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Data Response Set 1 (Responses to Data Requests 1 to 111)

Submitted to
California Energy Commission

Prepared by
Morton Bay Geothermal LLC

With assistance from
Jacobs

Morton Bay Geothermal Project
(23-AFC-03)

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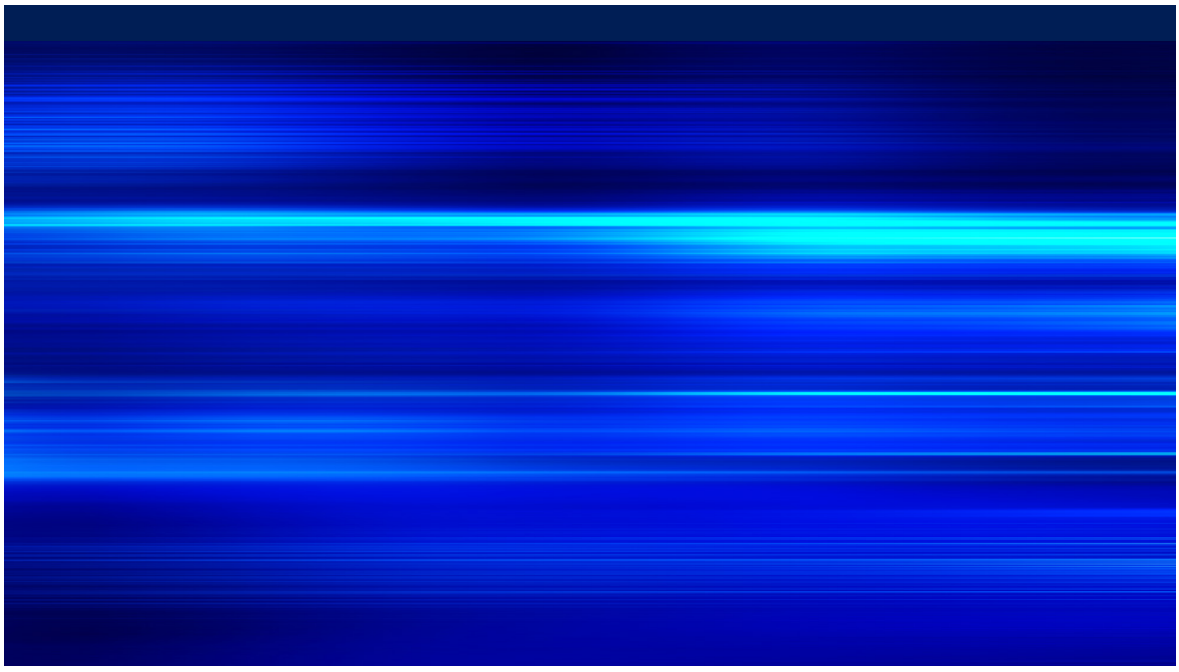

Introduction

Attached are Morton Bay Geothermal LLC's[1] (Applicant) responses to the California Energy Commission (CEC) Staff's Data Requests Set 1 regarding the Application for Certification (AFC) for the Morton Bay Geothermal Project (MBGP) (23-AFC-01). This submittal includes a response to Data Requests 1 through 111.

The responses are grouped by individual discipline or topic area. Within each discipline area, the responses are presented in the same order as presented in *Data Requests Set 1* and are keyed to the Data Request numbers.

New or revised graphics or tables are numbered in reference to the Data Request number. For example, the first table used in response to Data Request 28 would be numbered Table DRR 28-1. The first figure used in response to Data Request 28 would be Figure DRR 28-1, and so on. Figures or tables from the MBGP AFC that have been revised have a "R" following the original number, indicating a revision.

Additional tables, figures, or documents submitted in response to a data request (for example, supporting data, stand-alone documents such as plans, folding graphics, etc.) are found at the end of each discipline-specific section and are not sequentially page numbered consistently with the remainder of the document, though they may have their own internal page numbering system.

[1] An indirect, wholly owned subsidiary of BHE Renewables, LLC ("BHER").

Contents

Attachments

Tables

Acronyms and Abbreviations

ACC	Air Cooled Condenser
AFC	Application for Certification
ATCM	Airborne Toxic Control Measure
AFT	Atmospheric Flash Tank
ANSI	American National Standards Institute
ARMR	Archaeological Resource Management Report
AFY	Acre-Foot per Year
BACT	Best Available Control Technologies
BHER	BHE Renewables, LLC
BRGP	Black Rock Geothermal Project
BSA	Biological Survey Area
CEC	California Energy Commission
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CGS	California Geologic Survey
CNEL	Community Noise Equivalent Level
CPUC	California Public Utilities Commission
CUP	Conditional Use Permit
DA	Data Adequacy
dBA	decibels
DRR	Data Request Response
EMF	Electric and Magnetic Fields
ENGP	Elmore North Geothermal Project
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment

E-T	Evapotranspiration Bed
°F	Fahrenheit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
gen-tie	generation interconnection transmission line
HARP2	Hyper-Angular Rainbow Polarimeter #2
HRA	Health Risk Assessment
ICAPCD	Imperial County Air Pollution Control District
IEEE	Institute of Electrical and Electronics Engineers
IID	Imperial Irrigation District
KGRA	Known Geothermal Resource Area
LiDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
LORS	laws, ordinances, regulations, and standards
LOS	Level of Surface
MBGP	Morton Bay Geothermal Project
MCV	*A Manual of California Vegetation, Second Edition*
MTU	Mobile Testing Unit
MVA	megavolt-amperes
MW	megawatts
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NAHC	Native American Heritage Commission
NPCA	Notice of Proposed Construction or Alteration
OHP	Office of Historic Preservation
PM	Particulate Matter
psig	pounds per square inch gage
PTE	Potential to Emit
PTU	Production Testing Unit

PRC	Public Resources Code
RWQCB	Regional Water Quality Control Board
SCE	Southern California Edison
SCIC	South Coastal Information Center
SMARA	Surface Mining and Reclamation Act
SSGF	Salton Sea Geothermal Field
SWRCB	State Water Resources Control Board
SWRegGAP	*Landcover Descriptions for the Southwest Regional Gap Analysis Project*
TLS&N	Transmission Line Safety and Nuisance
TRVs	Toxicity Reference Values
TSDN	Technical Support Data Notebook
USACE	US Army Corps of Engineers
USFWS	US Fish and Wildlife Service
VMT	Vehicle Miles Travelled
WDR	Water Discharge Requirements

1. Air Quality (DR 1-15)

1.1 Background: Air District Review (DR 1-2)

The proposed project will require permits from the Imperial County Air Pollution Control District (ICAPCD). For purposes of inter-agency consistency, CEC staff needs copies of all correspondence between the applicant and the ICAPCD in a timely manner to stay up to date on any issues that arise prior to completion of the Preliminary and Final Staff Assessments (PSA and FSA).

Data Requests:

1. *Please provide copies of all substantive correspondence between the applicant and the ICAPCD regarding the project, including any application(s), supplemental information, including attachments or information referenced in correspondence, and e-mails. Please provide all existing records in accordance with the requirements of title 20, California Code of Regulations, section 1716. This is a continuing request, requiring ongoing submission of relevant correspondence. Please provide correspondence no more than one week from the date it is created or received. This request is in effect until staff publishes the PSA and FSA.*

Response: The air permit application was submitted on April 27, 2023 (TN# 250006-01 through 250006-04) to ICAPCD. ICAPCD requested additional information on May 30, 2023, The Applicant responded to ICAPCD's request for additional information on June 12, 2023 and the ICAPCD deemed the air permit application complete on June 22, 2023 (TN# 250730). These documents were docketed in this proceeding on June 23, 3023. ICAPCD requested further information relating to the air permit application on September 29, 2023. The information request is under review and will be provided promptly to CEC Staff. No other substantive correspondence has occurred between the Applicant and the ICAPCD to date. Any future substantive correspondence with the ICAPCD will be provided as requested.

2. *Please provide a copy of the permit application that was submitted to the ICAPCD.*

Response: A copy of the permit application (TN 250006-01 through 250006-4) was docketed on May 4, 2023. In addition, a confidential process flow diagram included as Figure 2-2 of the permit application was provided under a request for confidential designation to the CEC on April 18, 2023 (TN# 249771 and TN# 250024) and approval granted on May 22, 2023 (TN# 250257).

1.2 Background: Emission Calculation Spreadsheets (DR 3-4)

Appendices 5.1A, 5.1B, and 5.1D of the Application for Certification (AFC) (TN# 249726) contain tables with estimates of the project's operational and construction emissions (Appendices 5.1A and 5.1D) as well as tables showing the model inputs used in the project's air quality impact analysis (Appendix 5.1D). CEC staff requires spreadsheet versions of the tables contained in the appendices, with live, embedded calculations, to complete the analysis.

Data Requests:

3. *Please provide spreadsheet versions of the tables listed in Appendix 5.1A and Appendix 5.1B, with live, embedded calculations.*

Response: Spreadsheet versions of Appendices 5.1A and 5.1B are included with this Data Request Response as Attachments DRR 3-1 and DRR 3-2, respectively. In addition, air modeling files were provided

on April 28, 2023 (TN# 249917). However, Appendices 5.1A and 5.1B are in the process of being revised to incorporate refinements to the MBGP design and address other CEC Staff comments provided herein. Therefore, spreadsheet versions of these documents with live, embedded calculations will be provided no later than November 10, 2023.

4. *Please provide spreadsheet versions of the tables listed in Appendix 5.1D, with live, embedded calculations. Please also provide a construction schedule showing the estimated start and end dates of each construction phase, the type of equipment used during each phase, the operating time of each equipment type during each phase, and the number of each equipment type used.*

Response: A spreadsheet version of Appendix 5.1D is included with this Data Request Response (DRR) as Attachments DRR 4-1 and DRR 4-2. Note that Appendix 5.1D is in the process of being revised to incorporate refinements to the MBGP design and address other CEC comments provided herein. Therefore, an updated spreadsheet version of this document with live, embedded calculations will be provided no later than November 10, 2023.

1.3 Background: Emergency Diesel Engines (DR 5-6)

The proposed project would install six emergency standby diesel fueled engines, including one fire water pump and five emergency generators. The diesel fire pump engine would be a Tier 2-certified unit, and the five emergency generators would be compliant with Tier-4 emission standard through the use of a selective catalytic reduction (SCR) control device, diesel particulate filter, and diesel oxidation catalyst. Staff needs vendor documentation to verify the diesel engines' emission factors. In addition, staff needs the justification for the use of Tier-2 fire pump engine.

5. *Please provide the vendor documentation to verify the emission factors for the diesel fire pump engine and the five emergency generators.*

Response: Vendor documentation is provided as Attachments DRR 5-1 and DRR 5-2.

6. *Please indicate if a Tier-4 fire pump is available for the project. If available, please justify the use of the proposed Tier-2 engine over a Tier-4 engine.*

Response: The Applicant proposes to use a Tier-3 certified engine. The standby diesel fueled direct drive fire pump engine meet the emission standards as Table 2 of the Stationary Diesel ATCM (Title 17, Cal. Code Regs., §93115.6(a)(4)) representing BACT for the fire pump engines. In addition, Page 5.1-18 of the AFC contained a typographical error and should read as follows:

> "The diesel fire pump engine would be a Tier ~~2~~ **3**-certified unit."

1.4 Background: Mobile Testing Unit Modeling (DR 7)

Page 5.1-40 of the AFC (TN# 249723) states that the mobile testing unit (MTU) was not included in the modeling analysis due to its use at various (i.e., temporary) well locations throughout the project site for only a limited number of hours. The AFC also states that the emissions from MTU operation would be minimal and less than emissions from the production testing units (PTUs) and rock muffler (RM). However, pages 3 and 4 of 176 of Appendix 5.1A (TN# 249726) show that the hourly and first year annual emissions of the MTU would be higher than those of the PTUs. In addition, page 3 of Appendix 5.1A shows that the MTU would operate 2,160 hours and 2,640 hours per year for production well testing and injection well testing respectively, which would be 10 times more than the PTU operation. CEC staff needs an impact analysis of the MTU with other emission sources modeled previously to complete the analysis.

Data Requests:

7. *Please provide a revised impact analysis to include the MTU with other emission sources modeled previously. The analysis to be revised would include but not be limited to the hydrogen sulfide (H2S) impact analysis, and the nitrogen deposition modeling analysis.*

Response: Although the annual operational hours for the MTU are larger than those for the Production Testing Units (PTUs), the MTU will only operate during construction and commissioning while the PTUs are being constructed and the MBGP is being commissioned. Following construction of the two PTUs, all future well startup or shutdown activities will be routed through the PTUs instead of the MTU. Furthermore, the MTU will operate no more than 10 days at any single well during - construction and commissioning. The Applicant chose to exclude the MTU from the modeling analyses presented in the AFC due to these limited operations in spatially varying locations outside of the fence line. However, the Applicant will revise the criteria air pollutant, health risk assessment (HRA), and nitrogen deposition modeling analyses to include the MTU, as requested.

As set forth in the Applicant's *Notice Pursuant to 20 C.C.R. § 1716(f) for CEC Staff's Data Requests Set 1,* additional time is needed to respond to this request. The Applicant will provide a response on or before November 10, 2023.

1.5 Background: Hydrogen Sulfide Modeling Results (DR 8)

Table 5.1-30 of the AFC (TN# 249723) shows the maximum modeled H2S concentration to be 39.6 µg/m3. However, the modeling files provided by the applicant show that the maximum modeled H2S concentration would be 369.5 µg/m3 CEC staff also performed an independent H2S modeling at the sensitive receptors used in the health risk assessment (HRA). The maximum H2S concentration from staff's independent modeling is 51.5 µg/m3 at sensitive receptor number 5,897 (shown on page 10 of 40 in TN# 249733). Staff needs clarification regarding the difference in the modeled H2S results shown above and the location of the modeled result of 39.6 µg/m3 shown in Table 5.1-30.

Data Requests:

8. *Please clarify the difference in the modeled H2S results shown above and provide the location of the modeled result of 39.6 µg/m^3 shown in Table 5.1-30.*

Response: The H_2S modeling analyzed routine operations of MBGP, which is represented with source group "ROUT" in the previously provided modeling files. The source group "ALL" was included in the modeling files for informational purposes only and does not represent a possible operating scenario as the rock muffler, PTUs, and cooling towers will not all concurrently operate at their maximum emission rates. This explanation of source groups should account for the difference in results identified. The location of the receptor with a modeled result of 39.6 µg/m^3 is 633,750 E and 3,673,250 N (UTM NAD83 Zone 11, meters).

1.6 Background: Cooling Tower Modeling (DR 9)

Page 50 of 176 of Appendix 5.1A (TN# 249726) and the applicant's modeling files indicate that the applicant modeled the H2S emissions of 5.57 pounds per hour (lbs/hr) for the cooling tower during routine operations. However, Table 5.1-11 on page 5.1-20 of the AFC (TN# 249723) and page 3 of 176 of Appendix 5.1A (TN# 249726) show that H2S emissions would be much higher during sparger bypass (84.2 lbs/hr) and biological oxidation box bypass (57.2 lbs/hr).

CEC staff believes that a worst-case impact analysis should consider the higher emission scenarios.

Data Requests:

9. Please update the H2S impact analysis with the worst-case emission rates for the cooling tower.

Response: As set forth in the Applicant's *Notice Pursuant to 20 C.C.R. § 1716(f) for CEC Staff's Data Requests Set 1,* the Applicant objects to this data request. The sparger and biological oxidation box bypass operations are only expected to occur during breakdown scenarios in which the associated control equipment is not properly functioning. Although these breakdown scenarios are possible, they are not considered reasonably foreseeable. Furthermore, these breakdown operations would be limited in duration by ICAPCD Rule 111, which provides that breakdown conditions must be remedied within 24 hours of the event. If not remedied within that time, the facility must be shut down.

Though infrequent and unforeseeable, the Applicant conservatively included emissions associated with these breakdown conditions in the facility's Potential to Emit (PTE). This approach assures New Source Review, Title V, and Prevention of Significant Deterioration permit applicability are based on the highest possible emissions. Emissions associated with these breakdown conditions were not, however, incorporated into the dispersion modeling and HRA. This approach of including unforeseeable emissions in a facility's PTE for permit applicability determinations but not modeling analyses is consistent with the Bay Area Air Quality Management District's 2019 policy titled "Calculating Potential to Emit for Emergency Backup Power Generators".[2] Although this policy is geared towards emergency backup power generators, parallels do exist regarding the expected infrequent events of unknown duration.

1.7 Background: Nitrogen Deposition Modeling (DR 10-11)

Page 50 of 176 of Appendix 5.1A (TN# 249726) and the applicant's modeling files indicate that the applicant modeled the HNO3 emissions of 228 grams/second for each of the 14 point sources defined for the cooling tower. That would result in a total HNO3 emissions of 25,333 (=228×3,600/453.6×14) lbs/hr or 110,960 (=25,333×8,760/2,000) tons per year (tpy). If this were derived from the NH3 emissions, the equivalent NH3 emissions would be 6,836 (=25,333×17/63) lbs/hr or 29,942 (=6,836×8,760/2,000) tpy. CEC staff is not able to find such high emission rates in the application. Staff needs to understand how the HNO3 emissions were derived.

Data Requests:

10. Please provide spreadsheet versions of the tables showing how the modeled emission rates for nitrogen deposition were derived, with live, embedded calculations.

Response: Air modeling files are being currently revised to incorporate refinements to the ENGP design and to other CEC Staff comments provided herein. Therefore, spreadsheet versions of these documents with live, embedded calculations will be provided no later than November 10, 2023.

11. Please update the nitrogen deposition modeling if necessary.

Response: As set forth in the Applicant's *Notice Pursuant to 20 C.C.R. § 1716(f) for CEC Staff's Data Requests Set 1,* additional time is needed to respond to this request. The Applicant will provide a response on or before November 10, 2023.

[2] Available online at https://www.baaqmd.gov/~/media/files/engineering/policy_and_procedures/banking-and-offsets/calculating-pte-for-emergency-generators-06032019-pdf.pdf?la=en.

1.8 Background: Cumulative Modeling (DR 12-13)

Page 5.1-45 of the AFC (TN# 249723) states that both 24-hour and annual PM2.5 predicted concentrations during project operation exceed their respective Significant Impact Level (SIL) and will, therefore, require a cumulative modeling analysis. Page 5.1-50 of the AFC states that 1-hour and annual NO2, 24-hour and annual PM10, and annual PM2.5 predicted concentrations during construction exceed their respective SIL and will, therefore, require a cumulative modeling analysis. In addition, page 5.1-43 of the AFC also mentioned a cumulative impacts analysis to include the project with new or modified sources (individual emission units) that would cause a net increase of 5 tpy or more per modeled criteria pollutant within a 6-mile radius that have received construction permits but are not yet operational or are in the permitting process.

Data Requests:

12. Please provide an update on the cumulative impacts analyses mentioned in the AFC.

Response: A cumulative impacts analysis modeling protocol is included as Attachment DRR 12 and docketed on September 28, 2023 (TN 252436) for CEC Staff's consideration. This protocol outlines the proposed methodology for conducting the cumulative impacts analysis for the MBGP. The Applicant will conduct the cumulative impacts analysis once the cumulative impacts analysis modeling protocol was finalized and will provide the analysis on or before November 10, 2023.

13. Please provide the modeling files if they are available for review.

Response: Modeling files associated with the cumulative impacts modeling analysis will be provided no later than November 10, 2023 unless future correspondence with the CEC indicates otherwise.

1.9 Background: Offset Proposal (DR 14-15)

The applicant proposed Best Available Control Technologies (BACT) to mitigate the particulate matter emissions from the cooling tower and the H2S emissions from the geothermal stream, as shown in Table 5.1-21. Staff generally recommends that emissions from the nonattainment pollutants and their precursors be offset in addition to BACT. While CEC staff believes that the ozone nonattainment situation in Imperial County is directly attributable to pollutant transport and so staff is not currently recommending offsets for ozone precursors, staff believes that PM10 attainment problems in the ICAPCD are more attributable to the man-made emissions occurring within Imperial County, so offsets from within the County would provide substantive mitigation. Staff needs additional information from the applicant for available PM10 offset/mitigation proposal.

Additionally, the hydrogen sulfide offsets were considered necessary due to the potential direct emission impacts and the potential for the project to create new exceedances of the California Ambient Air Quality Standard for hydrogen sulfide. CEC staff needs more detailed information from the applicant on how the proposed project will reduce emissions to eliminate the potential for project or cumulative hydrogen sulfide impacts.

14. Given staff's recommendation to offset all nonattainment pollutant and their precursors by a minimum 1:1 ratio, please provide a PM10 offset proposal or clear rationale why the PM10 offset is considered unnecessary.

Response: As presented in Table 5.1-1 of the AFC, maximum daily PM10emissions for MBGP operations were estimated at 89.3 pounds per day (lbs/day). Since this estimate is below the ICAPCD Rule 207(C)(2)(a) offset threshold of 137 lbs/day, PM_{10} offsets are not required by ICAPCD regulations.

Furthermore, in ICAPCD's 2018 PM10 Resignation Request and Maintenance Plan[3] they conclude "The major source of primary PM is fugitive windblown dust, with other contributions from entrained road dust, farming, and construction activities.". The recommendation to procure or generate emission offsets would not materially improve the PM10 attainment status of Imperial County nor would it result in a measurable reduction in ambient PM10 monitoring results at the nearest monitoring station located in Niland California.

15. *Please identify how the proposed project will eliminate the potential for project or cumulative hydrogen sulfide impacts.*

Response: As described in Section 5.1.8.2 of the AFC, the MBGP design will incorporate best available control technology (BACT) for hydrogen sulfide using a combination of an air sparging system and oxidation box control system to mitigate potential impacts from H2S. This approach is consistent with previous ICAPCD approvals for similar operations.

[3] https://apcd.imperialcounty.org/wp-content/uploads/2020/01/FinalPM10.pdf

2. Alternatives (DR 16 -18)

2.1 Background: Alternative Project Sites (DR 16)

Section 6.3 of the application, "Power Plant Site Alternatives," generally discusses the reasons why the MBGP is proposed for siting in the Salton Sea Known Geothermal Resource Area (KGRA).

Data Requests:

16. *Please describe other potential sites that were considered for the MBGP, either in the Salton Sea KGRA or any of the other KGRAs in Imperial County. Please describe the locations of any sites initially considered and specific reasons why those sites were rejected.*

Response: Beyond the parcel selected for MBGP, parcels APN 020-100-004, 020-010-026, 020-100-032, 020-010-028, 020-010-029, and 020-100-033 (parcels shown in Figure 2-3 of the AFC) were considered as potential sites that are proximal to the geothermal resource with high heat flows and allow for reasonable access through production pipeline distances. H However, these parcels were rejected as they would have caused greater impacts on special-status species habitat and wetlands. along with construction challenges. Additionally, parcels APN 020-010-032 and 020-010-035 were considered yet the underlying minerals are not controlled by the Applicant, which risks surface disturbance of MBGP site from the mineral leaseholder. Well and pipeline siting avoided placement on Obsidian Butte, Red Hill and near any mud pots, which are considered sensitive areas.

Overall, a major determining factor in site selection for MBGP is the adequacy of the geothermal resource to support operations. The MBGP site was ultimately chosen because of the presence of adequate geothermal resources, in terms of heat flows, to support the proposed generating capacity of the facility and the ability to site the necessary production and injection wells to sustain sufficient production and injection capacity for the project life. The adequacy of the geothermal resource for the MBGP site was confirmed using numerical reservoir simulation and accepted as adequate by CEC and California Department of Conservation, Geologic Energy Management Division. The results were provided to CEC in a report entitled "Numerical Reservoir Simulation of the Salton Sea Geothermal Resource for Power Generation," dated May 2023 (TN# No. 250042). After defining the geothermal resource adequacy and well locations, pipeline distances between the wells and power plant were kept as short as reasonable to retain the geothermal fluid's enthalpy with a basis towards reducing production pipeline lengths relative to injection pipelines. The production fluid is hotter and more critical for converting the fluid to electricity. Site selection was also filtered by parcels to avoid or reduce impacts to species habitat, environmental sensitivity, presumed tribal cultural sensitivity, accessibility and existing land use. Finally, parcel ownership and availability were considered for final siting locations.

The Applicant is unaware of available geothermal resource of this magnitude in other KGRAs in Imperial County. So, no other KGRAs were considered for this project.

2.2 Background: Power Plant Cooling Alternative (DR 17-18)

In section 6.5.2 of the application, it states that the project would "require the use of a cooling tower to condense steam from the steam turbine." Section 5.15 states that process water for the proposed project would require approximately 5,560 acre-feet per year (AFY) from the Imperial Irrigation District (IID) canal. (Water taken from the IID canal for the Morton Bay, Elmore North, and Black Rock geothermal projects would total approximately 13,000 AFY.)

IID's Interim Water Supply Policy for Non-Agricultural Projects (IID 2009) states that IID may conserve and set aside up to 25,000 AFY for non-agricultural use within its service area. A proposed water user has options for funding and implementing a different means of securing water, subject to approval by IID. Options include water conservation or water storage projects or using an alternative source such as recycled water. As of July 2023, a total of 5,380 AFY has been committed to some users, leaving up to 19,620 AFY that may be made available to new non-agricultural projects by implementing conservation and efficiency measures (CEC 2023). The combined annual operational water demand of the three proposed geothermal projects constitutes two-thirds of the available non-agricultural water that may be set aside. In a May 22, 2023, letter to the U.S. Bureau of Reclamation (Reclamation), the lower Colorado River basin states (California, Arizona, and Nevada) proposed a plan (Lower Basin Plan) to conserve at least 3 million AFY of water deliveries between 2023 and 2026, with 1.5 million AF in 2024 (Lower Division States 2023). According to a Holtville Tribune article (Holtville Tribune 2023), IID announced increasing water conservation to 250,000 AFY as part of the Lower Basin Plan, voluntarily reducing its water use to 2.85 million AFY. It is not certain how the Lower Basin Plan will affect future IID non-agricultural water deliveries.

Regardless of Lower Basin Plan conservation efforts, water demand can be expected to grow due to future development and continue to exceed the Colorado River basin's ability to supply water. In 2022, releases from Hoover Dam totaled 8,742,390 AF (Reclamation 2023), which would be a deficit of 257,610 AF when compared to total lower basin water user allotments (9.0 million AFY) based on treaties and agreements known as the "Law of the River" (Reclamation 2023). Given that IID's water allocations of 3.1 million AFY amount to 70 percent of California's total Colorado River water allotment (greater than any other state or Mexico), combined with the fact that future conflicts over Colorado River water rights are highly anticipated, it seems doubtful that IID's water set aside will be reliable for the life of all three projects.

The applicant proposes the use of a crossflow cooling tower with seven sections. An alternative cooling technology using an air-cooled condenser (ACC) is discussed in section 6.5.2 of the application. However, other alternative cooling systems are available, such as an augmented adiabatic cooling system used in large-scale data centers (up to 99 MW capacity) in the Silicon Valley area. An augmented adiabatic cooling system is known as an evaporative pre-cooling system which pre-cools the incoming ambient air into an ACC with either a water fogging system or an evaporative pad. Pre-cooling the ambient air would reduce the ambient air temperature prior to reaching the condenser, during hot days, providing better heat exchange and increasing cooling capacity efficiency. Furthermore, it would use less water than the traditional cooling tower and less electricity to operate than a traditional ACC during hot days. However, this system can lead to particulate matter emissions.

Data Requests:

17. *Please describe and analyze an augmented adiabatic cooling system project alternative. Include its water use requirements, assess its potential feasibility, and describe its ability to attain the project objectives.*

Response: Augmented adiabatic cooling is not a feasible cooling system alternative due to plant performance impacts, additional land usage required, and auxiliary power requirements. These reasons are similar to why a dry Air-Cooled Condenser (ACC) is not a feasible cooling system for the project.

First, augmented adiabatic cooling systems, similar to a dry ACC operation will limit the plant output compared to a wet cooling tower. On the upper end of the ambient temperature approaching the wet bulb with an adiabatic cooling system, the project will roughly use the same amount of water as a wet cooling tower. On the lower end, water consumption will be reduced at a cost to plant net power output. Plant net power of the thermal cycle will be reduced via an increase on the condenser operational pressure

(saturation temperature) by the cooling modifications requested. Therefore, the augmented adiabatic cooling system will not enable the project to achieve one of its primary project objectives, to construct and operate a geothermal power plant with a net generating capacity of 140 MW. Alternate cooling types will require additional auxiliary power resulting in a lower gross output and a less efficient facility.

Second, an augmented adiabatic cooling system will require an increased project footprint. An augmented adiabatic cooling system will increase the size and complexity of the equipment necessary for operation of the project. This cooling method quickly becomes infeasible where the sizes of the required equipment increase beyond the sensible design constraints and diminished plant output are applied rapidly.

In summary, an augmented adiabatic cooling system or an air cooled condenser will result in much larger land usage and construction costs for the project. The goal of the plant is efficient power output. The design requirements regarding cooling water temperature have a greater direct impact to the plant objective. An ACC (dry or wet) cannot feasibly attain the current project objectives due to substantial cost increases, greater footprint, and reduced power output from the plant.

18. *Staff requests data on particulate emissions to determine whether the alternative cooling system would have less impacts on air quality compared to the proposed cooling tower. For the alternative cooling system, please estimate the associated particulate matter (PM10) emissions.*

Response: PM10 emissions have not been estimated because of the infeasibility as discussed in the response to DR 17. In general, a traditional ACC (Air Cooled Condenser) does not have any PM10 emissions since it is closed loop. Adiabatic system would have PM10 emissions due to the projects not having a significant source of deionized water available. Utilizing the current plant design service water for cooling and the amount of windblown dust that could collect on the screens of an adiabatic system will cause PM10 emissions and does not provide an optimized solution.

3. Biological Resources (DR 19-26)

3.1 Background: Class II Surface Impoundment (Brine Pond) (DR 19-21)

The AFC (TN249723) discusses a Class II surface impoundment also called a brine pond. According to the AFC, the brine pond would receive "aerated process fluid, geothermal fluid from unplanned overflow events, and geothermal fluid from the partial draining of clarifiers during maintenance events". In addition, the brine pond "stores solids that have either precipitated or settled out of the geothermal fluids" and "hold fluids generated during emergency situations, maintenance operations, and water from hydro blasting, safety showers, and eye wash stations, vehicle wash station effluent, water from the plant conveyance system, and reject water from reverse osmosis. The brine pond collects geothermal fluid from wells during flow-testing, after drilling maintenance, and from startup." The brine pond would be of earth construction with a concrete surface and have two feet of freeboard.

There is no discussion of the water quality of this brine pond, although based on the fluids that would be contained within it, it is expected to be toxic. In addition, there is no discussion as to the impacts this would have on special status wildlife and birds. The information provided includes no mention of any enclosure, cover, or netting over this brine pond to protect special status wildlife, particularly birds, from gaining access. Although similar facilities have perimeter fencing, mammals such as desert kit fox and coyotes, have found ways into facilities. There is no discussion of the pond containing escape ramps to allow birds or other species of wildlife to escape. Desert kit fox and other species have been known to be trapped and drown in surface water impoundments.

Data Requests:

19. Please confirm the toxicity of the expected water quality of the brine pond.

Response: Predicted concentrations of brine pond fluid were compared to ecological screening levels, selected according to the following hierarchy based on availability of relevant screening levels:

- Water Quality Control Plan for the Colorado River Basin Region (Region 7), 2003
- California Toxics Rule Criteria for Enclosed Bays and Estuaries, 2000

Due to the high salinity of the fluid (approximately 386 parts per thousand (ppt)), screening levels for saltwater environments were selected when available. Salt water ecological screening levels are not available for calcium, chloride, magnesium, potassium, and sodium, and the elements were not analyzed as potential toxicants.

As expected, conditions at the brine pond are unattractive to wildlife (ephemerality, high discharge temperatures, unpalatable salinity, higher quality habitat nearby) and it was assumed that exposure to chemicals in the brine pond fluid would be short term. Acute screening levels were used when available.

Table DRR 19-1. Saltwater Ecological Screening Levels for Various Metals

Chemical	Predicted Concentration (mg/L)	Ecological Screening Level (mg/L)	Hazard Quotient	Reference
Arsenic	8	0.1	80	Regional Board 7 Basin Plan Water Quality Objectives
Barium	109	1	109	Regional Board 7 Basin Plan Water Quality Objectives
Cadmium	0.9	0.005	180	Regional Board 7 Basin Plan Water Quality Objectives
Lead	94	0.015	6266.667	Regional Board 7 Basin Plan Water Quality Objectives
Mercury	0.0004	0.002	.02	Regional Board 7 Basin Plan Water Quality Objectives
Selenium	0.03	0.05	0.6	Regional Board 7 Basin Plan Water Quality Objectives
Silver	0.03	0.1	0.3	Regional Board 7 Basin Plan Water Quality Objectives
Zinc	437	90	4.855556	CA Toxics Rule Criteria: Enclosed Bays and Estuaries
pH	5	6.0-9.0	N/A	Regional Board 7 Basin Plan Water Quality Objectives

Predicted concentrations in the brine fluid exceed the screening levels (HQ>1) for the following metals: arsenic, barium, cadmium, lead, and zinc, indicating potential risk to wildlife receptors from these metals. Additionally, the predicted pH is below the acceptable range set in the Basin Plan and could potentially increase the bioavailability of metals. Predicted concentrations of mercury, selenium and silver were below the screening levels (HQ<1), indicating a low risk from these three metals.

For the metals in exceedance of screening levels, potential toxicity to wildlife was modelled. The primary route of exposure to birds and mammals is drinking water. As the pond salinity is projected to be approximately 386 ppt (over six times the salinity of the Salton Sea and over ten times the salinity of the ocean), it is not expected to support aquatic prey items such as fish and amphibians, or even communities of hypersaline specialists such as brine shrimp and brine flies (Brown 2010). As a result, birds stopping at the pond would not be exposed to heavy metals through diet. Finally, exposure due to contact with the brine fluid is expected to be minimal as metals are typically unable to penetrate fur, feathers, and skin.

The daily intake of each metal for each species was calculated using the following formula:

$$DI_x = \left(\frac{(WIR)(WC_x)}{BW}\right)$$

DI = Dietary intake for chemical x (mg chemical/kg body weight/day)

WIR = Water ingestion rate (L/day)

WC = Concentration of chemical in drinking water (mg/L)

BW = Body weight (kg)

The resulting daily intake of each metal for each species was then compared to Toxicity Reference Values (TRVs). TRVs are dosage-based effect levels obtained from the literature and are expressed as milligrams chemical per kilogram bodyweight of the receptor per day. TRVs are typically developed using sublethal endpoints, such as growth or reproduction, which are more sensitive than survival. The resulting hazard quotient may be used to quantify the risk through consumption of drinking water.

Several surrogate species were selected to represent local wildlife that may be accessing the brine pond.

Table DRR 19-2a. Toxicity Reference Values for Surrogate Mammal Species – Gray Fox

Gray fox (water ingestion rate: 0.45 L/d; body weight 3.24 kg)	Predicted Concentration (mg/L)	Modelled Daily Intake from Drinking Water (mg/kg)	TRV (mg/kg/day)	HQ
Arsenic	8.00	1.07	1.04	**1.03**
Barium	109.00	14.57	51.8	0.28
Cadmium	0.90	0.12	0.77	0.16
Lead	94.00	12.56	4.70	**2.67**
Zinc	437.00	58.40	75.4	0.77

Table DRR 19-2b. Toxicity Reference Values for Surrogate Mammal Species – Raccoon

Raccoon (water ingestion rate: 0.61 L/d; body weight 4.23 kg)	Predicted Concentration (mg/L)	Modelled Daily Intake from Drinking Water (mg/kg)	TRV (mg/kg/day)	HQ
Arsenic	8.00	1.15	1.04	**1.11**
Barium	109.00	15.70	51.8	0.30
Cadmium	0.90	0.13	0.77	0.17
Lead	94.00	13.54	4.70	**2.88**
Zinc	437.00	62.93	75.4	0.83

Table DRR 19-2c. Toxicity Reference Values for Surrogate Avian Species – Canada Goose

Canada goose (water ingestion rate: 0.20 L/d; body weight 3.31 kg)	Predicted Concentration (mg/L)	Modelled Daily Intake from Drinking Water (mg/kg)	TRV (mg/kg/day)	HQ
Arsenic	8.00	0.48	5.14	0.09
Barium	109.00	6.51	20.80	0.31
Cadmium	0.90	0.05	1.47	0.04
Lead	94.00	5.61	1.63	**3.44**
Zinc	437.00	26.08	66.10	0.39

Table DRR 19-2d Toxicity Reference Values for Surrogate Avian Species – Mallard

Mallard (water ingestion rate: 0.09 L/d; body weight 0.61 kg)	Predicted Concentration (mg/L)	Modelled Daily Intake from Drinking Water (mg/kg)	TRV (mg/kg/day)	HQ
Arsenic	8.00	1.11	5.14	0.22
Barium	109.00	15.14	20.80	0.73
Cadmium	0.90	0.05	1.47	0.09
Lead	94.00	13.05	1.63	**8.01**
Zinc	437.00	60.68	66.10	0.92

Lead, in the predicted concentrations, was found to present risk of adverse effects (HQ>1) to all four modelled species and arsenic to the two mammal species via exposure through drinking water. However, these calculations are very conservative as they assume that the wildlife receptors use the brine pond as their sole source of drinking water. This is unlikely due to the assumed unpalatability of 386 ppt brine, wide foraging ranges and/or migratory nature, ephemerality of the pond, and more attractive sources of drinking water nearby. As this brine pond is unlikely to be a major source of drinking water to local and migratory wildlife, the risk of adverse effects through toxicity is low.

Further, as part of new Water Discharge Requirements (WDR) requirements, it is anticipated that brine pond fluids and solids at the site will be tested on a semi-annual basis to ensure compliance with these requirements.

20. *If the brine pond liquid contains chemicals that can harm and kill special status wildlife, please explain how the wildlife would be prevented from gaining access to this pond and what physical features such as escape ramps are proposed.*

Response: As discussed in DRR 19, the risk of adverse effects from exposure to the brine pond fluids, either through ingestion or contact, is low. Regardless, measures are in place to prevent wildlife from gaining access to the pond.

The design and operation of the project currently includes several safeguards to keep wildlife from accessing the brine pond. The entire facility, which includes the pond, will be fenced as discussed in the AFC (Section 5.5.4.2.4 Security Plan).

The pond will be concrete lined with a 3:1 slope. A 3:1 slope is a standard agency requirement for mandatory wildlife escape ramps. Wildlife that may enter the pond can utilize the pond slope to escape and the concrete surface will provide traction to facilitate upward movement. However, the characteristics of the pond itself during operation will likely deter wildlife. No vegetation will be present around the brine pond and the fluids will not support fish or invertebrate prey. The solids in the pond will be routinely dewatered and removed. The fluids in the pond fluctuate in color but often are a -light brown color, which is unlikely to attract wildlife or be perceived as a source of water. During operations, it is anticipated that the brine pond will be inspected every shift and an environmental field technician will conduct weekly pond inspections. Any wildlife that enters the facility or comes in contact with the pond will be identified during pond inspections.

21. *Please provide a description of the impacts this brine pond would have on special status wildlife and any mitigation measures that would be necessary to minimize significant impacts.*

Response: The brine pond could potentially impact special-status wildlife in the event that the pond is approached or perceived as a source of water. However, the analysis in DR19 has indicated that adverse risks to wildlife from exposure to the brine pond fluids, either through ingestion or contact, is low. Further, as noted above in DR 20, there are several safeguards in place to keep wildlife away from the pond and thus minimize any significant impacts. Notwithstanding these measures, it is possible that wildlife that enter the pond could potentially drown. To further mitigate potential effects of the pond on special-status wildlife, a brine pond wildlife protection plan will be prepared and implemented during operations. This plan will describe efforts that will be undertaken to prevent wildlife access to the pond, including monitoring, and remedial actions to address any impacts that may occur.

It should also be noted that during the Formal Consultation for the CalEnergy Obsidian Energy LLC Salton Sea Unit 6 Geothermal Power Plant, Imperial County, California (File No. 200301514-JMB), provided as Attachment DRR 21, the U.S. Fish and Wildlife Service (USFWS) determined that operation of the power generation facilities, including the presence of brine ponds, would not be likely to result in impacts to wildlife, including special status species.

3.2 Background: Atmospheric Flash System (DR 22-24)

The AFC (TN# 249723) mentions an atmospheric flash system which "lowers the fluid pressure from the LP crystallizer to atmospheric pressure conditions. Fluid from the LP crystallizer discharges into the Atmospheric Flash Tank (AFT). Fluid from the AFT flows by gravity to the primary clarifier. The steam from the AFT is discharged to the dilution water heaters and excess steam is vented to atmosphere." It is this steam from the AFT vented to the atmosphere that is of concern.

Steam vented to the atmosphere is not discussed in the AFC. In CEC staff's Data Adequacy Recommendation (TN# 250066), dated May 8, 2023, staff requested more information on steam venting such as how high and how often the venting occurs; however, the applicant's response only contained a description of the steam flashing and that it would not impact wildlife species.

Data Requests:

22. *Please provide information on the expected temperature of the steam vented to the atmosphere.*

Response: The geothermal fluid enters the AFT at temperature of 232 Fahrenheit (°F) and pressure of 1 pound per square inch gauge (psig) and the steam and fluid exits at a temperature of 216 °F and a pressure of 1 psig.

23. *Please provide information on the approximate height of the steam that vents into the air, how often this event occurs, and how long the venting occurs.*

Response: The AFT is 95 feet above grade. The AFT will operate continuously anytime electricity is being generated or geothermal fluid is flowing at the facility.

24. *Please provide a description of the impacts this vented steam would have on avian species that may encounter this steam and any mitigation that would be necessary to minimize significant impacts.*

Response: The plume emitted by the AFT will exponentially cool from 216°F to ambient temperature. Therefore, the Applicant does not expect adverse impacts to avian species that may momentarily fly through the plume.

3.3 Background: Vegetation Mapping (DR 25-26)

The Biological Resources Section of the AFC (TN# 249723) discusses vegetation communities in the biological survey area and classified the vegetation communities using Landcover Descriptions for the Southwest Regional Gap Analysis Project (NatureServe 2004). This document is from the Southwest Regional Gap Analysis Project that covers Arizona, Colorado, Nevada, New Mexico, and Utah but not California. Since California was not included, this vegetation community mapping reference is not applicable for the project survey area. In addition, the California Department of Fish and Wildlife (CDFW) has specific guidelines for the mapping of natural communities.

The CDFW guidance is found here, https://wildlife.ca.gov/data/vegcamp/natural-communities along with protocols for surveying and evaluating impacts to special status native plant populations and natural communities. The goal is to identify all natural communities using the best means possible. These should be identified and described in accord with A Manual of California Vegetation, Second Edition (Sawyer et al. 2009) or in classification or mapping reports from the region, if applicable. Available on the VegCAMP's Reports and Maps page here (https://wildlife.ca.gov/Data/VegCAMP/Reports-and-Maps). This page breaks down the reports by regions. The proposed project would fall under California Deserts. While there are regional maps from the Desert Renewable Energy Conservation Plan (DRECP) that cover the project area for the desert region, these maps are not detailed enough. Therefore, the applicant should only use the DRECP maps for preliminary high-level identification and then use A Manual of California Vegetation, Second Edition to develop more specific natural community mapping for the biological survey area.

It is important to use the proper natural community mapping guidance and protocol to ensure sensitive natural communities and the special-status species that may occur within are not overlooked or missed.

Data Requests:

25. *Please provide vegetation community mapping using A Manual of California Vegetation, Second Edition (Sawyer et al. 2009) for the biological survey area. Pursuant to these mapping refinements, applicant should be prepared to answer subsequent data requests relative to avoidance and mitigation techniques and measures, if necessary for state waters or species/habitat not previously identified.*

Response: Please see the updated vegetation community mapping based on *A Manual of California Vegetation, Second Edition (*Sawyer et al. 2009*)* provided as Figure DRR-25. No additional jurisdictional (riparian) or species habitats were identified.

26. *Please include descriptions of the communities and the dominant and subdominant plant species as well as any associated plant species for each vegetation community found in the biological survey area.*

Response: Natural vegetation communities were characterized in the field based on dominant and subdominant plant species and community structure and form and delineated in accordance with CDFW guidelines (CDFW 2022). Vegetation within the biological survey area (BSA) was classified using vegetation and land cover descriptions following the *Landcover Descriptions for the Southwest Regional Gap Analysis Project* (SWRegGAP) (NatureServe 2004) and *A Manual of California Vegetation, Second Edition* (MCV) *(*Sawyer et al. 2009*).* Both classifications are presented below and on figures for comparison purposes. In addition, the SWRegGAP classification provides specifics regarding the land cover (i.e., habitat) associated with the vegetation community. The SWRegGAP classification system also includes nonnatural land cover types, which are not found in the MCV. A total of 3 natural vegetation communities were mapped in the BSA, and 5 nonnatural different land cover types were mapped.

3.3.1 Vegetation Communities

Invasive Southwest Riparian Woodland and Shrubland corresponds to *Tamarix* spp. Shrubland Semi-Natural Alliance (Tamarisk thickets) in MCV. Tamarisk or salt cedar (*Tamarix ramosissima* or another *Tamarix* species) is dominant in the open to continuous shrub canopy of this seminatural vegetation community. Emergent trees, such as willows (*Salix* sp.) or cottonwood (*Populus fremontii*), may be present at low cover. Other associated species include giant reed (*Arundo domax*), common reed (*Phragmites australis*), and arrowweed (*Pluchea sericea*). Tamarisk thickets form in temporarily flooded areas along rivers or streams or in depressions. This vegetation community provides cover, foraging, and nesting for wildlife species.

North American Arid West Emergent Marsh corresponds to *Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (cattail marsh) in MCV. In this vegetation community, cattails (*Typha angustifolia*, *Typha domingensis* or *Typha* latifolia) are dominant or co-dominant in the herbaceous layer, which is intermittent to continuous. Other herbaceous vegetation includes bulrush (*Schoenoplectus* spp.) and common reed (*Phragmites australis*). Emergent trees, such as willows (*Salix* sp.), may be present at low cover. This community is found in semi-permanently flooded freshwater or brackish areas, such as along slow-moving streams and rivers, sloughs, and ponds, with clayey or silty soils. A variety of wildlife has potential to use cattail marsh habitat for foraging and nesting. This vegetation community is also observed in intermittently flooded managed wetlands. Managed wetlands may be used for bird habitat or hunting and are found on private and public property. This vegetation type primarily occurs in the BSA buffer.

North American Warm Desert Playa corresponds to the *Allenrolfea occidentalis* Shrubland Alliance (iodine bush scrub) in the MCV. Iodine bush (*Allenrolfea occidentalis)* is the dominant or co-dominant in this vegetation community, which is found on intermittently flooded alkaline or saline playas and hummocks. Vegetation is typically sparse with less than 10% cover and highly alkaline or saline soils. Within the BSA, this vegetation community is restricted to Salton Sea margins and may include other salt-tolerant species such as bush seepweed (*Suaeda nigra*) and salt cedar. These areas provide poor wildlife nesting habitat but could provide foraging habitat when flooded. Varying levels of disturbance were noted within iodine bush scrub. Areas that were highly disturbed were nearly devoid of vegetation but were classified as such due to the alkaline soils and other indicators of a playa habitat.

3.3.2 Land Cover Types

Agriculture – The predominant land cover within the BSA is agriculture. The crops grown in these fields during the botanical surveys include alfalfa (*Medicago sativa*), beets (*Beta* sp.), Bermuda grass, corn (*Zea mays*), cultivated oats (*Avena sativa*), romaine lettuce (*Lactuca sativa*), and wheat (*Triticum aesti*vum). Some fields were fallow or in between crop rotation. These lands may provide foraging habitat for overwintering migratory birds and resident waterfowl. The agriculture land cover type includes an area of planted palm trees observed in the Project buffer.

Canals and Drains – Canals and drains are a nonnatural land cover type that includes concrete-lined and unlined drains located along north-south and east-west oriented roads and in between agricultural fields. Generally, drains are less than 20 feet in width and have steep earthen banks. The drains within the BSA support sparse vegetation consisting of southern cattail (*Typha domingensis*), giant reed, and salt cedar. Periodic maintenance, including removal of vegetation, precludes habitat from supporting special-status plant species. Wildlife may forage in these locations. Burrowing owls are known to use holes in drains and under concrete canals. Irrigation infrastructure, including canals and drains, will not be impacted by the proposed Project.

Developed – The developed land cover type is a nonnatural land cover type with manmade structures. Within the BSA, these areas generally consist of energy production facilities and associated infrastructure. The areas lack natural vegetation cover. Some buildings and structures provide suitable roosting or nesting habitat for common bat and bird species.

Disturbed with Vegetation – The disturbed with vegetation land cover type is not a natural land cover type and is characterized by some form and intensity of human disturbance. The amount and type of vegetation present is dependent on such things as level of soil compaction and duration since last disturbance; species typically found here are generally ruderal such as Bermuda grass (*Cynodon dactylon*) and Russian thistle (*Salsola* sp.) This category also includes previously disturbed wetlands now with dead vegetation. The disturbed with vegetation land cover provides poor-quality wildlife habitat because of the level of human disturbance, sparse vegetation, and compacted soil. Wildlife species may still walk or fly over this land cover type as they move between higher-quality habitats.

Disturbed with No Vegetation – The disturbed with no vegetation land cover type is also nonnatural. These areas consist of unpaved north-south and east-west oriented roads, and other cleared areas adjacent to agricultural fields and roadways typically used for equipment and material staging, parking, and deliveries in support of agricultural activities in the BSA. Wildlife use of disturbed areas would be transient only.

3.3.3 References

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California Regional Water Quality Control Board. 2023. *Water Quality Control Plan for the Colorado River Basin*. Palm Desert, California.

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Establishment of numeric criteria for priority toxic pollutants for the State of California. 2000. 40 CFR 131.38.

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Sawyer, J.O., T. Keeler-Wolf, and J.M Evens. 2009. *A Manual of California Vegetation, Second Edition*. Sacramento: California Native Plant Society Press.

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U.S. Environmental Protection Agency (USEPA). 2005. Ecological soil screening levels for lead. OSWER Directive 9285.7-70. March.

U.S. Environmental Protection Agency (USEPA). 2007. Ecological soil screening levels for zinc. OSWER Directive 9285.7-73. June.

4. Cultural and Tribal Resources (DR 27-35)

4.1 Background: Incorrect Source Citation and Reference (DR 27)

The Cultural Resources section of the AFC contains numerous source citations in the text and the bibliographic entries to match. Although the completeness of this information is high, staff identified an incorrect source citation and reference. Resolving this gap in the AFC will enable CEC staff and other interested parties to better understand the factual basis for the applicant's analysis.

In its discussion of railroad development in Imperial and San Diego counties, the AFC cites "Crawford, n.d." (Jacobs 2023a, page 5.3-11). The accompanying cultural resources report cites "Crawford, 2010" in the same discussion (Jacobs 2023d, page 32). The References in the AFC section and cultural resources report both contain a bibliographic entry for "Crawford, Richard" dating to 2010 (Jacobs 2023a, page 5.3-43; (Jacobs 2023d, page 72). Staff followed the URL given in the references cited and the article contains no mention of railroad development, instead finding a treatment of the San Diego Aqueduct.

Data Requests:

27. Please provide a source applicable to the San Diego and Arizona Eastern Railroad's history.

Response: The correct citation is:

Dodge, Richard V. 1956 San Diego's "Impossible Railroad." Dispatcher 6. Railway Historical Society of San Diego, Campo, California. Available at: https://www.psrm.org/sda/ Accessed September 9, 2023.

4.2 Background: Location of Makeup Well (DR 28-30)

The AFC identifies 20 wells as part of the proposed MBGP; Data Adequacy Response Set 1 also identifies the location of a backup well pad as the future location for two makeup wells that could be drilled during the MBGP's operational life to maintain full capacity (Jacobs 2023a, page 2-9 and Jacobs 2023u. AFC Figure 2-7b, however, depicts two wells that do not appear on other figures in the document.

Data Requests:

28. Please describe the wells labeled 19-1 and 19-2in the AFC (Jacobs 2023a, Figure 2-7b)

Response: Wells 19-1 and 19-2 provided in Figure 2-7b were inadvertently shown on Figure 2-7b for MBGP, but are not part of the MBGP. An updated figure is provided as Figure 2-7bR. Wells 19-1 and 19-2 are not part of the MNGP nor affiliated with the Applicant and are drilled geothermal wells with API numbers 02591501 and 02591502. Information on wells can be found at CalGEM's geosteam website (geosteam.conservation.ca.gov).

29. Depending on the description of the two wells mentioned in the previous data request, what route would the associated hot brine line (see Jacobs 2023a, Figure 2-7b) take to the MBGP??

Response: Please see the response to DR 28. The two wells are not part of the MBGP.

30. Have qualified cultural resource specialists surveyed the associated hot brine line for the presence of cultural resources, as described in Appendix B to the CEC's Siting Regulations?

Response: Please see the response to DR 28. The two wells are not part of the MBGP.

4.3 Background: Archaeological Survey Coverage (DR 31–34)

Qualified archaeologists were able to survey most of the archaeological study area for the presence of archaeological resources. A sizable portion of the applicant's archaeological study area was inaccessible because it was fenced off or underwater. This means that no archaeological survey was conducted in these areas; however, a significant portion of the inaccessible area is part of the proposed primary MBGP facility. This area would be subject to significant ground disturbance.

The applicant estimates that the excavation depth at the main power plant site and well pads would reach 5 feet below the current ground surface (Jacobs 2023a, Figure 2-7a). Altogether, inaccessible portions of the archaeological study area encompass about 110 acres out of the 2,068-acre archaeological study area (5.3 percent); however, the majority of this acreage is located within the footprint of the proposed power plant site. Additionally, four portions of the applicant's archaeological study area had effectively no ground surface visibility. Agricultural crops covered the ground surface in these areas to such an extent that only 10 percent or less of the surface was visible to archaeologists (Jacobs 2023d, Figure 6-5).

The lack of accessibility in these areas of the proposed project calls into question the completeness of the archaeological survey and site control. The proposed project site is near three recorded cultural resources.

Data Requests:

31. *Please indicate when qualified archaeologists will have access to currently inaccessible portions of the archaeological study area.*

Response: Portions of the study area that remain inaccessible due to being under water are anticipated to be accessible to the qualified archaeologists for resurvey on or before November 30, 2023. In addition, in discussions held with CEC Staff, some portions of the study area's 200-foot buffer that are behind fencelines for existing geothermal facilities were deemed inaccessible, and as such, were not surveyed as there will be no impact to these areas as a result of the Project. The survey coverage map previously provided in the AFC as part of Appendix 5.3A Cultural Resources Technical Report, has been updated to distinguish inaccessible areas where surveys are still required. The updated figure is provided as Figure DRR 31.

32. *Please indicate when the crops will be harvested from the low-visibility portions of the archaeological study area.*

Response: The Applicant has resurveyed some areas that were previously identified as low visibility. The updated survey map is provided as Figure DRR 31. However, there are still some areas that are under cultivation and will be resurveyed at a later date once the parcel is cleared. It is anticipated that these areas will be accessible for resurveys in November 30, 2023

33. *Please direct qualified archaeologists to survey the currently inaccessible portions of the archaeological study area after access has been gained*
    - *Space survey transects at 33–50-foot intervals*
    - *Report survey methods and results in an addendum to the cultural resources report and section of the AFC*
    - *The archaeologists shall record any cultural resources identified as a result of the survey on the appropriate Department of Parks and Recreation 523 forms*

- *Submit any sensitive cultural resources information, such as the location of archaeological resources and tribal cultural resources, under request for confidential designation*

Response: The Applicant has resurveyed previously inaccessible areas September 12-14, 2023. Areas of improved visibility where surveys were completed are shown in Figure DRR 31. As set forth in the Applicant's *Notice Pursuant to 20 C.C.R. § 1716(f) for CEC Staff's Data Requests Set 1,* additional time is needed to respond to this request. The Applicant expects to provide the requested information within 30 days of the completion of surveys.

34. *Please direct qualified archaeologists to resurvey the low-visibility portions of the archaeological study area after crops have been harvested and ground surface visibility is improved*
    - *Space survey transects at 33–50-foot intervals*
    - *Report survey methods and results in an addendum to the cultural resources report and section of the AFC*
    - *The archaeologists shall record any cultural resources identified as a result of the survey on the appropriate Department of Parks and Recreation 523 forms*
    - *Submit any sensitive cultural resources information, such as the location of archaeological resources and tribal cultural resources, under request for confidential designation*

Response: The Applicant has resurveyed some previously low visibility areas September 12-14, 2023. Areas of improved visibility where surveys were completed are shown in Figure DRR 31. As set forth in the Applicant's *Notice Pursuant to 20 C.C.R. § 1716(f) for CEC Staff's Data Requests Set 1,* additional time is needed to respond to this request. The Applicant expects to provide the requested information within 30 days of the completion of surveys.

Background: Sources Consulted During the Records Search (DR 35)

The applicant conducted a records search at the South Coastal Information Center (SCIC) of the California Historical Resources Information System (CHRIS) on March 23, 2022. The records search covered the proposed MBGP and a 1.0-mile buffer around all proposed project elements except for transmission lines, to which a 0.5-mile buffer applied. The records search included examinations of the SCIC's base maps of previous cultural resource studies and known cultural resources. (Jacobs 2023a, page 5.3-16; Jacobs 2023d, page 36.) In addition to the SCIC's base maps, the CHRIS Data Request Form indicates that other sources of information are available to the researcher. Of particular interest to CEC staff are the following sources of information, which staff has not located in the AFC.

- *The Office of Historic Preservation's (OHP's) Built Environment Resources Directory*
- *The OHP's Archaeological Resources Directory*
- *California Inventory of Historic Resources*
- *The California Department of Transportation's Bridge Survey. (CHRIS 2020, page 3.)*

Data Requests:

35. *Please provide copies of the results of examining the aforementioned sources for the records search area*

Response: The OHP Built Environment Resources Directory and Archaeological Determinations of Eligibility are provided in Attachment DRR 35 submitted under a repeated request for confidential

designation. SCIC did not have data for the Project area from the OHP Archaeological Resources Directory, the California Inventory of Historic Resources, or the Caltrans Bridge Survey.

5. Geology and Soils (DR 36-61)

5.1 Background: Mullet Fault Zone (DR 36-39)

Section 2.3.2.2, Project Site Selection, of the AFC states, "Production wells access the hotter parts of the reservoir to produce geothermal fluid that will be used to convert thermal and pressure energy to electricity are north of the fault." The Preliminary Geotechnical Investigation prepared by Landmark Geo-Engineers and Geologists, dated October 20, 2022, Section 3.7 Seismic and Other Hazards, indicates the plant site is in the general alignment of the Mullet Fault Zone as evidenced by CO2 mud pots and mud volcanos in the area. This fault is neither shown nor identified on either the Landmark or Jacobs geology maps (Landmark Figures 1 and 2, Landmark Plate A-5, or Jacobs Figure 5.4-1 and 5.4-2); however, the Brawley Seismic Zone is shown west of the site in Landmark Figures 1 and 2 and four hidden faults (two east and two west of the site) are mapped in the vicinity of the site as shown on Landmark Plate A-5.

Data Requests:

36. Please explain what fault you are referencing in the AFC.

Response: The referenced fault in Section 2.3.2.2 is a lineament connecting two surface manifestations (hot springs/mud pots). This lineament, referred to as the Mullet Fault in Landmark Geo-Engineers and Geologists document, is not formally recognized as a fault by California Department of Conservation, California Geological Survey. Additional information is available in the 2008 *The Wister Mud Pot Lineament: Southeastward Extension or Abandoned Strand of the San Andreas Fault?* prepared by David K. Lynch and Kenneth W. Hudnut which identifies the "Mullet" fault as passing roughly through Mullet Island and aligning with the Calipatria fault shown on Figure 4 of that report. The report is provided as Attachment DRR 36.

37. Please identify the location of the Mullet Fault Zone in a figure or plate.

Response: Please see response to DR 36.

38. Please provide the referenced Landmark report that discusses the Mullet Fault Zone.

Response: The requested Landmark report was previously docketed in the AFC as Appendix 5.4 (TN# 249730) and the Lynch and Hudnut report is provided as Attachment DRR 36.

39. Please provide a discussion on the seismic activity level of the Mullet Fault Zone.

Response: Please see response to DR 36. Further, there is little published information on the lineament described as the Mullet Fault Zone. Seismic activity within the Salton Sea KGRA is indistinguishable on this lineament.

5.2 Background: Geologic Resources of Recreational, Commercial, or Scientific Value (DR 40-42)

Section 5.4.2.3, Geologic Resources, of the AFC states, "The Project lies within a known geothermal resource area, the Salton Sea Known Geothermal Resource Area, where geothermal fluids contain unusually high concentrations of metals such as zinc, lead, copper, silver, iron, manganese, sodium, calcium, potassium, and lithium." However, lithium is not mentioned in AFC Section 5.4.1.6, Geologic Resources of Recreational, Commercial, or Scientific Value.

Data Requests:

40. Please explain your reasoning why lithium is not discussed in Section 5.4.1.6, Geologic Resources of Recreational, Commercial, or Scientific Value, to be of known commercial or scientific value.

Response: Lithium extraction and production is not proposed as part of the BRGP. Further, as described in Section 5.4.1.6 of the AFC, the BRGP is not otherwise mapped as near any surface mines or within an area of Mineral Land Classification under the Surface Mining and Reclamation Act ("SMARA").

41. Please provide a discussion of whether MBGP is considering incorporating lithium extraction and production in a current or future phase, and if so, how that incorporation will impact the environment or the project area.

Response: Lithium extraction and production is not proposed as part of the MBGP. The MBGP is proposed to be an approximately 140 (net) MW geothermal power plant that will meet the State's need for new baseload renewable energy resources to support grid reliability and the transition to a 100% renewable energy and zero-carbon resource supply to end-use customers by 2045. The MBGP is not currently designed to integrate lithium extraction and production. ~~Incorporation of lithium extraction and production in a future phase of the MBGP is not reasonably foreseeable at this time. The feasibility of lithium extraction and production from Salton Sea geothermal brine is yet to be proven commercially viable.~~

42. Whether or not lithium extraction and production is planned, please provide a discussion regarding how MBGP could impact the ability of other entities to do lithium extraction and production.

Response: The MBGP does not impact the ability of other entities to independently pursue lithium extraction and production projects. Such projects with mineral rights are free to proceed presumably following any necessary entitlements and environmental review.

Furthermore, the MBGP would not result in a significant loss of availability of mineral resources, potentially including lithium, found in geothermal brine. The geothermal process separates steam from the geothermal production brine. Approximately 7 to 22 percent of the geothermal brine is lost as water vapor to the atmosphere through this process. This means the injection brine is 7-22% less in mass than the production brine, with more concentrated minerals within the injection brine, including lithium. The injection brine is returned to the geothermal reservoir for reheating and production. Over time, the geothermal process concentrates minerals within the geothermal resource. Any mineral potential from the brine is returned to the geothermal reservoir for reheating and production.

5.3 Background: Salton Sea Known Geothermal Resource Area (DR 43-44)

Section 2.1, Introduction, of the AFC states, "The Salton Sea KGRA is known to have significant geothermal reserves. A ''known geothermal resource area'' is an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary of the Interior, engender a belief in those who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose."

Data Requests:

43. Please provide a discussion of the potential for the depletion of the Salton Sea KGRA and the associated short- and long-term impacts of a depletion.

Response: Depletion is assessed based on the level of reservoir pressure decline. Potential reservoir pressure decline was evaluated and forecasted through year 2065 using a numerical reservoir simulation. The results were included in the resource adequacy report entitled "Numerical Reservoir Simulation of the Salton Sea Geothermal Resource for Power Generation, "dated May 2023 (TN# No. 250040). The resource adequacy report was previously provided to CEC and states that (Page 3-1: last paragraph and Figure 3.1) "The forecast results show modest decline in reservoir pressure and enthalpy through 2065 which indicates geothermal reservoir of the SSGF is quite robust." Therefore, the potential for depletion of the Salton Sea KGRA is low, and there are no associated short- or long-term impacts of a depletion.

44. *Please explain if the possibility of a depletion in the resource was considered in your Cumulative Effects, as presented in Section 5.4.3, and if not, why.*

Response: Yes, potential depletion was evaluated using numerical reservoir simulation and forecast of reservoir pressure through the year 2065. The results were included and provided in a report entitled "Numerical Reservoir Simulation of the Salton Sea Geothermal Resource for Power Generation", dated May 2023 (TN# 250042). The report states that (Page 3-1, last paragraph) "The forecast results show modest decline in reservoir pressure and enthalpy through 2065 which indicates geothermal reservoir of the SSGF is quite robust." The impact of the forecast reservoir pressure decline was also evaluated as part of the resource adequacy study. Last paragraph of Page 3-1 of the resource adequacy report states that "the modest decline in reservoir pressure and enthalpy could be mitigated by drilling additional make-up production and injection wells during the life of the projects in order to maintain sufficient production and injection capacity for full power generation".

5.4 Background: Sections 2.6 and 5.4.10, References (DR 45)

Sections 2.6 and 5.4.10 of the AFC references the Preliminary Geotechnical Investigation, Proposed 81 MW Black Rock Geothermal Power Plant, Calipatria, California, dated October 20, 2022.

Data Requests:

45. *Please explain if this is the reference you intended to provide or if you intended to reference the Preliminary Geotechnical Investigation for Morton Bay.*

Response: An inadvertent reference was made to the BRGP. The correct reference is to Preliminary Geotechnical Investigation for the Morton Bay Geothermal Project.

5.5 Background: Geomorphic Provinces and Physiographic Provinces (DR 46-47)

Section 5.4.1.1, Local Settling and Regional Geology, of the AFC references both geomorphic provinces and physiographic provinces. Physiographic provinces were first introduced by Nevin Fenneman in 1917 and geomorphic provinces are used by the California Geologic Survey as introduced in their 2002 Note 36. Using both systems can be confusing to the reader.

Also, the reference for Frost et al. 1997 was not included in your references in Section 5.4.10.

Data Requests:

46. *Please clarify how the two systems of provinces are related.*

Response: The term geomorphic province is a more appropriate term to describe the siting of the project site per California Geologic Survey (CGS) Note 36. The terms geomorphic province and physiographic province are often used interchangeably.

47. Please provide the document referenced, Frost et al. 1997

Response: The complete reference is:

> Frost, E.G., Suitt, S.C., and Fattahipour, M.F., 1997. Emerging Perspectives of the Salton Trough Region With an Emphasis on Extensional Faulting and its Implications for Later San Andreas Deformation, *in* Southern San Andreas Fault, Whitewater to Bombay Beach, Salton Trough, California: South Coast Geological Society Annual Field Trip Guide Book No. 25, p. 57-97.1997.

The Applicant has been unable to locate an electronic copy of the referenced material. A hard copy of the book containing the referenced material will be provided to CEC Staff once received from the South Coast Geological Society.

5.6 Background: Depth to Groundwater and Liquefaction (DR 48-51)

Section 5.4.1.2, Local Geology and Stratigraphy, of the AFC states, "The site is in an area of shallow local groundwater conditions. The surficial soils were observed to be saturated, and groundwater was encountered in all of the subsurface explorations at depths of approximately six feet below ground surface (bgs)." Emphasis added. Section 5.4.1.5.3, Liquefaction, of the AFC states, "Depth to water during the geotechnical investigation conducted at this property (Landmark 2022) was reported at 3.5 to 5 feet bgs." Emphasis added. Section 5.15.1.6, Groundwater, of the AFC states, "Groundwater was encountered in the borings at about 13 feet at the time of the exploration but may rise with time to approximately 6 to 8 feet below the ground surface at the site."

Section 3.8, Liquefaction, of the Landmark Preliminary Geotechnical Investigation states, "The [liquefaction] analysis was performed using a PGAM value of 0.61g was used in the analysis with an 8-foot groundwater depth and a threshold factor of safety (FS) of 1.3."

Section 3.8, Liquefaction, of the Landmark Preliminary Geotechnical Investigation states, "Liquefaction can occur within several isolated silt and sand layers between depths of 8 to 50 feet." Emphasis added. Section 4.5, Deep Foundations, of the Landmark Preliminary Geotechnical Investigation states, "Since the subsurface soils at the project site may experience liquefaction settlements at depths between 8.5 to 50 feet below ground surface, a deep foundation system like drilled piers founded at a minimum depth of 30 feet below ground surface is estimated to reduce settlements to approximately ¼ inch or less." Emphasis added.

Data Requests:

48. Please provide information on the consensus on the depth to groundwater at the site.

Response: The MBGP AFC Section 5.4.1.5.3 states that groundwater measured at 3.5 to 5 feet, however, these depths are for the Black Rock Geothermal Project and the Elmore North Geothermal Project. The historical high groundwater depth at the MBGP site is 6 feet bgs based on Landmark's report.

49. Please explain why the shallowest determined historic depth to groundwater (high groundwater) was not used in the liquefaction analysis.

Response: The liquefaction analyses was re-calculated using a groundwater depth of 6 feet. The depth previously used was 8 feet. The computed liquefaction settlements using a groundwater depth of 6 feet bgs is 0 to 1 inch, thus, consistent with those reported in the 2022 where a depth of 8 feet was used.

50. *Please provide information about the range of depths of potential liquefaction based on high groundwater as determined by the geotechnical engineer.*

Response: Liquefaction may occur at depths between 9 and 50 feet based on a historical groundwater depth of 6 feet.

51. *If liquefaction was analyzed with the historic high groundwater, please explain if you considered the possibility that liquefaction settlement could occur at shallower depths.*

Response: Liquefaction may occur at depths between 9 and 50 feet based on a historical groundwater depth of 6 feet. The soils above the historic groundwater level are not liquefiable based on soil type.

5.7 Background: Liquefaction (DR 52)

Section 3.8, Liquefaction, of the Landmark Preliminary Geotechnical Investigation states, "Because of the depth of the liquefiable layer, the 17.5-foot-thick non-liquefiable clay layer will likely act as a bridge over the liquefiable layer resulting in a fairly uniform ground surface settlement; therefore, wide area subsidence of the soil overburden would be the expected effect of liquefaction rather than bearing capacity failure of the proposed structures."

Data Requests:

52. *Please explain if there is a 17.5-foot-thick non-liquefiable clay layer across the site or if liquefaction settlement can occur as shallow as 8 feet as noted.*

Response: There is an 18-foot thick non-liquefiable layer across the project site. At location CPT-2, liquefaction is estimated to occur at a depth of about 9 feet, but the liquefiable layer is approximately 0.1 ft. thick and is discontinuous. Therefore, this thin layer is not considered to pose a liquefaction risk.

5.8 Background: Jacobs Figure 2-6B (DR 53)

According to Jacobs Figure 2-6B, of the AFC, site grades would be raised as much at approximately 7.5 feet to promote drainage.

Data Requests:

53. *Please provide a discussion regarding the possibility that settlement could occur due to fill placement and if it was accounted for in the preliminary design and borrow quantity needs.*

Response: The revised design raises the site approximately 3 feet. Little if any settlement will occur due to the limited site grade since the pre-consolidation pressure of the soil exceeds the pressures imposed by the site grade raise.

5.9 Background: Mud Pots (DR 54-55)

Mud pots are visible in aerial photographs adjacent to the site, approximately 0.13 miles toward the southeast and approximately 1.3 miles northwest of the site near Mullet Island. According to the Executive Summary in Landmark 2022, "The proposed plant is located adjacent to CO2 mud pots and above a

naturally occurring CO2 gas reservoir. The reservoir is generally located at depths of greater than 50 feet. The measured gas pressure obtained from previous investigation adjacent to the geothermal plant site was approximately 15 to 25 pounds per square inch." Section 3.1, Site Conditions, of the Landmark Preliminary Geotechnical Investigation states, "Several carbon dioxide (CO2) mud volcanoes are sited at the vacant parcel southeast of the project site." Section 3.7, Seismic and Other Hazards, of the Landmark Preliminary Geotechnical Investigation states, "…this plant is located in the general alignment of the Mullet Fault Zone as evident by CO2 mud volcanoes."

Data Requests:

54. *Please explain if the presence of mud pots on either side of the proposed plant are significant or not to site development. If they are not significant, please provide an explanation as to why they are not significant.*

Response: The presence of nearby mud pots was considered by the Applicant during the preparation of the AFC and determined not to be significant to site development. However, after further consideration, the Applicant determined that an even more conservative distance would be appropriate. Therefore, the power plant and ancillary features will be moved approximately [915 feet south/southwest on the current parcel. This will provide a further buffer between the power plant and the potential future occurrence of mud pots. A supplemental filing documenting this relocation will be submitted in the middle of October 2023.

55. *Please explain if the presence of the Mullet Fault Zone or nearby CO2 gas releases would affect the construction, operation, or occupation of the MBGP*

Response: An existing project has been constructed, operated, and occupied on a nearby parcel to the proposed plant site. The MBGP will be designed, constructed, and operated in accordance with applicable civil engineering LORS, including seismic standards. No negative impacts are expected from either the Mullet Fault Zone or nearby CO2 gas releases.

5.10 Background: Section 2.3.2.2, Project Site Selection (DR 56)

Section 2.3.2.2, Project Site Selection of the AFC, states that the top of the geothermal reservoir is 300 to 1,400 feet bgf but is also hydrologically disconnected from the Salton Sea. According to the Executive Summary in Landmark 2022, "The proposed plant is located adjacent to CO2 mud pots and above a naturally occurring CO2 gas reservoir. The reservoir is generally located at depths of greater than 50 feet."

Data Requests:

56. *Please explain the origin of the CO2 gas reservoir and its connection or lack thereof to the geothermal reservoir and Salton Sea.*

Response: Heating of the Lake Cahuilla and Colorado River sediments at depth by the active volcanics in the area has created CO2 gas found in the subsurface (Muffler and White, 1968) and is the source of the Imperial CO2 Gas Field (Rook and Williams, 1943). The presence of CO2 is a naturally occurring phenomena. The shallower CO2 zone is disconnected from the geothermal reservoir where geothermal brine is produced for commercial power generation.

5.11 Background: 2009 Geotechnical Investigation (DR 57)

Section 5.4.1.5.3, Liquefaction, of the AFC states, "…a previous geotechnical investigation conducted at the site in 2009." The referenced investigation was not provided in the AFC.

Data Requests:

57. Please provide the referenced document.

Response: A copy of the 2009 geotechnical investigation is provided as Attachment DRR 57.

5.12 Background: Expansive Soils (DR 58)

Section 5.4.1.5.6, Expansive Soils, of the AFC states, "The MBGP area is not noted to be in a known area of expansive soil. However, the materials encountered during the 2022 geotechnical investigation borings did note the presence of clay-rich soils from 5 feet to 100 feet bgs during field activities. These native soils likely exhibit high swell potential (Landmark 2022) and will be further evaluated during design-level geotechnical investigations." Landmark logged the site soils as Fat and Lean Clay (CH and CL) starting at the ground surface and as documented with Atterberg Limits testing. Section 3.3 Subsurface Soil of the Landmark Preliminary Geotechnical Investigation states, "The subsurface soils encountered during the field exploration conducted on September 28 and 29, 2022 consist of approximately 18 feet of near-surface fat clays."

Data Requests:

58. Please accurately describe if the MBGP area is in a known area of expansive soil.

Response: The Landmark 2022 report was provided as Appendix 5.4 of the AFC (TN# 249730). Section 3.3 of Landmark's 2022 report provides information on expansive potential of site soils.

5.13 Background: Borrow Sites USCS Classifications (DR 59)

Section 4.1, Site Preparation and Backfill, of the Landmark Preliminary Geotechnical Investigation states, "Imported fill soil shall be non-expansive and should meet the USCS classifications of ML (non-plastic), SM, SP-SM, or SW-SM with a maximum rock size of 3 inches and no less than 5% passing the No. 200 sieve." Section 3.3, Subsurface Soil, of the Landmark Preliminary Geotechnical Investigation states, "The subsurface soils encountered during the field exploration conducted on September 28 and 29, 2022 consist of approximately 18 feet of near-surface fat clays." The boring logs included in Appendix B of the Landmark Preliminary Geotechnical Investigation report show Lean and Fat Clay (CL and CH) were logged starting at the ground surface in all the borings.

Data Requests:

59. Please provide subsurface data from the proposed borrow sites showing soil types ML (non-plastic), SM, SP-SM, or SW-SM are present.

Response: The quantity of imported material required for the projects has is still being finalized and subsurface data is not available at this time from the proposed borrow pits. Current updated projections indicate there may be a net export required and borrow may not be necessary. If required, samples of potential borrow soils will be collected and tested to verify that they meet the specified classification for borrow soils.

5.14 Background: Seiches (DR 60)

Section 3.7, Seismic and Other Hazards, of the Landmark Preliminary Geotechnical Investigation states, the site lies adjacent to the Salton Sea, so the threat of seiches or other seismically-induced flooding is considered possible." Emphasis added. But Section 5.4.1.5.7, Tsunamis and Seiches, of the AFC states, "While the MBGP site is located adjacent to wetlands hydraulicly connected to the Salton Sea the actual Salton Sea is located approximately two miles away from the Project. With a current elevation of approximately -240 feet, the potential for a seiche event that would affect the site is not considered likely." Emphasis added.

Data Requests:

60. Please resolve the inconsistency between these two statements regarding seiches and accurately state the likelihood/possibility of seiches.

Response: Currently the edge of the Salton Sea is over 2.25 miles west of the project site. Shallow wetlands are located to the west of the project site. Because of the distance to the Salton Sea and the presence of wetlands between the Salton Sea and the project site, the potential for seiches affecting the project site is negligible.

5.15 Background: Extrusive Rhyolite Domes (DR 61)

Section 5.4.1.2, Local Geology and Stratigraphy, of AFC states, "Obsidian Butte lies west of the site and is the westernmost of five small extrusive rhyolite domes arranged along a northeast trend. These domes erupted approximately 5,000 to 10,000 years before present and are collectively known as the Salton Buttes, which were extruded onto Quaternary alluvium." Section 5.8.1.1 Physiographic and Geologic Setting, of the AFC states, "The fourth major rock group includes modern volcanic deposits collectively known as the Salton Buttes lava domes. The Salton Buttes lava domes consist of four small volcanoes that include, from southwest to northeast, Obsidian Butte, Rock Hill, Red Hill, and Mullet Island (Robinson et al. 1976). These volcanoes last erupted approximately 16,000 years ago." Emphasis added. Section 3.7 Seismic and Other Hazards, Volcanic Hazards, of the Landmark Preliminary Geotechnical Investigation states, "Obsidian Butte and Red Hill, located at the south end of the Salton Sea approximately 1 mile west of the project site, are small remnants of volcanic domes. The domes erupted about 1,800 to 2,500 years ago (Wright et al, 2015)." Emphasis Added.

Data Requests:

61. Please resolve the inconsistency of the age(s) of the last eruption of the domes.

Response: Age dating has different techniques which result in variability. The age dates referenced here are from various sources. The most recent and detailed analysis is presented in a publication by Heather M. Wright et al. (2015) Episodic Holocene eruption of the Salton Buttes rhyolites, California, from paleomagnetic, U-Th, and Ar/Ar dating. A copy of this document is provided as Attachment DRR 61.

6. Land Use (DR 62-66)

6.1 Background: Consistency with Development Standards for Supportive/Ancillary Sites (DR 62)

On pages 5.6-12 to 5.6-13, the MBGP application shows various zoning designations for the locations of the proposed project's supportive/ancillary elements, which include the production and injection well sites, aboveground production and injection pipelines, freshwater connections, generation interconnection transmission (gen-tie) line, laydown yards, parking areas, construction camps, and borrow pits. However, the application only analyzes the project's consistency with the development standards for the zoning designation of the main project site, not the zoning designations for the supportive/ancillary sites.

Data Requests:

62. Please show how the development of each supportive/ancillary site is consistent with the development standards for the site's zoning designation.

Response: The aboveground wells (injection), aboveground pipelines (injection), and construction camps require Imperial County (County) review and approval of a Conditional Use Permit (CUP). During the CUP process, the County will determine applicable development standards (if any), including setbacks and maximum structure height, for the wells, pipelines, and construction camps. The County will require consistency with applicable development standards prior to the issuance of a CUP or as conditions of approval.

The generation interconnection transmission line (gen-tie) is under jurisdiction of the Imperial Irrigation District (IID) and is not subject to County development standards. The freshwater supply lines and connections are located underground and are not subject to County development standards. Due to the temporary nature of laydown yards, parking areas, borrow pits, development standards are not applicable.

Therefore, the project will be consistent with development standards which the County determines as applicable. Please refer to Attachment DRR 62, which provides the September 28, 2023 letter from the County which includes confirmation that development standards do not directly apply to these ancillary facilities, provided as DRR 62.

6.2 Background: Consistency with Development Standards for Height (DR 63-65)

The application states on page 5.6-13 that the project conflicts with Imperial County zoning regulations for maximum height. The proposed atmosphere flash tanks, at 95 feet in height, exceed the maximum building height of 35 feet in the Open Space/Recreational zoning district with a Geothermal Overlay (S-1-G). This requires an approved variance from Imperial County, according to Imperial County zoning regulations. The application states that Imperial County staff have indicated during discussions with the applicant that variance findings for the project could be made. However, CEC staff needs to confirm this, either through submittals from the applicant or communications with Imperial County. Although the CEC has exclusive authority over the proposed project, the CEC must ensure compliance with Imperial County laws, ordinances, regulations, and standards (LORS).

Data Requests:

63. *Please submit materials supporting the statement that Imperial County could make variance findings for the height of the atmosphere flash tanks. This includes copies of any communications with the County regarding the variance. If the applicant's communications with the County were not in writing, please include a summary of discussions with the County and the name/s of the Imperial County staff contacted.*

Response: The Applicant participated in a meeting with Mr. Jim Minnick, Imperial County Planning & Development Services Director, on March 30, 2023, to discuss the project and associated permitting approach, specifically AFC Sections 2.0 Project Description, 5.6 Land Use and 5.10 Socioeconomics. During this meeting, Mr. Minnick indicated that, due to project components exceeding the 35-foot maximum building height of structures within the S-1-G zone, a formal County variance process would be required. Please refer to the September 28, 2023 letter from the County which includes confirmation that development standards do not directly apply to these ancillary facilities, provided as DRR 62.

64. *Please submit, in accordance with the application form for variances used by Imperial County, the reason why the variance is needed, and a description of the properties immediately to the north, south, west, and east of the project property.*

Response: A variance to the maximum building height in the S-1-G zone is required to accommodate multiple essential structures exceeding 35 feet in height. Due to the MBGP facility's design and engineering, it is not feasible to reduce all project component's height to 35-feet or less. In order for the MBGP facility to function efficiently at optimal production levels, these structures, which include various atmospheric flash tanks, that must exceed the 35-foot threshold.

Table 5.6-1 provided below as well as in Section 5.6.1.5.1 of the AFC identifies the current uses and zoning of the properties immediately to the north, south, west, and east of the primary MBGP site.

Table 5.6-1. Land Uses Adjacent to the Project Site

Location From Project Site	Current Use	Zoning
North of the Plant Site	Open Space; recreational	Open Space/Recreational with Geothermal Overlay (S-1-G)
East of the Plant Site	Open Space; Geothermal energy production	Medium Industrial Area with Geothermal and Pre-Existing Allowed/Restricted Overlays (M-2-G-PE)
South of the Plant Site	Open Space; recreational	Open Space/Recreational with Geothermal Overlay (S-1-G)
West of the Plant Site	Open Space; recreational	Open Space/Recreational with Geothermal Overlay (S-1-G)

Sources: Imperial County 2023, Google Earth 2023

65. Please include a discussion of how the proposed project could meet the required variance findings in Section 90202.08.

Response: In order to issue a variance for exceeding the maximum structure height of 35 feet within the S-1-G zone, the County would need to make the following findings, pursuant to Section 90202.08 of the County's Municipal Code:

1. Findings. Approval or conditional approval may be granted only if the director/commission/board of supervisors first determines that the variance satisfies the criteria set forth in Government Code Section 65906, and the following findings can be made:
    a. That there are special circumstances applicable to the property described in the variance application, that do not apply generally to the property or class of use in the same zone or vicinity;
    b. That the granting of such variance will not be materially detrimental to the public welfare or injurious to the property or improvements in such zone or vicinity in which the property is located;
    c. That because of special circumstances applicable to subject property, including size, shape, topography, location or surroundings, the strict application of zoning laws is found to deprive subject property of privileges enjoyed by other properties in the vicinity and under identical zone classifications;
    d. That the granting of such variance will not adversely affect the comprehensive general plan.

Finding #1: Special circumstances exist at the MBGP site in the form of rare geothermal resources near the surface. The Salton Sea area is one of only 19 designated Known Geothermal Resource Areas in California (CEC 2020). There are 12 existing geothermal power plants operating within the Salton Sea area. Due to these special circumstances, it is possible the County could make Finding #1.

Finding #2: The MBGP site is located in an area dominated by agricultural and geothermal energy uses. The nearest permanent residence is located approximately 3.6 miles east of the MBGP site. Due to the rural setting and lack of nearby permanent residences, granting of a variance is not expected to result in materially detrimental impacts to the public welfare or injurious to the property or improvements in the vicinity and it is possible that the County could make Finding #2.

Finding #3: The Hell's Kitchen project is similarly located in S-1-G zoning and are in the County review process for a variance to the 35-foot maximum building height (Variance #21-0005). According to Variance #21-0005, onsite project components for the Hell's Kitchen project would reach heights up to 50, 60, 80, and 110 feet. Because similar projects located in identical zoning classifications are able to apply for similar variances with the County, it is not believed that MBGP would be receiving special privileges and the County could make Finding #3.

Finding #4: Granting of a variance which would allow for structures of an allowable land use to exceed the 35-foot maximum building height in the S-1-G zone would not adversely affect the comprehensive general plan and the County could make Finding #4.

Please refer to the September 28, 2023 letter from the County which includes confirmation that development standards do not directly apply to these ancillary facilities, provided as DRR 62.

6.3 Background: Consistency with Conditional Use Permit Findings (DR 66)

The application notes on pages 5.6-12 to 5.6-13 that the generating facility and many of the supportive/ancillary elements would require a conditional use permit (CUP) from Imperial County under the applicable zoning designations. Although the CEC has exclusive authority over the proposed project, the CEC must ensure compliance with Imperial County LORS.

Data Requests:

66. *Please state how each project element, including development on the primary site and supportive/ancillary sites, meet the findings required for a CUP from Imperial County. The findings for approval of a CUP are in Section 90203.09 of the Imperial County Code.*

Response: The MBGP components which would be subject to a CUP, if reviewed by the County, include the following:

- Primary powerplant: Per Section 90518.02 of the County's Municipal Code, major facilities related to the generation and transmission of electrical energy are permitted as conditional uses.
- Injection wells and injection pipelines: Per Section 90508.02 and 90512.02 of the County's Municipal Code, major facilities related to the generation and transmission of electrical energy are permitted as conditional uses.
- Temporary laydown yards and parking areas: Per Section 90509.02 and 90518.02 of the County's Municipal Code, temporary contractor storage yards are permitted as conditional uses.
- Temporary construction camps: Per Section 90509.02 and 90518.02 of the County's Municipal Code, labor camps are permitted as conditional uses.
- Temporary borrow pits: Per Section 90509.02 and 90507.02 of the County's Municipal Code, mineral extraction and resource extraction are permitted as conditional uses.
- Gen tie-line: Per Section 90518.02, transmission lines are permitted as conditional uses.

In order to issue CUPs, the County would need to make the following findings, pursuant to Section 90203.09 of the County's Municipal Code:

1. The proposed use is consistent with the goals and policies of the adopted county general plan;
2. The proposed use is consistent with the purpose of the zone or sub-zone within which the use will be located;
3. The proposed use is listed as a use within the zone or sub-zone or is found to be similar to a listed conditional use according to the procedures of Section 90203.10;
4. The proposed use meets the minimum requirements of this title applicable to the use and complies with all applicable laws, ordinances and regulations of the county of Imperial and the state of California;
5. The proposed use will not be detrimental to the health, safety, and welfare of the public or to the property and residents in the vicinity;

6. The proposed use does not violate any other law or ordinance;

7. The proposed use is not granting a special privilege.

Finding A: The land use-related goals and policies of the County's adopted general plan are identified in Table 5.6-3 of the Application for Certification. It was determined that the project, as a whole, is not significantly inconsistent with any of the identified goals and policies. Therefore, the County could make Finding A.

Finding B: Because the proposed primary powerplant, injection wells and pipelines, temporary laydown yards, parking areas, construction camps, borrow pits, and gen-tie components align with land uses identified in the County's Municipal Code as permitted conditional uses within the respective zoning designations which they are located, these uses are consistent with the purpose of the zone. Therefore, the County could make Finding B.

Finding C: As discussed in bullet points above, the primary power plant and injection wells and pipelines can be considered major facilities related to the generation and transmission of electrical energy, which are permitted as a conditional uses. The temporary laydown yards and parking areas can be considered temporary contractor storage yards, which is permitted as a conditional use. Temporary construction camps can be considered labor camps, which is permitted as a conditional use. Temporary borrow pits can be considered mineral extraction and resource extraction, which are permitted as conditional uses. The gen tie-line can be considered a transmission line, which is permitted as a conditional use. Each of these project components align with permitted conditional uses in the County's Municipal Code. Therefore, the County could make Finding C.

Finding D: With the approval of a County variance for structure height at the primary MBGP site, and as discussed in Section 5.6.2.2.2 of the Application for Certification, the project is not inconsistent with applicable laws, ordinances, and regulations of the County or State. Therefore, the County could make Finding D.

Finding E: The MBGP site is located in an area dominated by agricultural and geothermal energy uses. The nearest permanent residence is located approximately 3.6 miles east of the MBGP site. Due to the rural setting and lack of nearby permanent residences, granting of a CUP for ancillary facilities is not expected to result in impacts that would be detrimental to the health, safety, and welfare of the public or to the property and residents in the vicinity. Therefore, the County could make Finding E.

Finding F: With the approval of a County variance for structure height at the primary MBGP site, and as discussed in Section 5.6.2.2.2 of the Application for Certification, the project is not inconsistent with any other applicable law, ordinance, or regulation. Therefore, the County could make Finding F.

Finding G: Within approximately 10 square miles of the Project, there are 10 existing geothermal powerplants (State Lands Commission, 2015), including the Hell's Kitchen facility. The geothermal powerplants in the vicinity employ similar ancillary facilities such as aboveground pipelines, wells, transmission lines, freshwater supply lines, and temporary construction support areas. Therefore, the proposed use is not granting a special privilege. The County could make Finding G.

Please refer to the September 28, 2023letter from the County which includes confirmation that development standards do not directly apply to these ancillary facilities, provided as DRR 62.

6.3.1 References

California Energy Commission (CEC). 2020. Known Geothermal Resource Areas- California, 2020. https://gis.data.ca.gov/documents/CAEnergy::known-geothermal-resource-areas/about. Accessed on March 31, 2023.

California State Lands Commission. 2015. The Geysers and Salton Sea Geothermal Fields. Updated June 2015. https://slc.ca.gov/wp-content/uploads/2018/10/07-TheGeysersandSaltonSeaFields.pdf. Accessed March 30, 2023.

Google. 2023. Google Earth imagery of Imperial County. Retrieved January 31, 2023.

Imperial County. 2023. Zoning Information. https://www.icpds.com/planning/maps.

7. Project Description (DR 67-72)

7.1 Background: Construction Camp Details (DR 67-72)

The application does not provide many details about the construction camps in the Project Description. However, some general details of construction-related activities proposed for the supportive/ancillary sites, including the construction camps, are spread throughout the application. Section 5.10.1.7.3 (Socioeconomics) of the application states that wastewater would be generated by portable restrooms, showers, and kitchens at the crew construction camps and stored for removal and disposal at an appropriate wastewater facility. This section also states that sanitary waste from restroom, kitchen, and similar facilities would be directed to a septic tank constructed to Imperial County specifications, and that sludge from the septic system would either be sent to an onsite leach field or trucked offsite for disposal. Section 5.11.2.2.6 (Soils and Agricultural Resources) provides additional detail, stating that activities and construction at laydown yards and construction camps would include Best Management Practices (BMP) installation, clearing and leveling the sites, installation of temporary ground cover/gravel suitable for material and equipment staging areas, parking, power and security site lighting installation, perimeter fencing, portable construction trailers, camp facilities, and associated utility construction.

It is difficult to differentiate between which improvements are generally planned for the project site and supportive/ancillary sites, and which improvements are planned specifically for the construction camps. In addition, staff needs more detail on the specific improvements planned for the construction camps to assess impacts. Please provide the following additional information needed for the Project Description.

Data Requests:

67. *Please confirm that the information on the handling of wastewater and sanitary waste provided in Section 5.10.1.7.3 of the application applies to the construction camps.*

Response: For the construction camps, wastewater and sanitary waste would be directed to a septic tank constructed to Imperial County specifications, and that sludge from the septic system would either be designed to utilize an Evapotranspiration (E-T) Bed for sanitary wastewater effluent disposal downstream of the septic tank or be trucked offsite for disposal. Any sites for construction housing that may be developed would adhere to all local and state sanitary requirements.

68. *Please provide information on the type (mobile trailers, etc.) and number of housing units that would be used at the construction camps; also if the kitchen facilities referenced would be in each housing unit or if consolidated meal service is proposed.*

Response: As described in Section 5.10.2.3.3 of the AFC, the Applicant expects that the construction workforce will most likely commute daily to the MBGP site or stay in hotels/motels in Calipatria and Brawley, or in recreational vehicle parks and campgrounds in the vicinity of the project site. The Applicant's preferred option is to contract with offsite housing and recreational vehicle (RV) site developers. Onsite construction camp(s) are the Applicant's last option. The exact number of units is uncertain and would be less than 750 trailer / RV sites. No meal services or community kitchen services are anticipated.

The Applicant expects that the existing options will serve all construction workforce housing needs, but is exploring the possibility of providing additional options, such as directly contracting with off-site housing and recreational vehicle ("RV") site developers to facilitate the ability of workers to easily find accommodations. The Applicant has included the potential construction camps in the AFC out of an

abundance of caution. If the Applicant proceeds with construction camps, the Applicant expects that the camps would provide space to park approximately 750 trailer/RV sites to park onsite.

69. Please provide a list and description of facilities that would be used at the construction camps, including restroom, kitchen, vehicle fueling, recreation, and commissary facilities, and any other facilities that would be provided.

Response: The Applicant expects that the construction camps would include a temporary power drop, temporary potable water tank, and a sanitary station. The construction camps will not include a kitchen, vehicle fueling, recreation or commissary facilities, or facilities other than those described above.

70. Please provide details on the proposed temporary power and water supply for the construction camps.

Response: Site development plans will be produced, if developed as noted in DR 68, but are not available at this time. All local and state codes will be followed when constructing any construction housing facilities. However, the Applicant expects that the construction camps would include a temporary power drop, temporary potable water tank, and a sanitary station.

71. Please provide more detailed information on current site conditions at the sites proposed for construction camps and plans for grading or any other alterations of the surface.

Response: As described in Section 2.4.4.1.2 of the AFC, three potential locations for the construction camps, located at APN 020-120-054, 020-120-056, and 020-120-057), have been identified. The locations have all been subject to biological resources and cultural resources surveys. (AFC Sections and 5.3.2.2.1; AFC Figure 5.3-1c.) These sites are designated as Prime Farmland and consist of flat agricultural fields with active crops or plowed soil. (AFC Figures 5.2-4, 5.11-2; Table 5.13-1.) Soil map units for the construction camps are identified in Figure 5.11-1 and described in Sections 5.11.1.2 and 5.11.1.3. As described in AFC Section 5.11.2.2.6, potential surface alterations include vegetation removal, excavation, minor grading as needed to level the surface, and gravel application.

72. If possible, please provide to scale or dimensioned site plans for the proposed construction camp areas.

Response: Site development plans are not available at this time.

8. Public Health (DR 73-79)

8.1 Background: Construction Health Risk Assessment (HRA) (DR 73-74)

In the AFC for MBGP (TN# 249723), the construction health risk assessment (HRA) estimated the rolling cancer risks for each 29-month period during a 30-year exposure duration (starting with exposure during the third trimester), aligned with the expected construction duration, at the point of maximum impact (PMI), the maximally exposed individual resident (MEIR), maximally exposed individual worker (MEIW), and maximally exposed sensitive receptor. The results of the analysis are contained in Table 5.9-9 and Appendix 5.9B.

The construction HRA indicates that the maximum cancer risk due to exposure to air toxics emitted by a Power Generation Facility (PGF) construction would be approximately 28.9 in one million at the PMI, which is above the SCAQMD's "significant health risk" threshold of 10 in one million. The applicant stated that 'although this risk level is greater than the SCAQMD's "significant health risk" threshold, the location of the PMI represents the maximum possible cancer risk outside of the facility boundary. Cancer risks are expected to be much less in locations where long-term exposure is more likely to occur, such as at the locations of the MEIR, MEIW, and maximally exposed sensitive receptor. Cancer risks at these locations are 1.03, 0.67, and 1.03, respectively, which are all less than the significance threshold. Non-cancer chronic and acute effects (i.e., HI values) from project construction are also well below the SCAQMD significance thresholds of 1.0 at all locations. Additionally, the project construction activities will be finite, and best available emission control techniques would be used throughout the 29-month construction period to control pollutant emissions. Therefore, the potential cumulative health risk impacts from construction are also expected to be less than significant.' (TN# 249723, P. 5.9-19)

Staff needs to verify that the health impact during construction is less than significant.

Data Requests:

73. *Please provide spreadsheet versions of the tables listed in Appendix 5.9B, including live, embedded calculations.*

Response: A spreadsheet version of Appendix 5.9B is provided including live, embedded calculations as Attachment DRR 73. As discussed in DR 3 and DR 4, Appendix 5.9B is in the process of being revised to incorporate refinements to the MBGP design and address other CEC Staff comments provided herein. Therefore, spreadsheet versions of these documents with live, embedded calculations will be provided no later than November 10, 2023

74. *For residential exposures, please provide a map containing health risk isopleths, including an isopleth showing the risk value of 10 in a million.*

Response: A map containing health risk isopleths, including an isopleth showing the risk value of 10 in a million was included in the AFC as Figures DR 74-1 and DR 75-1. However, as discussed in DR 3 and DR 4, construction HRA modeling is in the process of being revised to incorporate updates to the MBGP design and address other CEC comments provided herein. Therefore, an updated map containing cancer risk isopleths, including an isopleth showing the risk value of 10 in a million, will be provided no later than November 10, 2023.

8.2 Background: Operation Health Risk Assessment (DR 75)

In the AFC (TN# 249723), the operation HRA estimated cancer risks by using the 30-year continuous exposure duration scenario for residence and by using the 25-year exposure duration (8 hours per day starting at age 16 years old) for worker, at the point of maximum impact (PMI), the maximally exposed individual resident (MEIR), maximally exposed individual worker (MEIW), and maximally exposed sensitive receptor. The results of the analysis are contained in Table 5.9-8 and Appendix 5.9A.

The operation HRA indicated that the maximum cancer risk due to exposure to air toxics emitted by a Power Generation Facility (PGF) operation would be 16.4 in one million at the PMI, which is above the SCAQMD's "significant health risk" threshold of 10 in one million.

The applicant stated that 'Although this risk level is greater than the SCAQMD's "significant health risk" threshold, its location represents the maximum possible cancer risk outside of the facility boundary. Cancer risks are expected to be much less in locations where long-term exposure is more likely to occur, such as at the locations of the MEIR, MEIW, and maximally exposed sensitive receptor. Cancer risks at these locations are 0.47, 0.73, and 0.47, respectively, which are all less than the significance threshold, as is the estimated cancer burden rate. Non-cancer chronic and acute effects (i.e., HI values) from project operations are also below the SCAQMD significance thresholds of one (1) at all receptor locations. Additionally, emission control technologies for key toxic air contaminants (TACs) will also be installed as part of the project, as described in Section 5.9.6, which will reduce TAC emissions to the extent technically feasible. Therefore, the potential cumulative health risk impacts from operation are expected to be less than significant.' (TN# 249723, P. 5.9-18) Staff needs to verify that the health impact during operation is less than significant.

Data Requests:

75. *For residential exposures, please provide a map containing health risk isopleths, including an isopleth showing the risk value of 10 in a million.*

Response: A map containing health risk isopleths, including an isopleth showing the risk value of 10 in a million was included in the AFC as Figures DR 74-1 and DR 75-1. However, as discussed in DR 3 and DR4, operation HRA modeling is in the process of being revised to incorporate updates to the MBGP design and address other CEC comments provided herein. Therefore, an updated map containing cancer risk isopleths, including an isopleth showing the risk value of 10 in a million, will be provided no later than November 10, 2023.

8.3 Background: Hydrogen Sulfide (H2S) HRA (DR 76)

Project operation would result in emissions of hydrogen sulfide (H2S). H2S causes a wide range of health effects, including odor nuisance, nausea, tearing of the eyes, headaches or loss of sleep, airway problems (bronchial constriction) in some asthma patients, possible fatigue, loss of appetite, headache, irritability, poor memory, dizziness, coughing, eye irritation, loss of smell, etc.[4] In the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values[5], noncancer acute and chronic Reference Exposure Levels (RELs) are listed.

However, it is stated that "the acute risk threshold for H2S in the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values is equal to the 1-hour CAAQS of 42 micrograms per cubic meter (CARB 2022a), which was adopted for purposes of odor control. As a result of the acute threshold

[4] https://www.osha.gov/hydrogen-sulfide/hazards

[5] https://ww2.arb.ca.gov/sites/default/files/classic/toxics/healthval/contable08042023.pdf

developed by OEHHA and the CAAQS being based upon the same concentration, the CAAQS analysis presented in Section 5.1 is considered sufficient for addressing short-term impacts and associated risks of H2S. This HRA does not analyze H2S in the presented HARP2 modeling and associated health risk results." (TN# 249723, P.5.9-16) Staff doesn't agree with this argument. Staff needs a complete HRA to sum hazard quotients for all the TACs, including H2S, to determine whether the total hazard index would be less than 1.

Data Requests:

76. Please revise the operation HRA (i.e., noncancer chronic and noncancer acute) including H2S.

Response: The Applicant will revise the operation HRA to include H_2S emissions, as requested. Updated modeling files and results will be provided no later than November 10, 2023.

8.4 Background: Mobile Testing Unit Modeling (DR 77)

Page 5.1-40 of the AFC (TN# 249723) states that the mobile testing unit (MTU) was not included in the modeling analysis due to its use at various (i.e., temporary) well locations throughout the project site for only a limited number of hours. The AFC also states that the emissions from MTU operation would be minimal and less than emissions from the production testing units (PTUs) and rock muffler (RM). However, pages 3 and 4 of 176 of Appendix 5.1A (TN# 249726) show that the hourly and first year annual emissions of the MTU would be higher than those of the PTUs. In addition, page 3 of Appendix 5.1A shows that the MTU would operate 2,160 hours and 2,640 hours per year for production well testing and injection well testing respectively, which would be 10 times more than the PTU operation. CEC staff needs a revised HRA to include the MTU with other emission sources modeled previously to complete the analysis.

Data Requests:

77. Please revise the HRA to include the MTU with other emission sources modeled previously.

Response: As described in the response to DR 7, the Applicant chose to exclude the MTU from the modeling analyses presented in the AFC due to its limited operations in spatially varying locations outside of the fence line. However, the Applicant will revise the operation HRA to include the MTU, as requested. Updated modeling files and results will be provided no later than November 10, 2023.

8.5 Background: Cooling Tower Modeling (DR 78-79)

The applicant's HRA modeling files show that the applicant used NH3 emissions of 8.53 lbs/hr, 74,686.8 lbs/yr (for 8,760 hours of routine operation scenario), and 71,454.8 lbs/yr (for startup/shutdown scenario) for the cooling tower. However, page 3 of 176 of Appendix 5.1A (TN# 249726) shows that the hourly NH3 emission of the cooling tower with sparger during continuous operation or during biological oxidation box bypass would be 119 lbs/hr and 572 lbs/hr during sparger bypass. Page 5 of 176 of Appendix 5.1A (TN# 249726) shows that the annual NH3 emission of the cooling tower with sparger, sparger bypass, and biological oxidation box bypass would be 1,000,649 (=[0.00718+2.48+0.0274+5.9+4.81+418+57.2+11.9]× 2000) lbs/yr for subsequent year without commissioning. Page 6 of 176 of Appendix 5.1A (TN# 249726) shows that the annual NH3 emission of the cooling tower with sparger would be 1,045,800 (=[517+5.94]×2000) lbs/yr for 8,760 hours of routine operation.

CEC staff needs clarification regarding how the modeled NH3 emission rates were determined. Staff believes that a worst-case HRA should consider the worst-case emission scenarios.

Data Requests:

78. Please clarify how the modeled NH3 emission rates were determined.

Response: The dispersion modeling for use in the HRA used a 1 gram per second (g/s) emission rate for each of the cooling tower sources, for a combined total of 14 g/s of emissions. The "CT" source group in the HRA represents the combined emissions from the fourteen cooling tower sources. Therefore, the HARP2 emissions entry represents the total worst-case hourly emissions from all cooling towers (119 pounds per hour [lbs/hr]) divided by a factor of 14 (to account for each of the 14 cooling tower sources). This approach assures that the total cooling tower emissions are included in the dispersion modeling as HARP2 calculations are only based upon a 1 g/s emission rate.

79. Please update the HRA with the worst-case NH3 emission rates for the cooling tower

Response: Based upon the above response to DR 78, the cooling tower NH_3 emission rates do not need to be updated in the HRA.

9. Socioeconomics (DR 80-82)

9.1 Background: Construction Camps (DR 80-82)

CEC staff needs additional information on the proposed construction camps to temporarily house construction workers on the proposed MBGP.

In section 2.3.4.2 page 2-41 of the AFC the applicant states "Affiliates of the Applicant anticipate constructing separate geothermal power plants (Elmore North Geothermal Project and Black Rock Geothermal Project) concurrently with MBGP, which will increase regional peak workforce and may require temporary housing and facilities for construction workers affiliated with MBGP and the two other projects. These potential construction camps would be used by personnel working on the construction of the Black Rock Geothermal Project, Elmore North Geothermal Project, and MBGP."

Data Requests:

80. What is the maximum number of construction workers that could be housed at the construction camps?

Response: As explained in response to Data Request 68, the Applicant expects that most of the construction workers will either commute to the site or utilize hotels, motels, or existing RV/trailer sites. However, for conservative planning purposes, the Applicant expects that the number of available RV/trailers sites at the construction camps will not exceed 750.

81. Would each geothermal project be allocated a specified area for their workers? If so, how many workers could be housed in the area set aside for MBGP workers?

Response: Allotted space will not be designed to be project specific. Workers will have options of staying in existing housing options or newly developed options.

82. Would the construction camps be available for workers the entire 29 months of construction and commissioning of MBGP? If not, how long would the construction camps be in use?

Response: Construction camps would be available for the full construction duration if approval and development of the construction camp aligns with the beginning of MBGP construction. I The Applicant expects that individual workers or groups of workers would supply their own RV or travel trailer that would be removed after the project was complete.

10. Transportation (DR 83-92)

10.1 Background: Facilities, Operations, and Maintenance (DR 83-84)

The MBGP AFC indicates in its Project Description section that "The MBGP is expected to be operated by a staff of approximately 61 full-time, onsite employees. The facility will be capable of operation seven days per week, 24 hours per day." To provide clarification and aid staff analysis of any operational impacts, CEC staff requires description of anticipated shift hours and number of staff required per shift, as well as any anticipated heavy truck activity to occur to/from the site.

Data Requests:

83. Please clarify whether the number of operating staff is 61 persons per shift, or 61 persons total. How many employees are anticipated per shift, and what are shift hours? What is the potential for staff to arrive/depart during AM/PM peak hours?

Response: The total number of new operations staff for the Project is estimated to be 61. For the purposes of environmental review of the Project, the Applicant assumed that during normal operations and maintenance, all 61 workers would access the Project site each working day, resulting in 122 daily operational workforce trips (61 trips twice per day) with two-thirds of the trips occurring during the day shift (5:30 AM to 5:30 PM) and one-third occurring during the night shift (5:30 PM to 5:30 AM) will be required onsite during operations of the Project for each working day. The facility will be capable of operation seven days per week, 24 hours per day. As a conservative assumption, it is assumed that all day shift staff will arrive and night shift staff will leave during the morning peak hour and the reverse would occur during the evening peak hour. Note this is a conservative number. The Applicant expects that the actual number of workers traveling to the site during normal operations will be lower than this as the administrative staff typically works weekdays and out of the 28 shift workers, 14 will be on their days off.

84. Please provide information on anticipated number of trucks accessing the project site each day, as well as any information regarding the timing of truck arrival/departures.

Response: It is estimated conservatively that a total of approximately 95 trucks (includes lighter vehicle and heavy-duty trucks) will access the Project site each working day, resulting in 189 delivery/haul/maintenance truck trips per day to support daily operations and maintenance of the facility. It is assumed that truck trips will occur throughout the day during off-peak hours to the Project site and to the Desert Valley Company Monofill landfill site.

10.2 Background: Existing Traffic Conditions and Level of Service (LOS) Analysis (DR 85-86)

The MBGP AFC indicates a specific set of traffic count data used in the Existing Traffic Conditions and Level of Service Analysis. Section 5.12.1.2.1: Existing Roadway Conditions states that "Traffic volumes were obtained from traffic counts published by Caltrans in 2019 and field counts conducted in October 2022. Field traffic counts were collected for 2 days during the weekday." Section 5.12.1.2.2: Existing Intersection Conditions states that "Traffic volumes at the intersections were collected in October 2022. Traffic counts were collected for two days during the weekday morning period of 5:00 a.m. - 8:00 a.m. and afternoon period of 4:00 p.m. to 8:00 p.m." Table 5.12-4: Existing Intersection LOS Summary provides LOS results for study intersections operating under the Existing Conditions scenario.

No details regarding traffic volumes or LOS calculations are provided. CEC staff requires copies of the traffic data and LOS calculations that inform the analysis, for use in the independent CEC staff assessment.

Data Requests:

85. *Please provide any raw and adjusted traffic count data used or referenced in the LOS analysis, including heavy vehicle/truck data*

Response: Raw traffic count data is provided as Attachment DRR 85.

86. *Please provide LOS calculations and turning movement counts for the study intersections used in the analysis, for each scenario and peak period analyzed.*

Response: Existing LOS calculations, which includes the turning movement volumes at the study intersections, is provided as an Attachment DRR 86.

10.3 Background: Construction Traffic (DR 87-90)

The MBGP AFC section 5.12.2.2.1 contains operational analyses of the project under the "Construction Conditions" scenario. Table 5.12-6: Construction Trip Generation shows an assumption of two passengers (workers) per vehicle for trip generation purposes. The paragraph immediately below the table explains that "During construction, up to 560 workers would access the Project site each working day. Because it is assumed that construction employees would be recruited locally and would stay in hotels and RV campsites in nearby cities, workers would carpool (ride with others), resulting in 560 daily trips." Table 5.12-7: Construction Condition Roadway Segment LOS Analysis Summary provides LOS results for study roadway segments operating under the "Construction Conditions" scenario. It is stated in the paragraph immediately preceding the table that "The daily traffic volumes generated during the MBGP peak construction period were added to the existing traffic volumes on each roadway segment, and the V/C ratio was calculated." Table 5.1-8: Construction Condition Intersection LOS Summary provides LOS results for study intersections operating under the "Construction Condition" scenario. It is stated in the paragraph immediately preceding the table that "The AM and PM peak-hour traffic generated during the construction period was added to the existing turning movement counts at the study intersections."

Details regarding how trips were assigned to study roadways are not provided. No details regarding traffic volumes or LOS calculations are provided. CEC staff requires copies of the traffic data and LOS calculations that inform the analysis, for use in the independent CEC staff assessment. Additionally, CEC staff requests clarification on assumptions regarding trip generation.

Data Requests:

87. *Please provide any data or reasoning to support the assumption of 2 passengers per vehicle arriving to and leaving from the project site.*

Response: The assumption of two passengers (or workers) per vehicle for construction traffic arriving to and leaving is based on the assumption that construction employees would be recruited locally and would stay in hotels and RV sites in nearby cities. Because the workers would be staying geographically near each other or at the same location, it is assumed that the workers would carpool to work. The two workers per vehicle would be a conservative assumption since the workers staying at the same location may have more than two workers per vehicle.

88. *Please provide details (via figures, diagrams, spreadsheet, etc.) that demonstrate how project trips were distributed to the roadway network. Were different routes assumed for construction worker trips (passenger vehicles) vs. heavy vehicle trips?*

Response: Figure DRR 88 illustrates how construction project trips were distributed to the roadway network. The same routes for construction worker trips and heavy vehicle trips were assumed due to the location of the Project construction laydown and parking areas. Along the public roadways, construction trips (workers and heavy vehicles) were distributed along the designated heavy haul routes.

89. *Please provide LOS calculations and turning movement counts for the study intersections used in the analysis, for each scenario and peak period analyzed.*

Response: Construction LOS calculations are provided as Attachment DRR 89.

90. *Please provide details (via figures, diagrams, spreadsheet, etc.) that demonstrate how project trips were assigned to the study intersections. A summary of the project trips added to each turning movement at each study intersection for each scenario and peak period analyzed, would be ideal.*

Response: Figure DRR 88 illustrates project added volumes at the study intersections.

10.4 Background: VMT Thresholds and Analysis (DR 91)

The MBGP AFC contains an analysis of Vehicle Miles Travelled (VMT), and states assumptions regarding the geographic residency of employees required for operation and maintenance of the facility. These assumptions inform commute distances used in the VMT analysis, and as such, CEC staff request confirmation of any information regarding where employees may reside.

Data Requests:

91. *Please provide any data that shows a breakdown/distribution of where maintenance and operation employees, as well as construction workers are anticipated to be housed, geographically.*

Response: Section 5.12.2.1.5 (Operations and Maintenance VMT Impacts) and Table 5.12-11 of the AFC (Calculation of VMT per Employee during Operations and Maintenance) provides a geographical breakdown and distribution of anticipated housing locations for maintenance and operation employees. The following assumptions were for the operations and maintenance workforce origins when accessing the Project site:

- 10% of the Project workforce would originate from Niland and areas to the north (Indio and nearby communities)
- 25% of the Project workforce would originate from the Calipatria and Westmorland areas
- 65% of the Project workforce would originate from farther south, including Brawley, El Centro, and Imperial

As discussed in Section 5.12.2.2.1 (Construction Traffic), it is assumed that all workers commuting daily would come from within Imperial County. Workers currently residing locally within the County would be expected to commute from their residences, while many temporary workers from outside the County would be housed temporarily in hotels, rentals, trailer parks, or campgrounds during the work week.

10.5 Background: Cumulative Operations and Maintenance Effects (DR 92)

The MBGP AFC section 5.12.4.2 contains operational analyses of the project under the "Cumulative Conditions" scenario. Table 5.12-12: Cumulative Condition Roadway Segment LOS Analysis Summary provides LOS results for study roadway segments operating under the "Cumulative Condition" scenario. It is stated in the paragraph immediately preceding the table that "Potential cumulative Project traffic increases were determined based on available information from published documents on the Imperial County planning website."

Details regarding the potential projects contributing to these increases, or their respective magnitudes, are not provided. CEC staff requests details regarding other projects assumed in the cumulative scenario that inform the analysis, for use in the independent CEC staff assessment.

Data Requests:

92. *Please provide information regarding the projects assumed to contribute to an increase in traffic volumes in the cumulative conditions scenario, and how the addition of cumulative project traffic was calculated. Also, please provide a description of each cumulative project assumed under this scenario and an explanation of how trips were estimated for each. Please include data sources and calculations for trip generation estimates, as applicable.*

Response: A list of cumulative projects considered for the transportation analysis and their associated operations and maintenance average daily traffic trip estimates are provided in Table DRR 92-1. (also see AFC Appendix 5.6A). This list of cumulative projects has been compiled based on provided information from the Imperial County Planning Department and review of published documents on the Imperial County planning website.

The following provides a summary of the sources and assumptions used to develop the cumulative Project traffic increases for operations:

- Solar projects require minimal operations and maintenance activities and would not require the presence of full-time employees.
- Traffic volume estimate for the Hell's Kitchen PowerCo 1 and LithiumCo 1 project were obtained from the transportation chapter of the Initial Study & Environmental Analysis for Hell's Kitchen PowerCo 1 and LithiumCo 1 Project (March 2022).
- Traffic volume estimate for the Energy Source Mineral ALTiS project were obtained from the transportation chapter of the Draft Environmental Impact Report for the Energy Source Mineral ATLis project (June 2021).
- Traffic volume estimate for the Morton Bay, Elmore North and Black Rock Geothermal projects were obtained from the transportation chapter of the AFC for each of the projects.

Table DRR 92-1. Cumulative Project Trip Generation

Project Name	Area-Location	Average Daily Traffic (ADT)
Wilkinson Solar Farm	City of Niland	--
Lindsey Solar Farm	City of Niland	--

Project Name	Area-Location	Average Daily Traffic (ADT)
Midway Solar Farm IV	City of Calipatria	--
Ormat Wister Solar	City of Niland	--
Hell's Kitchen Geothermal Exploration Project	City of Niland	377
Energy Source Mineral ALTiS	Imperial County	179
Morton Bay Geothermal Project	Imperial County	406
Elmore North Geothermal Project	Imperial County	406
Black Rock Geothermal Project	Imperial County	311
	Total	**1679**

11. Transmission System Engineering (DR 93-98)

11.1 Background

The California Environmental Quality Act (CEQA) requires the identification and description of the "Direct and indirect significant effects of the project on the environment." The AFC requires discussion of the "energy resource impacts which may result from the construction or operation of the power plant." For the identification of impacts on the transmission system resources and the indirect or downstream transmission impacts, staff relies on the Phase I and Phase II Interconnection Studies for ensuring the interconnecting grid meets the California Independent System Operator (California ISO) reliability standards. The studies analyze the effect of the proposed project on the ability of the transmission network to meet reliability standards. When the studies determine that the project will cause a violation of reliability standards, the potential mitigation or upgrades required to bring the system into compliance are identified. The mitigation measures often include the construction of downstream transmission facilities. CEQA requires the analysis of any downstream facilities for potential indirect impacts of the proposed project. Without a complete Phase I or Phase II Interconnection Study, staff is not able to fulfill the CEQA requirement to identify the indirect effects of the proposed project.

Data Requests:

93. Please provide California ISO Affected System Study, if available.

Response: The Applicant has inquired with the Imperial Irrigation District (IID) regarding the status of any Affected System Study request they may have with either California Independent System Operator or another regulated utility. The Applicant will provide an update to this Data Response once a response is received from IID.

94. Please provide the IID BHE Cluster System Impact Study and all the appendix and attachments.

Response: The IID BHE Cluster System Impact Study was provided as Confidential AFC Appendix 3A (TN#: 249769.). Applicant is confirming with IID if additional attachments can be provided.

95. Please clarify the length of the gen-tie line, which is listed as 3.2-miles long in Executive Summary and 2.3-miles long in Section 2.3.5.3.?

Response: The length of the Gen-Tie line between the Morton Bay Substation and the IID Switching Station is 3.2 miles. The length of the gen-tie line within Section 2.3.5.3 was inadvertently transposed in the AFC.

96. Section 2.3.1 indicated that the System Impact Study identified system upgrades required to deliver additional energy to SCE Devers Substation. Would the MBGP generation be directly delivered to the SCE system in addition to the IID 230 kV grid?

Response: The Morton Bay Substation will connect directly to the new IID Sinclair Switching Station at the first point of interconnection into IID's network. A new transmission line will be constructed from the 230kV Sinclair switching station to the Coachella Valley substation, approximately 70 miles in length. Additional upgrades proposed are from the Ramon substation to SCE's Devers substation, approximately 15 miles in length and from the Coachella Valley substation to the Ramon substation, approximately 20 miles in length.

97. *As stated in Section 2.3.3.5.1, "The generator is anticipated to have a design rating of 174,000 megavolt-amperes (MVA) at a power factor of 0.85 lagging and leading." Please clarify the generator rating.*

Response: The generator nameplate is anticipated to have a design rating of 174,000 megavolt-amperes (MVA) with a power factor of 0.85 and matched with the steam turbine. The overall plant net output is anticipated to be 140MW or less. This is assuming a plant auxiliary load of 10% of the plant gross output.

98. *Please provide a detailed IID Switching Station one-line diagram with the proposed project interconnection. Show all equipment ratings, including the bay arrangement of the breakers, disconnect switches, buses, and other equipment that would be required for interconnection of the project.*

Response: A preliminary, not for construction, one-line diagram for the IID Switching Station is provided as Attachment DRR 98 under a request for confidential designation.

12. Water Resources (DR 99-111)

12.1 Background: Geothermal Plant Operations Water Supply (DR 99-100)

Per Section 1.7.7, annual water demand for the Morton Bay Geothermal Project (MBGP) is estimated at 5,560 acre-feet per year (AFY), the majority of which would be to offset evaporation loss in the cooling towers. The combined annual operational water demand for the proposed MBGP, Elmore North, and Black Rock geothermal projects would be approximately 13,165 AFY. IID's Interim Water Supply Policy (IWSP) for Non-Agricultural Projects (IID 2009) sets aside up to 25,000 AFY that may be available for non-agricultural use projects through conservation and efficiency measures. As of July 2023, a total of 5,380 AFY has been committed through water use agreements, leaving up to 19,620 AFY that may be made available to new non-agricultural projects (CEC 2023). Water demand for Morton Bay, Elmore North, and Black Rock geothermal projects constitutes 67 percent of the available non-agricultural designation. Given that 97 percent of available water was allotted to agriculture in 2022 (CEC 2023) and water set aside for non-agricultural projects is dependent upon water conservation, a question arises about the reliability of IID's commitment to provide water for the three proposed geothermal projects. CEC staff needs documentation demonstrating that IID can provide reliable water supply to the MBGP as well as Elmore North and Black Rock geothermal projects during normal, as well as single and multiple-year dry periods throughout the life of the projects.

Data Requests:

99. Please provide the draft water assessment prepared by Jacobs listed as a reference in Section 5.15.7.

Response: Reference to the 2023 draft Water Supply Assessment (WSA) was included in error and should have referred to the Imperial Integrated Regional Water Management Plan, Appendix J III - SB610 WSA Supporting Documentation. However, since the AFC was submitted, a revised template has been provided by IID named the "SB 610 Water Supply Assessment" which was provided in early May 2023. This WSA is currently underway and will be provided to Staff once it is submitted to IID for review. Submission of the WSA is anticipated by October 31, 2023

100. Please provide a preliminary agreement or will-serve letter along with a statement from IID describing contingencies for providing water to non-agricultural projects during conditions of scarcity, as well as the process to conserve water to create annual water demand for the three geothermal projects.

Response A Water Supply Request letter was submitted by the Applicant to IID in April 2022 during initial design of the Project. It is the Applicant's understanding that IID does not issue Will Serve letters.

12.2 Background: Lithium Omitted from Produced Fluid Chemical Composition (DR 101)

Table 2-2, Expected Chemical Composition of Produced Fluids Constituent Concentrations does not include an expected concentration of lithium. Section 5.4.2.3 lists lithium as one of the metals "contained in unusually high concentrations" within geothermal fluids of the Salton Sea Known Geothermal Resource Area (KGRA) that includes the proposed project site. Moreover, the typical lithium concentration of the Salton Sea KGRA geothermal fluids is estimated at 211 milligrams per liter (mg/L) (NREL 2015).

Data Requests:

101. Please provide an expected concentration for lithium in Table 2-2.

Response: Any figure used for an "expected concentration" would be speculative. A recent NREL study suggests that the average lithium concentration for the Salton Sea KGRA is 200 mg/l. [6]

12.3 Background: Clarification of Non-Agricultural Project Designation (DR 102)

Section 5.15.1.9.1 states that The IWSP currently designates up to 25,000 afy (each) of water for potential Non-Agricultural Projects within IID's water service area. This statement is repeated in Section 5.15.2.1.2 and is paraphrased in Section 5.15.3. However, the IWSP states in the background section that "This IWSP currently designates up to 25,000 afy of water for potential Non-Agricultural Projects within IID's water service area". Based on this statement and other supporting text, it is apparent that the 25,000 AFY designation is the total for all projects that meet the IWSP requirements and not for each project.

Data Requests:

102. Please verify if the applicant realizes that the 25,000 AFY designation is for multiple non-agricultural projects and not for each project.

Response: The Applicant is aware the 25,000 AFY designation is for multiple non-agricultural projects and not per project.

12.4 Background: Cooling Water Feasibility (DR 103-104)

Application Page 5.15-28, states "The analysis of alternatives for the original Project demonstrated that the use of reclaimed water for dry cooling were not reasonably feasible."

Data Requests:

103. Please provide the referenced alternatives analysis cited.

Response: Please see page 161 of the Salton Sea Unit 6 Final Decision (TN# 30637)[7] and the supporting Final Staff Assessment (Part 1, filed on August 5, 2003).

104. Please include assumptions, evidence, references, and calculations used in the analysis to assess why alternative water supplies and alternative cooling are "environmentally undesirable," or "economically unsound".

Response: The issue of alternative cooling technologies is discussed above in DRR 17. The conclusions regarding the availability of alternative water supplies reeached in the in the Salton Sea Unit 6 Final Decision (TN# 30637) are fundamentally unchanged. Groundwater is not a feasible source as it provides water to the Salton Sea. The populations of local municipalities (Westmoreland and Calipatria) are not large enough to provide adequate quantities of recycled/wastewater to provide a fraction of what is needed. In addition, the Calipatria Wastewater Treatment Plant (WWTP) is permitted for an average monthly flow of 1.73 million gallons per day (MGD). However, the historic annual average flow has been approximately 0.59 MGD. The 0.59 MGD annual average flow translates to approximately 660 acre-feet

[6] Technology for Lithium Extraction in the Context of Hybrid Geothermal Power (stanford.edu) p. 2, Table 1

[7] https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=02-AFC-02

year (AFY), far below the total water supply needs of the Project. It is possible that Calipatria WWTP supply could meet a portion of the makeup supply needs . The current Calipatria WWTP is considered secondary treatment, and improvements would be required to upgrade the plant to tertiary treatment standards. Based on the Calipatria Water System consumer confidence report on water quality, the average total dissolved solids (TDS) of drinking water is 680 mg/L (typical canal water quality). Typically, wastewater effluent will increase TDS levels by 200-400 mg/L because of dissolved solids added to water through use, resulting in anticipated TDS levels in the recycled water in the range of 900-1100 mg/L. Depending on the final geothermal plant requirements, this salinity may be too high for cooling water makeup without membrane processes (reverse osmosis) to remove salts, but could be used as partial stream of makeup water blended with the condensed water, or to be used for dilution water. At present, the evaluation assumes only tertiary treatment will be provided to meet California's recycled water regulations but no additional process to remove dissolved solids. The distance between the Calipatria WWTP and the MBGP site is 5 miles.Therefore, the assumptions and conclusions reached by the CEC in 2003 remain applicable to the MBGP.

12.5 Background: Percentage of Water Demand Generated by Steam (DR 105)

Section 5.15.1.9.1 states in the first paragraph that Approximately 50 percent of the operational water required by the facility will be generated by steam condensed in the main condenser. This is reiterated in the first paragraph of Section 6.5.2. However, the paragraph describing the State Water Resources Control Board, Resolution 75-58 under Section 5.15.5.2, State LORS, describes the same portion of the operational water demand as 95 percent.

Data Requests:

105. Please explain the discrepancy in condensed steam percentage or modify the application text for consistency.

Response: Approximately 50 percent of the operational water required by the project is provided by steam condensate. Any other value reported was in error.

12.6 Background: Request to Revise Base Flood Elevations Depicted on FIRMS (DR 106-108)

Section 5.15.1.8 states that the applicant is preparing a Letter of Map Revision (LOMR) to the Federal Emergency Management Agency (FEMA) requesting revisions to the 100-year base flood elevations currently depicted on Flood Insurance Resource Maps (FIRMs) 06205C0700C and 06205C0725C (both effective 09-26-2008) based on declining Salton Sea surface elevation. The applicant expects to submit the LOMR in the second quarter of 2023.

Data Requests:

106. Please explain the process used to determine the revised floodplain area shown in Figure 5.15-3b.

Response: The process included hydraulic modeling and the preparation and submittal of a Letter of Map Revision (LOMR) application to FEMA. The application includes items such as a brief description of the request, updated LiDAR maps, hydraulic models, a LiDAR report, and updated mapping including of the current Salton Sea and Alamo River water elevations. A Technical Support Data Notebook (TSDN) with this

information was submitted to FEMA on May 18, 2023 with additional information requests received on July 12, 2023.

107. Please explain if the LOMR has already been prepared and submitted to FEMA. If so, please provide a copy to CEC staff. If not, please provide a copy as soon as it is submitted to FEMA.

Response: As discussed in DR 106 a LOMR application was submitted on May 18, 2023 and additional information was requested by FEMA on July 14, 2023. The Applicant is currently preparing responses to these information requests and will be submitted by October 12, 2023. A copy of the LOMR application consisting of the TSDN is provided as attachment DRR 107. The Applicant is also evaluating options that may eliminate the need for a LOMR.

108. Please provide any information about how long it should take FEMA to approve or deny the map revision.

Response: Once responses are submitted, FEMA will have 90 days to request more information or to provide approval. The best case for approval would be mid-January 2024, however, there may be delays in approval due to labor shortages.

12.7 Background: Class II Surface Impoundment Construction (DR 109)

Under the Class II Surface Impoundment portion of Section 2.3.3.2.4, the proposed Class II Surface Impoundment (brine pond) is described as a triple-lined basin with a concrete primary liner. No information was provided regarding the secondary and tertiary liners.

Data Requests:

109. Please provide the characteristics of the secondary and tertiary liner materials and describe how they relate to the Leachate Collection and Removal System (LCRS).

Response: Class II Surface Impoundment Construction consists of a triple liner system. The primary liner is an 80-millimeter flexible membrane liner followed by a geogrid leachate collection and removal layer. The secondary liner is an 80-millimeter flexible membrane liner. The tertiary liner is a geosynthetic Clay liner on top of compacted native soils. These specifications meet class II SWRCB Waste Management Unit Construction Standards as described in CCR Title 27 Section 20320, 20330, 20340, and 20360. See Attachment DRR 109 for the drawings showing pond liner design.

12.8 Background: Wastewater Disposal/Containment (DR 110-111)

The first sentence in Section 5.15.2.3.2 Operation states, "The Project will dispose of fluid wastewater streams, in accordance with CalGEM injection parameters." Since the majority of this section discusses the injection of spent geothermal fluids into Class II wells, it appears this statement was not meant to include the sanitary sewer at the end of the section. However, the term "fluid wastewater streams" implies that it does.

Sections 2.3.3.4.3 Fluid Process Streams, 2.3.3.4.11 Plumbing, 2.3.3.4.19 Sanitary Sewer System, and 5.15.2.3.2 Operation list a leach field as a possible alternative for septic system dispersal. The IID Public Water Map, interactive mapping application indicates that a tile-drain system underlies and surrounds the proposed MBGP site (IID 2023a). Since this tile-drain system is meant to drain excess saline groundwater

to below the level of crop roots and groundwater is shallow (3-6 feet), using a leach field does not seem like a viable option for septic system dispersal.

Data Requests:

110. Please clarify Section 5.15.2.3.2 to provide missing or unclear information.

Response: Sanitary waste will not be injected through any of the Class II wells.

111. Please explain how a leach field could be a viable option for septic system dispersal or remove from the text.

Response: After further design development and discussions with the local authorities the design has progressed in such a way that it is now planned for MBGP to utilize an Evapotranspiration (E-T) Bed for sanitary wastewater effluent disposal downstream of the septic tank. Due to extremely low infiltration rates of the on-site clay soils (identified in the soils reports as >240 minutes/inch), traditional infiltrative leach field practices are not viable. The E-T Bed approach was verified as an acceptable alternative disposal approach by the RWQCB and was preliminarily designed following EPA recommended sizing guidelines based on local rainfall and evapotranspiration rates. No infiltration was accounted for in the preliminary design.

MBGP Attachment DRR 3-1 Operational Emissions Inventory Spreadsheets

Native files for Attachment DRR 3-1 have been provided separately and are available upon request.

MBGP Attachment DRR 3-2 Operational Air Quality Impacts Analysis Spreadsheets

Native files for Attachment DRR 3-2 have been provided separately and are available upon request.

MBGP Attachment DRR 4-1
Construction Emissions Inventory Spreadsheets

Native files for Attachment DRR 4-1 have been provided separately and are available upon request.

MBGP Attachment DRR 4-2 Construction Air Quality Impacts Analysis Spreadsheets

Native files for Attachment DRR 4-2 have been provided separately and are available upon request.

MBGP Attachment DRR 5-1 EPA Tier 4 Vendor Documentation

KOHLER®

KD3250-4

60 Hz. Diesel Generator Set

Tier 4 EPA Certified for Stationary and Mobile Applications

ENGINE INFORMATION

Model:	KD83V16	Bore:	175 mm (6.89 in.)
Type:	4-Cycle, 16-V Cylinder	Stroke:	215 mm (8.46 in.)
Aspiration:	Turbocharged, Intercooled	Displacement:	83 L (5048 cu. in.)
Compression ratio:	16:0:1		
Emission Control Device:	Direct Diesel Injection, Engine Control Module, Turbocharger, Charge Air Cooler, Ammonia Slip Catalyst, Selective Catalytic Reduction		

NOMINAL EMISSION DATA

Cycle point	100% ESP	75% ESP	50% ESP	25% ESP
Power [kW]	3490	2618	1745	873
Speed [rpm]	1800	1800	1800	1800
Exhaust Gas Flow [kg/h]	19000	15180	10970	6860
Exhaust Gas Temperature [C]	475	445	440	430
NO_X [g/kWh]	0.30	0.38	0.36	0.42
CO [g/kWh]	0.19	0.16	0.15	0.09
HC [g/kWh]	0.02	0.01	0.01	0.01
PM [g/kWh]	0.02	0.02	0.03	0.03

NOT TO EXCEED EMISSION DATA

Cycle point	100% ESP	75% ESP	50% ESP	25% ESP
NO_X [g/kWh]	0.36	0.46	0.43	0.50
CO [g/kWh]	0.29	0.24	0.22	0.13
HC [g/kWh]	0.03	0.02	0.02	0.02
PM [g/kWh]	0.03	0.03	0.04	0.04

NOMINAL EMISSION DATA

Cycle point	100% PRP	75% PRP	50% PRP	25% PRP
Power [kW]	3173	2380	1586	793
Speed [rpm]	1800	1800	1800	1800
Exhaust Gas Flow [kg/h]	17730	13930	10020	6390
Exhaust Gas Temperature [C]	460	450	445	420
NO_X [g/kWh]	0.30	0.30	0.32	0.54
CO [g/kWh]	0.19	0.16	0.14	0.08
HC [g/kWh]	0.02	0.01	0.01	0.01
PM [g/kWh]	0.02	0.02	0.03	0.03

NOT TO EXCEED EMISSION DATA

Cycle point	100% PRP	75% PRP	50% PRP	25% PRP
NO_X [g/kWh]	0.36	0.36	0.38	0.65
CO [g/kWh]	0.28	0.24	0.21	0.12
HC [g/kWh]	0.03	0.02	0.02	0.02
PM [g/kWh]	0.03	0.03	0.04	0.04

NOMINAL EMISSION DATA

Cycle point	100% COP	75% COP	50% COP	25% COP
Power [kW]	2644	1983	1322	661
Speed [rpm]	1800	1800	1800	1800
Exhaust Gas Flow [kg/h]	15330	12160	8880	6010
Exhaust Gas Temperature [C]	445	440	440	400
NO_X [g/kWh]	0.40	0.40	0.35	0.56
CO [g/kWh]	0.16	0.16	012	0.08
HC [g/kWh]	0.01	0.01	0.01	0.01
PM [g/kWh]	0.02	0.02	0.03	0.03

NOT TO EXCEED EMISSION DATA

Cycle point	100% COP	75% COP	50% COP	25% COP
NO_X [g/kWh]	0.48	0.48	0.42	0.67
CO [g/kWh]	0.25	0.24	0.18	0.11
HC [g/kWh]	0.02	0.02	0.02	0.02
PM [g/kWh]	0.03	0.03	0.04	0.04

TEST METHODS AND CONDITIONS

Test Methods:
Steady-State emissions recorded per EPA CFR 40 Part 1065, and ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rated stabilized using Ramped Mode Cycle.

Fuel Specification:
40-48 Cetane Number, ≤15ppm Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.

Diesel Exhaust Fluid Specification:
32.5% urea in de-ionized water meeting ISO-22241

Reference Conditions:
25 °C (77 °F) Air Inlet Temperature, 40 °C (104 °F) Fuel Inlet Temperature, 100 kPa (29.53 in Hg) Barometric Pressure; 10.7 g/kg (75 grains H2O/lb.) of dry air Humidity (required for NOx correction); Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back pressure set to maximum allowable limit.

Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Tests conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results.

Data and specifications subject to change without notice.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2022 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Liebherr Machines Bulle SA**
(U.S. Manufacturer or Importer)

Certificate Number: **NLHAL103.VQC-002**

Effective Date: 09/23/2021

Expiration Date: 12/31/2022

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 09/23/2021

Revision Date: N/A

Model Year: 2022
Manufacturer Type: Original Engine Manufacturer
Engine Family: NLHAL103.VQC

Mobile/Stationary Indicator: Both
Emissions Power Category: kW>900
Fuel Type: Diesel
After Treatment Devices: Ammonia Slip Catalyst, Selective Catalytic Reduction
Non-after Treatment Devices: Electronic Control

Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Parts 60 and 1039, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Parts 60 and 1039 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Parts 60 and 1039 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Parts 60 and 1039.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Parts 60 and 1039. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Parts 60 and 1039.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

MBGP Attachment DRR 5-2 EPA Tier 3 Vendor Documentation

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2022 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Deere & Company**
(U.S. Manufacturer or Importer)

Certificate Number: **NJDXL13.5103-009**

Effective Date: 08/09/2021

Expiration Date: 12/31/2022

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 08/09/2021

Revision Date: N/A

Model Year: 2022
Manufacturer Type: Original Engine Manufacturer
Engine Family: NJDXL13.5103

Mobile/Stationary Indicator: Stationary
Emissions Power Category: 225<=kW<450
Fuel Type: Diesel
After Treatment Devices: No After Treatment Devices Installed
Non-after Treatment Devices: Electronic Control, Smoke Puff Limiter, Engine Design Modification, Non-standard Non-After Treatment Device Installed, Electronic/Electric EGR - Cooled

Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Part 60, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

The actual engine power may lie outside the limits of the Emissions Power Category shown above. See the certificate application for details.

Rating Specific Emissions Data

Nameplate Rating Information

Clarke Model	**JU6H-UFADP0**
Power Rating (BHP/kW)	**209/156**
Certified Speed (RPM)	**2100**

Refer to **Rating Data** section on page 2 for emissions output values

Rating Specific Emissions Data - John Deere Power Systems

Rating Data

Rating	6068HFC48B	
Certified Power(kW)	236	
Rated Speed	2400	
Vehicle Model Number	OEM (Clarke Fire Pump-Emergency)	
Units	g/kW-hr	g/hp-hr
NOx	3.43	2.56
HC	0.09	0.07
NOx + HC	N/A	N/A
Pm	0.11	0.08
CO	0.8	0.6

Certificate Data

Engine Model Year	2022
EPA Family Name	NJDXL13.5103
EPA JD Name	650HAA
EPA Certificate Number	NJDXL13.5103-009
CARB Executive Order	
Parent of Family	6135HF485A
Units	g/kW-hr
NOx	3.31
HC	0.11
NOx + HC	N/A
Pm	0.10
CO	0.6

* The emission data listed is measured from a laboratory test engine according to the test procedures of 40 CFR 89 or 40 CFR 1039, as applicable. The test engine is intended to represent nominal production hardware, and we do not guarantee that every production engine will have identical test results. The family parent data represents multiple ratings and this data may have been collected at a different engine speed and load. Emission results may vary due to engine manufacturing tolerances, engine operating conditions, fuels used, or other conditions beyond our control.

Emissions Results by Rating run on Apr-05-2022

MBGP Attachment DRR 12 Cumulative Impacts Analysis Modeling Protocol

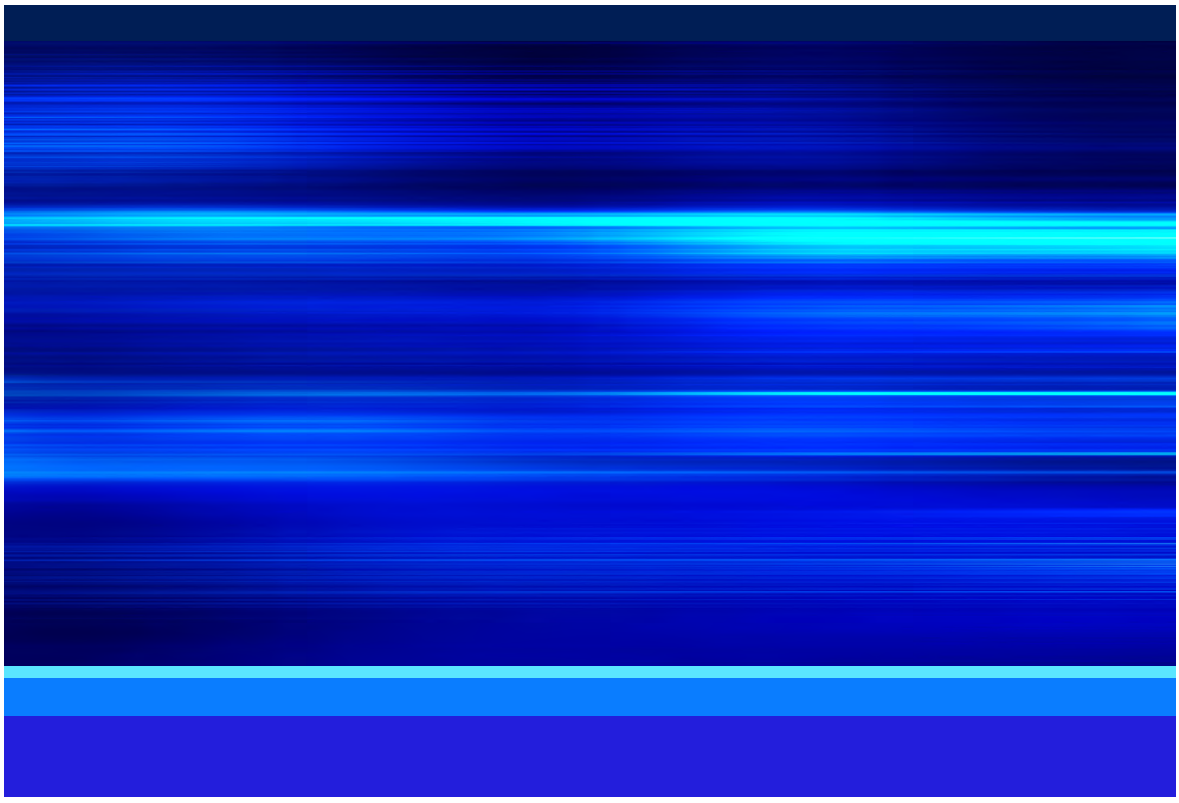
Air Dispersion Modeling Protocol for Morton Bay Geothermal Plant Cumulative Impact Analysis

Revision No: 0

Morton Bay Geothermal Plant
Berkshire Hathaway Energy Renewables, LLC
Salton Sea Geothermal Project Development

Document no: 230915112914_d0bb2ac1

September 26, 2023



Contents

Appendices

Tables

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Acronyms and Abbreviations

AFC	Application for Certification
Applicant	Morton Bay Geothermal, LLC
BHER	BHE Renewables, LLC
BRGP	Black Rock Geothermal Project
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CFR	*Code of Federal Regulations*
CO	carbon monoxide
ENGP	Elmore North Geothermal Project
EPA	U.S. Environmental Protection Agency
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
ICAPCD	Imperial County Air Pollution Control District
MBGP	Morton Bay Geothermal Project
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
PSD	Prevention of Significant Deterioration
SIL	Significant Impact Levels
SO_2	sulfur dioxide
VOC	volatile organic compound

1. Project Overview

Morton Bay Geothermal, LLC (the Applicant), an indirect, wholly owned subsidiary of BHE Renewables, LLC (BHER), submitted an Application for Certification (AFC) to the California Energy Commission (CEC) on April 18, 2023[1]. In response to this AFC, the CEC issued *Data Request Set 1 for Morton Bay Geothermal Project* on August 31, 2023 (Docket Number 23-AFC-01; TN #252095). Specifically, data request number 12 states the following: "Please provide an update on the cumulative impacts analyses mentioned in the AFC". This document serves to provide a status update regarding the cumulative impact analyses for the Morton Bay Geothermal Project (MBGP) and a protocol establishing the methodology that will be used to conduct the cumulative impact analyses.

The goal of a cumulative impact analysis is to determine the potential ambient air concentrations through modeling that result from construction and operation of MBGP in addition to existing background concentrations, existing nearby sources of air pollution not represented in the background monitoring data, and future development. The cumulative impact analysis is used to determine the cumulative impacts and exposure that may be experienced in the area surrounding a specific project. This cumulative air quality impacts modeling protocol outlines the methodology that will be used to determine what sources of air pollution, other than MBGP, would need to be considered in the modeling analysis to capture cumulative impacts in the surrounding area. The methodology presented in this modeling protocol generally aligns with the specific models, data and approach specified in Section 5.1 of the AFC and serves as an addendum to that modeling analysis.

Other air quality and public health analyses which require modeling updates will be included in this proposed modeling analysis, as described in the Applicant response document to be filed prior to completion of this analysis. The modeling analysis will be updated based upon the latest design for MBGP, which may result in changes to the previously-modeled results and significant impact radii included in this protocol. These revisions are not expected to notably change the magnitude of results or significant impact radii.

[1] The CEC website for the project is: https://www.energy.ca.gov/powerplant/steam-turbine/morton-bay-geothermal-project-mbgp.

2. Area and Facility Classification

MBGP will be situated to the southeast of the Salton Sea, southwest from the town of Niland, located in Imperial County, California. Being located in California, the project would be subject to both the National Ambient Air Quality Standards (NAAQS) and the California Ambient Air Quality Standards (CAAQS).

The primary North American Industrial Classification System for the facility is 221116. The MBGP is not expected to be a "major" source of air pollution because the facility would emit less than 100 tons per year of any regulated pollutant. Additionally, the facility is expected to be a minor source for hazardous air pollutants (HAPs) with total potential aggregate HAP emissions of less than 25 tons per year and emissions of any single HAP of less than 10 tons per year. MBGP is not a listed facility in 40 *Code of Federal Regulations* (CFR) Part 52 (100 tons per year threshold) and is not otherwise subject to Part 52 Prevention of Significant Deterioration (PSD) requirements due to potential emissions being less than 250 tons per year per criteria air pollutant for which the area is designated as attainment. MBGP emissions are also expected to be below the applicable Nonattainment New Source Review thresholds of 100 tons per year for moderate nonattainment particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) and 100 tons per year each for oxides of nitrogen (NO_X) and volatile organic compound (VOC) for the marginal nonattainment ozone designation as per 40 CFR Part 51.165.

Imperial County is designated as attainment for the carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) NAAQS. The county is in moderate nonattainment for $PM_{2.5}$, and marginal nonattainment for the 8-hour ozone NAAQS. Particulate matter less than 10 micrometers in diameter (PM_{10}) was redesignated to attainment in September 2020.

At the state level, Imperial County is designated as attainment or unclassified for the $PM_{2.5}$, CO, NO_2, SO_2, sulfates, lead, hydrogen sulfide (H_2S), and visibility reducing particulates CAAQS. The county is designated as nonattainment for the ozone and PM_{10} CAAQS.

The closest and most representative ambient air monitoring data to the Project site are from the following monitoring stations, as shown in Figure 2-1:

- Niland-English Road (AQS ID: 60254004) [2.3 miles from Project]: 24-hour PM_{10} concentrations (2019-2021) and ozone concentrations (2019)
- Brawley-220 Main Street (AQS ID: 60250007) [15.7 miles from Project]: 24-hour $PM_{2.5}$ concentrations (2019-2021), and annual $PM_{2.5}$ concentrations (2019-2020)
- El Centro-9th Street (AQS ID: 60251003) [28.4 miles from Project]: annual $PM_{2.5}$ concentrations (2021), ozone concentrations (2020-2021), 1-hour NO_2 concentrations (2019-2021), and annual NO_2 concentrations (2020-2021)
- Calexico-Ethel Street (AQS ID: 60250005) [36.9 miles from Project]: annual NO_2 concentrations (2019), 1-hour SO_2 concentrations (2019-2021), 24-hour SO_2 concentrations (2019-2021), 1-hour CO concentrations (2019-2021), and 8-hour CO concentrations (2019-2021).

Table 2-1 provides a summary from the AFC of measured ambient air quality concentrations by year and site for the period 2019-2021, based on the above delineation. Data from these sites are a reasonable representation of background air quality for the Project area.

Figure 2-1
Nearby Ambient Air Monitoring Stations
Morton Bay Geothermal Project
Imperial County, California

Jacobs

Table 2-1. Measured Ambient Air Quality Concentrations by Year

Pollutant	Units	Averaging Time	Basis	Site	2019	2020	2021
Ozone	ppm	1-hour	CAAQS-1st High	Niland	0.06	0.054	0.065
		8-hour	CAAQS-1st High	Niland	0.055	0.046	0.055
			NAAQS-4th High	Niland (2019) and Calexico (2020-2021)	0.054	0.078	0.080
NO_2	ppb	1-hour	CAAQS-1st High	El Centro	37	45	56
			NAAQS-98th percentiles	El Centro	30	36	38
		Annual	CAAQS/NAAQS-AAM	El Centro (202-2021) and Calexico (2019)	9.26	7.93	6.73
CO	ppm	1-hour	CAAQS/NAAQS-2nd High	Calexico	4.30	4.60	3.80
		8-hour	CAAQS/NAAQS-2nd High	Calexico	3.10	2.70	2.90
SO_2	ppb	1-hour	CAAQS/NAAQS-1st High	Calexico	7.5	7.1	8.6
		24-hour	CAAQS/NAAQS-1st High	Calexico	1.6	1.9	2.7
		Annual	CAAQS/NAAQS-AAM	Calexico	0.31	0.4	0.42
PM_{10}	$\mu g/m^3$	24-hour	CAAQS-1st High	Niland	156.3	241.3	218.2
			NAAQS-2nd High	Niland	124	142	156
		Annual	CAAQS-AAM	Niland	32.7	35.9	39.8
$PM_{2.5}$	$\mu g/m^3$	24-hour	NAAQS-98th percentiles	Brawley	21.0	21.0	21.0
		Annual	CAAQS/NAAQS-AAM	Brawley (2019-2020) and El Centro (2021)	8.30	9.40	8.30

Notes:

$\mu g/m^3$ = microgram(s) per cubic meter

AAM = annual arithmetic mean

ppb = part(s) per billion

ppm = part(s) per million

The maximum representative background concentrations for the most recent 3-year period (2019-2021) are summarized in Table 2-2. These background values represent the highest values reported for the most representative air quality monitoring site during any single year of the most recent 3-year period for the

CAAQS assessments. These CAAQS maxima are conservatively used for some of the NAAQS modeling assessments (CO and SO_2). The appropriate values for the NAAQS, according to the format of the standard, are used for the remainder of the NAAQS modeling assessments (NO_2, PM_{10}, and PM_{25}), and also summarized in Table 2-2.

Table 2-2. Background Air Quality Data

Pollutant and Averaging Time	Background Value (µg/m^3) [a]
Ozone – 1-hour Maximum CAAQS	128
Ozone – 8-hour Maximum CAAQS/NAAQS	108
PM_{10} – 24-hour Maximum CAAQS	241.3
PM_{10} – 24-hour High, 2nd High NAAQS [b]	142
PM_{10} – Annual Maximum CAAQS	39.8
$PM_{2.5}$ – 3-Year Average of Annual 24-hour 98th Percentiles NAAQS	21.0
$PM_{2.5}$ – Annual Maximum CAAQS	9.40
$PM_{2.5}$ – 3-Year Average of Annual Values NAAQS	8.67
CO – 1-hour Maximum CAAQS/NAAQS	5,266
CO – 8-hour Maximum CAAQS/NAAQS	3,549
NO_2 – 1-hour Maximum CAAQS	105
NO_2 – 3-Year Average of Max Daily Annual 1-hour 98th Percentiles NAAQS	65.2
NO_2 – Annual Maximum CAAQS/NAAQS	17.4
SO_2 – 1-hour Maximum CAAQS/NAAQS	22.5
SO_2 – 3-hour Maximum NAAQS [c]	22.5
SO_2 – 24-hour Maximum CAAQS/NAAQS	7.10
SO_2 – Annual Maximum NAAQS	1.10

[a] Where applicable, monitored concentrations were converted from ppm/ppb to µg/m^3 using the standard molar volume of air at normal temperature and pressure conditions (NTP) of 24.45 liters per mole.

[b] 24-hour PM_{10} background value assumes one exceedance may occur per year on average. Over the 3-year period, two of the maximum three concentrations occur in 2021. Therefore, the design value is the high, 2nd high for 2020.

[c] The 3-hour SO_2 background value conservatively uses the 1-hour SO_2 background value.

3. Project Air Quality Impact Analysis Summary

The following sections present the results of the air quality impact analyses from the AFC for determining the changes to ambient air quality concentrations in the Project region as a result of Project construction and operation.

3.1 Project Operation

As can be seen in Table 3-1, MBGP operation impacts are less than the U.S. Environmental Protection Agency's (EPA) Significant Impact Levels (SILs) for all pollutants and averaging periods except $PM_{2.5}$. For pollutants and averaging periods with a predicted concentration that is not significant (that is, if they are less than the SIL), the modeling is complete for that pollutant and averaging period and compliance with the NAAQS/CAAQS is demonstrated by not causing or contributing to a violation. If impacts are above the SIL, a cumulative modeling analysis is required. Both 24-hour and annual $PM_{2.5}$ predicted concentrations exceed their respective SIL and will, therefore, require a cumulative modeling analysis.

Table 3-1. Operation Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m³)	Class II SIL (µg/m³)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maxima (NAAQS)	1.59	7.55	No
	Annual maximum	0.04	1.00	No
Ozone	8-hour maximum	0.01	1.96	No
CO	1-hour maximum	1,668	2,000	No
	8-hour maximum	131	500	No
SO_2	1-hour maximum	<0.01	7.86	No
	3-hour maximum	<0.01	25.0	No
	24-hour maximum	<0.01	5.00	No
	Annual maximum	<0.01	1.00	No
PM_{10}	24-hour maximum	4.74	5.00	No
	Annual maximum	0.55	1.00	No
$PM_{2.5}$	5-year average of 24-hour yearly maxima (NAAQS)	2.29	1.20	Yes
	5-year average of annual concentrations (NAAQS)	0.32	0.20	Yes

3.2 Project Construction

As can be seen in Table 3-2, MBGP construction impacts are less than the EPA's SILs for all pollutants and averaging periods except 1-hour and annual NO_2, 24-hour and annual PM_{10}, and annual $PM_{2.5}$. For

pollutants and averaging periods with a predicted concentration that is not significant (that is, if they are less than the SIL), the modeling is complete for that pollutant and averaging period and compliance with the NAAQS/CAAQS is demonstrated by not causing or contributing to a violation. If impacts are above the SIL, a cumulative modeling analysis is required. 1-hour and annual NO_2, 24-hour and annual PM_{10}, and annual $PM_{2.5}$ predicted concentrations exceed their respective SIL and will, therefore, require a cumulative modeling analysis.

Table 3-2. Construction Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration ($\mu g/m^3$)	Class II SIL ($\mu g/m^3$)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maxima (NAAQS)	55.7	7.55	Yes
	Annual maximum	10.2	1.00	Yes
Ozone	8-hour	0.03	1.96	No
CO	1-hour maximum	135	2,000	No
	8-hour maximum	108	500	No
SO_2	1-hour maximum	0.32	7.86	No
	3-hour maximum	0.29	25.0	No
	24-hour maximum	0.17	5.00	No
	Annual maximum	0.11	1.00	No
PM_{10}	24-hour maximum	7.37	5.00	Yes
	Annual maximum	1.35	1.00	Yes
$PM_{2.5}$	5-year average of 24-hour yearly maxima (NAAQS)	1.15	1.20	No
	5-year average of annual concentrations (NAAQS)	0.24	0.20	Yes

The modeled exceedances of the PM_{10} CAAQS are due to high background concentrations, which already exceed the CAAQS (like the majority of the state, the area is designated as a nonattainment area for the PM_{10} CAAQS). The Project is not below the SIL for the 24-hour and annual PM_{10} standards though the Project Owner will implement construction control measures as described in Section 5.1.7.2.2 of the AFC. These control measures would reduce particulate emissions to the extent required by the Imperial County Air Pollution Control District (ICAPCD), thus making the Project consistent with attainment plans for the PM_{10} standards. Additionally, the PM_{10} emissions associated with construction of the Project, as presented in Table 5.1-20 of the AFC, are below the ICAPCD significance threshold of 150 pounds per day. Therefore, the Project construction would likely result in less-than-significant impacts with respect to particulate emissions.

4. Cumulative Impact Analysis Methodology

4.1 Applicable Pollutants and Averaging Periods

4.1.1 Project Operation

MBGP operational emissions would result in modeled impacts that exceed the SILs for 24-hour and annual $PM_{2.5}$, as illustrated in Table 3-1, thus requiring a cumulative impact analysis based on the potential to cause or contribute to a violation of the NAAQS. The significant impact radius for each of these pollutant averaging periods are 0.3 kilometers (km) and 0.2 km, respectively. Appendix A includes the receptor locations with modeled impacts greater than the SIL for each of these two pollutant averaging periods.

Previously-modeled impacts for all other pollutant averaging periods included in Table 3-1 (1-hour and annual NO_2; 8-hour ozone; 1-hour and 8-hour CO; 24-hour and annual PM_{10}; and 1-hour, 3-hour, 24-hour, and annual SO_2) are below their respective SIL. Therefore, MBGP operations would not cause or contribute to a violation of the NAAQS for these pollutant averaging periods. It is similarly assumed that, with the impacts being less than the SIL, MBGP operations would not cause or contribute to a violation of the CAAQS. Therefore, a cumulative impact analysis is not proposed for these pollutant averaging periods.

4.1.2 Project Construction

MBGP construction emissions would result in modeled impacts that exceed the SILs for 1-hour and annual NO_2, annual $PM_{2.5}$, and 24-hour and annual PM_{10}, as illustrated in Table 3-1, thus requiring a cumulative impact analysis based on the potential to cause or contribute to a violation of the NAAQS. The significant impact radius for each of these pollutant averaging periods is presented in Table 4-1 below. Appendix B includes the receptor locations with modeled impacts greater than the SIL for each of these pollutant averaging periods.

Table 4-1. Construction Impacts – Significant Impact Radius

Pollutant	Averaging Period	Significant Impact Radius (km)
NO_2	1-hour	10
	Annual	1.9
$PM_{2.5}$	Annual	<0.1
PM_{10}	24-hour	<0.1
	Annual	<0.1

[a] Impacts greater than the SIL occur only along the fenceline.

The PM_{10} background concentrations already exceed the CAAQS (like the majority of the state, the area is designated as a nonattainment area for the PM_{10} CAAQS with fugitive windblown dust as the major contributor). Because the Project's construction impacts are not below the SIL for the 24-hour and annual PM_{10} standards, the Project Owner will implement construction control measures as described in AFC Section 5.1.7.2.2. These control measures would reduce particulate emissions to the extent required by ICAPCD, thus making the Project consistent with attainment plans for the PM_{10} standards. Additionally, the PM_{10} emissions associated with construction of the Project, as presented in AFC Table 5.1-20, are below the

ICAPCD significance threshold of 150 pounds per day. Therefore, a cumulative air quality impacts analysis will not be performed for 24-hour and annual PM_{10}.

Based on the above discussion, a cumulative air quality impacts analysis will only be prepared for 1-hour and annual NO_2 and annual $PM_{2.5}$.

Previously-modeled impacts for all other pollutant averaging periods included in Table 3-2 (8-hour ozone; 1-hour and 8-hour CO; 24-hour $PM_{2.5}$; and 1-hour, 3-hour, 24-hour, and annual SO_2) are below their respective SIL. Therefore, MBGP construction would not cause or contribute to a violation of the NAAQS. It is similarly assumed that, with the impacts being less than the SIL, MBGP construction would not cause or contribute to a violation of the CAAQS. Therefore, a cumulative impact analysis is not proposed for these pollutant averaging periods.

4.2 Analysis of Nearby Existing Sources

A review of existing and permitted sources of $PM_{2.5}$ and NO_2 air pollution surrounding MBGP yields multiple geothermal power plants, agricultural operations, and the Salton Sea as a source of naturally occurring air pollution.

As presented in Section 2, the associated $PM_{2.5}$ and NO_2 background monitoring data was obtained from the Brawley monitoring site approximately 15.7 miles to the South of MBGP and/or the El Centro monitoring site approximately 28.4 miles to the South of MBGP. Each of these monitoring sites are located in an urban area with nearby major vehicle-related emissions sources. Specifically, the Brawley monitor is located adjacent to Highway 86 (Main Street) and near South 1st Street, which represent major routes for vehicles within the area. Similarly, the El Centro monitor is located near multiple arterial streets, with Interstate 8 located approximately one mile to the South.

As per the California Air Resources Board's (CARB) Criteria Pollutant Emission Inventory Data[2], windblown dust is the major contributor to $PM_{2.5}$ emissions within Imperial County. Emissions from windblown dust would be generated in predominantly undeveloped areas and would result in regional impacts that are generally not localized. Therefore, these regional impacts would be expected to occur both around the town of Brawley and the Project area as both areas are surrounded by undeveloped land in most directions. The proposed Project site is also surrounded by the Salton Sea from the West to the North, which is not a source of fugitive $PM_{2.5}$ dust. Accordingly, background concentrations from the monitoring data represent conservative estimates of windblown $PM_{2.5}$ impacts at the Project site. As a result, no existing area or fugitive sources of pollution are proposed to be included in the cumulative impacts analysis.

Apart from windblown dust, onroad vehicles are a greater contributor of $PM_{2.5}$ emissions within Imperial County than electric utilities. With the background monitors being located near arterial streets, an interstate, and a highway, the background concentration reflects a potentially higher localized $PM_{2.5}$ loading than would likely occur from the stationary sources of emissions near MBGP. Therefore, the background concentrations from the monitoring data represent conservative estimates of ambient air concentrations and nearby stationary source $PM_{2.5}$ impacts at the Project site. As a result, no existing stationary sources of pollution are proposed to be included in the cumulative impacts analysis.

Emissions resulting from the combustion of vehicles represents a large regional source of NO_2. With the background monitors being located near arterial streets, an interstate, and a highway, the background concentration reflects a potentially higher regional NO_2 loading due to diesel traffic. Nearby sources of NO_2 would likely include emergency generators and agricultural equipment, both of which would operate

[2] CARB's emissions inventory data is available at: https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool.

intermittently and in potentially varying locations. Therefore, the background concentrations likely represent a higher concentration of NO_2 than would be observed surrounding MBGP and should be considered representative of nearby operating sources. As a result, no existing sources of pollution are proposed to be included in the NO_2 cumulative impacts analysis.

4.3 Analysis of Nearby Proposed Sources

A review of other stationary emissions sources within a 6-mile radius that have received construction permits but are not yet operational or are in the permitting process (such as the New Source Review or California Environmental Quality Act [CEQA] permitting process) was performed. These stationary emissions sources were screened to only include new or modified sources (individual emission units) that would cause a net increase of 5 tons per year or more per modeled criteria pollutant. Therefore, VOC sources, equipment shutdowns, permit-exempt equipment registrations, rule compliance, permit renewals, and replacement/upgrading of existing systems will not be included in the cumulative impacts analysis. The facilities with sources identified for screening in the operational cumulative air quality impacts analysis are presented in Table 4-2.

Table 4-2. Cumulative Impacts Assessment – Facility List

CUP-0011	Project Name	Applicant	Area-Location	Phase	Greater than 5 TPY of $PM_{2.5}$ or NO_2 Emissions?	Include in Cumulative Analysis?
13-0031	Wilkinson Solar Farm	8 Minute Energy	Niland	Pending Construction	No	No
13-0032	Lindsey Solar Farm	8 Minute Energy	Niland	Pending Construction	No	No
17-0014	Midway Solar Farm IV	8 Minute Energy	Calipatria	Pending Construction	No	No
18-0040	Ormat Wister Solar	Omi 22 LLC/Ormat	Niland	Operational	No	No
21-0021	Hell's Kitchen Geothermal Exploration Project	Controlled Thermal Resources	Niland	Entitlement Process [a]	N/A	No
20-0008	Energy Source Mineral ALTiS	Energy Source Minerals	Imperial County	Pending Construction	No	No
--	Black Rock Geothermal Project (BRGP)	Black Rock Geothermal, LLC	Imperial County	AFC Under Review	Yes	Yes
--	Elmore North Geothermal Project (ENGP)	Elmore North Geothermal, LLC	Imperial County	AFC Under Review	Yes	Yes

[a] Hell's Kitchen Geothermal Exploration Project is in the entitlement process, which occurs before any air emissions-related permitting and licensing.
Notes:
N/A = Not applicable
tpy = ton(s) per year

As presented in Table 4-2, only two proposed sources within 6 miles of MBGP were identified as having emissions greater than 5 tons per year of $PM_{2.5}$ or NO_2 and are in the permitting process. Because MBGP operations are not expected to overlap with construction of Black Rock Geothermal Project (BRGP) and Elmore North Geothermal Project (ENGP), only their operational emissions will be considered in the operations cumulative impacts analysis. Similarly, because MBGP construction is not expected to overlap with operation of BRGP and ENGP, only their construction emissions will be considered in the construction cumulative impacts analysis. Therefore, it is proposed that the BRGP and ENGP operations be included in the $PM_{2.5}$ cumulative air quality impacts analysis for MBGP operations and that the BRGP and ENGP construction be included in the NO_2 and $PM_{2.5}$ cumulative air quality impacts analysis for MBGP construction.

Appendix A
Operation Significant Impact Radius Figures

Figure A-1: Operation 24-Hour $PM_{2.5}$ Significant Impact Radius

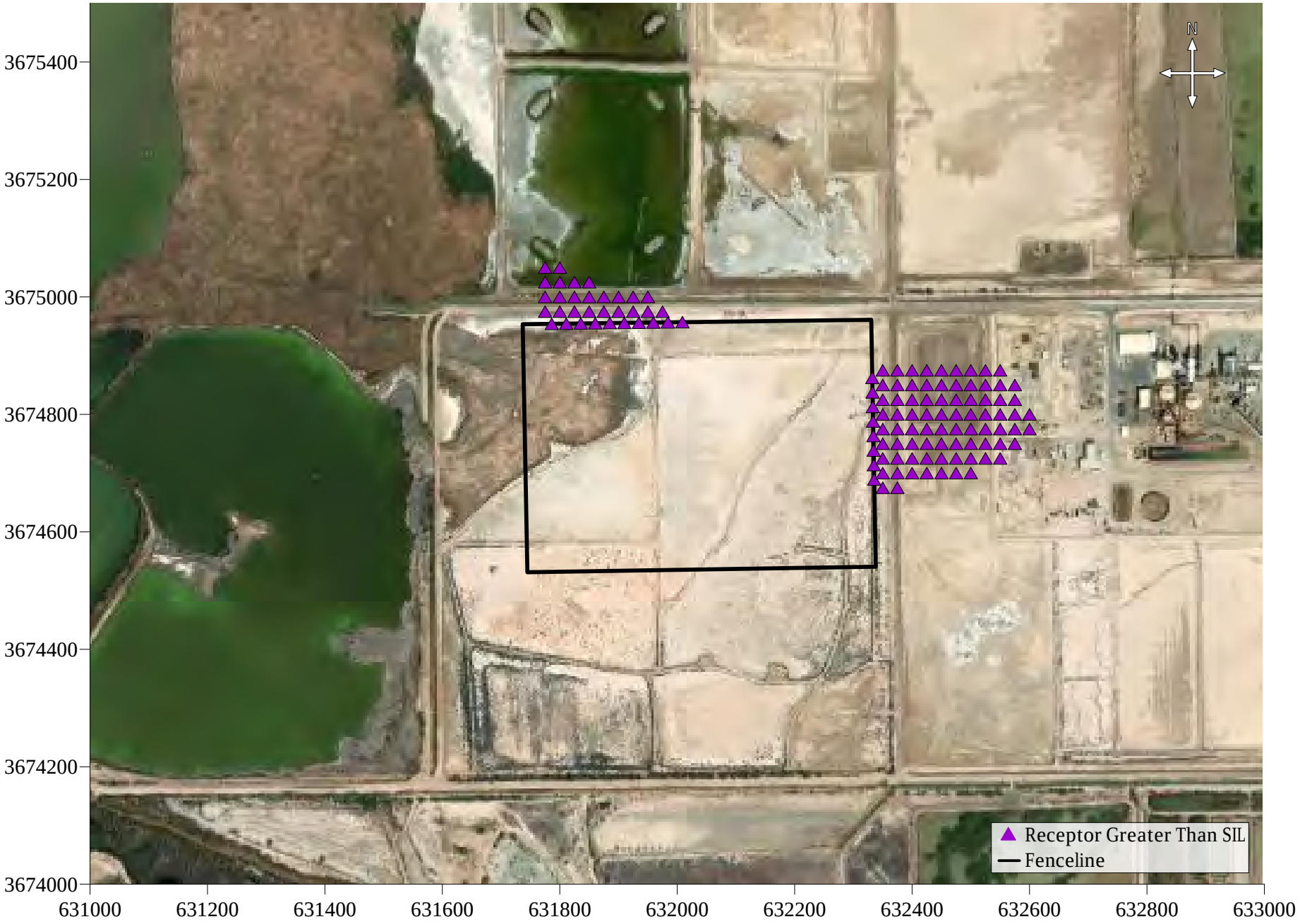
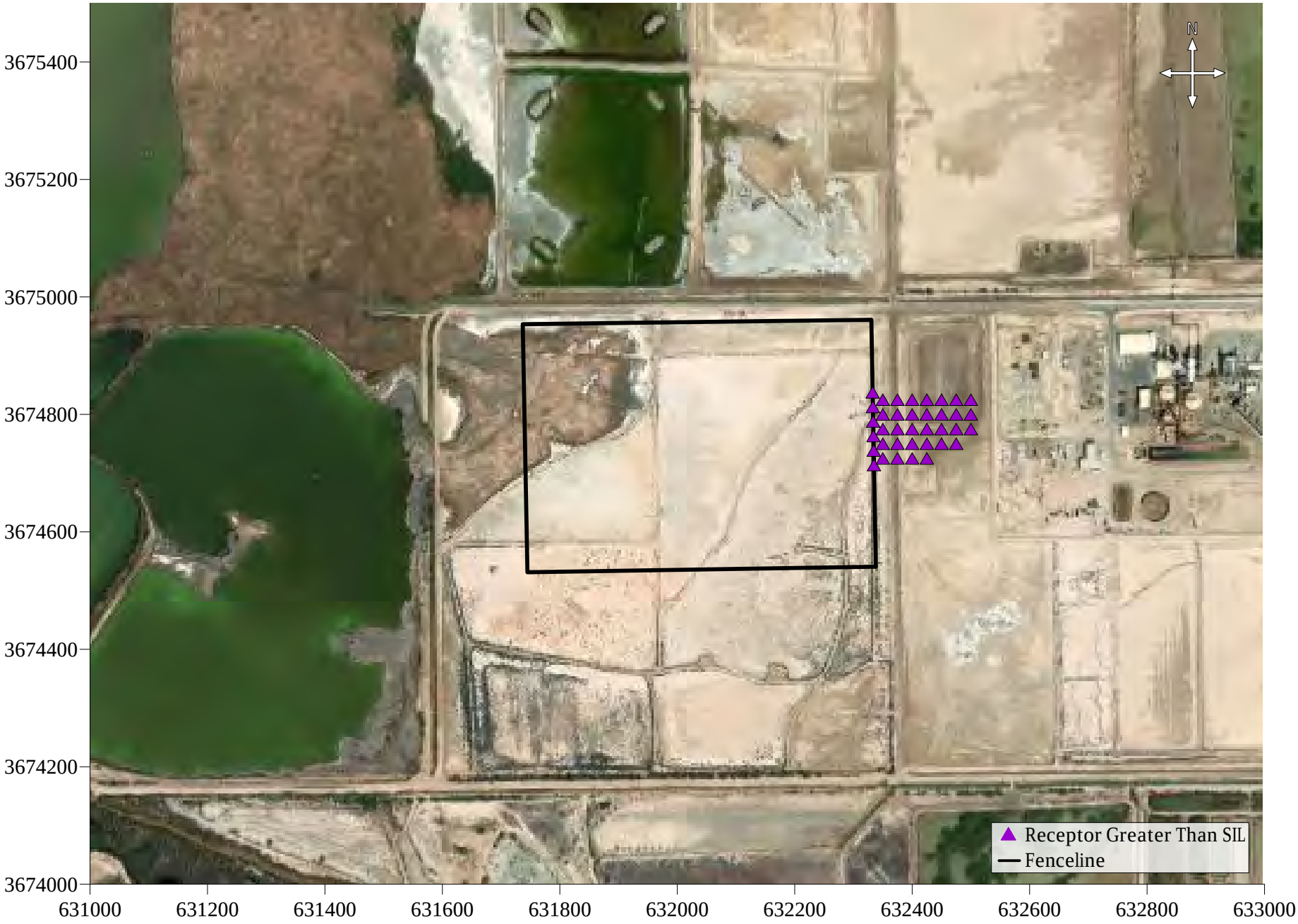


Figure A-2: Operation Annual $PM_{2.5}$ Significant Impact Radius



Appendix B
Construction Significant Impact Radius Figures

Figure B-1: Construction 1-Hour NO_2 Significant Impact Radius

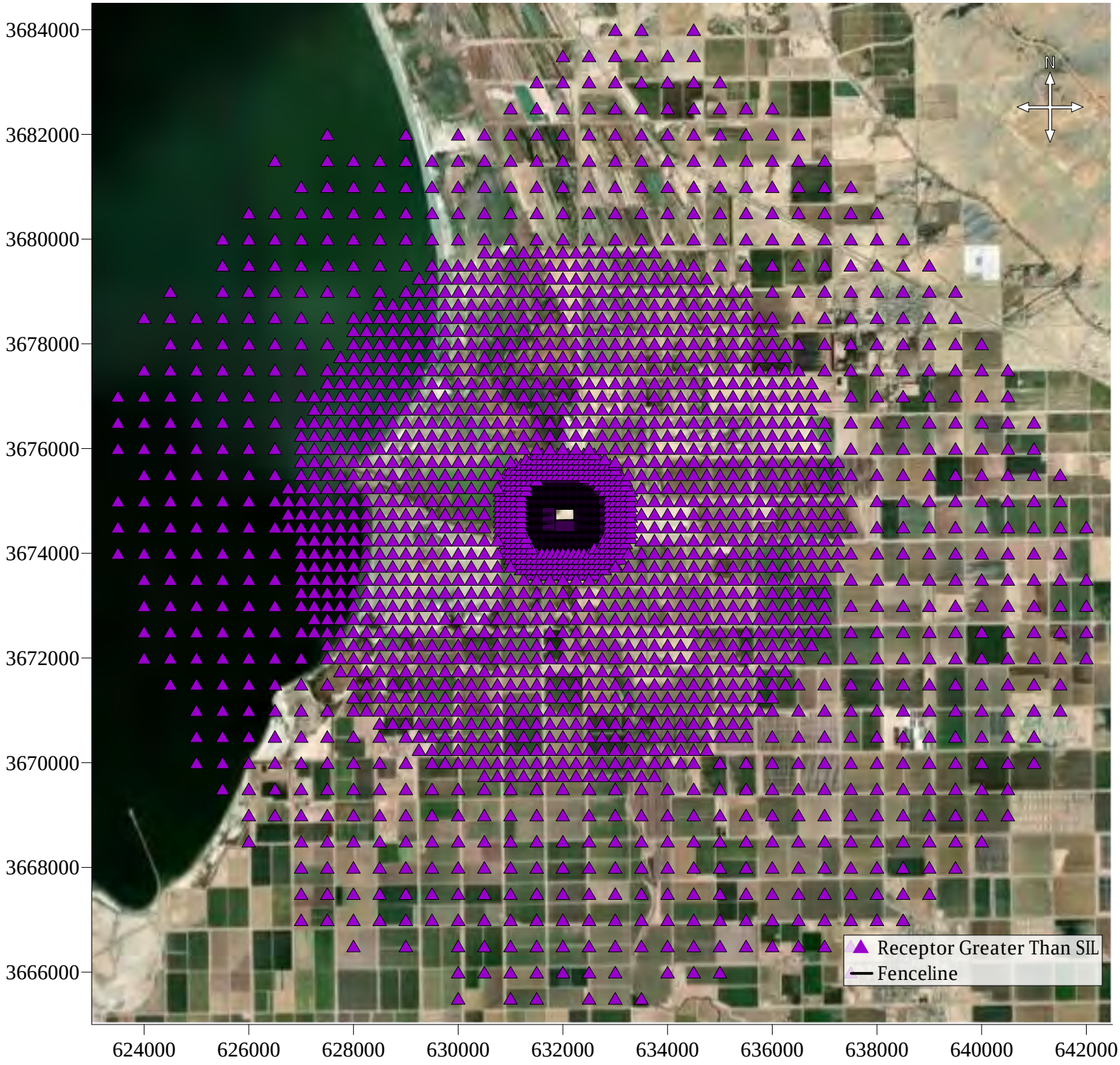


Figure B-2: Construction 24-Hour PM_{10} Significant Impact Radius

Figure B-3: Construction Annual NO_2 Significant Impact Radius

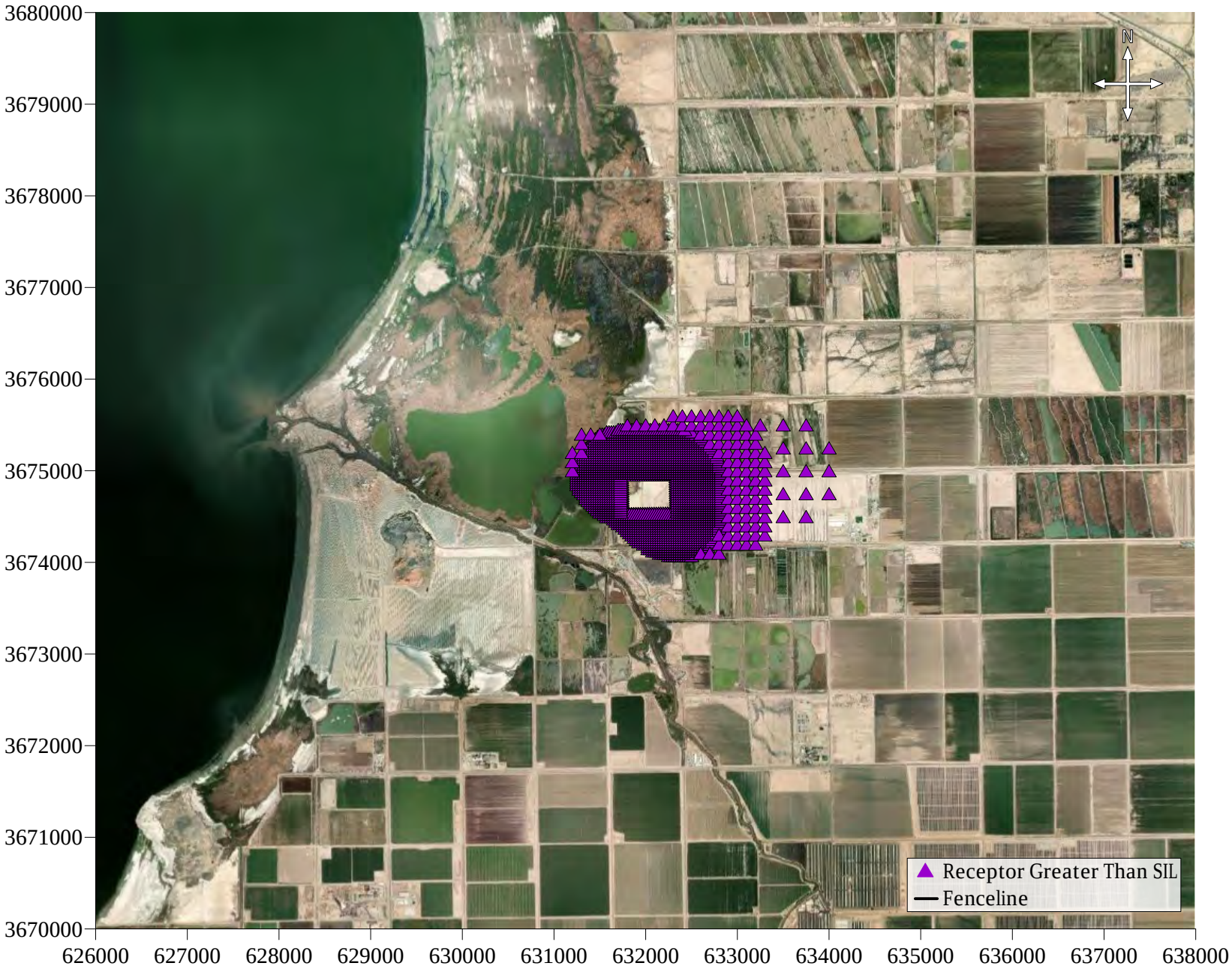


Figure B-4: Construction Annual PM_{10} Significant Impact Radius

Figure B-5: Construction Annual $PM_{2.5}$ Significant Impact Radius

MBGP Attachment DRR 21 Formal Consultation for the CalEnergy Obsidian Energy LLC Salton Sea Unit 6 Geothermal Power Plant

United States Department of the Interior
Fish and Wildlife Service
Ecological Services
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road
Carlsbad, California 92009

In Reply Refer To:
FWS-IMP-3191.6

NOV 2 1 2003

Mr. Mark Durham, Chief, South Coast Section
Regulatory Branch
Los Angeles District, Corps of Engineers
Department of the Army
P.O. Box 532711
Los Angeles, California 90053-2325

Re: Formal Consultation on the CE Obsidian Energy LLC Salton Sea Unit 6 Geothermal Power Plant, Imperial County, California (File No. 200301514-JMB)

Dear Mr. Durham:

This document transmits the Fish and Wildlife Service's (Service) biological opinion for the proposed CE Obsidian Energy LLC (CEOE) Salton Sea Unit 6 Geothermal Power Plant, and its effects on the federally listed species, and their designated critical habitat where applicable, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). We received your September 9, 2003, letter requesting formal consultation on these species on September 12, 2003. Formal consultation on this project was originally initiated with the Bureau of Land Management (BLM) on June 11, 2003. The consultation concerns the possible effects of the proposed Salton Sea Unit 6 Geothermal Power Plant (SSU6) and associated facilities on the endangered Yuma clapper rail (*Rallus longirostris yumanensis*), California brown pelican (*Pelecanus occidentalis*), and desert pupfish (*Cyprinodon macularius*). The mountain plover (*Charadrius montanus*) was withdrawn from consideration for listing under the Endangered Species Act (ESA) and will not be addressed in this consultation.

This biological opinion is based on information provided in the following: (1) Biological Assessment (BA) for the above proposed project developed by the project proponent, (2) Application for Certification filed with the California Energy Commission (CEC), (3) information contained in the responses to data requests filed by the CEC and the California Unions for Reliable Energy (CURE), and (4) other existing information in the Service's files. A complete administrative record of this consultation is on file at the Service's Carlsbad Fish and Wildlife Office (CFWO).

We have evaluated the project description and supplementary information provided by CEOE, including detailed information on the operation of the spill containment mechanisms included in the wells and pipeline associated with well pad OB-3. The known location for occurrence of desert pupfish is on the north side of McKendry Road in McKendry Pond (last found in this location in 1994), and it is not expected to occur within the area where the road widening and pipeline construction will take place. The construction and operation of the SSU6 are not anticipated to impact the flows in the Vail 5 drain that flows into McKendry Pond. The spill containment mechanisms included in the OB-3 wells and pipeline (adequate capacity in the outer pipeline to contain the volume that would be released prior to the shut-off of the remotely controlled valve) are expected to prevent spills from entering the drain and flowing downstream. Therefore, we concur with your determination that the construction and operation of the SSU6 may affect but are not likely to adversely affect the desert pupfish. Designated critical habitat for this species does not occur in the project area. This species will not be discussed further in this biological opinion.

CONSULTATION HISTORY

The CFWO was first contacted about this project early in 2002. An introductory meeting was held at the CEOE office in Calipatria on March 5, 2002. The project proponent provided some history of geothermal power generation in the Imperial Valley along with basic information on the facilities that would be associated with the proposed project. A summary was provided of the environmental work that was being done in preparation for the permitting process associated with the project.

CFWO received copies of the BA and jurisdictional delineation for the project on July 15, 2002. A copy of the Application for Certification that was submitted to the CEC was received by CFWO on August 9, 2002. A second meeting and field tour were held on August 21, 2002. At this meeting we discussed the permitting process that would be required by the project. The CEC would be addressing all of the State's requirements through their process. Federal requirements include a Clean Water Act section 404 permit from the Army Corps of Engineers (ACOE), a right-of-way permit from the BLM for the transmission line, and an incidental take exemption via section 7 of the Endangered Species Act from the Service. We discussed the desirability of a single process to address all Federal permitting requirements. We also discussed some of the pertinent biological issues identified by CEC staff. Noise concerns figured prominently in the discussion.

The ACOE submitted a letter to the Service on October 9, 2002, requesting our concurrence that the portion of the project over which they had jurisdiction would not adversely impact federally-listed species. The Service requested additional information from the ACOE, and we provided our concurrence on their determination on December 6, 2002. Based on information presented at the Biological Resources Workshop held by the CEC on January 9, 2003, the Service contacted the ACOE to inform them that there may be outstanding issues relative to the California brown pelican. A conference call was held on March 12, 2003, with the project proponent and ACOE staff to discuss these concerns, and it was determined that there were opportunities to avoid or

minimize impacts that could be incorporated into the project. The ACOE would not issue their permit until these details had been worked out.

On March 14, 2003, CFWO staff met with the project proponent to discuss the section 7 nexus and the requirements of a section 10(a)(1)(B) incidental take permit. They were considering the option of obtaining an incidental take permit because they were not the applicant with BLM (Imperial Irrigation District (IID) is to build and operate the transmission lines). The alternative was for them to be a co-applicant with IID. Given the steps involved with the incidental take permit and the obligations of their contract with IID, the project proponent expressed a strong preference for the co-applicant approach.

On March 20, 2003, representatives from the Service, BLM, ACOE and the project proponent met to establish the process that would be carried out to address endangered species impacts. It was determined that the right-of-way to be granted by the BLM would make the project viable and would thus serve as the Federal nexus for the project. The ACOE would use the consultation with BLM to support their process and would incorporate by reference any applicable terms and conditions. We discussed some of the information needs that were still outstanding, and the project proponent provided some additional details regarding the geothermal extraction process.

The CEC held another workshop on May 14 and 15, 2003. The Service provided comments on the Preliminary Staff Assessment regarding endangered species issues as well as concerns regarding migratory birds and potential impacts to the Sonny Bono Salton Sea National Wildlife Refuge (SBSSNWR). A follow-up site visit was held with Service staff and the project proponent. The primary concerns were the closest approach of the L-line to the Salton Sea and the location of well pad OB-3 relative to the pelican roosts along Obsidian Butte. Additional information was requested by the Service for our evaluation of the project.

An additional information packet was received from the project proponent on June 11, 2003. While minor additional information needs were identified as a result of the Service's review, the information package was adequate for the initiation of formal consultation. The Service informed BLM on June 26, 2003, that the formal consultation process had been initiated as of June 11, 2003.

On July 10, 2003, staff from the BLM contacted CFWO staff to inform them that BLM had determined that their approval of the transmission line right-of-way did not constitute a Federal nexus for the rest of the project. BLM was pursuing approval of the right-of-way but was not planning to consult on the project because there were no federally-listed species along the transmission line right-of-way. They inquired with CFWO staff as to other opportunities for a Federal nexus and the process required for an incidental take permit.

On July 11, 2003, CFWO staff received a call from CEOE to discuss the status of the consultation. They were hopeful that the need for a permit under the Clean Water Act might constitute a Federal nexus for the project given that there are jurisdictional waters along the pipeline route to well pad OB-3, and there may be jurisdictional areas along the L-Line

Interconnection transmission line route. CFWO staff did not see that a change in Federal lead on the project would result in a change in the existing schedule, but the lack of a Federal nexus would result in the need for an incidental take permit. That process would be expected to take 18 months to two years. CEOE was concerned that the time required to obtain an incidental take permit might result in failure of the project given their contract obligations with IID.

A meeting/teleconference was held on July 22, 2003. The purpose of the meeting was to address process issues that had arisen relative to the section 7 in progress and technical questions that have come up in review of the responses to the Service's information request. The ACOE has determined that there are jurisdictional waters along the transmission line corridor. They are working with IID and CEOE to determine if the transmission line construction would impact these areas. If that is the case, these impacts will need to be permitted. This can be done under a nation-wide permit (as is the case for the McKendry Road impacts), and this permitting would provide a nexus for the project. ACOE staff is reviewing the project information and should have a final determination soon. There would be no National Environmental Policy Act (NEPA) requirements with this permit because NEPA has been addressed programmatically for the nation-wide permits. The remainder of the meeting involved detailed questions regarding aspects of plant construction and operation. CEOE agreed to provide specific additional information, and CFWO staff will continue to assimilate the information into a comprehensive project description for the biological opinion.

The BLM submitted a withdrawal of their request to initiate formal consultation to the Service on July 28, 2003 (and received by this office on July 30, 2003). The CFWO received a copy of the CEOE request to the ACOE for a permit to impact 0.18 acres of jurisdictional waters for the road and pipeline to OB-3 and the L-Line interconnection on July 31, 2003. Their letter included a request for ACOE to assume the role as Federal lead for the purpose of the section 7 consultation.

The Service received a letter from the ACOE on September 12, 2003, requesting that the formal consultation process continue with the ACOE as the Federal lead agency. The time frame for the consultation process was not extended as a result of this change.

A workshop was held by the CEC on October 1, 2003, to discuss outstanding issues on the certification. The biological issues addressed included the bird flight diverters, burrowing owl mitigation, and landscaping. IID presented their new plan for the bird flight diverters that would include placing diverters only along the most sensitive areas of the line (approximately 9 of the total 31 miles). CFWO raised concerns about the area west of the Calipatria prison where high numbers of flyovers were noted, so this area was added to the proposal. In addition, the entire line would be surveyed monthly for the first year to evaluate the effectiveness of the diverters. IID also presented a new plan for burrowing owl mitigation. They did not want to be obligated to provide foraging habitat mitigation when only burrows were impacted by the construction activity. CFWO recommended that the Habitat Conservation Plan for the water transfer be reviewed for insight relative to linear projects. CEC is to present a new condition for review prior to the formal hearing. A discussion of landscaping also occurred, and it was decided that

the use of natives offered the most benefits with the fewest impacts. No non-native, fast-growing species will be required by the CEC in the landscaping plan. The CEC asked for input from the Service to justify this approach.

CFWO staff met with the ACOE and CEOE staff to discuss the draft biological opinion and the effects of limited ACOE jurisdiction on October 17, 2003. A draft of the biological opinion was provided to ACOE and CEOE. It had recently come to the attention of CFWO staff that the ACOE only had jurisdiction over construction of the project; there was no continuing authority over operation. This limits the ability to cover incidental take associated with operation of the plant given that the ACOE would not have a long-term involvement. We discussed with CEOE possible approaches to permit the incidental take associated with operation, but the additional complicating factor is the status of the species as fully protected under State law. CEOE agreed to maintain the speed limit for McKendry Road (whether paved or unpaved) to avoid future vehicle strikes of Yuma clapper rails during operation of the plant. We briefly discussed potential sites for the wetland replacement, and the ACOE will be providing the applicant with additional guidance on that process. CFWO staff conferred with the Department of the Interior Office of the Solicitor and determined that avoidance was the appropriate course of action to address the potential incidental take associated with operation in this case.

CFWO staff met with the ACOE and CEOE staff via conference line on October 24, 2003. This meeting was called to discuss CEOE's comments on the draft biological opinion and potential means to avoid pelican collisions with the project's transmission lines. Most of CEOE's comments on the biological opinion were incorporated as they provided clarifications on the project description. CFWO staff made modifications to some of the proposed Terms and Conditions to more specifically reflect the activities associated with the project. CEOE was willing to consider the proposed project changes to reduce the risk of pelican collisions with the transmission line. We agreed to discuss these measures more at the CEC hearing scheduled on October 27. Acoe would be providing their comments in the very near future. In regards to the hearing, CEOE advised CFWO staff of what information they anticipated that the CEC would be seeking. CFWO staff did not anticipate any conflicts between the CEC Conditions of Certification and the Service's Terms and Conditions. The issues that remained to be resolved at this point were fairly narrow in scope such that resolution would be achieved shortly.

Another conference call was held on October 31, 2003. The primary topic of the call was baseline surveys and what is required for the species of concern. The Yuma clapper rail is surveyed via a specific protocol that needs to be scheduled appropriately, and this should occur prior to any disturbances at the site that could affect rails' use of the habitats in the project vicinity. We agreed to provide additional details in the opinion to address these issues.

A third conference call was held on November 17, 2003, to discuss IID's concerns with the draft biological opinion. Its concerns focused on the extent of line to be fitted with bird flight diverters and the specifications in the draft biological opinion regarding the type of diverters to be used. Service staff explained that it would be appropriate to place diverters in all areas that fell between pelican use areas; this would include the segment of the transmission line between

L-10 and L-13. The types of diverters used may vary from that specified in the biological opinion provided they are of comparable efficacy. IID would be responsible for providing documentation to that effect. IID inquired about the Service's expectations regarding the land owner reporting program. This is intended to be an informal process in which IID provides land owners/farmers along the right-of-way with a mechanism to report observations of bird strikes or carcasses. IID suggested posting placards on the transmission poles with contact information and providing flyers to the land owners encouraging them to participate. This would meet the Service's expectations in regards to the reporting requirements.

CFWO staff met with the ACOE and CEOE to discuss mitigation for the project on November 18, 2003. CEOE owns property adjacent to the Alamo River and in close proximity to the Hazard Unit of the SBSSNWR. Of the properties being considered, this location had the greatest potential for successful wetland creation based on the resources available at the site and the proximity to existing water bodies. As a result of this and other recent discussions, all substantive issues regarding the project have been resolved.

DESCRIPTION OF THE PROPOSED ACTION

Project Facilities

The SSU6 project is a proposed 185 Megawatt (net) geothermal power plant. It consists of the SSU6 geothermal plant site that would incorporate a turbine generator area, resource production facility, separation/brine clarification area, electrical/control building area, cooling towers, filter press and storage area, electrical switchyard, brine ponds, water pond and power generation facility rain water run off basin, emission control equipment, parking area, and a construction lay-down area. In addition, 10 production wells on five well pads, seven injection wells on three well pads, and two small plant injection wells on existing well pads would be located on or near the plant site, with pipelines connecting them to the plant. A 500-foot long water supply pipeline would connect the plant with an existing water supply canal, Vail 4a, pass under Boyle Road and run along the southern boundary of the plant site. A 16-mile transmission line operated at 161 kV (L-Line Interconnection) would be constructed to connect to the existing L- Line southwest of the plant site. Additionally, a 15-mile transmission line (IID Midway Interconnection) operated at 161 kV would be constructed to connect the plant site to the existing IID Midway Substation, located east of the plant site. The project footprint, including rights-of-way, would total 173 acres.

The plant would utilize 80 acres of a 160-acre parcel and would be located along the northern half of the block bounded by McKendry Road to the north, Severe Road to the west, Peterson Road to the south, and Boyle Road to the east. The grading footprint of the facility would be approximately 1,320 feet by 2,640 feet. Agriculture, agricultural drains supporting patches of disturbed desert sink scrub, and gravel roads surround this location. Approximately 1,000 feet to the west is an open water/riparian scrub area that connects to the Salton Sea by a series of channels. Two intersecting, 20-foot-high gravel roads (berms) and Drain Vail No. 5 separate this

inundated area from the proposed plant site. The SBSSNWR Headquarters is located approximately 2,500 feet from the proposed plant site boundary.

The proposed project would be composed of a resource production facility, a power generation facility, and ancillary facilities. The SSU6 project would include a high efficiency condensing steam turbine with a net plant output of 185 MW with corresponding brine production rate of 12,815 kilopounds per hour (kph). Normally, the facility would be operated in a base load mode: 8,000 hours per year or more. The design of the resource production facility is based on crystallizer reactor clarifier technology to process the brine and produce turbine-quality steam.

The resource production facility would include all the brine and steam handling facilities from the production wellheads, through the crystallizer/clarifier system, to the injection wellheads. It also would include a solids handling system for brine solids processing, brine ponds, steam polishing equipment designed to provide turbine-quality steam to the power generation facility, and appropriate steam-venting vessels to support operations during startup/shutdown and emergency conditions.

Ten production wells are proposed on five new well pads, with two wells on each pad (Figure 3.1-4). The proposed location of Production Well Pad OB-1 is in an agriculture field in the northeastern part of the northwest quarter of Section 33, with a grading footprint of approximately 300 feet by 700 feet. This location is adjacent to a freshwater marsh that supports Yuma clapper rail (Union Pond). This freshwater marsh was created by the SBSSNWR and is considered a jurisdictional wetland by the ACOE and the California Department of Fish and Game (CDFG). An access road that is approximately three feet higher than the adjacent agricultural field is at the south end of this marsh and is located between the marsh and the proposed location of the well pad.

The proposed location of Production Well Pad OB-2 and associated 560-foot by 560-foot grading footprint is immediately north of McKendry Road, southwest of Production Well Pad OB-1 (Figure 3.1-4). The proposed well pad location is occasionally used as an overflow parking lot during SBSSNWR-sponsored events, and it supports disturbed habitat with some desert sink scrub located on the west side of the site. A 20-foot levee separates this proposed site from a freshwater marsh (McKendry Pond).

The proposed location of Production Well Pad OB-3 and associated 300-foot by 700-foot grading footprint is on the south side of Obsidian Butte in the eastern half of Section 32 (Figure 3.1-4). The IID actively mines this area for rocks used as riprap to line the levees adjacent to the Salton Sea. The well pad would be located on a level portion of Obsidian Butte in an area previously disturbed by the IID. Construction of a pipeline between Production Well Pad OB-3 and the power plant site would affect wetlands over which the ACOE has jurisdiction pursuant to Section 404 of the Clean Water Act. Placing Production Well Pad OB-3 on Obsidian Butte would require widening the access road to Obsidian Butte and construction of in-water pilings to support a pipeline connecting wells on OB-3 to the plant.

The proposed location of Production Well Pad OB-4 and associated 300-foot by 700-foot grading footprint (Figure 3.1-4) is in the southwest corner of the proposed power plant site. This location is surrounded by agriculture, an agricultural drain supporting patches of disturbed riparian scrub and paved and gravel roads. The proposed location of Production Well Pad OB-5 and associated 300-foot by 700- foot grading footprint (Figure 3.1-4) is in the southwestern corner of the same agriculture field as Well Pad OB-4 and the plant site, immediately north of Peterson Road. This location is surrounded by agriculture, an agricultural drain supporting patches of disturbed riparian scrub, and paved and gravel roads.

In addition to the production wells, seven new injection wells on three new well pads are proposed. Injection Well Pads OBI-1 and OBI-2 would consist of two wells, and Injection Well Pad OBI-3 would consist of three wells (Figure 3.1-4). The proposed location of Injection Well Pad OBI-1 and associated 300-foot by 700-foot grading footprint is on the west side of Gentry Road and north side of Lindsey Road in the southeast quarter of Section 4. The proposed location of Injection Well Pad OBI-2 and associated 300-foot by 700- foot grading footprint is on the west side of Cox Road and south of Peterson Road. This proposed well pad is located south of the main injection areas of the Elmore, Vulcan, and Hoch geothermal power plants. The proposed location of Injection Well Pad OBI-3 is on the west side of Cox Road and south side of Montgomery Road, directly south of Injection Well Pad OBI-2 in an agricultural field. The proposed grading footprint of this well pad is 300-feet by 700-feet. The habitat at and around the sites is generally agricultural.

Two 800-foot by 90-foot brine ponds would be installed. The brine ponds would be large concrete-lined basins that are sized to accommodate up to four hours of brine released under upset conditions, plus 2 feet of freeboard. During such upset conditions, brine that overflows from the clarifiers and the thickener, and condensate from the steam vent tanks would be directed to these ponds for temporary containment, after which this liquid would be pumped to the aerated brine injection well located at the facility. Reject water from the reverse osmosis system would also be directed to the brine ponds. The brine ponds would also collect brine from the production wells when they are flow-tested after drilling and from the production wells when brine is initially introduced into the facility during startup. This liquid would be discharged into an injection well after startup is complete. Monitoring wells would be located adjacent to the brine ponds to comply with regional ground water regulations. Brine handling equipment would be contained in curbed concrete aprons, with drainage directed to the thickeners and subsequently to the aerated brine injection well.

The power generation facility would include a condensing turbine/generator set, the gas removal and abatement systems, and the heat rejection system. It also would include a 161 kV switchyard and several power distributions centers. Common facilities would include a control building, a service water pond, and other ancillary facilities. The power generation facility would include a multi-casing, triple-pressure, exhaust flow condensing turbine. Heat rejection for the steam turbines would be accomplished with a counterflow cooling tower. The turbine generator would be nominally rated at 200 MW with a net plant capacity of 185 MW.

The proposed interconnection of the facility to IID's existing transmission system would be via a new substation south of McKendry Road and east of Severe Road. A 16-mile, single-circuit transmission line operated at 161 kV would be built to the south to connect the new substation to the existing El Centro and Avenue 58 substations via the existing L-Line. This proposed L-Line Interconnection route would connect to the L-Line southwest of State Highway 86 and Bannister Road, and would cross desert land for approximately 2.8 miles (Figure 5.5-3). A 15-mile, single-circuit transmission line operated at 161 kV also would be constructed from the new substation east to the existing IID Midway substation. The Midway substation would have a 161 kV line termination, a 161 kV breaker and a 161/230 kV transformer installed for the connection of the 161 kV line (Figure 5.5-3).

Single-pole steel structures ranging from 100 to 125 feet high would be used for both the L-Line and IID Midway Interconnections. Approximately 132 structures spaced 800 to 1,200 feet apart would be necessary for both lines, depending on final design. The phase conductors would be arranged vertically on three 9.75-foot side arms for each line, and the arms would be separated vertically by 16.9 feet. Sag between poles would result in the height of the lowest conductor being at least 27 feet off the ground, and the ground wire will be 2 to 4 feet below its maximum height at the towers. All steel pole towers would have concrete foundations designed to support the imposed loads. The diameter and the depth of each foundation will be determined during the design phase of construction, and would be based on soil conditions and actual tower loads. The maximum anticipated size of the foundation is 10 feet in diameter by 30 feet deep.

A new water supply pipeline line would be built perpendicular to Boyle Road and would connect the plant site with the existing Vail 4A lateral (gates 459 and 460), located on the east side of Boyle Road. Disturbed/agricultural areas are present along the approximately 500-foot long section of pipeline starting at Boyle Road at the middle of the eastern boundary of the 160-acre parcel. The water would be used for dilution water, other process uses and the reverse osmosis (RO) potable water system. The SSU6 would require an average of 293 acre-feet per year of water when operating at full plant load for uses primarily including reverse osmosis and dilution. A service water pond (136,000 square feet) would be a lined earthen structure that would hold canal water for facility service water needs. The CEC staff proposed that the reverse osmosis reject water also be directed to the service water pond. It was their determination that this would be less hazardous to wildlife than discharging this flow into the brine ponds.

Lighting on the project site would be limited to areas required for safety, would be directed on site to avoid backscatter, and would be shielded from public view to the extent practical. All lighting that is not required to be on during nighttime hours would be controlled with sensors or switches operated such that the lighting would be on only when needed.

The Imperial County General Plan indicates that the project site is in an area inside the 100-year floodplain. To protect the site from flooding, the entire 80-acre site would be enclosed by an 8-foot-high perimeter berm designed with 2:1 sloping sides. The berm on the north side of the plant site would be 24 feet wide at the top with a 42-foot base. The berm surrounding the rest of the plant would be 12 feet wide at the top, with a 42-foot base. This berm would protect the

plant from flooding, and would be of adequate height to provide flood protection to an elevation of at least 220 feet below sea level in accordance with county flood control requirements. The plant site elevation is approximately 228 feet below sea level; consequently, the berm would need to be at least 8 feet high.

Within the actual project site, buildings and equipment would be constructed on foundations with the overall site grading scheme designed to route surface water around and away from all equipment and buildings. The storm water drainage system would be sized to accommodate 3 inches of precipitation in a 24-hour period (100-year storm event) and to comply with applicable local codes and standards. Storm water flows would be directed to a detention pond via ditches, swales, and culverts. Spill containment areas and sumps subject to spills of miscible chemicals would be drained to an enclosed oil/water separator. Oil from this oil/water separator would be collected in a waste oil tank for offsite recycling. Clean water from the oil/water separator would be discharged into the thickener. A storm water detention pond (96,000 square feet) would be incorporated into the facility layout. It would be an earthen structure.

Project Construction

The overall project schedule for the SSU6 Project from Limited Notice to Proceed (Procurement of Major Materials) to total Construction Site Cleanup and Demobilization is expected to take at least 23 months. Construction and startup of the power plant from the start of site mobilization to commercial operation is expected to take at least 19 months. Peak construction activity would require 15 months and would occur from November 2004 through January 2006 based on the current project schedule.

An area of approximately 20 acres south of the plant site would be devoted to equipment and materials laydown, storage, construction equipment parking, small fabrication areas, and office trailers. Layout of access roads and loading areas is important in the development of the laydown yard. Space is required for large turbine parts, structural steel, piping spools, electrical components, switchyard apparatus, and building parts. Sufficient space would be provided to accommodate equipment preventive and in-storage maintenance activities such as moving, shaft rotation, connecting, lubricating, and heating. Site access would be controlled for personnel and vehicles. A security fence would be installed around the site boundary, including the laydown area. Security personnel would be on site.

Excavation work would consist of the removal, storage, and/or disposal of earth, sand, gravel, vegetation, organic matter, loose rock, boulders, and debris to the lines and grades necessary for construction. Materials suitable for backfill would be stored in stockpiles at designated locations using proper erosion protection methods. Excess materials would be removed from the site and disposed of at an acceptable location. Disposal of any contaminated material encountered during excavation would comply with applicable Federal, State, and local regulations. The existing site topography would be graded to provide a level area for the facility at an approximate elevation of –228 feet. Where practical, topsoil would be segregated and stockpiled for reuse in areas that would be converted back to agriculture. Most soils in the project area are designated as Prime

and Statewide Important soil types and would be reserved for reuse, as feasible. It is assumed that excavated materials will be suitable for backfill. This would require typical construction equipment (bulldozers, graders, front-end loaders, and trucks), and the combined noise level is anticipated to be up to 89 dBA in McKendry Pond and 66 dBA in Union Pond (both identified as Yuma clapper rail habitat) as a result of these activities. The levee forming McKendry Road may provide for 5-10 dB of sound attenuation resulting in composite sound levels from these activities potentially dropping to 79 dBA and 56 dBA, respectively. CEOE would implement additional measures as necessary to maintain noise levels in sensitive habitat at or below 78 dBA during the breeding season.

Plant construction would also require pile driving for the steam turbine foundation, pouring concrete, and erecting steel infrastructure, and other mechanical activities. Much of this activity (particularly pile driving) would occur somewhat farther from the Yuma clapper rail habitats than the more general excavation and grading activities described above. This activity in combination with other construction activities (utilizing the same types of equipment as described above) is expected to result in composite noise levels in McKendry Pond and Union Pond of 83 and 69 dBA, respectively. McKendry Road may provide for some sound attenuation as before, with composite noise levels in McKendry Pond and Union Pond potentially being reduced to 73 and 59 dBA, respectively. Pile driving would be scheduled to occur between September and February. Pile driving should take less than one month's time, and pile shields (or other means to reduce the impact of pile driving) would be used for pile driving activities required by the project. Shields would reduce the noise levels associated with pile driving by 15 to 18 dBA.

Once construction is complete, the plant would need to be commissioned. Part of this process includes cleaning of the pipelines that lead to the steam turbine. This would be accomplished by means of high pressure steam being forced through the pipes for up to 72 hours. This procedure generates a noise level of 118 dBA at 100 feet. With the use of a silencer, this would be reduced to 83 dBA. Based on the distance of the steam turbine from McKendry Pond (approximately 650 feet), this would result in a noise level there of 67 dBA. The noise level at Union Pond would be approximately 52 dBA, but the noise would be continuous for up to 72 hours.

Well drilling operations would be conducted 24 hours a day, seven days a week until the total well depth is reached. An estimated eight weeks would be required to drill each well, and approximately 12 people would be working at each site at any one time. A diesel auger drilling rig would be used to construct the production and injection wells. The noise generated by this equipment would be expected to be approximately 70 dBA in Yuma clapper rail habitat as a result of the proximity of OB-1 to Union Pond and OB-2 to McKendry Pond. Site preparation, including drill rig assembly, should require approximately one to two weeks per well. Preparation of a typical drilling site would involve grading (clearing and leveling) approximately 1 to 1.5 acres (0.4 to 0.6 ha) per well, which would contain an equipment staging and activity area, a drill pad and a mud sump. Drilling muds would be contained in a tank at the well pad site and transported off-site for disposal. All of these activities would be scheduled to occur outside the shorebird breeding season of March through July at OB-1, OB-2, and OB-3 (if necessary). A system of aboveground pipelines would be constructed to connect the power plant with the

production and injection wells. Wherever possible, these pipelines would be placed next to the borders of fields or along access roads to minimize the amount of land affected. The proposed locations of the well pads and routes of the pipelines can be seen in Figure 3.1-4.

Pipeline construction would consist of various activities, including, but not limited to, clearing and grubbing, excavation for pipeline supports, pipe handling and welding. Site clearing and preparation (removing vegetation and minor leveling) would require the use of heavy diesel-powered earthmoving equipment, including bulldozers, scrapers, dump trucks, and front-end loaders. Noise levels associated with these activities would be similar to those described above for excavation activities. Site clearing and preparation would occur at all locations where equipment would be constructed or installed. Pipelines to well pads OB-1, OB-2, and OB-3 would be constructed outside the shorebird breeding season of March through July. The right-of-way would be prepared by removing debris and land leveling as each component is being constructed. Erosion control measures would include reducing time between clearing and construction and installing silt fencing. Surplus soils that cannot be used for restoration on site would be sent to a soils broker or the local, State-approved landfill.

Production and injection pipelines would be made of carbon steel pipe, 24 to 30 inch in diameter. Depending on the pressure rating and size of pipe, the steel thickness would vary between 0.6 inch and 1.0 inch. For protection against corrosion, a polymer concrete lining of approximately 0.5-inch thickness would be applied to the inside diameter of the pipe prior to shipment to the site. The pipe would be shipped to the SSU6 Project site in 40-foot-long segments. During storage and shipping, the pipe would be filled with water to prevent drying or cracking of the liner. The pipe would be field welded during assembly. The welding would be subject to 100 percent X-ray testing. Any portions that fail testing would be ground out, re-welded, and re-tested. After assembly, each pipeline would be subjected to a hydrostatic test at 150 percent of the system normal operating pressure. Test pressure is held for sufficient time to walk the entire length of the pipeline and inspect for leaks.

The existing roadway between the west end of McKendry Road and Obsidian Butte is used to provide service to a gravel pit located on Obsidian Butte. The road width is approximately 10 feet, and varies along its length. In order to provide a route for the drilling rigs that would be required to construct the two production wells located on Obsidian Butte, the road would be widened by approximately 15 feet, providing a 25-foot wide road surface. The widening would occur along the south side of the existing road with standard civil construction equipment, including dump trucks, bulldozers, compacting machines and grading machines.

Installation of the pipeline would require installation of approximately 20 pipe supports along a 600-foot distance (one support every 30 feet) on the south side of the widened road. The pipe supports are anticipated to be 12 feet wide and constructed of steel. Each support would be elevated above grade, supported by two piles, each approximately 14 inches in diameter. One of each pair of piles would be driven along the road slope and the other driven directly in the water. Construction of the pipeline would require cranes, a pile driving machine, fork lifts, welding machines and small trucks. Noise levels would be expected to be similar to those associated with

plant construction (up to 84 dBA with shielded pile driving), but these activities would be scheduled outside the breeding season of March through July.

Construction of a transmission line would follow the sequence of access road identification and construction (where needed), right-of-way and structure sites clearing (including construction yards and foundation concrete mixing areas, or "batch plants"), installing foundations, assembling and erecting the structures, clearing, pulling (i.e., stringing individual transmission lines through conductors), tensioning, and splicing sites, installing ground wires and conductors, installing counterpoise/ground rods, and cleanup and site reclamation. Various phases of construction would occur at different locations throughout the construction process. This would require several construction crews operating simultaneously in different locations.

The construction, operation and maintenance of the proposed transmission lines would require that heavy vehicles access structure sites along the rights-of-way. Use of existing public roads and maintenance roads within existing transmission lines rights-of-way is planned to the greatest extent possible to minimize potential impacts associated with new construction. Where necessary, certain road improvements would be made to allow passage of construction vehicles. Following construction, disturbed road sections would be restored to original contours. Some permanent road improvements may be left in place where necessary for operation or maintenance, or where the landowner or land managing agency requires. New access roads to the structure sites, or spur roads, may be constructed into the right-of-way from existing transmission line maintenance roads where terrain would prevent access over undisturbed surfaces. Wherever possible, new roads would be built at right angles to existing maintenance roads. All existing roads would be left in a condition equal to or better than their condition prior to the construction of the transmission line.

Culverts or other drainage structures would be installed only as necessary to allow passage of heavy equipment across drainages. This type of temporary facility would prevent damage to existing drainage banks by directing all traffic to a specified area. Existing paved and unpaved highways and roads would be used to the greatest extent possible. Additionally, road construction would include dust control and erosion control measures in sensitive areas. Either water or road sealant emulsion would be applied to non-paved access roads to control fugitive dust emissions.

At each structure site, leveled areas (i.e., pads) would be needed to facilitate the safe operation of equipment, such as construction cranes. The leveled area required for the location and safe operation of large cranes would be approximately 30 by 40 feet. At each structure site, a work area of approximately 200 feet square would be required for the location of structure footings, assembly of the structure, and the necessary crane maneuvers. The work area would be cleared of vegetation only to the extent necessary. After line construction, all pads not needed for normal transmission line maintenance would be restored to natural contours to the greatest extent possible and be re-vegetated where required.

Excavations for tower foundations would be made with power drilling equipment. A vehicle-mounted power auger or backhoe would be used to excavate for the structure foundations. In rocky areas, the foundation holes would be excavated by drilling. Although not expected, in some instances blasting could be necessary if necessitated by site-specific geologic conditions. In the unlikely event that blasting is necessary, conventional or plastic explosives would be used. Safeguards (e.g., blasting mats) would be employed when adjacent areas require protection. Footings would be installed by placing reinforcing steel and an anchor bolt cage into each foundation hole, positioning the bolt cage, and encasing it in concrete. Spoil material would be used for fill where suitable. Spoil materials that cannot be used for fill would be removed to a suitable location by the construction contractor for disposal. The foundation excavation and installation would require access to the site by a power auger or drill, a crane, material trucks, and ready-mix trucks.

Structural steel components and associated hardware would be shipped to each structure site by truck. Steel structure sections would be delivered to tower locations where they would be fastened together to form a complete structure and hoisted into place by a large crane. After the structures are erected, insulators, hardware, and stringing sheaves would be delivered to each structure site. The structures would be rigged with insulator strings and stringing sheaves at each ground wire and conductor position. Pilot lines would be pulled (strung) from structure to structure and threaded through the stringing sheaves at each structure. Following pilot lines, a larger diameter, stronger line would be attached to conductors to pull them onto structures. This process would be repeated until the ground wire or conductor is pulled through all sheaves. The shield wire and conductors would be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end of a conductor segment. Sites for tensioning equipment and pulling equipment would be approximately 2 miles apart. This distance will be essentially doubled where it is prudent to do so by pulling in two sets of conductors back to back. Each tensioning site would be an area approximately 200 feet by 200 feet. Tensioners, line trucks, wire trailers, and tractors needed for stringing and anchoring the ground wire or conductor would be necessary at each tensioning site. The tensioner in concert with the puller would maintain tension on the shield wires or conductors while they are fastened to the structures. The pulling site would require approximately half the area of the tension site. A puller, line trucks, and tractors needed for pulling and temporarily anchoring the shield wires and conductor would be necessary at each pulling site.

Temporary staging areas would be located at the SSU6 plant site, near the end of the transmission line right-of-way, and approximately every 4 to 5 miles along the route (for an expected total of four along each of the two routes). These areas would be located in previously disturbed sites wherever possible, and would be approximately 300 by 900 feet. Concrete for use in constructing foundations would be dispensed from a portable concrete batch plant. The portable batch plant would be moved from staging area to staging area following tower foundation construction activities. Raw materials would be stored within the site. Additionally, the batch plant sites would be of sufficient size to serve as staging areas for construction in general as well as for vehicle parking.

Construction sites, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Approved enclosed refuse containers would be used throughout the project. Refuse and trash would be removed from the sites and disposed of in an approved manner. Oils, fuels or chemicals would be hauled to a disposal facility authorized to accept such materials. No open burning of construction trash would occur without agency approval. The right-of-way would be restored as required by the property owner or land management agency. All practical means would be made to restore the land to its original contour and to restore natural drainage patterns along the right-of-way. Because re-vegetation would be difficult in many areas of the project as precipitation is minimal, it would be important to minimize disturbance during the construction. All practical means would be made to increase the chances of any vegetation re-establishment in disturbed areas.

Project Operation and Maintenance

The SSU6 Project is expected to have an operating life of 30 years. The facility would be capable of operation seven days per week, 24 hours per day. Plant operations would be controlled from the operator's panel, which would be located in the Control Room. Planned maintenance would be coordinated to reduce the impact of having a unit shutdown for maintenance and overhauls. Normally, this work would be planned during the spring periods when the need for electricity is reduced. Contract requirements would preclude unit shutdown during the highest use period of June 15 through September 15.

The time required for startup of the plant is approximately 45 hours when the plant has been completely shut down (cold startup), and all brine flow to the plant has been secured for an extended period. This event is projected to occur approximately once per year. A warm start would occur when the turbine is taken off line and the resource production facility continues to operate. A startup in this condition would require approximately four hours. It is anticipated that at least four starts and stops per turbine would occur over one year following short-term outages, for a total of at least five starts and stops per year.

Regular visual inspections would be made of the plant and associated facilities daily. This would include two or three inspections of the well pads and pipelines each 24 hour period. The inspection activities would require that power plant staff drive along the pipelines and take daily readings from the temperature and pressure sensors at each well head. Vehicle speeds would be 15 miles per hour or less on the unpaved roads used to access pipelines and well pads. Regular inspection activities would also include non-destructive testing to measure pipeline wall thickness so that worn sections could be replaced prior to failure. This testing would not entail any noise beyond that produced by the vehicle use associated with daily inspection activities.

The wells would require coil cleaning approximately every two years. The hydraulically operated coil cleaning equipment is powered by a diesel tractor engine, and it is anticipated that the noise associated with this activity would be on the order 72 dBA in the nearest Yuma clapper rail habitat (Union Pond for OB-1 and McKendry Pond for OB-2). Coil cleaning is expected to

take one to two days per well, and it would be scheduled to occur outside the shorebird breeding season of March through July.

The wells may require re-drilling at some point over the life of the project. Re-drilling is comparable to the original drilling process in terms of the equipment requirements and the noise generated. The re-drilling process would require approximately 21 days per well, and it would generate noise levels of 70 to 72 dBA in the nearest Yuma clapper rail habitat. The wells' flow characteristics would be continually monitored, so in most cases the need for re-drilling could be predicted and the activity scheduled outside the breeding season.

Another plant related maintenance activity that can be anticipated in the vicinity of Yuma clapper rail habitat would be the periodic cleaning of the detention pond to remove accumulated materials. This would require the use of a back hoe and would take approximately two days to complete. Noise levels associated with this activity would be approximately 82 dBA. This is not anticipated on a regular basis and would be scheduled to occur outside the breeding season.

Operation of the transmission system would be controlled by the IID. IID would own and maintain the transmission system, including the switchyard, down stream of the plant high-voltage disconnect switch, and 161 KV plant circuit breaker. All access ways would be maintained to minimize erosion and to allow access by the maintenance crew. Land use activities within and adjacent to the transmission line right-of-way would be permitted within the terms of the easement. The transmission line would be inspected regularly by both ground and air patrols. Maintenance would be performed as needed. Emergency repairs would be made if the transmission line is damaged and requires immediate attention. Maintenance crews would be responsible for repairing and maintaining insulators, conductors, structures, and access ways. When access is required for non-emergency maintenance and repairs, IID would adhere to the same precautions identified for original construction. The buildup of particulate matter on the ceramic insulators supporting the conductors on electrical transmission lines increases the potential for flashovers, which affects the safe and reliable operation of the line. Structures with buildup of particulate matter would be identified for washing during routine inspections of the lines. Washing operations would consist of spraying insulators with deionized water through high-pressure equipment mounted on a truck.

Temporary or unplanned closure can result from numerous unforeseen circumstances, ranging from natural disaster to economic forces. For a short-term unplanned closure, where there is no facility damage resulting in a hazardous substance release, the facility would be kept "as is", ready to re-start operations when the unplanned closure event is rectified or ceases to restrict operations. If there is a possibility of hazardous substances release, CEOE would follow the emergency plan(s) appropriate to the situation. Depending on the expected duration of the shutdown, chemicals may be drained from the storage tanks and other equipment. All wastes (hazardous and nonhazardous) would be disposed of according to the laws, ordinances, regulations and standards in effect at the time of the closure. Facility security would be retained so that the facility would be secure from trespassers.

The planned economic life of the SSU6 facility would be 30 years. However, if the facility were economically viable at the end of the 30-year operating period, it could continue to operate for a much longer period. As power plant operators continuously maintain the equipment up to industry standards, there is every expectation that the generation facility would have value beyond 30 years. It is also possible that the facility could become economically non-competitive earlier than the planned power plant's 30-year useful life. Decommissioning activities would follow a decommissioning plan that would be developed and submitted to the CEC for review at least 12 months prior to planned facility closure. In case of permanent closure, the facility would be cleaned and components salvaged to the greatest extent possible. Cleaning would consist of removal of scale from piping and equipment walls (primarily brine-handling piping and equipment) and the removal of sludge from the primary and secondary clarifiers, the brine ponds, and the cooling tower basin. All solids would be tested, and those found to be hazardous would be transferred to a permitted Class I landfill. Nonhazardous wastes would be transferred to a permitted Class II or Class III landfill as appropriate for each waste. These solids would be managed and disposed of properly so as not to cause significant environmental or health and safety impacts. Under permanent closure, the wells would be abandoned with proper certification using California Division of Oil, Gas and Geothermal Resources procedures.

Project Avoidance and Minimization Measures

Designated Biologist - Construction site and/or ancillary facilities preparation would not begin until a CEC approved designated biologist is assigned to the project. The designated biologist would perform the following duties: 1) advise CEOE's supervising construction or operations engineer on the implementation of the CEC Biological Resource Conditions of Certification; 2) supervise or conduct mitigation, monitoring and other biological resource compliance efforts, particularly in areas requiring avoidance or containing sensitive biological resources such as waterways and special-status species' habitats; and 3) notify the Service (and the CEC) of any non-compliance with any Condition of Certification.

Worker Environmental Awareness Program - CEOE would develop and implement a Worker Environmental Awareness Program in which each of its own employees, as well as employees of contractors and subcontractors who work on the project site or related facilities during construction and operation, are informed about biological resource sensitivities associated with the project. This program would be developed by the designated biologist and would include: the locations and types of sensitive biological resources on and adjacent to the project site, the reasons for protecting these resources, the purpose of various temporary and permanent habitat protection measures, and whom to contact for further information about the material in the program. The program would include training of CEOE and IID employees to observe the areas under the power transmission lines during the course of their duties to informally monitor for birds that have struck the transmission line.

Construction Area Demarcation - Sensitive resources near construction areas would be identified and clearly marked for avoidance. The construction area boundaries also would be clearly marked to minimize inadvertent degradation or loss of adjacent habitat during facility

construction. All equipment storage would be restricted to designated construction zones or areas that currently are not considered habitat occupied by any species protected under Federal or State law.

Biological Resources Mitigation Implementation and Monitoring Plan - CEOE would submit to the CEC for review and approval a final copy of the Biological Resources Mitigation Implementation and Monitoring Plan (BRMIMP). The BRMIMP would identify: 1) all sensitive biological resources to be impacted, avoided, or mitigated by project construction and operation; 2) all conditions agreed to in any Service Consultation and/or CDFG Consultation conducted for the proposed project; 3) all mitigation, monitoring and compliance conditions included in the CEC's final decision; 4) all conditions agreed to in the ACOE Clean Water Act permit(s); 5) all conditions specified in a CDFG streambed alteration permit, if required; 6) required mitigation measures for each sensitive biological resource; 7) required habitat compensation, including provisions for acquisition, enhancement and management, for any loss of sensitive biological resources; 8) a detailed plan for protecting the existence and monitoring the integrity of wetlands on or near the project site or facilities; 9) a detailed description of measures that will be taken to avoid or mitigate temporary disturbances from construction activities; 10) all locations, on a map of suitable scale, of laydown areas and areas requiring temporary protection and avoidance during construction; 11) aerial photographs of all areas to be disturbed during project construction activities--one set prior to site disturbance and one set subsequent to completion of mitigation measures; 12) monitoring duration for each type of monitoring and a description of monitoring methodologies and frequency; 13) performance standards to be used to help decide if/when proposed mitigation is or is not successful; 14) all remedial measures to be implemented if performance standards are not met; and 15) a process for proposing plan modifications to the CEC and appropriate agencies for review and approval.

Drainage and Erosion - The project would be designed and constructed to prevent spills from endangering adjacent properties and waterways and to prevent runoff from resulting in erosion, siltation, or other adverse water quality impacts to sensitive biological habitats. Best Management Practices for pipeline construction would be implemented to ensure that movement of surface water from upland habitats into the drains is not permanently disrupted. No drains or drain flows are expected to be impacted by the project.

Construction Noise Abatement - A detailed project-specific construction noise assessment would be conducted during final design to determine the most practicable measures to minimize noise impacts from construction at the plant site to occupied listed species breeding habitat. This may include such measures as sound barriers if necessary. Construction activities would need to occur throughout the year, with the exception of Production Well Pads OB-1, OB-2, and OB-3 and their associated pipelines to the plant site along with the associated widening of the access road to Obsidian Butte. Well pads OB-1 and OB-2 and their associated pipelines would be constructed during the non-breeding season between September and February. Pile driving also would be scheduled to occur during the months of September through February, and pile shields would be included to attenuate the noise associated with this activity. Construction of OB-3 would be scheduled based on the outcome of rails surveys. If pre-construction surveys identify

the presence of clapper rails in any area where noise levels will exceed 60 dBA, this well pad and pipeline would be constructed during the non-breeding season between September and February. If practicable, the steam blow process would be scheduled to coincide with the non-breeding season of the Yuma clapper rail. Regardless of scheduling, a silencer will be used to attenuate the noise level associated with the steam blow. CEOE has determined that it is feasible to reduce noise levels in the habitat during steam blows to 78 dBA.

Well Pad Construction Standards - Grading operations would avoid placing fill in sensitive habitat. Well pad cellars would be designed to prevent wildlife entry and entrapment.

Light Shielding - Light from construction or facility operations activities adjacent to sensitive habitat would be shielded downward to prevent side casting of light toward wildlife and sensitive-species habitat.

Wildlife Monitoring - CEOE would implement the above avoidance and minimization measures regarding construction standards, drainage and erosion, and noise abatement. Additionally, CEOE would perform surveys or participate in funding surveys by SBSSNWR personnel (based on ongoing SBSSNWR survey activities) for a three-year period following construction. Additional funding to SBSSNWR would be provided if necessary to facilitate the cooperative monitoring efforts. CEOE and IID would work with the Service, SBSSNWR, CEC, and CDFG to develop a reporting procedure for observations by land owners along the transmission lines of bird strikes or the presence of carcasses that may have resulted from transmission line strikes.

Construction Monitoring - During construction of the power plant facilities and associated well pads and transmission lines, a biologist approved by CDFG and the Service would monitor construction activities near occupied listed species breeding habitat. Noise monitoring at the edge of the project boundaries facing occupied listed species breeding habitat would also be conducted to verify compliance with any applicable noise restrictions. CEOE has determined that their activities should not result in noise levels exceeding 78 dBA in sensitive habitat during the breeding season.

Speed Limit - CEOE has committed to maintaining speeds at or below 15 miles per hour (MPH) on unpaved roads at the project site and on McKendry Road. In addition, CEOE would maintain speeds at 15 MPH or below on McKendry Road west of Boyle Road and Lack Road between Kuns and Lindsey Roads for its operation activities even if they are paved at some future date. The segment of Lack Road adjacent to the pond at Lack and Lindsey Roads (Lack Road between Kuns and Lindsey Roads) would not be used for the project's construction or regular maintenance by CEOE or IID vehicles at night or when winds exceed 15 MPH to prevent flushing roosting pelicans during conditions when they would have difficulty avoiding the transmission line.

Re-vegetation - Exotic species would be precluded from becoming established through implementation of post-construction monitoring and control (spray) program. Every three years for a period of nine years following construction CEOE would evaluate the need for control of

exotic plants in areas disturbed by construction of the plant and its associated facilities. In addition, the CEC has asked that CEOE plant trees along McKendry Road to improve the appearance of the plant when viewing from the Rock Hill Trail at SBSSNWR. CEOE has identified palo verde (*Cercidium floridum*) and mesquite (*Prosopis glandulosa* and *P. pubescens*) as potential choices for this landscaping. These are native species.

Burrowing Owl Program - CEOE would comply with all of the Conditions of Certification issued by the CEC relating to the burrowing owl, a California species of concern.

Trench Covers and Inspection - To prevent entrapment of wildlife species during the construction phase of the project, all excavated, steep-walled holes or trenches more than 2 feet deep would either be covered at the close of each working day by plywood or provided with one or more escape ramps constructed of earth fill or wooden planks. The ramps would be located at no greater than 1,000-foot intervals and would be sloped less than 45 degrees. Each morning before the start of construction and before such holes or trenches are filled, they would be thoroughly inspected for trapped animals. Any animals so discovered would be allowed to escape voluntarily (by escape ramps or temporary structures), without harassment, before construction activities resume, or removed from the trench or hole by a qualified biologist and allowed to escape unimpeded.

Bird Flight Diverter Installation – The locations of the bird flight diverters were determined originally based on the flyover survey data (Figure 5.5-3). In locations where the number of birds flying perpendicular to the proposed line exceeded 30 individuals, bird flight diverters would be installed. These locations are as follows: OBFLY1, 02, 06, 09, 10, 14, 17, and D24 (Figure 5.5-3). All of the transmission line that is located within 1 mile of the Salton Sea would have bird flight diverters installed regardless of the results of the flyover surveys. Upon further review of the need for avoidance measures for California brown pelicans, IID extended the length of the transmission line that would be marked from the proposal described above to the entire length between M10 and L13 (Figure 5.5-3). The bird flight diverters would be a minimum of 10 cm in diameter and would be placed on the ground wire at 5 m intervals (APLIC 1994) or would be of similar specifications that provide for a comparable reduction in bird strikes along those segments of the lines (M10-L13). The bird flight diverters would be maintained and replaced as needed. The transmission line does not run adjacent and parallel to the Salton Sea shoreline or other occupied habitat for listed species (of particular concern is the pond at Lack and Lindsey Roads). The configuration of the line is such that the point of closest approach to the Salton Sea and the pond at Lack and Lindsey Roads is where the line makes a 90° turn from Lindsey Road to the south along Lack Road. At that point the line is approximately 150 feet from the pond.

Firearms - CEOE would prohibit firearms on the site except those carried by security personnel.

Pets - CEOE would prohibit pets from the project site.

Maintenance - Shut-down maintenance of the wells at well pad OB-3 and other planned maintenance activities would be scheduled to occur outside the shorebird breeding season

(March through July). Regular transmission line maintenance within 1 mile of the intersection of Lack and Lindsey Roads would not be conducted at night or when wind speeds exceed 15 MPH.

Habitat Creation/Enhancement - Impacts to approximately 0.05 acres of Yuma clapper rail habitat would be offset by replacing habitat losses at an alternate location, possibly including enhancement of an existing wetland potentially used by clapper rail within the project vicinity. This would involve creation/enhancement of approximately 0.8 acres of habitat including open water, brackish marsh, and agricultural land. The sites currently being considered include agricultural land adjacent to a drain. Such sites would provide the opportunity to expand the aquatic habitat by re-contouring the land. This would allow for the development of vegetation that would provide the same habitat functions as the area being impacted by the project. The enhancement may also include the removal of exotic vegetation in an effort to encourage the growth of plant species preferred by Yuma clapper rails. CEOE would purchase the land or a conservation easement on the land and provide an endowment to fund management of the land to achieve the targeted functions and values. CEOE would obtain approval from the ACOE and the Service before the easement or fee title is purchased because the land must be consistent with the regional conservation strategy and must provide habitat for the species impacted by the project.

Spill Prevention and Response: The measures incorporated into the project to address spill prevention include double-walled pipe over the wetlands along McKendry Road and three sets of valves to provide for closure of that pipeline. Ths system is expected to provide for containment of a pipeline failure within approximately 50 seconds including the operator response. The volume that would be released from the inner pipeline would be 2,100 gallons, and this is within the containment volume of 9,680 gallons provided by the outer pipeline. The project calls for barriers along the pipelines to prevent leaks/sprays from entering sensitive habitat during pressurization and testing of the lines. Given the frequency of inspection activities, a leak would be discovered in 12 hours or less. If a spray were discovered as a result of a leak, poles and sheet plastic could be used to stop the sprays from entering sensitive habitat until the leak was secured. However, under most circumstances this would not be necessary as leaks are expected to occur on the underside of the pipelines and would not be expected to spray into sensitive habitat. The frequency of such events should be reduced by concrete lining in the pipelines, current pipeline handling strategies that provide for a slow warm up of the pipelines thus reducing internal damage, and the regular inspection of the pipelines that will identify areas where thinning of the lining has occurred. Soil that is affected by a spill would be removed and disposed of according to the appropriate laws and regulations. Vegetation would be removed and disposed of appropriately, or the vegetation could be washed and the run-off collected if the spill/spray had entered a sensitive area. The plant site is surrounded by berms so spills occurring within the plant itself would not be expected to leave the site.

STATUS OF THE SPECIES

Yuma Clapper Rail

The Yuma clapper rail is the size of a crow, with long, gray-brown legs and toes. The orange bill is long, thin, and slightly down-curved. The head, neck, and breast are gray-brown, and the back feathers are darker brown with gray centers. Both the flanks and the undertail covert feathers are distinctly marked with alternate black and white bars. Males and females are similar in plumage coloration. Compared with the other dozen or so described subspecies, its plumage is less richly colored (paler, with more olive and gray tones) and its bill more slender (Dickey 1923). The body is laterally compressed, the tail and wings are noticeably short, and legs are large and strong, all adaptations that allow birds to run through dense weeds or swim underwater to avoid danger.

Yuma clapper rail habitat is characterized by cattail (*Typha*), bulrush or tule (*Scirpus*) stands, and shallow, slow-moving water near high ground. Cattail and bulrush stands are often dissected by narrow channels of flowing water that may be covered by downed vegetation. These open channels are important for foraging. Rails commonly use areas with low stem densities and little residual vegetation. They are also found in the ecotone between emergent vegetation and higher ground, such as the shoreline, channel edge, levee, or hummocks in a marsh. In studies conducted along the lower Colorado River, rails were found to use areas far from a vegetative edge during early winter (Conway *et al.* 1993). The depth of water used by clapper rails also varied with season, with shallower water used during the breeding season, and water of moderate depth used during the winter. Although clapper rails are often found in larger stands of vegetation, they have also been found to use patches of habitat within agricultural drains (Bennett and Ohmart 1978, Hurlbert *et al.* 1997).

The Yuma clapper rail has a diverse diet. It has been documented to feed on a variety of invertebrates and some vegetation. Included in its diet are crayfish, fresh water prawns, weevils, isopods, clams, water beetles, leeches, damselfly nymphs, small fish, tadpoles, seeds, and twigs. Based on the available information, crayfish of the genera *Procambarus* and *Oropectus* appear to make up the majority of its food intake along the Colorado River (Ohmart and Tomlinson 1977). Similar crustaceans are taken at the Salton Sea, and the abundance of these animals may be a better predictor of rail population densities than vegetation (Anderson and Ohmart 1985; Patten *et al.* 2003). Reported rail densities vary widely. Bennett and Ohmart (1978) reported rail densities in the Imperial Valley of 0.9 to 6.3 rails/10 hectares (3.9 to 27.4 acres/rail). Todd (1986) reported range size in Mittry Lake averaged 2.5 acres/rail (5.0 acres/pair). In that same study Todd determined that the range size along the Gila River was 0.3 to 9.0 acres. Anderson and Ohmart (1985) reported a home range size of 18.5 acres/pair.

The Yuma clapper rail is one of seven clapper rail (*Rallus longirostris*) subspecies presently recognized in the western United States and the Pacific Coast of Mexico (American Ornithologists Union 1957), and it is one of three subspecies of federally endangered western clapper rail populations. It occurs primarily in the lower Colorado River Valley in California,

Arizona, and Mexico and is a fairly common summer resident from Topock south to Yuma in the U.S. and at the Colorado River Delta in Mexico. There are also populations of this subspecies at the Salton Sea in California, and along the Gila and Salt Rivers to Picacho Reservoir and Blue Point in central Arizona (Rosenberg *et al.* 1991). In recent years, individual clapper rails have been heard at Laughlin Bay and Las Vegas Wash in southern Nevada (NDOW 1998). Population centers for this subspecies include Imperial Wildlife Management Area (Wister Unit), SBSSNWR, Imperial NWR, Cibola NWR, Mittry Lake, West Pond, Bill Williams Delta, Topock Gorge, and Topock Marsh. The USFWS (1983a) estimated a total of 1,700 to 2,000 individuals throughout the range of the subspecies. Between 1990 and 1999, call counts conducted throughout the subspecies range in the U.S. have recorded 600 to 1,000 individuals. In 1985, Anderson and Ohmart (1985) estimated a population size of 750 birds along the Colorado River north of the international boundary. Based on the call count surveys, the population of Yuma clapper rails in the U.S. appears stable (USFWS unpublished data). The range of the Yuma clapper rail has been expanding over the past 25 years, and the population may be increasing (Ohmart and Smith 1973; Monson and Phillips 1981; Rosenberg *et al.* 1991; McKernan and Braden 1999). A recent genetic analysis showed that this subspecies is outbred; population numbers of the Yuma clapper rail have not become low enough to reduce genetic diversity (Bureau of Land Management 2001).

A substantial population of Yuma clapper rails exists in the Colorado River Delta in Mexico. Eddleman (1989) estimated that 450 to 970 rails inhabited this area in 1987. Piest and Campoy (1998) reported a total of 240 birds responding to taped calls in the Cienaga de Santa Clara region of the Delta. They estimated a population of over 6,000 based on the size of the entire area and the fact that up to 40 percent of the birds may not respond in call surveys (Piest and Campoy 1998). An estimate of 3,420 individuals was developed for the Cienaga de Santa Clara based on an extrapolation from call counts in 2003 (Hinojosa-Huerta *et al.* 2003).

The Yuma clapper rail begins breeding activities in February with males calling to attract mates (Eddleman and Conway 1998). Most pairs are involved with nesting activities by the end of February (Courtney Conway, U.S. Geological Survey, pers. comm.). Egg-laying occurs from March to July (with the peak in May) in marshes along the Colorado River from the Nevada/California border south to the Colorado River Delta region in Mexico. The peak in spring vocalization occurs from late February to mid-July, and most calling occurs in the evening and early morning hours with the latter being the shorter of the two calling periods (Eddleman and Conway 1998). Chicks generally fledge by early September (Eddleman and Conway 1998), with the peak in chick rearing in June and July. The peak in autumn vocalization occurs from mid-July to mid-October. It builds its nest on a raised platform of vegetation concealed in dense marsh vegetation (Patten *et al.* 2003). Males may build multiple nests, and the female chooses one for egg-laying. Alternate nests are used as platforms for loafing, preening, and as brood platforms (Eddleman and Conway 1998). Clapper rails have a broad range of vocalizations, and most vocalizations occur during the early morning and in the evening hours. Their vocalizations serve a variety of functions including attracting mates, establishing locations of the members of a pair, indicating alarm, and keeping a brood together (Eddleman and Conway 1998).

Populations of this species occur in the Palo Verde and Imperial valleys. This subspecies is partially migratory, with many birds wintering in brackish marshes along the Gulf of California but some remain on their breeding grounds throughout the year (BLM 2001). Yuma clapper rails are found around the Salton Sea, and in agricultural drains and canals that support marsh vegetation (i.e., cattail, giant bulrush, alkali bulrush, and common reed). This subspecies breeds only in the lower Colorado River Valley and in the Salton Sink, the latter area holding about 40% of the United States population (Setmire *et al.* 1990). The breeding site for the largest population of the Yuma clapper rail in the United States is at the Wister unit of the CDFG Imperial Wildlife Area, near the Salton Sea. The sea's elevation is important to the Yuma clapper rail (USDOI 1998) as clapper rails use shallow freshwater habitat that has formed at the mouths of many of the inflows to the Salton Sea. Yuma clapper rails avoid deeper water because it increases juvenile mortality (CDFG 1990).

The Yuma clapper rail apparently expanded its range in the early 1900's in response to changes in the vegetation along the Colorado River. Damming and associated changes in hydrology induced vegetation changes in some areas that favored rails. At the same time, damming and diversion of the Colorado River reduced the amount of water flowing into the Colorado River Delta, and reduced the availability of rail habitats in the Delta. Approximately two-thirds of the formerly extensive marshlands of the Delta disappeared following completion of Hoover Dam (Sykes 1937).

Yuma clapper rail habitat has been further affected by channelization, fill, dredging projects, bank stabilization, and water management practices along the Colorado River. Three Fingers Lake and Davis Lake were lost as Yuma clapper rail habitat from river channelization (USFWS 1983a), but these lakes recently may have been reconnected to the river (Leslie Fitzpatrick, Arizona Fish and Wildlife Office, pers. comm.). Cibola Lake experienced marsh destruction when channelization work was completed for that stretch of the river, but it has been subject to ongoing restoration efforts (Lesley Fitzpatrick, Arizona Fish and Wildlife Office, pers. comm.). Rail habitat has also been adversely affected by the spread of salt cedar (*Tamarix ramosissima*). Salt cedar consumes an unusually high amount of water, which results in reduced wetland areas for vegetation preferred by the rail.

Another threat to the Yuma clapper rail is environmental contamination due to selenium. High selenium levels have been documented in crayfish, a primary prey of clapper rails, and some adult birds and eggs. Other threats to the Yuma clapper rail include mosquito abatement activities, agricultural activities, development, and the displacement of native habitats by exotic vegetation (CDFG 1991). The population of Yuma clapper rails at the Cienega de Santa Clara is threatened by the loss of the source of water that maintains the wetland habitat.

On March 11, 1967, the Service determined the Yuma clapper rail to be an endangered species (32 FR 4001, USFWS 1967). The State of California added the bird to its list of rare wildlife in May of 1971 and later listed it as threatened on February 22, 1978 (USFWS 1983a). It is also fully protected under State law [California Fish and Game Code, section 3511(b)(13)]. The Yuma Clapper Rail Recovery Plan (USFWS 1983a) provides background information on the

species and identifies new or ongoing tasks necessary to achieve recovery of this species. This includes the long-term preservation of habitat in breeding and wintering areas of the United States and Mexico, and maintenance of suitable flows throughout the lower Colorado River. Many of the currently occupied breeding sites in the United States are on State and Federal lands that are protected and managed for wildlife. However, adequate water supplies are needed to assure the long-term availability of this habitat. Wintering areas and needs are not well known and require further study before habitat preservation needs can be determined. Many of the Mexican breeding sites are located in the Colorado River Delta area and require adequate flows in the lower Colorado River for long-term use by Yuma clapper rails.

California Brown Pelican

Brown pelicans (*Pelicanus occidentalis*) are recognized by their large size, impressive wingspan (up to 2 meters), short legs, distinctive long, hooked bill, and flexible lower mandible from which the highly expandable gular pouch is suspended. Six subspecies of brown pelicans have been described where the geographic variation in size is the primary distinguishing feature (Wetmore 1945). Unlike other brown pelican subspecies, the California brown pelican typically has a bright red gular pouch (the basal portion) that contrasts with its dark neck and is most visible during the courtship and egg-laying period (USFWS 1983b).

The California brown pelican is found in marine habitats which range from the open ocean to inshore waters, estuaries, bays, and harbors. Pelicans commonly use undisturbed beaches, breakwaters, and jetties near coastal bays as roosting areas and forage nearby. They breed on specific offshore islands of southern California and northwestern Baja California, Mexico. Nesting colonies can be found on the Channel Islands, the Coronado Islands, and on the islands in the Gulf of California (Garrett and Dunn 1981). Brown pelicans are colonial nesters, and breeding is typically initiated in late December or early January. The nest is a small mound of sticks or debris on rocky, or low, brushy slopes of undisturbed islands (Cogswell 1977), usually on the ground and less often on bushes (Palmer 1962). After breeding, they begin migrating as early as mid-May. Individuals leave colonies in the Channel Islands and in Mexico and disperse along the entire California coast. During the nesting season, they generally stay within 20 kilometers of nesting islands (Briggs *et al.* 1981). Brown pelicans lay eggs from March to April, but records have indicated egg laying even as late as June (Palmer 1962). Clutch size is usually 3 eggs, sometimes 2 with a single brood each year. Incubation lasts about 4 weeks. Young are altricial and cared for by both parents, but they fledge at about 9 weeks. Brown pelicans first breed at about 3-5 years of age.

Brown pelicans are diurnal and active throughout the year. In California brown pelicans feed primarily on northern anchovy, Pacific sardine, and Pacific mackerel (Thelander and Crabtree 1994). Brown pelicans generally forage in early morning or late afternoon, or when the tide is rising. They have been observed to forage at night, but usually when the moon is full (Jaques 1994). They feed almost entirely on fish, caught by diving from 6-12 meters in the air, and occasionally from up to 12 meters. They may completely or partially submerge, and water may be shallow or deep. Occasionally brown pelicans will feed on crustaceans, carrion, and young of

its own species (Palmer 1962). They usually rest on water or inaccessible rocks (either offshore or on mainland), but will also use mudflats, sandy beaches, wharfs, and jetties. They do not roost overnight on water, rather they concentrate at a few traditional roosts on the mainland or islands (Briggs *et al.* 1981). They cannot remain on the water for more than one hour without becoming water-logged, and they require undisturbed roosts where they can dry and maintain their plumage during the day and at night (Schreiber and Schreiber 1982). Schreiber and Schreiber (1982) identified the need for this species to have year round access to undisturbed loafing and roosting sites in proximity to foraging areas. This need was reinforced in the Recovery Plan for this species (USFWS 1983b) that identified roosting and loafing areas as essential habitat.

The current breeding distribution of the California brown pelican ranges from the Channel Islands off southern California southward (including the Baja California coast and the Gulf of California) to Isla Isabella, and Islas Tres Marias off Nayarit, Mexico, and Isla Ixtapa off Guerrero, Mexico. About 45,000 pairs nest on Mexico's west coast (Ehrlich *et al.* 1992) including approximately 35,000 pairs in the Gulf of California (David Pereksta, Ventura Fish and Wildlife Office, pers. comm.), and this population is considered stable at this time (Dan Anderson, University of California at Davis, pers, comm.). Between breeding seasons, brown pelicans may range as far north as Vancouver Island, British Columbia and south to Central America. As plunge divers, they require relatively clear water to visually locate their prey from on the wing. The largest numbers of brown pelicans (most of which derive from Mexican colonies) appear in California during late summer and fall. Year-to-year post-breeding dispersal patterns of brown pelicans are, however, largely determined by the oceanographic conditions which influence anchovy availability.

The brown pelican is a common post-breeding visitor to the Salton Sea, with numbers steadily increasing over the past decades from the first records beginning in the early 1950s (Patten *et al.* 2003). This species does not occur elsewhere inland in such numbers or with such regularity. In fact, the brown pelican colony closest to the Salton Sea is about 220 miles away, on San Luis Island in the Gulf of California (IID 1994). The Salton Sea currently supports a year-round population of brown pelicans, where during the past few years single-day counts have sometimes exceeded 3,000 individuals (Patten *et al.* 2003). Records indicate that a brown pelican nested successfully in 1996 at the Salton Sea (the first nesting of a California brown pelican on an inland lake) and exhibited nesting activity in 1997 and 1998 (Charlie Pelizza, SBSSNWR, pers. comm.). Because brown pelicans are associated with large open water bodies, habitat for brown pelicans in the proposed project area principally occurs at the Salton Sea where fish populations provide foraging opportunities for brown pelicans. This species occurs almost anywhere along the shoreline of the Salton Sea, most often around rock outcrops and embankments. From June through September they can be found at least occasionally on virtually every body of water in the Imperial Valley (Patten *et al.* 2003). In addition to the Salton Sea, brown pelicans are known to forage at Finney Lake in the Imperial Wildlife Area (U.S. Army Corps of Engineers 1996).

Juvenile brown pelicans tend to disperse the farthest from their natal site than any other age class and prefer estuaries over open coastal areas. As birds reach sexual maturity (3-5 years), it has been suggested that the birds return back to their natal site and rarely settle at another colony.

Thus, birds that now use the Salton Sea are more likely to stay in the Gulf of California once the Salton Sea is no longer a viable source of fish. However, band returns indicate that brown pelicans are capable of moving from the southern California coast to the Salton Sea. Adults may also use specific wintering areas rather than disperse like the juveniles.

Brown pelicans declined greatly in the mid-20th century because of human persecution and disturbance of nesting colonies. This species has also experienced widespread pollutant-related reproductive failures during the late 1960's and early 1970's due to the use of DDT and the resultant egg-shell thinning. Because of these declines, the brown pelican was classified as endangered by the Service on October 13, 1970 (35 FR [2] 16047, USFWS 1970). This species is listed as endangered by the State of California and is a fully protected species under State law [California Fish and Game Code, section 3511(b)(2)]. As of the 1990's, the ecological effects of DDT contamination still had not been entirely eliminated within the Southern California Bight, and incidences of eggshell thinning do occur but at a greatly reduced frequency as compared to the early 1970's. Acute contamination of the Southern California Bight water mass by DDT compounds has thus been replaced by low-level, chronic contamination. Complete recovery of the brown pelican reproductive rates from past pesticide contaminations may still be years away as DDT and its known breakdown product DDE are quite persistent in the environment. Although its use is banned in the United States (Bennett 1996), it is still present in the Imperial Valley and Salton Sea which can affect the brown pelican's reproductive success as a result of bioaccumulation of DDE from foraging at the Salton Sea during the non-breeding season (USFWS 1996).

Brown pelicans also have been impacted by disturbance of their nesting colonies by fishing and recreational activities, particularly in the Southern California Bight (David Pereksta, Ventura Fish and Wildlife Office, pers. comm.). Better regulation of human access (particularly at the Los Coronados Islands colony) and exotic predators would likely increase the nesting success of brown pelicans in these colonies by reducing the rate of nest abandonment.

Brown pelicans in the Southern California Bight rely largely on schooling fish species such as anchovy and sardine (USFWS 1983b). This species would benefit from tighter controls over commercial fishing of these species, particularly in the vicinity of the breeding colonies. Impacts of commercial fishing can be magnified in years with the "El Niño Southern Oscillation" when warm currents drive fish schools north of the breeding colonies. Prey availability may be limiting the productivity of the Southern California Bight colonies; the reproductive rates have been relatively constant and below recovery targets for several years (Frank Gress, University of California at Davis, pers. comm.).

ENVIRONMENTAL BASELINE

Yuma Clapper Rail

In California this species nests along the lower Colorado River, in wetlands along the Coachella Canal, in managed wetlands in the Imperial Valley, at the upper end of the Salton Sea in the

Whitewater River delta, and at Salt Creek (NatureServe 2001). Hydroelectric dams along the Colorado River have apparently increased the amount of marsh habitat, and population numbers of the Yuma clapper rail may have increased expanding the range northward in response to the increase in available habitat (BLM 2001). Also, habitat was expanded through the creation of the Salton Sea in the early 1900s. The population along the lower Colorado River was estimated in the 1980s at 550-750 in the U.S. and 200 in Mexico (NatureServe 2001). The action area essentially covers half the U.S. range of the species.

In the proposed project area, the principal concentrations of Yuma clapper rails are at the south end of the Salton Sea near the New and Alamo River mouths, at the SBSSNWR, at the Wister Unit of the Imperial Wildlife Management Area, and at Finney Lake in the Imperial Wildlife Management Area. As many of these areas occur on State reserve or NWR lands, these State and Federal properties will continue to have a major role in the long-term conservation of this species. Continued access to adequate water to maintain these habitats will be a key factor in the long-term management of the Yuma clapper rail.

Between 1995 and 2002, an average of 306 rails have been counted around the Salton Sea, and an average of 276 were counted in the same period along the lower Colorado River corridor (USFWS, unpublished data). The Imperial Valley population represents an estimated 42 percent of the entire U.S. population of this species (Point Reyes Bird Observatory 1999; USFWS 1999; Lesley Fitzpatrick, Arizona Fish and Wildlife Office, pers. comm.). Despite representing a sizeable proportion of the subspecies' population, overall numbers at the Salton Sea are modest (Patten *et al.* 2003). For example, only 279 were located during extensive surveys in 1999 (Shuford *et al.* 2000). Principal regional sites are the Wister Unit of the Imperial Wildlife Area, Unit 1 of the SBSSNWR, and adjacent marshes around the New River. Yuma clapper rails have been found outside these refuge areas also. Between 1995 and 2002, a range of 3 to 42 (average of 20) clapper rails were counted outside the refuges (USFWS unpublished data). This includes the Trifolium 1 and Holtville Main irrigation drains (Steve Johnson, SBSSNWR, pers comm.; Hurlbert *et al.* 1997). A maximum count in the Holtville Main drain at one time was 5 pairs and 2 individuals (USFWS unpublished data). This particular drain is unusual for its length (17.8 miles) and extent of vegetation (Hurlbert *et al.*, 1997), and it may be more likely than most drains in the system to provide habitat for Yuma clapper rails given those characteristics. In 1994, 2 pairs and 2 single rails were heard calling in the Bruchard drain during breeding season surveys (Ken Sturm, SBSSNWR, pers. comm.).

In 2003, Yuma clapper rail numbers were higher for the Imperial Valley. The total count for the Wister Unit was 293 birds, and the total count in and around the SBSSNWR was 155. Fewer birds were counted off the refuge lands in part as a result of reduced survey efforts in those areas. Including these newest figures, the average number of Yuma clapper rails in the Imperial Valley (1995-2003) is 322 birds. Based on these latest numbers, the Imperial Valley population comprises approximately half of the Yuma clapper rails in the United States (Lesley Fitzpatrick, Arizona Fish and Wildlife Office, pers. comm.).

California Brown Pelican

Food availability, disturbance, and oceanic pollution currently appear to be the major limiting factors to populations of California brown pelicans (USFWS 1983b). Potential threats related to these limiting factors include commercial fisheries, oil development, recreational fisheries, sonic booms and increased tourism (USFWS 1983b). Most North American populations of this species were extirpated by 1970. Since the banning of DDT and other organochlorine use in the early 1970s, brown pelicans have made a strong recovery and are now fairly common and perhaps still increasing on the southeast and west coasts (Kaufmann 1996). The endangered Southern California Bight population of the brown pelican grew to 7,200 breeding pairs by 1987, but has experienced considerable population fluctuations in recent years and has not been considered sufficiently stable for delisting (CDFG 1992). In 1992 there were an estimated 6,000 pairs in Southern California. Future restoration efforts (currently being planned) to reduce the existing DDT contamination in the Southern California Bight would be beneficial to this breeding population.

The Salton Sea is part of the Colorado River Delta, and the brown pelicans at the Sea are most likely affiliated with the breeding colonies in the Gulf of California. Brown pelicans probably had little historical use of the Salton Sea (Anderson 1993), although the Salton Sea may have recently taken on greater importance for these birds as a result of the degradation of habitat in the Delta. Some visiting postbreeding pelicans were documented at the Salton Sea in the late 1970s, but overwintering was not confirmed until 1987. Use of the Salton Sea by brown pelicans subsequently increased. Now use is largely seasonal, typically numbering 1,000 to 2,000 birds, with peak numbers ranging from 4,000 to 5,000 birds in the late summer/early fall (Charlie Pelizza, SBSSNWR, pers. comm.). The age structure also varies seasonally among brown pelicans at the Salton Sea where adults dominate in the spring, juveniles arrive in the summer, and adults return in the late summer/early fall. Based on behavioral observations, the brown pelicans using the Salton Sea may come from a single breeding colony in the northern Gulf of California (Dan Anderson, University of California at Davis, pers. comm.). If these birds have become dependent on the Salton Sea to supplement their non-breeding forage requirements, the impacts of the loss of access to the Sea may have a greater impact than if the effects were spread throughout the Gulf of California population as a whole.

Brown pelicans at the Salton Sea roost predominantly at Obsidian Butte, Mullet Island, and the sand bars associated with the three river mouths (Charlie Pelizza, SBSSNWR, pers. comm.). Other areas are used in low numbers (e.g., the break waters along the south end of the Salton Sea), but these areas are subject to various human activities (e.g., vehicle use and fishing) and thus are not consistently available. The high use areas are currently surrounded completely or largely by shallow water, and they may be lost as functional roosts due to greater accessibility to terrestrial species as the Salton Sea recedes. Pelicans recently have been observed using the Imperial wetlands pilot project. Fish have been stocked in the ponds, and pelicans have used the baffle across one of the sediment ponds as a day roost.

The brown pelican was first found to nest successfully at the Salton Sea in 1996 with 3 nests resulting in nine fledglings. Although pairs attempted to nest in 1997, five nests were unsuccessful due to flooding. An undocumented number of nesting attempts were observed in 1998, but no successful nests were established. No nesting activity has been recorded since 1998 (Charlie Pelizza, SBSSNWR, pers. comm.).

Brown pelicans have experienced losses at the Salton Sea as a result of annual outbreaks of avian botulism since 1996 (USFWS unpublished data). The greatest losses occurred in 1996 with a total of 2,034 brown pelicans affected by the botulism event. The losses have been less since that 1996 event, with numbers of brown pelicans affected ranging from 274 to 1,311. Given the increased effort to identify and rehabilitate sick birds, the number of mortalities relative to the total number of pelicans affected has decreased overall since the 1996 event. The cause of these annual outbreaks has not been determined conclusively, but the Salton Sea's highly eutrophic condition may be a contributing factor.

EFFECTS OF THE ACTION

Yuma Clapper Rail

The CEC staff proposed baseline and construction monitoring as part of the recommended conditions for certification. Because the protocol for surveying this species requires the use of taped calls, there would be some harassment of Yuma clapper rails associated with this activity. Up to 17 rails have been found in the vicinity of project facilities, although more moderate numbers (four to eight birds at Union and McKendry Ponds) have been found in recent years and would be subject survey disturbances.

The construction of the SSU6 plant site could result in impacts to the Yuma clapper rail through general construction activities, pile driving for the steam turbine foundation, and the steam blow to clean the pipelines prior to start up of the plant. Peak construction activity is scheduled to occur from November 2004 through January 2006. This would overlap with the breeding season for rails in 2005. Average noise levels at the edge of the nearest clapper rail habitat associated with the construction activities are up to 89 dBA for grading and excavation work, 83 dBA for plant construction and pile driving, and 107 dBA for the steam blow required to clean the pipes to the turbine. Sound attenuation methods have been incorporated for the pile driving (shielding is expected to reduce noise levels in rail habitat by 15 to 18 dBA) and the steam blow (the silencer is expected to reduce noise levels in the habitat by 40 dBA). The raised structure of McKendry Road may provide for additional sound attenuation of 5 to 10 dBA for activities occurring at ground level. Although other specific measures have not been identified (this will occur as part of the noise study conducted during the design phase), CEOE has committed to reducing maximum sound levels (known as L_{max}) in Yuma clapper rail habitat to 78 dBA during the breeding season.

Limited information is available on the effects of noise to clapper rails. More work has investigated the impacts of noise in Passerine species such as the California gnatcatcher

(*Polioptila californica*) and the least Bell's vireo (*Vireo bellii pusillus*). The criterion frequently considered for these species relative to noise impacts is 60 dBA L_{eq} hourly (L_{eq} is the continuous noise level over a specified time interval (one hour in this case) that is equivalent to the average A-weighted noise energy associated with a varying sound at that level). This criterion is based on the noise level required to mask bird communication in a laboratory setting (Sarigul-Klijn *et al.* 1997). Vocalization rates were found to be depressed in least Bell's vireos at noise levels above 60 dBA L_{eq} (Mock and Travares 1997), and Awbry and Hunsaker (1997) found a negative relationship between noise levels and the number of eggs laid by California gnatcatchers. Gnatcatchers were capable of breeding successfully at higher noise levels, however. Fletcher (1971) determined that a noise level of 85 dB was adequate to scare birds. This could result in birds being flushed from the nest, potentially exposing eggs to predators or temperature extremes. While Sarigul-Klijn *et al.* (1997) did identify 60 dBA L_{eq} as a reasonable starting point for a criterion, they discussed the need for more refinement of this criterion including study of a wider array of bird species.

Some anecdotal evidence indicates that clapper rails can be fairly tolerant of certain types of noise. California clapper rails have been known to nest in areas with regular noise and disturbance in several areas of San Francisco Bay (CEOE 2003). Light-footed clapper rails occur in Tijuana Slough in fairly close proximity to a landing field used by the U.S. Navy for practice helicopter landings and take-offs (U.S. Department of the Navy 2002), although sound level measurements have not been taken in clapper rail habitat. Given that the construction activities are scheduled to begin outside the breeding season, the rails will have the opportunity to habituate to the noise or move elsewhere prior to the start of nesting. Yuma clapper rails have been found to tolerate increases in noise levels in cases where the background level of noise and disturbance was somewhat elevated (Lesley Fitzpatrick, Arizona Fish and Wildlife Office, pers. comm.). These areas are adjacent to fields that are farmed for waterfowl forage and commercial crops, and they are subjected to the noise associated with farming equipment. This may be adequate to provide for habituation of these individuals to increasing levels of noise. If so, we would not expect abandonment of these areas to occur as a result of the project. If not, some or all the rails using the area may move away from the vicinity of the project as a result of the disturbance associated with construction activities. Up to 15 birds have been found in Union Pond, although more moderate numbers (2-6) have used the area since 2000 (SBSSNWR, unpubl. data). Two Yuma clapper rails were confirmed in McKendry Pond in 1999, and two rails were observed during project surveys in this area in 2001 (URS 2002). We do not have adequate information to determine if rails would abandon habitat near the project site prior to the 2005 breeding season, but this may occur if the individuals are unable to find suitable environmental conditions within the habitat.

Pile driving would be scheduled to occur during the months of September through February. In addition to the average noise levels of up to 83 dBA that would occur in rail habitat, induced ground vibrations also could disturb rails in the project vicinity. Given the distances involved, rails using McKendry Pond would be most affected by construction-related vibration. Union Pond is at a distance of greater than 1,500 feet from any pile driving activity. Vibration levels at Union Pond would fall below the level considered acceptable for residences. No thresholds have

been established for vibration impacts to wildlife. Because pile driving would be scheduled to occur from September through February, no abandonment of eggs or chicks would be expected to occur. Non-breeding rails may move out of and be precluded from breeding in the area affected by the project as a result of the disturbance. We do not have evidence to indicate that breeding habitat for Yuma clapper rails is limiting in the Salton Sink to the extent that rails that move from the project area would be precluded from breeding elsewhere.

Operation of the power generation facilities are not expected to impact the Yuma clapper rail as a result of the presence of the brine ponds, detention ponds, lighting on the plant, landscaping, and spills. The brine ponds and detention pond are not expected to have vegetative cover that would attract rails; therefore, rails likely would not be attracted to these ponds and be exposed to contaminants. Lighting on the plant would be the minimum necessary and would be shielded and directed towards plant facilities. This is not expected to impact rails as the habitat would not be lit be these lights; thus, the risk of predation would not increase, and rails likely would not become disoriented by the minimal amount of lighting on the plant. Landscaping is expected to be included along the north side of the plant. CEOE is planning to use native upland species such as palo verde and mesquite. We do not anticipate that the presence of these species would offer increased opportunities for raptor perching such that impacts to Yuma clapper rails would occur. Because of the spill containment offered by the berm around the plant's perimeter, we do not anticipate that brine spills at the plant would impact Yuma clapper rails.

Production well construction may result in impacts to the Yuma clapper rail through grading, drilling, and pile driving (in the case of OB-3) that generate high levels of noise. There would also be a loss of 0.05 acres of potential Yuma clapper rail habitat as a result of the widening of McKendry Road for the OB-3 well pad construction activities. The average noise level associated with these activities is expected to be on the order of 70 dBA at McKendry Pond and Union Pond as a result of the activities associated with drilling the wells at OB-2 and OB-1, respectively. However, these activities are scheduled to occur largely outside the clapper rail breeding season. Some anecdotal evidence suggests that the Yuma clapper rails may not be impacted by these activities. SBSSNWR staff recently observed rail numbers to increase in Hazard 6 Pond despite the fact that a nearby well was being re-drilled. This suggests that the activity would not preclude their use of habitat. The loss of habitat along McKendry Road would be offset by the creation of Yuma clapper rail habitat in the vicinity of the SBSSNWR. Because the habitat would be impacted outside of the breeding season, we do not anticipate that nest abandonment or destruction would occur, but individual birds may move out, making the area unavailable for foraging as a result of the construction activities. Two sightings of Yuma clapper rails occurred during surveys in the area that would be impacted by the road widening and pipeline placement.

Production well operation and maintenance includes such activities as visual inspections, coil cleaning, and re-drilling of wells. Routine visual inspections are not expected to impact Yuma clapper rails. However, these inspections would increase greatly the number of vehicle trips occurring in areas where clapper rail movement along the habitat edges has been observed. Given that CEOE has committed to a speed limit of 15 miles per hour on all unpaved roads used

for project activities, plant personnel should be able to avoid hitting Yuma clapper rails with their vehicles. CEOE has agreed to maintain this speed limit on McKendry Road even if it is paved, and this speed limit should prevent Yuma clapper rails from being hit in the vicinity of McKendry Pond and the Vail 5 drain. Coil cleaning would be scheduled to occur outside of the breeding season and is of short duration. This activity is not expected to result in impacts to rails. Re-drilling of the wells involves more extensive activities and might impact rails, although this activity is also planned outside the breeding season (barring emergency situations) so that disruptions of breeding activity would not occur. As mentioned previously, SBSSNWR staff recently observed that rail numbers increased in Hazard 6 Pond despite the fact that a nearby well was being re-drilled. In addition, pipeline leaks could result in a spill of brine. However, brine spills are not expected to impact Yuma clapper rails because of the measures that would be in place to prevent, contain, and respond to spills prior to brine entering rail habitat. Production wells are not anticipated to function as perches for raptors given the shape and temperatures of these structures; therefore, predation is not expected to increase as a result of the presence of these structures in the vicinity of Yuma clapper rail habitat.

Injection well construction, operation and maintenance are not anticipated to impact Yuma clapper rails given the physical distance between these facilities and occupied habitat. The closest injection well pad to Yuma clapper rail habitat is approximately 7,000 feet away, and noise/disturbance associated with construction and operation of these facilities would be considerably less than that associated with the production wells or the plant.

Construction, operation and maintenance of the water supply pipeline are not anticipated to impact Yuma clapper rails given the scale and location of this facility relative to the habitat for this species. This conveyance structure is expected to be a pipeline that would not be attractive to Yuma clapper rails thus eliminating the possibility of operational impacts. The service water pond will be open, and it will contain reverse osmosis reject in addition to the canal water used for various plant needs. Although the selenium concentration of this reject is expected to be on the order of 8 µg/L (as compared to a canal concentration of approximately 2 µg/L), this would comprise a small proportion of the total volume in the pond. Therefore, the overall pond concentration would be lower. This would be a lined structure, located adjacent to the cooling towers. This configuration is likely to discourage any use by Yuma clapper rails. No additional impacts are expected as a result of the presence and use of the service water pond.

Rails are among the groups of birds more prone to power line strikes (Hunting 2002), and clapper rails migrate at night and have been known to strike towers or wires (Eddleman and Conway 1998). However, construction and maintenance of the transmission lines are not anticipated to impact the Yuma clapper rail through collision with the new lines given the distance between these lines and the rail's habitat. Rails were observed by Winning and Murray (1997) to fly under power lines. Their flight was generally below 23 meters. The lowest conductor on the towers is expected to be at least 8.2 meters above the ground at the mid-point between towers, and it would be higher closer to the towers. The individual conductors are approximately 5 meters apart. This would still provide space for the rails to fly under or between the lines. Peak numbers in the vicinity of the project facilities would be on the order of 17 birds (15 is the high

count for Union Pond along with individual sightings for Vail 5 drain and Vail 4A drain), although more moderate numbers (up to 8) have been observed since 2000. Most movements to other rail habitat would result in flight paths away from the plant and power lines (e.g., to the Hazard Unit of SBSSNWR or Wister Unit of Imperial Wildlife Area). Movements to Unit 1 of the SBSSNWR potentially could put them in a flight path that passes near the turn in the L-Line Interconnection at Lack and Lindsey Roads. Such movements would be likely to occur outside the breeding season, and the limited number of birds using the area along with the configuration of the line at this location make it very unlikely that a strike would occur. No records of clapper rail strikes were included in the power line strike mortality information collected by SBSSNWR. In a study of a new transmission line to Mare Island (PG&E 1992), three rail species were observed among the power line mortalities. However, no clapper rails were found during the course of the monitoring. Winning and Murray (1997) also did not report any rails among the strikes/mortalities that they documented in their study.

Closure of the facility is not expected to result in impacts to the Yuma clapper rail as the activities associated with closure would not result in an increased level of activity or noise beyond normal operation of the plant.

California Brown Pelican

The construction of the SSU6 plant site could result in impacts to the California brown pelican through general construction activities, pile driving for the steam turbine foundation, and the steam blow to clean the pipelines as prior to start up of the plant. General construction activities at the plant site could result in average noise levels in the Obsidian Butte roost area of 58-59 dBA, but there are physical features (McKendry Road and the debris piles on Obsidian Butte) that break the line of sight. This would be expected to reduce the noise levels by another 5 to 10 dBA. With noise levels of 54 dBA or less, and given that the activities would not be visible to roosting pelicans, adverse effects of this general construction activity would not be expected.

Construction of the steam turbine would involve pile driving, thus the average noise levels would be on the order of 66-67 dBA at the roost site. Again, there is the possibility of additional attenuation due to the existing features resulting in average noise levels from this activity on the order of 62 dBA or less. This may be low enough to eliminate impacts, but no information is currently available regarding pelican sensitivity to noise. The activity would not be visible to roosting pelicans, and this may reduce the likelihood that these activities would be disruptive to roosting pelicans along Obsidian Butte. The pile driving is scheduled to occur outside the shorebird breeding season from May through July. This could assist in reducing impacts by eliminating the exposure for pelicans using the area from May through July. However, large numbers of pelicans are known to occur at the Salton Sea in August and September (SBSSNWR unpublished data), so shifting pile driving outside of those months would be required to eliminate the potential adverse effects altogether. SBSSNWR staff have observed up to 250 brown pelicans roosting on these rocks during survey activities conducted in August of 2003 (Charlie Pelizza, SBSSNWR, pers. comm.). Because pelicans require regular access to dry roosting spots to dry and preen their feathers (Schreiber and Schreiber 1982), elimination of the Obsidian Butte

rocks as a roost by the disturbance associated with construction activities may preclude foraging in this area. The steam blow required prior to the start up of the turbine would be conducted with a silencer, and the resulting sound level in the pelican roosting area over the 72 hours required for the steam blow would be approximately 50-51 dBA. This is not expected to result in adverse effects, particularly given that there would be no activities visible to the pelicans that would accompany this activity.

Operation of the power generation facilities would not be likely to result in impacts as a result of the presence of the brine ponds, detention pond, lighting on the plant, and spills. The brine ponds would be expected to contain brine fluids for short periods of time that have potentially acutely toxic levels of antimony, arsenic, cadmium, copper, and lead. However, the brine ponds are not anticipated to host the fish prey used by this species as they would not contain water continuously. They would be narrow, concrete-lined ponds that would not be anticipated to attract brown pelicans because pelicans generally sight their prey from the air prior to attempting a capture (Schreiber *et al.* 1975). Plant lighting would be shielded and directed downward and is not expected to result in adverse effects to brown pelicans. This species is known to roost during night hours, preferring offshore rocks or sandbars surrounded by water (Jaques and Strong 2002) and thus not accessible to mammalian predators. Given that they are generally roosting at night in protected areas, they would not be affected by night lighting on plant or well pad facilities. Spills from the plant would be contained within the plant site by the berm around the plant and would not affect brown pelicans.

Production well construction at OB-3 may result in impacts to the California brown pelican as it involves grading, drilling, and pile driving that generate high levels of noise. The widening of McKendry Road and construction of the pipeline (which requires pile driving) would be expected to generate average noise levels on the order of 59-64 dBA at the roost islands, considering the sound attenuation associated with the debris piles on Obsidian Butte that break the line of sight between these activities and the islands. Drilling the wells on well pad OB-3 would result in average noise levels at the roost area of up to 73 dBA depending on the attenuation provided by the debris piles. This may adversely affect the pelicans by discouraging their use of this roost area. As stated previously, pelicans require access to a dry roost regularly (Schreiber and Schreiber 1982), and protected roost sites are in limited supply at the Salton Sea (Charlie Pelizza, SBSSNWR, pers. comm.). The debris piles would block the view of much of the construction activity, although the derricks required for well drilling would be visible from the roost location. The construction of these wells is scheduled to occur in the months of September, October, December and January, so most of the activity would be outside the months of peak use of the Salton Sea by brown pelicans. Activities occurring in September may disrupt pelicans to the point that the roosts are abandoned thus precluding foraging and roosting in the Obsidian Butte area during this time. Activities related to the construction of the other production wells is not expected to result in impacts given the distance and visual barriers between the roost area and the locations of those facilities.

Production well operation and maintenance includes such activities as visual inspections, coil cleaning, and re-drilling of wells. Re-drilling of the wells on OB-3 could have similar impacts to

the original drilling and construction of these wells. However, because the need for re-drilling is believed to be predictable, this activity would be scheduled to occur outside the peak use period for pelicans at the Salton Sea. In addition, a pipeline leak could result in a spill of brine. The double-walled pipeline and remotely controlled shut-off valves are expected to fully contain a spill associated with the pipeline to OB-3. Therefore, there should be no impacts to brown pelicans as a result of the failure of the primary pipeline to well pad OB-3. The pipelines associated with the other production well pads do not cross any waterways. A leak from one of these pipelines would not be expected to impact brown pelicans.

Injection well construction, operation and maintenance are not anticipated to impact California brown pelicans given the physical distance between these facilities and occupied habitat. Average noise levels from these activities would not be expected to exceed 50 dBA, and may be less, depending on the sound attenuation associated with the various physical barriers between these well pads and the Obsidian Butte roost area.

Construction, operation and maintenance of the water supply pipeline are not anticipated to impact California brown pelicans given the scale and location of this facility relative to the habitat for this species. Average noise levels at the roost islands associated with construction would be similar to or less than that for the general of the plant (54 dBA). Given that this facility would not be visible to the pelicans roosting at Obsidian Butte, construction activities would not be expected to have any adverse effects. Operation and maintenance would not be expected to require activities that would result in disturbance as they would be similar to those associated with operating the plant in general; consequently, no adverse effects to brown pelicans are anticipated.

The service water pond would be open and contain reverse osmosis reject in addition to the canal water used for various plant needs. Although the selenium concentration of this reject is expected to be on the order of 8 µg/L (as compared to a canal concentration of approximately 2 µg/L), this would comprise a small proportion of the total volume in the pond. Therefore, the overall pond concentration would be lower. This would be a lined structure and located adjacent to the cooling towers. This configuration is likely to discourage any use by brown pelicans. No additional impacts are expected as a result of the presence and use of the service water pond.

Construction and maintenance of the transmission lines may impact the California brown pelican given the small distance between the L-Line Interconnection and roosting/foraging habitat used by the pelicans at the pond located at the intersection of Lack and Lindsey Roads. Construction activities are likely to result in noise and disturbance levels that would preclude temporarily the use of this pond by brown pelicans. Based on the activities required, average noise levels at the pond could be on the order of 80 dBA. Brown pelicans in this area are not accustomed to high levels of activity, and they have been observed to move off as a result of a vehicle approaching in close proximity (Carol Roberts, CFWO, pers. obs.; Charlie Pelizza, SBSSNWR, pers. comm.). During this construction activity, this roost area is not expected to be available to brown pelicans. Maintenance of the lines is predominantly washing to remove dust build-up. This would be a

short term activity and would not be preclude use of the site to the extend that adverse effects would occur.

The presence of new transmission lines may result in impacts through collision with these lines. Shields (2002) reported on several strikes that occurred in Venezuela when a power line was strung between a pelican breeding colony and the foraging area for that colony. However, the risk of strikes does appear to vary with the circumstances. The Mare Island monitoring (PG&E 1992) only recorded two pelican strikes (American white pelicans, *Pelecanus erythrorhynchos*, in that case) out of a total of 80 mortalities on that transect and 1,028 total mortalities in the study area. The L-Line Interconnection is of concern because it would be located in close proximity to roosting/foraging areas used by brown pelicans. Brown pelicans have been known to collide with power lines in the Imperial Valley (SBSSNWR, unpubl. data). In one case that involved multiple collisions of brown pelicans with a power distribution line adjacent to the Salton Sea, the situation was resolved by the addition of markers (orange balls) to the power line. No additional collisions were noted following the installation of these markers. Bird flight diverters are proposed for the majority of the project's new transmission lines, where they occur between wetlands or other pelican use areas, and this should greatly reduce the likelihood of collisions. APLIC (1994) indicates that average mortalities could be reduced by up to 90 percent with 10 cm bird flight diverters placed at 5 m intervals. By considering the specific situation and needs of the species involved, the project should reduce this further.

During overflight surveys conducted during project planning, a total of 20 brown pelicans were observed crossing the proposed L-Line Interconnection alignment, but their flight elevation was 150 feet or more above the height of the lines. These surveys were not conducted during the peak use months for the brown pelican at the Salton Sea, however. Given that destinations for brown pelicans away from the Salton Sea are expected to be some distance and transmission line segments between these areas and the Salton Sea would be marked, birds using the pond at the intersection of Lack and Lindsey Roads would be the most vulnerable to collision given the proximity of this site to the line. Numbers of pelicans using this area during the summer months are on the order of three to 20 birds at any one time (Charlie Pelizza, SBSSNWR, pers. comm.). However, the alignment of the line would not be in the direct path of pelicans moving between the pond and many other desirable locations (e.g., Alamo River Delta, New River Delta, Fish Partners Fish Farm), so collisions would not be likely without unusual circumstances such as strong winds or a sudden disturbance. Strong winds do occur in the area, but they are most common in the spring months when brown pelicans are few in number in the general area. Most human activity in the area would result from routine travel by geothermal plant staff or periodic fishing activity along the levee at Lack and Gruble Roads. Given the additional voluntary travel restrictions in the vicinity of the Lack and Lindsey Pond, pelicans would not be flushed from their roosts during conditions that would increase the risk of strikes (i.e., winds > 15 MPH or low light). In the unlikely event that pelicans left their roosts during the night to forage, this would most likely take them in the direction of the Salton Sea and away from the transmission line. Based on the information available to the Service at this time, including all of the measures that would be in place during operation of the plant and the associated transmission lines, we do not anticipate pelican strikes with the transmission lines during the operation of the plant.

Closure of the facility is not expected to result in impacts to the California brown pelican as the activities associated with closure would not result in an increased level of activity or noise beyond normal operation of the plant.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Several projects are planned in the action area that may affect listed species in the Imperial Valley and/or Salton Sea. However, a number of these projects require action on the part of a Federal agency, and thus would require independent review under section 7 of the ESA. Therefore, the impacts of such Federal projects are not considered to be cumulative effects. The Bureau of Reclamation (Reclamation) is the Federal lead agency on the Salton Sea Restoration Project, and the Service anticipates continuing to work with Reclamation to maximize the benefits and minimize the impacts associated with that project. Reclamation is the Federal lead agency on the Brawley wetlands demonstration project, and the Service intends to continue working with Reclamation to maximize the benefits and minimize the impacts associated with that project as it expands into other areas of the Imperial Valley.

Imperial Irrigation District - San Diego Water Authority Water Transfer

Although a formal consultation was completed for this project with Reclamation in 2002, recent changes to the project may result in the need to re-initiate consultation. Ultimately, the project impacts are intended to be permitted via a section 10(a)(1)(B) permit once a Habitat Conservation Plan has been completed. Should the modified project move forward, the salinity of the Salton Sea would increase more quickly and the elevation of the Sea would decline faster and farther than would occur without the project. This would have the effect of reducing the available pelican habitat in the vicinity of the project and reducing the likelihood that operation and maintenance of CEOE project facilities would impact California brown pelicans directly.

North Baja Powerline

The North Baja Powerline is a 6-mile powerline project in the southwest portion of the IID service area. The construction and maintenance of the powerline may result in the loss of riparian, wetland, and agricultural field habitats that may contribute to the impacts associated with the loss of these habitats from the proposed project under consultation. However, because of the linear nature of that power line project, habitat losses are not anticipated to occur in large blocks. Therefore, there would not be cumulative effects of that project in combination with the CEOE project under consultation here.

CONCLUSION

After reviewing the current status of the species, environmental baseline, effects of the proposed project's construction and operation/maintenance activities, and cumulative effects, it is the Service's biological opinion that the proposed Salton Sea Unit 6 Geothermal Power Plant is not likely to jeopardize the continued existence of the Yuma clapper rail and the California brown pelican. We reached this conclusion for the following reasons. The number of Yuma clapper rails potentially impacted by the project is small. The number of brown pelicans potentially impacted is larger, but the effects are limited to one large and one small roost area and one or two peak use periods (depending on the actual construction schedule). Most impacts are temporary in nature; permanent habitat loss is very limited. The project includes several avoidance and minimization measures that would reduce the incidental take associated with the project. No critical habitat has been designated for these species; therefore, none would be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4 (d) of the ESA prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, rather than the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with this Incidental Take Statement. This Incidental Take Statement does not address the restrictions or requirements of other applicable laws.

In conducting our analysis we have assumed that all of the avoidance and minimization measures will be implemented as described in the project description.. The take described below is that which is anticipated with all of the measures in place concurrent with the construction and/or operation of the power plant and its associated facilities. If any of the avoidance and minimization measures are not implemented as described in the project description, our analysis of effects would require modification through re-initiation of the consultation to address changes not contemplated in this opinion.

The measures described below are nondiscretionary, and must be undertaken by the ACOE or made a binding condition of any grant, agreement or permit, as appropriate, for the exemption in section 7(o)(2) to apply. The ACOE has a continuing duty to regulate the activity covered by this incidental take statement. If the ACOE fails to require the applicant to implement the project (including the mitigation measures) as described above and to adhere to the terms and conditions

of this incidental take statement through enforceable terms in the permit, the protective coverage of 7(o)(2) may lapse. This exemption does not take effect until the permit from the ACOE has been issued. To monitor the impact of the incidental take, the ACOE and/or the applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I)(3)]

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Yuma Clapper Rail

Based on available census results and approximate population levels in the project area described above, the Service anticipates that up to eight individual clapper rails may be harassed as a result of the protocol surveys conducted to monitor the impacts of project construction. These same rails may be harassed by the noise and disturbance associated with construction thus precluding them from foraging and nesting at the Union Pond and McKendry Pond sites during the peak construction period currently scheduled for November 2004 through January 2006. One Yuma clapper rail may be harmed by the loss of habitat south of McKendry Road resulting from road widening and pipeline construction. No incidental take of this species was identified as a result of long-term operation of the project; therefore, no take is exempted herein for operational impacts.

California Brown Pelican

The Service anticipates that up to 250 brown pelicans may be precluded from roosting and foraging near Obsidian Butte as a result of the harassment associated with the noise and activity of construction of Production Well Pad OB-3 and pile driving for the pipeline to well pad OB-3 and the steam turbine. These activities are anticipated to require a total of six months. Up to 20 brown pelicans may be precluded from roosting and foraging in the pond located at the intersection of Lack and Lindsey Roads as a result of the harassment associated with construction of the adjacent segment of the L-Line Interconnection. The mile-long segment in the vicinity of the pond will require approximately 45 days to complete. As a result of the avoidance and minimization measures incorporated into the project, no incidental take of this species is anticipated as a result of operation of the plant and its associated facilities. Therefore, no incidental take is exempted for operation activities.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the incidental take of Yuma clapper rails and brown pelicans. These measures are based on the premise that the project, as proposed above, will be implemented in its entirety, including all specified avoidance and minimization measures outlined in the project description, unless otherwise modified below.

1. Measures shall be taken to minimize the harassment of listed species associated with construction noise and disturbance.

2. Measures shall be taken to minimize the harm of listed species associated with the loss of existing habitats.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the ACOE must comply with the following terms and conditions which implement the reasonable and prudent measures described above and outline reporting/monitoring requirements. These terms and conditions are non-discretionary and shall be included as binding conditions of any permit.

The following terms and conditions implement reasonable and prudent measure 1:

1.1 The project proponent shall conduct a noise study to determine the most effective means to reduce sound levels in habitats adjacent to the project site and production facilities. The location and composition of barriers or implementation of other sound attenuation methodologies shall be based on the noise study such that the measures have the maximum sound attenuation effect practicable (i.e., beyond reductions to 78 dBA L_{max}) in the habitat areas. The existing debris piles on Obsidian Butte shall be left in place throughout construction of the project to maintain the sound attenuation they provide to the pelican roost islands along the west side of Obsidian Butte.

1.2 Shielding on the pile driving equipment shall be oriented to maximize the noise reduction achieved in habitat to the north and northwest of the project site (i.e., Union Pond, McKendry Pond and Obsidian Butte).

1.3 The silencer on the steam blow equipment shall be oriented to maximize the noise reduction achieved in habitat to the north and northwest of the project site (i.e., Union Pond, McKendry Pond and Obsidian Butte).

1.4 Construction activities at the plant site that occur during the period from February 15 through August 31 shall be scheduled to minimize noise generation during the primary vocalization periods for the rail during the half hour before and hour after sunrise and the hour before and half hour after sunset such that noise levels at the edge and within occupied clapper rail habitat during these periods do not exceed 60 dBA L_{eq} hourly.

1.5 Well construction and drilling activities at Production Well Pads OB-1 and OB-2, and road widening and pipeline construction (including pile driving) along McKendry Road, shall be confined to the period from September 1 through February 14 to minimize disturbance to breeding Yuma clapper rails.

Construction and drilling activities at OB-3 shall be confined to the period from October 1 through February 14 to minimize the disturbance to roosting California brown pelicans and breeding Yuma clapper rails. If rails are not found to be breeding at McKendry Pond, construction and drilling activities at OB-3 shall be confined to the period from October 1 through May 31. If rails are not found to be breeding at McKendry Pond, road widening and pipeline construction activities (excluding pile driving) along McKendry Road may be completed at any time provided these activities are in compliance with Term and Condition 1.4 above.

1.6 Workers shall confine their activities to the plant or facility (well pad or pipeline) side of any existing (i.e., roads or levees) or constructed barriers to reduce the potential disruption associated with human presence adjacent to occupied listed species habitat. All workers shall be informed of this requirement as part of the Worker Environmental Awareness Program prior to conducting any project work.

1.7 Protocol surveys for Yuma clapper rails shall be conducted by qualified individuals with experience in conducting the Service protocol (Attachment 1) at Union Pond and McKendry Pond (and the adjacent part of the Vail 5 drain) prior to the start of any construction-related activities[1] within 0.5 miles of these sites, during each year that construction is occurring, and the year following the completion of construction. Individuals with a section 10 (a)(1)(A) permit from the Service to survey for Yuma clapper rails are qualified to complete this work. Qualifications shall be provided to the Service for approval at least 30 days prior to the start of the survey period.

The following terms and conditions implement reasonable and prudent measure 2:

2.1 The proposed land acquisition and habitat enhancements shall be in place prior to the start of the first rail breeding season following the initiation of fill operations associated with the construction of Production Well Pad OB-3.

Reporting Requirements

The applicant shall submit reports of the previous year's activities to the Service by March 31 of each year following years during which construction and/or monitoring activities occurred. This report shall include a summary of the status of project construction including reports on specific facilities, avoidance and minimization measures implemented in the previous year, and the results of any monitoring/survey activities conducted. The Service shall have access to the raw data from monitoring activities for review upon request. The reporting will occur annually

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[1]Construction-related activities include grading, trenching, and other ground disturbing activities involved in site preparation in addition to the actual construction of permanent structures. Geo-technical studies and topographical surveys are not precluded by this Term and Condition and may occur prior to the completion of protocol surveys.

unless the Service approves a longer reporting interval. Following the completion of construction, the applicant shall submit to the Service reports of any monitoring activities conducted as a requirement of certification by the CEC.

The Service's SBSSNWR (760-348-5278) shall be notified within 24 hours of any upset condition at the power plant or its associated facilities that could impact federally-listed species, migratory birds, or SBSSNWR facilities.

The Service's Carlsbad Fish and Wildlife Office (760-431-9440) must be notified within three working days should any listed species be found dead or injured in or adjacent to the action area. A written notification must be made within five calendar days and include the date, time, and location of the discovered animal/carcass, the cause of injury or death, and any other pertinent information. Injured animals should be transported to a qualified veterinarian or permitted wildlife care facility and the Service informed of the final disposition of any surviving animal(s). All dead specimen(s)/carcass(es) shall be submitted to (1) educational/research institutions possessing the appropriate State and Federal permits, (2) Carlsbad Fish and Wildlife Office, or (3) Division of Law Enforcement (contact 310-328-1516 for further direction). Failing deposition to one of these entities, the carcass should be marked, photographed, and left in the field.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of the reasonable and prudent measures provided. The ACOE must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information. The recommendations provided here do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibility for these species.

The ACOE should work with CEOE to provide alternative roost structures for brown pelicans if monitoring of the Obsidian Butte and Lack and Lindsey Roads pond sites indicates that project construction activities are precluding the use of these sites.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

RE-INITIATION NOTICE

This concludes formal consultation on CEOE's Salton Sea Unit 6 Geothermal Power Plant. As provided in 50 CFR §402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

If you have any questions about this consultation or the biological opinion, please contact Carol Roberts of my staff at (760) 431-9440 ext. 271.

Sincerely,

Therese O'Rourke
Assistant Field Supervisor

cc: Jeanette Baker, Army Corps of Engineers, San Diego Office
Jeff Hansen, MidAmerican Energy Holdings Company
Gavin Wright, Bureau of Land Management, El Centro Field Office
Natasha Nelson, California Energy Commission, Sacramento

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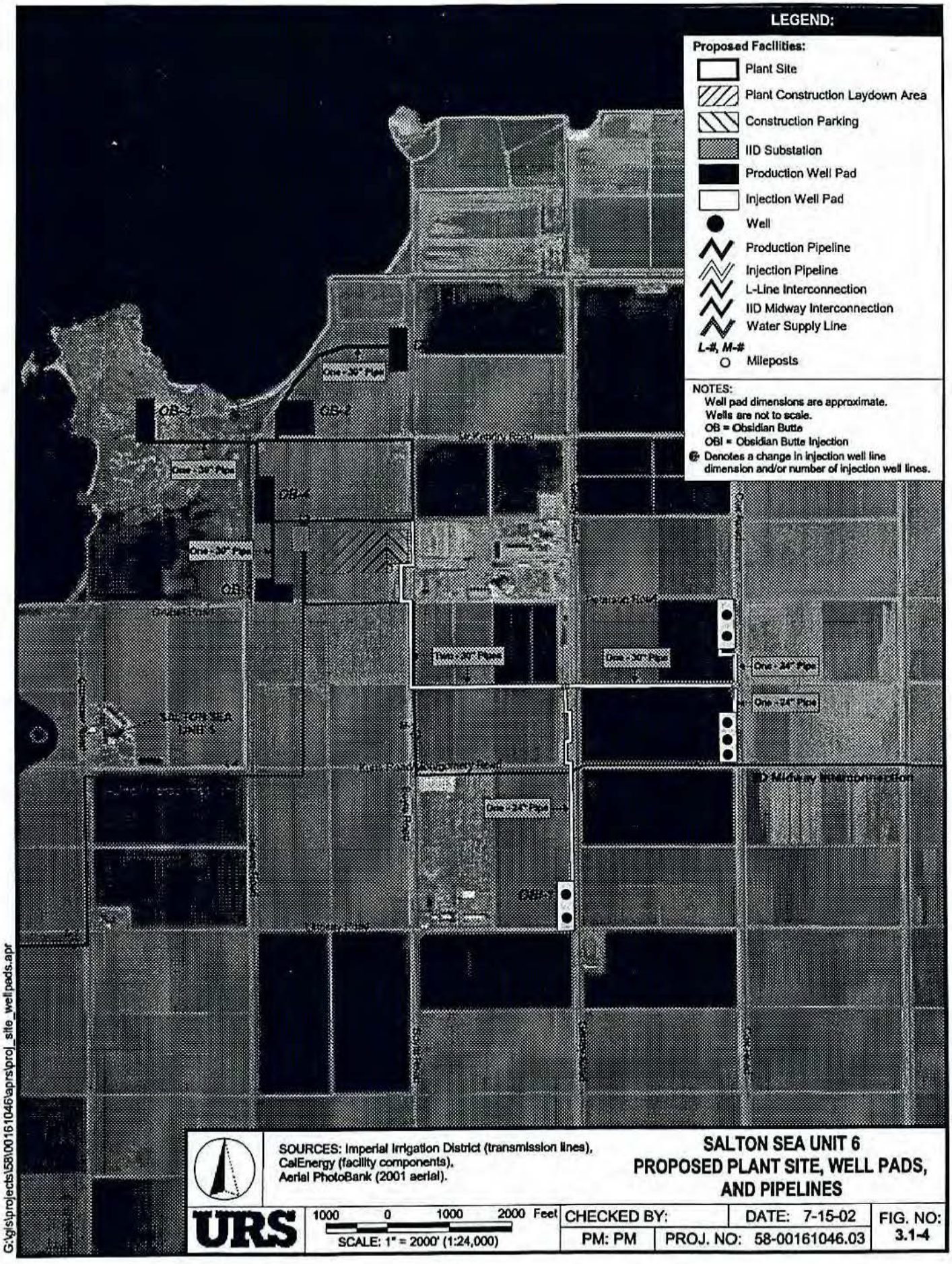

SOURCES: Imperial Irrigation District (transmission lines), CalEnergy (facility components), Aerial PhotoBank (2001 aerial).

SALTON SEA UNIT 6 PROPOSED PLANT SITE, WELL PADS, AND PIPELINES

URS

1000 0 1000 2000 Feet

SCALE: 1" = 2000' (1:24,000)

CHECKED BY:	DATE: 7-15-02	FIG. NO:
PM: PM	PROJ. NO: 58-00161046.03	3.1-4

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Legend:

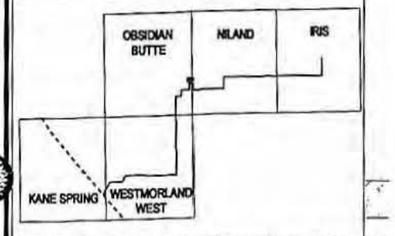
Proposed Facilities:

- Plant Site
- L-Line Interconnection
- IID Midway Interconnection
- Production Well Pad
- Injection Well Pad
- Production Well Line
- Injection Wells Line
- L-#, M-# Milepost

Existing Facilities:

- L-Line
- IID Midway Substation
- Flyover Survey Location
- Direction of Bird Flights Between 75' and 150' Elevation
- Bird Diverters to Run Along Line Between These Points

OVERVIEW MAP:



SOURCES: USGS 7.5 Minute Quads (Niland, Obsidian Butte, Westmoreland, Kane Spring, and Iris), URS (proposed transmission lines and facility components), TIGER (existing transmission lines).

5000 0 5000 10000 Feet

SCALE: 1" = 10,000' (1:120,000)

SALTON SEA UNIT 6 FLYOVER STATIONS AND PROPOSED BIRD DIVERTER LOCATIONS

URS

CHECKED BY:	DATE: 7-18-02	FIG NO:
PM: PM	PROJ. NO: 58-00161046.03	5.5-3

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United States Department of the Interior
U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 FAX: (602) 242-2513

In Reply Refer To:
AESO/SE

January 23, 2003

Memorandum

To: Yuma Clapper Rail Interested Parties

From: ACTING Field Supervisor

Subject: Change to January 2000 Yuma Clapper Rail Survey Protocol

The Fish and Wildlife Service, Arizona Ecological Services Field Office appreciates receiving your input and suggestions concerning the proposed extension of the official survey period for the Yuma Clapper Rail Survey Protocol. The consensus of respondents was that the extension was appropriate. Please revise the January 2000 survey protocol as follows:

4. All official surveys must be conducted between March 15 and May 31. *(Rest of this paragraph remains unchanged)*

All other components of the survey remain the same. Surveyors can use the additional two weeks to complete their surveys as necessary. Surveys do not have to be extended into this additional period if the surveying agency does not wish to use it.

Please provide the results of the 2003 surveys to our office by July 1, 2003 so we may compile the results. Copies of the data sheets should be sent, along with a summary of results.

On the other topic of interest for the Yuma clapper rail, the FWS will be working with the University of Arizona to seek funding for the development of a training course for surveyors. Considerable interest in such training was expressed to us, and we believe training would be beneficial and assist in our efforts. Training before the 2003 field season is not likely; however, we hope to be operational for the 2004 season.

We would also like to schedule a meeting in August to discuss research and management issues that remain unresolved for the Yuma clapper rail. If there are issues you would like to see addressed, or know of funding sources that may be useful, please let us know by July 1, 2003.

U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 640-2720 FAX: (602) 640-2730

In Reply Refer To:
AESO/SE

February 15, 2000

Memorandum

To: Yuma Clapper Rail Interested Parties

From: Field Supervisor

Subject: Yuma Clapper Rail Revised Survey Protocol

The Fish and Wildlife Service has completed the revision of the Yuma clapper rail official survey protocol. This protocol is for use starting in the 2000 survey season. The Service would like to thank all those who provided materials, comment and other input to the draft protocols. Not all suggestions proved workable, but we have attempted to incorporate as many suggestions as possible.

The basic parameters of the protocol have not changed, however there are some significant differences to be aware of. The survey period now includes the first part of March and routes have been formally assigned. There is a new tape to use during survey and a training tape with rail calls to familiarize yourself with the calls you will hear. Copies of the survey tapes are included in this information package. The training tape will be mailed separately. Please review all the materials before going into the field.

Please provide copies of the survey results to this office by July 1, 2000.

If there are any questions concerning the survey, the survey materials, or other issues involving the Yuma clapper rail, please contact Lesley Fitzpatrick (x236) or Tom Gatz (x240). Thank you for your participation in the survey.

David L. Harlow

Attachments

Yuma clapper rail 2000 protocol.LAF

YUMA CLAPPER RAIL SURVEY PROTOCOL
JANUARY 2000

These instructions are for the official surveys for Yuma clapper rail (*Rallus longirostris yumanensis*) which are used to provide information on population trends of this endangered species. Significant changes have been made from earlier survey protocols and these instructions require the use of the new survey tape. These instructions will be in place for the 2000-2004 survey seasons, after which the Fish and Wildlife Service will review them in concert with the Yuma Clapper Rail Recovery Team. If there are questions about this survey protocol, or to obtain cassette tapes for use in the survey, please contact the Arizona Ecological Services Office at the address at the end of this document.

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1. Please review the list of official survey locations on pages 3 and 4. If your agency will be unable to survey any or all of the assigned locations, please contact the AESO as soon as possible so we can try and find volunteers to survey the location.

2. Before any survey for the Yuma clapper rail, review the training tape and the survey tape to become familiar with the various calls. The tapes repeat various "clatter" and "kek" calls and are 60 minutes long. This will allow you to complete several stops before having to rewind. Also, make sure your tape recorder and speaker produce good quality sound at 80 decibels, measured one meter from the speaker.

3. Use 1:24000 USGS topolographic maps for base maps. Sections of the map should be enlarged to show the survey location and route. Before beginning the survey, review maps of past surveys. Note especially the placement of "stops" from previous years. The same stops should be used, maintaining the same number. Any new stops added should have a unique number and be recorded on the map. GPS may be used to more carefully delineate stop locations.

4. All official surveys must be conducted between March 15 and May 15. The survey protocol calls for 2 surveys of each location or route per year. A third survey can be added if time and staff resources permit. There is a minimum of one week between surveys. Surveys should be conducted on the same routes used in previous years. Survey stops should be at 150-200 meter intervals unless local conditions warrant a different distance. Make sure the route and all stops are clearly recorded on the survey map.

5. Arrive at the survey location to begin surveying about 30 minutes before sunrise. Surveys should continue no later than 3 hours after sunrise. No evening surveys should be conducted for the official survey.

6. Upon reaching the location, fill in the weather information section of the cover sheet. If the wind speed is greater than 10 mph (a breeze that keeps leaves and small twigs in constant motion or extends a light flag), do not conduct official surveys. Responses to the calls are difficult to hear over the rustling of marsh vegetation.

7. For the survey, get as close to the marsh vegetation as possible at each stop. Note the time in the "time start" column. Wait quietly for one minute to listen for rails. Then play the tape, directing the speaker toward the marsh and at approximately 80 decibels volume. At each stop, play the tape for 2 minutes, turn it off for 2 minutes, turn it on for 2 minutes and turn it off then listen for one minute (total survey time 7 minutes). Keep to the 2 minute intervals as carefully as possible. Listen for rail responses during the entire period and record responses on the data sheet.

8. Record responses from each rail on a different line. If you do see/hear a pair, record the individuals separately and check the "was rail paired" column. All rails seen or heard at stops during the survey are to be counted. If you hear the same rail twice, only count it as one bird. Rails heard or seen at other times while on site during the survey are incidental and are recorded at the bottom of the data sheet. Since some observers are interested in other species, there is a column to record other species of birds observed during the survey on the data sheet.

9. After the survey has been completed, record on the cover sheet any events or disturbances that may have affected the survey results (other loud birds, boat or vehicle noise, etc.). Also, record the weather conditions. Make any other notes of observations of other species (as appropriate).

10. Please make sure the cover and data sheets are clearly filled out. The information can be used to define rails/station (all rails seen/heard), rails/stop (rails seen/heard at each stop or an average) and rails/hour (each stop has 7 minutes of survey time) after the surveys have been completed. The official survey will continue to look at rails per station.

11. Completed reports are due to AESO by July 1 of the survey year. Reports will include cover and data sheets and a map showing the survey route. Send completed survey forms and maps to:

Yuma Clapper Rail Coordinator
USFWS-AESO
2321 W. Royal Palm Rd. Suite 103
Phoenix, Arizona 85021
602/640-2720 FAX 602/640-2730

YUMA CLAPPER RAIL SURVEY
COVER SHEET
(JANUARY 2000)

Date:_____

Location Information:
Location Name_____Route_____

Map Name_____Township/Range/Section_____

Observer(s)_____

Weather:
Start %Cloud Cover____Temp_____Wind Speed_____
End % Cloud Cover____Temp_____Wind Speed_____

Data Summary:

1) Total individual rails seen or heard while surveying _____
2) Number of other rails seen or heard (incidentals) _____

Total rails per route or location equals #1+#2 _____
For rails/hour, each stop is 7 minutes

Observations:

Events during survey that may have affected results:

Other Observations/Comments:

Yuma Clapper Rail Survey Data Sheet

Location________________________ Route_____________________ Date______________

Weather-start_____________________ end_____________________ Observer_________________

Stop #	Time Start	Time Stop	Clatter Call	Kek Call	Other Call	Was Rail Seen?	Was Rail Heard?	Was Rail Paired?	Other Species?	Habitat Type Where Rail Was Detected

total:

Total rails recorded on survey ________

Incidental observations of rails in survey area __________

MBGP Attachment DRR 35 Confidential OHP Built Environmental Resources Directory and Archaeological Determinations of Eligibility

Attachment DRR 35, OHP Built Environment Resources Directory and Archaeological Determinations of Eligibility has been provided under a repeated request for confidential designation.

MBGP Attachment DRR 36 The Wister Mud Pot Lineament: Southeastward Extension or Abandoned Strand of the San Andreas Fault?

Bulletin of the Seismological Society of America, Vol. 98, No. 4, pp. 1720–1729, August 2008, doi: 10.1785/0120070252

The Wister Mud Pot Lineament: Southeastward Extension or Abandoned Strand of the San Andreas Fault?

by David K. Lynch and Kenneth W. Hudnut

Abstract We present the results of a survey of mud pots in the Wister Unit of the Imperial Wildlife Area. Thirty-three mud pots, pot clusters, or related geothermal vents (hundreds of pots in all) were identified, and most were found to cluster along a northwest-trending line that is more or less coincident with the postulated Sand Hills fault. An extrapolation of the trace of the San Andreas fault southeastward from its accepted terminus north of Bombay Beach very nearly coincides with the mud pot lineament and may represent a surface manifestation of the San Andreas fault southeast of the Salton Sea. Additionally, a recent survey of vents near Mullet Island in the Salton Sea revealed eight areas along a northwest-striking line where gas was bubbling up through the water and in two cases hot mud and water were being violently ejected.

Introduction

Mud pots and mud volcanoes are geothermal features produced when water and/or gas is forced upward through soil and sediments (e.g., Planke *et al.*, 2003). They are usually associated with volcanic and seismic activity and thus reveal activity at plate boundaries and hot spots (Martinelli and Panahi, 2005). The most common gases are H_2O and CO_2, although significant amounts of H_2S, CH_4, C_2H_{10}, and NH_3 may also be present, as well as other noble gases such as He, Ar, Rn, Ne, and Kr.

Mud pots can assume a variety of morphologies, typically being depressions or enclosed basins containing gas seeps, bubbling water, or viscous mud (Fig. 1). They can also be water laden and appear as bubbling muddy water. Mud volcanoes are elevated conical structures composed of accumulations of viscous mud extruded from a central vent. According to Milkov (2003), "mud volcanoes often occur at the surface and the seafloor as a result of migration of fluidized sediment along active faults due to overpressure, and may also form on top of seafloor-piercing shale diapirs." Mud volcanoes can range from finger sized to several kilometers across, and the eruption of some may be associated with earthquake activity (Mellors *et al.*, 2007). Small mud volcanoes on land (1–3 m tall) are usually called mud cones or gryphons.

Mud pots are of interest because of their unusual gaseous emissions and their potential role in influencing the atmosphere and climate. They also indicate subsurface activity and effects of changing land use, such as anthropogenic introduction and variation in levels of surficial or groundwater in an area with high heat flow.

In the Salton Trough, a relatively shallow magma body results in high heat flow in the area, hydrothermal alteration of near-surface sediments (Sturz, 1989), as well as a number of active geothermal features including mud pots, mud volcanoes, and gas vents (Sturz *et al.*, 1997; Svensen *et al.*, 2007). Wells in the area were formerly a commercial source of CO_2 used to manufacture dry ice. For a good historical review of mud volcanoes in the Salton Trough and Colorado River delta region, see Strand (1981).

The region of study (Fig. 2) is a quadrilateral defined by geographic coordinates 33°13.188′–115°31.152′ and 33°18.440′–115°37.323′, and it is situated immediately east of the southeastern-most portion of the Salton Sea in Imperial County, California. This encompasses the northern end of the Brawley seismic zone (BSZ), a region of enhanced earthquake activity (e.g., Meltzner *et al.*, 2006) and frequent earthquake swarms, sometimes accompanied by surface faulting (e.g., Johnson and Hadley, 1976; Sharp, 1976). The BSZ encloses a right-hand step in the plate boundary (releasing bend for right-lateral motion) that serves to transfer plate motion between the Imperial fault and the San Andreas fault (SAF) to the north (Lomnitz *et al.*, 1970; Elders *et al.*, 1972; Hill *et al.*, 1975; Dokka *et al.*, 1990). The BSZ also contains the Salton Buttes (Salton Domes), five young (16,000 yr before present [B.P.]) rhyolitic volcanoes (Wood and Kienle, 1990) within the Salton Sea geothermal field (Elders *et al.*, 1972; Rex, 1972; Robinson *et al.*, 1976). This area overlies what is generally considered to be the northern-most spreading center of the East Pacific Rise (Menard, 1960; Robinson *et al.*, 1976). Most of the seismicity and active faulting within the BSZ, however, appears to be on strike-slip structures. Northwest- and north-northwest-oriented faulting is predominantly right lateral within the BSZ. The northeast-oriented faulting in the BSZ, while ex-

Figure 1. Typical mud pot (W12—see Table 1). Most of the major mud pots in the Wister Unit are circular, steep-sided holes 0.5–3 m deep and 0.5–10 m in diameter with varying amounts of bubbling water, spattering mud, and hissing gas. Some are completely inactive. Their activity and morphology varies seasonally with the amount of rain and the level of the water table. It is likely that the surface structure of many pots has been influenced by the earthen rings constructed around some of them. Unlike the hot steaming mud pots and mud volcanoes (*M* 9 in Table 1) a few kilometers south in the Salton Sea geothermal field (Svensen *et al.* 2007), the temperature of water and mud in the Wister mud pots is not noticeably elevated.

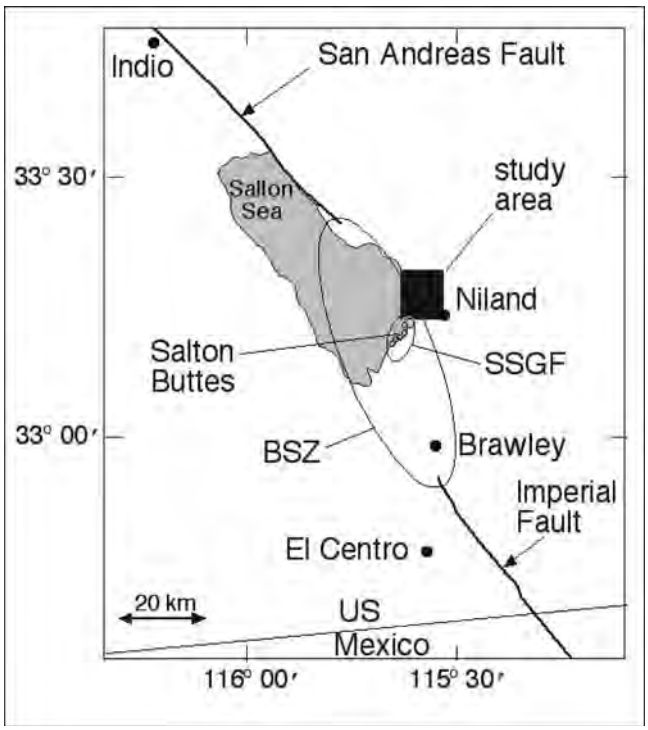

Figure 2. Index map of the study region. The study area is shown as a solid black quadrilateral defined by the coordinates 33°13.188′–115°31.152′ and 33°18.440′–115°37.323′. The BSZ is a region of enhanced seismicity that links the San Andreas fault and the Imperial fault. It contains the young rhyolitic Salton Buttes (volcanic necks) and the SSGF.

pected from a classic pull-apart model to be normal faulting, is instead left lateral, as first recognized on their fault *A* by Johnson and Hadley (1976) and dramatically demonstrated by the 1987 Elmore Ranch event (e.g., Hudnut, Seeber, and Rockwell, 1989; Hudnut, Seeber, Rockwell, Goodmacher, *et al.*, 1989; Magistrale *et al.*, 1989). Recently, Lohman and McGuire (2007) deduced the existence of a northeast-trending left-lateral fault associated with the 2005 earthquake swarm. This fault appears to terminate to the northeast in the Wister Unit, part of our study area.

The Wister Unit of the Imperial Wildlife Area is presently a large field of levee-partitioned seasonal wetlands managed by the California Department of Fish and Game. Ponds are created by man-made levees whose water levels are maintained through a network of fresh water delivery channels. The source of the water is the Colorado River, along with natural and agricultural runoff. Ponds are filled in the fall and winter to provide nesting sites for migratory birds and to provide sport for duck hunters and bird watchers. A. Hernandez (personal comm., 2007) reported that some of the ponds are filled with fresh water in late summer to accommodate migrating birds, and some mud pot fields are covered. As the ponds evaporate or are emptied after duck hunting season ends (in January), some mud pots and volcanoes are exposed. Hernandez noted that new mud pots can appear anytime. Just such an event happened some years ago (exact date unknown) when a new pot appeared outside of a fenced area designed to keep people away from the W11 mud pots (see Table 1). In 2006, new gas vents (W2, W23 in Table 1) developed in water delivery channels.

In this article, we report the result of a comprehensive survey of mud pots and related geothermal structures in the Wister Unit. We also relate the mud pot locations to the known faults in the area—especially the Sand Hills and San Andreas faults—and to nearby geothermal features in the BSZ.

Methods and Results

We first searched satellite imagery and identified possible mud pots in the rectangle defined previously. The survey was unbiased in the sense that we searched the entire area without regard for possible fault locations. Visibility of many pots was enhanced because of the earthen dams around them that were constructed by the California Department of Fish and Game (CDF&G). With these sites in hand, we asked personnel of the CDF&G (Imperial Wildlife Area, Wister Unit) if they knew of any mud pots or related geothermal features in the area that we might visit. They kindly led us to about a dozen, some of which we had identified from the satellite imagery. Further *in situ* reconnoitering revealed a number of other mud pot regions in the Wister Unit, totaling 32 in all (Table 1). We also surveyed vents in the Salton Sea between Mullet Island and the mainland. Several entries in Table 1 refer to clusters of pots, some with too many pots

Table 1

Known Mud Pots, Mud Volcanoes, and Related Geothermal Features in the Survey Area (Black Rectangle in Fig. 2)

Geothermal Vents in the Wister and Mullet Island Areas			
Designation	Latitude	Longitude	Notes
W1	33°16.548′	−115°35.633′	Four large pots with parking area (local attraction)
W1A	33°16.487′	−115°35.661′	Two large active pots, two small inactive pots, trending N30°W
W1B	33°16.598′	−115°35.621′	Gully of ~10 pots trending N6°W, younger to south and one large active pot
W1C	33°16.567′	−115°35.604′	Two small inactive mud volcanoes
W2	33°15.913′	−115°34.789′	Bubbles in water delivery ditch (new 2006)
W3	33°14.733′	−115°33.379′	Three large pots
W4	33°14.706′	−115°33.228′	Small pot (private)
W5	33°14.911′	−115°33.448′	Very large pot Spoony Road
W6	33°15.713′	−115°34.424′	Two large pots straddling road
W7	33°16.270′	−115°35.238′	Small pot, little activity
W8	33°14.216′	−115°33.366′	Large active pot
W9	33°17.117′	−115°34.620′	Large active shieldlike pot (private)
W10	33°17.295′	−115°34.630′	Large area of active shieldlike pots (private)
W11	33°17.580′	−115°35.144′	Five small pots, one of them outside fence
W12	33°17.355′	−115°36.263′	Large active pot
W12E	33°17.356′	−115°36.218′	Two medium active pots
W13	33°17.030′	−115°35.846′	Two dry pots
W14	33°16.833′	−115°35.827′	One dry pot
W15	33°16.851′	−115°35.761′	Small gas vent and bubbles
W16	33°17.085′	−115°36.050′	Small volcano
W16A	33°17.085′	−115°35.864′	Small volcano
W17	33°17.013′	−115°36.063′	Large pot (6’ across), little activity
W18	33°17.218′	−115°36.260′	Four medium active pots, many small ones
W19	33°16.281′	−115°35.386′	Wet spot with perimeter of vegetation
W20	33°13.804′	−115°30.059′	Large shield pot in alfalfa field (private) Niland
W21	33°17.169′	−115°36.245′	New (1 yr?) bubbles in pond near W18 (inaccessible)
W22	33 17.118′	−115°35.496′	Several bubbling vents in water delivery channel
W23	33°17.165′	−115°36.233′	Loud gurgling in brush (new) near W18
W24	33°14.684′	−115°34.743′	Bulldozed ring in pond (inaccessible)
W25	33°16.623′	−115°35.806′	Two large dry pots
W26	33°16.608′	−115°35.858′	Three pots, main and southwest attached pots wet
W27	33°16.574′	−115°35.881′	Very large field of wet and dry pots and volcanoes
W28	33°16.376′	−115°35.271′	One large pot, wet but not active
W29	33°16.516′	115°35.568′	One large dry pot
W30	33°16.278′	115°35.315′	Wet semicircle of vegetation
W31	33°16.960′	−115°36.062′	One 6’ pot, one 1’ pot , two small vents, all dry
M1	33°13.466′	−115°36.376′	Three bubble vents, east end of Mullet Island
M2	33°13.260′	−115°36.204′	5–10 bubble vents
M3	33°13.180′	−115°36.114′	Several bubble vents
M4	33°13.121′	−115°36.077′	Main vent, hot, steam, black mud, 1 acre
M5	33°13.134′	−115°36.126′	Smaller vent, hot, steam, black mud
M6	33°12.732′	−115°35.723′	Hundreds of bubble vents, 1/2 acre
M7	33°12.810′	−115°35.596′	Several dozen bubble vents, H_2S odor
M8	33°12.895′	−115°35.616′	Another cluster
M9	33°12.048′	−115°34.687′	Large field of volcanoes and pots (well known)
R1	33°11.434′	−115°35.120′	~dozen bubbles in water with mud pot sign
R2	33°11.354′	−115°35.104′	~dozen bubbles in water with mud pot sign
R3	33°11.305′	−115°35.188′	Bubbles (approximate location)
R4	33°11.294′	−115°35.134′	100-m-long line of bubbles striking ~N12° E

Prefix W refers to the Wister area. Prefix M refers to vents southeast of Mullet Island in the Salton Sea, except for M9, the well-known field of mud pots and volcanoes at the corner of Davis and Schrimpf Roads. Prefix R refers to mud pots southeast of Red Island. Underlined entries represent a field of pots, usually dozens. For completeness, mud pots and vents associated with the former CO_2 wells are listed in Appendix I.

to count, for example, W10, W27, and M9. Most features were ordinary mud pots and a few were small mud volcanoes or gas venting through shallow water. We visited each site and measured the pot’s geographic position, photographed it, and characterized its structure.

Most of the mud pots in the Wister area had similar morphologies (Fig. 1): they are composed of a circular depression that is usually shallower than the diameter of the pot, typically 1:2, probably representing the angle of repose for the poorly consolidated sediments of the Salton

Trough. The walls of the pot often show collapsed material and incised rings indicating a changing water level. Such rings may be found as high as the lip of the pot, a probable sign of overflow by ground water. Many pots are circumscribed by partial or complete ring scarps that form as the pot grows and its walls begin to collapse inward. Some pots are wet and show recent activity; others appeared to be completely dry with significant collapse and aeolian debris suggesting little or no recent activity. It seems likely that dry pots continue to emit gas, their absence of moisture probably being due to a lack of ground water. Indeed, some dry pots are heard to hiss.

We have broadly referred to many features as mud pots because of the bubbling mud—or evidence of it—but many of them have morphologies that are more similar to sinkholes (dolines) or collapse pits (Delle Rose *et al.*, 2004). Sinkholes are basinlike, funnel-shaped, or vertical-sided depressions in the ground's surface that have formed with essentially no horizontal material transport. They are the result of subsidence (Abbass Fayad *et al.*, 2003) and can occur by any of several mechanisms such as dissolution of rock or withdrawal of ground water. Like sinkholes, virtually all of the mud pots in the study area are circular and most lack crater rims or obvious ejecta blankets. Even in the loosely consolidated sediments, many have steep sides and circumscribed ring scarps. This suggests recent formation or perhaps frequent renewal. Even if occasionally filled with sediments by flooding, the continuous emission of CO_2 from below would probably reform the structures. The subsidence mechanism is probably local compaction as upwelling CO_2 is displaced by collapsing soil. This is similar to the bathtub model of sinkhole formation (Kochanov, 1999).

The distinction between pots and volcanoes is not always clear, with some mud pots being slightly elevated shieldlike structures overflowing with water or having a central pool in the caldera that sits below grade. There seems to be a continuum of features between pots and volcanoes and one may evolve into the other with time as water levels and gas supply change. Rains and flooding can also dramatically alter or destroy the surface morphology of pots and volcanoes without affecting the subsurface forces that produce them. In their early stages, both may begin their lives as small wet spots on otherwise dry, unremarkable ground. As subsurface conditions change, the pots and volcanoes may grow inactive and eventually be erased by erosion.

Mud pots in the Wister Unit fall along a lineament about 16 km long that strikes about N45°W (Fig. 3), a feature previously suggested by Meidav and Furgerson (1972*, attributed by Schroeder [1976]) that they called the Wister fault (WF). The mud pot lineament was also noted by Muffler and White (1969) based on 16 mud pots. The indicated WF (dotted line) would seem to be a good linear fit to the pot locations. Except for three mud pots—two of whose structure is quite different from the others (W9, W10, and W11)—the mud pots define a lineament that we suppose to be a fault, possibly the previously named WF, and arguably coincident with the Sand Hills/Algodones fault. Citing Muffler and White (1969): "These lines of hot springs probably mark upward leakage of hot water from faults at depth."

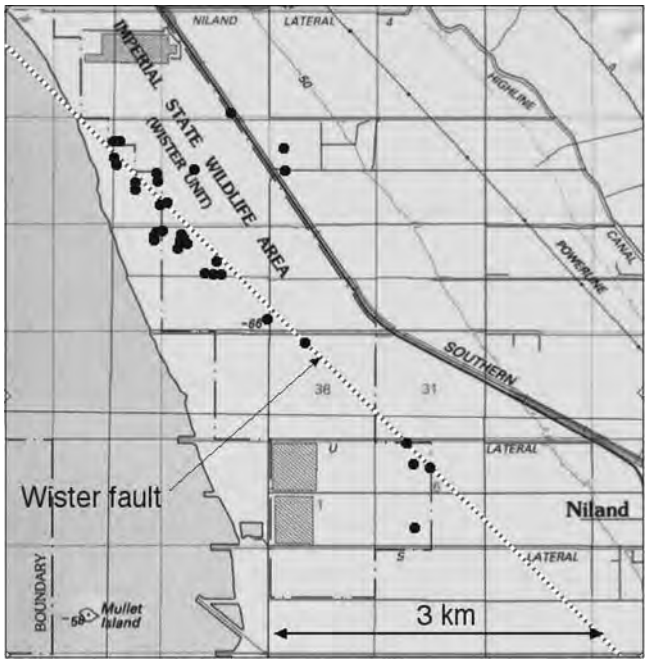

Figure 3. Study area from Figure 1 that shows the Wister mud pot field distribution. Each feature is shown as a black filled circles. The postulated Wister fault (dotted line) is defined by the coordinates 33°10.0′–115°27.6′ and 33°18.64′–115°27.92′ based on measurements of Figure 5. The mud pots tend to cluster along a northwest-trending line that is reasonably well defined by the Wister fault.

To our knowledge, the existence of the WF or Sand Hills fault has never been confirmed to exist at depth or by surface faulting, but their apparent correlation with the Wister field mud pots may provide some evidence for such a structure. Because of the relative lack of seismicity, and hence the uncertainty about whether this is a deep structure, we shall refer to this alignment of geothermal features as the Wister mud pot lineament (WMPL).

Is the Wister Mud Pot Lineament an Extension of the San Andreas Fault?

We were unable to find any *in situ* evidence of the Wister fault such as scarps, pressure ridges, etc. Most of the landforms in the Wister Unit of the Imperial Wildlife Area have been completely erased by bulldozing. Many of those outside

*Note: our Fig. 5 did not appear in this article as Schroeder (1976) claimed. We have been unable to locate the original source of the figure. Whatever the heritage of the figure, it seems to have been prescient so we included it. It was useful to us and represents a potentially unifying concept regarding faults in the region. In view of the fact that other people have used the same nomenclature (e.g., Calipatria, Red Hill, and Brawley faults), its inclusion seems warranted.

the Wister Unit are on private land, and some have been altered by agricultural activity intended to level the fields for irrigation. A search of modern-day satellite imagery revealed nothing to indicate the fault's presence outside of the developed areas or disturbed ground. Thus, any surficial evidence of slippage along the possible fault, or direct evidence of the supposed causal fault itself, is understandably unavailable. A search for historical air photos that predate development has begun, and it is hoped that evidence may be found of the original morphology and distribution of mud pots along the WMPL.

The BSZ and SSGF contain other mud pots and volcanoes (Fig. 4). These features are about 8 km south of the Wister Unit and are separated from the mud pots reported here by regions with no known apparent geothermal features except former CO_2 wells (see the appendix). Mud pots and volcanoes do not appear to be uniformly or randomly distributed throughout the BSZ and SSGF, but rather, they cluster along faults, mainly the Calpatria and supposed Sand Hills faults. We believe that the Wister pots reported here represent a separate and distinct body of mud pots dispersed along the Sand Hills fault.

Kelley and Soske (1936) noted that mud volcanoes near the corner of Davis and Schrimpf roads (about 8 km south of the WMPL) and those that were a popular tourist attraction in the 1920s (Laflin, 1995)—before being submerged as a result of a rise in the Salton Sea—fell along a line striking more or less N45°W that passed through Mullet Island. In 1972, Meidav and Furgerson suggested that this line might indicate the location of a fault that they called the Calipatria fault (CF). Elders *et al.* (1972) also named a feature farther to the northeast the Sand Hills fault based on Meidav and Furgerson's data. The prior basis for identification of the WF and Sand Hills fault was subsurface geophysical data, not necessarily indicative of an active structure. According to Schroeder (1976), Meidav and Furgerson posited several other northwest-trending faults in the area that they called (from north to south) the Wister, Calipatria, Red Hill, Brawley, Fondo, and Westmorland faults (Fig. 5). This map suggests that the fault locations are only conceptual because all six indicated faults are exactly parallel to each other and strike N45°W. The current status of these faults has been succinctly described by Younker *et al.* (1981, 1982): "The Brawley fault zone was identified by a portable seismic survey (Gilpin and Lee, 1978) and a resistivity survey (Meidav and Furgerson, 1972). The Calipatria fault was identified

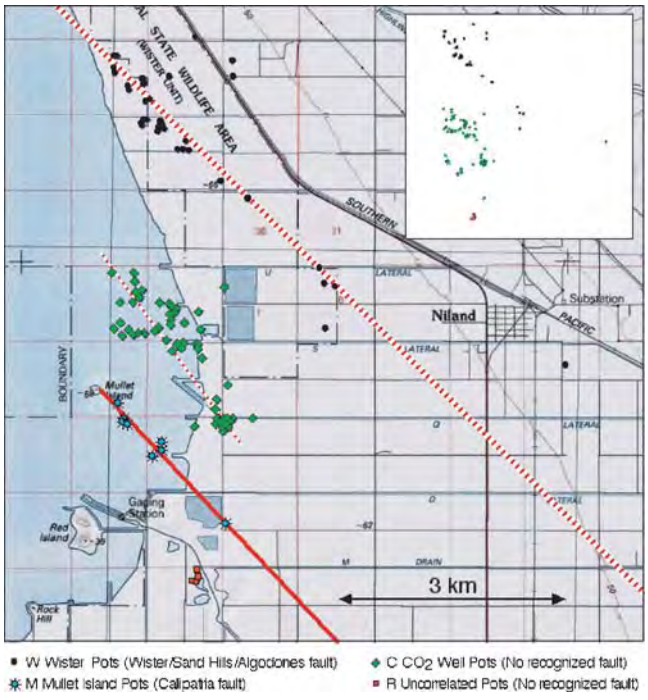

Figure 4. All known geothermal features in the area. The upper dotted red line indicates mud pots and vents in the Wister Unit. Those along the lower red solid line are associated with the Calipatria fault that is presumed to pass through Mullet Island. In the middle are old CO_2 wells indicated on the USGS topographic map based on WGS84. For reference, the inset (upper right) shows all of the features in map projection without lines or base map. See Table 1 and Appendix I for the mud pot locations.

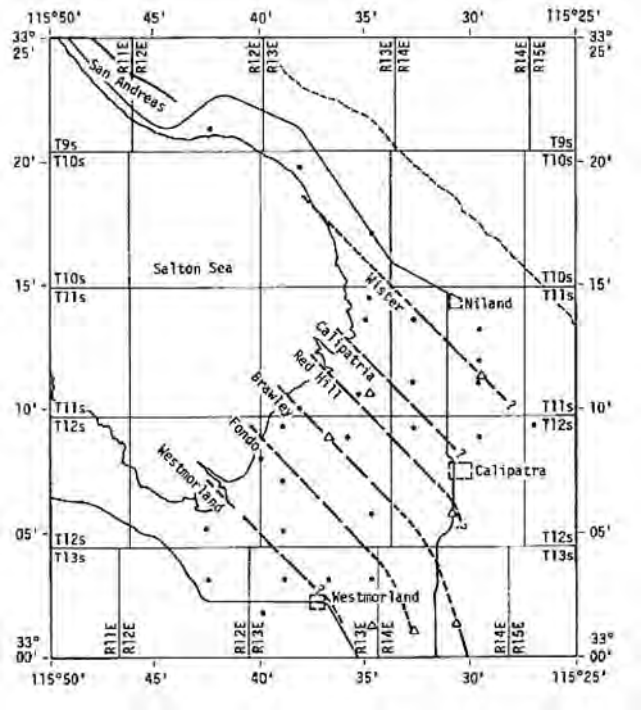

Figure 5. Conceptual fault map attributed to Meidav and Furgerson (1972) by Schroeder (1976). Based on the alignment of the Davis–Schrimpf mud volcanoes, some historically reported mud pots and fumaroles, and Mullet Island, Meidav and Furgerson suggested that their might be a series of en echelon faults trending northwest that reach from Westmorland to Niland. Since that time, the Brawley, Calipatria, and Red Hill faults have been verified. The heretofore unrecognized Wister fault seems to be coincident with another hypothesized fault, the Sand Hills fault, also called the Algodones fault.

using infrared detection (Babcock, 1971) and the alignment of thermal hot springs (Muffler and White, 1968). The Red Hill fault, located between the Brawley and the Calipatria faults, was traced with correlations derived from electric logs (Towse, 1975), interpreted from the ground magnetic survey (Meidav and Furgerson, 1972), and subsequently located with a seismic refraction survey (Frith, 1978)."

Towse (1976) further elaborated on faults in the area. The Wister fault shown in Figure 5 is essentially coincident with the Sand Hills fault of Elders *et al.* (1972) and passes nicely through the WMPL. To our knowledge, the indicated Westmorland and Fondo faults have not been identified. Commercial CO_2 wells (C series in Table 1) were operated during the early part of the twentieth century along a loosely defined northwest-trending line about 2 km north of what was to become recognized as the Calipatria fault. If this line represents a fault, it has not yet been identified.

In view of the evidence for three of the six faults, these faults appear to form an en echelon structure with slippage striking about N45°W. Some of these structures have subsequently been illuminated by seismicity, which often occurs in swarms (e.g., Johnson and Hadley, 1976), whereas others have remained seismically quiescent during the past 30 yr of intensive seismic monitoring. The Wister fault, also known as the Sand Hills fault, is one that has remained essentially silent, although a few small earthquakes appear to lie along this trend.

Along nearly the same trend as the WF of Schroeder (1976), yet extending much farther to the southeast, is the Sand Hills fault, based on the map of Elders *et al.* (1972) and shown in subsequent papers (e.g., Hill *et al.*, 1975; Johnson and Hadley, 1976). Furthermore, Fuis *et al.* (1982) identify the East Highline seismicity lineament, and Sharp (1982) shows a queried feature along this same trend. Yet the Wister and Sand Hills faults and East Highline seismicity lineament are all shown as dashed (inferred) in these original published maps, and these features are not described definitively in the literature. As cited in a footnote by Elders *et al.* (1972), the Sand Hills fault was identified by "electrical soundings [and] … unpublished aeromagnetic data." Sharp (1982) summarized this lack of clear evidence for a southeastward extension of the San Andreas fault as follows: "From the south terminus of the San Andreas fault trace near Bombay Beach, no surface evidence for recent faulting on strike with the fault zone to the southeast is known. Although a linear concealed extension of the San Andreas fault may exist under the Salton Sea or in the northern Imperial Valley, no convincing geological or geophysical evidence yet supports such a projection. Babcock (1971) argued that photolineaments in cultivated fields and offset concrete canal liners southeast of Niland, Calif., represent possible active fault traces, but comparison of these photolineaments with earlier aerial photographs show them to be recessional shoreline features of former Lake Cahuilla. The offsets of canal liners are not convincing evidence of fault movement because of structional irregularities and because buckled and misaligned liners are widespread throughout the Imperial Valley."

Figure 6 shows the southeastern side of the Salton Sea and the surface relation between the WMPL and San Andreas fault (SAF). Also shown are the locations of the mud pots from Table 1. Because fault traces can be nonlinear, a southeastern extension of the SAF through the Salton Sea coincides closely enough with the trajectory of the Wister field mud pots to lead us to believe that the WMPL may be a through-going tectonic feature.

Based on Clark (1984), the southern 8 km of the SAF strikes N48°W ±1.6° with the southern-most two kilometers striking N51°W before the main trace vanishes about 4 km northwest of Bombay Beach. A 20-km southeastward extrapolation of the SAF striking N51°W to the Wister area (Fig. 6) falls on the northwestern end of the WMPL. The WF was shown to strike ≈N45°W (Meidav and Furgerson, 1972) but being uncertain, the strike could be a few degrees more or less than N45°W. Several degrees of strike variation over 30 km is entirely reasonable. More recent compilations such as the Qfaults database (see http://earthquake.usgs.gov/regional/qfaults/ and ftp://hazards.cr.usgs.gov/maps/qfault/, last accessed July 2008) from the U.S. Geological Survey (USGS), the California Geological Survey, and other partners, show a north-northwesterly strand that nearly passes through Bombay Beach and appears to be aligned with the seismicity lineaments in Figure 7. Clearly the spreading center associated with the BSZ is more complex than just two strike-slip faults bounding an extensional fault.

The possible southeastward extension of the SAF as a discrete fault through and beyond the Salton Sea is frequently mentioned in the literature but has never been resolved. Many maps show no extension beyond the accepted

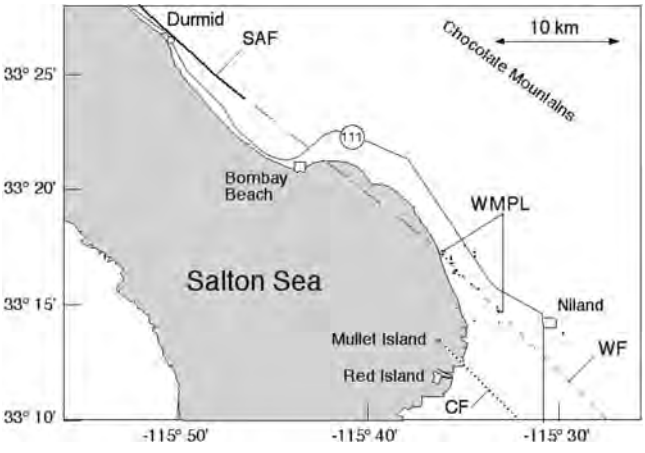

Figure 6. Map showing the spatial relation between the SAF, WF, and WMPL. SAF—thick solid line, WF)—thin dashed line (also coincident with the Sand Hills fault), SAF extrapolation—thin dot-dashed line through the Salton Sea. Mullet Island is the most northerly volcanic neck of the Salton Buttes and is part of a mud pot lineament (Kelley and Soske, 1936) associated with the CF. Red Island consists of two merged volcanic necks.

Figure 7. Known and inferred faults in the southern Salton Trough region. Most were taken from the Qfaults database (http://earthquake.usgs.gov/regional/qfaults/, last accessed July 2008). SA denotes San Andreas, HS denotes Hot Springs, CC denotes Coyote Creek, ER denotes Elmore Ranch, C denotes Calipatria, RH denotes Red Hill, W/SH/A denotes Wister/Sand Hills/Algodones, SM denotes Superstition Mountain, SH denotes Superstition Hills, B denotes Brawley, I denotes Imperial, CP denotes Cerro Prieto. LM is the fault inferred by Lohman and McGuire (2007) from the 2005 earthquake swarm. The Calipatria and Red Hill faults locations were taken from Figure 5.

southern terminus north of Bombay Beach. Crowell (1975) shows a minor fault transecting the sea slightly north of the WMPL. Crowell and Sylvester (1979) show the SAF extending through the Salton Sea east of the WMPL and joining the possible Sand Hills fault while Korsch (1979) suggests that the SAF passes just north of the Salton Sea before joining the Sand Hills fault. Sharp's map (1982), on the other hand, suggests that a SAF extension might pass through the sea south of the WMPL and in the same reference shows a map with the SAF bending well south and probably joining the Brawley fault as suggested by others. Because of the absence of direct evidence for an extension, the lack of consensus is understandable.

The tectonic complexity of the region is evident from the number of unparallel transform faults that strike predominantly N35°W and N35°E, corresponding to an intersection angle of 70°, not 90°. Based on recent earthquake relocation studies (Shearer *et al.*, 2005; Lin, Shearer, and Hauksson, 2007; Lin *et al.*, 2007), there are also northwest- and northeast-striking seismicity lineaments that are roughly parallel to the faults (Fig. 8). Cutting through the northwest-trending WMPL, and Wister, Calipatria, and Red Hills faults is a northeast-trending fault left-lateral fault (Lohman and McGuire, 2007) revealed by the 2005 earthquake swarm. The fault strikes N35°E and appears to terminate on or very near the WMPL.

In view of the nearly perfect alignment of the SAF, the Wister mud pots, and the seismicity lineament, we suggest that the SAF extends at least as far east as Niland and perhaps farther. It may be an abandoned trace of the fault or one that has simply been seismically inactive in historic times. The presence of a linear field of geothermal features is

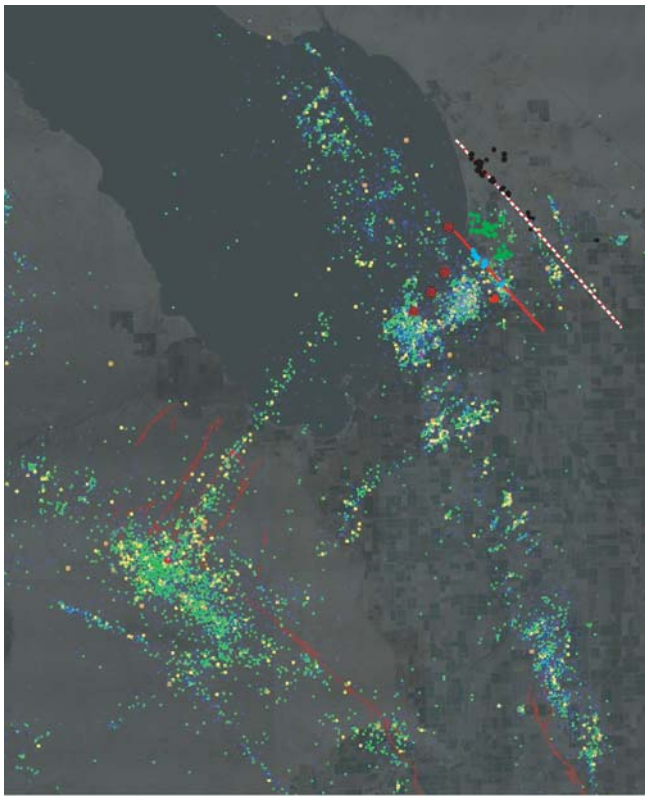

Figure 8. Precisely relocated earthquake epicenters shown as small colored dots are from the period 1981—2005 (Shearer *et al.*, 2005). Earthquake magnitudes from Lin *et al.* (2007) are shown by the color of symbols: orange are $M > 4$, yellow are $M > 3$, green are $M > 2$, and blue are $M > 1$ (approximately). Mud pots are indicated by black dots (Wister pots), blue stars (Mullet Island pots), green diamonds (CO_2 well locations), and red squares (unassigned pots). The Salton Buttes volcanoes are indicated by four orange dots and active fault traces by red lines. The two red–white dotted lines show the known CF (lower) and the putative Sand Hills/Wister fault (upper). At center right is a grouping of epicenters that trends northeast and represents the 2005 swarm. Also evident are a number of narrow seismicity lineaments that trend N36°E that seem to terminate along another lineament (top center) that trends N38°W. These lineaments do not meet at right angles. The broad northwest-trending seismicity lineament at the lower right suggests the existence of a fault but none has been identified. See Hudnut, Seeber, and Rockwell (1989) for the geologic background of the area.

evidence of a planar rift extending to considerable depth in the crust, that is, a fault. The absence of surface evidence for slippage is probably the result of intense agricultural reshaping of the landscape and the fact that there have been no surface-rupturing earthquakes along the SAF-WMPL in recent times.

Summary and Conclusions

We have surveyed and mapped the mud pots in the Wister field and shown that they show a strong clustering along the putative Wister fault (also known as the Sand Hills fault). Within the uncertainties of the trace of the San Andreas fault, a southeastward extrapolation of its trace coincides with the alignment of Wister mud pots. At present, no concrete evidence exists that we know of to definitively connect the San Andreas fault through the Salton Sea all the way to the WMPL. The alignment, however, is strongly suggestive of a deep-seated connection such as a through-going extension of the San Andreas fault towards the southeast. Although such a structure has been previously suggested and called the Wister or Sand Hills fault, neither of these were based on surficially active features. We strongly suspect but cannot prove that the WMPL is of a tectonic origin. We cannot detect a sense of finite slip across the WMPL, but we believe that the high rate of carbon dioxide flux along the WMPL may indicate a component of extension normal to the WMPL. The WMPL appears to be a southeastern extension of the San Andreas fault or at least associated with the SAF.

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Appendix

Listed in Table A1 are mud pots and vents associated with former CO_2 commercial production and identified on

Table A1

Most of the Mud Pots Listed Here Were Used in the Production of CO_2; Some Are Now Covered by the Salton Sea and All Are Now Abandoned

Designation	Latitude	Longitude	Comment
C1	33°13.018′	−115°34.752′	
C2	33°13.053′	−115°34.753′	
C3	33°13.055′	−115°34.682′	S
C4	33°13.077′	−115°35.151′	
C5	33°13.085′	−115°34.807′	S
C6	33°13.099′	−115°34.861′	S
C7	33°13.110′	−115°34.752′	S
C8	33°13.115′	−115°34.795′	S
C9	33°13.132′	−115°34.812′	S
C10	33°13.132′	−115°34.644′	S
C11	33°13.147′	−115°34.696′	S
C12	33°13.160′	−115°34.753′	S
C13	33°13.160′	−115°34.828′	S
C14	33°13.166′	−115°34.629′	S
C15	33°13.174′	−115°34.349′	
C16	33°13.177′	−115°34.807′	S
C17	33°13.269′	−115°34.854′	S
C18	33°13.383′	−115°34.840′	S
C19	33°13.559′	−115°34.693′	S
C20	33°13.857′	−115°35.042′	
C21	33°13.947′	−115°35.457′	
C22	33°13.967′	−115°35.097′	
C23	33°13.980′	−115°35.324′	
C24	33°14.017′	−115°35.098′	
C25	33°14.019′	−115°35.125′	
C26	33°14.022′	−115°35.381′	
C27	33°14.046′	−115°35.292′	
C28	33°14.070′	−115°35.529′	

(*continued*)

Table A1 (*Continued*)

Designation	Latitude	Longitude	Comment
C29	33°14.121′	−115°36.134′	S
C30	33°14.128′	−115°35.993′	S
C31	33°14.149′	−115°35.832′	S
C32	33°14.158′	−115°35.933′	S
C33	33°14.179′	−115°35.696′	S
C34	33°14.194′	−115°36.052′	S
C35	33°14.198′	−115°35.058′	
C36	33°14.209′	−115°36.250′	S
C37	33°14.214′	−115°35.635′	S
C38	33°14.241′	−115°35.472′	
C39	33°14.272′	−115°35.283′	
C40	33°14.275′	−115°36.159′	S
C41	33°14.310′	−115°35.478′	
C42	33°14.372′	−115°35.482′	
C43	33°14.385′	−115°35.416′	
C44	33°14.400′	−115°35.094′	
C45	33°14.427′	−115°35.399′	
C46	33°14.460′	−115°35.458′	
C47	33°14.489′	−115°35.504′	
C48	33°14.503′	−115°35.621′	S
C49	33°14.503′	−115°36.004′	S
C50	33°14.510′	−115°36.168′	S
C51	33°14.557′	−115°35.898′	S
C52	33°14.621′	−115°35.956′	S
C53	33°14.641′	−115°35.866′	S
C54	33°14.657′	−115°35.867′	S
C55	33°14.750′	−115°35.970′	S
C56	33°14.848′	−115°35.981′	S
C57	33°14.856′	−115°36.288′	S
A1	33°13.013′	−115°34.757′	
A2	33°13.054′	−115°34.688′	
A3	33°13.080′	−115°34.810′	
A4	33°13.110′	−115°34.810′	
A5	33°13.124′	−115°34.649′	
A6	33°13.129′	−115°34.811′	
A7	33°13.133′	−115°34.759′	
A8	33°13.171′	−115°34.698′	
A9	33°13.145′	−115°34.827′	
A10	33°13.157′	−115°34.632′	
A11	33°13.174′	−115°34.884′	
A12	33°13.179′	−115°34.649′	
A13	33°13.277′	−115°34.860′	
A14	33°13.555′	−115°34.702′	

Prefix C indicates that the pot locations were taken from identifiers on topographic maps. Prefix A indicates that the pot is clearly visible in modern aerial imagery. S indicates that the vent is in the Salton Sea or in the marshes immediately adjacent to the sea.

the World Geodetic System 1984 (WGS84) topographic survey as CO_2 well. Though not geothermal structures themselves, the wells are indicative of significant CO_2 emissions and therefore are suggestive of geologic features. Most of the accessible pots are within a few hundred meters of the intersection of Davis Road and Pound Road (33°13.214′–115° 34′.788′) where remains of the old CO_2 plant are found. There are many smaller pots and vents in the area that are not listed here.

U.S. Geological Survey
525 South Wilson Avenue
Pasadena, California 91106-3212

Manuscript received 10 October 2007

MBGP Attachment DRR 57 2009 Geotechnical Investigation

APPENDIX B

Geotechnical Study

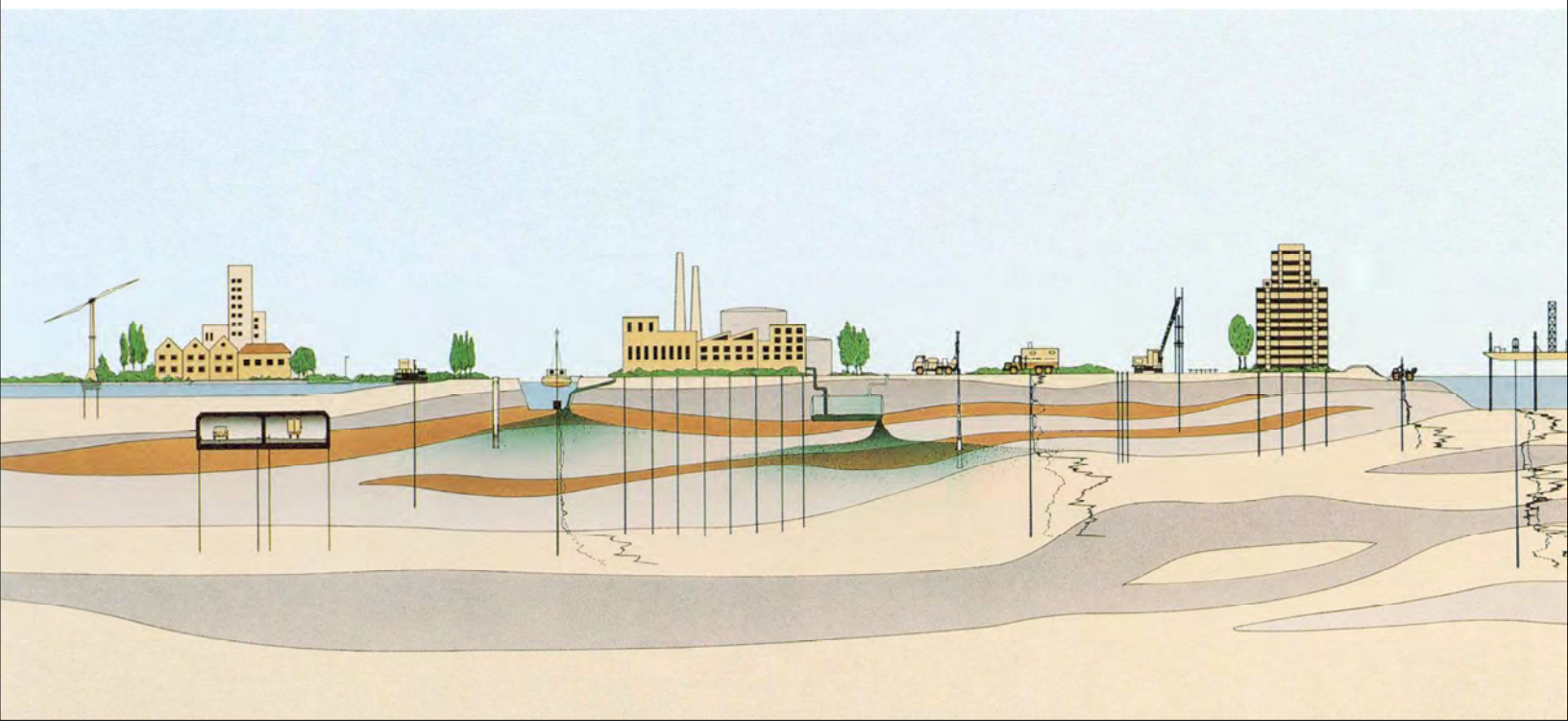
FUGRO WEST, INC.

GEOTECHNICAL STUDY

PROPOSED BLACK ROCK UNITS 1, 2 & 3
SINGLE FLASH GEOTHERMAL PLANT
CALIPATRIA, CALIFORNIA

Prepared for:
CalEnergy Operating Corporation

January 2009
Fugro Project No. 3652.001



FUGRO WEST, INC.

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Ventura, California 93003-7778
Tel: (805) 650-7000
Fax: (805) 650-7010

January 20, 2009
Project No. 3652.001

CalEnergy Operating Corporation
7030 Gentry Road
Calipatria, California 92233

Attention: Mr. George Furmanski, Senior Project Engineer

Subject: Geotechnical Study for the Proposed Black Rock Units 1, 2 & 3, Single Flash Geothermal Plant, Calipatria, California

Dear Mr. Furmanski:

Fugro herewith presents our geotechnical study and input relative to development of the Black Rock Units 1, 2 & 3 Single Flash Geothermal Plant in Calipatria, California. The purpose of this study was to provide the initial geotechnical engineering efforts for the development of the proposed geothermal power plant.

From a geotechnical perspective, we consider the development of the project to be feasible. The proposed site for the development of the geothermal power plant is currently undeveloped and used for agriculture. The primary geotechnical considerations for development of the site include the impact of potentially high seismically-induced settlements on the proposed structures, mitigating potentially liquefiable soils beneath the project area, and establishing seismic design criteria for structural design of the turbine/genrators, cooling towers and other critical structures.

We look forward to working with CalEnergy Operating Corporation in the development of this project. Please call if further information is required or if we can answer any questions.

Sincerely,

FUGRO WEST, INC.

Jon M. Everett, P.E., G.E.
Principal Geotechnical Engineer

Craig D. Prentice, P.G., C.E.G.
Principal Engineering Geologist

Copies Submitted: (2) Addressee and Pdf

LIST OF ACRONYMS AND ABBREVIATIONS

ACI	American Concrete Institute
ASTM	ASTM International
bpf	blows per foot
CalEnergy	CalEnergy Operating Corporation
CBC	California Building Code
CDSM	Cement Deep Soil Mixing
CGS	California Geologic Survey
CPT	cone penetration test
DLE	Design Level Earthquake
HSA	hollow-stem auger
IBC	International Building Code
mV	millivolt
MW	megawatt
NAD83	North American Datum 83
NAVD88	North American Vertical Datum 88
PGA	peak ground acceleration
ppm	parts per million
psf	pounds per cubic foot
psf	pounds per square foot
R-value	Resistance-value
RW	rotary wash
SAF	San Andreas Fault
sec	second
SPT	standard penetration test
USA	Underground Service Alert

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APPENDICES

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

CalEnergy Operating Corporation (CalEnergy) plans to construct a geothermal power plant comprising three separate units known as Black Rock 1, 2 and 3. The facility will be located on a 160-acre parcel located approximately 5 miles west of Calipatria in Imperial County, California. The approximate location of the site is depicted in Figure 1-1 (Vicinity Map).

Each unit of the proposed facility will consist of a generating area and a production area having identical structural and mechanical components. Each unit will have a gross output of 59 mega watts (MW) and a net output of 53 MW, resulting in a gross combined output of 177 MW and a net combined output of 159 MW for the entire facility. Based on preliminary equipment loading data furnished by CalEnergy, we understand that the largest structural loads will be at the Cooling Tower (7.6 million pounds [lbs]) and the Condenser/Turbine/Generator structure (1 million lbs). Various elements of the project will serve all three units. These common elements include a control building, fire water and purge water storage tanks, pipe support structures, a stormwater retention basin, and site access roads. The features of the proposed facility are depicted in Figure 1-2 (Site Layout). A list of the proposed major structures and loads, as provided by CalEnergy, is presented in Figure 1-3.

1.2 FUGRO SERVICES

To aid CalEnergy in the development and design of the proposed Black Rock Units 1, 2 and 3 Geothermal Power Plant, Fugro conducted a geotechnical study to provide data and recommendation relative to site grading and foundation design. The findings and recommendations for this study, described herein, are applicable for the project description and project components as known to Fugro as of September 2008. Fugro's recommendations are based, in part, on our general knowledge of the project area and recent and historical subsurface explorations that have been conducted in the proposed geothermal power plant area. Pertinent data and results from previous studies applicable to the project were reviewed for this study. This report supersedes any prior reports or memoranda prepared by Fugro for this proposed project.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of our study was to explore subsurface conditions at the project site to aid in the design of the proposed facility. The scope of work included the following:

1.3.1 Data Review, Site Reconnaissance, and Access Coordination

In preparation for the field exploration program, Fugro reviewed boring and CPT logs and report data from the previous geotechnical study performed by Geotechnics on the north half of the site, project plans for the current development provided by CalEnergy, and other documents, maps, and existing geologic literature relevant to the site. Fugro also visited the site to meet with CalEnergy to locate and stake the borings and CPTs in the field in advance of mobilizing the drilling crews.

1.3.2 Field Exploration

The field exploration program was completed by Fugro in October, 2008, and consisted of 30 borings and 21 cone penetration test (CPT) soundings. The explorations were concentrated at the planned locations of major plant components. Further details regarding the field exploration program are presented in Section 3.0 and in Appendix A.

1.3.3 Laboratory Testing

Laboratory testing was performed on selected soil samples obtained during the field exploration program. The types and numbers of tests were chosen to help classify and characterize the subsurface soil and evaluate its engineering properties with respect to the proposed construction. Further details regarding the laboratory testing program are presented in Section 4.0 and in Appendix B.

1.3.4 Geotechnical Analyses and Evaluation

Using the data obtained from the field exploration and laboratory testing programs together with preliminary design and loading information provided by CalEnergy, Fugro performed geotechnical analyses and evaluations regarding the following topics:

- Geohazards evaluation consisting of fault rupture, liquefaction potential, seismically-induced settlement, lateral movements, and expansive/collapsible soils ;
- Ground motions for use in seismic design of structures;
- Allowable bearing pressure and settlement analyses for various structural elements assuming shallow footing or mat foundations;
- Ground improvement procedures to mitigate excessive settlement;
- Axial and lateral capacities for driven pile foundations;
- Slope stability for berms or levees;
- Slab and pavement design parameters for various vehicle loading conditions; and
- Corrosion potential for buried concrete and metal.

1.3.5 Engineering Report

Fugro has compiled the results of the geotechnical analyses and evaluations into this report for use by the design team. The report includes recommendations for the following information:

- Summary of soil and groundwater conditions observed during subsurface exploration at the site;
- Geohazard evaluation;
- California Geologic Survey (CGS) ground motion parameters for seismic design from published references including ground acceleration, mapped geologic units, and nearby faults;
- Criteria for temporary excavations and support, and dewatering, where appropriate;
- Suitability of onsite materials for use as fill or backfill material;

- Site preparation including overexcavation recommendations, stabilization measures, and grading and compaction requirements for fill placement;
- Design of ground improvement procedures where appropriate;
- Design of shallow foundations, where appropriate, including foundation preparation recommendations, maximum allowable bearing pressures and potential settlement, resistance to lateral loads, passive soil pressures, and friction coefficients;
- Design of deep foundations, where appropriate, including pile tip elevations, allowable axial and uplift capacities, lateral load capacity, and pile construction recommendations;
- Static and dynamic lateral earth pressures for retaining walls;
- Requirements for imported soils and fill materials placed behind retaining walls;
- An assessment of slope stability during saturated conditions for the existing levee along the western border of the site;
- Expansion potential of onsite soils;
- Design of flexible pavement sections for facility driveways and access roads; and
- Corrosion potential (pH, resistivity, sulfate, chlorides) for buried concrete and metal.

Fugro understands that the proposed stormwater retention basin will be unlined, but is intended to rely primarily on evaporation for disposal of accumulated stormwater. Also, sewage will be contained in temporary holding tanks prior to collection for offsite disposal, rather than through an on-site septic and leach field system. Therefore, the percolation characteristics of site soils were not addressed in this report.

1.4 AUTHORIZATION

This geotechnical study was authorized by CalEnergy in their Consulting Agreement with Fugro dated October 2, 2008.

1.5 LIMITATIONS

The conclusions and professional opinions presented in this report were developed by Fugro solely for CalEnergy for use during the design of foundations and other improvements to be constructed at the project site. Although information contained in this report may be of some use for other purposes, it may not contain sufficient information for other parties or uses. If any changes are made to the project as described in this report, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or validated in writing by Fugro.

The scope of services did not include any environmental assessments for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere. Any statements, or absence of statements, in this report or data presented herein regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous/toxic assessment.

In performing our professional services, we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers currently practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report. We recommend that Fugro be retained to review and comment on the geotechnical aspects of the project plans and specifications before they are finalized.

Users of this report should recognize that the construction process is an integral design component with respect to the geotechnical aspects of a project, and that geotechnical engineering is an inexact science due to the variability of natural and man-induced processes, which can produce unanticipated or changed conditions. Proper geotechnical observation and testing during construction are imperative in allowing the geotechnical engineer the opportunity to verify assumptions made during the design process. Therefore, we advise that Fugro be retained during site grading and foundation construction to observe compliance with the design concepts and geotechnical recommendations and to allow design changes in the event that subsurface conditions, or methods of construction, differ from those anticipated.

2.0 SITE DESCRIPTION

The project site is located on a 160-acre parcel approximately 5 miles west of Calipatria in Imperial County, California. As depicted on Figure 1-2, the site is bordered by McKendry Road to the north, Boyle Road to the east, Peterson Road to the south and Severe Road to the west. The site is divided into two 80-acre parcels separated a dirt road running in the east-west direction through the middle of the property. At the time of Fugro's field investigation in October 2008, the site was undeveloped and was being used for cultivation of alfalfa.

Generally, the site is relatively flat with a gentle downward gradient from southeast to northwest. The four roads that form the perimeter of the site, and the access road through the middle of the site, are all slightly higher in elevation than the adjacent cultivated fields, which vary in elevation from approximately -221 feet at the southeast corner to -229 feet at the northwest corner. The access road along the west side of the site separates the property from a drainage canal situated between the access road and Severe Road, and thereby functions as a levee or dike preventing the drainage canal water from flowing on to the site. The top of the access road/levee is about 4 to 8 feet above the adjacent fields.

3.0 FIELD EXPLORATION

3.1 PRIOR SUBSURFACE EXPLORATION PROGRAM

A geotechnical investigation was performed on the north half of the site for a project formerly known as the Salton Sea Unit No. 6 geothermal power plant. The report was prepared by Geotechnics, dated February 5, 2002 (Project No. 0673-002-00, Document No. 02-0022). This document, together with the Addendum to Geotechnical Investigation prepared by Geotechnics, dated March 27, 2002 (Project No. 0673-002-02, document No. 02-0296), was provided to Fugro by Tobey-Wade Consulting (Tobey-Wade) as authorized by CalEnergy. This project was postponed and eventually abandoned in favor of the currently proposed facility.

A brief review of the Geotechnics report indicates that the investigation included nine electric CPT soundings to depths ranging from 50 to 100 feet, and two hollow-stem-auger (HSA) borings ranging in depth from 58 to 77 feet. The locations of explorations performed as part of the Geotechnics study are shown on Figure 3-1. Geotechnics found that the site was underlain by loose sands and soft silts and clays susceptible to liquefaction and settlement and recommended that ground improvement methods (e.g., stone columns or vibroflotation) plus driven concrete pile foundations be used to support the facility structures.

As shown on Figure 3-1, the previous exploration program by Geotechnics (2002) for the former Salton Sea Unit No. 6 project provided only partial coverage of the currently proposed area of Black Rock Units 1, 2 and 3 power plant. Therefore, an additional exploration program was requested by CalEnergy and performed by Fugro.

3.2 FUGRO EXPLORATION PROGRAM

Overview. The field exploration program completed by Fugro for the Black Rock Units 1, 2 and 3 Project consisted of borings and CPTs. The locations of borings and CPTs performed for this study are shown on Figure 3-1. Information for each exploration including the California State Plane Zone 6 coordinates (in feet), ground surface elevations, and total exploration depth are tabulated in Table 3-1.

October 2008 Exploration. The field exploration program performed for the Black Rock Units 1, 2 and 3 project was initiated on October 7, 2008, and was completed on October 17, 2008. The subsurface exploration program consisted of 30 borings to obtain soil samples and 21 CPTs.

Of the 30 borings drilled on site, 23 were performed using a HSA and 7 were performed using rotary wash (RW) drilling equipment. RW borings were located under or near the planned locations of major features of the three generating areas. HSA borings were completed under the proposed locations of ponds, smaller equipment pads and along the access roads. The RW borings ranged in depth from approximately 50 to 85 feet below ground surface. The HSA borings ranged in depth from approximately 5 and 25 feet below ground surface. Soil samples were obtained at various depth intervals in both the RW and HSA borings. A Fugro geologist prepared a written log of the drilling and sampling conditions and the soil types observed for each boring. Further details regarding the field exploration program, including the boring logs, are presented in Appendix A.

Twenty-one CPTs were advanced at various locations across the site. The depths of the CPTs ranged from between 25 and 76 feet below ground surface. A total of about 1,330 linear feet of CPT soundings were performed for this study. A graphic log was generated in the field for each CPT performed. Further information regarding the CPT and the CPT logs are presented in Appendix A.

3.3 REFERENCE DATUM

A topographic survey map of the project site was provided by CalEnergy for Fugro's use in planning and executing the field investigation and engineering analyses. The map was based on the following data:

Horizontal Datum. California State Plane North American Datum 83 (NAD83), Zone 6 (Feet).

Vertical Datum. The vertical datum reference for this project is North American Vertical Datum 88 (NAVD88) (Feet).

3.4 SUBSURFACE OBSTRUCTIONS AND UTILITIES

Fugro notified Underground Service Alert (USA) and coordinated with CalEnergy for utility identification prior to commencement of the field exploration program. No utilities were identified at the site at any of Fugro's boring or CPT locations and no subsurface obstructions were encountered during the Fugro's field exploration program. However, it should be noted that other buried utilities and structures not located by USA or CalEnergy, or observed by Fugro, such as irrigation pipelines used for farming activities and pipes or other buried structures used by CalEnergy for their existing adjacent geothermal facilities, may be present on or adjacent to the Black Rock project site.

Table 3-1. Subsurface Explorations Summary

Boring / CPT	Estimated Ground Surface Elevation (feet, NAVD88)	Completion Depth (feet)	Start Date	Completion Date	Coordinates (feet) California State Zone 6, NAD 83	
					Northing	Easting
Rotary Wash Borings						
RW-01	-227.5	76.5	10/7/2008	10/8/2008	2004839	6752288
RW-02	-228.0	51.5	10/10/2008	10/10/2008	2004568	6751983
RW-03	-226.0	76.5	10/14/2008	10/14/2008	2004120	6751781
RW-04	-225.9	86.5	10/14/2008	10/14/2008	2004092	6751986
RW-05	-225.6	76.5	10/13/2008	10/13/2008	2004222	6752411
RW-06	-225.0	76.5	10/10/2008	10/10/2008	2004172	6752610
RW-07	-227.0	76.5	10/8/2008	10/8/2008	2004790	6752499
Hollow-Stem Auger Borings						
HSA-01	-228.5	6.5	10/15/2008	10/15/2008	2005752	6752870
HSA-02	-228.3	6.5	10/15/2008	10/15/2008	2005656	6752525
HSA-03	-228.9	26.5	10/15/2008	10/15/2008	2005555	6752124
HSA-04	-228.8	6.5	10/15/2008	10/15/2008	2005469	6751158
HSA-05	-224.0	6.5	10/17/2008	10/17/2008	2005837	6754161
HSA-06	-228.1	6.5	10/15/2008	10/15/2008	2005027	6752048

Boring / CPT	Estimated Ground Surface Elevation (feet, NAVD88)	Completion Depth (feet)	Start Date	Completion Date	Coordinates (feet) California State Zone 6, NAD 83	
					Northing	Easting
Hollow-Stem Auger Borings						
HSA-07	-228.0	6.5	10/15/2008	10/15/2008	2004934	6751075
HSA-08	-223.0	6.5	10/17/2008	10/17/2008	2005823	6755553
HSA-09	-227.5	26.5	10/15/2008	10/15/2008	2004753	6751236
HSA-10	-227.0	6.5	10/15/2008	10/15/2008	2004617	6751677
HSA-11	-227.0	11.5	10/15/2008	10/15/2008	2004291	6751165
HSA-12	-223.0	6.5	10/17/2008	10/17/2008	2004491	6752434
HSA-13	-219.0	6.5	10/17/2008	10/17/2008	2005204	6753571
HSA-14	-226.0	16.5	10/16/2008	10/16/2008	2004317	6751970
HSA-15	-226.2	11.5	10/15/2008	10/15/2008	2003996	6751182
HSA-16	-222.0	16.5	10/16/2008	10/16/2008	2004195	6750966
HSA-17	-226.0	6.5	10/16/2008	10/16/2008	2003936	6751586
HSA-18	-225.8	6.5	10/16/2008	10/16/2008	2003894	6752364
HSA-19	-221.0	16.5	10/18/2008	10/18/2008	2003583	6750967
HSA-20	-224.6	26.5	10/16/2008	10/16/2008	2003443	6752397
HSA-21	-225.8	6.5	10/16/2008	10/16/2008	2003288	6751504
HSA-22	-225.5	11.5	10/16/2008	10/16/2008	2003352	6751853
HSA-23	-225.8	6.5	10/16/2008	10/16/2008	2003270	6752135
Cone Penetration Tests (CPTs)						
C-101	-221.0	25.41	10/8/2008	10/8/2008	2005421	6750956
C-102	-228.9	50.19	10/8/2008	10/8/2008	2005697	6752117
C-103	-221.0	25.37	10/8/2008	10/8/2008	2004791	6750954
C-104	-227.9	75.24	10/7/2008	10/7/2008	2004966	6752229
C-105	-227.2	75.31	10/7/2008	10/7/2008	2004829	6752401
C-106	-227.3	50.15	10/7/2008	10/7/2008	2004673	6751827
C-107	-227.5	75.25	10/7/2008	10/7/2008	2004748	6752273
C-108	-226.6	75.36	10/7/2008	10/7/2008	2004655	6752567
C-109	-226.2	75.41	10/8/2008	10/8/2008	2004265	6751740
C-110	-225.6	75.37	10/9/2008	10/9/2008	2004312	6752361
C-111	-226.2	75.34	10/8/2008	10/8/2008	2004119	6751643
C-112	-225.7	75.37	10/8/2008	10/8/2008	2003996	6751779
C-113	-225.8	75.29	10/8/2008	10/8/2008	2004171	6751918
C-114	-225.7	75.28	10/8/2008	10/8/2008	2003947	6752088
C-115	-225.8	75.48	10/9/2008	10/9/2008	2004188	6752273
C-116	-225.2	75.43	10/8/2008	10/8/2008	2004134	6752408
C-117	-225.4	75.31	10/9/2008	10/9/2008	2004215	6752530
C-118	-224.9	75.8	10/9/2008	10/9/2008	2004045	6752706
C-119	-221.0	25.26	10/8/2008	10/8/2008	2003867	6750965
C-120	-224.9	50.33	10/8/2008	10/8/2008	2003460	6752247
C-121	-225.9	50.38	10/8/2008	10/8/2008	2004311	6752168

4.0 LABORATORY TESTING PROGRAM

The purpose of the laboratory testing program was to supplement field classification of soils and provided relevant physical indices and engineering properties of the subsurface materials. The primary objectives of the program were to:

- Classify and characterize sampled subsurface materials;
- Evaluate the existing in situ conditions; and
- Develop relevant strength and compressibility properties of selected subsurface materials.

To meet these objectives, various tests were performed on selected samples. Test types are generally grouped into six categories: classification and index tests, moisture content and density evaluations, strength tests and estimates, compressibility tests, soil chemical tests (for corrosion evaluations), and subgrade characterization tests. Classification and index, soil chemical, and subgrade characterization tests were performed on both disturbed and relatively undisturbed samples, including 3.0-inch diameter thin-wall push (i.e., Shelby) samples, 2.4-inch diameter drive (i.e., ring) samples, Standard Penetration Test (SPT), and bulk samples. Density evaluations, strength tests, and compressibility tests were typically performed only on relatively undisturbed Shelby and ring samples.

The numbers of the various tests conducted for the Black Rock units 1, 2 and 3 are listed in Table 4-1.

Table 4-1. Summary of Laboratory Tests Performed on Selected Samples

Laboratory Testing	Number of Tests	ASTM Test Designation[1]
Water Content	81	ASTM D2216
Density	79	ASTM D2937
Grain Size Distribution	3	ASTM D422
Percent Fines #200 Sieve	19	ASTM D1140
Atterberg Limits	22	ASTM D4318
Compaction	3	Cal. 216A[2]
Consolidation (Incremental Load Control)	6	ASTM D2435
Direct Shear	1	ASTM D3080
R-Value	3	ASTM D2435
Expansion Index	3	ASTM D4828
Corrosivity	5	ASTM D1498 ASTM D4972 ASTM G57 ASTM D4327

[1]ASTM International (2005)
[2]California Department of Transportation Test Designation

Laboratory test results are tabulated or presented graphically in Appendix B. A tabular summary of all laboratory tests performed for the Black Rock Units 1, 2 and 3 project is presented on Figures B-1 through B-6. Various laboratory test results also are tabulated versus depth on the individual boring logs (Figures A-2 through A-31). Test results that cannot be conveniently tabulated or plotted versus depth on logs also are provided in Appendix B. Test results in this category include: grain-size curves, plasticity charts, direct shear, consolidation, compaction test results and the corrosivity test results performed by a subconsultant laboratory.

5.0 GEOLOGIC AND SUBSURFACE CONDITIONS

5.1 REGIONAL SETTING

5.1.1 Geomorphic, Physiographic and Structural Setting

Southern California is divided into several physiographic regions, or provinces. The proposed project area is located in the Colorado Desert Geomorphic Province, which is a low-lying, barren basin dominated by the Salton Sea. The province is a depressed block that is bounded by the Mojave Desert Geomorphic Province to the east, and the Peninsular Ranges Geomorphic Province to the west (CGS, 2002).

The Salton Trough consists of the Coachella Valley to the north of the Salton Sea, the Salton Sea itself, and the Imperial Valley to the south (see Figure 5-1). The trough widens toward the southeast due to the nature of the relative plate motion as described in the following section. As shown on Figure 5-2, the Salton Trough is bounded by the San Andreas fault zone, Orocopia Mountains and Chocolate Mountains to the east; and the San Jacinto fault zone, Superstition Hills and Peninsular Ranges to the west. The east wall of the Trough at the San Andreas fault consists of Precambrian Rocks, Mesozoic plutons, and schists (Figures 5-3 and 5-4). The west wall consists of Cretaceous plutonic rocks of the Southern California (Peninsular Ranges) batholith and their metamorphic host rocks (Wallace, 1990, Jennings, 1994).

The structure of the Salton Trough itself can be generally described as a gap in the crystalline basement between the two walls of the Trough. This deep basin is underlain by a thick sequence of sediments and volcanic rocks. The volcanic rocks intrude into the sedimentary section as both silicic rocks that form volcanoes and as mafic rocks that are penetrated in geothermal wells. The volcanoes are found in areas where spreading is actively occurring in the Brawley Seismic Zone and Cerro Prieto geothermal area. Rhyolite and obsidian domes at the Salton Buttes are found in the Brawley Seismic Zone on the southeastern side of the Salton Sea near the project site, and Cerro Prieto Volcano is present in the Cerro Prieto geothermal area to the south (Wallace, 1990, Harden, 2004). Inclusions of mid-ocean ridge basalt have been found within the high-silica volcanic rocks indicating that mid-ocean ridge magma is interacting with the continental crust beneath the Salton Trough (Harden, 2004). Heat flow measurements also show that rifting is active in the trough, and the geothermal gradient is high enough to produce geothermal reservoirs. The proposed project will tap into one of these geothermal reservoirs.

The Salton Trough is being lengthened by continued right-lateral oblique transtension, and is being deepened by vertical motion on smaller faults associated with extension in the seismic zones where rifting is occurring. Thus, the trough is getting bigger and deeper as sediments accumulate in the large, subsiding basin. This process has been occurring continuously for the past 4 million years, allowing 5 to 6 kilometers (km) of Pliocene and Pleistocene sediments to accumulate (Wallace, 1990, Harden, 2004). This sediment thickness is obtained from numerous geophysical studies and wells drilled in the area (Wallace, 1990). Thus, "basement rock" or bedrock is at a depth of approximately 15,000 feet in the deepest portions of the trough. The subsidence in the trough has created a low-lying basin that is up to approximately 275 feet below sea level. Much of the Salton Trough, including the project site area, is below sea level.