **Figure I-1** shows the existing Redhawk Power Plant power blocks and site of the planned Expansion Project.

This noise study will analyze the combined-operational effects for two scenarios:

- Scenario A: Existing Redhawk Power Plant—Including the operation of the existing power plant with two power blocks under maximum load.
- Scenario B: Planned Expansion Project—Including the operation of the existing power plant with the additional four power blocks of the Expansion Project under maximum load.

Figure I-1. Location of Existing and Proposed Power Blocks



2. Regulatory Setting and Noise Impact Criteria

2.1 Federal

Several laws and guidelines at the federal level direct the consideration of a broad range of noise and vibration issues; these include the National Environmental Policy Act, Noise Control Act, and Federal Energy Regulatory Commission guidelines. Because noise generated by the Expansion Project does not fall within the purview of (or require action by) federal agencies, the Expansion Project is not directly subject to federal noise regulations other than the Occupational Safety and Health Administration (OSHA) for worker occupational noise exposure.

2.1.1 U.S. Environmental Protection Agency Guidance

The U.S. Environmental Protection Agency (EPA) has published guidance that specifically addresses issues of community noise (EPA 1974). This guidance, commonly referred to as the "levels document," contains goals for noise levels affecting residential land use of day-night sound level (L_{dn}) ≤ 55 A-weighted decibels (dBA) for exterior levels and L_{dn} ≤ 45 dBA for interior levels. The U.S. Department of Housing and Urban Development *Noise Guidebook*, Chapter 2 Section 51.101(a)(8), also recommends that exterior areas of frequent human use follow the EPA guideline of 55 dBA L_{dn} (HUD 2009). Hence, in the absence of a quantified noise threshold from local regulations, 55 dBA L_{dn} would be considered a guidance-based threshold for determining potential noise impacts at noise-sensitive receivers like residences.

2.1.2 Occupational Safety and Health Administration

The OSHA Occupational Noise Exposure, Hearing Conservation Amendment (Standards 29 CFR 1910, Subpart G) standard stipulates that protection against the effects of noise exposure shall be provided for employees when time-weighted average (TWA) sound levels exceed 90 dBA over an 8-hour exposure period. It also states that worker protection shall consist of feasible administrative or engineering controls, and if such controls fail to reduce sound levels to within acceptable levels, personal protective equipment shall be provided and used to reduce employee exposure. Additionally, a Hearing Conservation Program (HCP) must be implemented by the employer whenever employee noise exposure equals or exceeds the Action Level of an 8-hour TWA sound level of 85 dBA. The HCP requirements consist of periodic area and personal noise monitoring, performance and evaluation of audiograms, provision of hearing protection, annual employee training, and recordkeeping.

2.2 Local

The Expansion Project site and nearest noise-sensitive receptors (NSRs) are located wholly within unincorporated Maricopa County, Arizona.

2.2.1 Maricopa County Noise Ordinance

The Maricopa County Noise Ordinance does not define limits for noise emitted by industrial land uses. Additionally, noise from power plants is exempt from the provisions of the Maricopa County Noise Ordinance during normal operation. Therefore, the EPA guidance limit of 55 dBA L_{dn} will be used to evaluate noise impacts at noise-sensitive receivers.

3. Baseline Ambient Outdoor Sound Level Survey

3.1 Methodology and Instrumentation

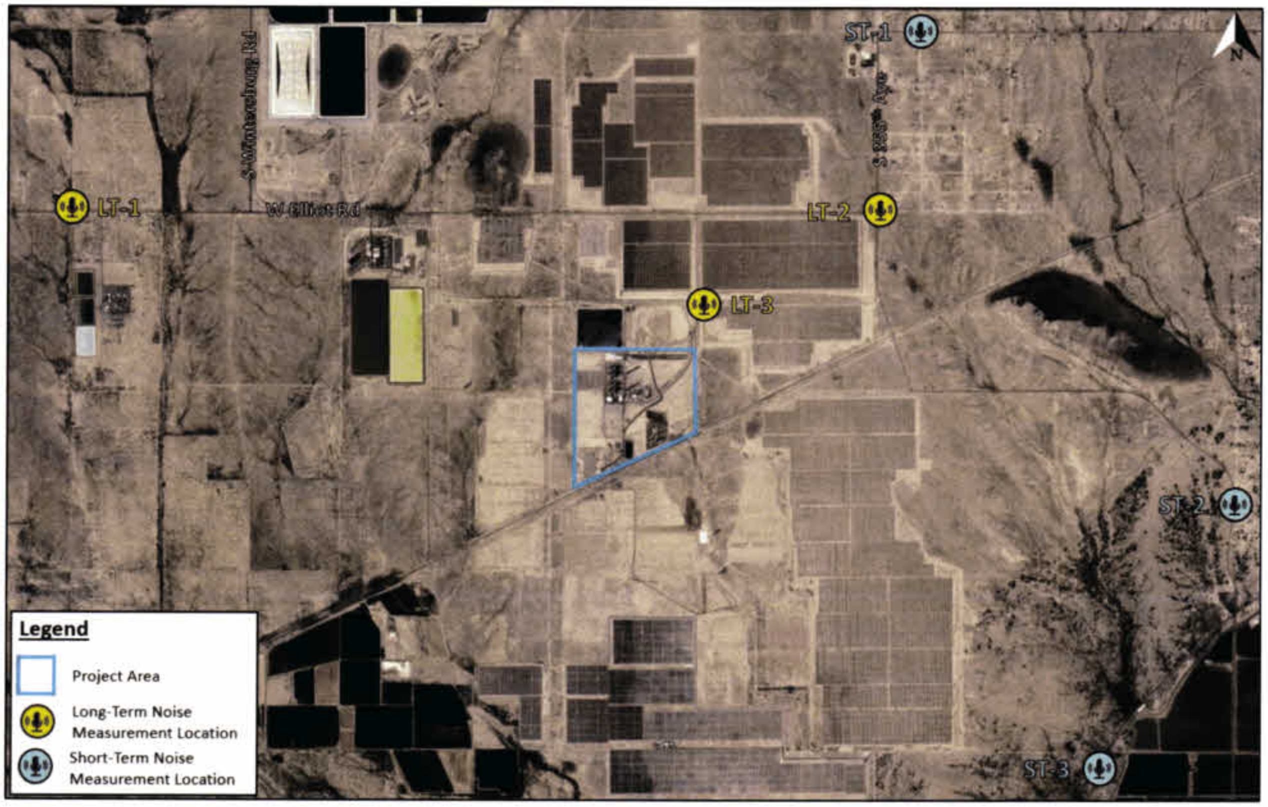
3.1.1 Methodology

Baseline sound pressure level (SPL) measurements were conducted from Tuesday, December 12th to Wednesday, December 13th, 2023. Three long-term and three short-term SPL measurements were conducted to establish and characterize the existing ambient noise environment at representative noise-sensitive land uses in the Expansion Project vicinity. An AECOM field investigator set up each of the noise monitors and performed pre-measurement instrument calibration checks prior to monitoring start. Secured to existing fixed man-made or natural features, long-term monitors were left unattended until revisited by the investigator to check instrument function, remaining onboard memory, and battery life. Short-term measurements were attended by an AECOM field investigator during the measurement period.

All field observations were recorded on field data sheets. Collected data includes time, name, and location of measurement; instrument identification information; observed meteorological data; field calibration results; and notes regarding the dominant noise sources and any other audible sources of continuous or intermittent noise (e.g., passing vehicles, operation of construction/ agricultural equipment, or aircraft flyovers).

Figure I-2 shows the long-term and short-term measurement locations on aerial imagery of the study area. Field photos of the deployed long-term and short-term noise monitoring systems are provided in **Appendix A**.

Figure I-2. Long-Term Noise Measurement Locations



3.1.2 Instrumentation

Baseline SPL measurements were conducted using Larson Davis Model LxT sound level meters (SLMs) rated by the American National Standards Institute (ANSI) as Class 1 per ANSI S1.4-2014. All microphones were fitted with standard open-cell foam windscreens and positioned approximately 5 feet above grade. The SLMs were set using slow time response and the A-weighting scale. SLM calibration was field-checked before and after the measurement period with a Larson Davis Model CAL200 acoustic calibrator, and all instruments were laboratory-calibrated within 1 year of the measurement period. Where not already described, sound level measurements performed for this field survey were conducted in a manner based on guidance from applicable portions of the International Organization for Standardization 1996-1, 1996-2, and 1996-3 standards.

3.2 Survey Results and Observations

3.2.1 Measurement Location Details

The following narratives summarize descriptions of the sound level monitoring locations and highlight perceived or witnessed key acoustical contributors to the measured outdoor ambient sound environment.

Site Vicinity Notes

At the time of the sound level survey, the AECOM field investigator observed that some sound was emanating from existing operations at the Expansion Project site but at a very low level that was unlikely to contribute significantly at the receiver locations. The dominant noise source in the area was truck and automobile traffic on local roads.

LT 1

This measurement position was located northwest of the Expansion Project site at the corner of Elliot Road and 391st Avenue and is representative of the nearest residential NSR at 40512 West Elliot Road. The SLM was attached to a utility pole and faced south toward the Expansion Project. The dominant noise source at this location during both the daytime and nighttime period was vehicular traffic on Elliot Road. Mechanical noise such as that from the industrial operations was only faintly audible, but it was unclear if this noise emanated from the Redhawk Power Plant or another neighboring generation power plant.

LT 2

This measurement position was located northeast of the Expansion Project site at the corner of Elliot Road and 355th Avenue and is representative of the nearest residential NSR at 35401 West Western Star Boulevard. The SLM was attached to a monopole secured to a guy wire and faced southwest toward the Expansion Project. The dominant noise source at this location during both the daytime and nighttime period was vehicular traffic on 355th Avenue. Power plant operations were only faintly audible. Also audible were barking dogs northeast of the measurement location and sporadic traffic on Elliot Road.

LT 3

This measurement position was located northeast of the Expansion Project site along 363rd Avenue approximately 950 feet north of the Redhawk Power Plant. This location is not representative of an existing NSR but was included to quantify the noise of the existing power plant. The SLM was attached to a utility pole and faced southwest toward the Expansion Project. The dominant noise source at this location was Redhawk Power Plant operations. Additionally, sporadic traffic on 363rd Avenue contributed to the ambient noise environment.

ST 1

This measurement position was located northeast of the Expansion Project site along Dobbins Road and is representative of the nearest residential NSR at 8838 South 353rd Avenue. The SLM was attached to a tripod and faced southwest toward the Expansion Project. The dominant noise sources at this location while investigators were present were traffic on Dobbins Road and barking dogs from the nearby residences. Power plant operations were not audible.

ST 2

This measurement position was located southeast of the Expansion Project site along Arlington School Road and is representative of the nearest residential NSR at 13221 South 339th Avenue. The SLM was attached to a tripod and faced northwest toward the Expansion Project. The dominant noise sources at this location while investigators were present were traffic on Arlington School Road and barking dogs from the nearby residences. During the daytime period, distant gunfire was audible from the area north of Narramore Road, north of the measurement location. Power plant operations were not audible.

ST 3

This measurement position was located southeast of the Expansion Project site along Old US Highway 80 and is representative of the nearest residential NSR at 15905 South Old US Highway 80. The SLM was attached to a tripod and faced northwest toward the Expansion Project. The dominant noise source at this location while investigators were present was traffic on Old US Highway 80. During the daytime period, distant gunfire was audible from the area north of Narramore Road, north of the measurement location. During the nighttime period, agricultural operations from the northeast contributed significantly to the ambient noise level. Power plant operations were not audible.

Photos of measurement locations are provided in **Appendix A**.

3.2.2 Measured Sound Level Data

Tables I-1 and **I-2** present a summary of acoustical metrics representing the measured SPL at each measurement location. Detailed measurement data are presented in Appendix B.

Table I-1. Long-Term Noise Survey Summary

Measurement Location	Nearest NSR	Total Duration of Collected Data (hours)	Daytime Sound Level (L_d, dBA)	Nighttime Sound Level (L_n, dBA)	24-Hour Sound Level (L_{dn}, dBA)
LT 1	40512 West Elliot Road	24	62	59	66
LT 2	35401 West Western Star Boulevard	24	59	54	61
LT 3	N/A*	24	60	56	63

Notes:
Daytime: 7:00 a.m. to 10:00 p.m.
Nighttime: 10:00 p.m. to 7:00 a.m.
***Measurement location LT 3 is not considered representative of any NSR.**

Table I-2. Short-Term Noise Survey Summary

Measurement Location	Nearest NSR	Total Duration of Collected Data (Minutes)	Daytime Sound Level (L_d, dBA)	Nighttime Sound Level (L_n, dBA)	24-Hour Sound Level (L_{dn}, dBA)
ST 1	8838 South 353rd Avenue	Day: 19 Night: 20	68	57	68
ST 2	13221 South 339th Avenue	Day: 19 Night: 19	64	41	63
ST 3	15905 South Old US Highway 80	Day: 15* Night: 20	69	53	68

Measurement Location	Nearest NSR	Total Duration of Collected Data (Minutes)	Daytime Sound Level (L_d, dBA)	Nighttime Sound Level (L_n, dBA)	24-Hour Sound Level (L_{dn}, dBA)

Notes:
Daytime: 7:00 a.m. to 10:00 p.m.
Nighttime: 10:00 p.m. to 7:00 a.m.
*A malfunction occurred during the daytime noise measurement for ST 3 that limited the useable data to 15 minutes.

Figures I-3 through **I-5** show summary plots of measured 1-hour noise levels collected throughout the monitoring period at the long-term measurement locations. The 1-hour equivalent noise level (L_{eq}) and other metrics used to develop these plots are provided in Appendix B.

Figure I-3. Measured Hourly SPLs at LT 1

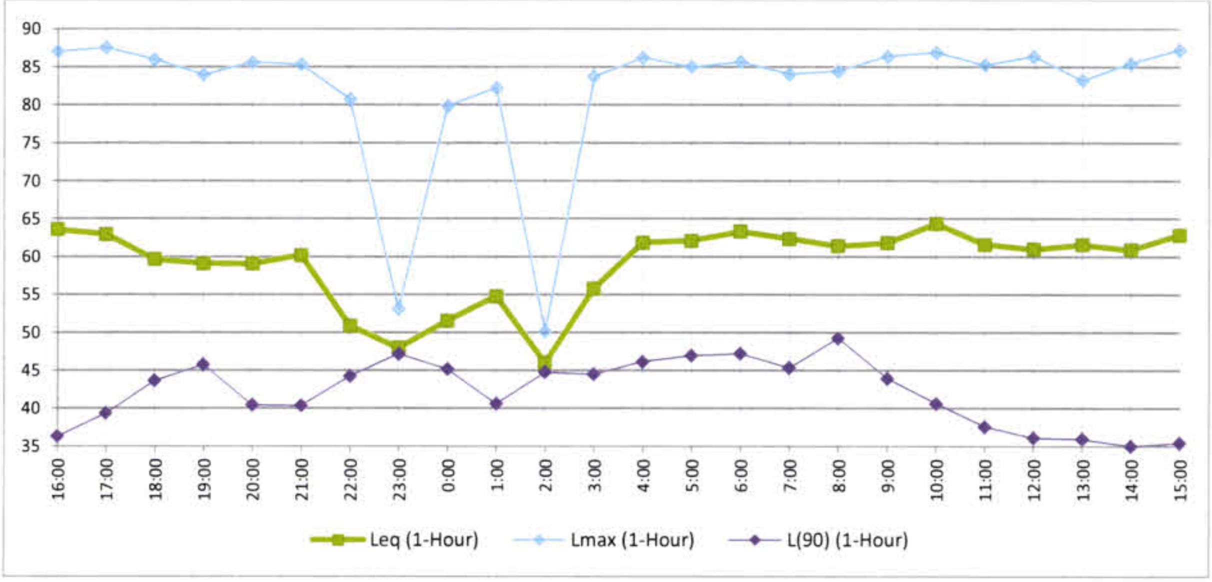


Figure I-4. Measured Hourly SPLs at LT 2

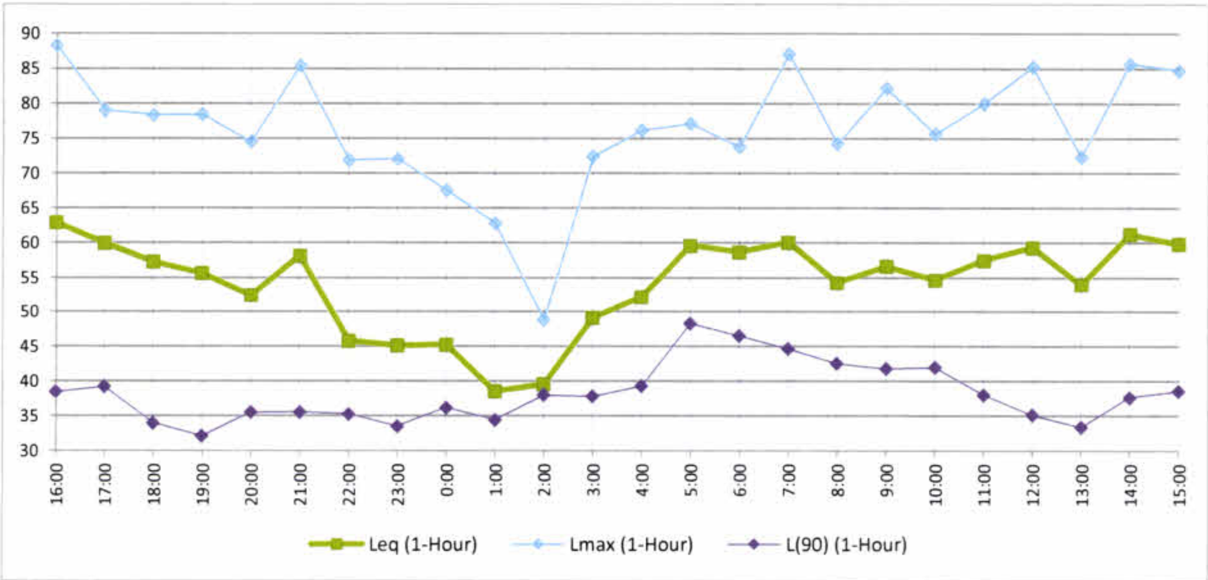
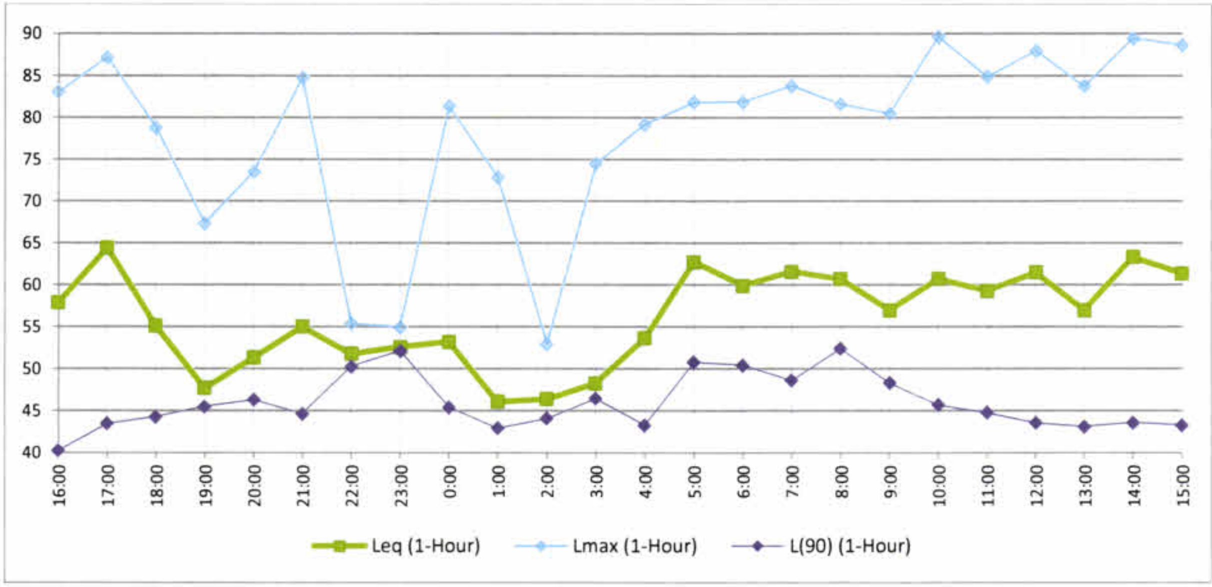


Figure I-5. Measured Hourly SPLs at LT 3



Measured hourly noise levels generally ranged between 39 to 64 dBA during the monitoring period in the Expansion Project area, with the highest levels collected at LT 1. The measured noise level plots suggest that ambient noise levels in the area generally are higher during mid- to late-morning hours and through the afternoon. During the daytime period, traffic on local roads was the dominant noise source. Additional observed noise sources included agricultural operations southeast of the Expansion Project site.

4. Predicted Operation Noise Effect Assessment

4.1 Methodology

The CadnaA® noise prediction model (Version 2023) was used to estimate the propagation of sound from aggregate Expansion Project operations and predict SPL at various distances from the Expansion Project, including specific locations such as the representative NRSs selected for the ambient sound survey. CadnaA is a Windows-based software program that predicts and assesses noise levels near industrial noise sources based on ISO 9613-2 (ISO 1996) algorithms for noise propagation calculations. The software can accept sound power levels (PWL or L_w) (in decibels [dB] referenced to 1 picoWatt) in octave band center frequency resolution to describe the multiple sound propagation sources of the site processes or activity to be modeled.

The software's calculations account for classical sound wave divergence plus attenuation factors resulting from air absorption, basic ground effects, and barrier/shielding. The advantage of using CadnaA is that it can handle the three-dimensional sound propagation complexity of considering realistic intervening natural and man-made topographical barrier effects, including those resulting from terrain features and structures such as multi-level buildings, storage tanks, and large equipment.

4.1.1 Sound Sources Definitions

Equipment PWL (or L_w) for nominal steady-state operation are shown in **Table I-3**. Designs and reference levels were not available for the existing Redhawk Power Plant or the proposed Expansion Project; therefore, equipment rosters and reference levels from a similar gas-fired power station project in Arizona were used to approximate the design for noise modeling.

Table I-3. Major Expansion Project Operations Noise-Producing Sources

Equipment/Source Type	Individual Reference PWL (A-Weighted)	Quantity of Equipment/Source (Existing Power plant Model)	Quantity of Equipment/Source (Proposed Power plant Model)
Turbine Enclosure	96.3	6	18
Cooling Tower	99.0	2	2
Step-Up Transformer	93.5	6	18
Generator Enclosure	92.6	10	30
Generator Inlet Fan	102.7	4	12
Generator Exhaust	107.3	4	12

While the Expansion Project mechanical systems include several additional types of equipment, the sources listed in **Table I-3** represent the loudest features and are thus expected to have the greatest impact on the ambient sound environment. Equipment not appearing in **Table I-3** is not expected to produce noise at a magnitude that will challenge the expected dominance of the power block equipment.

4.1.2 Predictive Model Configuration Settings

Additional CadnaA model configuration settings and operations noise analysis assumptions are 10 degrees Celsius outdoor temperature, 70 percent relative humidity, calm wind conditions (< 0.5 meter per second), one order of acoustic reflections, and an average acoustical ground absorption coefficient of 0.5 (representing an estimate for the observed Expansion Project vicinity—a conservative blend of hard, reflective surfaces [roadways and other pavement] that tend towards zero and highly absorptive ground cover [loose soils and/or vegetative ground cover] that approaches unity).

4.2 Analyzed Scenarios

This noise study considers two Expansion Project operations noise analysis scenarios:

- Scenario A: Continuous operation of the two existing power blocks operating at full load.
- Scenario B: Scenario A as described above but includes the operation of the proposed four power blocks at the new power plant.

These scenarios are considered to be conservative estimations of the power plant's impact on the ambient noise environment, as it is rare and unlikely for all power blocks to be operating at full load simultaneously.

4.3 Results

Predicted aggregate Expansion Project operation noise levels at the nearest residential receptors for studied operational Scenarios A and B are shown in **Table I-4**.

Table I-4. Predicted Operation Noise Levels

Receiver ID	Land Use Type	Receiver Address	Predicted Operation Noise Levels (dBA, L_{dn})		Relative Increase (dB)
			Scenario A	Scenario B	
R-01	Residential	40512 West Elliot Road	43	43	+1*
R-02	Residential	35401 West Western Star Boulevard	51	51	+0

Receiver ID	Land Use Type	Receiver Address	Predicted Operation Noise Levels (dBA, L_{dn}) Scenario A	Scenario B	Relative Increase (dB)
R-03	Residential	13221 South 339th Avenue	42	42	+0
R-04	Residential	15905 South Old US Highway 80	42	42	+0

* dB values presented in this table are rounded to the nearest whole dB. Therefore, arithmetic calculations may be inconsistent with expectations.

Figures I-6 and **I-7** display modeled operational noise contours superimposed upon aerial imagery of the Expansion Project site and its surroundings. Note that the Expansion Project-attributed noise contours appearing in contour figures do not include the acoustical contribution of the existing outdoor sound environment.

Figure I-6. Predicted Expansion Project Operation Noise Contours—Scenario A

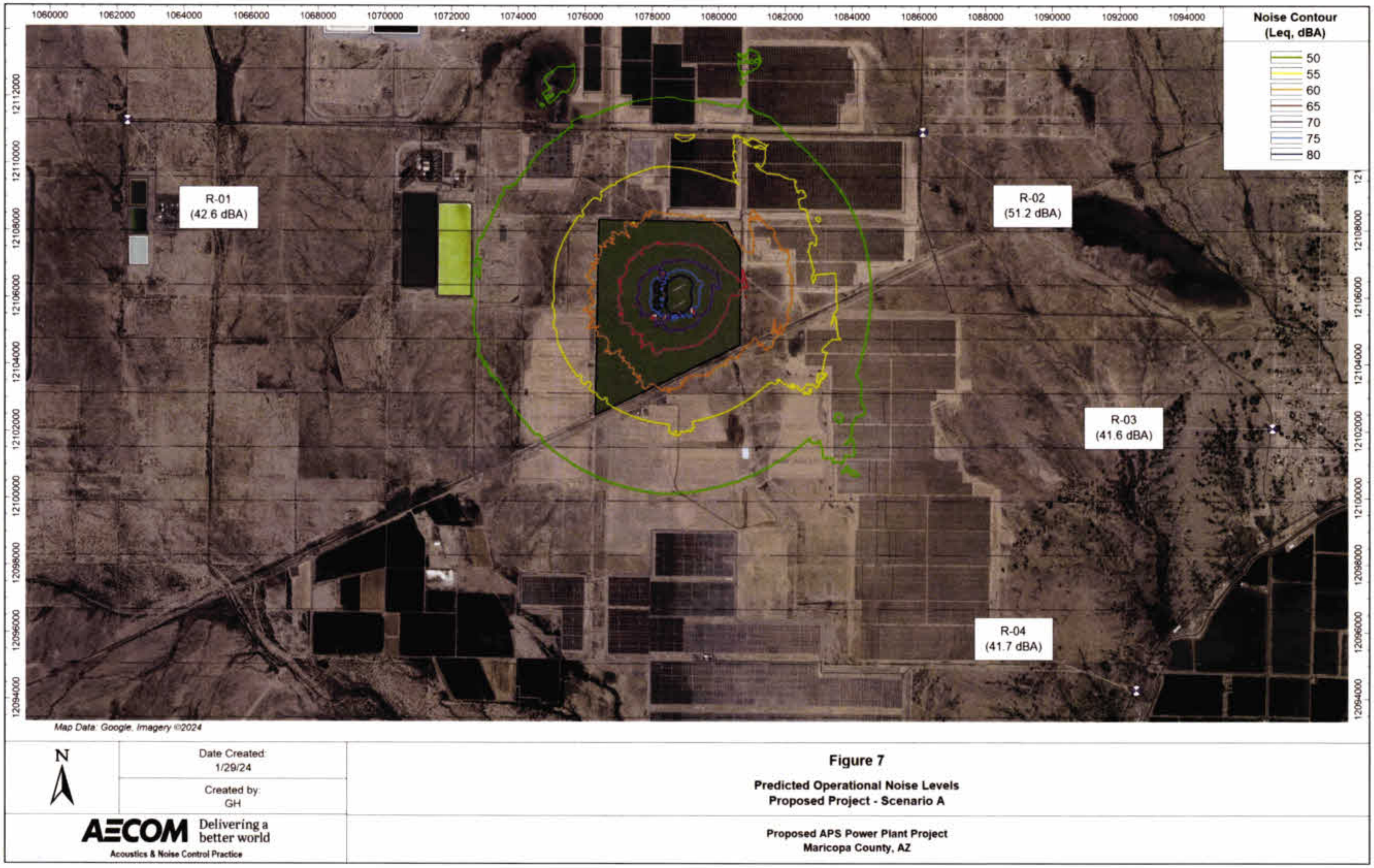
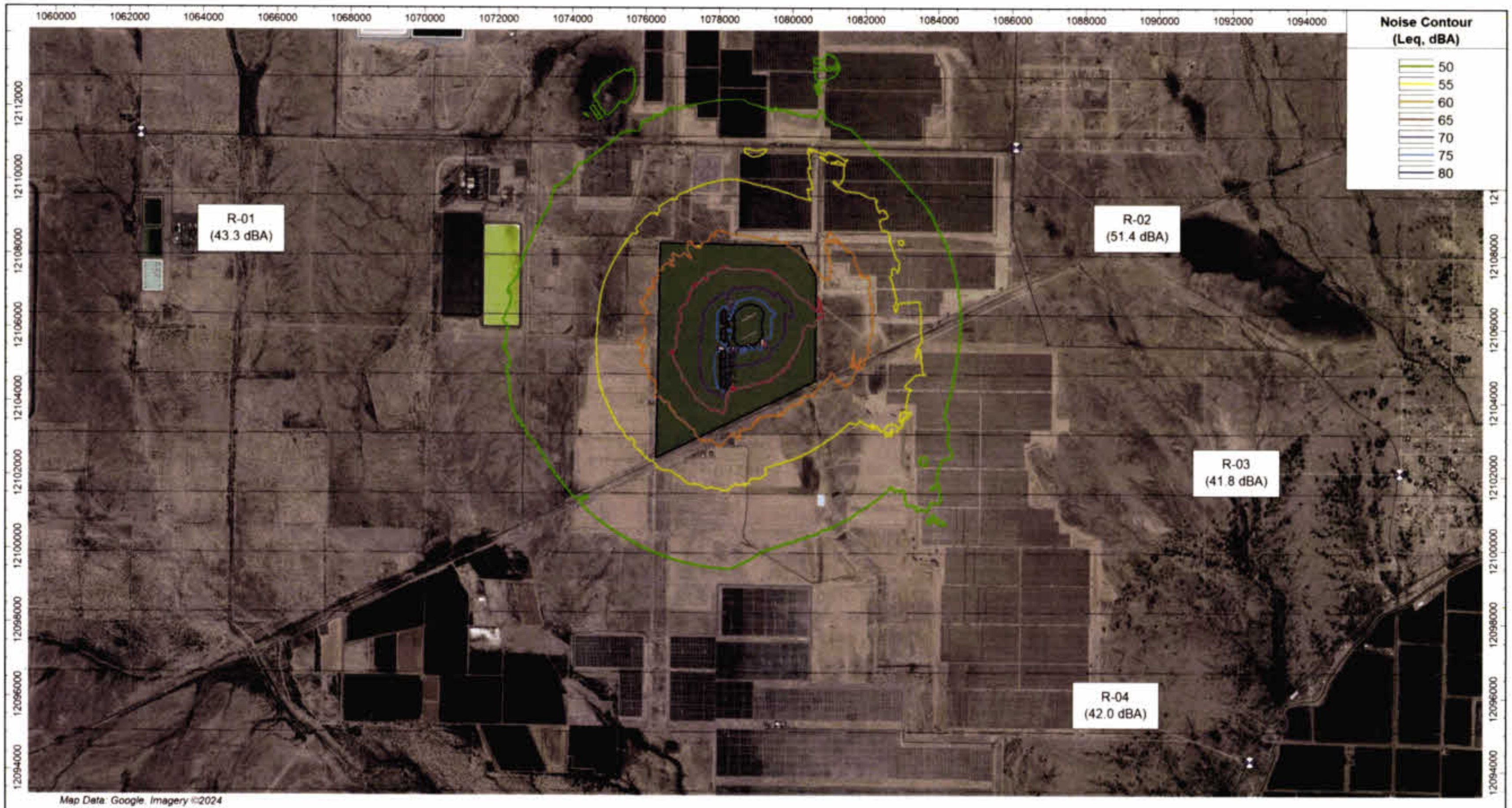


Figure I-7. Predicted Expansion Project Operation Noise Contours—Scenario B



N

Date Created:
1/29/24

Created by:
GH

AECOM Delivering a better world
Acoustics & Noise Control Practice

Figure 8

Predicted Operational Noise Levels
Proposed Project - Scenario B

Proposed APS Power Plant Project
Maricopa County, AZ

5. Findings and Recommendations

5.1 Expansion Project Noise Effects

Under maximum load operating conditions, **Table I-4** shows that aggregate Expansion Project operational noise levels will not exceed the EPA thresholds for either scenario (existing or future). Maximum load operation is expected to be atypical, and, as shown in **Table I-2**, the current noise contribution from the power plant does not significantly affect the ambient noise environment. **Table I-4** shows that noise levels generated by power plant operation are not expected to increase the ambient noise levels by more than 1 dBA at any location, with the greatest increases occurring at receptor location R-01. A change in sound level of 3 dBA is generally considered to be the smallest change perceptible outside of a laboratory environment. Therefore, the predicted maximum increase in power plant noise of up to 1 dBA at nearby receptors is not expected to result in adverse effects.

5.2 Conclusions

Predicted Expansion Project operation noise is compliant with county standards and is not expected to significantly impact the ambient noise environment. Therefore, no additional noise control measures are recommended.

6. References

U.S. Department of Housing and Urban Development (HUD). 2009. *The Noise Guidebook*.

U.S. Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. USEPA 550/9-74-004.

Appendix A Photo Log

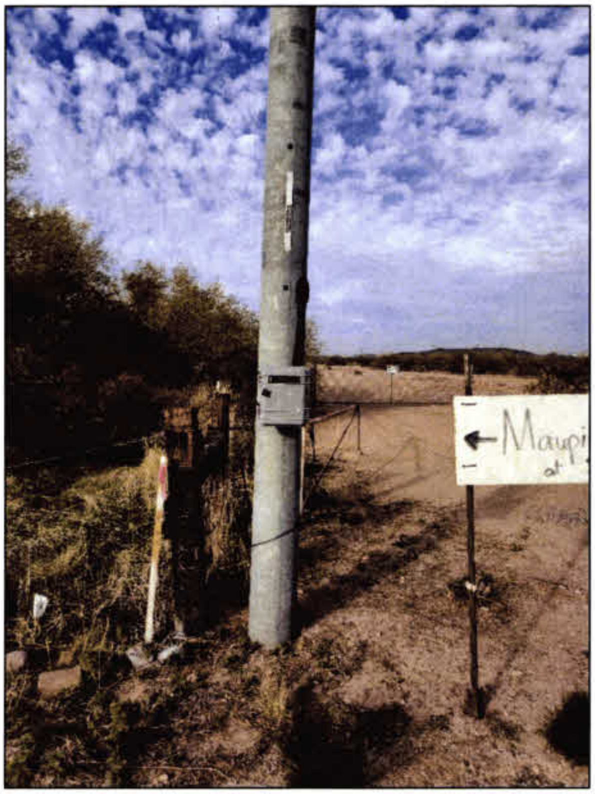


Photo 1

Monitoring Site:

LT-1

Date Taken:

December 12, 2023

Camera Facing:

North

Description:

View toward SLM.

Photo 2

Monitoring Site:

LT-1

Date Taken:

December 12, 2023

Camera Facing:

East

Description:

View toward Expansion Project (not visible) with SLM in foreground.

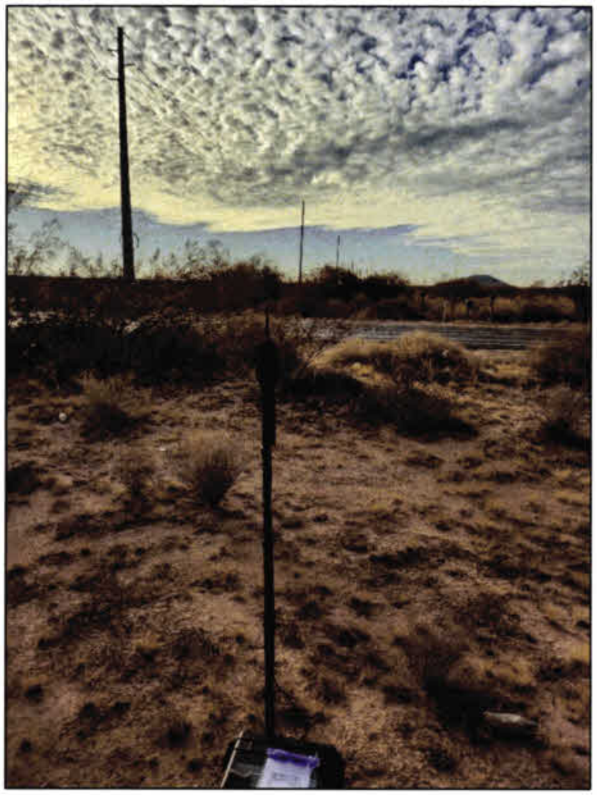


Photo 3

Monitoring Site:

LT-2

Date Taken:

December 12, 2023

Camera Facing:

Southwest

Description:

View toward Expansion Project (not visible) with SLM in foreground.

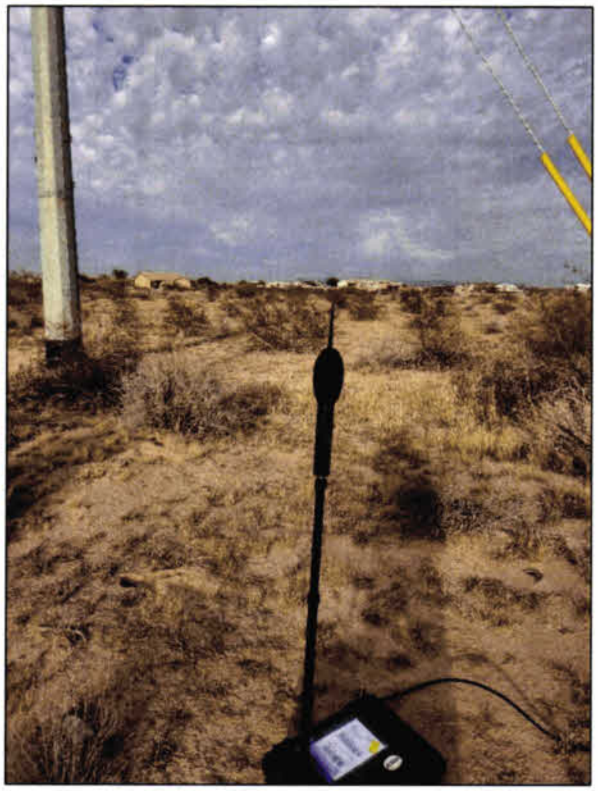


Photo 4

Monitoring Site:

LT-2

Date Taken:

December 12, 2023

Camera Facing:

East

Description:

View toward sensitive receptors with SLM in foreground.

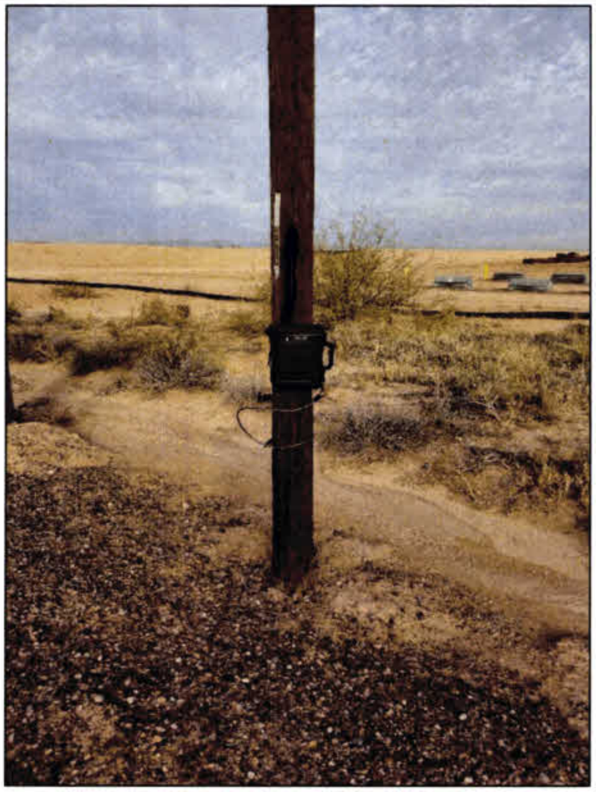


Photo 5

Monitoring Site:

LT-3

Date Taken:

December 12, 2023

Camera Facing:

Northeast

Description:

View toward SLM.

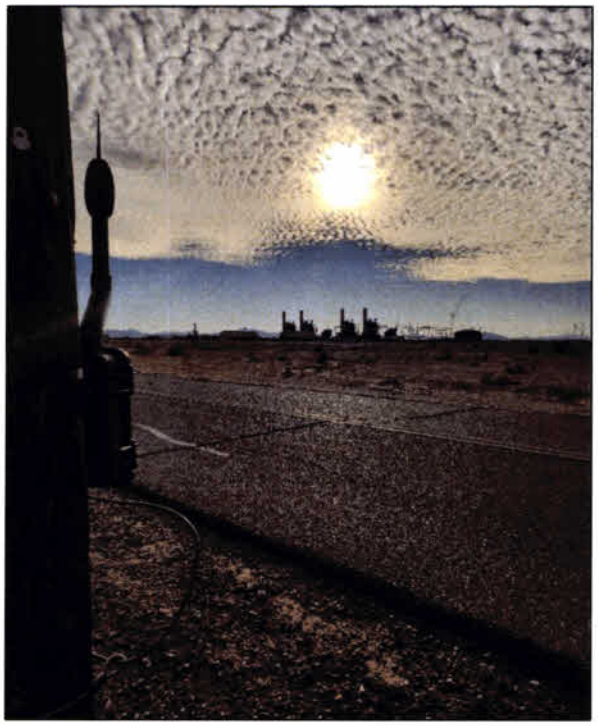


Photo 6

Monitoring Site:

LT-3

Date Taken:

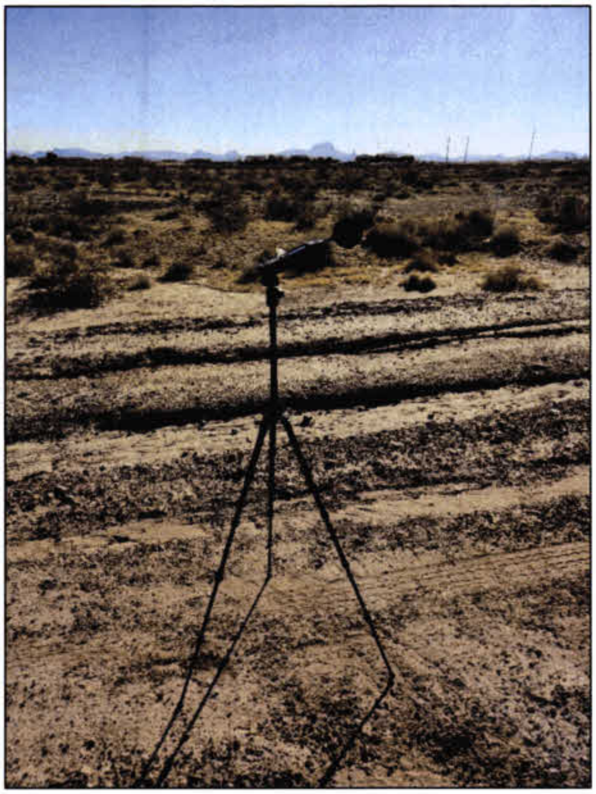
December 12, 2023

Camera Facing:

Southwest

Description:

View toward Expansion Project (visible) with SLM in foreground.

	Photo 7 Monitoring Site: ST-1 Date Taken: December 13, 2023 Camera Facing: Northwest Description: View toward SLM.
	Photo 8 Monitoring Site: ST-1 Date Taken: December 13, 2023 Camera Facing: Northwest Description: View toward sensitive receptors with SLM in foreground.

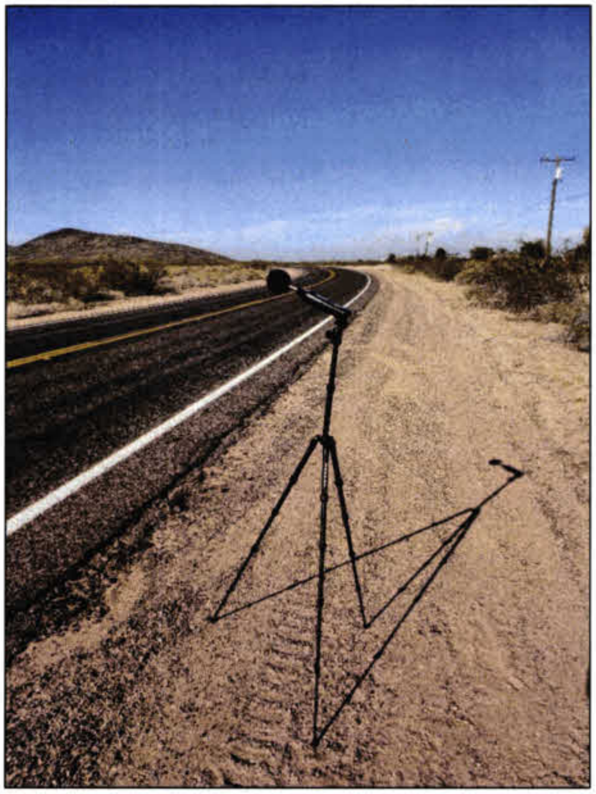


Photo 9

Monitoring Site:

ST-2

Date Taken:

December 13, 2023

Camera Facing:

North

Description:

View toward SLM.

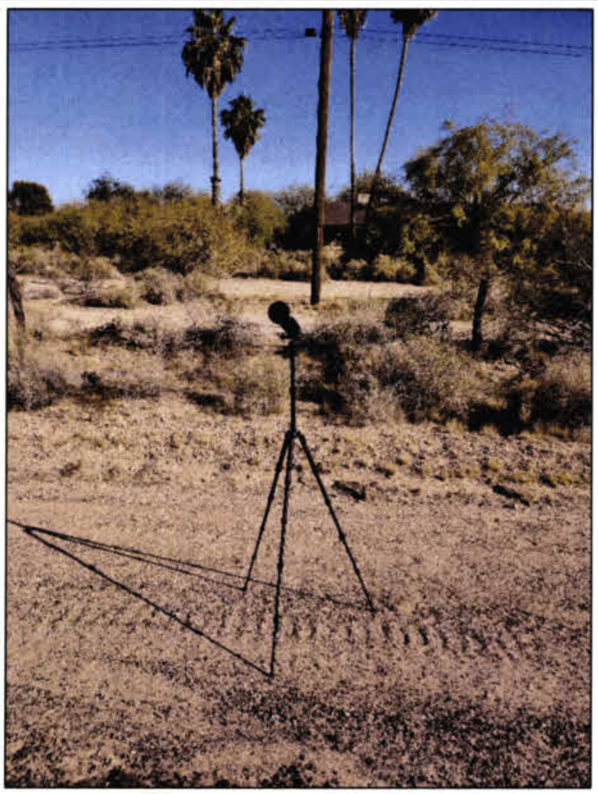


Photo 10

Monitoring Site:

ST-2

Date Taken:

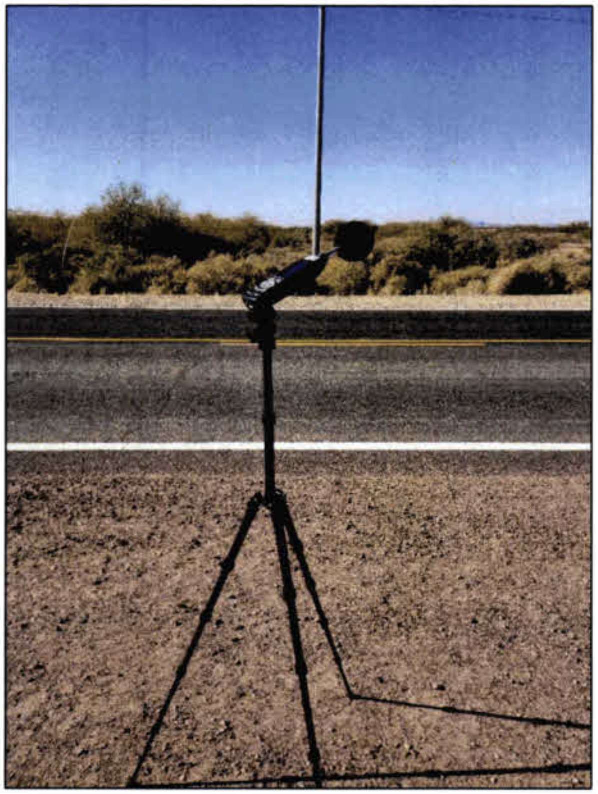
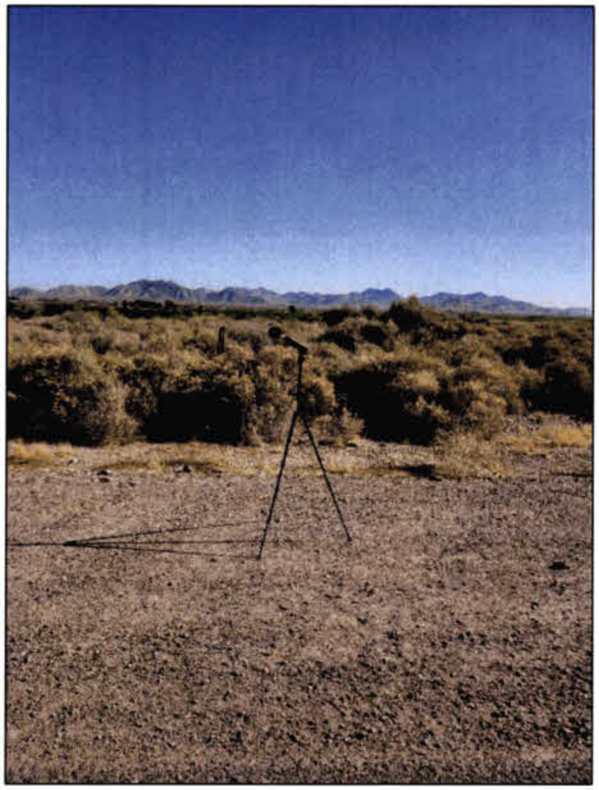
December 13, 2023

Camera Facing:

East

Description:

View toward sensitive receptors with SLM in foreground.

	Photo 11 Monitoring Site: ST-3 Date Taken: December 13, 2023 Camera Facing: West Description: View toward SLM. .
	Photo 12 Monitoring Site: ST-3 Date Taken: December 13, 2023 Camera Facing: East Description: View toward SLM with agricultural land use in background.

Appendix B Hourly Noise Level Detail

Table B-1. Long-Term Measurement Hourly Data Summary

Date	Time	L_{eq}, dBA	L_{min}, dBA	L_{max}, dBA	
			LT 1		
12/12/23	16:00	64	31	87	36
12/12/23	17:00	63	36	88	39
12/12/23	18:00	60	41	86	44
12/12/23	19:00	59	43	84	46
12/12/23	20:00	59	34	86	40
12/12/23	21:00	60	33	85	40
12/12/23	22:00	51	40	81	44
12/12/23	23:00	48	44	53	47
12/13/23	0:00	52	40	80	45
12/13/23	1:00	55	38	82	41
12/13/23	2:00	46	39	50	45
12/13/23	3:00	56	41	84	45
12/13/23	4:00	62	43	86	46
12/13/23	5:00	62	44	85	47
12/13/23	6:00	63	44	86	47
12/13/23	7:00	62	41	84	45
12/13/23	8:00	61	46	84	49
12/13/23	9:00	62	38	86	44
12/13/23	10:00	64	37	87	41
12/13/23	11:00	62	33	85	38
12/13/23	12:00	61	34	86	36
12/13/23	13:00	62	32	83	36
12/13/23	14:00	61	30	85	35
12/13/23	15:00	63	29	87	35
			LT 2		
12/12/23	16:00	63	26	88	38
12/12/23	17:00	60	22	79	39
12/12/23	18:00	57	26	78	34
12/12/23	19:00	56	28	78	32
12/12/23	20:00	52	28	75	36
12/12/23	21:00	58	32	85	36
12/12/23	22:00	46	30	72	35
12/12/23	23:00	45	31	72	34

Date	Time	L_{eq}, dBA	L_{min}, dBA	L_{max}, dBA	
12/13/23	0:00	45	32	68	36
12/13/23	1:00	39	32	63	34
12/13/23	2:00	40	35	49	38
12/13/23	3:00	49	34	72	38
12/13/23	4:00	52	35	76	39
12/13/23	5:00	60	37	77	48
12/13/23	6:00	59	38	74	47
12/13/23	7:00	60	37	87	45
12/13/23	8:00	54	38	74	43
12/13/23	9:00	57	38	82	42
12/13/23	10:00	55	39	76	42
12/13/23	11:00	58	30	80	38
12/13/23	12:00	59	28	85	35
12/13/23	13:00	54	25	72	33
12/13/23	14:00	61	28	86	38
12/13/23	15:00	60	27	85	39
			LT 3		
12/12/23	16:00	58	38	83	40
12/12/23	17:00	64	38	87	44
12/12/23	18:00	55	41	79	44
12/12/23	19:00	48	41	67	46
12/12/23	20:00	51	41	74	46
12/12/23	21:00	55	42	85	45
12/12/23	22:00	52	43	55	50
12/12/23	23:00	53	50	55	52
12/13/23	0:00	53	38	81	45
12/13/23	1:00	46	39	73	43
12/13/23	2:00	46	38	53	44
12/13/23	3:00	48	43	74	46
12/13/23	4:00	54	37	79	43
12/13/23	5:00	63	45	82	51
12/13/23	6:00	60	45	82	50
12/13/23	7:00	62	41	84	49
12/13/23	8:00	61	47	82	52
12/13/23	9:00	57	44	81	48
12/13/23	10:00	61	42	90	46
12/13/23	11:00	59	42	85	45

Date	Time	L_{eq}, dBA	L_{min}, dBA	L_{max}, dBA	
12/13/23	12:00	62	40	88	44
12/13/23	13:00	57	41	84	43
12/13/23	14:00	63	40	89	44
12/13/23	15:00	61	38	89	43

Exhibit J
Special Factors

As stated in Arizona Corporation Commission Rules of Practice and Procedure R14-3-220, Exhibit 1:

> "Describe any special factors not previously covered herein, which applicant believes to be relevant to an informed decision on its application."

Introduction

This exhibit includes information regarding the public and agency involvement program that has been conducted for the Redhawk Power Plant Expansion Project (Expansion Project). The outreach efforts provided information to agencies and individuals, solicited feedback on the proposed Expansion Project and information on the Expansion Project Study Area, and helped to identify potential issues relative to the Expansion Project.

The public involvement program was initiated to provide local jurisdictions, relevant agencies, and community residents with the opportunity to relay information or potential concerns relevant to the Expansion Project. To reach the affected residents and agencies, Arizona Public Service Company (APS) and AECOM (as consultant to APS) instituted multiple public engagement initiatives such as a project newsletter, a project website, an in-person open house meeting, a meeting reminder postcard, a virtual open house, social media advertisements, newspaper advertisements, an email to APS customers in the area, a phone hotline, and a dedicated project email to facilitate feedback from interested parties. Various outreach materials are available in English and Spanish to promote inclusivity and to ensure that all Expansion Project-related information is comprehensible to wide range of residents. By offering Expansion Project information in two languages, APS aims to inform, engage, and encourage greater community participation and feedback opportunities.

Expansion Project Newsletter

One bilingual newsletter was prepared to provide technical information to the public such as the Expansion Project webpage address, the Expansion Project objective, information about the various methods to comment on the Expansion Project (e.g., in email or by telephone), and how to otherwise become involved in the process (**Figure J-1**). The newsletter was mailed on April 12, 2024, and was circulated to residences and business within three (3) miles of the Expansion Project. Approximately 460 copies of the newsletter were mailed. As of June 20, 2024, eleven (11) comments have been received through project outreach.

Reminder Postcard

One bilingual in-person open house reminder postcard was developed and distributed to ensure public awareness about the upcoming meeting. The postcard was mailed out on May 20, 2024, to approximately the same 460 local residents within a 3-mile radius of the Expansion Project. A copy of the postcard is included as **Figure J-2**.

Customer Email

A Project-specific email address (apsredhawkproject@aps.com) was established to collect comments from the public and to allow the project team to respond to all feedback received. As of June 20, 2024, four emails have been received. Also, a direct email was sent by APS to approximately 1,200 customers on May 23, 2024, detailing the upcoming in-person open house and contact information for any Expansion Project comments. A copy of the email is included as **Figure J-3**.

Expansion Project Website and Virtual Open House

A Expansion Project webpage (https://www.aps.com/redhawkexpansion) and a virtual open house website (https://apsredhawkproject.com) was created and maintained to provide the public with a convenient way to access Expansion Project information. The websites are written in both English and Spanish to accommodate a broader audience and to reflect the linguistic diversity of the neighboring community. Through the websites, viewers can access Project information, review environmental study results, view maps, and provide feedback. Viewers can provide their comments or questions on the Expansion Project through an email hyperlink on each website. The virtual open house is compliant with the Rehabilitation Act of 1973, Section 508, which requires electronic content, such as websites, to be accessible to all users regardless of disability. Examples of accessibility include keyboard navigation in addition to mouse option, optimization for screen readers, and high-level color contrast ratio to allow visual content to be interpreted easily. The virtual open house and/or the Expansion Project webpage URLs were included in the newsletter, the in-person open house reminder postcard, the open house newspaper ad, the customer email, and the social media ads. The Expansion Project website went live on April 10, 2024, and the virtual open house was launched on April 12, 2024. According to Google analytics, the virtual open house has been viewed by approximately 2,100 visitors since its launch on April 12, 2024, through June 20, 2024. The majority of the visitors to the website are from Arlington, Buckeye, and additional visitors from Maricopa County and other locations within and outside of Arizona. As of June 20, 2024, four (4) comments have been received via email. A screenshot of the APS webpage and Expansion Project virtual open house website are provided in **Figures J-4** and **J-5**. Expansion Project virtual open house visitor analytics and city demographics analytics from April 12 to June 20, 2024, are included in **Figures J-6** and **J-7.**

In-Person Open House

APS hosted an in-person open house at the Arlington Elementary School located at 9410 South 355th Avenue, Arlington, Arizona on June 6, 2024, from 4:00 p.m. to 8:00 p.m. During the open house, APS provided display boards with Expansion Project maps and details, and APS staff attended the event to allow customers to interact with the Project team one-on-one and to solicit feedback. A Spanish translator was present to provide clear communication of Project information, address any concerns or questions, and ensure that all comments are accurately understood and considered. Comment sheets were provided and as of June 6, 2024, six (6) written comments were received. Photos of the in-person open house are included in **Figure J-8.**

Social Media

APS placed an advertisement through Instagram and Facebook targeted to users in a 10-mile radius of the Expansion Project, encompassing the Study Area and adjacent neighborhoods. The advertisement provided brief information on the Expansion Project, directed users to the virtual open house, and provided information for an in-person open house. The advertisements ran from May 17, 2024, to May 31, 2024, with the bilingual advertisement reaching 53,358 people and with about 5.04 percent of viewers clicking on the ad linked to the Expansion Project webpage. Screenshots of these advertisements are included in **Figure J-9**. Social media ad engagement analytics are included in **Figure J-10**.

Newspaper Advertisement and Legal Notice

APS placed an advertisement in the West Valley View newspaper. The advertisement was placed on May 22, 2024, announcing the public open house on June 6, 2024, from 4 p.m. to 8 p.m.

APS placed a legal notification in the *West Valley View* newspaper and *Arizona Republic* newspaper announcing the Arizona Power Plant and Transmission Line Siting Committee hearing on August 19 to 23, 2024. The legal notification was placed in the *West Valley View* on July 17, 2024, and July 24, 2024. The legal notification was also placed in the *Arizona Republic* newspaper on July 17, 2024, and July 20, 2024. A copy of the legal notifications is included as **Figure J-11.**

Agency and Local Officials Briefings

During the Expansion Project process, APS coordinated with representatives of Maricopa County, including elected officials and planning staff. The agency and local official outreach objective are to relay information on the Expansion Project to their community members to help better understand landowner development plans, answer questions, and request feedback. These meetings enabled the Expansion Project team to identify stakeholder issues, consider suggestions during the planning process, and relay information on developments in the Expansion Project. A list of agencies contacted is included in **Table J-1**.

Table J-1. Agency and Local Officials Representatives

Contact Name	Title	Jurisdiction/Agency
Sine Kerr	Senator	Arizona District 25
Michael Carbone	Representative	Arizona District 25
Tim Dunn	Representative	Arizona District 25
Blaise Caudill	Energy Policy Advisor	Arizona Governor's Office
Eric Orsborn	Mayor	City of Buckeye
Dan Cottermann	City Manager	City of Buckeye
Mark Burdick	Fire Chief	Arizona Fire and Medical Authority
Eric Kriwer	Assistant Fire Chief	Operations/Community Risk Management Division, Arizona Fire and Medical Authority

Public Outreach Comments

As of June 20, 2024, APS received eleven (11) comments from the public. All comments provided to APS are included in **Table J-2**.

Cultural Resources Report

A report documenting a cultural resources survey report was discussed In **Exhibit E**. The full report is included as **Exhibit J-12**.

Table J-2. Public Comment Matrix

No.	Date	Commenter	Notification Type	Issues / Comments	Concern / Topics	Response
1	05/22/2024	Rudy Larez	Email	"Is the chemicals being used in the cooling towers to prevent algae and calcium build-up harmful to our water system for our wells? There is a lot of droplets coming out of the towers from the main nuclear plant. When it rains does it affect out underwater table our wells? Has there been a study in our area on the water to make sure the chemicals are not reaching our water table. Where is the bleed off from the cooling towers getting drained too to keep your TDS (total dissolved solids) readings in line?"	Environmental Concerns	Kevin Duncan of APS responded via email stating, "Thank you for your question. The Redhawk Power Plant Expansion Project, as described on our page at apsredhawkproject.com, is an expansion of our existing plant and does not include the use of cooling towers. APS is committed to using groundwater in a reasonable manner to safeguard the area and minimize impacts to our neighbors. Please provide a phone number so we can have an APS representative contact you. Our offices will be closed on Monday for the Holiday, and will reopen on Tuesday, May 28th."
2	05/23/2024	Shannon Armstrong	Email	"Where can I find information regarding employment for the expansion of RedHawks."	Employment Opportunities	Kevin Duncan of APS responded via email stating, "Thank you for your question. This email address is intended for comments about the project. For employment, please refer to the careers page at aps.com."

No.	Date	Commenter	Notification Type	Issues / Comments	Concern / Topics	Response
3	06/06/2024	Mark Cardenas	Open House Comment Sheet	"A good mix of power sources is key for the summer months. Solar is good, but it only goes so far. The gap needs to be filled by nuclear and nitrogen gas."	Support of project	Letter of support. No response required.
4	06/06/2024	Richard Lerma	Open House Comment Sheet	"I am in support of the APS Redhawk Expansion Project. We need a reliable energy source other than just wind and solar. The Expansion Project would create a lot of direct and indirect jobs for Arizonians and the surrounding community."	Support of Project	Letter of support. No response required.
5	06/06/2024	Aaron Burka	Open House Comment Sheet	"Very informative and great presentation."	Open House Praise	Letter of support. No response required.
6	06/06/2024	Laura Cherry	Open House Comment Sheet	"I thought this open house was very informative and well put together. I thought the virtual open house was very useful for those who can't attend."	Open House Praise	Letter of support. No response required.
7	06/06/2024	Karen Adams	Open House Comment Sheet	"The open house was very informative. I'm happy to see the Redhawk Power Plant expanded and the land used for natural gas project, instead of being used for solar energy."	Support of Project	Letter of support. No response required.
8	06/06/2024	Elise Marsh	Open House Comment Sheet	"Open house info was great. My only concern is the traffic created during construction. I have almost been hit multiple times by traffic as the solar plants were being built so I would appreciate if the construction workers could be reminded there is local traffic."	Traffic Impacts	Letter of support. APS acknowledges construction traffic concerns. No response required.

No.	Date	Commenter	Notification Type	Issues / Comments	Concern / Topics	Response
9	06/05/2024	Dolores Washington	800 Phone Number	Called from state of Georgia. Called to verify which time zone the meeting was going to be held in.	Open House	Mark Turner of AECOM called Ms. Washington back and left a message stating that the meeting on 6/6/24 was an in-person meeting at the Arlington Elementary School (AZ time) and was using the same message boards as used for the project virtual open house. Informed her APS would have staff available to answer questions. She never called back.
10	06/13/24	Michael Sheehan	Email	"My name is Michael Sheehan with Capital Power. We're the owner/operator of your neighbor, Arlington Valley. A colleague of mine directed me to your virtual open house for the Redhawk expansion. It's a very impressive site! I'm wondering if you could tell me who put virtual open house site together for the Redhawk Power Plant Expansion Project? I would really appreciate the information, so I can investigate possibly using it for future projects at Capital Power."	Virtual Open House Praise	Sandra Hemmingsen of APS responded via email stating, "Thank you for your nice comments. We engaged AECOM environmental services and with input on content from our APS team, they put together the virtual open house. They have been very helpful to us through the CEC application and outreach process."

No.	Date	Commenter	Notification Type	Issues / Comments	Concern / Topics	Response
11	06/18/2024	Claudia Ochoa	Email	"I have two properties in the area and would like to confirm which one will be affected by the Redhawk Power Plant Expansion Project. The two parcel numbers are: 401-42-459, 401-42-016Q. Can you provide information regarding the process regarding the sale of the property to APS? Is there a timeline when it needs to be completed?"		Sandra Hemmingsen of APS responded via email stating, "The Redhawk Power Plant Expansion project will be located entirely within the existing plant site. All of that land is currently owned by APS. We do not plan to purchase any land for this project. Please visit our Virtual Open House for more detailed information on the project. apsredhawkproject.com"

Figure J-1. Expansion Project Newsletter

Mail Station 3293
P.O. Box 53933, Phoenix, AZ 85072

Presorted
Standard Mail
US Postage Paid
Phoenix, AZ
Permit No. 90

APS REDHAWK POWER PLANT EXPANSION PROJECT

You're invited!

You're invited! Join us to learn more about the **APS Redhawk Power Plant Expansion Project** at our in-person open house. Come by at your convenience to meet with APS representatives and to discuss the project one on one.

Thursday, June 6, 2024
4:00 - 8:00 p.m.
Arlington Elementary School
9410 South 355th Avenue,
Arlington, AZ 85322

Visit our virtual open house starting in **April 2024** at **www.apsredhawkproject.com**. We encourage you to submit questions and comments by phone at **(800) 484-1358** or email to **apsredhawkproject@aps.com** by **June 20, 2024**.

PROYECTO DE EXPANSIÓN DE LA CENTRAL ELÉCTRICA REDHAWK DE APS

¡Estás invitado!

¡Estas invitado! Únete a nosotros para obtener más información sobre el Proyecto de Expansión de la Central Eléctrica Redhawk en nuestra sesión informativa en persona. Ven a tu conveniencia para reunirte con los representantes de APS y discutir el proyecto en persona.

Jueves, el 6 de junio del 2024
4:00 - 8:00 pm
Arlington Elementary School
9410 South 355th Avenue,
Arlington, AZ 85322

Visita nuestra sesión informativa virtual a partir de **abril del 2024**. Te recomendamos que envíes preguntas y comentarios por teléfono al **(800) 484-1358** o por correo electrónico a **apsredhawkproject@aps.com** antes del **20 de junio del 2024**.

APS REDHAWK POWER PLANT EXPANSION PROJECT

APRIL | ABRIL 2024

Arizona Public Service (APS) proposes to expand its existing Redhawk Power Plant, located near you. The expansion includes the addition of eight new natural gas units, adding 397 megawatts (MW) to the energy grid by 2028 – enough to serve 63,520 Arizona homes.

These new units are necessary to support the reliable service our customers count on. Modern natural gas units, like those planned for this location, provide flexible, on-demand energy when customers need it most.

The Redhawk Power Plant is a key component of our energy infrastructure. Adding additional units at Redhawk maximizes the current infrastructure and gas pipeline capacity to generate reliable energy for Arizona.

POWERING ARIZONA
Why is this project needed?

There is significant growth in demand for energy in our service territory, and we are preparing to meet nearly 40% load growth by 2031. We are committed to providing reliable and affordable service and use a rigorous selection process and detailed analysis to determine the best combination of resources to serve customers. Our natural gas fleet is an important part of a diverse energy mix and a critical partner to the large quantities of solar and battery energy storage we're adding to our system. These new units will provide much-needed energy during the late-afternoon and evening hours, when customer energy use is highest.

Arizona Public Service (APS, por sus siglas en inglés) propone expandir su Central Eléctrica Redhawk, ubicada cerca de ti. La expansión incluye la adición de ocho nuevas unidades de gas natural, agregando 397 megavatios (MW) a la red de energía para 2028, suficiente para servir a 63,520 hogares en Arizona.

Estas nuevas unidades son necesarias para apoyar el servicio confiable con el que cuentan nuestros clientes. Las unidades modernas de gas natural, como las planificadas para esta ubicación, proporcionan energía flexible y bajo demanda cuando los clientes más la necesitan.

La Central Eléctrica Redhawk es un componente clave de nuestra infraestructura energética. La adición de unidades adicionales en Redhawk maximiza la infraestructura actual y la capacidad de los gasoductos para generar energía confiable para Arizona.

IMPULSANDO ARIZONA
Por qué es necesario este proyecto?

Hay un crecimiento significativo en la demanda de energía en nuestro territorio de servicio, y nos estamos preparando para cumplir con un crecimiento de carga de casi el 40% para 2031. Estamos comprometidos a proveer un servicio confiable y asequible y utilizamos un riguroso proceso de selección y un análisis detallado para determinar la mejor combinación de recursos para servir a los clientes. Nuestro sistema de gas natural es una parte importante de una combinación de energía diversa y un complemento fundamental para las grandes cantidades de energía solar y almacenamiento de energía en baterías que estamos agregando a nuestro sistema. Estas nuevas unidades proporcionarán la energía necesaria durante las últimas horas de la tarde y la noche, cuando el uso de energía de los clientes es más alto.

Project timeline | Línea de tiempo del proyecto

APRIL 2024	JUNE 2024	JULY 2024	2025-2027	SPRING 2028
Comment period begins. Air permit filed with Maricopa County	Community open house	CEC application filed with Arizona Corporation Commission	Construction	Start plant operations ahead of summer demand

What's next?

Impact studies for the APS Redhawk Power Plant Expansion Project are underway. The results of these studies will be shared with the community during the in-person open house on June 6, 2024, and online at the virtual open house: **www.apsredhawkproject.com**.

This summer, APS will include these results and public comment we receive through June 20, 2024, when we file the application for the plant's Certificate of Environmental Compatibility (CEC) with the Arizona Corporation Commission.

We will also file a modification to our existing permit in April. Maricopa County and the Environmental Protection Agency (EPA) will review the air quality impact analysis results to ensure air quality in the area remains within established guidelines to protect health.

Both the CEC and air permit processes include opportunities for the public to provide comment.

We're committed to connecting you with information about the Redhawk Power Plant Expansion Project.

ABRIL 2024	JUNIO 2024	JULIO 2024	2025-2027	PRIMAVERA 2028
Comienza el periodo de comentarios. Permiso de aire presentado ante el condado de Maricopa	Sesión informativa comunitaria	Solicitud de CEC presentada ante la Arizona Corporation Commission	Construcción	Comienza operaciones de planta antes de la demanda de verano

¿Que sigue?

Se están llevando a cabo estudios de impacto para el Proyecto de Expansión de la Central Eléctrica Redhawk de APS. Los hallazgos de estos estudios se compartirán con la comunidad durante la sesión informativa presencial el 6 de junio del 2024 y en línea en la sesión informativa virtual: **www.apsredhawkproject.com**.

Este verano, APS incluirá estos resultados y los comentarios del público que recibamos hasta el 20 de junio del 2024, cuando presentemos la solicitud del Certificado de Compatibilidad Ambiental (CEC, por sus siglas en inglés) de la central eléctrica ante la Arizona Corporation Commission.

También presentaremos una modificación a nuestro permiso existente en abril. El Condado de Maricopa y la Agencia de Protección Ambiental (EPA, por sus siglas en inglés) revisarán los resultados del análisis de impacto en la calidad del aire para garantizar que la calidad del aire en el área se mantenga dentro de las pautas establecidas para proteger la salud.

Tanto el proceso del CEC como el de permisos aéreos incluyen oportunidades para que el público envíe comentarios.

Nos comprometemos a conectarte con información sobre el Proyecto de Expansión de la Central Eléctrica Redhawk.

Where can I learn more? | ¿Dónde puedo obtener más información?

We're committed to connecting you with information about the Redhawk Power Plant Expansion Project.

- **In-Person Open House:**
  Thursday, June 6, 2024, 4:00 - 8:00 p.m.
  Arlington Elementary School
  9410 South 355th Avenue,
  Arlington, AZ 85322
- **Project website:**
  www.apsredhawkproject.com
  Virtual open house live April - September 2024
- **Hotline: (800) 484-1358**
- **Email: apsredhawkproject@aps.com**

We encourage you to submit your questions and comments by **June 20, 2024**.

Estamos comprometidos a conectarte con información sobre el Proyecto APS Sundance.

- **Sesión informativa en persona:**
  Jueves, 6 de junio del 2024, 4:00 - 8:00 p.m.
  Arlington Elementary School
  9410 South 355th Avenue,
  Arlington, AZ 85322
- **Sitio web del proyecto:**
  www.apsredhawkproject.com
  Sesión informativa virtual disponible abril - septiembre 2024
- **Línea directa: (800) 484-1358**
- **Correo electrónico:**
  apsredhawkproject@aps.com

Te recomendamos que envíes tus preguntas y comentarios antes del **20 de junio del 2024**.

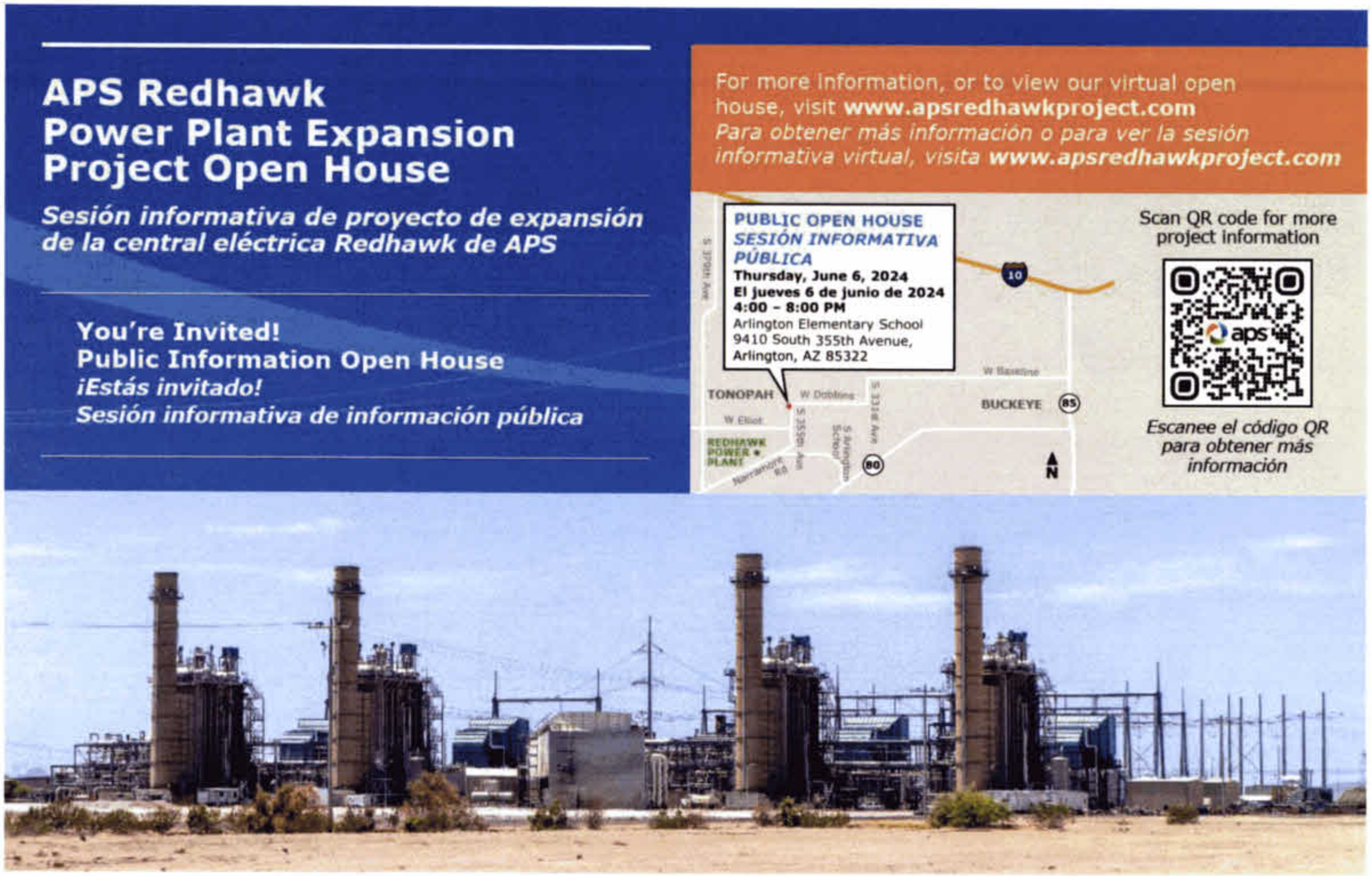
ABOUT ARIZONA PUBLIC SERVICE (APS)

APS owns and operates the Redhawk Power Plant near you. We are the state's largest electric utility, serving approximately 1.4 million homes and businesses in 11 of Arizona's 15 counties. You can learn more about APS and our commitment to deliver reliable, affordable, clean energy to Arizona at **aps.com**.

SOBRE ARIZONA PUBLIC SERVICE (APS)

APS posee y opera la planta de energía Redhawk cerca de ti. Somos la empresa de servicios eléctricos más grande del estado, y servimos a aproximadamente 1.4 millones de hogares y empresas en 11 de los 15 condados de Arizona. Puede obtener más información sobre APS y nuestro compromiso de proporcionar energía confiable, asequible y limpia a Arizona en **aps.com**.

Figure J-2. May 2024 Postcard



aps

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P.O. Box 53933, Phoenix, AZ 85072

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ABOUT THE APS REDHAWK POWER PLANT EXPANSION PROJECT
SOBRE EL PROYECTO DE EXPANSIÓN DE LA CENTRAL ELÉCTRICA REDHAWK DE APS

Arizona Public Service (APS) proposes to expand its existing Redhawk Power Plant, located near you. The expansion includes the addition of eight new natural gas units, adding 397 megawatts (MW) to the energy grid by 2028 – enough to serve 63,520 Arizona homes. The proposed new units will provide much-needed energy during the late-afternoon and evening hours, when customer energy use is highest.

Arizona Public Service (APS) propone expandir su existente central eléctrica Redhawk, ubicada cerca de ti. La expansión incluye la adición de ocho nuevas unidades de gas natural, agregando 397 megavatios (MW) a la red de energía para 2028, suficiente para servir a 63,520 hogares de Arizona. Las nuevas unidades propuestas proporcionarán la energía que tanto se necesita durante las últimas horas de la tarde y la noche, cuando el uso de energía de los clientes es más alto.

Figure J-3. APS Email Announcing June 6, 2024, Open House

View in browser | Forward to friend

Redhawk Power Plant Expansion Project

To reliably serve customers, APS is proposing to build eight new natural gas units at its existing Redhawk Power Plant in Arlington, Arizona. The units will add approximately 397 megawatts (MW) to the energy grid by 2028 - enough to serve 63,520 Arizona homes.

There is significant growth in demand for energy in our service territory; we are preparing to meet nearly 40% load growth by 2031. APS is committed to providing reliable and affordable service and uses a rigorous selection process and detailed analysis to determine the best combination of resources to serve customers. Our natural gas fleet is an important part of a diverse energy mix and a critical partner to the large quantities of solar and battery energy storage we're adding to our system. These proposed new units will provide much-needed energy during the late-afternoon and evening hours, when customer energy use is highest.

You're invited!

Join us to learn more about the APS Redhawk Power Plant Expansion Project at our in-person open house. Come by at your convenience to meet with APS representatives and discuss the project one-on-one.

Thursday, June 6, 2024

4:00 - 8:00 p.m.

Arlington Elementary School

9410 South 355th Avenue

Arlington, AZ 85322

You can also visit our virtual open house at **apsredhawkproject.com**.

We encourage you to submit questions or comments about the project by June 20, 2024 so they can be included when we file the application for the plant's Certificate of Environmental Compatibility (CEC) with the Arizona Corporation Commission. APS will continue to consider and review comments throughout the permitting process. You can submit comments by phone at (800) 484-1358 or email to **apsredhawkproject@aps.com**.

Thank you for providing valuable input on the Redhawk Power Plant Expansion Project.

Figure J-4. APS Expansion Project Webpage

Redhawk Power Plant Expansion Project

Location: Arlington, AZ
Estimated Completion Date: Spring 2028

Project description

APS proposes to expand its existing Redhawk Power Plant. The expansion includes the addition of eight new natural gas units, adding up to 397 megawatts (MW) to the energy grid by 2028 – enough to serve 63,520 Arizona homes.

Project need

There is significant growth in demand for energy in our service territory, and we are preparing to meet nearly 40% load growth by 2031. These new units will provide much-needed energy during the late-afternoon and evening hours, when customer energy use is highest. We are committed to providing reliable and affordable service and use a rigorous selection process and detailed analysis to determine the best combination of resources to serve customers. Our natural gas fleet is an important part of a diverse energy mix and a critical partner to the large quantities of solar and battery energy storage we're adding to our system.

These new units are necessary to support the reliable service our customers count on. Modern natural gas units, like those planned for this location, provide flexible, on-demand energy when customers need it most.

The Redhawk Power Plant is a key component of our energy infrastructure. Adding additional units at Redhawk maximizes the current infrastructure and gas pipeline capacity to generate reliable energy for Arizona.

Public open house

Join us to learn more about the APS Redhawk Power Plant Expansion Project at our in-person open house. Come by at your convenience to meet with APS representatives and to discuss the project one on one.

Thursday, June 6, 2024

4:00 - 8:00 p.m.

Arlington Elementary School

9410 South 355th Avenue (**map**)

Arlington, AZ 85322

Virtual open house

You can also attend our virtual open house at any time online to learn more about the project: **www.apsredhawkproject.com**.

We encourage you to submit questions or comments about the project by June 20, 2024 so they can be included when we file the application for the plant's Certificate of Environmental Compatibility (CEC) with the Arizona Corporation Commission. You can submit comments by phone at (800) 484-1358 or email to **apsredhawkproject@aps.com**.

Resources:

Newsletter April 2024

Air Permit Revision Application

Figure J-5. Expansion Project Website—Virtual Open House


Air Quality
Calidad Del Aire
Noise Assessment
Evaluación Del Ruido
Visual Evaluation
Evaluación Visual
Day Time Visual Simulations
Simulaciones Visuales Diurnas


Night Time Visual Simulations
Simulaciones Visuales Nocturnas
Biological and Cultural Resources
Recursos Biológicos Y Culturales
Land and Water Use
Uso de tierra y recursos hídricos
Summary of Environmental Conclusions
Resumen De Las Conclusiones Ambientales


Summary of Environmental Conclusions
Resumen De Las Conclusiones Ambientales
WELCOME!
¡BIENVENIDO!
?

Figure J-6. Virtual Open House Visitor Analytics (April 12 - June 20, 2024):

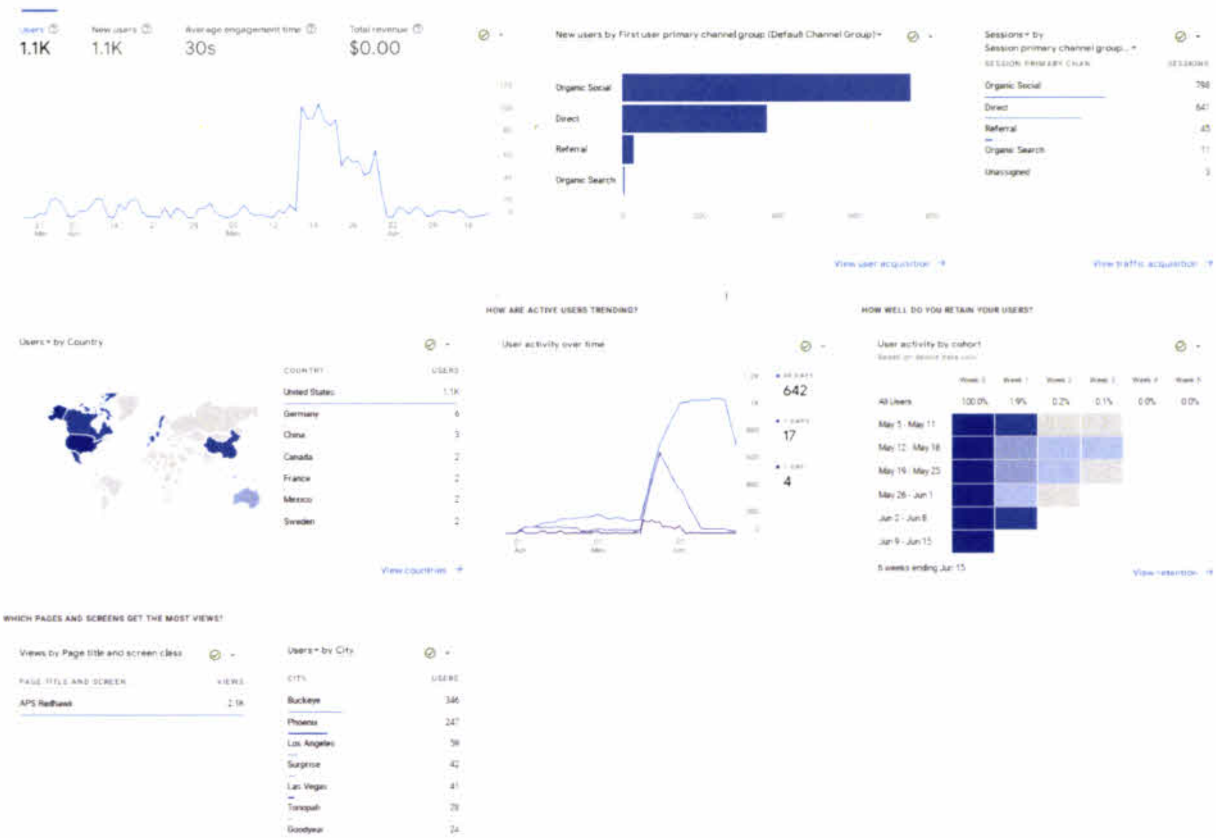


Figure J-7. Virtual Open House City Demographic Analytics (April 12 - June 20, 2024):

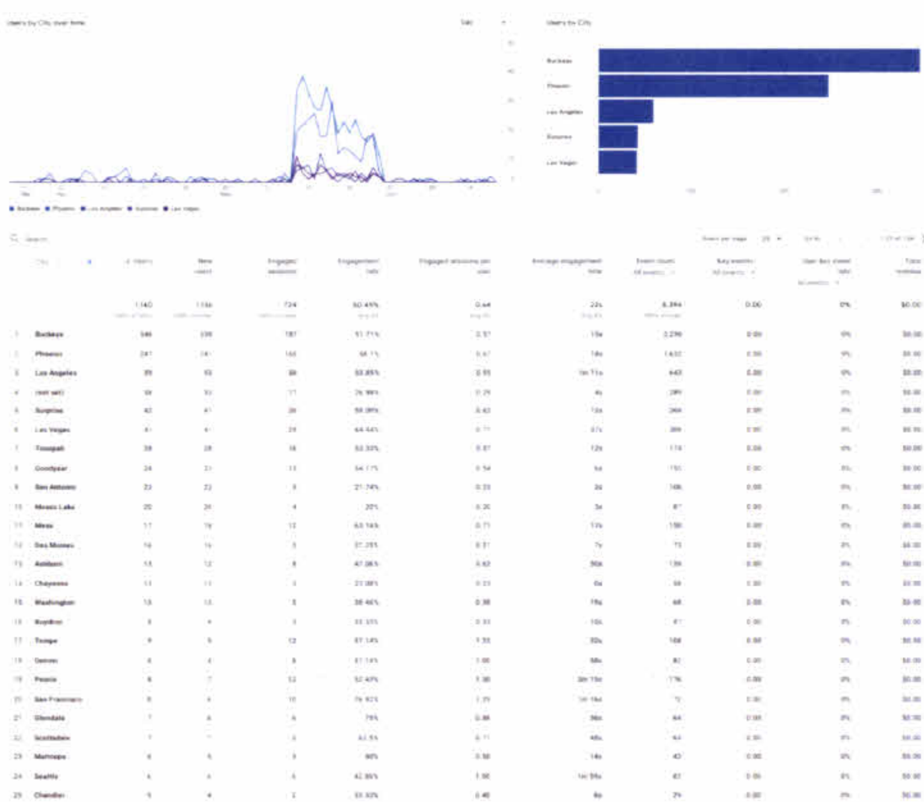


Figure J-8. In-Person Open House Photos

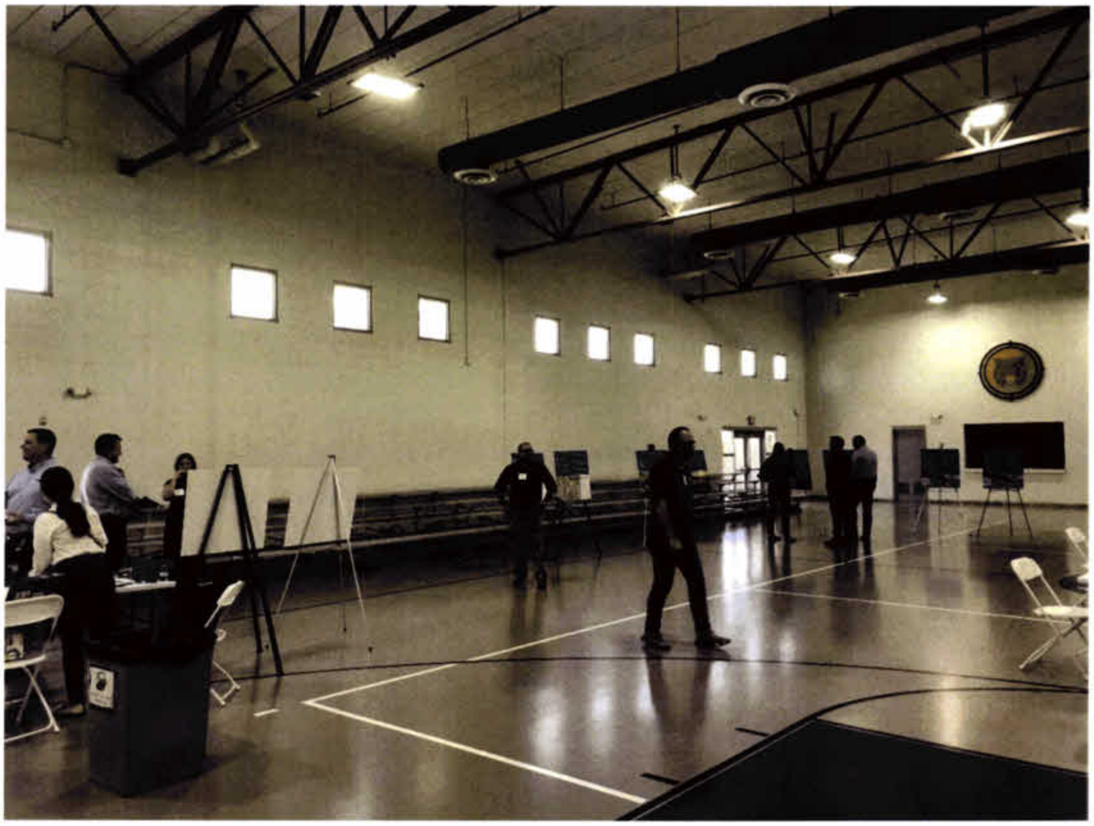


Figure J-9. Social Media Advertisements

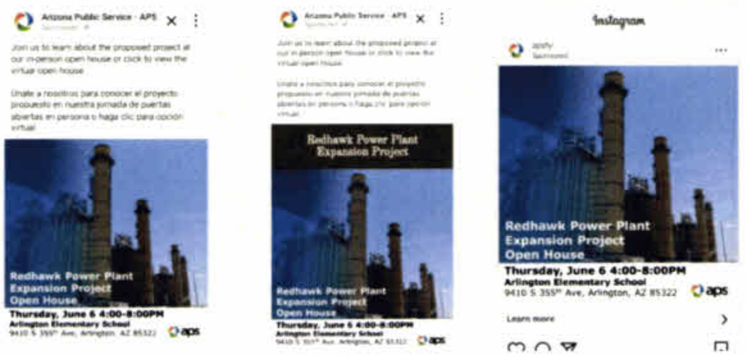


Figure J-10. Social Media Ad Engagement Analytics

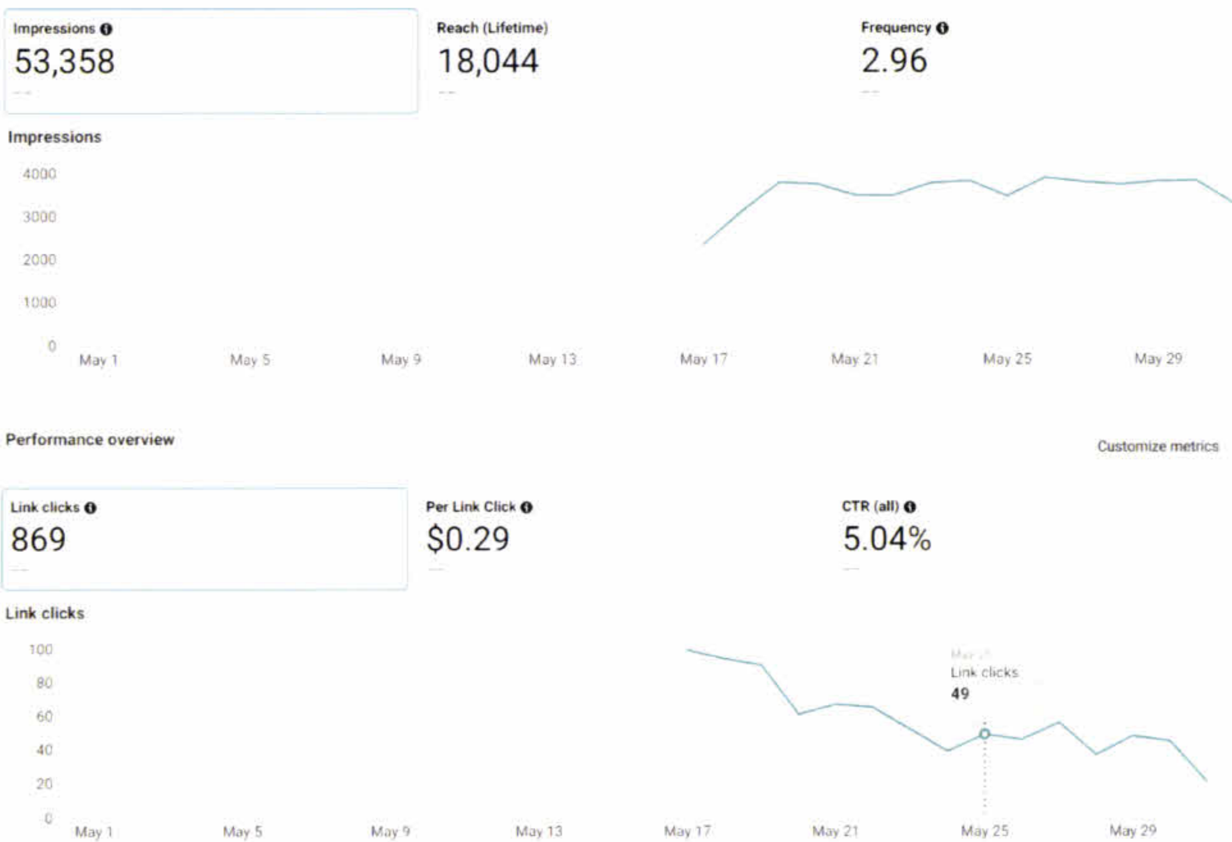


Figure J-11. Newspaper Advertisement and Legal Notice

West Valley View 5-22-2024 Advertisement for Open House

A PUBLIC INVITATION FROM APS

Redhawk Power Plant Expansion Project
Public Information In-Person & Virtual Open Houses

Arizona Public Service (APS) proposes to expand its existing Redhawk Power Plant in Arlington, Arizona. The proposed expansion includes the addition of eight new natural gas units, adding 397 megawatts (MW) to the energy grid by 2028 — enough to serve 63,520 Arizona homes. These new units are necessary to support the reliable service our customers count on. Modern natural gas units, like those planned for this location, provide flexible, on-demand energy when customer energy use is highest.

Your input is important to us. We invite you to join us at our virtual and in-person open houses to learn more about the APS Redhawk Power Plant Expansion Project.

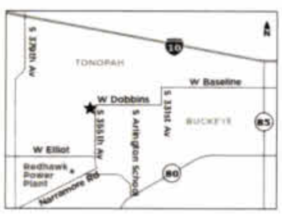
You're Invited!
In-Person Open House
Thursday, June 6, 2024
4:00 - 8:00 p.m.
Arlington Elementary School
9410 South 355th Avenue
Arlington, AZ 85322

Virtual Open House:
www.apsredhawkproject.com

Project information phone number: (800) 484-1358
Project email: apsredhawkproject@aps.com

We encourage you to submit questions or comments about the project by June 20, 2024, so they can be included when we file the application for the plant's Certificate of Environmental Compatibility (CEC) with the Arizona Corporation Commission.

Information about the Redhawk Power Plant Expansion Project can also be found on our project website at **www.aps.com/redhawkexpansion**. A QR code to the virtual open house can be scanned below. Comments and questions about the project may be submitted at the in-person open house, through the virtual open house, by email or by phone.



aps.com

aps

2404713 Redhawk Newspaper Ad.indd 1

5/14/24 2:58PM

Figure J-12. Cultural Resources Assessment for the Redhawk Power Plant Expansion Maricopa County, Arizona

Cultural Resource Assessment for the Redhawk Power Plant Expansion, Maricopa County, Arizona

Prepared for
Arizona Public Service Company

Prepared by
AECOM
7720 North 16th Street, Suite 100
Phoenix, Arizona 85020

Restricted Distribution:
Restrict distribution of information in this document about the location, character, or ownership of archaeological and historic resources if that information could result in significant invasion of privacy, damage to the archaeological and historical resources, or impede the use of traditional religious sites by practitioners, in accordance with applicable regulatory requirements, including Section 304 of the National Historic Preservation Act, Section 9(a) of the Archaeological Resources Protection Act, and Section 39-125 of the Arizona Revised Statutes.

Cultural Resource Report 2024-1(AZ)

April 2024

1. REPORT TITLE

1a. Report Title:
Cultural Resource Assessment for the Redhawk Power Plant Expansion, Maricopa County, Arizona
1b. Report Author(s): A.E. (Gene) Rogge and Chad Kirvan
1c. Date: 5 April 2024 **1d. Report No.:** 2024-1(AZ)

2. PROJECT REGISTRATION/PERMITS
2a. ASM Accession Number: none required
2b. AAA Permit Number: none required
2c. ASLD Lease Application Number(s): not applicable
2d. Other Permit Number(s): none

3. ORGANIZATION/CONSULTING FIRM
3a. Name: AECOM
3b. Internal Project Number: 60721326
3c. Internal Project Name: Redhawk Power Plant Expansion
3d. Contact Name: A.E. (Gene) Rogge
3e. Contact Address: 7720 N. 16th Street, Suite 100, Phoenix, AZ 85020
3f. Contact Phone: 602-317-1772
3g. Contact Email: gene.rogge@aecom.com

4. SPONSOR/LEAD AGENCY
4a. Sponsor: Arizona Public Service Company (APS)
4b. Lead Agency:
Power Plant and Transmission Line Siting Committee, Arizona Corporation Commission (ACC)
4c. Agency Project Number(s): to be determined
4d. Agency Project Name: to be determined
4e. Funding Source(s): APS
4f. Other Involved Agencies: none
4g. Applicable Regulations:
ACC Rules of Practice and Procedure R14-3-219,
State Historic Preservation Act (Arizona Revised Statutes § 41-861 through § 41-864),

5. DESCRIPTION OF PROJECT OR UNDERTAKING:
APS is preparing an application for submittal to the ACC Arizona Power Plant and Transmission Siting Committee for a Certificate of Environmental Compatibility (CEC) for the proposed expansion of the Redhawk Power Plant (Project). The proposed expansion includes eight LM6000 gas turbine generators, water tank, turbine chiller building, well head building, and a transmission line to connect to an existing adjacent switchyard. The generators would be arranged in pairs and cooled by water-to-air closed loop coolers using demineralized water-glycol cooling medium. Natural gas to power the generators would be supplied by an existing pipeline, and water for operating the power plant would be provided by existing wells and infrastructure. The Project site is within the area covered by the CEC the ACC issued for the Redhawk Power Plant on 23 February 2000 (Case 95, Docket No. L-00000J-99-0095. Decision 62324).

Exhaust gases from the turbines would discharge directly to the atmosphere through stacks with continuous emissions monitors and test connections for performance monitoring. An existing regulatory storage pond (approximately 5 acres) would hold a supply of raw water that would be processed with an on-site reverse osmosis system to remove dissolved solids. Vendor-supplied portable demineralization trailers would completely demineralize the water, and the trailers would be taken off-site for regeneration and disposal of spent resins and chemicals in accordance with applicable regulations. The byproduct from the reverse osmosis system and clean water from an oil separator would be blended with irrigation water supplied by the Central Arizona Project to reduce total dissolved solids so the water could be reused to irrigate existing fields in the Project vicinity.

6. PROJECT AREA/AREA OF POTENTIAL EFFECTS:
The Project site includes the area that construction of the Project could disturb, which is a parcel a maximum of approximately 1,350 feet wide and 1,400 feet long.

7. PROJECT LOCATION
7a. Address: adjacent to the Redhawk Power Plant, which is at 11600 S. 363rd Avenue
7b. Route: not applicable **7c. Mileposts Limits:** not applicable
7d. Nearest City/Town: Arlington **7e. County:** Maricopa
7f. Project Locator UTM: 328,514 Easting, 3,689,556 Northing **7g. NAD** 83 **7h. Zone:** 12
7i. Baseline & Meridian: Gila and Salt River **7j. USGS Quadrangle:** Arlington
7k. Legal Description(s): Township 1 South, Range 6 West, N1/2 Section 23 (**Figures 1, 2, and 3**)

8. SURVEY AREA
8a. Total Acres: the Project site covers approximately 38.2 acres
8b. Survey Area

1. Land Jurisdiction	2. Total Acres Surveyed	3. Total Acres Not Surveyed	4. Justification for Areas Not Surveyed
private	none	not applicable	not applicable

9. ENVIRONMENTAL CONTEXTS
9a. Landform:
The survey area is on basin floor deposits in the Central Sonoran/Colorado Desert Basins ecoregion of central Arizona (Griffith and others 2014).
9b. Elevation: 880 feet
9c. Surrounding Topographic Features:
The project is in Arlington Valley. The Palo Verde Hills are to the northwest, the Gila Bend Mountains are to the south, and Arlington Mesa is to the east.
9d. Nearest Drainage:
The Project site is approximately 2.5 miles north of Centennial Wash, which drains approximately 6 miles southeast to the Gila River.
9e. Local Geology:
The local geology is late to middle Pleistocene unconsolidated to weakly consolidated basin floor deposits primarily of sand, silt, and clay (Richard and others 2000).
9f. Vegetation:
The Project site is former farmland that has been graded and is almost completely devoid of vegetation. Native vegetation is likely to have been a creosote bush-bursage community typical of the Lower Colorado River Subdivision of Sonoran Desertscrub (Turner and Brown 1994).
9g. Soils/Deposition:
Soils in the Project site are predominantly classified as Estrella loam, saline-alkali, with 0 to 1 percent slopes and loam overlying clay loam and gravely clay loam, and Laveen loam, saline-alkali, with 0 to 1 percent slopes and loam overlying gravely loam (Natural Resources Conservation Service 2024).
9h. Buried Deposits: not likely
9i. Justification: The geomorphological setting indicates there is potential for buried archaeological deposits but they would be relatively shallow and typically there would be surface indications of such deposits. A cultural resource survey did not identify any archaeological sites before the Project site was graded (Rogge and others 2000).

I0. BUILT ENVIRONMENT:
The Project site and surrounding area is former farmland, much of which is now a complex of electrical energy generating facilities (nuclear, natural gas, and solar). The Palo Verde Nuclear Generating Station is approximately 3.5 miles to the north and the Mesquite Generating Station and Capitol Power-Arlington Valley Power Station are about 1.5 miles and 2.7 miles to the west/northwest, respectively. Arrays of photovoltaic panels of the Mesquite Solar, Sun Streams Project, and Arlington Valley Solar Energy

Project are located to the north, east, and south of the Project site, respectively. The Project site is currently vacant and undeveloped.

11. INVENTORY CLASS COMPLETED
11a. Class I Inventory: ☒
11b. Researcher(s): A.E. (Gene) Rogge and Ronald Savage
11c. Class II Survey: ☐
11d Sampling Strategy:
11e. Class III Inventory: ☐

12. BACKGROUND RESEARCH SOURCES
12a. AZSITE: ☒
12b.Arizona State Museum (ASM) Archaeological Records Office: ☒
12c. State Historic Preservation Office (SHPO) Inventories and/or SHPO Library: ☐
12d. NRHP Database: ☒
12e. ADOT Portal: ☐
12f. GLO Maps:
In 1914, the General Land Office made the first cadastral survey of Township 1 South, Range 6 West, where the Project is located, and filed the plat in 1916 (**Figure 4**). The relatively late date of the cadastral survey probably reflects lack of early interest in homesteading the arid area that lacked surface water. The plat shows no cultural features in the Project site, but a number of unnamed roads traversed the township at that time. Two were at the edge of the records review area. One road, approximately 1.5 miles south of the Project site, was labeled as heading east to Arlington. The only other cultural features mapped in the township were two windmills located approximately 2.5 miles southwest of the Project site along Centennial Wash and 3 miles to the northwest along Winters Wash, where ground water was probably relatively shallow. The windmills likely were associated with livestock grazing. The General Land Office Historical Index indicates the federal government transferred Section 23, where the Project site is located, to the State of Arizona in 1918.
12g. Land- Managing Agency Files:
12h. Tribal Cultural Resources Files:
12i. Local Government Websites:
12j. Other:
In 1954, 1957, 1958, 1960, 1969, and 1971, the United States Geological Survey (2024) issued a series of the Phoenix, Arizona, 1- by 2-degree topographic map (scale of 1:250,000) that covered the review area. The series consistently showed the Southern Pacific Railroad south of the Project site, and unnamed roads in the vicinity but no cultural features in the Project site. The 1962 and 1971 US Geological Survey Arlington, Arizona, 15-minute topographic maps (scale 1:62,500) showed a well and irrigation canals in the Project site. The canals are visible on a series of aerial photos taken in 1961, 1971, 1981, 1992, and 1996 but not on a 2002 aerial photo (NETR Online 2024). It is likely the features were obliterated when the Redhawk power plant was constructed nearby.

13. BACKGROUND RESEARCH RESULTS
13a. Previous Projects Within Study Area
The review identified 31 prior cultural resource studies (see Figure 3) conducted within or overlapping the review area between 1955 and 2023. The studies covered about two-thirds of the review area (approximately 1,774 acres of 2,681 acres).

Two prior surveys overlapped the Project site. The most relevant was a survey conducted to support the CEC application for the Redhawk Power Plant. That survey covered 1,103 acres, including the entire Project site, and discovered three archaeological sites, all outside the current Project site (Rogge and others 2000). Another survey for the Palo Verde to North Gila 500kV transmission line appears to have covered a short, narrow corridor at the western edge of the Project site and recorded no cultural resources in the review area (Rowe 2007).

1. Project Reference Number		2. Project Name	3. Author(s)	4. Year
Overlapping or Adjacent to the Project Site				
1	1999-435.ASM	Cultural Resources Survey for the Proposed Redhawk Power Plant	Rogge and others	2000
2	2006-335.ASM	Palo Verde Hub to N. Gila Substation 500kV Transmission Project	Rowe	2007
In or Overlapping the 1-Mile-Wide Review Buffer Area (1)				
3	1955-3.ASM	Southern Pacific Pipeline Survey	McConville and Holzkamper	1955
4	BLM-020-10-108/ 11-42	Palo Verde to Kyrene transmission line	Powers and others	1978
5	1981-162.ASM. BLM-020-10-101	Yuma 500 kV Transmission Line (Southwest Powerlink)	Effland and others	1982
6	1994-270.ASM	PacificCorp Turbine Pipeline Project-Wintersburg Alternative	Rogge and Darrington	1994
7	1999-409.ASM	Palo Verde Switchyard Survey	Hart	2000
8	1999-542.ASM	Harquahala Generating Project	Rogge and others	2000a, 2000b
9	1999-587.ASM	PBNS Level 3 Fiber Optic Line	Doak	1999
10	2000-118.ASM	Sempra Survey Project	Walsh	2000
11	2000-428.ASM	Redhawk to Hassayampa Power Line Intertie Project	Rogge and Bauer	2000
12	2000-429.ASM	Arlington Valley/Redhawk Pipeline Project	Rogge and Bauer	2000
13	2000-631.ASM	Palo Verde transportation route, Cotton Center to Palo Verde NGS	Garcia and Folb	2001
14	2001-724.ASM	Mesquite Pipeline Project	Wilcox and Adamson	2002
15	2001-767.ASM	Redhawk Power Plant Access Road	Wilcox	2001
16	2003-951.ASM	Hassayampa to Jojoba 500kV Transmission Line	Chapin-Pyritz and Hill	2002
17	2004-104.ASM	Copper Eagle Gas Storage	Luhnow and others	2003
18	2006-18.ASM	Transwestern Pipeline Phoenix Expansion	Howell	2007
19	2006-597.ASM	Palo Verde to Pinal West Survey	Clark and Henderson	2007
20	2008-59.ASM	APS 500-4 Palo Verde-North Gila 500-kV Transmission Line	Bild and others	2011
21	2009-1.ASM	Williams Communications Fiber Optic Line	Copeland and Breternitz	2001
22	2009-217.ASM	APS On-Call Cultural Resources Surveys	Rowe and Davis	2010
23	2010-2.ASM	Arlington Valley Solar Energy -State Lands	Moses and Luchetta	2010
24	2011-175.ASM	1,935 Acres at Narramore Road and 355th Avenue	Florie and Ryan	2011
25	2011-380.ASM	Arlington Valley Solar Energy II- private lands	Moses and Luchetta	2011
26	2012-251.ASM	Perennial cultural resources Survey	Buckles and others	2012
27	2013-17.ASM	Sun Streams - Parcel D	Lundin	2012
28	2016-44.ASM	Sun Streams Gen-Tie Project	Mitchell	2015
29	2017-318.ASM	Transwestern Pipeline Arlington Valley Interconnection	Brown	2017
30	2022-265.ASM	Redhawk Overhead 12kV Distribution Line	Kirvan and Garner	2022
31	2022-481.ASM	Sun Basin West Parcels 9 and 10	Butero	2023

NOTE: (1) Pursuant to SHPO and ASM guidelines (2019) citations for these studies are not included in the list of cited references.

13b. Previously Recorded Cultural Resources Within Study Area

The record research identified 19 cultural resources recorded in the review area (see Figure 3). None are in the Project site. All are archaeological sites or abandoned or in-use structures that date to the historic-period. Prior consultations formally determined one resource is eligible for the Arizona Register of Historic Places (ARHP). It is the Southern Pacific Railroad Phoenix Main Line, which was constructed between 1923 and 1926. The railroad is eligible for the ARHP under Criterion A for its association with the development of railroad transportation in Arizona. The Union Pacific Railroad continues to use the line, now designated as the Roll Industrial Lead, for hauling freight. The railroad passes within about 800 feet to the south of the Project site.

	1. Site Number/Name	2. Affiliation	3. Site Type	4. Eligibility Status	5. Associated References
1	AZ T:9:24(ASM)	historic	1920s-1930s homestead	unevaluated	Effland and Green 1983; Bild and others 2011; Butero 2023
2	AZ T:9:55(ASM)	historic	circa 1940s-1980s farm labor camp with several ruins of buildings	not eligible (SHPO 2012-02-15)	Rogge and others 2000

	1. Site Number/Name	2. Affiliation	3. Site Type	4. Eligibility Status	5. Associated References
3	AZ T:9:56(ASM)	historic	circa 1950s ramada (probable bee hive shelter)	not eligible (SHPO 2001-05-30)	Rogge and others 2000
4	AZ T:9:57(ASM)	historic	post-World War II farm labor camp with ruins of several buildings and one occupied house	not eligible (SHPO 2001-05-30)	Rogge and others 2000
5	AZ T:9:60(ASM)	historic	circa 1940s single episode trash dump	not eligible (SHPO 2012-02-15)	Hart 2000
6	AZ T:9:63(ASM)	historic	twentieth-century road	not eligible (SHPO 2012-02-15)	Hart 2000
7	AZ T:3:93(ASM)	historic	abandoned concrete-lined irrigation ditch	recommended not eligible	Howell 2007
8	AZ T:3:94(ASM)	historic	abandoned earthen irrigation ditch	recommended not eligible	Howell 2007
9	AZ T:3:97(ASM)	historic	abandoned concrete-lined irrigation ditch	recommended not eligible	Howell 2007
10	AZ T:3:98(ASM)	historic	abandoned concrete-lined irrigation ditch	recommended not eligible	Howell 2007
11	AZ T:9:116(ASM), Arlington Siding	historic	razed 1926 Southern Pacific Railroad Phoenix Main Line siding	recommended eligible, Criterion A	Rowe and Davis 2010
12	AZ T:9:127(ASM)	historic	circa 1900-1950 irrigation complex (canals, berms, culvert, check dam, wing walls, road)	not eligible (SHPO 2015-10-29)	Florie and Ryan 2011
13	AZ T:9:151(ASM)	historic	circa 1900-1950 trash scatter	not eligible (SHPO 2015-10-29)	Florie and Ryan 2011
14	AZ T:9:155(ASM)	historic	circa 1900-1950 road	not eligible (SHPO 2015-10-29)	Florie and Ryan 2011
15	AZ T:9:159(ASM)	historic	unimproved road	not eligible (SHPO 2012-03-09)	Buckles and Prasciunas 2012
16	AZ T:9:163(ASM)	historic	circa 1950s-1970s trash dump	recommended not eligible	Mitchell 2015
17	Union Pacific Railroad, Palo Verde Nuclear Generating Station industrial lead	modern	1975 railroad spur line, in use	not eligible (SHPO 2012-02-15)	Berelov 2006
18	AZ T:9:192(ASM)	historic	pre-1961 earthen irrigation canal	recommended not eligible	Butero 2023
19	Southern Pacific Railroad, Phoenix Main Line	historic	1926 railroad, in use as a freight line (Roll Industrial Lead)	eligible, Criterion A (SHPO 2014-11-14)	Harmon and Beyer 1995

NOTE: None of these cultural resources are in the Project site. All are in the surrounding 1-mile-wide buffer.

The Arlington Siding archaeological site, AZ T:9:116(ASM), which was associated with the Phoenix Main Line, is adjacent to the tracks approximately three-fourths of a mile east of the Project site. Cultural resource surveyors evaluated the site as eligible for the ARHP under Criterion D for its potential to yield important information, but the SHPO has not formally determined the site's eligibility.

The SHPO determined that 10 of the cultural resources recorded in the review area lack historical significance and are not eligible for the ARHP. Cultural resource surveyors evaluated six other cultural resources as ineligible for the ARHP but the SHPO has not formally determined their eligibility.

The other cultural resource is an archaeological site, AZ T:9:24(ASM), which Effland and Green (1983) discovered and briefly described as having abandoned irrigation canals and ruins of structures and recorded fewer than 15 artifacts. They interpreted the site as remnants of a 1920s to 1930s homestead, and indicated Bureau of Land Management records supported that conclusion. General Land Office records, however, indicate the federal government transferred the land to the State of Arizona in 1918 and it would not have been available for homesteading in the 1920s or 1930s. Effland and Green evaluated the site as ineligible for the ARHP. A survey recorded the site again in 2008 and found two artifact concentrations (dated 1930s to 1960s) but saw no evidence of ruined buildings. That survey designated an approximately 1-mile-long irrigation canal and a field approximately 0.5 miles wide and 1 mile long as features of the site and evaluated the site as eligible for the ARHP under Criterion D for its potential to yield important information (Bild and others 2011). A recent survey (Butero 2023) recorded the site as much smaller because the survey recorded irrigation canals as separate sites, pursuant to revised ASM policy. That survey also found no remnants of buildings but did find the two artifact concentrations recorded in 2008 and concluded they probably were not associated with a homestead and recommended more research to complete evaluation of the ARHP eligibility of the site. The SHPO has not formally determined the eligibility of the site. The ASM plotting of the site location, based on the small scale ambiguous mapping in 1981, is just inside the review area. The two subsequent recordings mapped the site just outside the review area.

13c. Historic Buildings/Districts/Neighborhoods.

1. Property Name or Address	2. Year	3. Eligibility Status
none		

14. CULTURAL CONTEXTS
14a. Prehistoric Culture: Paleoindian, Archaic, Hohokam, Patayan
14b. Protohistoric Culture: Yavapai, Akimel O'odham, PeePosh
14c. Indigenous Historic Culture: Yavapai, Akimel O'odham, PeePosh
14d. Euro-American Culture: Euro-American, late-1800s to present

15. FIELD SURVEY PERSONNEL
15a. Principal Investigator: not applicable
15b. Field Supervisor: not applicable
15c. Crew: not applicable
15d. Fieldwork Date(s): not applicable

16. SURVEY METHODS
16a. Transect Intervals: not applicable
16b. Coverage (%):not applicable
16c. Site Recording Criteria: not applicable
16d. Ground Surface Visibility: not applicable
16e. Observed Disturbances: not applicable

17. FIELD SURVEY RESULTS
17a. No Cultural Resources Identified: ☐ not applicable
17b. Historical In-Use Structures Identified: ☐ **Form(s) Attached:** ☐ not applicable
17c. Number of IOs Recorded: not applicable
17d. Table of IOs

1. IO Number	2. Description	3. Date Range	4. UTMs
not applicable			

18. COMMENTS:
APS is preparing an application for submittal to the Arizona Power Plant and Transmission Siting Committee of the ACC for a CEC for a proposed power plant expansion. This cultural resource assessment was prepared to support the application pursuant to ACC Rule of Practice and Procedure R14-3-219 and compliance with the State Historic Preservation Act. The review identified two prior cultural resource studies that covered the 38.2-acre Project site and another 29 prior cultural resource studies within one mile of the Project site.

Prior studies recorded 19 cultural resources within the review area, but none are in or adjacent to the Project site. All date to the historic period and none relate to the Indigenous occupation of the region.

Prior consultations formally determined one of the recorded cultural resources (Southern Pacific Railroad Phoenix Main Line) is eligible for the ARHP under Criterion A for its association with the development of railroad transportation in Arizona. Cultural resource surveyors evaluated one archaeological site—the Arlington Siding, which was associated with the Phoenix Main Line—as eligible for the ARHP but the SHPO has not formally determined the site's eligibility. The SHPO determined that 10 of the other recorded cultural resources lack historical significance and are not eligible for the ARHP. Cultural resource surveyors evaluated six of the other cultural resources as ineligible for the ARHP but the SHPO has not formally determined their eligibility. The eligibility of one other archaeological site in the review area remains unevaluated.

Rogge and others (2000) conducted an intensive cultural resource survey in conjunction with planning and permitting the Redhawk Power Plant. That survey covered the proposed Project site and found no cultural resources in the current Project site. The adequacy of that survey could be questioned because it was done more than two decades ago, but the survey was conducted by walking transects spaced at intervals of 20 meters, which meets current ASM standards for complete, intensive survey and it is unlikely to have missed any cultural resources. The results of numerous subsequent surveys in the vicinity suggest that agricultural facilities (such as canals) might have become of historic age since the survey in 2000 but review of recent aerials show the Project site is almost completely cleared of vegetation and any field ditches that might have been present were removed and a drainage channel appears to have been constructed through the Project site. If any unrecorded cultural resources had been present in the Project site, that degree of disturbance is likely to have destroyed them. The review concluded that resurvey of the Project site is not warranted.

The review documented there are no historical sites and structures or archaeological sites recorded in the Project site. The proposed Project is unlikely to have any adverse proximity impacts on nearby cultural resources due to factors such as visual changes of the landscape or increased noise. The one ARHP-eligible resource is the Southern Pacific Railroad Phoenix Main Line. Its setting has been substantially altered by prior development and the proposed Project would not substantially diminish the historic integrity of the railroad. Most of the other cultural resources recorded within a mile of the Project site have been determined or recommended not eligible for the ARHP. If the one archaeological site recommended eligible and the one unevaluated site were determined to be ARHP eligible, it would likely be for their potential to yield important information, which would not be degraded by any proximity impacts.

In summary, the review indicated the Project site is not in an archaeologically or historically sensitive location and the available cultural resource survey information is considered an adequate basis for concluding the proposed Project would not demolish or substantially alter any properties listed in or eligible for the ARHP.

SECTION 19. ATTACHMENTS

19a. Project Location Map: ☒ Figure1 and 2
19b. Land Jurisdiction Map: ☒ Figure 3
19c. Background Research Map(s): ☒ Figure 3
19d. GLO Map(s): ☒ Figure 4
19e. References: ☒

SECTION 20. CONSULTANT CERTIFICATION

I certify the information provided herein has been reviewed for content and accuracy and all work meets applicable agency standards.

Gene Rogge
Signature
Cultural Resource Team Leader
Title

SECTION 21. DISCOVERY CLAUSE

In the event that previously unreported cultural resources are encountered during ground disturbing activities, all work must immediately cease within 30 meters (100 feet) until a qualified archaeologist has documented the discovery and evaluated its eligibility for the Arizona or National Register of Historic Places in consultation with the lead agency, the SHPO, and Tribes, as appropriate. Work must not resume in this area without approval of the lead agency.

If human remains are encountered during ground-disturbing activities, all work must immediately cease within 30 meters (100 feet) of the discovery and the area must be secured. The Arizona State Museum, lead agency, SHPO, and appropriate Tribes must be notified of the discovery. All discoveries will be treated in accordance with NAGPRA (Public Law 101-601; 25 U.S.C. 3001-3013) or Arizona Revised Statutes (A.R.S. § 41-844 and A.R.S. § 41-865), as appropriate, and work must not resume in this area without authorization from ASM and the lead agency.

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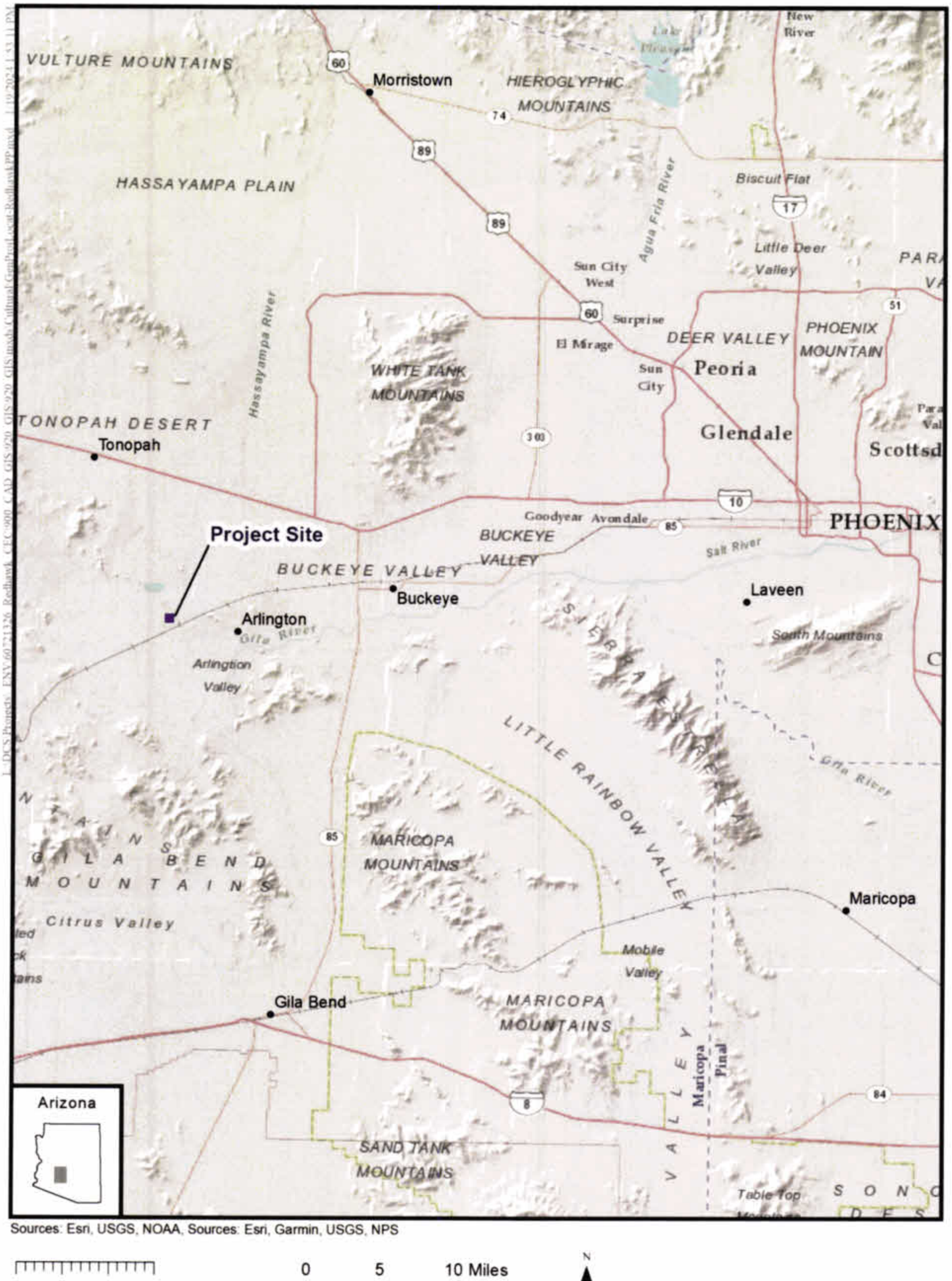


Figure 1. General Project Location

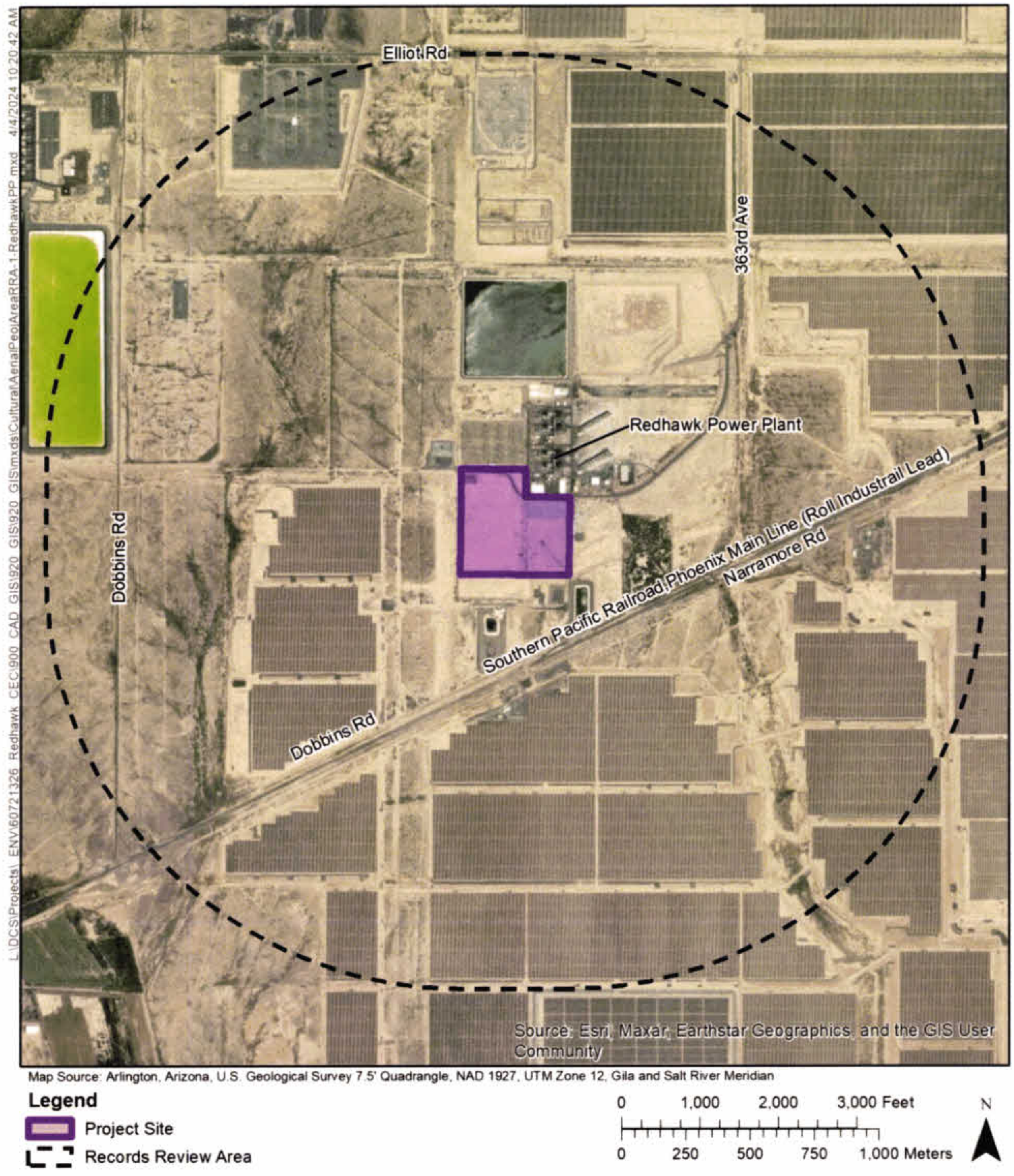
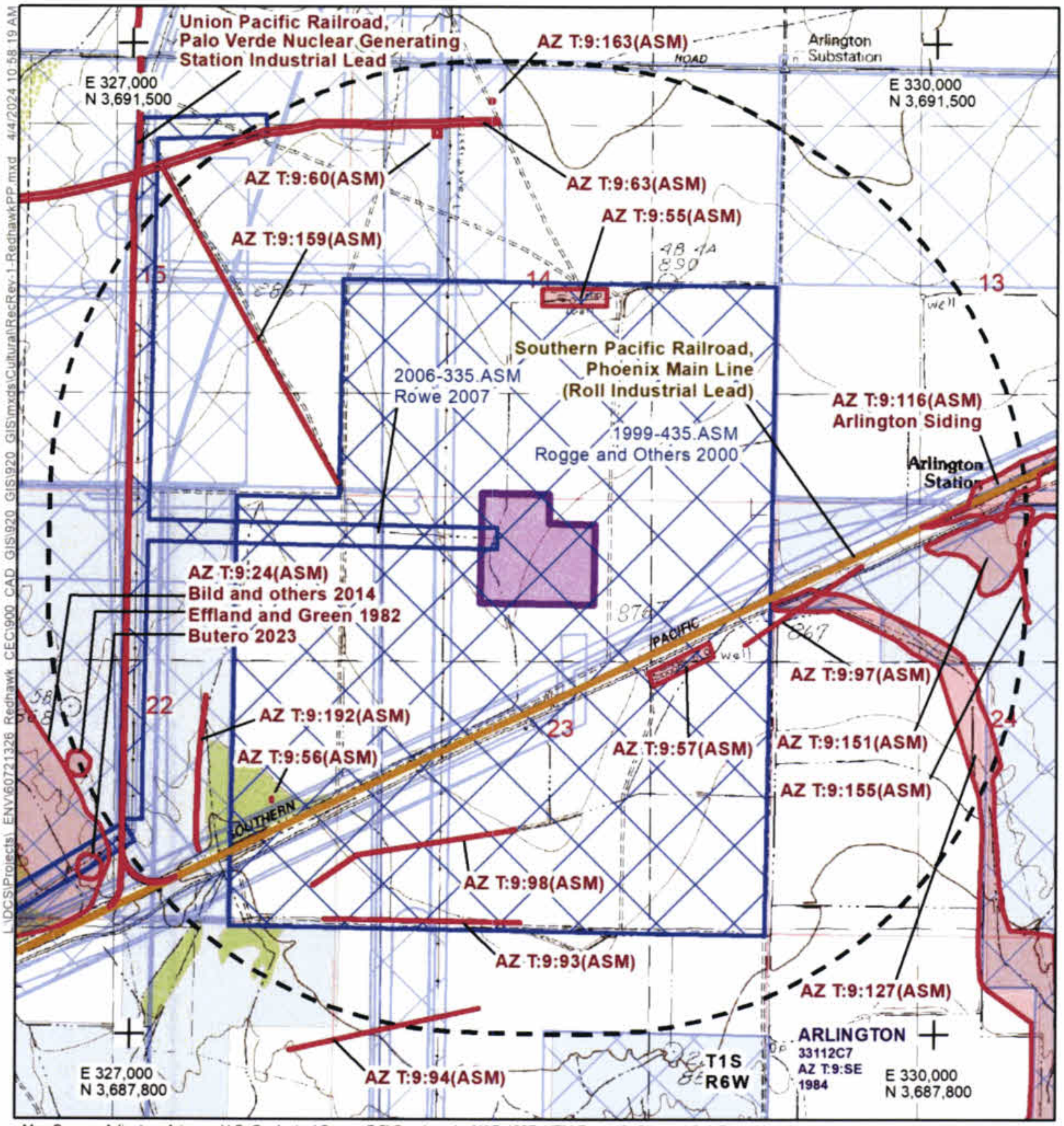


Figure 2. Aerial Photo of Project Site Adjacent to the Redhawk Power Plant



Map Source: Arlington, Arizona, U.S. Geological Survey 7.5' Quadrangle, NAD 1927, UTM Zone 12, Gila and Salt River Meridian

Legend

- Project Site
- Previously Recorded Archaeological Site
- Prior Survey
- UTM Coordinate (NAD 1983 Zone 12 North)
- Historical In-Use Structure
- Records Review Area

Surface Management

- State Trust Land
- Private

0 1,000 2,000 3,000 Feet

0 250 500 750 1,000 Meters

N

Restrict distribution of this map if it could result in significant invasion of privacy, damage to archaeological and historical resources, or impede the use of traditional religious sites by practitioners, pursuant to applicable regulatory requirements, including Section 39-125 of the Arizona Revised Statutes, Section 304 of the National Historic Preservation Act, and Section 9(a) of the Archaeological Resources Protection Act

Figure 3. Records Review Results

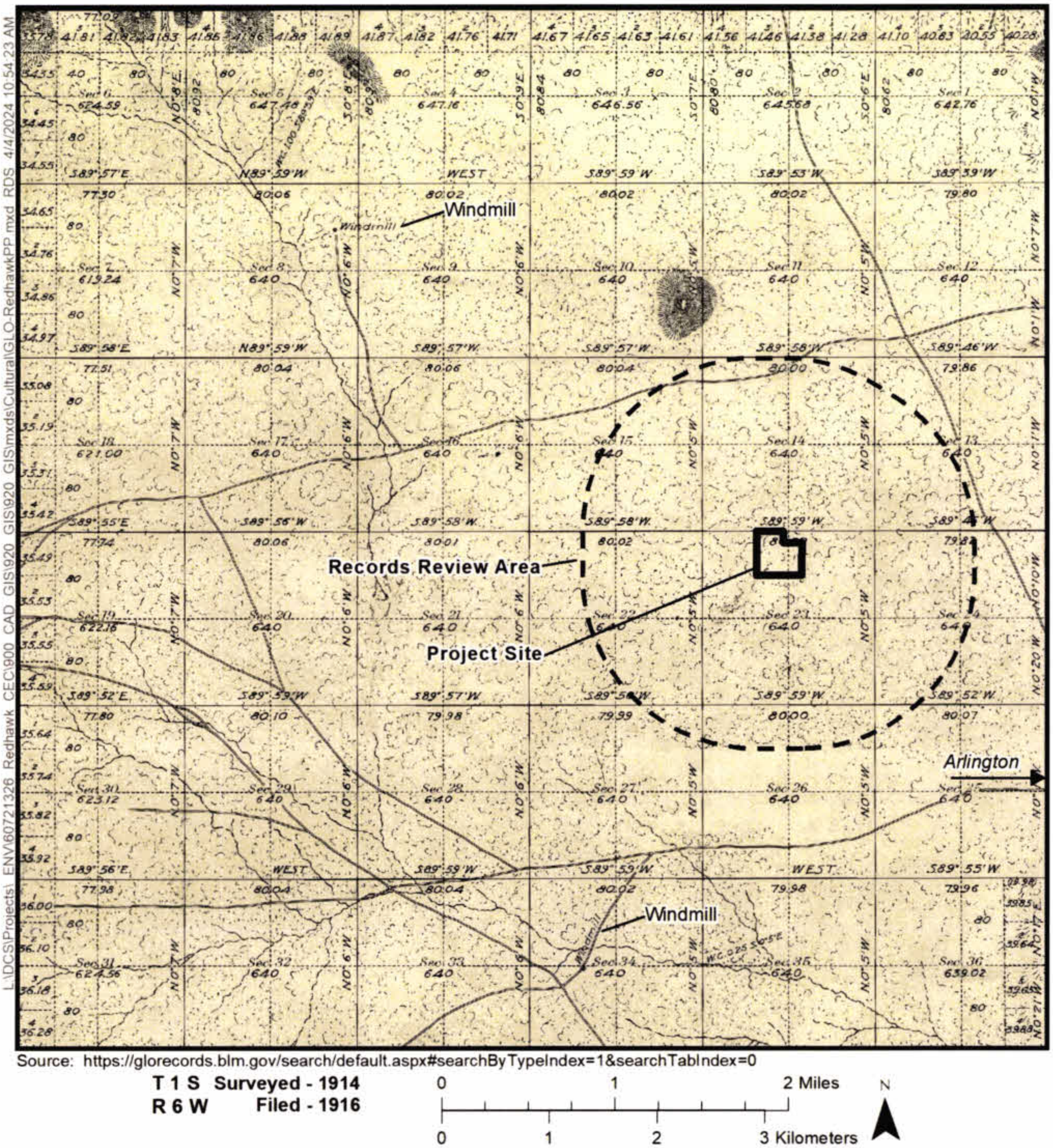


Figure 4. General Land Office Plat