DOCKETED

Docket Number:	23-AFC-03
Project Title:	Black Rock Geothermal Project (BRGP)
TN #:	250003-2
Document Title:	Black Rock Geothermal Project Air Quality Permit Application Part 1
Description:	N/A
Filer:	Jerry Salamy
Organization:	Jacobs
Submitter Role:	Applicant Consultant
Submission Date:	5/4/2023 1:39:41 PM
Docketed Date:	5/4/2023

Black Rock Geothermal LLC
4124 NW Urbandale Drive
Urbandale, IA 50322

Jon Trujillo
General Manager, Geothermal Development

April 24, 2023

Mr. Jesus Ramirez
APC Division Manager
Imperial County Air Pollution Control District
150 South Ninth Street
El Centro, California 92243

RE: Black Rock Geothermal, LLC Imperial County Air Pollution Control District Permit Application to Construct the Black Rock Geothermal Project

Dear Mr. Ramirez:

Black Rock Geothermal, LLC (the Applicant), an indirect, wholly owned subsidiary of BHE Renewables, LLC (BHER), is submitting five copies of the application materials for an Imperial County Air Pollution Control District (ICAPCD) Authority to Construct (ATC) for the Black Rock Geothermal Project (BRGP). This application is being submitted to ICAPCD in conjunction with an Application for Certification (AFC) that was submitted to the California Energy Commission (CEC) on April 18, 2023[1].

The BRGP will provide an efficient method for meeting power needs in California by providing firm, clean power from a renewable geothermal source. The Project design applies known equipment, operational lessons learned, and corrosion-resistant materials for a planned operational life of 40 years. BRGP's maximum continuous rating is approximately 87 megawatts (MW) gross output, with an expected net output of approximately 77 MW.

The BRGP consists of a proposed geothermal Resource Production Facility, a geothermal-powered Power Generation Facility, and associated facilities. The RPF includes geothermal production wells, pipelines, fluid and steam handling facilities, a solid handling system, a Class II surface impoundment, a service water pond, a retention basin, process fluid injection pumps, power distribution centers, and injection wells. The RPF also includes steam-polishing equipment designed to provide turbine-quality steam to the PGF. The PGF electrical power is generated using a triple pressure condensing turbine/generator set with a surface condenser, a non-condensable gas (NCG) removal system, an NCG sparger abatement system (located within the cooling tower basin), condensate bio-oxidation abatement systems adjacent to the cooling tower, a heat rejection system cooling tower, and a generator step-up transformer. Heat rejection for the steam turbines will be accomplished with a mechanical draft counterflow wet cooling tower. The PGF also includes a 230 kilovolt substation, power distribution centers, and five emergency standby diesel-fueled engines (four generators and one fire water pump. The Project also includes a control building, a service water pond, and other ancillary facilities.

The contents of this application package include the required ICAPCD forms and the following sections from the AFC:

- Section 1.0: Executive Summary
- Section 2.0: Project Description

[1] The CEC website for the project - https://www.energy.ca.gov/powerplant/steam-turbine/black-rock-geothermal-project-brgp

Black Rock Geothermal LLC
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Jon Trujillo
General Manager, Geothermal Development

- Section 5.1: Air Quality (includes Appendices 5.1A through 5.1E)
- Section 5.9: Public Health (includes Appendices 5.9A through 5.9B)

As described in Sections 5.1 and 5.9 of the AFC, the Applicant conducted a health risk assessment (HRA) and a criteria pollutant air quality impact analysis consistent with the current practice of estimating emissions from the cooling towers, geothermal brine systems, and diesel combustion engines and associated modeling guidelines. Emissions of criteria pollutants, air toxics, and greenhouse gases associated with operation of the BRGP were estimated using emission factors approved by the California Air Resources Board and the U.S. Environmental Protection Agency or representative analytical data from other geothermal power plants in the area, as detailed in Section 5.1 and Appendices 5.1A and 5.1B of the AFC. Section 5.9 of the AFC also summarizes the air toxics emissions used for the HRA. The results of these analyses indicate that BRGP would result in less than significant impacts with respect to air quality and public health. The BRGP is also not expected to require any offsets or emission reduction credits.

Emissions to the air due to BRGP operation will be minimized through the use of high-efficiency drift eliminators and a combination of hydrogen sulfide sparging and bio-oxidation box, which are considered best available control technology for the BRGP's cooling towers and geothermal processes, respectively. The diesel-fired emergency generators will be Tier 4 certified engines, meaning diesel particulate matter and criteria pollutant emissions will be minimized through the use of Tier 4 controls, including selective catalytic reduction, diesel particulate filtration, and a diesel oxidation catalyst.

Attached to this application is a check in the amount of $213.00 for the requisite application filing fee.

The Applicant looks forward to working with the ICAPCD during the review of these application materials and the issuance of the ICAPCD ATC. Please contact Anoop Sukumaran at (760) 348-4275 (email address: Anoop.Sukumaran@calenergy.com) or Andrew Dunavent at (707) 372-7810 (email address: Andrew.Dunavent@jacobs.com) if you have any questions or if you need additional information.
Sincerely,

Jon Trujillo
General Manager, Geothermal Development

AIR POLLUTION CONTROL DISTRICT

150 S 9th Street
El Centro, CA 92243
P. 442.265.1800
F. 442.265.1799

APPLICATION FOR

- [x] Authority to Construction
- [ ] New
- [ ] Amendment
- [ ] Permit to Operate
- [ ] Transfer of Ownership
- [ ] Relocation
- [ ] Name change
- [ ] Emission Credit Banking
- [ ] Change of Permit Conditions
- [ ] Equipment Modification or Addition

PERMIT NUMBER (if any) ____________

1. Name of Applicant: **Black Rock Geothermal, LLC**
2. Responsible Person: **Jon Trujillo**
3. Mailing Address: **7030 Gentry Road**
4. Title: **GM, Geothermal Development**
5. City: **Calipatria** State: **CA** Zip Code: **92233**
6. Phone: **(760) 604-0045** Cell Phone:
7. Type of Organization (Corp., Government, Individual, etc.): **Corporation**
8. Brief Description of Project/Activity: **Geothermal Resource Production and Power Generation Facility**
9. Location of Project/Activity: **APN 020-110-008 Bounded by Mckendry Road, Boyle Road, and Sever Road**
10. Property Owner: **BHE Renewables, LLC**
11. Person in Charge at Location: **Anoop Sukumaran**
12. Title: **Director**
13. Phone Number: **(760) 348-4275**
14. Anticipated Date of Construction — Start: **Apr 01, 2024**
15. Anticipated Life of Project: **40 Years** — Completion: **Aug 31, 2026**
16. Estimated Emissions

	Uncontrolled lbs/day	Controlled lbs/day
For largest single pollutant	See Attachments.	See Attachments.
Total for all emissions	See Attachments.	See Attachments.

17. Other Permits Have Been or Will be Obtained From: **Application for Certification was filed with the California Energy Commission on 04/18/23.**
18. Plot plans, flow charts, calculations, equipment description and other information required by "List and Critieria" attached.
19. The information previously submitted with **N/A** is still valid and no changes have been made except as shown on attachement.
20. Request for confidential handling of attached.
21. Total pages attached **807**

"I am familiar with the Rules and Regulations of the Imperial County Air Pollution Control District and I certify that the operation of the plant and/or equipment which is subject to the application will comply with said Rules and Regulations."

4/24/2023
Date

Signature of Responsible Person

OFFICE USE ONLY All payments must be made by Check or Money Order. Cash will not be accepted. An application fee of $213.00 is due upon submission of an application for 2023. Thank you.

Date application submitted: ____________ **Amount paid:** ____________

Received by: ____________ **Receipt Number:** ____________

Staff Comments:

150 South Ninth Street
El Centro, CA 92243
(442) 265-1800

IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

NOTICE

An application will not be processed unless ALL fields in "Section A" are complete.

Section A

Company/Agency Black Rock Geothermal, LLC	Phone Number 760-348-4275
Equipment Location Black Rock Geothermal Project	Existing Permit # (if any)
Engine Manufacturer Clarke	Model Number JU6H-UFADP0
Engine Serial Number: TBD	EPA/C.A.R.B. 12-character Engine Family Name NJDXL13.5103
Manufacturer Date: TBD	Is unit equipped with a non-resettable hour meter? ☒ Yes ☐ No

Utilization of Engine

- ☐ Electrical Generator ______ Kw
- ☐ Compressor Driver ______ cfm
- ☐ Pump Driver ______ gpm
- ☒ Fire Pump
- ☐ Rental
- ☐ Portable
- ☐ Other ______

Fuel Information

Air to Fuel Ratio ______

- ☐ Natural Gas
- ☐ Digester Gas
- ☐ Gasoline
- ☐ Landfill Gas
- ☐ LPG
- ☒ Diesel Oil
- ☐ Other ______

Engine Size (Manufacturers Rating) BHP@ 316 RPM 2400

Operating Schedule

1 Hr/Days 1 Days/Week

50 Weeks/Year Maximum Operating Hours Varies Hrs/Days

☒ Emergency Only (indicate hours operated for testing & maintenance)

Section B

Is this unit designed to be moved or carried from one location to another, or does it have wheels, skids,

☐ Yes (Portable) ☒ No (Stationary)

150 South Ninth Street
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IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

Section C

Engine Description — Number of Cylinders: 6

- ☐ Two Cycle or ☒ Four Cycle
- ☒ Lean Burn or ☐ Rich Burn
- ☒ Turbocharged ☐ Turbocharged/Aftercooled ☐ Naturally Aspirated

Sulfer Content of Disgester Gas, Landfill Gas or Diesel
15 ppm

Maximum Rated Fuel Consumption (Gas/Hr, Cu. Ft/Hr)
6 gal/hr

Average Load Percentage % 100

Energy Recovery From Exhaust ☐ Yes ☒ No If yes, please explain

Emission Control Device ☒ Yes ☐ No If yes, please explain
OEM Manufacturer Certification

Emission Data:

POLLUTANT	EMISSION BEFORE CONTROL Gr/BHP PPM Lb/Day	EMISSION AFTER CONTROL Gr/BHP PPM Lb/Day
NMHC or TOC	N/A	0.07
NOx	N/A	2.56
CO	N/A	0.6
PM10	N/A	0.08
SOx	N/A	<0.00001
	☒ Manufacturer Data	☐ Source Test Data

Section D

Stationary Engines Only

Stack Dimensions
Height Above Grade 15 Ft Height Above Building 5 Ft

Exhaust Cross Section
Diameter 6 In Width In Length In

Exhaust Temperature 737 ºF Direction of Stack Outlet ☐ Horizontal ☐ Other ☒ Vertical

End of the Stack ☐ Open ☐ Capped ☒ Flapper Valve

Stack Serves
- ☒ Only this equipment
- ☐ Other equipment also

Exhaust Flow 1995 CFM
Total Flow Rate CFM
Exhaust Pressure CFM

Receptor Information. A receptor is a residence or business whose occupants could be exposed to toxic emissions from your facility.

Nearest offsite receptor Agricultural Land
Distance to nearest offsite receptor 470 feet
Distance to nearest school grounds >10,000 feet

Andrew Dunavent
Name of preparer

4/24/2023
Date

150 South Ninth Street
El Centro, CA 92243
(442) 265-1800

IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

NOTICE

An application will not be processed unless ALL fields in "Section A" are complete.

Section A

Company/Agency: **Black Rock Geothermal, LLC**
Phone Number: **760-348-4275**

Equipment Location: **Black Rock Geothermal Project**
Existing Permit # (if any):

Engine Manufacturer: **Kohler**
Model Number: **KD62V12**

Engine Serial Number: **TBD**
EPA/C.A.R.B. 12-character Engine Family Name: **TBD**

Manufacturer Date: **TBD**
Is unit equipped with a non-resettable hour meter? ☒ Yes ☐ No

Utilization of Engine
☒ Electrical Generator **2700** Kw ☐ Fire Pump ☐ Portable
☐ Compressor Driver ______ cfm ☐ Other ______
☐ Pump Driver ______ gpm ☐ Rental

Fuel Information
Air to Fuel Ratio ______
☐ Natural Gas ☐ Gasoline ☐ LPG ☐ Other ______
☐ Digester Gas ☐ Landfill Gas ☒ Diesel Oil

Engine Size (Manufacturers Rating) BHP@ **3621** RPM **1800**

Operating Schedule
1 Hr/Days **1** Days/Week
50 Weeks/Year Maximum Operating Hours **Varies** Hrs/Days

☒ Emergency Only (indicate hours operated for testing & maintenance)

Section B

Is this unit designed to be moved or carried from one location to another, or does it have wheels, skids,
☐ Yes (Portable) ☒ No (Stationary)

150 South Ninth Street
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IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

Section C

Engine Description — Number of Cilinders: 12

☐ Two Cycle	or	☒ Four Cycle
☒ Lean Burn	or	☐ Rich Burn
☒ Turbocharged	☐ Turbocharged/Aftercooled	☐ Naturally Aspirated

Sulfer Content of Disgester Gas, Landfill Gas or Diesel
15 ppm

Maximum Rated Fuel Consumption (Gas/Hr, Cu. Ft/Hr)
175 gal/hr

Average Load Percentage % 100

Energy Recovery From Exhaust ☐ Yes ☒ No If yes, please explain

Emission Control Device ☒ Yes ☐ No If yes, please explain
Tier 4 Certified Unit with SCR, Diesel Oxidation Catalyst and Diesel Particulate Filter

Emission Data:

POLLUTANT	EMISSION BEFORE CONTROL Gr/BHP PPM Lb/Day	EMISSION AFTER CONTROL Gr/BHP PPM Lb/Day
NMHC or TOC	N/A	0.14
NOx	N/A	0.5
CO	N/A	2.61
PM10	N/A	0.02
SOx	N/A	<0.00001
	☒ Manufacturer Data	☐ Source Test Data

Section D

Stationary Engines Only

Stack Dimensions
Height Above Grade 20.5 Ft Height Above Building 6 Ft

Exhaust Cross Section
Diameter 12.6 In Width In Length In

Exhaust Temperature 914 ºF Direction of Stack Outlet ☐ Horizontal ☐ Other ☒ Vertical

End of the Stack ☐ Open ☐ Capped ☒ Flapper Valve

Stack Serves
☒ Only this equipment
☐ Other equipment also

Exhaust Flow 19467 CFM
Total Flow Rate CFM
Exhaust Pressure CFM

Receptor Information. A receptor is a residence or business whose occupants could be exposed to toxic emissions from your facility.

Nearest offsite receptor Agricultural Land
Distance to nearest offsite receptor 610 feet
Distance to nearest school grounds >10,000 feet

Andrew Dunavent — Name of preparer

4/24/2023 — Date

150 South Ninth Street
El Centro, CA 92243
(442) 265-1800

IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

NOTICE

An application will not be processed unless ALL fields in "Section A" are complete.

Section A

Company/Agency: Black Rock Geothermal, LLC
Phone Number: 760-348-4275

Equipment Location: Black Rock Geothermal Project
Existing Permit # (if any):

Engine Manufacturer: Kohler
Model Number: KD83V16

Engine Serial Number: TBD
EPA/C.A.R.B. 12-character Engine Family Name: TBD

Manufacturer Date: TBD
Is unit equipped with a non-resettable hour meter? ☒ Yes ☐ No

Utilization of Engine
- ☒ Electrical Generator 3490 Kw
- ☐ Compressor Driver ______ cfm
- ☐ Pump Driver ______ gpm
- ☐ Fire Pump
- ☐ Rental
- ☐ Portable
- ☐ Other ______

Fuel Information
Air to Fuel Ratio ______
- ☐ Natural Gas
- ☐ Digester Gas
- ☐ Gasoline
- ☐ Landfill Gas
- ☐ LPG
- ☒ Diesel Oil
- ☐ Other ______

Engine Size (Manufacturers Rating) BHP@ 4680 RPM 1800

Operating Schedule
1 Hr/Days 1 Days/Week
50 Weeks/Year Maximum Operating Hours Varies Hrs/Days

☒ Emergency Only (indicate hours operated for testing & maintenance)

Section B

Is this unit designed to be moved or carried from one location to another, or does it have wheels, skids,
☐ Yes (Portable) ☒ No (Stationary)

150 South Ninth Street
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IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

Section C

Engine Description — Number of Cylinders: 16

- ☐ Two Cycle — or — ☒ Four Cycle
- ☒ Lean Burn — or — ☐ Rich Burn
- ☒ Turbocharged — ☐ Turbocharged/Aftercooled — ☐ Naturally Aspirated

Sulfer Content of Disgester Gas, Landfill Gas or Diesel

15 ppm

Maximum Rated Fuel Consumption (Gas/Hr, Cu. Ft/Hr)
219 gal/hr

Average Load Percentage % 100

Energy Recovery From Exhaust ☐ Yes ☒ No If yes, please explain

Emission Control Device ☒ Yes ☐ No If yes, please explain
Tier 4 Certified Unit with SCR, Diesel Oxidation Catalyst and Diesel Particulate Filter

Emission Data:

POLLUTANT	EMISSION BEFORE CONTROL Gr/BHP PPM Lb/Day	EMISSION AFTER CONTROL Gr/BHP PPM Lb/Day
NMHC or TOC	N/A	0.14
NOx	N/A	0.5
CO	N/A	2.61
PM10	N/A	0.02
SOx	N/A	<0.00001
	☒ Manufacturer Data	☐ Source Test Data

Section D

Stationary Engines Only

Stack Dimensions
Height Above Grade 20.5 Ft — Height Above Building 6 Ft

Exhaust Cross Section
Diameter 12.6 In — Width In — Length In

Exhaust Temperature 887 ºF — Direction of Stack Outlet ☐ Horizontal ☐ Other ☒ Vertical

End of the Stack ☐ Open ☐ Capped ☒ Flapper Valve

Stack Serves
- ☒ Only this equipment
- ☐ Other equipment also

Exhaust Flow 23700 CFM
Total Flow Rate ______ CFM
Exhaust Pressure ______ CFM

Receptor Information. A receptor is a residence or business whose occupants could be exposed to toxic emissions from your facility.

Nearest offsite receptor Agricultural Land
Distance to nearest offsite receptor 150 feet
Distance to nearest school grounds >10,000 feet

Andrew Dunavent — **Name of preparer**

4/24/2023 — **Date**

150 South Ninth Street
El Centro, CA 92243
(442) 265-1800

IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

NOTICE

An application will not be processed unless ALL fields in "Section A" are complete.

Section A

Company/Agency: Black Rock Geothermal, LLC	Phone Number: 760-348-4275
Equipment Location: Black Rock Geothermal Project	Existing Permit # (if any):
Engine Manufacturer: Kohler	Model Number: KD83V16
Engine Serial Number: TBD	EPA/C.A.R.B. 12-character Engine Family Name: TBD
Manufacturer Date: TBD	Is unit equipped with a non-resettable hour meter? ☒ Yes ☐ No

Utilization of Engine

- ☒ Electrical Generator 3490 Kw
- ☐ Compressor Driver ______ cfm
- ☐ Pump Driver ______ gpm
- ☐ Fire Pump
- ☐ Rental
- ☐ Portable
- ☐ Other ______

Fuel Information

- ☐ Natural Gas
- ☐ Digester Gas
- ☐ Gasoline
- ☐ Landfill Gas
- ☐ LPG
- ☒ Diesel Oil
- ☐ Other ______

Air to Fuel Ratio ______

Engine Size (Manufacturers Rating) BHP@ 4680 RPM 1800

Operating Schedule

1 Hr/Days 1 Days/Week

50 Weeks/Year Maximum Operating Hours Varies Hrs/Days

☒ Emergency Only (indicate hours operated for testing & maintenance)

Section B

Is this unit designed to be moved or carried from one location to another, or does it have wheels, skids,

☐ Yes (Portable) ☒ No (Stationary)

150 South Ninth Street
El Centro, CA 92243
(442) 265-1800

IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

Section C

Engine Description — Number of Cylinders: 16

- ☐ Two Cycle or ☒ Four Cycle
- ☒ Lean Burn or ☐ Rich Burn
- ☒ Turbocharged ☐ Turbocharged/Aftercooled ☐ Naturally Aspirated

Sulfer Content of Disgester Gas, Landfill Gas or Diesel
15 ppm

Maximum Rated Fuel Consumption (Gas/Hr, Cu. Ft/Hr)
219 gal/hr

Average Load Percentage % 100

Energy Recovery From Exhaust ☐ Yes ☒ No If yes, please explain

Emission Control Device ☒ Yes ☐ No If yes, please explain
Tier 4 Certified Unit with SCR, Diesel Oxidation Catalyst and Diesel Particulate Filter

Emission Data:

POLLUTANT	EMISSION BEFORE CONTROL Gr/BHP PPM Lb/Day	EMISSION AFTER CONTROL Gr/BHP PPM Lb/Day
NMHC or TOC	N/A	0.14
NOx	N/A	0.5
CO	N/A	2.61
PM10	N/A	0.02
SOx	N/A	<0.00001
	☒ Manufacturer Data	☐ Source Test Data

Section D

Stationary Engines Only

Stack Dimensions
Height Above Grade 20.5 Ft Height Above Building 6 Ft

Exhaust Cross Section
Diameter 12.6 In Width In Length In

Exhaust Temperature 887 ºF Direction of Stack Outlet ☐ Horizontal ☐ Other ☒ Vertical

End of the Stack ☐ Open ☐ Capped ☒ Flapper Valve

Stack Serves
- ☒ Only this equipment
- ☐ Other equipment also

Exhaust Flow 23700 CFM
Total Flow Rate ______ CFM
Exhaust Pressure ______ CFM

Receptor Information. A receptor is a residence or business whose occupants could be exposed to toxic emissions from your facility.

Nearest offsite receptor Agricultural Land
Distance to nearest offsite receptor 175 feet
Distance to nearest school grounds >10,000 feet

Andrew Dunavent
Name of preparer

4/24/2023
Date

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(442) 265-1800

IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

NOTICE

An application will not be processed unless ALL fields in "Section A" are complete.

Section A

Company/Agency Black Rock Geothermal, LLC	Phone Number 760-348-4275
Equipment Location Black Rock Geothermal Project	Existing Permit # (if any)
Engine Manufacturer Kohler	Model Number KD83V16
Engine Serial Number: TBD	EPA/C.A.R.B. 12-character Engine Family Name TBD
Manufacturer Date: TBD	Is unit equipped with a non-resettable hour meter? ☒ Yes ☐ No

Utilization of Engine

☒ Electrical Generator 3490 Kw ☐ Fire Pump ☐ Portable
☐ Compressor Driver ______ cfm ☐ Other ______
☐ Pump Driver ______ gpm ☐ Rental

Fuel Information — Air to Fuel Ratio ______

☐ Natural Gas ☐ Gasoline ☐ LPG ☐ Other ______
☐ Digester Gas ☐ Landfill Gas ☒ Diesel Oil

Engine Size (Manufacturers Rating) BHP@ 4680 RPM 1800

Operating Schedule

1 Hr/Days 1 Days/Week

50 Weeks/Year Maximum Operating Hours Varies Hrs/Days

☒ Emergency Only (indicate hours operated for testing & maintenance)

Section B

Is this unit designed to be moved or carried from one location to another, or does it have wheels, skids,

☐ Yes (Portable) ☒ No (Stationary)

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IMPERIAL COUNTY
AIR POLLUTION CONTROL DISTRICT

INTERNAL COMBUSTION ENGINE SUMMARY FORM

Section C

Engine Description — Number of Cylinders: 16

- ☐ Two Cycle or ☒ Four Cycle
- ☒ Lean Burn or ☐ Rich Burn
- ☒ Turbocharged ☐ Turbocharged/Aftercooled ☐ Naturally Aspirated

Sulfer Content of Disgester Gas, Landfill Gas or Diesel
15 ppm

Maximum Rated Fuel Consumption (Gas/Hr, Cu. Ft/Hr)
219 gal/hr

Average Load Percentage % 100

Energy Recovery From Exhaust ☐ Yes ☒ No If yes, please explain

Emission Control Device ☒ Yes ☐ No If yes, please explain
Tier 4 Certified Unit with SCR, Diesel Oxidation Catalyst and Diesel Particulate Filter

Emission Data:

POLLUTANT	EMISSION BEFORE CONTROL Gr/BHP PPM Lb/Day	EMISSION AFTER CONTROL Gr/BHP PPM Lb/Day
NMHC or TOC	N/A	0.14
NOx	N/A	0.5
CO	N/A	2.61
PM10	N/A	0.02
SOx	N/A	<0.00001
	☒ Manufacturer Data	☐ Source Test Data

Section D

Stationary Engines Only

Stack Dimensions
Height Above Grade 20.5 Ft Height Above Building 6 Ft

Exhaust Cross Section
Diameter 12.6 In Width In Length In

Exhaust Temperature 887 ºF Direction of Stack Outlet ☐ Horizontal ☐ Other ☒ Vertical

End of the Stack ☐ Open ☐ Capped ☒ Flapper Valve

Stack Serves
- ☒ Only this equipment
- ☐ Other equipment also

Exhaust Flow 23700 CFM
Total Flow Rate CFM
Exhaust Pressure CFM

Receptor Information. A receptor is a residence or business whose occupants could be exposed to toxic emissions from your facility.

Nearest offsite receptor Agricultural Land
Distance to nearest offsite receptor 200 feet
Distance to nearest school grounds >10,000 feet

Andrew Dunavent
Name of preparer

4/24/2023
Date

Attachments: California Energy Commission Application For Certification Sections and Appendices for ICAPCD

1. Executive Summary

Black Rock Geothermal LLC (the Applicant), an indirect, wholly owned subsidiary of BHE Renewables, LLC (BHER), proposes to site and construct the Black Rock Geothermal Project (BRGP or Project) within the Salton Sea Known Geothermal Resource Area (KGRA) located near Calipatria, Imperial County, California. The Project will be owned and operated by Black Rock Geothermal LLC, along with the associated interconnection transmission line (gen-tie). The Project permanent facilities include geothermal production wells, pipelines, fluid and steam handling facilities, a solids handling system, Class II surface impoundment, service water pond, a retention basin, process fluid injection pumps, and injection wells.

The Project will provide an efficient method for meeting power needs in California by providing firm, clean power from a renewable geothermal source. The Project design applies known equipment, operational lessons learned, and corrosion resistant materials for a planned operational life of 40 years. The Project's maximum continuous rating is approximately 87 megawatts (MW) gross output, with an expected net output of approximately 77 MW.

1.1 Project Objectives

The Project's primary objective is to develop, construct and operate a baseload renewable electrical generating facility that supports grid reliability and the State's goal for a transition to a 100% renewable energy and zero-carbon resource supply to end-use customers by 2045.

1.2 Project Location

The Project will be located on approximately 55 acres of a 160-acre parcel within the unincorporated area of Imperial County, California, and is bounded by McKendry Road to the north, Severe Road to the west, and Boyle Road to the east. The town of Niland is approximately eight miles to the northeast, and the town of Calipatria is approximately six miles southeast of the plant site as shown on Figure 1-1. The surrounding area consists of actively farmed fields as well as other geothermal projects located throughout the area, including the Vulcan Power Plant and the Hoch (Del Ranch) Power Plant, collectively operated as the Region 2 facilities, both located to the southeast of the site. The Sonny Bono National Wildlife Refuge headquarters is approximately 0.7 mile northeast of the Project. A rendering of the Project site prior to construction is shown on Figure 1-2, and an architectural rendering is provided as Figure 1-3. A list of the owners of property within 1,000 feet of the Project and 500 feet of project linears is provided in Appendix 1A. A list of preparers is provided as Appendix 1B.

1.3 Project Elements

The main Project elements, including linear facilities and construction laydown areas, are shown on Figure 1-4 and are as follows:

- One steam turbine generator system consisting of a condensing turbine generator set with three steam entry pressures (high pressure, standard pressure, and low pressure).
- Geothermal fluid processing systems, including steam separation vessels, pipelines, and tanks.
- One seven-cell cooling tower.
- An interconnection to the proposed Imperial Irrigation District (IID) Elmore North switching station via an approximately 2.2-mile-aboveground generator tie-line that runs from the BRGP northeast to the substation.
- Twelve wells and seven associated well pads.
- Five production wells on three well pads adjacent to the plant; three production pipelines will connect production wells to the plant site.

- Seven injection wells on four well pads south of the plant; three aboveground injection pipelines will exit the southern border of the plant site and follow existing roads to the injection wells.
- A Class II surface impoundment (Brine Pond) sized to receive aerated process fluid, geothermal fluid from unplanned overflow events, geothermal fluid from the partial draining of clarifiers during maintenance events; aerated fluid from the Brine Pond will be directed to a dedicated aerated fluid injection well.
- Process water supply from IID via the Vail 4A Lateral Gate 459 or 460 immediately east of the Project, as well as an approximately 0.5-mile-long secondary connection via Vail 4 Lateral Gate 417 or 418 adjacent to Gentry Road to the east of the Project; potable water will be supplied through a reverse osmosis system or an equivalent system, and/or delivered through a commercial water service.
- Up to nine laydown and parking areas, two construction crew camps, and up to four borrow pits located throughout the region; most of the laydown and parking areas for BRGP will be located adjacent to the site immediately south and east; however, all sites may be used and will be shared between three proposed geothermal projects: the Project, Elmore North Geothermal Project, and Morton Bay Geothermal Project.

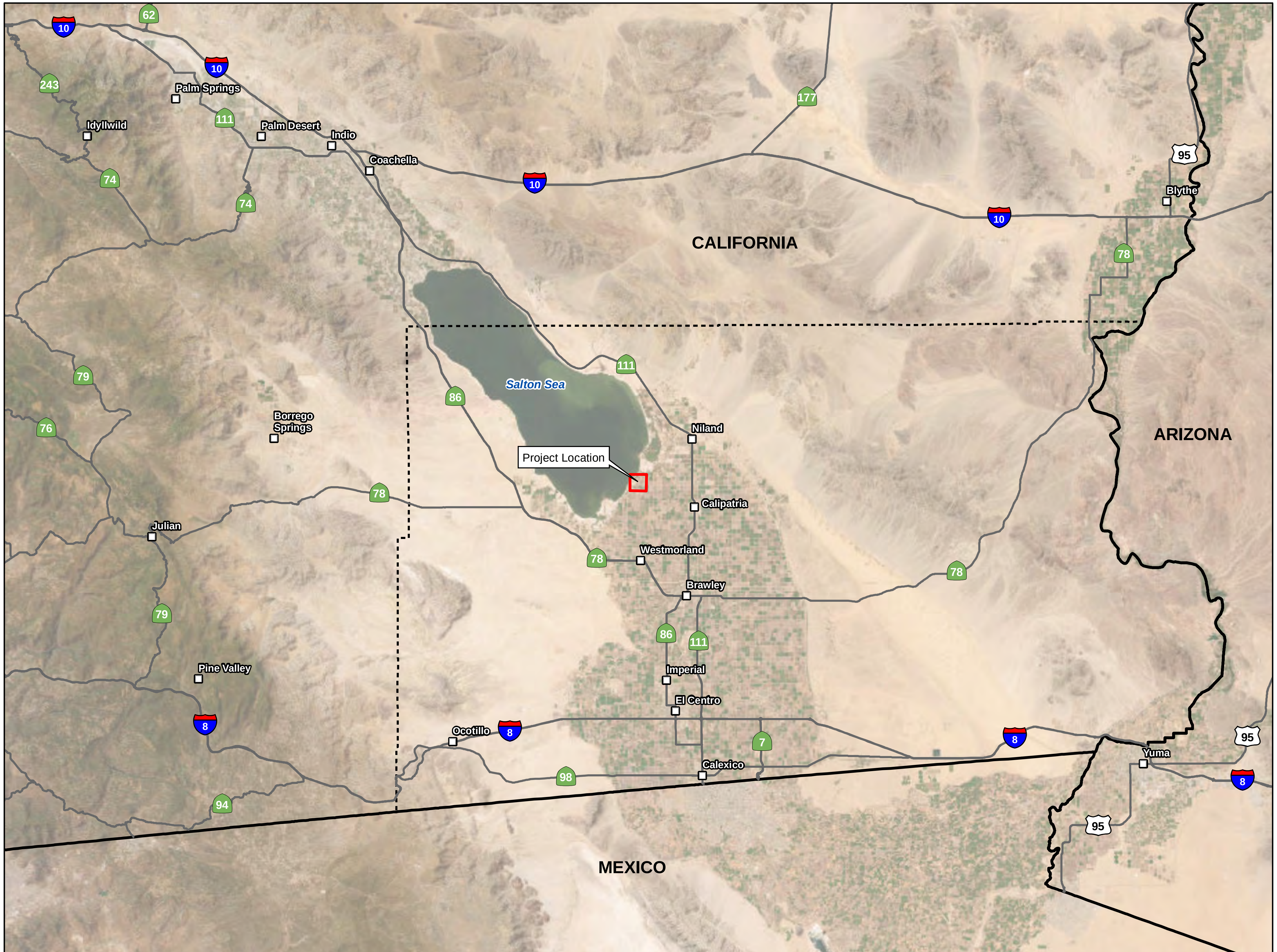
1.4 Project Benefits

BRGP will provide the following key environmental and economic benefits:

- **Baseload Renewable Portfolio Standard Resource:** The Project is an eligible renewable energy resource able to satisfy California's Renewable Portfolio Standard (RPS) requirements and will generate geothermal energy 24 hours a day, 365 days a year, with an average availability of 95% or higher. By providing clean, efficient power using renewable geothermal resources by the end of the second quarter of 2026, the Project helps fulfill the long-term energy needs of California and goals of State Bill (SB) 100.
- **Reliability Support for the California Grid:** As RPS goals increase, a larger portion of the power mix will be supplied by intermittent and weather-dependent resources; firm clean power will become a critical piece of the power mix. The Project's ability to provide much-needed renewable baseload generation was determined necessary for the reliability of the California grid, considering the projected 2030 closure of the Diablo Canyon Nuclear Generating Station.
- **Key Project for Baseload Clean Energy Production:** The Project will provide 77 MW (net) baseload renewable electricity using geothermal resources, which assists with meeting the State's goal for a transition to a 100% renewable energy and zero-carbon resource supply to end-use customers by 2045.
- **Numerous Construction Jobs:** The Project will provide for a peak of approximately 426 construction workers over a 29-month construction and commissioning period.
- **Substantial Property Tax Revenue for Imperial County:** The Project will generate approximately $5.9 million to $10 million in property tax per year.
- **Local Economic Benefits:** Once operating, the Project will not significantly impact local housing, educational, or emergency response resources. In addition to the direct employment benefit of approximately 61 jobs when online, the Project will enhance the local economy by using the services of local or regional firms for major maintenance and overhauls, plant supplies, and other support services throughout the life of the Project.

1.5 Project Ownership

The Applicant, an indirect, wholly owned subsidiary of BHER, will construct, own, and operate the Project. The geothermal leasehold is owned and will be operated by Magma Power Company, a parent of the Applicant.



Legend

- City or Town
- Major Road
- Imperial County Boundary
- State or National Boundary

N

0 5 10 20
Miles

Figure 1-1
Project Vicinity
Black Rock Geothermal Project
Imperial County, California

Jacobs

Figure 1-2
Project Site Prior to Construction,
Black Rock Geothermal Project
Imperial County, California

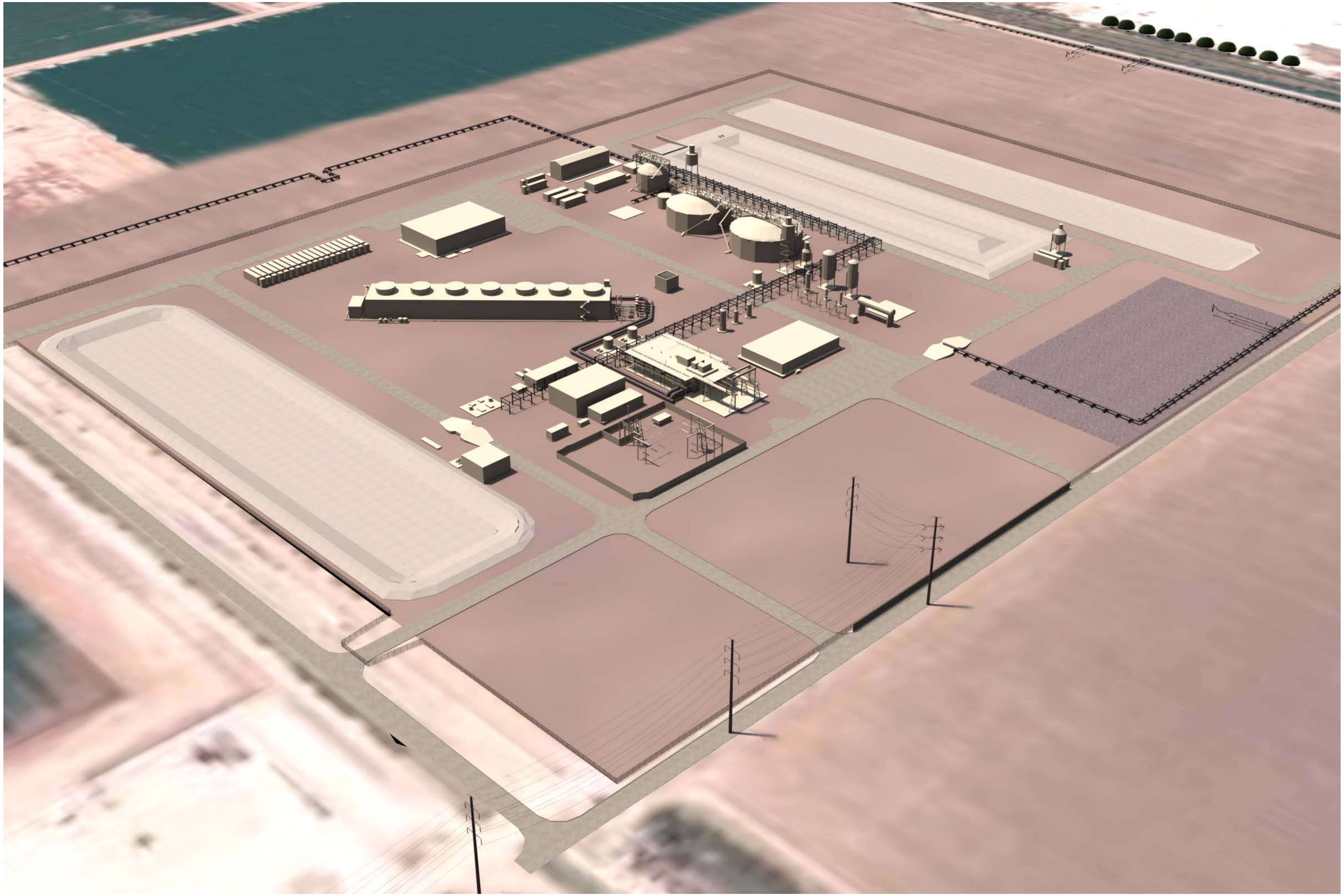
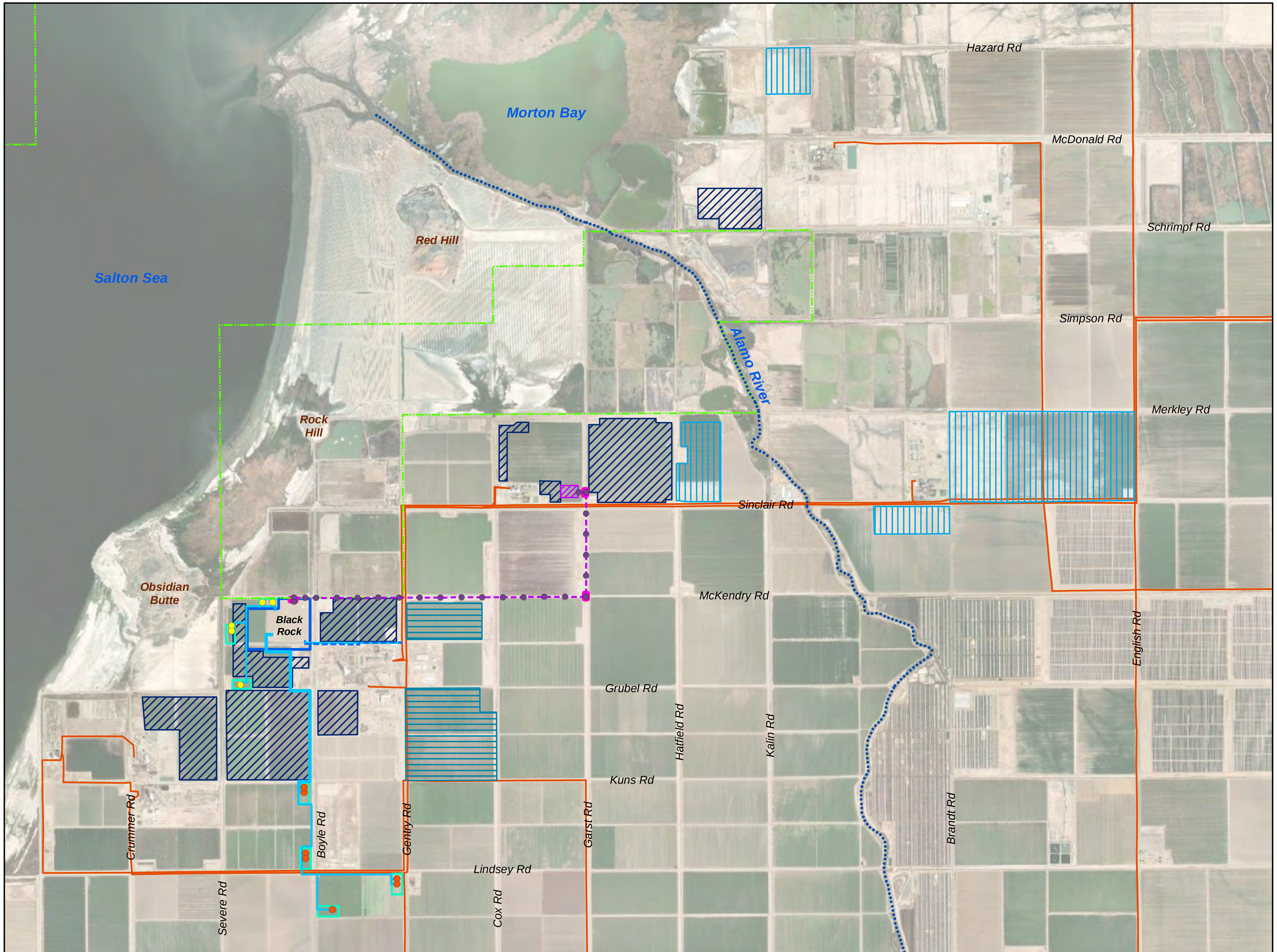


Figure 1-3
Architectural Rendering,
Black Rock Geothermal Project
Imperial County, California

Jacobs



Legend

- Plant
- Well Pad
- Injection Well
- Production Well
- Pipeline
- Water Supply Pipeline
- Gen-Tie Line Pole
- Gen-Tie Line
- Pull Site
- Switching Station
- Borrow Pit
- Construction Camp
- Construction Laydown and Parking Areas
- Existing Transmission/Distribution Power Lines
- Sonny Bono Salton Sea National Wildlife Refuge

N

0 0.25 0.5 1
Miles

Figure 1-4
Project Location
Black Rock Geothermal Project
Imperial County, California

Jacobs

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1.6 Project Schedule

The Applicant is filing this Application for Certification (AFC) under the California Energy Commission's (CEC's) 12-month licensing process for geothermal projects located on a site capable of providing geothermal resources in commercial quantities. Construction of the Project is expected to begin no later than second quarter 2024 and full-scale commercial operation is expected to begin by the second quarter of 2026.

1.7 Environmental Considerations

Pursuant to the requirements set forth in existing environmental laws and the CEC's regulations, 16 areas of possible environmental impact from the Project were investigated. Detailed descriptions and analyses of these areas are presented in Sections 5.1 through 5.16 of the AFC. As discussed in detail in this AFC, with the implementation of the proposed mitigation measures and the anticipated Conditions of Certification, there will be no significant unmitigated environmental impacts associated with the construction and operation of BRGP. This Executive Summary highlights seven subject areas that have historically been of interest in CEC proceedings: air quality, biological resources, cultural resources, land use, noise, visual resources, and water resources.

1.7.1 Air Quality

An assessment of the potential impact on air quality was conducted based on the Project emission estimates and air dispersion modeling. As discussed in Section 5.1, the predicted impacts are expected to be less than the California Ambient Air Quality Standards for the attainment pollutants (carbon monoxide, nitrogen oxides, and sulfur dioxide). The Project is located in an area designated by the U.S. Environmental Protection Agency as nonattainment for ozone and by the California Air Resources Board as nonattainment for ozone and particulate matter with a diameter less than 10 microns. The Project's potential air quality impacts will be mitigated by the installation and operation of best available control technology for hydrogen sulfide emissions from geothermal processes and for particulate emissions from cooling tower operations. After mitigation, the Project will have less than significant air quality and public health impacts. Refer to Section 5.1 for a detailed analysis of air quality and Section 5.9 for a detailed analysis of public health.

1.7.2 Biological Resources

The Project is located on privately owned lands in a low area surrounded by mountains with no outlet for flowing water. This area is highly disturbed by agriculture and geothermal development and does not contain high-quality natural habitat. Land cover types are mostly nonnatural, including agriculture, developed, and disturbed. The natural vegetation types include Barren, Invasive Southwest Riparian Woodland and Shrubland, North American Arid West Emergent Marsh, and North American Warm Desert Playa. The Project does not contain any California Department of Fish and Wildlife special-status habitats or U.S. Fish and Wildlife Service (USFWS)-designated critical habitat. However, there are six special-status species that have a high potential to be present or are present at the Project, including burrowing owl and long-billed curlew.

Standard avoidance and mitigation measures will be developed in the Biological Resources Mitigation Implementation Monitoring Plan that will be submitted to CEC. The Project may have temporary and/or permanent impacts on biological resources. Section 5.2, Biological Resources, provides a detailed discussion of potential impacts on biological resources from the construction and operation of the Project.

1.7.3 Cultural Resources

There is one identified archaeological property within the Project's area of potential effect which does not appear to be eligible for inclusion in the California Register of Historical Resources (CRHR). Initial information requests with Native American Tribes have identified resources and cultural landscapes in the area. A historic architectural literature search and field survey indicates that a building and several structures older than 50 years are located in the area surrounding the Project, but that this building and structures do not meet the criteria for listing in the National Register of Historic Places or CRHR. Section 5.3 provides a detailed discussion of potential impacts on cultural resources from the construction and operation of the Project. The Applicant has been and will continue to be in close communication with Native American Tribes and other stakeholders to ensure that potential Project impacts on these resources will be mitigated.

1.7.4 Land Use

The Project is consistent with all applicable federal, state, and local plans and policies, and as such, there are no significant land use impacts associated with the implementation of the Project. The Project is subject to applicable policies in the *Imperial County General Plan* and has a General Plan Land Use designation of Agriculture. The Project is on land that is zoned A-3 with a Geothermal Overlay. Per Imperial County Code Section § 90509.02, major geothermal projects that meet the requirements of Division 17 are conditionally permitted in the A-3 zoning. Further, the Geothermal Overlay identifies the parcel as suitable for geothermal activities. The Project will not conflict with air navigation operations associated with Calipatria Municipal Airport. Section 5.6 contains a detailed discussion of the Project's land use.

1.7.5 Noise

There will be no significant adverse noise impacts from the construction or operation of the Project. The Project will comply with Imperial County's guidelines, which have established a sound limit of 70 A-weighted decibels Community Noise Exposure Level at the nearest residence. A USFWS-owned house at Sonny Bono National Wildlife Refuge headquarters used for employee housing is approximately 0.7 mile from the Project and the nearest permanent private residence is located approximately 2.5 miles from the Project. Given the large distances to the closest residence, the steady-state operations of the Project will readily comply. Section 5.7 contains a detailed discussion of the noise impact assessment.

1.7.6 Visual Resources

The Project will not result in significant adverse visual impacts, nor will it significantly degrade the existing visual character or quality of the site and its surroundings. Surrounding land uses include existing agricultural operations, geothermal powerplant facilities, and open space. Approximately five existing geothermal powerplants are located within a 10-mile radius of the Project. The Project will be visible from nearby public viewpoints, including roadways, Red Hill Marina County Park, Rock Hill, and within other areas of the Sonny Bono Salton Sea National Wildlife Refuge. The existing visual character and quality of the area includes industrial and utility structures, primarily from existing geothermal powerplants, electrical distribution lines, and various agricultural facilities. Therefore, even where the Project would be seen, it will not substantially degrade the visual character or quality of the surroundings. The Project is not located within a designated scenic area and there are no state scenic highways in its vicinity. Section 5.13 contains a detailed discussion of the visual resources assessment.

1.7.7 Water Resources

There will be no significant adverse impacts on water resources from the construction or operation of the Project. The largest water demand for the facility is cooling tower makeup water to offset water lost through evaporation. Cooling tower makeup water will primarily be provided by condensed geothermal steam from the main condenser except during high ambient conditions when supplemental water will be used from the service water pond. Approximately 80% of the operational water required by the facility will be generated by steam condensed in the main condenser. On an annual average basis during operation, water needs from the IID canal are approximately 1,125 acre-feet per year at design conditions, which is less than 20% of the total facility water needs. IID canal water also will serve as the water source for maintenance activities, the fire protection system, and to fill the cooling tower prior to startup. IID, the water service provider, has requested a water supply assessment. Section 5.15 contains a detailed analysis of water resources.

1.8 Conclusion

The Project will provide reliable and clean renewable energy meeting California's goals, enhance the local economy and create jobs, and have no significant adverse impacts to the local environment. Accordingly, the Project is in the public interest and should be expeditiously permitted.

2 Project Description

2.1 Introduction

Black Rock Geothermal LLC (the Applicant), an indirect, wholly owned subsidiary of BHE Renewables, LLC (BHER), proposes to site (Assessor Parcel Number 020-110-008) and construct the Black Rock Geothermal Project (BRGP or Project) within the Salton Sea Known Geothermal Resource Area (KGRA) near Calipatria, Imperial County, California. The BRGP will be owned and operated by Black Rock Geothermal LLC, along with the associated interconnection transmission line (gen-tie line).

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. Refer to 30 United States Code (USC) 1001.

The BRGP will deliver an efficient method for meeting power needs in California by providing firm, clean power from a renewable geothermal source. The Project design applies known equipment, operational lessons learned, and corrosion-resistant materials for a planned operational life of 40 years. BRGP's maximum continuous rating (MCR) is approximately 87 megawatts (MW) gross output, with an expected net output of approximately 77 MW.

The BRGP is located on a site capable of providing geothermal resources in commercial quantities. Therefore, as provided for in California Public Resources Code Section 25540.2 and Section 1803 of the California Energy Commission (CEC) regulations, the Applicant requests a 12-month certification process for this Application for Certification (AFC).

2.2 Project Objectives

It is the policy of the state of California to encourage the use of geothermal resources for thermal power plants, wherever feasible, recognizing that such use has the potential of providing direct economic benefit to the public, while helping to preserve limited fossil fuel resources and promoting air cleanliness (Public Resources Code Section 800). The Project objectives of the BRGP are described in the following sections.

2.2.1 Primary Objective

The Project's primary objective is to develop, construct, and operate a baseload renewable electrical generating facility that supports grid reliability and the state's goal for a transition to a 100% renewable energy and zero-carbon resource supply to end-use customers by 2045.

2.2.2 Related Objectives

1. Construct and operate an approximately 77-MW (net) baseload renewable electrical generating facility that uses geothermal resources.
2. Develop a renewable electrical generating facility that minimizes significant environmental impacts of project development through the use of existing infrastructure, existing real property interests and rights-of-way, project design measures, and feasible mitigation measures.
3. Develop new incremental capacity from a facility eligible under the Renewables Portfolio Standard (RPS) program with a capacity factor of at least 80% capable of satisfying the procurement requirements of California's utilities under the California Public Utilities Commission's (CPUC's) Decision 21-06-035 (Mid-Term Reliability Decision) and subsequent decisions.
4. Develop an eligible renewable energy resource facility that can assist community choice aggregators, investor-owned utilities, and publicly owned utilities in meeting their California Renewables Portfolio Standard (RPS) requirements.

5. Encourage the responsible development and revitalization of the Salton Sea KGRA region in a manner that benefits local and regional communities and tribes.

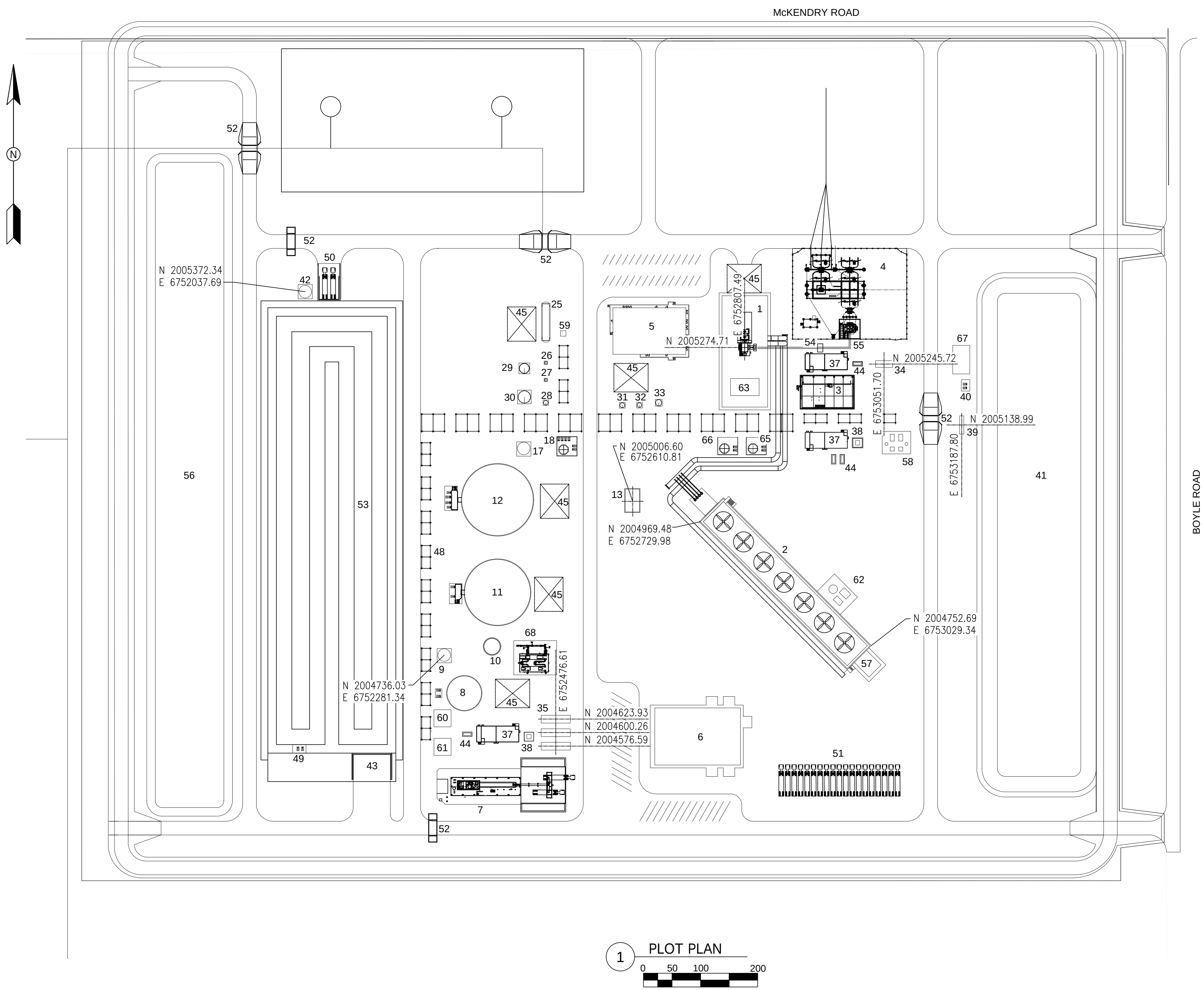
6. Create new, high-paying construction jobs, operations and maintenance jobs, and skilled trades and professional roles in Imperial County, California.

2.3 Facility Description and Location

2.3.1 Introduction

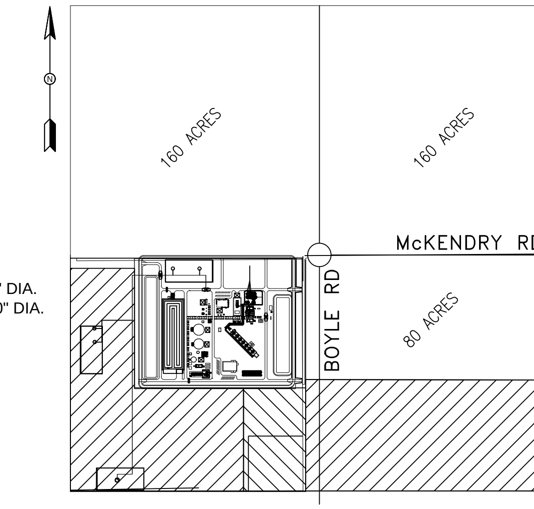
The BRGP consists of a proposed geothermal Resource Production Facility (RPF), a geothermal-powered Power Generation Facility (PGF), and associated facilities. Figure 1-1 shows the project regionally, and Figure 1-4 depicts the Project area, including proposed generation interconnection gen-tie line, production/injection well pads, and pipelines. The RPF includes geothermal production wells, pipelines, fluid and steam handling facilities, a solid handling system, Class II surface impoundment, service water pond, a retention basin, process fluid injection pumps, power distribution centers, and injection wells. The RPF also includes steam-polishing equipment designed to provide turbine-quality steam to the PGF. The PGF electrical power is generated using a triple pressure condensing turbine/generator set with a surface condenser, non-condensable gas (NCG) removal system, a sparger NCG abatement system (located within the cooling tower basin), condensate bio-oxidation abatement systems adjacent to the cooling tower, a heat rejection system cooling tower, and a generator step-up transformer (GSU). The PGF also includes a 230 kilovolt (kV) substation and power distribution centers, and five emergency standby diesel-fueled engines (four generators and one fire water pump). Shared facilities among the RPF and PGF include a control building, a service water pond, and other ancillary facilities. Heat rejection for the steam turbines will be accomplished with a mechanical draft counterflow wet cooling tower. The steam turbine will have a maximum continuous rating (MCR) of 77 MW (net) and the generator will have an approximate rated capacity of 97,000 kilovolt-amperes (kVA) at a 0.85 power factor, for a maximum annual electrical production of 674,500 megawatt-hours. Figure 2-1 presents a general arrangement plan and Figure 2-2 presents a process flow diagram. A heat and mass balance is provided as Appendix 2C, submitted under a request for confidential designation.

Geothermal fluid will be produced from five initial production wells near the PGF (Figure 1-4). The fluid will flow, without pumping, through aboveground production pipelines to the steam-handling system adjacent to the PGF. At the steam-handling system, the geothermal fluid will be separated from the steam phase (flash) to produce high-pressure (HP) steam. The fluid then will be flashed at successively lower pressures to produce standard-pressure (SP) and low-pressure (LP) steam for use in the steam turbine. A final steam separation will occur in an atmospheric flash tank to ensure that no residual pressure is transferred to the clarifier tanks. The depressurized fluid will flow into the primary and secondary clarifiers to remove suspended solids that precipitated upstream, by design, in the RPF. Solids precipitation returns geothermal fluid to chemical equilibrium from a state of super saturation, particularly for silica and iron constituents, during reductions in temperature and pressure. Stabilizing the geothermal fluid makes the injection process sustainable. Injection of super saturated silica fluid and suspended solids would be an unmanageable process because of scaling and plugging of wells. Geothermal fluid is injected and returned to the geothermal reservoir to maintain pressure and allows for the fluid to be reheated causing the resource to be renewable and sustainable. Spent geothermal fluid is returned to the reservoir using fluid specific injection wells for three types of fluids; spent geothermal fluid, aerated fluid, and condensate. The fluid streams are separated through the RPF process; remixing the fluids risks sustainable injection through scaling and excess solids precipitation. These reactions between fluid streams are caused by differentials in oxygen content, pH, and temperature. Spent geothermal fluid comes from the process described here. Aerated fluid is oxygenated and near ambient temperature, which comes from RPF surface impoundment and similar sources. Condensate comes from the cooling tower as an aerated mix of condensed steam and cooling tower makeup water. All production and injection wells will be operated in accordance with California Department of Conservation, Geologic Energy Management Division (CalGEM) regulations.



PLANT DESCRIPTION

1. TURBINE GENERATOR TG-3001
2. COOLING TOWER
3. GAS REMOVAL SYSTEM
4. SWITCHYARD
5. CONTROL ROOM/LAB 130'x80'
6. MAINTENANCE BLDG 100'x150'
7. HORIZONTAL BELT FILTER
8. TK-2801 THICKENER
9. FLASH/DRAIN AFT
10. TK-2701 HEAD TANK
11. TK-2601 SEC. CLARIFIER 115'-0" DIA.
12. TK-2501 PRIM. CLARIFIER 125'-0" DIA.
13. ROCK MUFFLER
14. NOT USED
15. NOT USED
16. NOT USED
17. T-2401 A PROCESS AFT
18. T-5101 PURGE WATER
19. NOT USED
20. NOT USED
21. NOT USED
22. NOT USED
23. NOT USED
24. NOT USED
25. V-2101 HP SEP
26. V-3131 HP SCRB
27. V-3231 SP SCRB
28. V-3331 LP SCRB
29. V-2201 SP CRYST
30. V-2301 LP CRYST
31. V-3161 HP DMSTR
32. V-3261 SP DMSTR
33. V-3361 LP DMSTR
34. EMERGENCY GENERATOR
35. EMERGENCY GENERATOR
36. NOT USED
37. POWER DISTRIBUTION CENTER (PDC)
38. 4160V TRANSFORMERS
39. FIRE WATER PUMPS
40. DOMESTIC WATER PUMPS
41. SERVICE WATER POND (180,000± SF)
42. WARM-UP AFT
43. HYDRO BLAST PAD
44. 480V TRANSFORMERS
45. CRANE ACCESS
46. NOT USED
47. NOT USED
48. PIPE RACK
49. AERATED BRINE INJ. PUMPS
50. TRAILER DUMP
51. TRAILER PARKING
52. CULVERT
53. BRINE POND (CONCRETE LINED)
54. GENERATOR CIRCUIT BREAKER
55. ISOLATED PHASE BUS DUCT
56. RETENTION BASIN
57. OX BOX
58. INSTRUMENT AND SERVICE AIR SYSTEM
59. ANTI-FOAM STORAGE AND INJECTION SYSTEM
60. NORMS STORAGE AND INJECTION SYSTEM
61. POLYMER STORAGE AND INJECTION SYSTEM
62. COOLING TOWER CHEMICAL FEED SYSTEM
63. STEAM TURBINE LUBE OIL SYSTEM
64. NOT USED
65. CONDENSATE STORAGE TANK
66. EXCESS CONDENSATE STORAGE TANK
67. POTABLE WATER SYSTEM
68. PROCESS BRINE INJECTION PUMPS



2 BLACK ROCK LOCATION PLAN

Scale: 1"=1000'

TOWNSHIP 11 SOUTH, RANGE 13 E,
SECTION 33, NE 1/4 OF SW 1/4
APPROXIMATELY 60 ACRES

Figure 2-1
General Arrangement,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-M3-101-1H, 4/5/2023.

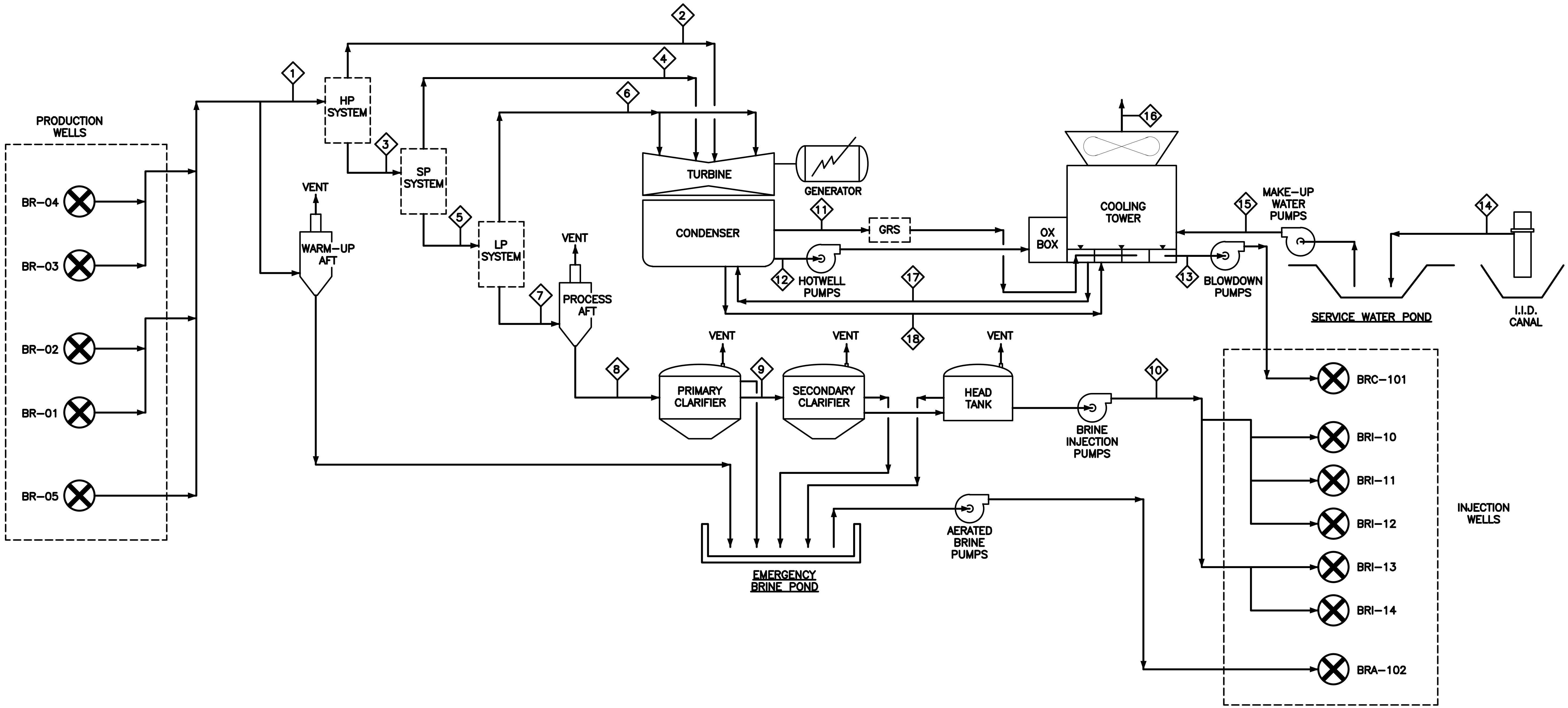


Figure 2-2
Process Flow Diagram
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-M0-200-1F, 4/5/2023.

Jacobs

Steam from the RPF will have impurities removed, after which it will be delivered to a triple-pressure condensing steam turbine. Steam condensed in a surface condenser will be used as makeup water for the cooling towers, turbine steam washes, and other minor process activities. NCGs will be extracted from the main condenser by the gas removal system and then directed to the cooling tower basin for abatement.

Electricity generated by the BRGP will be delivered to a substation near the northeast corner of the BRGP site. This substation will deliver energy through a generation interconnection gen-tie line into the Imperial Irrigation District (IID) transmission system at a new switching station near the intersection of Garst Road and West Sinclair Road.

The Project anticipates supplying capacity and energy to California's electric markets, supporting the state's pursuit of an environmentally clean and reliable electrical system.

The location and the configuration of the Project have been selected to best match operating needs and the available geothermal resource. A System Impact Study concluded IID network (transmission) upgrades are required to deliver additional energy to the Southern California Edison (SCE) Devers Substation, including a new gen-tie with capacity for BRGP and future projects (refer to Section 3.3.6). IID's network upgrades will support sustainable operation of IID's system and further power generation projects not affiliated with the BRGP. IID will construct and complete the network updates prior to Project operations.

2.3.2 Salton Sea KGRA Geothermal Resources

2.3.2.1 Regional History of Geothermal Resources

The Salton Trough is a 3,100-square-mile geological structural depression that extends from the Transverse Mountain Range on the north to the Gulf of California on the south. The Peninsular Mountain Range forms the western boundary, and the Colorado River forms the eastern boundary. The Salton Trough is a seismically active rift valley where sedimentation and natural tectonic subsidence are nearly in equilibrium. The California Department of Conservation, California State Mining and Geology Board (SMGB) recognizes the Salton Trough as an area with thermal water of sufficient temperature for potential geothermal energy development. Distinct geothermal anomalies are distributed throughout the Salton Trough, where hotter fluids suitable for electric generation are accessible (Imperial County General Plan, Renewable Energy and Transmission Element, 2015).

The Salton Sea KGRA has been known to have significant geothermal reserves since oil and gas companies first discovered the field in 1958 during exploration. The Salton Sea KGRA comprises 161 square miles (103,221.51 acres). The SMGB also has designated the Salton Sea as a geothermal field.

Development of the resource was slow in the 1960s and 1970s because of technical challenges associated with processing the highly corrosive and scaling hypersaline fluid. Union Oil Company of California (Unocal), Magma Power Company, and various governmental agencies overcame these challenges. Commercial operation of the Salton Sea geothermal reservoir began in 1982 at Unocal's Salton Sea (Unit) 1 power plant and subsequently, in 1986, at Magma Power Company's Vulcan plant. Since then, nine additional generating units were developed and operate at a total capacity of 395 MW (net). The most recent facility, Hudson Ranch Power 1, began commercial operations in 2012 (Table 2-1).

Table 2-1. Geothermal Power Plants Operating in the Salton Sea Area

Project Name/Location	Net Capacity (MW)	Commercial Operation Date
Elmore Backpressure Turbine	7	2019
Elmore	42	1989
Leathers	42	1990
Vulcan	38	1986
Del Ranch	42	1989

Project Name/Location	Net Capacity (MW)	Commercial Operation Date
CE Turbo (backpressure turbine)	10	2000
Salton Sea 1	10	1982
Salton Sea 2	16	1990
Salton Sea 3	50	1989
Salton Sea 4	42	1996
Salton Sea 5	46	2000
Hudson Ranch Power I	50	2012
Total Existing	395	

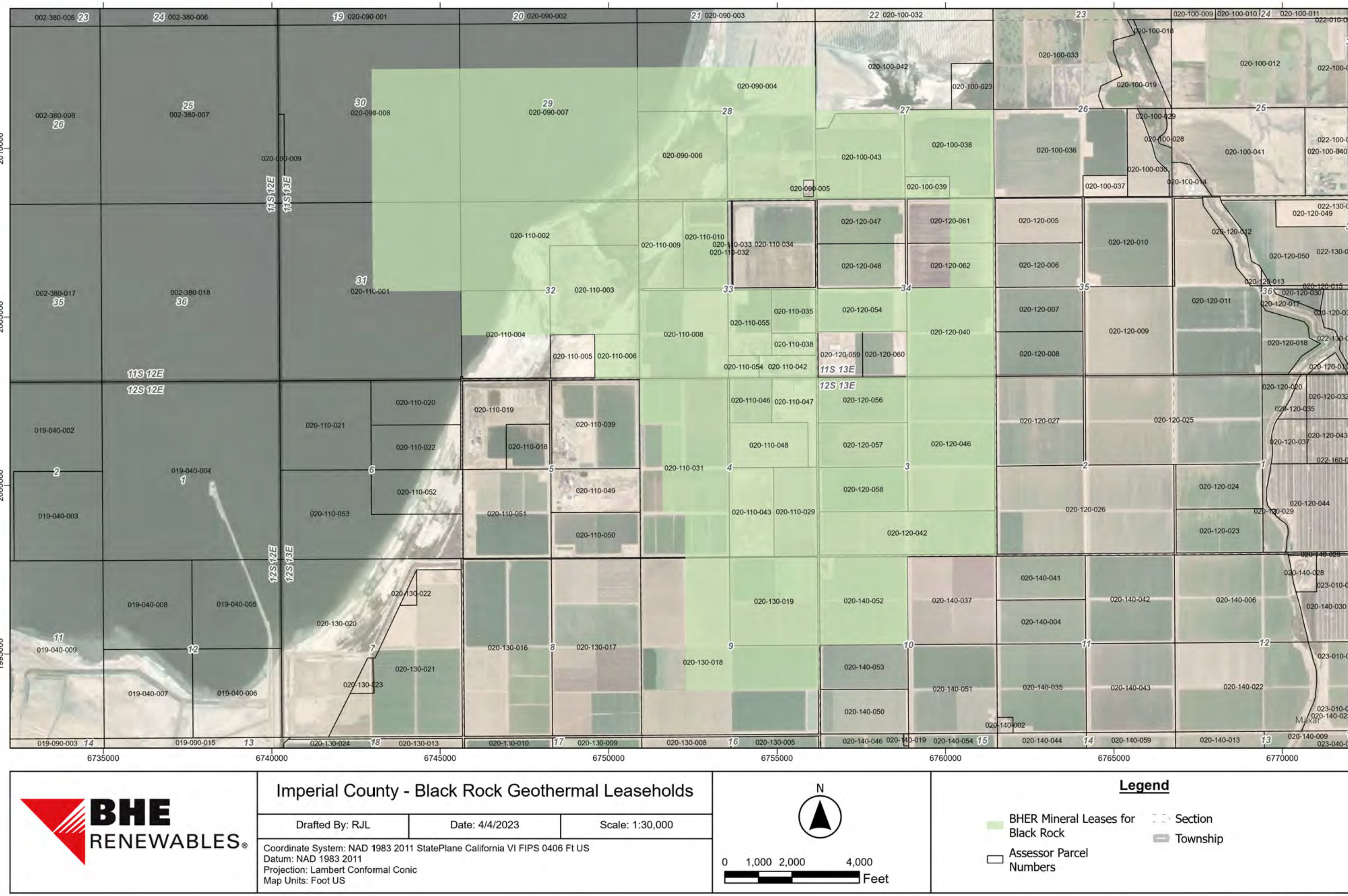
2.3.2.2 Project Site Selection

The BRGP incorporates a feasible and practical layout for the generation of geothermal energy from the Salton Sea Geothermal Reservoir, which contains proven resources. The proposed well locations, resource area, power plant site, production supply, and associated injection capacity will provide the geothermal energy required, while maintaining sufficient spacing between wells to minimize possible thermal and pressure impact without undue interference between wells. This well spacing will yield sustainable production and injection capacity over the Project's life. The Applicant's and its affiliates' mineral and geothermal interests for BRGP are shown on Figure 2-3. Appendix 2A presents the Applicant's Incorporation documentation and legal description for the Project site.

The Salton Sea Geothermal Reservoir is distinguished from the Salton Sea KGRA by its producible fluids contained within the geothermal reservoir, whereas the overall Salton Sea KGRA contains an elevated geothermal gradient (higher temperatures near the surface) that potentially could be harnessed for electricity production or direct used. Simply put, it is the heart of the resource. 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. The production wells would have average flow rates of about 1.6 million pounds per hour (which includes spare capacity for well scaling and associated performance decline) at wellhead pressures of 350 to 400 pounds per square inch at wellhead temperatures of 430 to 480 degrees Fahrenheit (°F). The production wells would be drilled to an average total depth of approximately 7,500 feet. Injection wells will receive the cooled and clarified (solids removed) geothermal fluids and return the fluid to the geothermal reservoir. The spent geothermal fluid injection wells are estimated to have an injection capacity of up to 3.0 million pounds per hour per well at a temperature of about 220 to 225°F and wellhead pressure of 200 pounds per square inch. Injection wells would be drilled to a total depth of approximately 7,500 feet. The aerated fluid and condensate injection wells will be of similar depth, but the fluid temperature will be near ambient temperatures.

Reservoir characteristics in the BRGP site are modeled and measured to be 530 to 600°F and a total dissolved solid content of approximately 22.4% with non-condensable gases of 0.14% at reservoir condition (preflash). Dissolved elements within the geothermal fluid consist primarily of chloride, sodium, calcium, and potassium. There are also significant amounts of zinc, manganese, iron, and silica dissolved in the fluid. The major component of the non-condensable gases is carbon dioxide, which is naturally occurring from the diagenesis of minerals and rocks. There is a large variety of other components in the geothermal fluid, although each is less than 0.01%.

The reservoir is hydrologically disconnected from the neighboring inland shallow Salton Sea (Salton Sea Lake). The static fluid level within the reservoir is measured at depths ranging from 300 feet to 1,400 feet below ground level, whereas the deepest point of the Salton Sea Lake is 51 feet. The reservoir continually creates a clay envelope on its outer edges. Dissolved minerals within the geothermal fluid circulate away from the heat source then begin to cool and precipitate clays, which create a secondary boundary between the similarly named Salton Sea Geothermal Reservoir and Salton Sea Lake.



Development_Permit_Tabloid_004001_AFC-Permit-ApxBb3B-BR

Figure 2-3
Applicant's Mineral Leases,
Black Rock Geothermal Project
Imperial County, California

Wells are sited to maintain the renewable and sustainable geothermal energy process. Sufficient distance between production and injection areas ensures that production fluid is not quenched by injection fluid and the reservoir receives adequate pressure support from the returned injection fluid. Adequate pressure and temperature in the reservoir allow production wells to flow, after initial stimulation, without use of pumps. The corrosive, high temperature, and scaling nature of the reservoir's fluid would not allow for sustainable use of downhole production well pumps. Additionally, injection and production must be planned so that spent geothermal fluid is placed slightly deeper than production to allow gravity to support the migration of denser injection fluid toward the heat source for reheating, while hotter, less-dense fluid upwells toward the production area.

The guiding principles used in locating the wells for the BRGP are as follows:

- Production wells would be located near known production areas.
- Sufficient spacing between production and injection wells is maintained to prevent thermal breakthrough of injection fluid.
- Production wells are located to minimize production impacts to existing geothermal projects.
- Well spacing will ensure adequate resource to support generation for the project life.
- Well pads, when possible, will support multiple directionally drilled wells to limit the impact on surface lands.

2.3.2.2.1 Individual Well Pad Locations

Five initial production wells will be located on three well pads, and seven initial injection wells will be located on four well pads. The injection wells include five wells for spent geothermal fluid, one well for condensate, and one well for aerated fluid. The Applicant identified additional wells and well pads for future wells, known as makeup wells, that would potentially be drilled during the Project's operational life to support continual power generation at full capacity.

2.3.2.2.2 Geothermal Resource Adequacy

Reservoir properties vary laterally and vertically and are dependent on distance from the heat source, host geology, and structural controls (faults and fractures), which result in variation in heat content, fluid chemistry, gas chemistry, and pressure. The reservoir properties and associated reservoir response from production and injection activity were modeled mathematically using a reservoir model. Historical measured data (for the past 40 years), including reservoir pressure, reservoir temperature, enthalpy, and total dissolved solids, were used to calibrate the reservoir model such that the modeled results are matched with historical measured data. This process is referred to as history matching and validates the ability of the reservoir model to forecast the effect of production and injection associated with BRGP on the reservoir, the operating geothermal power plants, and the ability to operate BRGP throughout the Project life. The numerical reservoir modeling results demonstrate that the geothermal resource can support BRGP while supporting the existing geothermal projects and other geothermal developments proposed by affiliates of the Applicant, including the Elmore North Geothermal Project and the Morton Bay Geothermal Project.

2.3.3 Facility Description

2.3.3.1.1 Site Access

The BRGP site can be reached via either State Route 86 (SR 86) or State Route 111 (SR 111) on existing roads. Upgrades to existing roads, if required, are expected to be minor. From SR 86, access to the site is via Forrester Road, Gentry Road, and McKendry Road. From SR 111, access to the site will be via Sinclair Road, Gentry Road, and McKendry Road. The site is located southwest of the intersection of McKendry Road and Boyle Road.

Production well pads will be located adjacent to the project site and injection well pads will be located to the south of the project site. All well pads are adjacent or near to existing roads, which are either paved or rock surfaced.

2.3.3.1.2 Site Location

The BRGP site is in the Imperial Valley, southeast of the Salton Sea. The Imperial Valley is the southwest part of the Colorado Desert that merges northwestward into the Coachella Valley near the northern shore of the Salton Sea. The BRGP is located in a region of the Imperial Valley characterized mostly by agriculture and geothermal power production, with more recent additions of utility scale solar power plants. The area surrounding the BRGP site is primarily agricultural land.

The BRGP site is bounded by McKendry Road to the north, Boyle Road to the east, and Severe Road to the west. The town of Niland is approximately eight miles northeast of the plant site, and the town of Calipatria is approximately six miles southeast of the plant site. The Red Hill Marina County Park is approximately two miles east of the power plant. The Sonny Bono Wildlife Refuge Headquarters is approximately 0.7 mile northeast of the power plant. The Alamo River is approximately 3.5 miles southwest of the plant site and the New River is approximately five miles southwest.

The power plant will be located on approximately 55 acres (plant site) of a 160-acre parcel (APN 020-110-008) (Township 11 South, Range 13 East, Section 33, NE 1/4 of SW 1/4) within Imperial County, California. The BRGP will include onsite and offsite laydown/parking areas in addition to borrow pits. These construction laydown/parking areas and four borrow pits also will be used by other applicant-owned projects currently before the CEC (the Elmore North Geothermal Project and Morton Bay Geothermal Project).

The location and configuration of the BRGP was selected to most effectively and efficiently use the geothermal resources at the site.

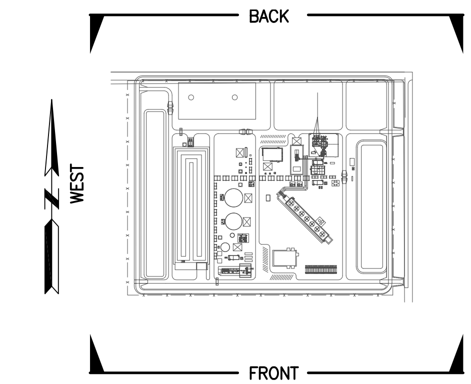
2.3.3.1.3 Site Layout

The BRGP general arrangement drawing is shown on Figure 2-1. Elevation drawings of the Project are shown on Figures 2-4a to 2-4c. The BRGP will comprise the following elements:

- Turbine/generator
- Cooling tower
- Gas removal system
- Surface condenser
- Switchyard
- Control room and laboratory
- Maintenance building
- Solids dewatering system
- Thickener clarifier
- Flash/drain atmospheric flash tank
- Head tank
- Secondary clarifier
- Primary clarifier
- Rock muffler
- Process atmospheric flash tank
- Purge water system
- High pressure separator
- High pressure scrubber
- Standard pressure scrubber
- Standard pressure crystallizer
- Low pressure crystallizer
- High pressure demister

PLANT DESCRIPTION

1. TURBINE GENERATOR TG-3001
2. COOLING TOWER
3. GAS REMOVAL SYSTEM
4. SWITCHYARD
5. CONTROL ROOM/LAB 130'x80'
6. MAINTENANCE BLDG 100'x150'
7. HORIZONTAL BELT FILTER
8. TK-2801 THICKENER
9. FLASH/DRAIN AFT
10. TK-2701 HEAD TANK
11. TK-2601 SEC. CLARIFIER 115'-0" DIA
12. TK-2501 PRIM. CLARIFIER 125'-0" DIA
13. ROCK MUFFLER
14. NOT USED
15. NOT USED
16. NOT USED
17. T-2401A PROCESS AFT
18. T-5101 PURGE WATER
19. NOT USED
20. NOT USED
21. NOT USED
22. NOT USED
23. NOT USED
24. NOT USED
25. V-2101 HP SEP
26. V-3131 HP SCRB
27. V-3231 SP SCRB
28. V-3331 LP SCRB
29. V-2201 SP CRYST
30. V-2301 LP CRYST
31. V-3161 HP DMSTR
32. V-3261 SP DMSTR
33. V-3361 LP DMSTR
34. EMERGENCY GENERATOR
35. EMERGENCY GENERATOR
36. NOT USED
37. POWER DISTRIBUTION CENTER (PDC)
38. 4160V TRANSFORMER
39. FIRE WATER PUMPS
40. DOMESTIC WATER PUMPS
41. SERVICE WATER POND (180,000± SF)
42. WARM-UP AFT
43. HYDRO BLAST PAD
44. 480V TRANSFORMERS
45. CRANE ACCESS
46. NOT USED
47. NOT USED
48. PIPE RACK
49. AERATED BRINE INJ. PUMPS
50. TRAILER DUMP
51. TRAILER PARKING
52. CULVERT
53. BRINE POND (CONCRETE LINED)
54. GENERATOR CIRCUIT BREAKER
55. ISOLATED PHASE BUS DUCT
56. RETENTION BASIN
57. OX BOX
58. INSTRUMENT AND SERVICE AIR SYSTEM
59. ANTI-FOAM STORAGE AND INJECTION SYSTEM
60. NORMS STORAGE AND INJECTION SYSTEM
61. POLYMER STORAGE AND INJECTION SYSTEM
62. COOLING TOWER CHEMICAL FEED SYSTEM
63. STEAM TURBINE LUBE OIL SYSTEM
64. NOT USED
65. CONDENSATE STORAGE TANK
66. EXCESS CONDENSATE STORAGE TANK
67. POTABLE WATER SYSTEM
68. PROCESS BRINE INJECTION PUMPS



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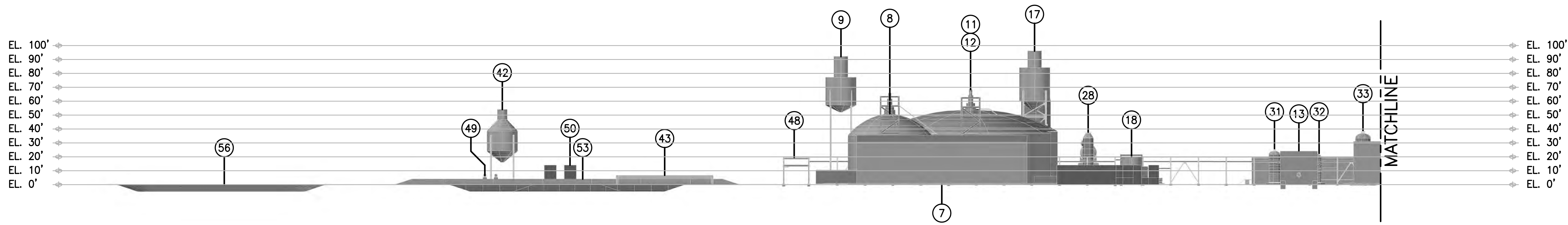
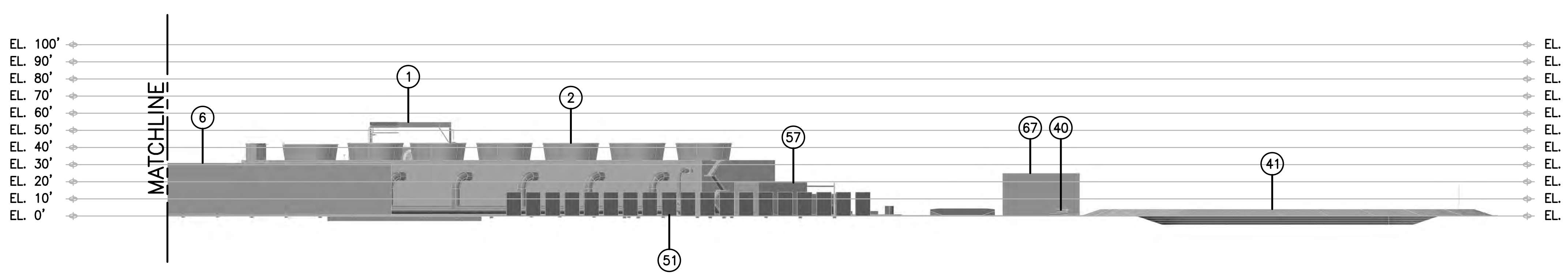


FRONT VIEW (LOOKING NORTH)

HORIZONTAL: 1"=40'
VERTICAL: 1"=40'



FRONT VIEW (LOOKING NORTH)

HORIZONTAL: 1"=40'
VERTICAL: 1"=40'

NOTE:
1. GRID ELEVATIONS FOR REFERENCE ONLY, NOT TRUE ELEVATIONS.
2. (#) PLANT DESCRIPTION ITEM.

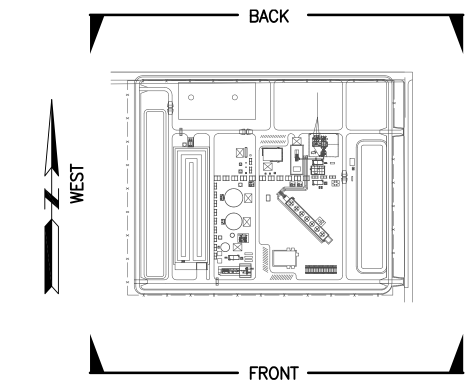
Figure 2-4a
Elevation View Looking North,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-M3-301-1C, 4/5/2023.

Jacobs

PLANT DESCRIPTION

1. TURBINE GENERATOR TG-3001
2. COOLING TOWER
3. GAS REMOVAL SYSTEM
4. SWITCHYARD
5. CONTROL ROOM/LAB 130'x80'
6. MAINTENANCE BLDG 100'x150'
7. HORIZONTAL BELT FILTER
8. TK-2801 THICKENER
9. FLASH/DRAIN AFT
10. TK-2701 HEAD TANK
11. TK-2601 SEC. CLARIFIER 115'-0" DIA
12. TK-2501 PRIM. CLARIFIER 125'-0" DIA
13. ROCK MUFFLER
14. NOT USED
15. NOT USED
16. NOT USED
17. T-2401A PROCESS AFT
18. T-5101 PURGE WATER
19. NOT USED
20. NOT USED
21. NOT USED
22. NOT USED
23. NOT USED
24. NOT USED
25. V-2101 HP SEP
26. V-3131 HP SCRB
27. V-3231 SP SCRB
28. V-3331 LP SCRB
29. V-2201 SP CRYST
30. V-2301 LP CRYST
31. V-3161 HP DMSTR
32. V-3261 SP DMSTR
33. V-3361 LP DMSTR
34. EMERGENCY GENERATOR
35. EMERGENCY GENERATOR
36. NOT USED
37. POWER DISTRIBUTION CENTER (PDC)
38. 4160V TRANSFORMER
39. FIRE WATER PUMPS
40. DOMESTIC WATER PUMPS
41. SERVICE WATER POND (180,000± SF)
42. WARM-UP AFT
43. HYDRO BLAST PAD
44. 480V TRANSFORMERS
45. CRANE ACCESS
46. NOT USED
47. NOT USED
48. PIPE RACK
49. AERATED BRINE INJ. PUMPS
50. TRAILER DUMP
51. TRAILER PARKING
52. CULVERT
53. BRINE POND (CONCRETE LINED)
54. GENERATOR CIRCUIT BREAKER
55. ISOLATED PHASE BUS DUCT
56. RETENTION BASIN
57. OX BOX
58. INSTRUMENT AND SERVICE AIR SYSTEM
59. ANTI-FOAM STORAGE AND INJECTION SYSTEM
60. NORMS STORAGE AND INJECTION SYSTEM
61. POLYMER STORAGE AND INJECTION SYSTEM
62. COOLING TOWER CHEMICAL FEED SYSTEM
63. STEAM TURBINE LUBE OIL SYSTEM
64. NOT USED
65. CONDENSATE STORAGE TANK
66. EXCESS CONDENSATE STORAGE TANK
67. POTABLE WATER SYSTEM
68. PROCESS BRINE INJECTION PUMPS



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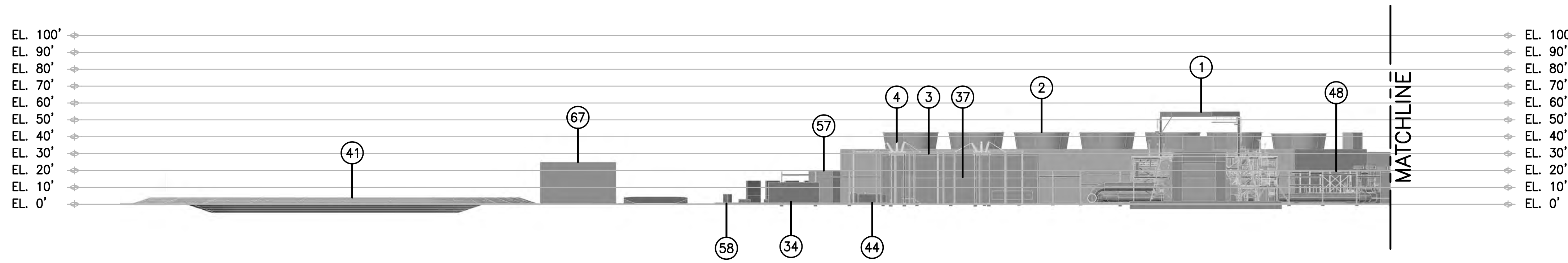
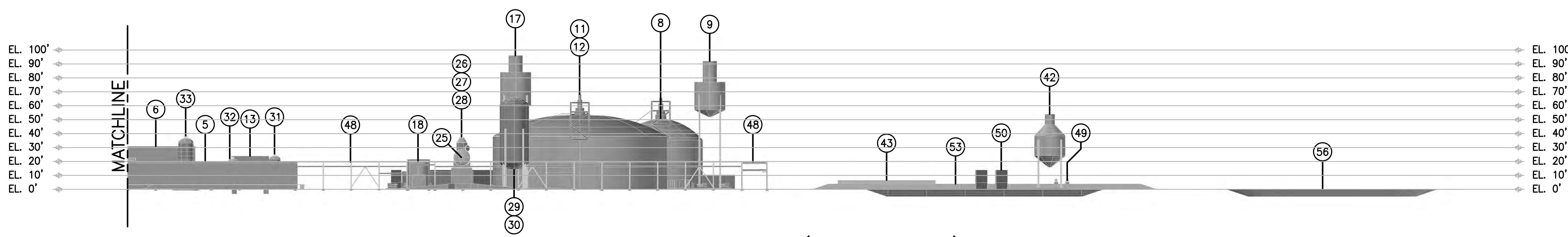


BACK VIEW (LOOKING SOUTH)

HORIZONTAL: 1"=40'
VERTICAL: 1"=40'



BACK VIEW (LOOKING SOUTH)

HORIZONTAL: 1"=40'
VERTICAL: 1"=40'

NOTE:
1. GRID ELEVATIONS FOR REFERENCE ONLY, NOT TRUE ELEVATIONS.
2. (#) PLANT DESCRIPTION ITEM.

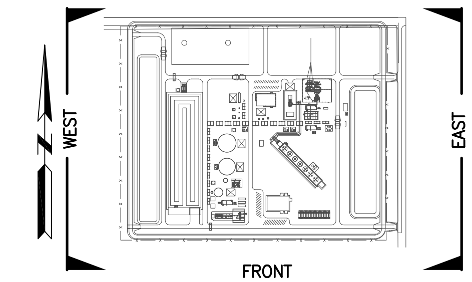
Figure 2-4b
Elevation View Looking South,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-M3-301-2C, 4/5/2023.

Jacobs

PLANT DESCRIPTION

1. TURBINE GENERATOR TG-3001
2. COOLING TOWER
3. GAS REMOVAL SYSTEM
4. SWITCHYARD
5. CONTROL ROOM/LAB 130'x80'
6. MAINTENANCE BLDG 100'x150'
7. HORIZONTAL BELT FILTER
8. TK-2801 THICKENER
9. FLASH/DRAIN AFT
10. TK-2701 HEAD TANK
11. TK-2601 SEC. CLARIFIER 115'-0" DIA
12. TK-2501 PRIM. CLARIFIER 125'-0" DIA
13. ROCK MUFFLER
14. NOT USED
15. NOT USED
16. NOT USED
17. T-2401A PROCESS AFT
18. T-5101 PURGE WATER
19. NOT USED
20. NOT USED
21. NOT USED
22. NOT USED
23. NOT USED
24. NOT USED
25. V-2101 HP SEP
26. V-3131 HP SCRB
27. V-3231 SP SCRB
28. V-3331 LP SCRB
29. V-2201 SP CRYST
30. V-2301 LP CRYST
31. V-3161 HP DMSTR
32. V-3261 SP DMSTR
33. V-3361 LP DMSTR
34. EMERGENCY GENERATOR
35. EMERGENCY GENERATOR
36. NOT USED
37. POWER DISTRIBUTION CENTER (PDC)
38. 4160V TRANSFORMER
39. FIRE WATER PUMPS
40. DOMESTIC WATER PUMPS
41. SERVICE WATER POND (180,000± SF)
42. WARM-UP AFT
43. HYDRO BLAST PAD
44. 480V TRANSFORMERS
45. CRANE ACCESS
46. NOT USED
47. NOT USED
48. PIPE RACK
49. AERATED BRINE INJ. PUMPS
50. TRAILER DUMP
51. TRAILER PARKING
52. CULVERT
53. BRINE POND (CONCRETE LINED)
54. GENERATOR CIRCUIT BREAKER
55. ISOLATED PHASE BUS DUCT
56. RETENTION BASIN
57. OX BOX
58. INSTRUMENT AND SERVICE AIR SYSTEM
59. ANTI-FOAM STORAGE AND INJECTION SYSTEM
60. NORMS STORAGE AND INJECTION SYSTEM
61. POLYMER STORAGE AND INJECTION SYSTEM
62. COOLING TOWER CHEMICAL FEED SYSTEM
63. STEAM TURBINE LUBE OIL SYSTEM
64. NOT USED
65. CONDENSATE STORAGE TANK
66. EXCESS CONDENSATE STORAGE TANK
67. POTABLE WATER SYSTEM
68. PROCESS BRINE INJECTION PUMPS



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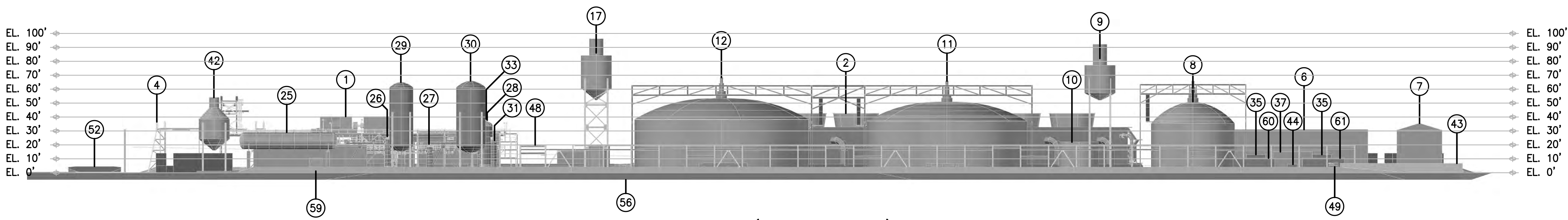
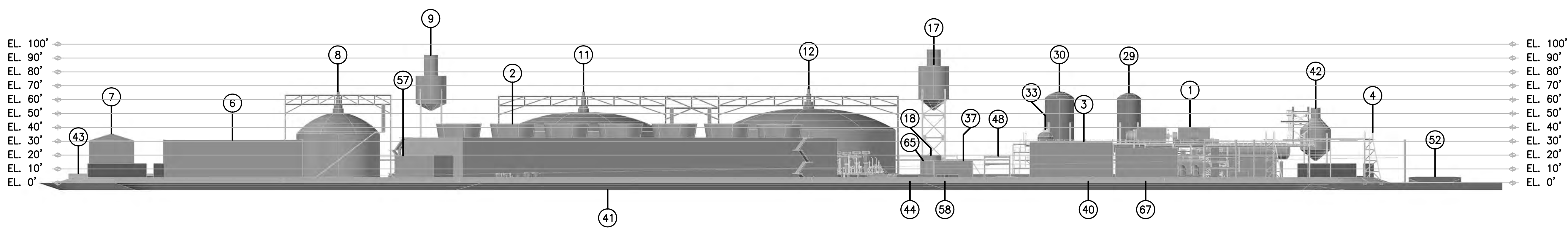


WEST VIEW (LOOKING EAST)

HORIZONTAL: 1"=40'
VERTICAL: 1"=40'



EAST VIEW (LOOKING WEST)

HORIZONTAL: 1"=40'
VERTICAL: 1"=40'

NOTE:
1. GRID ELEVATIONS FOR REFERENCE ONLY, NOT TRUE ELEVATIONS.
2. (#) PLANT DESCRIPTION ITEM.

Figure 2-4c
Elevation View Looking East and West,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-M3-301-3C, 4/5/2023.

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- Standard pressure demister
- Low pressure scrubber
- Low pressure demister
- Emergency diesel generators
- Power distribution centers
- Auxiliary transformers (4,160 volt)
- Fire water pumps (electric and diesel powered)
- Domestic water pumps
- Service water pond
- Warmup atmospheric flash tank
- Hydro blast pad
- Auxiliary transformers (480 volt)
- Aerated fluid injection pumps
- Class II surface impoundment
- Generator circuit breaker
- Isolated phase bus duct
- Retention basin
- Instrument and service air system
- Anti-foam chemical storage and injection system
- Naturally Occurring Radioactive Material (NORM) inhibitor chemical storage and injection system
- Polymer storage and injection system
- Cooling tower chemicals storage and feed system
- Steam turbine lube oil system
- Dilution water pumps
- Condensate storage tank
- Excess condensate storage tank
- Potable water system
- Process fluid injection pumps
- Bio-oxidation box (OxBox)
- Non-condensable gas sparger system (located within the cooling tower basin)
- Production well pads and pipelines
- Injection well pads and pipelines

2.3.3.2 Resource Production Facility

The purpose of the RPF is to extract geothermal fluid, produce steam to power the turbine, and inject the spent geothermal fluid. There are two different types of wells associated with the RPF. Production wells are used to extract geothermal fluid. Injection wells are used to return spent geothermal fluid to the geothermal reservoir after heat and steam have been harnessed for power generation. The RPF components are described in the following subsections.

2.3.3.2.1 Production Wells and Pipelines

Initially, five production wells will be required for full PGF operation. The well pads will be located near the PGF, with aboveground production pipelines that run to the RPF. Numerous factors were considered in selecting well locations, including efficient utilization of the geothermal resource, minimizing interference with existing production wells, and environmental constraints. The proposed production wells are spatially separated from injection wells to optimize field development and reservoir management. Each well pad will be equipped with a production warmup pipeline. This will be used for starting up wells during facility startup. During initial startup, the warmup pipeline will discharge into the atmospheric flash tank and then discharge into the Class II surface impoundment located at the PGF site.

Production fluids will be piped through production pipelines to the HP separator located at the PGF site. Each well will produce approximately 1,626,000 pounds per hour of a mixture of steam, NCG, and fluid. Expected properties of the produced fluid are as follows:

- 22.4% total dissolved solids (TDS) at reservoir conditions (pre-flash)
- 0.14 weight % NCG in the production fluids at reservoir conditions (pre-flash)
- Total enthalpy: 402 British thermal units per pound (Btu/lb)

The chemical composition of the produced fluids is shown in Table 2-2.

Table 2-2. Expected Chemical Composition of Produced Fluids Constituent Concentration

Chemical	Milligrams per Kilograms
Hydrogen (H^+)	ND
Beryllium (Be^{+2})	ND
Ammonium (NH_4^+)	322.9 (for NH_3)
Sodium (Na^+)	49,889.0
Magnesium (Mg^{+2})	55.5
Aluminum (Al^{+3})	ND
Potassium (K^+)	12,430
Calcium (Ca^{+2})	23,220
Chromium (Cr^{+3})	ND
Manganese (Mn^{+2})	820
Iron (Fe^{+2})	710
Nickel (Ni^{+2})	ND
Copper (Cu^{+2})	2
Zinc (Zn^{+2})	300
Cadmium (Cd^{+2})	1
Barium (Ba^{+2})	170
Mercury (Hg^{+2})	ND
Lead (Pb^{+2})	70
Fluorine (F^-)	10
Chloride (Cl^-)	135,000
Silicon Dioxide (SiO_2)	430
Carbon Dioxide (CO_2)	1,450
Hydrogen Sulfide (H_2S)	8
Ammonia (NH_3)	30
Methane (CH_4)	6
Total Dissolved Solids (TDS)	224,200
Potential of Hydrogen (pH)	5.7

ND = not detected

Three production pipelines will connect the production wells to the PGF. These wells will be located within the 160-acre parcel in which the BRGP site will be located. The pipelines will have a 50-foot right-of-way (ROW) plus an additional 10% to accommodate several expansion loops required along the length of the pipelines. One or more pipelines would be constructed within each ROW.

The production well lines will have two parallel emergency shutdown valves (ESVs). Piping from the wellhead to the ESVs will be made of Inconel 625 or an equivalent corrosion-resistant alloy or functionally equivalent. The pipeline material from the ESVs to the HP separator located at the power plant will be made of 2507 super duplex stainless steel or an equivalent corrosion-resistant alloy or functionally equivalent.

The pipeline design is modeled using stress analysis software programs to determine the best location and spacing requirements of thermal expansion loops. For personnel protection and to prevent energy loss, the pipelines are insulated.

Pipeline construction would consist of various activities, including 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 earth-moving equipment, including bulldozers, scrapers, dump trucks, and front-end loaders. Site clearing and preparation would occur at all locations where equipment would be constructed or installed. The ROW would be prepared by removing debris and land leveling as each component is being constructed. Erosion control measures would include installing silt fencing. Surplus soils that cannot be used for restoration onsite would be sent to a soils broker or the local, state-approved landfill.

2.3.3.2.2 Fluid/Steam Handling System

Two-phase production fluid (steam and fluid) entering the power plant site will be separated in the HP separator. HP steam will be processed and introduced into the turbine. Remaining fluid will undergo further steam separation at successive lower pressures to produce SP and LP steam that will be conditioned prior to entering the steam turbine.

High Pressure Separator System

The production wells flow into a common collection pipeline that delivers the geothermal fluid to the HP separator. HP steam is discharged from the separator through a pipeline to the HP scrubber and HP demister, then into the HP inlets of the steam turbine.

Standard Pressure Crystallizer System

Fluid from the HP separator discharges into the SP crystallizer. This pressure vessel (crystallizer) also is injected with iron-silicate-laden slurry (known as seed material) that comes from the underflow of the primary clarifier to minimize the adhesion of iron-silicate scale to the walls of the vessels, pipelines, and tank. The SP crystallizer also separates SP steam and fluid. The SP steam is discharged from the crystallizer through a pipeline to the SP scrubber and SP demister, then into the SP inlets of the steam turbine.

Low Pressure Crystallizer System

The LP crystallizer operates in much the same way as the SP crystallizer in that it stabilizes the fluid and separates the steam and fluid for further processing, although at a lower pressure and temperature than the SP crystallizer. The geothermal fluid flows from the LP crystallizer to the atmospheric flash tank (AFT).

Atmospheric Flash System

The atmospheric flash system lowers the fluid pressure from the LP crystallizer to atmospheric pressure conditions. Fluid from the LP crystallizer discharges into the AFT. Fluid from the AFT flows by gravity to the primary clarifier. The steam from the AFT is discharged to the atmosphere.

Primary and Secondary Clarifiers

The heat-depleted, seeded fluid is directed to the fluid clarification system for solids separation and removal, also known as fluid clarification. This is the final stage of geothermal fluid processing prior to injection. The fluid clarification system consists of two clarifiers, the primary and secondary. Fluid from the LP crystallizers flows through the process AFT to ensure that any remaining pressure is released before entering the primary clarifier (tank). Flocculation assists in the settling of iron-silicate solids through amalgamation in the primary clarifier. A rake rotates within the tank to keep settled particles moving toward the underflow and launders allow for clarified fluid to overflow from the primary to the secondary clarifier to further remove solids from the geothermal fluid. The slurry that comes from the underflow within the primary clarifier is sent upstream as seed material and the remainder goes to the solids dewatering system. The secondary clarifier functions much the same as the primary clarifier with a rake, underflow, and overflow. The underflow slurry passes back to the primary clarifier for further particle amalgamation and the clarified fluid overflows and returns to the reservoir through injection wells. By removing the solids through clarifiers, frequent plugging of injection wells is avoided. Both the primary and secondary clarifiers are blanketed with steam to prevent oxygen intrusion and are designed to minimize corrosion. The primary and secondary clarifiers will each be equipped with emergency overflow. The overflow piping is routed to the Class II surface impoundment.

2.3.3.2.3 Solids Dewatering

A portion of the slurry from the underflow of the primary clarifier is directed to the solids dewatering system. Iron-silicate material is intentionally formed and separated through the process. The solids are removed in two stages: primary process removal in the form of slurry and secondary removal by dewatering of the slurry. The dewatered solids (filter cake) are loaded by covered conveyor belts directly into end-dump trailers. After loading, these trailers are covered to minimize fugitive dust emissions and for waste management best practices. These filled trailers are staged at the geothermal facility for up to five days while Total Threshold Limit Concentration and Soluble Threshold Limit Concentration analysis of the filter cake is performed to confirm the material will be nonhazardous. Infrequently, the filter cake exceeds hazardous thresholds and would be disposed of appropriately. Nonhazardous filter cake will be transferred to a Class II regulated landfill for disposal.

Plant sumps, fluids from the Class II surface impoundment, and similar aerated fluid streams will be directed to the thickener. The thickener is designed similarly to the clarifiers in function and receives oxygenated fluids from the geothermal process. By keeping these oxygenated fluids separate from the primary geothermal process fluids, excess solids, scaling, and corrosion is avoided. Slurry from the thickener underflow is directed to the solids dewatering system. Fluid from the thickener is directed to an aerated fluid injection well.

2.3.3.2.4 Fluid Injection System

The spent geothermal fluid from the secondary clarifier is pumped from the RPF to the remote injection well pads via aboveground pipelines. An injection pump system is designed with redundancy and spare capacity to ensure the delivery of spent geothermal fluid to the injection wells through injection pipelines. Each injection well is remotely monitored for temperature and flow rate.

Injection Pumping System

The pumping system will be sized for a targeted capacity of 50% above anticipated flow rates. The injection pumping system will include a local control panel. The main control for this pumping system will be included within a motor control center at the local power distribution and control (PDC) system. Additionally, there will be remote monitoring in the control room allowing operator control of the system.

Injection Wells

Seven injection wells will be located on four new injection well pads. The injection well pads will be located south and southeast of the RPF. Wells are expected to be drilled to reach an approximate depth of 7,500 feet. Injection wells will be cased to a depth where the subsurface formation is competent. The injection wells will be drilled using directional drilling technology.

Five injection wells will be dedicated to injection of spent geothermal fluid from the secondary clarifier overflow. One injection well will be dedicated to the condensate injection, and another injection well will be dedicated to aerated fluid. Anticipated spent geothermal fluid chemistry is summarized in Table 2-3.

Table 2-3. Condensate and Injected Geothermal Fluid Characterization

Constituent	Condensate (mg/L)	Spent Geothermal Fluid (mg/kg)	Aerated Fluid (mg/kg)
Ammonia	500	NA	NA
Sodium	NA	66,867	75,800
Magnesium	13	78	48
Potassium	NA	16,153	22,400
Calcium	69	32,314	41,500
Chromium	NA	0.5	NA
Manganese	NA	1,149	NA
Iron	0.3	1,096	NA
Nickel	NA	0.2	NA
Copper	NA	3.0	NA
Zinc	NA	387	437
Strontium	NA	556	NA
Silver	NA	0.8	0.03
Cadmium	NA	2	0.9
Barium	NA	233	109
Mercury	NA	NA	0.0004
Lead	NA	91	94
Nitrate (NO3)	313	NA	NA
Fluoride	NA	27.0	NA
Sulfate	708	124	NA
Chloride	323	177,836	213,600
Arsenic	NA	16	8
Selenium	NA	NA	0.03
Silica	NA	168	NA
Boron	NA	381	NA
Total Dissolved Solids	1,818	313,442	369,400
pH	6.5	4.9	4.6

Notes:

All numbers are approximate.
NA = not available

Injection Pipelines

A ROW for three injection lines will exit the southern border of the plant site and follow existing roads to the new injection wells. The pipelines would require a 50-foot ROW plus an additional 10% to accommodate several expansion loops required along the length of the pipelines. One or more pipelines would be constructed within each ROW. The aboveground injection distribution pipelines will be constructed of 2205 duplex stainless steel or an equivalent corrosion-resistant alloy (or functionally equivalent) for spent geothermal fluid. Appropriate materials of construction for condensate injection and aerated fluids include, for example, high-density polyethylene (HDPE), stainless steel, and carbon steel. The pipes are installed on supports and are elevated three to five feet above grade.

Class II Surface Impoundment

There will be a Class II surface impoundment (brine pond) within the Project site. The brine pond is a concrete-surfaced basin that is sized to accommodate draining of the primary and secondary clarifier, plus two feet of freeboard. The triple-lined brine pond will include a Leachate Collection and Removal System (LCRS) to detect any leaks in the primary liner. The LCRS will have an automated pump collection system that will discharge into a sufficiently sized containment system and is designed to overflow into the Class II surface impoundment. Monitoring wells will be adjacent to the brine pond to comply with Regional Water Quality Control Board (RWQCB) regulations.

During upset conditions, spent geothermal fluid that overflows from the clarifiers and the thickener would be directed to the brine pond for temporary storage, after which this fluid is pumped to the aerated fluid injection well. In addition to temporarily retaining spent geothermal fluid prior to injection, the brine pond temporarily stores solids that have either precipitated or settled out of the geothermal fluid during the power generation process. The brine pond also holds 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 (RO). The brine pond would collect fluid from the wells during flow-testing, after drilling, during maintenance, and from startup. This fluid would be discharged into an injection well after startup is complete.

2.3.3.3 Power Generation Facility

2.3.3.3.1 Turbine Generator System

The turbine generator system will consist of a condensing turbine and a generator set with three steam entry pressures (HP, SP, and LP). The 3,600-revolutions-per-minute turbine generator is a triple-pressure, double-exhaust flow condensing turbine. It will be rated at a maximum continuous rating of 77 MW (net). Nominal turbine inlet pressures are as follows:

- High pressure: 285 pounds per square inch gauge (psig)
- Standard pressure: 125 psig
- Low pressure: 16 psig

The turbine is directly coupled to a totally enclosed water and air-cooled (TEWAC) synchronous generator. The generator is anticipated to have a design rating of 97 megavolt-amperes (MVA) at a power factor of 0.85 lagging and leading. The turbine generator unit will be fully equipped with all the necessary auxiliary systems for turbine control and speed protection, lubricating oil, gland sealing, generator excitation, and cooling.

2.3.3.3.2 Heat Rejection System

The power cycle heat rejection system includes a stainless steel (or similar material) shell-and-tube type condenser, a counterflow cooling tower, an NCG removal system, and H_2S abatement system. Steam from the turbine exhaust is condensed in the shell-and-tube type condenser. Stainless steel piping will transfer condensate to the biological oxidizer unit located adjacent to the cooling tower, where soluble hydrogen sulfide is abated. Gases that accumulate in the condenser will be removed by the gas removal system (GRS) and transferred to the spargers located in the cooling tower basin. The GRS consists of multiple redundant trains of ejectors, and liquid ring vacuum pumps. Auxiliary steam for the ejectors will be supplied from the SP steam pipeline.

2.3.3.3.3 Cooling Tower

The cooling tower will have seven cells, each equipped with 480-volt motor-driven fans. Each cell will be partitioned from the adjacent cells, allowing maintenance during normal operation. The cooling tower basin will be equipped with vertical wet-pit circulating water pumps designed to circulate water between the cooling tower and the turbine condensers. The cooling tower also will be equipped with vertical, wet-pit auxiliary water pumps designed to move water between the cooling tower and the plant auxiliary cooling loads. The plant auxiliary cooling water loads will include the generator cooling system, NCG removal system, turbine and control oil cooling system, and solids dewatering system. The cooling tower will be equipped with drift eliminators that limit drift to no more than 0.0005% of the recirculating water flow rate.

2.3.3.4 Facility Support Systems

2.3.3.4.1 Major Electrical Equipment

Alternating Current Power Transmission

Electricity will be produced at the facility by the 13.8 kV TEWAC generator. The output of the steam turbine generator is connected by isolated phase bus to a two-winding, oil-filled (13.8 to 230 kV) steam turbine generator (STG) main step-up transformer with a load tap changer. Surge arrestors around the high-voltage bushings protect the transformer in the 230 kV system from lightning strikes or other disturbances. The transformer is set on a concrete pad with an oil containment system. The main transformers will be protected per the National Fire Protection Association (NFPA) by either maintaining adequate separation or providing sprinklers.

AC Power Distribution System

Plant power will be provided from the switchyard through the STG main step-up transformer and unit auxiliary transformers. The medium-voltage auxiliary load is supplied by two separate 4,160-volt switchgears, each with an incoming main circuit breaker supplied by a 13,800-4,160-volt auxiliary transformer. A 4,160-volt cable tie is connected to a 4,160-volt tie circuit breaker connected in each switchgear. One of the 4,160-volt tie circuit breakers is normally open, and each 13,800-4,160-volt auxiliary transformer is sized for the installed 4,160-volt station auxiliary load. Paralleling standby generators are connected through circuit breakers to one 4,160-volt switchgear. Medium-voltage motors will be supplied from the 4,160-volt system.

The load center transformers will provide power to the 480-volt Motor Control Centers (MCCs). The MCCs distribute power to all 480-volt motors, 480-volt power panels, and to other 480-volt loads. The neutral of the 480-volt system is grounded with individual feeder ground fault detection.

The 480-volt MCCs and 480-volt power panels provide power to 480-120/208-volt dry-type transformers.

Facility Startup Power

The BRGP is not black-start capable. Electric power from the utility system must be present to be able to bring the facility online. During normal startup, power required for auxiliaries will be provided from the utility (IID) through the STG main step-up transformer, then through the unit auxiliary transformers.

Standby Emergency Power

In case of a total loss of auxiliary power, or in a situation when the utility system is out of service, the emergency electrical power for the plant critical loads (fluid booster pumps; air compressor; turbine turning gear; emergency lighting; heating, ventilation, and air condition; injection pumps; and other vital loads) will be supplied by standby diesel engine driven emergency generators. Preliminary design identified a need for up to four generators. Three of the generators will have an output of up to 3.25 MW, 4,160 volts and one generator will have an output of up to 2.5 MW, 480 volts. These generators are sized to maintain operation of the RPF and critical loads associated with the PGF and common facilities.

Direct Current (DC) Power Supply

The direct current (DC) power supply system consists of a battery bank, with redundant 125 volts of direct current (VDC) full-capacity battery chargers, metering, ground detector, and distribution panel. The station 125 VDC system supplies control power to the generator circuit breakers, protection relay panels, switchgear, turbine generator DC lube oil pump, and to other critical control circuits. Under normal operating conditions, the battery chargers supply DC power to the DC loads. The battery chargers receive 480 V, 3-phase AC power from one of the MCCs and continuously charge the batteries while supplying power to the DC loads. The 125 VDC system is an ungrounded system, and a ground detector will monitor for grounds on the DC power supply system.

Essential Service AC

The facility essential service 120 volts of alternating current (VAC), single-phase, 60 hertz (Hz) power source will supply AC power to essential distributed control system (DCS) loads and to unit protection and safety systems that require uninterruptible AC power. The essential service AC system and its DC power supply system are both designed to supply critical safety and unit protection control circuits. The essential service AC system consists of an inverter, a solid-state transfer switch, a manual bypass switch, an alternate source transformer and voltage regulator, and AC panelboards.

If the normal 480-volt source of power to the system fails, the dedicated 125 VDC battery powers the inverter to the panel boards. The solid-state transfer switch continuously monitors both the inverter output and the alternate AC source. The transfer switch automatically transfers essential AC loads without interruption from the inverter output to the alternate source upon loss of the inverter output. A manual bypass switch isolates the inverter-static transfer switch for testing and maintenance without interruption to the essential service AC loads. Recharging of a battery occurs when 480-volt power returns from the AC power supply (480-volt) system. The rate of charge depends on the characteristics of the battery, battery charger, and the connected DC load during charging; however, the maximum recharge time is eight hours.

2.3.3.4.2 Water Supply and Treatment

The water source for the BRGP will be IID canal water. The delivery point for the IID canal water will be the Vail 4A Lateral, Gate 459 or 460, with a backup delivery point of Vail Lateral 4, Gate 417 or 418. Transfer to the service water pond will be from the Vail 4A Lateral at Boyle Road east of the site. The water will be used for cooling tower makeup, other process and maintenance uses, and for the RO potable water system.

Cooling Tower Makeup Water and Other Process Uses

Water for the facility is required for cooling tower makeup to offset water lost through evaporation. Cooling tower makeup water will be provided primarily by condensed geothermal steam from the main condenser. During high ambient conditions more supplemental water will be used from the service water pond. The BRGP also uses condensate for steam wash water, purge water for pump seals, and water for the solids dewatering system. By doing this, it is expected that approximately 20% of the process water needs on an annual average basis will be met from IID canal water supply.

IID canal water also will serve as the water source for maintenance activities, the fire protection system, and to fill the cooling tower prior to startup.

Reverse Osmosis Potable Water System

An RO potable water system will be used to supply drinking water, wash basin water, eyewash equipment water, water for showers and toilets in crew change quarters, and sink water in the sample laboratory.

Water Supply Requirements

The BRGP requires 1,125 acre-feet per year (afy) of water when operating at full plant load for uses including RO, plant wash down, and cooling tower makeup. The expected daily and annual water uses for the BRGP are shown in Table 2-4. Average annual supply requirements will vary, depending on the capacity factor of the overall facility.

Table 2-4. Estimated Daily and Annual Water Use for Operations

Water Use	Average Ambient Use Rate (gpm)	Peak Use Rate (gpm)	Average Annual Use[a] (acre-feet per year)
Plant Water	700	1,400	1,125

[a] Assumes 8,322 hours of operation

Water Balance

Figure 2-5 shows the water balance for the peak design conditions.

Approximately 80% of the water required by the BRGP will be generated by steam condensed in the main condenser. On an annual average basis during operation, water needs from the IID canal are approximately 1,125 afy at design conditions, which is less than approximately 20% of the total facility water needs.

Water Quality

The expected concentration of constituents in the IID canal water supply is listed in Table 2-5. With two exceptions, no constituents violate Maximum Contaminant Level (MCL) concentration levels. Specific conductance and TDS were detected above their respective Secondary MCLs in one well. Secondary MCLs are established for various compounds to protect against unpleasant aesthetic effects, such as taste and color. Exceeding Secondary MCLs for these compounds does not pose a health risk.

Table 2-5. Expected Supply Water Quality

Parameter	Units	MCL	Amount Detected
Aluminum	µg/L	200	160
Arsenic	µg/L	300	170
Fluoride	mg/L	2	0.37
Nitrate as Nitrite	mg/L	10	0.40
Chloride	mg/L	500	120
Color	color units	15	10
Odor	odor units	3	1
Sulfate	mg/L	500	260
Total Dissolved Solids	mg/L	1,000[f]	289
Turbidity	NTU	5	12
Boron	µg/L	Not Regulated	190
Calcium	mg/L	Not Regulated	93
Hardness, total	mg/L	Not Regulated	370
Magnesium	mg/L	Not Regulated	34
pH	pH units	Not Regulated	8.3
Sodium	mg/L	Not Regulated	120
Potassium	mg/L	Not Regulated	5.0

µg/L = microgram(s) per liter

µmho/cm = micromho(s) per centimeter

MCL = Maximum Contaminant Level

mg/L = milligram(s) per liter

NTU = nephelometric turbidity unit

2.3.3.4.3 Fluid Process Streams

The primary discharge will consist of spent geothermal fluid from the secondary clarifiers that is injected into the injection wells to replenish the geothermal resource. Process fluid characteristics are summarized in Table 2-3 and the annual average and maximum daily peak flows of waste to the brine pond (and ultimately to the injection wells) are shown in Table 2-6. In overflow conditions, this spent geothermal fluid would be directed to the Class II surface impoundment, after which it would be injected into a dedicated aerated fluid injection well. This injection well also would receive fluid from the thickener, which collects filter press filtrate, and fluid from the plant conveyance system around the plant equipment. The Class II surface impoundment also receives fluid generated during emergency situations, maintenance operations, spills and water from hydro blasting, portable shower effluent, vehicle wash station effluent, and reject water from the RO system. Monitoring wells would be provided adjacent to the Class II surface impoundment to comply with RWQCB groundwater regulations. Fluid injection will take place in accordance with CalGEM requirements.

Table 2-6. Estimated Daily and Annual Process Fluid Discharge to Brine Pond for Operations

Fluid Process Stream	Maximum Discharge Rate (gpm)	Average Annual Discharge[a] (acre-feet per year)
Normal Operations Process Fluid to Brine Pond	460	744.6

[a] Assumes 8,322 hours of operation at the average daily maximum temperature.

Another geothermal process fluid is blowdown from the cooling towers; blowdown originates as geothermal steam. This process stream will be returned to the reservoir through a dedicated condensate injection well.

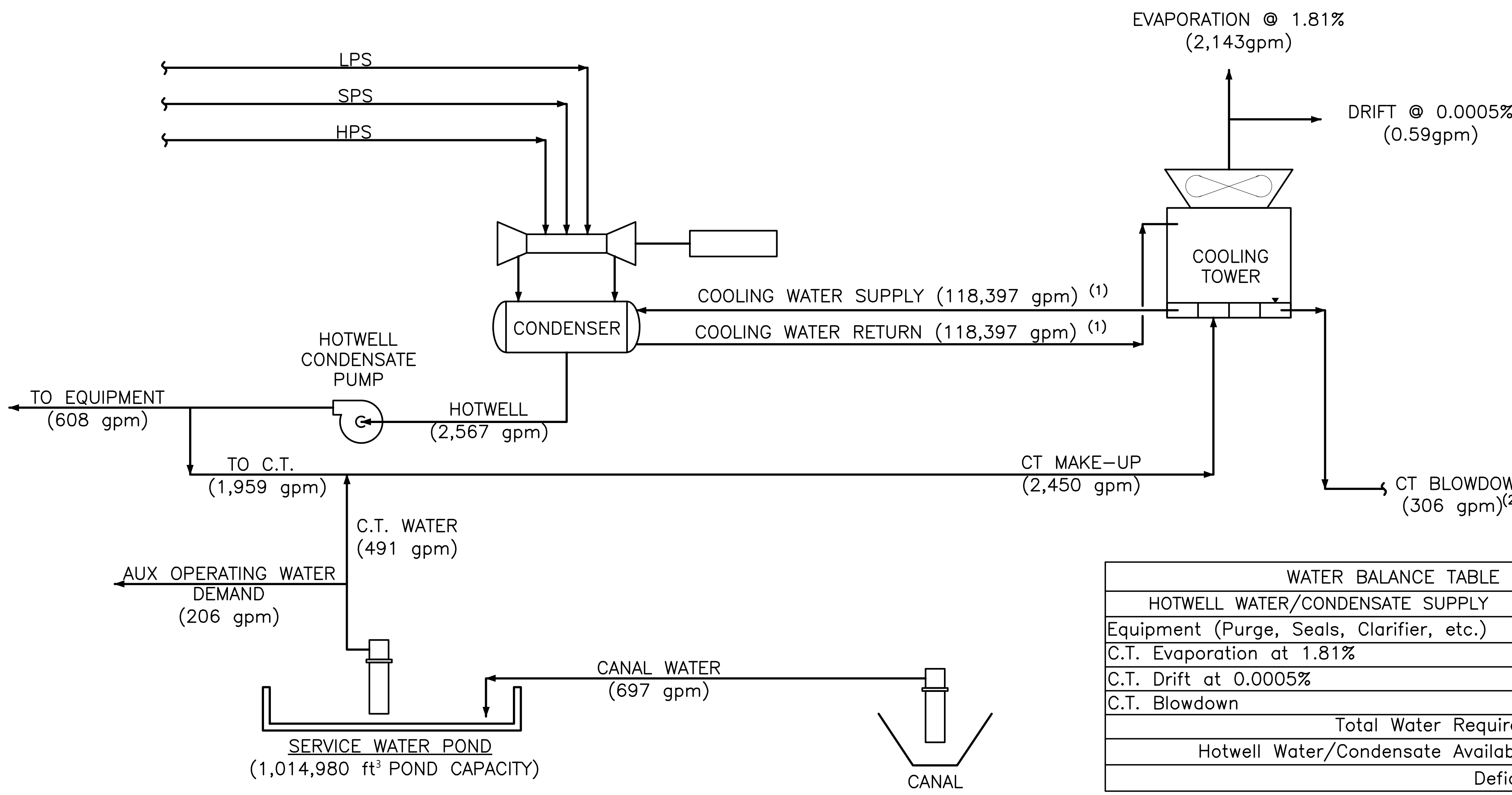
The sanitary drains will discharge to a septic tank. Waste from the septic tank will be pumped out periodically. The septic tank will outlet to the dispersal system, such as a leach field, evapotranspiration bed, or other approved disposal method based on site constraints. Storm drainage will be collected in the retention basin on the west side of the facility and either pumped to the brine pond or allowed to evaporate.

2.3.3.4.4 Nonhazardous Waste Management

The construction and operation of the BRGP will generate nonhazardous and hazardous waste. The hazardous materials and wastes expected to be used or generated by the facility are described in the following subsections. The largest nonhazardous waste stream will be filter cake, with approximately 46 tons per day to be generated during operations. The construction of the facility will generate various types of nonhazardous wastes, including debris and other materials requiring removal during site grading and excavation, excess concrete, lumber, scrap metal, and empty nonhazardous chemical containers.

Solid Waste Construction

Inert solid waste from construction activities may include lumber, excess concrete, metal, glass scrap, cardboard, general trash, and empty nonhazardous containers. Typical management practices required for nonhazardous waste management include recycling when possible, proper storage of waste and debris to prevent wind dispersion, and weekly pickup and disposal of wastes to local Class III landfills. The total amount of solid waste to be generated by construction activities has been estimated to be similar to that generated for normal commercial construction.



WATER BALANCE TABLE	
HOTWELL WATER/CONDENSATE SUPPLY	FLOW (GPM)
Equipment (Purge, Seals, Clarifier, etc.)	608
C.T. Evaporation at 1.81%	2,143
C.T. Drift at 0.0005%	0.59
C.T. Blowdown	306
Total Water Required	3,058
Hotwell Water/Condensate Available	2,567
Deficit	−491

TOTAL CANAL WATER DEMAND	FLOW (GPM)
Cooling Tower Water	491
Auxiliary Operating Water	206
Total Water Demand	697

NOTES:
1. INCLUDES AN ASSUMED 8,000gpm COMPONENT COOLING WATER.
2. BASED ON 8 CYCLES OF CONCENTRATION.

Figure 2-5
Peak Water Balance,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-M0-202-1D, 4/5/2023.

Solid Waste Operations

Facility maintenance will include the removal of scale from the walls of piping and fluid handling equipment, and the removal of sludge from the primary and secondary clarifiers and the brine pond. All nonhazardous wastes will be recycled to the greatest extent practical and the remainder removed regularly by a certified waste handling contractor.

The primary source of solid waste will be the precipitated solids from the geothermal resource fluid. After the steam separation, the geothermal resource fluid will be treated through clarifiers where some of the silica, iron, and manganese contained in the fluid will be removed. Following this clarification process, the solids slurry discharging from the bottom of the clarifiers will be directed to a solids dewatering system. The slurry feed from the clarifiers to the dewatering system may be acidified to prevent heavy metal precipitation in the filtration system. Based on the proposed design of the facility, it is likely that, over the life of the Project, the BRGP can achieve a goal of generating 95% of the filter cake that will be characterized as nonhazardous. Five percent will likely be characterized as hazardous because of elevated concentrations of heavy metals. Fluids from the dewatering system will be routed to a thickener system for additional solids removal. Slurry discharged from the thickener will be discharged to the dewatering system. The filter cake will be disposed of at a suitable offsite landfill in accordance with applicable regulations.

In addition to temporarily retaining geothermal fluid prior to injection, the brine pond temporarily stores solids that have either precipitated or settled out of the geothermal fluid during the energy-generating process. Periodically, the brine pond solids are removed and disposed of at a proper disposal facility.

Office waste and general refuse will be removed by the local sanitation service.

2.3.3.4.5 Hazardous Waste Management

Small quantities of hazardous wastes will be generated over the course of construction. Table 2-7 presents the expected wastes and volumes that may be generated during construction. These may include waste paint, spent solvents, and spent welding materials. All hazardous wastes generated during facility construction and operation will be handled and disposed of in accordance with applicable laws, ordinances, regulations, and standards. Any hazardous wastes generated during construction will be collected in hazardous waste accumulation containers near the point of generation and moved to the contractor's 90-day hazardous waste storage area located onsite. The accumulated waste will subsequently be delivered to an authorized waste management facility. Hazardous wastes will be either recycled or disposed of in a licensed Class I disposal facility as appropriate. Managed and disposed of properly, these wastes will not cause significant environmental or health and safety impacts.

Some hazardous wastes will be recycled, including used oils from equipment maintenance, and oil-contaminated materials such as spent oil filters, rags, or other cleanup materials. Used oil will be recycled, and oil or heavy metal contaminated materials (for example, filters) requiring disposal will be disposed of in a Class I waste disposal facility. Scale from pipe and equipment cleaning operations, laboratory waste, cooling tower debris, and solids from the brine pond, will be disposed of in a similar manner.

The BRGP will generate hazardous solid waste from maintenance. The source of these solid wastes will be solid deposits in the clarifiers and other equipment and piping. These solid wastes will be disposed of at an appropriate landfill.

2.3.3.4.6 Hazardous Materials Management

Construction

A variety of chemicals will be stored and used during construction of the BRGP. Hazardous materials to be used during construction include unleaded gasoline, diesel fuel, oil, lubricants (for example, motor oil, transmission fluid, and hydraulic fluid), solvents, adhesives, and paint materials. There are no feasible alternatives to these materials for construction or operation of construction vehicles and equipment, or for painting and caulking buildings and equipment. The contractor will bear sole responsibility and liability for such hazardous materials brought onto or generated at the site by the construction contractor. A hazardous materials handling program will be implemented during construction in compliance with applicable laws, ordinances, regulations, and standards (LORS). Table 2-7 presents expected hazardous waste that may be generated during the BGRP construction.

Operation

Prior to operation, the BRGP will develop and implement a Hazardous Materials Business Plan (HMBP), which will include procedures for the following:

- Hazardous materials handling, use, and storage
- Emergency response
- Spill control and prevention
- Employee training
- Reporting and record keeping

The storage, containment, handling, and use of these chemicals will be managed in accordance with applicable LORS.

Table 2-7. Wastes Generated during Construction

Waste	Origin	Composition	Estimated Quantity	Classification	Disposal
Scrap wood, glass, plastic, paper, calcium silicate insulation, and mineral wool insulation	Construction	Normal refuse	154,000 pounds per month (Dumpster)	Nonhazardous	Recycle or dispose of in a Class II or III landfill.
Scrap Metals	Construction	Parts, containers	66,000 pounds per month	Nonhazardous	Recycle or dispose of in a Class III landfill.
Concrete	Construction	Concrete	200 tons[a] during construction	Nonhazardous	Recycle or dispose of in a Class III landfill.
Empty liquid material containers	Construction	Drums, containers, totes	840 containers[b]	Nonhazardous solids	Containers <5 gallons will be disposed of as normal refuse. Containers >5 gallons will be returned to vendors for recycling or reconditioning.
Spent welding materials, i.e. welding rods	Construction	Solid	5 pounds per month	Nonhazardous	Recycle with vendors or dispose of at a Class I landfill if hazardous.
Solvents, paint, adhesives	Maintenance	Varies	10 pounds per month	Hazardous	Recycle at a permitted TSDF.
Steam turbine piping cleaning waste	Piping	Oily rags, misc.	110 gallons (2 55-gallon drums) before plant startup	Hazardous or nonhazardous liquid	Dispose at a permitted TSDF.

[a] 30 cubic yards

[b] Containers include <5-gallon containers and 55-gallon drums or totes

TSDF = treatment, storage, and disposal facility

Chemicals will be stored in chemical storage areas appropriately designed for their individual characteristics. Bulk chemicals will be stored outdoors on impervious surfaces in aboveground storage tanks with secondary containment. Secondary containment areas for bulk storage tanks will provide secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. Any chemical spills in these areas will be removed with portable equipment and reused or disposed of properly. Other chemicals will be stored and used in their delivery containers. A portable storage trailer may be onsite for storage of maintenance lube oils, chemicals, paints, and other construction materials, as needed. All drains and vent piping for volatile chemicals will be trapped and isolated from other drains to eliminate noxious vapors.

Safety showers and eyewash stations will be provided in or adjacent to chemical storage and use areas. Safety equipment will be provided for personnel use if required during chemical containment and cleanup activities. All personnel working with chemicals will be trained in proper handling and emergency response to chemical spills or accidental releases. Hose connections will be provided near chemical storage and feed areas to flush spills and leaks, and absorbent materials will be stored onsite for spill cleanup. Table 2-8 presents expected hazardous waste that may be generated during the BGRP operations.

2.3.3.4.7 Emissions Control Equipment

The BRGP does not use combustion to generate electricity. Therefore, there are only minimal emissions of criteria pollutants. The Applicant proposes to use best available control technology, management practices, and process monitoring equipment to minimize the air emissions from the Project. The pollutants that would have the potential of significant impacts to air quality if uncontrolled are particulate matter with an aerodynamic diameter or 10 microns or less (PM_{10}) and hydrogen sulfide (H_2S). This section describes the emissions controls.

The following subsections describe the emissions controls for these pollutants. Additional information on these pollutants and their controls is included in Section 5.1.

Particulate Emissions

The primary source of particulate emissions from the BRGP is the cooling towers. During normal operating condition, the BRGP is predicted to generate a minimal amount of particulate emissions. Particulate emissions from the cooling towers will be minimized by maintaining the TDS concentration in the circulating water and by controlling cooling tower drift losses to not more than 0.0005% of the total circulation rate. Particulate emissions from the filter cake handling equipment will be controlled by minimizing handling and keeping the filter cakes covered.

Hydrogen Sulfide Emissions

Low concentrations of H_2S are present in non-condensable gas and condensate in the main condenser. NCGs from the main condenser are pressurized and removed from the main condenser by the GRS and discharged through submerged water distribution sparger pipes located near the bottom of the cooling tower basin for H_2S abatement using the oxidizing biocide process (BIOX). The H_2S contained in the NCG is abated in the cooling water and converted to sulfate by reacting with oxidizing biocides and dissolved oxygen in the water. H_2S present in the condensate from the main condenser is routed to the bio-oxidation box (OxBox) adjacent to the cooling tower where naturally occurring bacteria present in geothermal cooling water abates H_2S present in the condensate. The OxBox includes a trickle block, splash fill, or equivalent packing that mixes cooling tower water with the condensate from the main condenser and drains into the cooling tower basin. The H_2S emissions compliance limit will be measured on the discharge of each cooling tower cell.

Table 2-8. Wastes Generated during Operations

Waste	Origin	Composition	Estimated Quantity (Lbs/yr)	Classification	Disposal
Petroleum Contaminated Solids, >51% Debris	Small leaks and spills from the turbine lubricating oil system	Hydrocarbons	95,027	Hazardous	Cleaned up using sorbent and rags – disposed of by certified oil recycler
Oil, water, sludge	Turbine lube oil console PAL units	Oily water	95,221	Hazardous	Recycle or dispose of offsite at a permitted TSDF
Used Oil	Turbine, valves, pumps, motor oil change out	Hydrocarbons	40,245	Hazardous	Recycled by certified oil recycler
Brine Pond Solids	Clarifier/Well maintenance/Plant conveyance/Atmospheric Flash Tank, scrubber drains	Geothermal fluid solids	13,691,020	Hazardous	Dispose of offsite at a permitted TSDF
Geothermal Scale	Hydro blasting scale debris from pipes, process valves, and vessels	Geothermal scale	6,077,787	Hazardous	Dispose of offsite at a permitted TSDF
Failed filter cake	Filter press solids	Filter cake not meeting BHER monofill nonhazardous requirements	973,347	Hazardous	Dispose of offsite at a permitted TSDF
Cooling tower debris and sludge	Cooling tower sludge	Solid debris, sludge containing mud and spent chemicals	397,593	Hazardous	Dispose of offsite at a permitted TSDF
Aerosol containers, solvents, paint, adhesives	Maintenance	Varies	715	Hazardous	Dispose of offsite at a permitted TSDF
Laboratory analysis waste	Process related	Waste reagents/ laboratory chemicals	2,641	Hazardous	Dispose of offsite at a permitted TSDF
Spent lead acid batteries	Electrical room, equipment	Metals	82	Hazardous	Store no more than 10 batteries (up to one year), then recycle offsite
Spent alkaline batteries	Equipment	Metals	37	Universal waste solids	Recycle or dispose of offsite at a Universal Waste Destination Facility
Fluorescent tubes	Lighting of maintenance areas	Metals	178	Universal waste solids	Recycle or dispose of offsite at a Universal Waste Destination Facility
Electronic Components	Distributed control system, plant computers, instruments	Metals	1,000	Universal waste solids	Recycle with an approved facility

2.3.3.4.8 Fire Protection and Safety Systems

The BRGP fire protection and safety systems are designed to limit personnel injury, property loss, and plant downtime caused by a fire or other event. The systems are designed in accordance with:

- Federal, state, and local fire codes, occupational health and safety regulations, and other jurisdictional requirements
- California Building Code (CBC)
- Applicable NFPA standards

The fire protection system will consist of an underground fire main and surface distribution equipment meeting NFPA standards such as yard hydrants, sprinkler systems for the maintenance building, turbine generator, lube oil modules, diesel driven fire pump, as well as a complete fire detection and alarm system. The main transformers will be protected per the NFPA by either maintaining adequate separation or providing sprinklers. The fire water supply and pumping system will provide an adequate quantity of firefighting water.

An underground fire main loop, in accordance with NFPA 24 standards, will supply water to the cooling tower area, crystallizer/clarifier area, and the turbine generator area. Buried and subsurface carbon steel pipe will be wrapped and coated externally for corrosion resistance. Nonmetallic pipe is permitted, but design considerations must account for surface loads on the aboveground area and settlement potential of the pipe. Several hydrants strategically located around the plant perimeter are connected to this fire main loop. Hydrant locations will permit full coverage of the protected areas with approximately 75-foot-long fire hoses.

Post indicator valves would be located at various points along the fire main loop to permit shutdown of one section of the fire main loop without shutting down the entire loop. The turbine generator lube oil system, including the turbine and generator bearings, will be protected with automatic sprinklers or water spray systems in accordance with NFPA 13 and NFPA 15. Electrical equipment buildings will be monitored with a smoke detection system.

A fire protection control panel will be provided and installed in the control room. The fire protection control panel will monitor and alarm the complete fire protection system. The fire detection and monitoring systems will be designed and installed in accordance with NFPA 72D and 72E. The fire protection system will include electrical and a diesel-fired fire water pumps with an output of up to 236 kW. This system will be skid mounted. The systems will be enclosed by a pump house with accessories, all conforming to NFPA 20. The pump house will include sprinkler system, louvers, engine heaters, lights, exhaust fans, and an electrical distribution panel, and will conform to all local and state building codes. Fire water storage will be included within the service water pond capacity, which will ensure an adequate water supply for fire protection.

In addition to the fixed fire protection system, portable carbon dioxide (CO_2) and dry chemical extinguishers will be located throughout the plant (including the switchgear rooms), with size, rating, and spacing in accordance with NFPA 10. Handcart CO_2 extinguishers also will be provided in the turbine area as necessary for specific hazards.

There are three PDCs designed for this site, and the control building also includes an electrical equipment room. Each of these PDCs will be provided with smoke detection and pull stations inside the enclosure. PDCs with battery rooms will have hydrogen sulfide detection and also be equipped with an exhaust system that runs continuously to mitigate any accumulation of hydrogen sulfide gas in the PDC. Both the hydrogen sulfide sensor and a fan failure alarm will be tied into the plant DCS system.

Local building fire alarms will be provided in accordance with NFPA 72. All materials will be free of asbestos and will meet the fire and smoke rating requirements of NFPA 255.

2.3.3.4.9 Plant Auxiliaries

Lighting

Lighting on the Project site will be limited to areas required for safety, will be directed onsite to avoid backscatter, and will be shielded from public view to the greatest extent practical.

All lighting that is not required to be on during nighttime hours will be controlled with sensors or switches operated such that the lighting will be on only when needed.

Lighting will be provided in the following areas:

- Building interior, office, control, and maintenance areas
- Building exterior entrances
- Outdoor equipment platforms and walkways
- Transformer areas
- Power island perimeter roads
- Parking areas
- Plant entrance

Emergency lighting from DC battery packs will be provided in areas of normal personnel traffic to permit egress from the area in case of failure of the normal lighting system. In major control equipment areas and electrical distribution equipment areas, emergency lighting permits equipment operation to allow auxiliary power to be reestablished.

Grounding

Safety is imperative for site personnel and electrical equipment. The electrical system is protected against ground faults that result in unit ground potential rises. The station grounding system provides a path to dissipate unsafe ground fault currents and reduces the ground potential rise. The grounding conductor will be sized for sufficient capacity to reduce the most severe fault conditions to within allowable limits by reducing voltage gradients to remote earth. The ground grid spacing will be assessed to provide sufficient step and touch potentials throughout the site. Bare conductors would be installed below grade in a grid pattern. Each junction of the grid will be bonded together by either an exothermic welding process or mechanical connectors.

Ground grid impedance performed as part of the grounding study would be used to determine the necessary number of grounding electrodes and grid spacing to ensure safe step and touch potentials under fault conditions. The grounding conductor will bond the ground grid to the building steel and nonenergized metallic parts of electrical equipment. Isolated grounding conductors to the ground grid will be provided for sensitive control systems.

Cathodic Protection and Lightning Protection

Cathodic protection for underground metallic piping and structures (except rebar) takes into account cathodic protection and grounding influences associated with any existing cathodic protection system to which the facility is adjacent and connected. Cathodic protection would be provided by an impressed current system, a sacrificial system, and protective coatings. Lightning protection would be furnished for buildings and structures in accordance with NFPA 78. Lightning protection for the switchyards would be in accordance with industry practice.

Distributed Control System

A DCS would provide modulating control, digital control, and monitoring and indicating functions for operation of the proposed plant power island and offsite systems. Plant operation would be controlled from the video display unit (VDU) type control consoles and the auxiliary control panels that would be located in the control room.

The DCS would provide coordinated control among the STG and balance-of-plant equipment. The STG control systems would interface with the DCS via a data link and/or hardwired input/output (I/O) devices. Limited monitoring and control will be available from the DCS for STGs. The balance-of-plant equipment will be monitored and controlled via the DCS. A sequence-of-events recorder will be an integral part of the DCS. Indication of process changes that warrant action (process alarms), or information that the operator in the control room should be made aware of (annunciation) will primarily be done by the DCS. Major packaged subsystems (for example, water treatment system, fire protection system) may have a local alarm system with a single trouble alarm to the control room.

2.3.3.4.10 Heating, Ventilation, and Air Conditioning

The HVAC system will provide an acceptable environment for personnel comfort and equipment operation within the plant buildings. The HVAC system will be designed in accordance with the Uniform Building Code (UBC) and the Uniform Mechanical Code (UMC) as prescribed by the California Code of Regulations (CCRs). The HVAC system will be designed to allow for compliance with Title 8, Section 3205, for COVID-19 prevention as required. Air conditioning in the control and administrative areas will maintain a suitable environment for plant personnel. If required for proper equipment operation, humidity control will be provided in the control room. Outside air ventilation systems will be provided for buildings where air conditioning is not required. Normally occupied plant areas, including toilet areas, will be supplied with fresh air in accordance with the Uniform Building Code, ASHRAE Standard 62, and the CCR.

2.3.3.4.11 Plumbing

The plumbing system will supply potable water to all fixtures and will collect and convey waste fluids to the waste collection system. Plant plumbing systems will be constructed in accordance with the Uniform Plumbing Code and local and state regulations. Potable water will be provided from IID with RO treatment. Potable water will be provided to restrooms and kitchen facilities in the control building. Drinking water will be provided in the control building. Safety showers, eyewash stations, and utility hose bibs will be provided at appropriate locations throughout the facility.

Restrooms, sinks, water coolers, and floor drains will flow to the onsite septic tank, advanced treatment system, and/or potentially leach fields pending adequacy of local soils.

2.3.3.4.12 Facility Civil/Structural Features

This section describes the buildings, structures, and other civil/structural features that will constitute the facility. The entire site will be protected from flooding by a berm approximately five feet above the finished grade surrounding the site of suitable height to provide flood protection up to an elevation of at least -223.80 mean sea level, in accordance with County flood control requirements and the request to Federal Emergency Management Agency (FEMA) to revise the 100-year flood zone in the Salton Sea area.

Power Generation Facility

The power generation facility will consist of the following major components:

- Condensing turbine with totally enclosed water and air-cooled synchronous-type generator and auxiliary systems (including lube oil skid)
- Non-condensable gas removal system
- Heat rejection system consisting of condenser and mechanical draft counterflow cooling tower
- H2S abatement systems
- Control building and power distribution centers, including MCCs and switchgear
- Generator step-up transformer

The civil/structural features related to these major components are described in the following subsections. Based on the geotechnical evaluation that was performed, most structures will likely require pile support. Pile requirements may change when detailed foundation designs are created.

Steam Turbine Generator and Condenser

The steam turbine generator will be mounted on a raised concrete pedestal supported by reinforced concrete mat foundation at grade. Concrete piles or a similar foundation support will be used for the mat foundation. The condenser will be located under the steam turbine and will be supported by the mat foundation. For operation and maintenance access, platforms are provided adjacent to the equipment.

Cooling Tower

The cooling tower will be supported and anchored to a reinforced mat foundation or equivalent foundation concrete basin coated with a waterproofing system. Piles will support the basin mat if necessary (as determined by detailed foundation design).

Non-condensable Gas Removal System

The non-condensable gas removal system will be installed adjacent to the main condenser.

Control Building and Power Distribution Center

The control building will be a reinforced concrete slab on grade single-story structure. The control building will be approximately 130 feet by 80 feet by 20 feet tall. The control building houses the facility control room, offices, kitchenette, electrical room, mechanical room, battery room, laboratory, and lavatory facilities.

The power distribution centers will be pre-engineered, single-story metal buildings supported above grade to provide cable access beneath the structures by reinforced concrete pier foundation. The power distribution centers will house electrical switchgear, MCCs, and DCS/SIS remote I/O cabinets. The control building and power distribution centers will be provided with HVAC equipment as required for equipment and personnel.

Lube Oil Skid

The lube oil skid will be supported on a reinforced concrete mat foundation.

Balance of Plant

Individual reinforced concrete foundations at grade will be used to support balance of plant (BOP) mechanical and electrical equipment. The BOP mechanical and electrical equipment includes common facilities and equipment not listed previously.

2.3.3.4.13 Resource Production Facility

The resource production facility consists of the following major components:

- Production and injection piping
- HP separator
- SP crystallizer
- LP crystallizer
- HP, SP, and LP scrubbers and demisters
- Primary, secondary, and thickener clarifiers
- Atmospheric flash tanks
- Emergency relief tanks
- Steam vent rock muffler

- Steam vent tanks
- Filter press
- Class II surface impoundment (brine pond)
- Service water pond
- Retention basin
- Yard tanks

Offsite Production and Injection Piping

Offsite production and injection piping will consist primarily of up to 36-inch piping made of corrosion-resistant alloy (or functionally equivalent) and 12-inch carbon steel well warmup piping. These will be supported on drilled pier cast-in-place foundations.

Separator, Crystallizers, Scrubbers, and Demisters

The separator, crystallizers, scrubbers, and demisters will be supported on reinforced concrete mats or pedestals as necessary.

Atmospheric Flash Tanks, Emergency Relief Tanks, and Steam Vent

The AFTs, emergency relief tanks, and steam vent tanks will each be supported by individual reinforced concrete or structural steel structures. These concrete structures will be supported on reinforced concrete mats with piles.

Primary and Secondary Clarifiers

The primary clarifier and secondary clarifier will be alloy or alloy lined carbon steel or partially alloy lined carbon steel tanks (or functionally equivalent) of approximately 125-feet and 115-feet in diameter, respectively. Mat base or ring wall base will support the clarifiers.

Solids Dewatering System

The solids dewatering system or systems will be supported on a structural steel reinforced concrete mat with containment for effluent.

Class II Surface Impoundment, Service Water Pond, Storm Water Retention Pond

One "U" shaped, approximately 750-foot by 200-foot Class II surface impoundment (brine pond) will be installed. The pond will be designed in accordance with Title 27, Division 2 of the CCR – Special Requirements for Surface Impoundment. The brine pond will be of earth construction and surfaced with concrete. Monitoring wells will be placed around the periphery of the pond. The center of the "U" allows for equipment access when the pond requires maintenance.

The service water pond (180,000 square feet) will be a lined earthen structure that would hold water for facility service water needs. The retention basin (127,500 square feet) will be a lined earthen structure.

2.3.3.4.14 Skids

Packaged skid-mounted equipment will be supported by a reinforced concrete mat foundation.

2.3.3.4.15 Yard Tanks

The major yard tanks will include the following:

- Condensate storage tank
- Spent condensate injection tank
- Thickener tank

- Thickener head tank/aerate fluid injection tank
- Excess condensate storage tank
- Various chemical holding tanks

The major yard tanks will be vertical, cylindrical, steel (or equivalent material) tanks supported on a suitable foundation consisting of either a reinforced concrete ring wall with an interior bearing layer of compacted sand for the tank bottom, or a reinforced concrete mat. Both types of tank bottoms may require piles. These tanks are protected from corrosion with internal and external coatings, as required.

All tanks will be securely anchored on a reinforced concrete foundation. Tanks, foundations, and piping connections will be designed to appropriate standards for the contents and seismic requirements. Pilings and anchor bolts will be used, as required.

2.3.3.4.16 Roads

The facility will be served by an existing road network. The main access to the facility will be from McKendry Road with secondary access from Boyle Road. The primary and secondary access roads will be improved. The control room parking lot and all in-plant roads will be surfaced with asphalt or concrete paving.

2.3.3.4.17 Perimeter Berm/Flood Protection

The *Imperial County General Plan* indicates that the Project site is in an area inside the 100-year floodplain. The site is within FEMA Zone A, which is considered an area within the 100-year floodplain, and Zone D, which is considered an undetermined, but possible, flood hazard zone (FEMA 1984). However, the Applicant is in the process of requesting a Letter of Map Revision (LOMR) to remap the area because of extensive changes in the Salton Sea elevation in recent years. The hydraulic modeling performed to support the remapping request shows that the BRGP site's impact is reduced to a 100-year flood depth of 1.61 feet with a perimeter berm. This request will be submitted to FEMA early in the second quarter of 2023 and, at the time of filing, a copy will be provided to CEC. To protect the site from flooding, the entire site would be enclosed by a berm. This berm would protect the plant from flooding and will be of adequate height to provide flood protection based on a separate LOMR request submitted to Imperial County and FEMA.

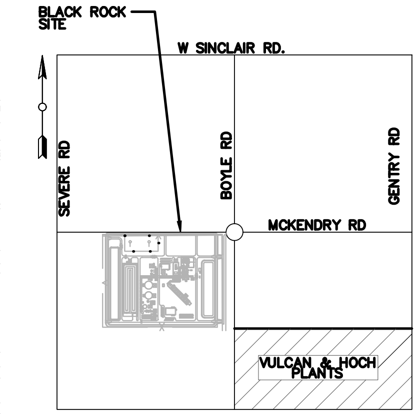
2.3.3.4.18 Site Grading and Drainage

The site is fairly level. The proposed drainage design in general will flow west toward the retention basin in the western portion of the site. Figures 2-6a and 2-6b show the pre- and post-construction site drainage.

Within the Project site, buildings and equipment are constructed on foundations with the overall site grading scheme designed to route surface water around and away from all equipment and buildings. The stormwater drainage system is sized to accommodate five inches of precipitation in a 24-hour period (100-year storm event) and to comply with applicable local codes and standards. Buildings and equipment are constructed in a manner that provides protection from the 100-year storm.

Stormwater flows will be directed to the retention basin via ditches, swales, and culverts.

Fluid handling equipment will be contained in curbed concrete aprons, with drainage directed to the thickeners and subsequently to the aerated fluid injection well.



BLACK ROCK LOCATION PLAN
NTS

NOTES:

1. THE BLACK ROCK SITE IS BORDERED BY IRRIGATION CANALS ON THE AST, WEST AND SOUTH SIDES OF THE SITE. THE EXISTING SLOPE DIRECTION OF THE SITE AND SURROUNDING FIELDS IS IN A GENERAL NORTH–WEST IRECTION. THUS THE IRRIGATION CANALS CREATE A BARRIER BLOCKING THE MAJORITY OF ANY OFF SITE STORM WATER FLOWS FROM MIGRATING ONTO THE SITE.
2. STORM WATER FLOWS ORIGINATING ON THE BLACK ROCK SITE DRAIN TO THE NORTH–WEST CORNER OF THE SITE.
3. AT NORTH EDGE OF THE SITE NEXT TO MCKENDRY ROAD THERE IS A 5–6 FOOT TALL SLOPE UP TO THE ROAD FROM THE FIELD. THIS SLOPE BLOCKS ANY STORMWATER FROM MIGRATING OFF THE SITE TO THE NORTH.
4. FENCE CORNER COORDINATES LISTED ARE IN CALIFORNIA STATE PLANE ZONE 6 NAD83 US FEET UNITS.
5. TOTAL AREA WITHIN FENCE LINE IS 61.61 ACRES.

LEGEND:

–230	EXISTING MAJOR CONTOURS
–229	EXISTING MINOR CONTOURS
—— x ——	SITE PERIMETER FENCE
————	SECTION QUARTER LINE
————	VARIOUS EASEMENTS
0.25% ←	EXISTING SLOPE AND DIRECTION

100 0 100 200
SCALE IN FEET

Figure 2-6a
Pre-Construction Drainage,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-C3-200-3A, 2/16/2023.

Jacobs

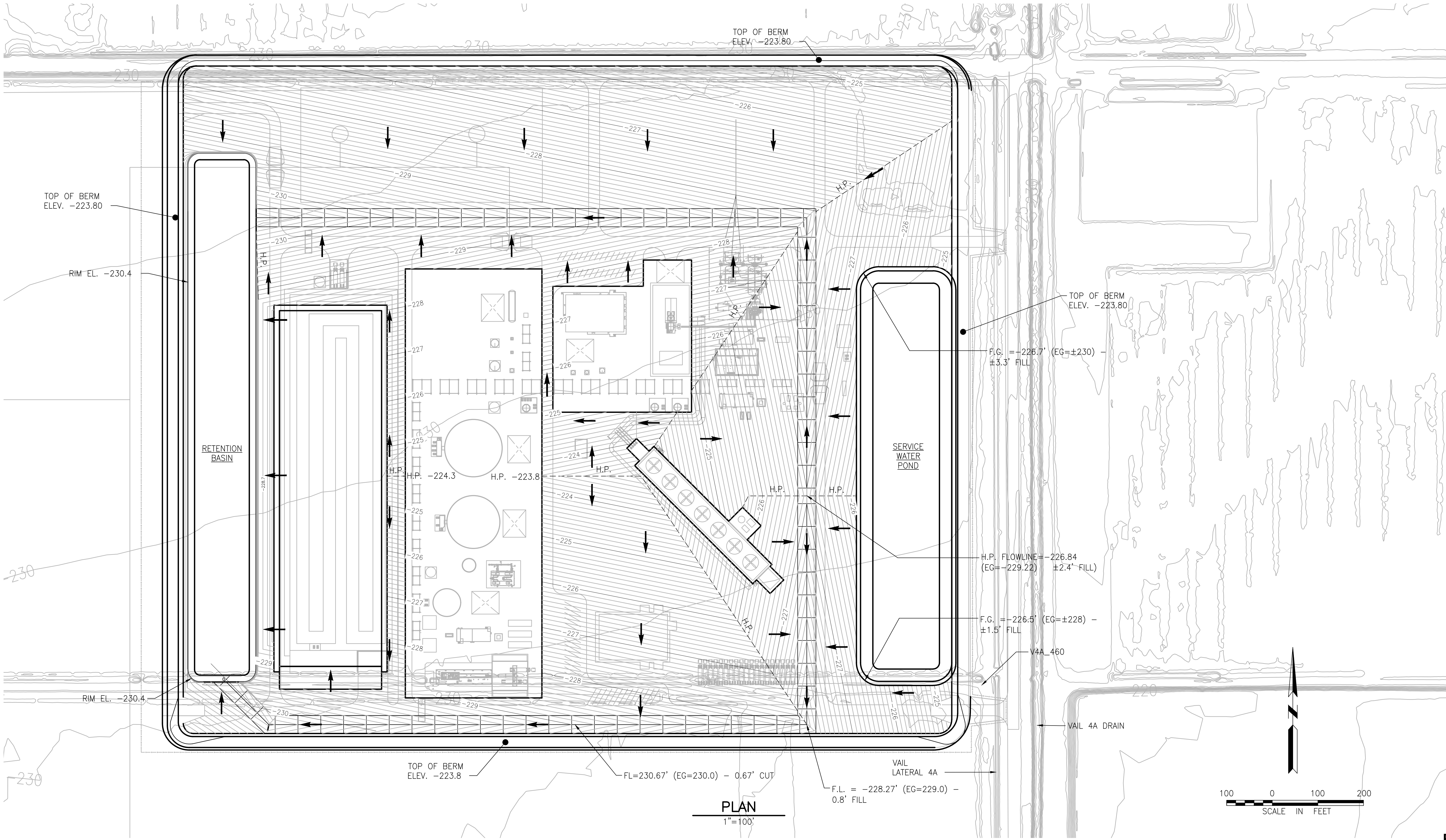


Figure 2-6b
Post-Construction Drainage,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-C3-200-2B, 4/5/2023.

Jacobs

Earthwork

Excavation work will consist of the removal, storage, and disposal of earth, sand, gravel, vegetation, organic and deleterious material, loose rock, boulders, and debris to the lines and grades necessary for construction. Materials suitable for backfill will be stored in small stockpiles at designated locations using proper erosion protection methods. Excess materials will be removed from the site and disposed of at an acceptable location. Disposal of any contaminated material encountered during excavation will comply with applicable federal, state, and local regulations.

The existing site topography shown on Figure 2-6a will be graded to provide a level area for the Project site. Where practical, topsoil will be segregated and stockpiled for reuse in areas that will be converted back to agriculture. Most soils in the Project area are designated as Prime Farmland and Farmland of Statewide Importance soil types and will be reserved for reuse, as feasible. It is assumed that excavated materials will be suitable for backfill.

Graded areas will be smooth, compacted, free from irregular surface changes, and sloped to drain. Cut and fill slopes for permanent embankments will be designed to withstand horizontal ground accelerations consistent with the applicable building codes. Slopes for embankments will be no steeper than 2:1 (horizontal : vertical). Areas to be backfilled will be prepared by removing unsuitable materials and rocks. The bottom of an excavation will be examined for loose or soft areas. Such areas will be excavated fully and backfilled with compacted fill.

Backfilling will be done in layers of uniform, specified thickness. Soil in each layer will be properly moistened to facilitate compaction to achieve the specified density. To verify compaction, representative field density and moisture-content tests will be performed during compaction. All testing will be in accordance with ASTM International standards.

The depth of excavation is presented in Figures 2-7a and 2-7b.

2.3.3.4.19 Sanitary Sewer Systems

Sanitary waste will be conveyed via an underground sewer system to a buried septic tank. Waste from this tank will be pumped out periodically. The septic tank will outlet to the dispersal system, such as a leach field, evapotranspiration bed, or other approved disposal method based on site constraints. The system will be constructed in conformance with the state of California and Imperial County regulations.

2.3.4 Construction

The overall project schedule for the BRGP construction and commissioning is expected to take approximately 29 months, including four months of post-commercial operation wrap-up activities. The schedule and staffing requirements are described in the following sections by major project components.

2.3.4.1 Power Plant Facility

Construction is anticipated to begin in the second quarter 2024. The overall Project staffing schedule is displayed in Table 2-9 by month. The construction schedule is based on two shifts, 10 hours per day, six days per week. Facility startup schedules are based on a two-shift, 24 hours per day, seven days per week work week. Overtime and shift work for construction may be used to maintain or enhance the construction schedule.

Construction worker parking will be in one of up to nine parking and laydown areas identified within the Project vicinity, with the most likely parking areas nearest to the construction. Laydown and parking areas are shown on Figure 1-4.

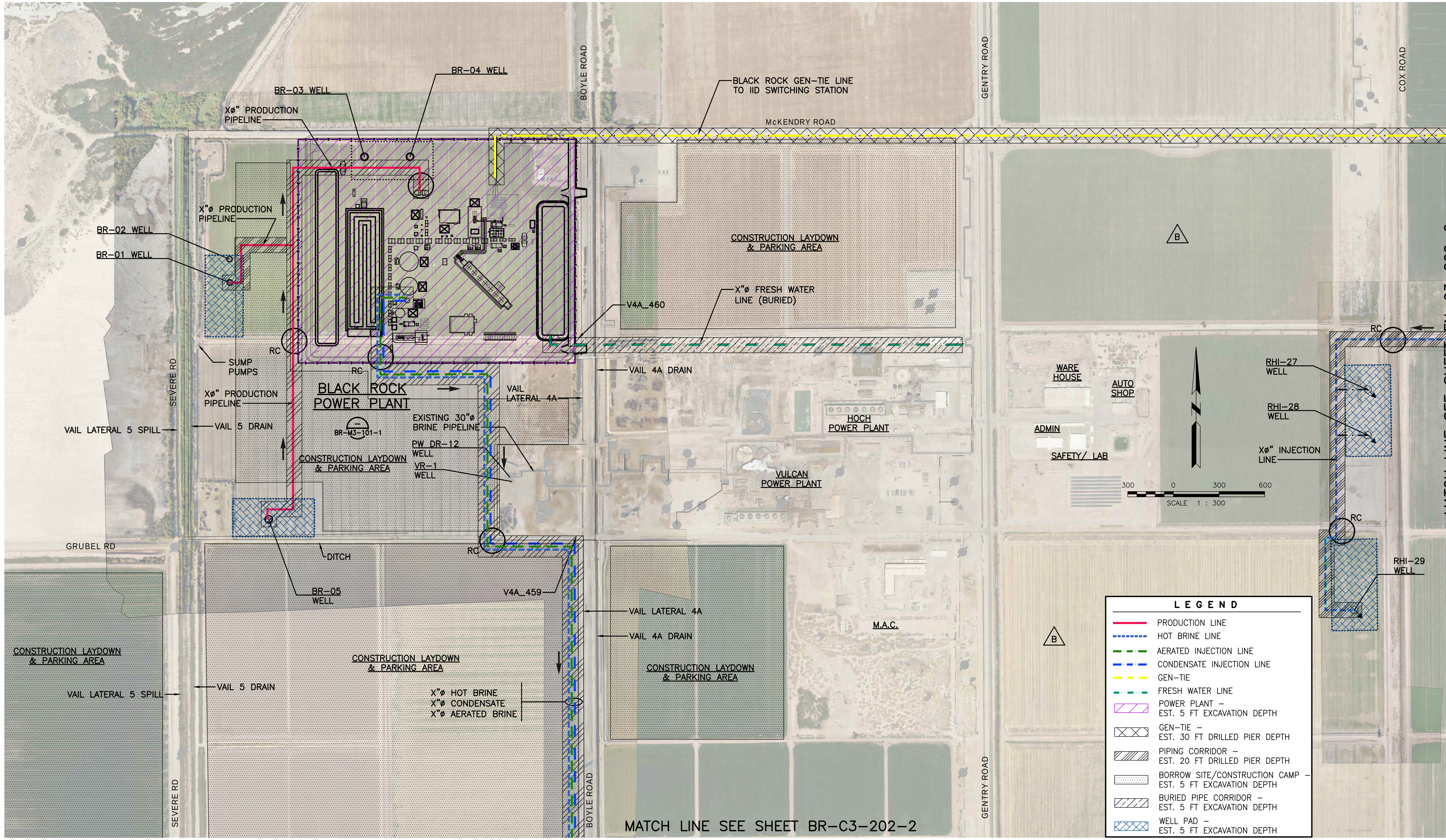


Figure 2-7a
Depth of Excavation,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-C3-202-1A, 2/16/2023.

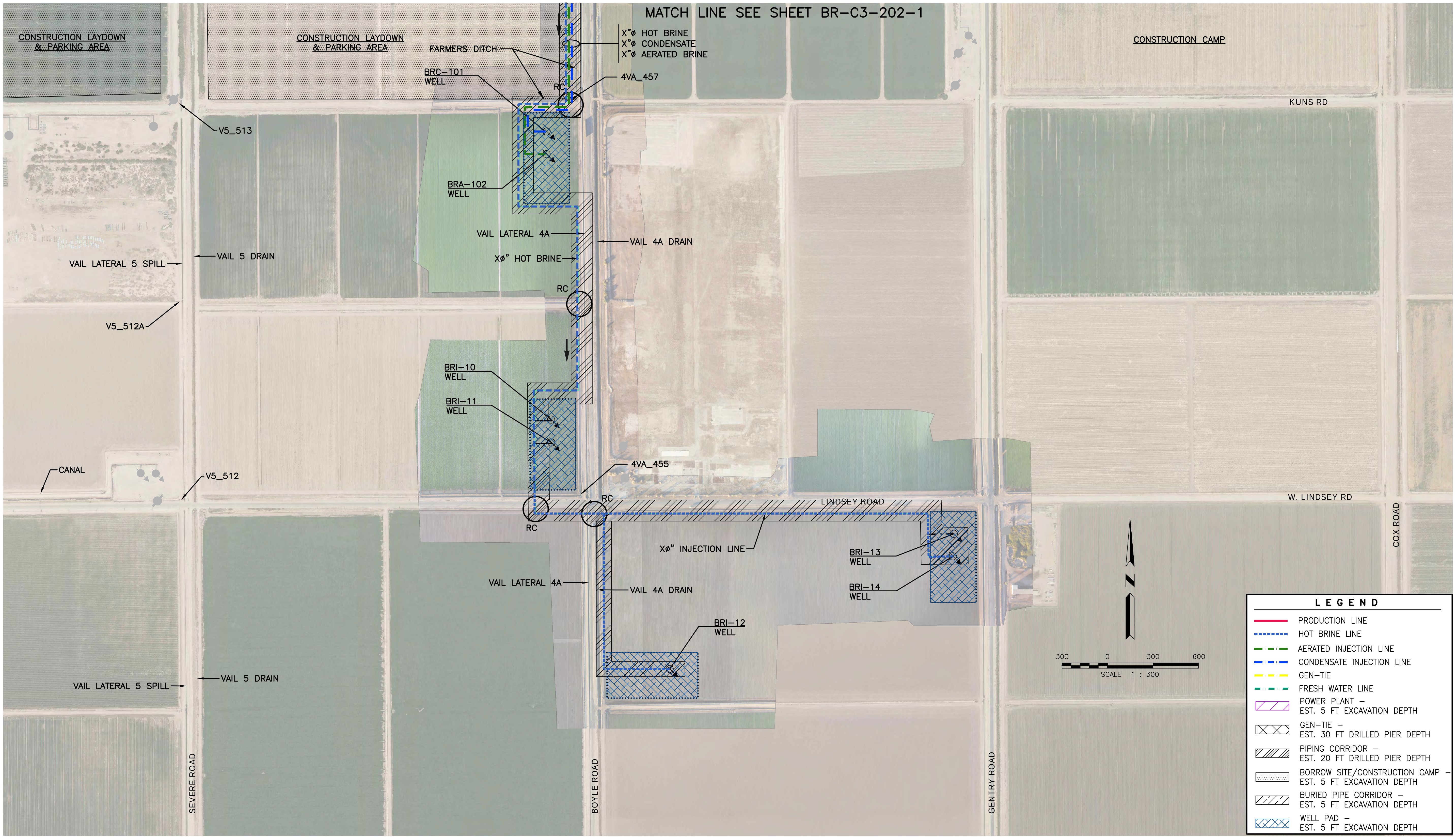


Figure 2-7b
Depth of Excavation,
Black Rock Geothermal Project
Imperial County, California

Source: Veizades & Associates, Drawing BR-C3-202-2A, 2/16/2023.

Jacobs

Table 2-9. Construction Workforce by Month

BHER Black Rock Project Construction Labor Estimate	2024												2025												2026											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Based on CEC certificate April 1, 2024																																				
No demolition anticipated																																				
Construction Craft Labor																																				
Piling (6 person Crew)						18	24	24	24																											
Carpenters							20	20	20	20	20	12	12	12	10	8	8	8	6	6	6	6	6	4	4	4				4	4					
Laborers					4	8	10	12	12	12	12	12	12	12	12	10	10	10	8	8	8	8	8	8	8	8				6	4	4				
Teamsters				2	4	7	7	7	8	8	12	12	12	12	12	12	12	12	12	12	12	12	12	12	6	6	6	6	6	12	12	8				
Electricians							4	4	4	4	4	24	24	24	24	40	40	40	40	40	40	40	40	40	40	40	10	10	10	4	4	6				
Ironworkers							10	10	10	10	10	10	10	10																						
Millwrights										6	6							12	16	24	24	24	24	24	18	18	6	6	6							
Boilermakers																																				
Plumbers															4	4					6	6														
Pipefitters									20	40	60	60	120	120	120	120	120	120	120	120	120	120	120	120	80	60										
Insulation workers											20	20	20	40	40	40	40	60	60	80	80	80	60	60	60	60	40									
Operating Engineers				6	6	12	12	12	12	12	14	14	14	14	16	16	16	16	16	16	18	18	18	18	12	12	6	6								
Oilers / Mechanics										2	2	2	2	2						4	4	4	4	2												
Cement Finishers							8	8	8	8	8	6	6	6	6	6	6	6	6	6																
Masons																																				
Sheetrockers																				10	10	12	12													
Roofers																	10																			
Sheetmetal Workers																				10	20	10														
Sprinkler Fitters																		8	8	10	10															
Painters																			6	6				6	6	6										
I&C - Control Room																				12	12	12	12	12	10	10	10	10								
Cooling Tower subcontract																				12	16	16	16	16												
Clarifier subcontract																		10	20	20	24	24	24	24												
Total craft LABOR	0	0	0	8	14	45	95	97	118	122	168	172	232	252	244	256	262	302	318	396	410	392	356	346	244	224	78	38	22	26	24	18	0	0	0	0
Total supervision	0	0	0	4	4	4	8	8	12	12	12	16	16	16	16	16	16	16	16	16	16	16	18	18	20	20	20	20	12	4	2	2	0	0	0	0
Total manpower	0	0	0	12	18	49	103	105	130	134	180	188	248	268	260	272	278	318	334	412	426	408	374	364	264	244	98	58	34	30	26	20	0	0	0	0

Construction Facilities

Mobile trailers or similar suitable facilities (modular offices) will be used as construction offices. These construction facilities will be located at one of the nearby construction laydown areas. Visitor parking will be available in an area adjacent to the construction offices.

2.3.4.2 Construction Camp

Affiliates of the Applicant anticipate constructing separate geothermal power plants (Elmore North Geothermal Project and Morton Bay Geothermal Project) concurrently with BRGP, which will increase regional peak workforce and may require temporary housing and facilities for construction workers affiliated with BRGP and the two other projects. These potential construction camps would be used by personnel working on the construction of the BRGP, Elmore North Geothermal Project, and Morton Bay Geothermal Project. Two potential areas have been identified for use as construction camps, as shown on Figure 1-4. Because of the possible need, the temporary camp locations are included as part of the Project and may be located east of Gentry Road and south of Sinclair Road (APN 020-120-054), east of Gentry Road and north of Kuns Road (APN 020-120-056 and APN 020-120-057).

Construction Parking/Laydown/Storage

Construction worker parking, laydown, and storage will be in one of up to nine parking and laydown areas in the Project vicinity.

Several areas in the vicinity of the Project site will be available for equipment and materials laydown, storage, construction equipment parking, small fabrication areas, and office trailers. Layout of access roads and loading areas are important in the development of the laydown yard. Outdoor and weather-protected space is required, planned, and provided for turbine parts, structural steel, piping spools, electrical components, switchyard apparatus, well drilling equipment, and associated maintenance activities. Site access will be controlled for personnel and vehicles. Security fencing will be installed around the site boundary, including the laydown areas.

Emergency Facilities

Emergency services will be coordinated with the local fire department and hospital. First aid kits will be provided at the construction site and regularly maintained. As required by federal, state, and local requirements, first aid training will be provided to the appropriate staff.

Fire extinguishers will be placed throughout the Project area at strategic locations during construction.

Construction Utilities

Temporary utilities will be provided for the construction offices, laydown areas, construction camps, and the Project construction site. Temporary construction power at the site will be supplied by temporary generators and, as practical, utility-furnished power. Area lighting will be provided and strategically located for safety and security. Raw canal water will be used for construction water. Drinking water will be imported and distributed daily. Portable toilets will be provided throughout the site. During hydrotests, water usage will increase.

Construction Equipment and Materials Delivery

Equipment planned for use in the construction of the BRGP is provided in Table 2-10. Truck deliveries will occur primarily weekdays between 6:00 a.m. and 4:30 p.m. The estimated daily average of truck deliveries is shown in Table 2-11. Materials such as concrete, pipe, wire and cable, fuels, reinforcing steel, and small tools and consumables will be delivered to the site by truck.

2.3.4.3 Drilling Production/Injection Wells and Pipelines

Well-drilling operations are conducted 24 hours per day, seven days per week. Eight weeks is estimated to drill each well, and approximately 17 people will be working at each drilling site at any one time. A diesel/electric drilling rig would be used to construct the production and injection wells.

Drill rig assembly (rig mobilization) is anticipated to require approximately one week per well. Prior to drilling and rig mobilization, preparation of a drilling site requires grading (clearing and leveling) of approximately 2 to 4.5 acres per well pad. A well pad will contain typically one to three wells reducing the overall surface disturbance by hosting more than one well on a well pad. This cleared area includes an equipment staging and activity area, a drill pad, and mud tank storage area. Well-drilling operations and construction are regulated by CalGEM, which includes the well design and drilling program and inspection of blowout prevention equipment.

A system of aboveground pipelines will be constructed to connect the BRGP with the production and injection wells. Wherever possible, these pipelines will be placed next to the borders of fields or along access roads to minimize the amount of land affected.

2.3.4.4 Interconnection Transmission Lines

2.3.4.4.1 Project Schedule and Workforce

Construction of the new 230 kV electrical interconnection gen-tie line from BRGP to the first point of interconnection will include a new switching station, part of the IID transmission system. Construction of the gen-tie line is estimated to take up to 12 months.

2.3.4.4.2 Gen-tie Right-of-way

IID requirements, the National Electrical Safety Code (NESC), and operational considerations determine the width of the ROW. Specific ROW requirements depend on the structure type, height, span, and conductor configuration. IID generally requires ROWs that are the height of the structure on either side of the centerline to avoid issues associated with structure failure. The single steel pole structures for the BRGP lines would range from 100 to 125 feet in height, with an overall ROW width of 125 feet. The proposed BRGP interconnection gen-tie would be located immediately adjacent to existing Imperial County road ROWs where possible, which is 50 feet wide.

2.3.4.4.3 Construction Activities

Construction of an interconnection gen-tie includes structure site clearing; installing foundations; assembling and erecting the structures; clearing, pulling (stringing individual 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 may require several construction crews operating simultaneously in different locations. Table 2-12 lists permanent disturbance for the Project.

Table 2-10. Construction Equipment

Construction	2024										2025												2026											
Description	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Excavators				1																														
Backhoe		2	2	2	2																													
10 Wheel Dump Truck		2	4	4	4																													
Dozer		1	1																															
Front End Loader				1	1																													
150 Ton Hydraulic Crane																		1	1	1	1	1												
75 Ton Hydraulic Crane									3	3	3	3	3	3	3	3	3	3	3	3	3	3												
35 Ton Hydraulic Crane				3	3	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6												
Pile Driver		3	4	4	4																													
Fork Lift						1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3												
Grader		1	1																															
Drill Rigs (in separate count)																																		
Electrical Generators					3	3	3	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3									
Concrete Pump Trucks					1								6																					
Diesel Welders							4	4	4	4	10	10	10	10	10	10	10	10	10	10	10	10	3	2	2	2								
Compactor					3	3	3	3	3	3	3	3	3	3	3	3	3	3																
Stake Truck		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
Water Truck (shared between 3 projects)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
Pick-up Truck		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2							
Air Compressor								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
Light Towers																																		
Heavy Lift Lattice boom Main Crane																																		
Heavy Lift Lattice boom Tail Crain																																		
Heavy lift Gantry Crane																	1	1																

Table 2-11. Construction Truck Deliveries by month

	Months After Project Commencement																																			
Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Standard Truck Deliveries																																				
Fill Material																																				
Mechanical Equipment													1.5	1.5	1.5	2	4	4	4	4	4	4	3	2	2	2	2				2	2	1	1	0	0
Electrical Equip. & Materials					0.75	0.75	0.75	1.5	2	2	2	2	2	2	2	2	2	2	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1	1
Piping, Supports, & Valves							0.75	0.75	0.75	0.75	2	2	2	2	2	2	2	1	1	1	1	1												1	1	1
Concrete and Rebar			0.75	0.75	0.75	0.75	0.75	1.5	2	2	2	2	2	1	1	1																				
Steel/ Architectural					0.75	0.75	0.75	0.75	0.75	0.75	1	2	2	2	2	2	1	1	1	1	1	1									1	1	1	0	0	0
Consumables & Supplies	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1	1	1	1	1	1	1	1	1	1	1	1	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1	1	1	1	1	1
Contractor Mobilization	0	0.375	0.375	0.375	0.375	0.375	0	0	0	0	0	0	0	0	0																					
Contractor Demobilization																		0.2	0.2	0.2	0.2	0.2											0.2	0.2	0.2	0.2
Construction Equipment	0.4	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.5	0.5	0.5	0.5	0.5											0.5	0.5	0.5	0.5
Drilling and Well Development																																				
Heavy Haul Truck Deliveries																																				
Clarifier														1	1	1	1																			
Steam Turbine												0.5	0.5	0.5																						
Cooling Tower														0.5	0.5	0.5																				
Misc.													0.5	0.5	0.5																					
Main Transformers														0.1	0.5	0.1																				
Well Pipelines																																				
Total Truck Traffic at Site																																				
																																			0.0	
Trucks/Day/Month	0.4	0.6	1.4	2.1	3.6	3.6	4.0	5.5	6.5	6.5	8.3	9.8	11.8	12.4	12.3	12.1	11.5	9.7	8.7	8.7	8.2	8.2	3.8	2.8	2.8	2.8	2.8	0.8	0.8	0.8	5.0	5.0	4.7	4.7	3.7	3.7
Trucks/Month	9.2	14.4	31.6	48.9	83.4	83.4	92.0	126.5	149.5	149.5	189.8	224.3	270.3	284.1	281.8	278.3	264.5	223.1	200.1	200.1	188.6	188.6	86.3	63.3	63.3	63.3	63.3	17.3	17.3	17.3	115.0	115.0	108.1	108.1	85.1	85.1
Direct Delivery Traffic to Site																																				
Trucks/Day/Month	10	0.3	0.6	0.9	1.5	1.5	1.6	2.2	2.6	2.6	3.3	3.9	4.7	4.9	4.9	4.8	4.6	3.9	3.5	3.5	3.3	3.3	1.5	1.1	1.1	1.1	1.1	0.3	0.3	0.3	2.0	2.0	1.9	1.9	1.5	1.5
Trucks/Month	230	5.8	12.7	19.6	33.4	33.4	36.8	50.6	59.8	59.8	75.9	89.7	108.1	113.6	112.7	111.3	105.8	89.2	80.0	80.0	75.4	75.4	34.5	25.3	25.3	25.3	25.3	6.9	6.9	6.9	46.0	46.0	43.2	43.2	34.0	34.0
Total Traffic to Site																																				
Trucks/Day/Month	249.6	0.8	1.7	2.6	4.4	4.4	4.8	6.6	7.8	7.8	9.9	11.7	14.1	14.8	14.7	14.5	13.8	11.6	10.4	10.4	9.8	9.8	4.5	3.3	3.3	3.3	3.3	0.9	0.9	0.9	6.0	6.0	5.6	5.6		
Trucks/Month	5740.8	17.3	38.0	58.7	100.1	100.1	110.4	151.8	179.4	179.4	227.7	269.1	324.3	340.9	338.1	334.0	317.4	267.7	240.1	240.1	226.3	226.3	103.5	75.9	75.9	75.9	75.9	20.7	20.7	20.7	138.0	138.0	129.7	129.7		

Table 2-12. Project Features and Permanent Disturbances

Project Features	Approximate Dimensions
Project Site (Acres)	55
Production Well Pads (Acres)	9.2
Production Pipelines (Linear Feet)	7,137
Injection Well Pads (Acres)	16.5
Injection Pipelines (Linear Feet)	26,934
Gen-Tie Line (Linear Feet)	11,818
Laydown and Parking (Acres)	600
Borrow Pits (Acres)	460
Construction Camp (Acres)	206

Structure Sites

At each structure site, leveled areas (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 feet by 40 feet. At each structure site, a work area of approximately 200 square feet 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 gen-tie maintenance would be restored to natural contours to the greatest extent possible and be revegetated where required.

Clearing and Grading within Right-of-way

Clearing and grading would be conducted only as necessary at construction areas for the safe movement of vehicles and construction activities.

Foundation Installation

Excavations for 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. 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.

Structure Assembly and Erection

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.

Conductor Installation

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 up to two 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.

Ground Rod Installation

Part of standard construction practices prior to wire installation would involve measuring the resistance of structure footings. If the resistance to remote earth for each transmission structure is greater than 25 ohms, additional ground rods would be installed to lower the resistance below 25 ohms.

2.3.5 Facilities, Operations and Maintenance

2.3.5.1 Introduction

The BRGP is expected to have an operating life of 40 years. Reliability and availability are based on this projected operating life. The BRGP is a generating facility designed for the restructured California energy market. The Project design and operating philosophy will be based on operation as a merchant plant in the competitive California electricity market, with a high emphasis on efficiency and flexibility.

The BRGP 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. Operations will be controlled from the operator’s panel, which will be in the Control Room. A distributed control system will provide modulating control, digital control, and monitoring and indicating functions for operation of the resource production facility and power generation facility systems.

2.3.5.2 Power Plant Facility

2.3.5.2.1 Annual Operating Practices

Generally, the BRGP will be operated to provide its maximum electrical output throughout the year. To start the plant from a 0% dispatched operating mode, power will be back fed through the gen-tie to bring the facilities online. Auxiliary systems and the resource production facility will be started up first. After production of turbine-quality steam has been confirmed, steam will be directed to the turbine. After achieving full speed, the turbine generator will be synchronized with the transmission grid.

Planned maintenance will be addressed with safe operations as the primary priorities. Planned maintenance beyond these priorities will be coordinated to optimize availability and for scheduled power plant shutdowns for maintenance and overhauls. This work will be planned during seasonal periods when the need for electricity is reduced.

2.3.5.2.2 Operation with Daily and Seasonal Variation in Temperature and Demand

Output from the BRGP will be sensitive to the ambient wet bulb, which impacts the cooling capacity of the cooling tower and varies during the course of the year. The cooling tower will, therefore, be designed with an 80°F wet bulb to provide sufficient capacity for ambient temperature during the summer peaks, when the electrical customers' usage is at its highest.

2.3.5.2.3 Startup and Shutdown

A cold start would occur when the BRGP is completely shut down and all fluid flow to the plant is isolated for an extended period.

A warm start would occur when the turbine is taken offline and the RPF continues to operate. A startup in this condition will require approximately 10 hours.

2.3.5.2.4 Control Philosophy

The control system will consist of an integrated, microprocessor-based DCS. The control system will provide for startup, shutdown, and control of plant operation limits, and will provide protection for the equipment. Interlock and logic systems will be provided with hardwired relays, the DCS, or PLCs. Process variables (pressure, temperature, level) used for protective functions will be connected directly to the DCS and the protective system.

2.3.5.2.5 Degree of Automation and Control Systems

The BRGP will be designed with a high degree of automation to reduce the required actions performed by operating personnel. Where it is not beneficial, systems will not be automated. Through subsystem automation and a DCS, the number of individual control variables and indicators that confront the operator will be greatly reduced. This will reduce the complexity and size of the main control room consoles and panels.

Most equipment required to support the operation of the plant will be remotely accessed in the control room. The control room contains the DCS VDU-type control consoles and the auxiliary control panels. Additionally, the control room contains the alarm, utility, and log printers.

Local control panels or stations will be furnished only where operator attention is required to set up a system for operation, or where the equipment requires intermittent attention during plant operation. Main control room indication and control will only be duplicated for those variables critical to plant availability.

Functionally distributed and redundant microprocessor-based subsystem controllers will communicate with the main control room via a redundant high-speed communications network. The communications network will provide unit-wide data access for centralized operation and engineering functions through VDUs. Remote I/O capability will be provided to allow the DCS to interface with remote equipment and to reduce the quantity of long cable runs.

The DCS will perform the following functions and miscellaneous tasks:

- Perform analog and digital plant control functions to accommodate a consistent operator interface for controlling the power plant equipment.
- Monitor both analog and digital signals to provide the operator/engineer with access to the data around the network.
- Perform alarm monitoring in the main control room for the entire plant.
- Provide graphic displays for all systems and equipment, including electrical systems and controller faceplates.
- Provide data logging and reporting via displays and printed reports.
- Provide long-term data storage of process history.

2.3.5.3 Interconnection Transmission System Operation and Maintenance

Operation of the transmission system is controlled by IID, the regional balancing authority and transmission owner. The first point of interconnection is at the proposed IID 230 kV switching station approximately 2.3 miles from BRGP. The Applicant will engineer, construct, own, operate, and maintain the approximately 2.3-mile interconnection gen-tie between the proposed BRGP GSU and the proposed IID 230 kV switching station. Anticipated maintenance activities for the interconnection transmission system are described as follows:

- Access ways to poles and structures will be provided, as required. All access ways will be maintained to minimize erosion and to allow access by the maintenance crew.
- Land use activities within and adjacent to the gen-tie ROW will be permitted within the terms of the easement. Incompatible uses of the ROW include buildings and tall trees that interfere with required line clearances, as well as storage of flammable materials, or other activities that compromise the safe operation of the interconnection gen-tie.
- The interconnection gen-tie would be inspected regularly by both ground patrol and possibly air patrols. Maintenance would be performed as needed.
- Emergency repairs will be made if the interconnection gen-tie is damaged and requires immediate attention. Maintenance crews will use tools and other such equipment, as necessary, for repairing and maintaining insulators, conductors, structures, and access ways. When access is required for nonemergency maintenance and repairs, the Applicant would adhere to the same precautions identified for original construction.
- The buildup of particulate matter on the ceramic insulators supporting the conductors on electrical lines increases the potential for flashovers, which affects the safe and reliable operation of the line. Structures with buildup of particulate matter are identified for washing during routine inspections of the lines. Washing operations consist of spraying insulators with deionized water or limestone powder through high-pressure equipment mounted on a truck.

2.3.5.4 Water Supply System Maintenance

Operation of the water supply pipeline will be in accordance with general industry standards. The pipeline will receive periodic inspection as part of the BRGP maintenance program.

2.3.6 Facility Closure

Facility closure can be either temporary or permanent. Facility closure can result from two circumstances: (1) the facility is closed suddenly and/or unexpectedly because of unplanned circumstances, such as a natural disaster or other unexpected event; or (2) the facility is closed in a planned manner, such as at the end of its useful economic or mechanical life or because of gradual obsolescence. The two types of closure are discussed in the following subsections.

2.3.6.1 Temporary Closure

Temporary or unplanned closure can result from numerous unforeseen circumstances, ranging from natural disaster to terrorist attack 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 restart operations when the unplanned closure event is rectified or ceases to restrict operations. If there is a possibility of hazardous substances release, the Applicant will notify the appropriate agencies and follow emergency plans that are appropriate to the emergency. Depending on the expected duration of the shutdown, chemicals may be drained from the storage tanks and other equipment. All wastes (hazardous and nonhazardous) will be disposed of according to LORS in effect at the time of the closure. Facility security will be retained so that the BRGP is secure from trespassers.

Prior to the beginning of operations, the Applicant will develop a contingency plan to deal with unplanned or unexpected plant closure. This plan will include the following elements:

- Taking immediate steps to secure the facility from trespassing and encroachment
- Procedures for the safe shutdown and startup of equipment and procedures for dealing with hazardous materials, including draining of vessels and equipment and disposal of wastes
- Communication with CEC and local authorities regarding the facility damage and compliance with LORS

2.3.6.2 Permanent Closure

The planned economic life of the BRGP facility is 40 years. However, if the facility were economically viable at the end of the 40-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 will have value beyond 40 years. It is also possible that the facility could become economically noncompetitive earlier than the planned power plant's 40-year useful life. Decommissioning activities will follow a decommissioning plan that will be developed and submitted to the CEC for review at least 12 months prior to planned facility closure. The permanent closure plan will include the following elements:

- Activities required to permanently close the facility
- A listing of all applicable LORS and a plan to comply with them
- Coordination with CEC and interested local authorities, including workshops, to coordinate closure activities
- The maximization of recycling and other proper disposal methods
- The maintenance of site security, as required

In case of permanent closure, the facility will be cleaned and the facility components will be salvaged to the greatest extent possible. Cleaning will consist of removal of scale from piping and equipment walls (primarily fluid-handling piping and equipment) and the removal of sludge from the primary and secondary clarifiers and "clean closing" the brine pond and the cooling tower basin. All solids will be tested. Those found to be hazardous will be transferred to a permitted Class I landfill. Nonhazardous wastes will be transferred to a permitted Class II or Class III landfill as appropriate for each waste. These solids will be managed and disposed of properly so as not to cause significant environmental or health and safety impacts.

Under permanent closure, the wells will be abandoned with proper certification using CalGEM procedures and the brine pond will be "clean closed" in accordance with the RWQCB waste discharge requirements.

2.4 Facility Availability, Reliability, and Safety

2.4.1 Facility Availability

The BRGP will employ a geothermal condensing steam turbine. Generating plants employing geothermal steam turbines operating in continuous service have demonstrated operating availabilities above 95% over several years.

2.4.1.1 Range of Availability

Overall availability varies from year to year because of both unplanned causes and the structure of the overhaul cycle. Forced unavailability changes somewhat from year to year because the numbers and lengths of forced outages vary randomly. Planned outages also vary because the overhaul cycle requires different amounts of down time in different years. The geothermal steam turbine and fluid equipment for

BRGP is planned to be overhauled on a 3-year (triennial) cycle with a planned warranty outage in Year 1 and triennial outages starting in Year 3. Fluid equipment overhauls and turbine generator overhauls would occur simultaneously. All of the planned outage work for major overhauls will be performed in seasons when demand is relatively low. The expected service life of the facility is 40 years.

2.4.1.2 Basis for Forecasts of Availability

2.4.1.2.1 Resource Production Facility

Proper performance of the turbine, and of the overall facility, is dependent on the continuous supply of turbine-quality steam. The crystallizer/reactor clarifier process is a proven technology for producing turbine-quality steam and effectively processing the fluid. Commercial application employing this technology has been demonstrated in the Salton Sea KGRA. Design features that lead to this success are being incorporated in the design of this facility. These include a proven process design that effectively polishes the steam and removes solids from the fluid (thereby mitigating scale formation on facility internals and in the injection wells); use of corrosion-resistant alloy (or functionally equivalent) materials or cladding on vessels and tanks to mitigate corrosion and scale adhesion; equipment sufficiently sized to ensure performance; and use of redundant and standby equipment to ensure continued operation of the facility.

Although the crystallizer/reactor clarifier process effectively reduces solids in the fluid, periodic workovers of the injection wells will nonetheless be required. This is considered normal maintenance practice, and the workovers maintain the injectivity required to ensure long-term operation of the RPF.

2.4.1.2.2 Power Generation Facility

The risk of catastrophic failure for the geothermal condensing turbine is considered small. The design has been proven in the geothermal industry in similar commercial applications worldwide. The turbine manufacturers under consideration are reputable, and a review of turbines in geothermal service shows that catastrophic failures are extremely uncommon. Mitigation against failure or damage is achieved by proper design, operation, and maintenance, and by the incorporation of a spare rotor and stationary blades in the spare parts purchased with the machine.

Components of the heat rejection system, including the shell-and-tube type main condenser, the hybrid gas removal system comprised of steam ejector and liquid ring vacuum pump, and the counter flow cooling tower, have performed very reliably in geothermal applications such as this over many years.

2.4.1.2.3 Degradation in Output from Fouling and Wear

All steam turbines degrade in output from their new and clean condition because of fouling and wear. “Nonrecoverable” degradation from equipment wear increases rapidly in the first few thousand hours and then slows. Most of the degradation resulting from wear will be recovered during the major overhaul conducted on a planned 3-year interval.

2.4.1.2.4 Summary of Availability

The BRGP is expected to provide a high availability and be responsive to the needs of the system for power. Planned outages are anticipated to occur every three years in seasons when energy demand is relatively low.

2.4.2 Reliability

Critical functions and parameters will have redundant sensors, controls, indicators, and alarms. The system will be designed such that critical controls and indications do not fail because of a failure in the control system implementation of redundancy logic.

Control systems in general, and especially the protection systems, will be designed according to stringent failure criteria.

Measurement redundancy will be provided for all critical plant parameters. DCS microprocessors will be fully redundant with automatic tracking and switchover capability in case of primary microprocessor failure. Two fully redundant data communications networks will be provided. The system will permit either network to be disconnected and reconnected while the system remains online and in control. The control system will incorporate online self-diagnostic features to verify proper operation of system hardware, software, and related support functions such as control power, field contact interrogating power, and the system modules in position.

The following subsections identify equipment redundancy as it applies to project availability.

2.4.2.1 Resource Production Facility

Sufficient production and injection wells will be drilled to provide necessary capacity so that full plant output can be maintained while wells are being individually maintained.

2.4.2.2 Power Generation Facility

The turbine generator system includes an excitation system, lube oil system, and steam turbine control and instrumentation. Redundancy is provided in the steam turbine subsystems where practical. For example, the lube oil system consists of redundant pumps, filters, and coolers. The microprocessor-based control system consists of redundant microprocessors, as well as redundant sensors for critical measurements. Technological advancements, as well as redundancy as illustrated previously, have led to extremely high reliability for the steam turbines considered for this Project.

2.4.2.3 Balance of Plant Systems

BOP systems serve to enhance reliability. An instrument air system is incorporated in the design. The plant instrument air system provides a compressed, dry air for use in instruments and control devices. The system consists of a redundant capacity electric-driven air compressor, air dryer with pre-filter and post-filter, air receiver, instrument air headers, and distribution piping. A standby air compressor and standby ancillary equipment (regenerative air drier, receiver, and instrumentation) also will be provided for added reliability. The fire water system is to provide fire protection for all the plant personnel and equipment; it includes a primary fire water pump, a backup diesel-powered pump, and the fire water pipeline system.

2.4.2.4 Distributed Control System

The DCS will be a redundant microprocessor-based system that will provide control, monitoring, and alarm functions for plant systems and equipment. The following functions will be provided:

- Control the resource production facility and other systems in response to unit load demands (the steam turbine generator has its own control system).
- Provide control room operator interface.
- Monitor plant equipment and process parameters and provide this information to the plant operators in a meaningful format.
- Provide visual and audible alarms for abnormal events based on field signals or software-generated signals from plant systems, processes, or equipment.

The DCS will have functionally distributed architecture comprising a group of similar redundant processing units linked to a group of operator consoles and an engineering workstation by redundant data highways. Redundant processors will be identically programmed to perform the specific tasks for control information, data acquisition, annunciation, and historical purposes. Because of this redundancy, no single processor failure can cause or prevent a unit trip.

2.4.2.5 Power Plant Performance and Efficiency

Based on predicted power dispatching, the BRGP is expected to produce more than 8,000 hours per year. Under summer design conditions, the corresponding fluid production rate will be on average 6,601,437 pounds per hour.

2.4.2.6 Geothermal Fluid/Water Availability

The wellfield for the BRGP is in known productive resource areas with indicated and measured resources that are near active operational geothermal wells. This results in a high probability to classify the BRGP production wellfield as credible to proven production. The resource risk in this area is interference with the existing production wells, which has been minimized by well placement based on the use of reservoir modeling and forecasting. Redrilling of the open-hole section of the wells will be performed as required to maintain production. Use of pressure observation wells and ongoing reservoir modeling will be employed to manage the resource.

The source of water for the plant will be water from agricultural distribution canals. The water custody transfer point will be at the existing Vail 4A Lateral, water gate 459 or 460 (the IID is responsible for the operation and maintenance of the water supply system upstream of this point). Because this IID supply system is already in place, upgrades to the existing water supply system are expected to be minor. A buried pipeline will be installed to transfer the water either by gravity or via transfer pump system from the custody transfer point to the service water pond.

2.4.2.7 Operations Maintenance Plan

2.4.2.7.1 General Approach

During the operations phase, the Project Owner will perform all tasks necessary to operate and maintain the plant in accordance with an Operating Plan, approved procedures, and prudent, industry standards, including:

- Operations management
- Maintenance management
- Administrative support

Each of these are described in the following subsections.

Operations Management

Effective operations management provides the planning, scheduling, and training necessary for efficient and profitable plant operation. Table 2-13 presents the expected operational staffing for the project.

Table 2-13. Operating Employees

Classification	Number
Operations Manager	1
Control Operator	4
Shift Supervisor	2
Operators	11
Plant Operators	4
Project Analyst	4
Planner	1

Classification	Number
Process Engineer	1
Maintenance Technician III	3
Instrument & Electrical Technician	2
Maintenance Technician IV – Welder/Valve	2
Turbine	1
Resource Technician I	1
Resource Technician III	1
Resource Supervisor	1
Drilling Supervisor	1
DVC Support	2
Lab Tech I	1
Lab Tech II	1
Lab Tech III	1
Potable Water	1
Lab Supervisor	1
Project Engineer	1
Sr Project Engineer	1
NDE Tech	1
NDE Supervisor	1
Drafting	1
Lab and Engineering Manager	1
Environmental Engineer	1
Environmental Coordinator	1
Sr. Environmental Coordinator	1
Hazard Waste Coordinator	1
90 Day Crew	1
Health and Safety Specialist	1
Warehouse Staff	1
Procurement Specialist	1
Total	61

Staffing

Staffing plans are designed for the ongoing operational and maintenance requirements of the facility. All periodic testing, inspections, and maintenance activities will be identified, as well as those operational and maintenance requirements that require specialized and extra assistance at specific times during the maintenance cycle of the plant.

The staffing plan includes permanent facility staff who will be fully responsive to all electrical load demands and will be responsible for the performance of all preventive maintenance and routine repairs. The Applicant will strive to hire and train Project staff as much as possible from Imperial County residents consistent with Project needs and any applicable labor agreements. To that end, the Applicant has initiated efforts to develop training programs within local schools and other institutions.

The onsite operations and maintenance staff will be supported by the home office, the engineering procurement contractors, and subcontractors for nonroutine functions. Associated technical and specialized vendor support will be subcontracted as needed during planned outages, inspections, and overhauls.

Plant Operations and Supervision

The Operational Plan will require the following:

1. Operate the facility in accordance with the Operating Plan, Operations and Maintenance Manual, all applicable LORS and permits, and an approved annual budget and prudent industry standards.
2. Perform and record periodic operational checks and tests of equipment in accordance with approved maintenance procedures, the equipment manufacturer's specifications, and applicable laws and regulations.
3. Maintain operating logs, records, and reports for operation of the facility.
4. Coordinate scheduled shutdowns or other modifications in basic plant operations.

Ongoing Operations Training

The Project Owner will establish, implement, and conduct an ongoing operations training program. The plant staff will continue to receive training to maintain or improve plant reliability, availability, and capacity following Project startup.

Manufacturers' representatives and other sources of operations, maintenance, and overhaul literature will provide up-to-date information and techniques to the plant staff. Key staff members also will attend industry conferences and seminars to exchange information with other operators.

Maintenance Management Program

The Project will use a computerized maintenance/inventory management (CMIM) system. The key elements of the Project's maintenance/inventory systems will include:

- Preventive maintenance
- Predictive maintenance
- Corrective maintenance
- Outage management
- Spare parts inventory control

The control system will use a computerized maintenance management program to provide plant personnel with equipment histories, work orders, maintenance schedules, outage scheduling, inventory control, and equipment and man-hour costs.

Preventive Maintenance

Project preventive maintenance will consist of periodic equipment inspections and adjustments that will help avoid deterioration of plant performance. Preventive maintenance schedules will be included in the computerized plant monitoring program and will be calibrated to an overall plant schedule. This schedule will provide daily, weekly, monthly, and annual scheduling of necessary preventive maintenance activities and will include spare parts management.

Preventive maintenance schedules will be developed for particular pieces of equipment. The preventive maintenance schedules will be updated to reflect actual plant operating conditions, with adjustments made based on changes in key plant parameters. The equipment testing and monitoring will provide key data for the predictive maintenance component of the overall maintenance management program.

An integrated work order system will be used to schedule work and integrate the preventive maintenance into the overall maintenance management program.

Predictive Maintenance

Predictive maintenance generally improves the reliability/cost ratio and, subsequently, increases plant profitability by monitoring, recording, and evaluating plant performance systematically to develop a documented equipment and plant history. This history allows maintenance scheduling around critical plant components in the plant system. Sensitive areas will receive extra attention from preventive maintenance personnel.

Corrective Maintenance

Corrective maintenance activities will return the equipment quickly to operating order. At regular discussion meetings, plant maintenance personnel will review and evaluate failures to avoid repeat failures. Review of the events preceding the failure allows determination of the exact causes; these findings will be fed back into the predictive maintenance model to determine whether additional or different maintenance procedures are warranted for the key components responsible for the failure.

Outage Management

Outages for overhaul will be managed to minimize downtime through advanced planning, work packages, outage schedules, and other project management methods to allocate plant resources efficiently. Prior to each outage, the plant staff and the equipment manufacturers will conduct planned inspections beginning from three months to a year before the outage, depending on the need for and availability of major equipment components. Plant staff will work with vendor representatives to verify that the proper parts and tools are available, help coordinate inspections, and schedule work to be performed in the vendor repair shop.

A scheduling program using the critical path method will itemize various work packages, organize them, and calculate the affect any work package has on the overall outage length. The program will provide a reporting tool that allows the plant staff to create easy-to-understand outage schedules and reports showing manpower needs, equipment resources, and usage profiles. The program also will identify potential problems that could lead to schedule slippage.

Safety Program

To ensure the safety of all employees and personnel working in or near the BRGP, the Applicant will establish a safety plan that conforms to federal, state, and local regulations. Key components of the plan will include:

- Plant Familiarity: Employees are to be thoroughly familiar with Project operations and procedures, as well as the equipment being operated.
- Clearances: Written clearance procedures will be followed before working on or entering any equipment. No employee will work on any equipment that has been cleared for work unless the employee holds a clearance, or is reporting to another employee who holds such clearance.
- Proper Equipment Designation: Equipment to be operated or worked on will be properly designated, by name and number.
- Responsibility: Operations and duties are performed only by duly authorized employees, who are held responsible for their actions.
- Monitoring: Employees will be required to maintain a continuing check on operating conditions to prevent a potential hazard to personnel and equipment. These include items such as: high or low oil or water level, excessive temperatures and pressures, over speeding of rotating equipment, abnormal noises, unusual vibration, malfunctioning of auxiliaries.
- Records: Employees who are required to keep logs and records will keep them current and maintain a high level of accuracy. Abnormal or special conditions will be called promptly to the attention of the proper supervisors and logged. Shift employees will familiarize themselves with all activities within their jurisdiction that have taken place during the preceding shift.

Plant Security

The Applicant will develop and implement a formal, written security plan and staff will be trained in its requirements. Staff and all visitors will be required to adhere to the plan to ensure power plant security under all conditions.

2.4.3 Safety

2.4.3.1 Geothermal Power Facility

2.4.3.1.1 Seismic

The BRGP is situated within the south-central portion of the Salton Trough, a topographic and structural depression bounded to the north by the Coachella Valley and to the south by the Gulf of California. The primary geologic hazards at the site include strong ground motion from a seismic event centered on one of several nearby active faults. The site is within the Brawley Seismic Zone, which is a zone of transition between the northwest end of the Imperial Fault and the southwest end of the San Andreas Fault. The potential for ground rupture resulting from faulting is believed to be low. Potential impacts of the geologic hazards on the plant and ancillary facility operations include liquefaction, seismic shaking, post-liquefaction settlement, seismically induced flooding, settlement, and subsidence. With implementation of the measures outlined in Section 5.2.4, impacts to plant operations from geologic hazards will be reduced to a less-than-significant level.

Design and construction of the generating plant will be in conformance with the current California Building Code Seismic requirements.

2.4.3.1.2 Flooding

The facility is near the Salton Sea and is, therefore, in the special flood hazard area as defined by Imperial County, Title 9, Land Use Ordinance # 1203, Division 16. To mitigate the flood hazard, a berm will be constructed around the entire generating facility. The Applicant is preparing a LOMR to be submitted to Imperial County and FEMA in second quarter 2023. The LOMR is requesting a revision to the 100-year flood zone based on hydraulic modeling. The results of this modeling were used in the design of the flood protection berms.

During the construction phase of the Project, erosion and sediment control measures will be temporarily installed as required under the Project's National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharge associated with construction activity. The permanent stormwater management system will consist of ditches/swales in general areas and culverts under roadways draining to the retention basin. These measures will minimize the possibility of appreciable erosion and resulting sedimentation occurring on the site.

The drainage plan for the plant site will be designed to prevent flooding of permanent facilities by a 100-year, 24-hour storm event. Drainage design will be designed in accordance with Imperial County requirements. Figures 2-6a and 2-6b provide pre- and post-drainage drawings for the Project site.

2.4.3.2 Pipeline Safety

The production and injection pipelines would have several design and operation features related to assuring the safety and reliability of these system components. During commissioning of the pipeline, plant startups, and following work on the production wells, great care is taken to ensure gradual heatup and controlled thermal expansion of the pipelines. Operational procedures would be used to control the warmup rate of the pipelines to 50°F per hour. The warmup system includes regulation valves that control flow. Steam and fluid are recirculated from the plant back to the production well, slowly warming and pressurizing the pipeline prior to placing the well in service.

Pipelines would be inspected regularly to monitor for leakage. Plant operators would drive the pipeline routes daily and visually inspect the pipelines for leaks (the pipelines are installed on elevated supports above grade for inspection purposes). Additionally, the site staff includes a nondestructive examination group that inspects pipelines semiannually in accordance with a preventive maintenance program and schedule.

Each production well would be equipped with two parallel electrically operated isolation valves. The valves are powered and wired to the plant control room. These valves are stroked shut and open regularly to remove accumulated scale and ensure the valves will operate when required. If a leak in the pipeline is detected, the plant operator can shut these valves either manually or remotely. The pipeline also would be equipped with isolation valves at the plant site that will be shut by operational staff in case of a leak.

A fluid release to the ground of 200 to 400 gallons typically would remain within a 20- to 30-foot radius of the leak location. Cleanup involves removing all soil and gravel that has been in contact with geothermal fluid. The cleanup is verified by soils sampling after the contaminated material is removed. The material removed would likely be nonhazardous and disposed of in accordance with applicable regulations.

2.4.3.3 Safety Precautions and Emergency Systems

Safety precautions and emergency systems will be included in the design and construction of the BRGP to ensure safe and reliable operation of project facilities. Monitoring systems and a well-planned maintenance program will enhance safety and reliability.

Safety, auxiliary, and emergency systems consist of required lighting; battery backup for controls, fire, and hazardous materials safety systems; steam utilities; and chemical safety systems. The plant will include its own utilities and services such as plant air, instrument air, fire-suppression water, and potable water.

2.4.3.3.1 Safety Precautions

Worker Safety

Programs will be in place to assure, at a minimum, compliance with federal and state occupational safety and health program requirements. In addition to compliance with these programs, ongoing implementation of a program that effectively self-assesses potential hazards and mitigates them routinely will minimize the Project’s effects on employee safety.

Hazardous Materials Handling

Hazardous materials will be stored and used during construction and operation. Design and construction of hazardous materials storage and dispensing systems will be in accordance with applicable codes, regulations, and standards. Hazardous materials storage areas will be curbed or bermed to contain spills or leaks. Potential hazards associated with hazardous materials will be further mitigated by implementing a hazard communication program and thorough training of employees, including proper handling and emergency response to spills or accidental releases. Emergency eyewashes and showers will be provided at appropriate locations. Appropriate personal protective equipment also will be provided.

Security

Operating staff will provide security as they make their normal operating rounds. The facility will be staffed 24 hours per day. At each well pad, the high temperature well head valve area (commonly called the cellar) will be fenced. Firefighters and police will have access to the facility at all times. Additionally, the onsite substation and transformer area will be fenced with access gates.

Public Health and Safety

The programs implemented to protect worker health and safety also will benefit public health and safety. Facility design will include controls and monitoring systems to minimize the potential for upset conditions that may result in public exposure to hazardous materials. Potential public health impacts associated with operation of the BRGP will be mitigated by development and implementation of an Emergency Response Plan, an employee hazards communication program, a Spill Prevention, Countermeasures, and Control Plan, safety programs, and employee training. Coordination will be made with local emergency responders by providing them with copies of the plant site Emergency Response Plan (ERP), conducting plant site tours to point out the location of hazardous materials and safety equipment, and encouraging these providers to participate in annual emergency response drills.

2.4.3.3.2 Auxiliary Systems

The BRGP will include centralized control and monitoring systems that will help ensure safe operation of the Project facilities. Protection relays, alarms, and control logic will be implemented to protect equipment and minimize risk to the plant equipment.

2.4.3.3.3 Emergency Systems

Fire Protection Systems

The BRGP will have onsite fire protection systems and will be supported by local fire protection services. Portable and fixed fire suppression equipment and systems will be included in the BRGP. Portable fire extinguishers will be located at strategic locations throughout the Project site. Smoke detectors, sprinkler systems, and fire hydrants with hoses will be used.

Employees will be provided fire safety training, including instruction in fire prevention, use of portable fire extinguishers, and reporting fires to the local fire department. Employees will only suppress fires in an incipient stage. Fire drills will be conducted at least twice each year.

The Calipatria Fire Department in Calipatria will provide the primary fire protection, inspections, and firefighting services for the BRGP.

The Imperial County Fire Chief will perform a final fire safety inspection upon completion of construction and, thereafter, will conduct fire safety inspections. It is expected that, prior to startup, the County Fire Chief will visit the BRGP site to become familiar with the site and with the plant's emergency response procedures.

Medical Services and Emergency Response

The BRGP will have an ERP that will address potential emergencies, including chemical releases, fires, and injuries, and will describe emergency response equipment and its location, evacuation routes, reporting to local emergency response agencies, responsibilities for emergency response, and other actions to be taken in case of an emergency.

Employee response to an emergency will be limited to the awareness and first responder levels to minimize the risk of escalation of the accident or injury. Training consistent with these response levels will be provided to employees. A first aid station with adequate first aid supplies and personnel qualified in first aid treatment will be provided onsite.

The Calipatria Fire Department has the primary responsibility for dispatching emergency medical technicians (EMTs). Backup EMT units are available from Niland. They will respond to medical emergencies at the plant based on availability. Ambulances will be dispatched from Imperial by the Calipatria emergency response team. The nearest hospital is in Imperial; however, burn patients would be transported to the University of California, San Diego burn center via helicopter.

2.4.3.3.4 Aviation Safety – AFT Stacks

The closest airport (Cliff Hatfield Memorial Airport) to the Project site is approximately six miles southeast in Calipatria. This airport is classified as an airstrip. Currently, the only traffic allowed at this field is crop dusters and light private planes. There is no runway lighting, refueling, or control tower service.

Commercial air flights in the region are handled by Imperial County Airport. All commercial traffic is routed south and east of the Project by approximately 23 miles.

2.5 Applicable Laws, Ordinances, Regulations, and Standards

Refer to Appendix 2B for a detailed discussion of applicable LORS for engineering design criteria.

2.6 References

Landmark. 2022. *Preliminary Geotechnical Investigation, Proposed 81 MW Black Rock Geothermal Power Plant, Calipatria, California, LCI Report No. LE22199*. October 20.

Office of Energy Efficiency and Renewable Energy. 2023. Capacity Factor by Energy Source. Available at: https://www.energy.gov/ne/downloads/infographic-capacity-factor-energy-source-2019.

University of Utah. 2002. The Energy and Geoscience Institute.

Imperial County Planning/Building Department. 2015. *Imperial County General Plan*. Renewable Energy and Transmission Element. October 6.

Imperial Irrigation District (IID). 2022. *BHE Cluster – 357 MW (IPP-150, IPP-151, IPP-152) System Impact Study*. November 7.

Salton Sea Authority, Frequently Asked Questions (accessed 1/10/2023) https://saltonsea.com/about/faq/

5.1 Air Quality

This section presents the methodology and results of an analysis performed to assess the potential impacts of airborne emissions from the construction and operation of the Black Rock Geothermal Project (BRGP or "Project") and the Project's compliance with applicable air quality requirements. Section 5.1.1 presents an overview of the Project as it relates to air quality. Imperial County Air Pollution Control District (ICAPCD or "District") rules applicable to the Project, particularly as related to New Source Review (NSR), are summarized in Section 5.1.2. Section 5.1.3 provides a more detailed description of the Project. Section 5.1.4 presents the existing site conditions including geography, topography, climate, and meteorology. Section 5.1.5 summarizes the air quality standards for criteria pollutants. Section 5.1.6 summarizes the existing air quality at the Project site. Section 5.1.7 presents the Project's criteria pollutant and greenhouse gas (GHG) emissions estimates. Section 5.1.8 presents the best available control technology (BACT) evaluation for the Project. Section 5.1.9 presents the air quality impact analysis methodology; the air quality impact analysis results are presented in Section 5.1.10. Section 5.1.11 presents applicable federal, state, and local laws, ordinances, regulations, and standards (LORS). Section 5.1.12 presents agency contacts. Section 5.1.13 presents permit requirements and schedules. Section 5.1.14 contains references cited or consulted in preparing this section. Appendix 5.1A contains the support data for the operational emissions calculations. Appendix 5.1B presents the operational air quality impact analysis support data. Appendix 5.1C presents the approved dispersion modeling protocol. Appendix 5.1D contains the support data for the construction emissions calculations and accompanying air quality impact analysis. Appendix 5.1E presents the BACT determination support data. Potential public health risks posed by emissions of toxic air contaminants (TACs) are addressed in Section 5.9.

5.1.1 Project Overview as it Relates to Air Quality

The Project consists of a proposed geothermal Resource Production Facility (RPF), a geothermal-powered Power Generation Facility (PGF), and associated facilities in Imperial County, California. Figure 1-1 shows the Project regionally, and Figure 1-4 depicts the Project area, including proposed interconnection transmission lines (Gen-Tie), production/injection well pads, and pipelines. The Project will be owned by Black Rock Geothermal, LLC (Project owner or "Applicant").

The RPF includes geothermal fluids extraction (production) wells, pipelines, fluid and steam handling facilities, a solid handling system, a Class II surface impoundment, a service water pond, a stormwater retention basin, process fluid injection pumps, one power distribution center, and injection wells (Figure 1-4). It also includes steam-polishing equipment designed to provide turbine-quality steam to the PGF. The PGF consists of one geothermal power block. This geothermal power block includes a condensing turbine/generator set with a surface condenser, a non-condensable gas (NCG) removal system, an NCG sparger abatement system (located within the cooling tower basin), condensate bio-oxidation abatement systems attached to the cooling tower, a heat rejection system cooling tower, and a generator step-up transformer (GSU). The condensing turbine/generator set includes a multi-casing, triple pressure, exhaust flow condensing turbine and a steam turbine generator (STG) rated at 87 megawatts (MW) gross. Geothermal steam from the RPF will be the only source of thermal energy used by the STG. Heat rejection for the steam turbines will be accomplished with a mechanical draft counterflow wet cooling tower. In addition, the PGF also includes a 230 kilovolt (kV) substation, three power distribution centers, and four emergency standby diesel-fueled engines (three generators and one fire pump). Common facilities include a control building, a service water pond, and other ancillary facilities. The net output of the facility will be 77 MW.

Geothermal fluid will be produced from five production wells located on three well pads near the PGF (Figure 1-4). The fluid will flow, without pumping, to and through aboveground production pipelines to the steam-handling system adjacent to the PGF. At the steam-handling system, the geothermal fluid will be separated from the steam phase (flashed) at successively lower pressures to produce high-pressure (HP), standard-pressure (SP), and low-pressure (LP) steam for use in the STG. Chemically stabilized geothermal fluid flows from the steam-handling system into the solid handling system where solids are removed, after which the geothermal fluid is suitable for injection. The spent geothermal fluid is then pumped through the injection pipelines to seven injection wells located on four well pads. All production and injection wells will be operated in accordance with California Department of Conservation, Geologic Energy Management Division (CalGEM) and Colorado River Basin Regional Water Quality Control Board regulations.

Steam from the RPF will have impurities removed, after which it will be delivered to a multi-casing, triple-pressure, exhaust flow condensing turbine and STG. NCGs will be extracted from the main condenser by the gas removal system and then directed to the cooling tower basin for abatement.

Electricity generated by the Project will be delivered to a substation near the northeast corner of the site. This substation will have an interconnection into the Imperial Irrigation District (IID) transmission system at a new switching station near the intersection of Garst Road and West Sinclair Road.

The Project will supply capacity and energy to California's electric market. The location and the configuration of the plant have been selected to best match operating needs and the available geothermal resource. A System Impact Study (IID 2022) concluded a new transmission line is needed; this new transmission line will be completed to IID specifications prior to beginning Project operations.

5.1.2 Regulatory Items Affecting New Source Review

This air quality impact analysis was prepared pursuant to ICAPCD Rule 207(D)(4). The analysis includes discussions of emissions calculations, control technology assessments, regulatory review and modeling analysis, which include impact evaluations for criteria pollutants and TACs.

Project operations are not expected to result in emissions that will exceed ICAPCD Rule 207(B) "major stationary source" thresholds, nor is the facility expected to have emissions which would exceed Rule 207(C)(2)(a) offset threshold values. BACT will be implemented for particulate matter, and hydrogen sulfide (H_2S).

The emissions impacts associated with the Project were analyzed pursuant to ICAPCD and California Energy Commission (CEC) modeling requirements. The air quality analysis was conducted to demonstrate that impacts from nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter less than 10 micrometers (PM_{10}), particulate matter with an aerodynamic diameter less than 2.5 micrometers ($PM_{2.5}$), and H_2S will comply with the California and National Ambient Air Quality Standards (CAAQS and NAAQS, respectively) for the applicable averaging periods. Impacts from nearby sources (cumulative sources located within six miles of the Project site with emissions greater than five tons per year [tpy]) will be assessed for criteria pollutants under separate cover following consultation with the ICAPCD and CEC and completion of the CEC's data adequacy review.

Project operations are also not expected to trigger the Prevention of Significant Deterioration (PSD) permitting requirements outlined in Code of Federal Regulations (CFR), Title 40, Section 51.166(b)(1)(i)(b) because facility-wide emissions will not equal or exceed 250 tpy for any criteria pollutant. Worst-case hourly and annual Potential to Emit (PTE) emissions are summarized in Table 5.1-1.

Table 5.1-1. Facility PTE Summary

Pollutant	Facility PTE [a] (tpy)	(lbs/day)	ICAPCD Rule 207 Major Polluting Facility Thresholds (tpy)	ICAPCD Rule 207 Offset Thresholds (lbs/day)	EPA Major PSD Source Thresholds [b] (tpy)
NO_x	0.53	40.7	100	137	250
CO	2.55	108 [c]	--	137	250
VOC	0.93	15.8	100	137	250
SO_x	<0.01	<0.01	100	137	250

Pollutant	Facility PTE [a] (tpy)	(lbs/day)	ICAPCD Rule 207 Major Polluting Facility Thresholds (tpy)	ICAPCD Rule 207 Offset Thresholds (lbs/day)	EPA Major PSD Source Thresholds [b] (tpy)
PM_{10}	7.97	45.3	70	137	250
$PM_{2.5}$	4.79	27.9	100	--	250
CO_2e	50,861	341,272	--	--	75,000

[a] Emissions represent the maximum emissions of either the commissioning year or a subsequent operating year, including operation of the diesel-fueled emergency generators and fire pump, but do not include operations and maintenance activities which are not subject to permitting.

[b] PSD major source review would be triggered for criteria pollutant emissions greater than 250 tpy, from which the major modification thresholds are then used for the remaining pollutants. PSD review is not triggered solely based on greenhouse gas (GHG) emissions. If the Project triggered PSD for any non-GHG pollutant, then PSD would be triggered if the carbon dioxide equivalent (CO_2e) emissions were equal or greater than 75,000 tpy.

[c] CO daily emission estimates assume a maximum of two diesel-fired emergency generators would operate up to two hours per day for maintenance and testing.

Notes:

-- = Not applicable and/or no standard

EPA = U.S. Environmental Protection Agency

lbs/day = pound(s) per day

SO_X = sulfur oxides

VOC = volatile organic compound

A regulatory compliance analysis is presented in Sections 5.1.11 and 5.1.13, which will discuss in detail the applicable ICAPCD regulations that directly affect the Project's permitting application and review process. These regulations include the following:

- ICAPCD NSR Rule 207(C)(1) requires that BACT be applied to all proposed new or modified sources which will result in any emissions increase equal or greater than the following:
  - CO: 550 pounds per day (lbs/day)
  - Lead: 3.3 lbs/day
  - Fluorides: 16 lbs/day
  - Sulfuric Acid Mist: 38 lbs/day
  - H_2S: 55 lbs/day
  - Total Reduced Sulfur Compounds: 55 lbs/day
  - Ozone Precursors
    - NO_X: 25 lbs/day
    - VOC: 25 lbs/day
  - PM_{10}: 25 lbs/day
- The Project will implement BACT for PM10 and H2S, as described in Section 5.1.8.
- ICAPCD Rule 207(D)(3)(c) provides that all emission reduction credits proposed for use by the new source must be evaluated and approved prior to the issuance of the ICAPCD Authority to Construct (ATC). The Project is not expected to trigger the offset requirements, as shown in Table 5.1-1.
- ICAPCD Rule 207(F) requires that an air impact analysis be prepared to insure the protection of state and federal ambient air quality standards. This analysis is presented in Sections 5.1.9 and 5.1.10.
- ICAPCD Rule 207(C)(5)(c) also requires that, prior to the issuance of the ATC, all major stationary sources owned or operated by the Project applicant, which are subject to emissions limitations, are either in compliance or on a schedule for compliance with all applicable emissions limitations under the Clean Air Act (CAA).

- The Project will not require a PSD permit, per ICAPCD Rule 904 or the federal PSD regulations, as shown in Table 5.1-1.

5.1.3 Project Description

5.1.3.1 Project Site Location

The Project site is located in a region of the Imperial Valley, southeast of the Salton Sea, characterized mostly by agriculture and geothermal power production, with more recent additions of utility scale solar power plants. The area surrounding the site is primarily agricultural land. The Imperial Valley is the southwest part of the Colorado Desert that merges northwestward into the Coachella Valley near the northern shore of the Salton Sea.

The PGF will be located on approximately 60 acres (plant site) of a 160-acre parcel (APN 020-110-008) (Township 11 South, Range 13 East, Section 33, NE 1/4 of SW 1/4) within the unincorporated area of Imperial County, California. The production wells will be located on the plant site and the injection wells will be located offsite (see Figure 1-4). The plant site will include onsite and offsite laydown/parking areas in addition to borrow pits. These construction laydown/parking areas and borrow pits also will be used by other Applicant-owned projects currently before the CEC (the Elmore North Geothermal Plant and Morton Bay Geothermal Plant). The plant site is located northwest of the existing Vulcan Power Plant and the Hoch (Del Ranch) Power Plant.

The Project site is bounded by McKendry Road to the north, Boyle Road to the east, and Severe Road to the west. The town of Niland is approximately 8 miles northeast of the plant site, and the town of Calipatria is approximately 6 miles southeast of the plant site. The Red Hill Marina County Park is approximately 2 miles east of the PGF. The Sonny Bono Wildlife Refuge Headquarters is approximately 0.75 mile northeast of the PGF. The Alamo River is approximately 3.5 miles southwest of the plant site and the New River is approximately 5 miles southwest of the plant site.

5.1.3.2 Project Equipment Specifications

The layout of the proposed facility is illustrated in Section 2 including site cross sections, a plant site rendering, an isometric view of the facility, and a before and after plant visual rendering.

Approximately 60 acres of land will be required to accommodate the plant facilities (all areas approximate), and is comprised of the following:

- Turbine/generator
- Cooling tower (7-cells)
- Gas removal system
- Switchyard
- Control room and laboratory
- Maintenance building
- Horizontal belt filter
- Thickener clarifier
- Flash/drain atmospheric flash tank (AFT)
- Head tank
- Secondary clarifier
- Primary clarifier
- Rock muffler
- Production AFT
- Purge water system
- HP separator
- HP/SP/LP scrubbers
- SP/LP crystallizers
- HP/SP/LP demisters

- Emergency diesel generators
- Power distribution centers
- Auxiliary transformers (4,160 volts [V])
- Fire water pumps (electric and diesel fired)
- Domestic water pumps
- Service water and stormwater ponds
- Warm up AFT
- Hydro blast pad
- Auxiliary transformers (480 V)
- Aerated fluid injection pumps
- Class II surface impoundment
- Generator circuit breaker
- Isolated phase bus duct
- Instrument and service air system
- Naturally Occurring Radioactive Material (NORM) inhibitor chemical storage and injection system
- Polymer storage and injection system
- Cooling tower chemicals storage and feed system
- Steam turbine lube oil system
- Condensate storage tank
- Excess condensate storage tank
- Potable water system
- Process fluid injection pumps
- Biological oxidation box

A complete description of the Project is presented in Section 2.

5.1.4 Existing Site Conditions

The Project site is currently vacant. There are no current air pollution sources on the proposed site, and there are no facilities currently on the site that are permitted by the ICAPCD. Figure 1-2 shows the Project site and immediate vicinity.

5.1.4.1 Geography and Topography

The Project will be located in a flat lot located less than a mile from the Salton Sea coastline near Carcass Beach. The site topography is flat with an average elevation of 230 feet below average mean sea level. The nearest complex terrain (terrain exceeding Project stack heights) in relation to the Project is a string of mountainous terrain running from the southwest to the northwest approximately 17 miles northeast of the Project. Red Island Volcano is located less than two miles from the Project but is not considered to be complex terrain as it is a single piece of terrain less than a quarter-mile wide and gradually sloped no more than 100 feet tall. The nearest Class I area is Joshua Tree National Park located 35 miles to the north of the Project.

5.1.4.2 Climate and Meteorology

Climatic conditions in Imperial County are governed by the large-scale sinking and warming of air in the semi-permanent tropical high-pressure center of the Pacific Ocean. The high-pressure ridge blocks out most mid-latitude storms except in winter when it is weakest and farthest south. The coastal mountains prevent the intrusion of any cool, damp air found in California coastal environs. Because of the barrier and weakened storms, Imperial County experiences clear skies, extremely hot summers, mild winters, and little rainfall. On average, the sun shines more in Imperial County than anywhere else in the United States. (ICAPCD 2018)

Winters are mild and dry with daily average temperatures ranging between 65 and 75 degrees Fahrenheit (°F) (18-24 degrees Celsius [°C]). During winter months, it is not uncommon to record maximum temperatures of up to 80ºF. Summers are extremely hot with daily average temperatures ranging between 104 and 115ºF (40-46ºC). It is not uncommon to record maximum temperatures of 120ºF during summer months (ICAPCD 2018).

The flat terrain of the valley and the strong temperature differentials created by intense solar heating produce moderate winds and deep thermal convection. The combination of subsiding air, protective mountains, and distance from the ocean severely limits precipitation. Rainfall is highly variable with precipitation from a single heavy storm able to exceed the entire annual total during a later drought condition. The average annual rainfall is just over three inches (7.5 centimeters) with most of it occurring in late summer or mid-winter (ICAPCD 2018).

Humidity is low throughout the year, ranging from an average of 28 percent in summer to 52 percent in winter. The large daily oscillation of temperature produces a corresponding large variation in the relative humidity. Nocturnal humidity rises to 50 to 60 percent but drops to about 10 percent during the day (ICAPCD 2018).

The wind in Imperial County follows two general patterns. Wind statistics indicate prevailing winds are from the west-northwest through southwest; a secondary flow maximum from the southeast is also evident. The prevailing winds from the west and northwest occur seasonally from fall through spring and are known to be from the Los Angeles area. Occasionally, Imperial County experiences periods of extremely high wind speeds wherein wind speeds can exceed 31 miles per hour (mph). This occurs most frequently during the months of April and May. However, speeds of less than 6.8 mph account for more than one-half of the observed wind measurements (ICAPCD 2018).

5.1.5 Overview of Air Quality Standards

In 1970, the U.S. Congress instructed the EPA to establish standards for air pollutants, which were of nationwide concern. This directive resulted from the concern of the potential impacts of air pollutants on the health and welfare of the public. The resulting CAA set forth air quality standards to protect the health and welfare of the public. Two levels of standards were promulgated—primary standards and secondary standards. Primary NAAQS are “those which, in the judgment of the administrator [of EPA], based on air quality criteria and allowing an adequate margin of safety, are requisite to protect the public health (state of general health of community or population).” The secondary NAAQS are “those which, in the judgment of the administrator [of EPA], based on air quality criteria, are requisite to protect the public welfare and ecosystems associated with the presence of air pollutants in the ambient air.” To date, NAAQS have been established for the following seven criteria pollutants: SO_2, CO, ozone, nitrogen dioxide (NO_2), PM_{10}, $PM_{2.5}$, and lead.

Criteria pollutants are those pollutants that have been demonstrated historically to be widespread and have a potential to cause adverse health effects. EPA developed comprehensive documents detailing the basis of, or criteria for, the standards that limit the ambient concentrations of these pollutants. The State of California has also established ambient air quality standards (CAAQS) that further limit the allowable concentrations of certain criteria pollutants. Review of the established air quality standards is undertaken by both EPA and the State of California on a periodic basis. As a result of the periodic reviews, the standards have been updated and amended over the years following adoption.

Each federal or state standard is comprised of two basic elements: a numerical limit expressed as an allowable concentration, and an averaging time that specifies the period over which the concentration value is to be measured. Table 5.1-2 presents the current federal and state ambient air quality standards.

Table 5.1-2. State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	CAAQS	NAAQS
Ozone	1-hour	0.09 ppm (180 µg/m^3)	--
	8-hour	0.070 ppm (137 µg/m^3)	0.070 ppm (137 µg/m^3) (3-year average of annual 4th-highest daily maximum)
CO	1-hour	20 ppm (23,000 µg/m^3)	35 ppm (40,000 µg/m^3)
	8-hour	9.0 ppm (10,000 µg/m^3)	9 ppm (10,000 µg/m^3)
NO_2	1-hour	0.18 ppm (339 µg/m^3)	0.100 ppm (188 µg/m^3) (3-year average of annual 98th percentile daily maxima)
	Annual average	0.030 ppm (57 µg/m^3)	0.053 ppm (100 µg/m^3)
SO_2	1-hour	0.25 ppm (655 µg/m^3)	0.075 ppm (196 µg/m^3) (3-year average of annual 99th percentile daily maxima)
	3-hour	--	0.5 ppm (1,300 µg/m^3) [a]
	24-hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3) [b]
	Annual Average	--	0.030 ppm (80 µg/m^3) [b]
PM_{10}	24-hour	50 µg/m^3	150 µg/m^3
	Annual arithmetic mean	20 µg/m^3	--
$PM_{2.5}$	24-hour	--	35 µg/m^3 (3-year average of annual 98th percentiles)
	Annual arithmetic mean	12 µg/m^3	12 µg/m^3 (3-year average)
Sulfates	24-hour	25 µg/m^3	--
Visibility Reducing Particles	8-hour	Extinction of 0.23 per kilometer	--
H_2S	1-hour	0.03 ppm (42 µg/m^3)	--
Vinyl Chloride	24-hour	0.01 ppm (26 µg/m^3)	--
Lead	30-day	1.5 µg/m^3	--
	3-month rolling average	--	0.15 µg/m^3

Source: CARB 2016

[a] The 3-hour SO_2 NAAQS is a secondary standard

[b] The 24-hour and annual 1971 SO_2 NAAQS remain in effect until 1 year after the attainment status is designated by EPA for the 2010 NAAQS (the Project area is still undesignated for the 2010 NAAQS, but presumed to be in attainment).

Notes:

-- = Not applicable and/or no standard

µg/m^3 = microgram(s) per cubic meter

ppm = part(s) per million

Brief descriptions of health effects for the main criteria pollutants are as follows:

- **Ozone**—Ozone is a reactive pollutant that is not emitted directly into the atmosphere, but rather is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving VOC and NO_x. VOC and NO_x are therefore known as precursor compounds for ozone. Significant ozone production generally requires ozone precursors to be present in a stable atmosphere with strong sunlight for approximately three hours. Ozone is a regional air pollutant because it is not emitted directly by sources, but is formed downwind of sources of VOC and NO_x under the influence of wind and sunlight. Short-term exposure to ozone can irritate the eyes and cause constriction of the airways. In addition to causing shortness of breath, ozone can aggravate existing respiratory diseases such as asthma, bronchitis, and emphysema.

- **Carbon Monoxide—**CO is a non-reactive pollutant that is a product of incomplete combustion. Ambient CO concentrations generally follow the spatial and temporal distributions of vehicular traffic and are also influenced by meteorological factors such as wind speed and atmospheric mixing. Under inversion conditions, CO concentrations may be distributed more uniformly over an area out to some distance from vehicular sources. When inhaled at high concentrations, CO combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood. This results in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease or anemia, as well as fetuses.

- **Particulate Matter (PM_{10} and $PM_{2.5}$)—**Both PM_{10} and $PM_{2.5}$ represent fractions of particulate matter, which can be inhaled into the air passages and the lungs and can cause adverse health effects. Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, combustion, and atmospheric photochemical reactions. Some of these operations, such as demolition and construction activities, contribute to increases in local PM_{10} concentrations, while others, such as vehicular traffic, affect regional PM_{10} concentrations.

  Several studies that EPA has relied on have shown an association between exposure to particulate matter, both PM_{10} and $PM_{2.5}$, and respiratory ailments or cardiovascular disease. Other studies have related particulate matter to increases in asthma attacks. In general, these studies have shown that short-term and long-term exposure to particulate matter can cause acute and chronic health effects. $PM_{2.5}$, which can penetrate deep into the lungs, causes more serious respiratory ailments.

- **Nitrogen Dioxide and Sulfur Dioxide—**NO_2 and SO_2 are two gaseous compounds within a larger group of compounds, NO_x and sulfur oxides (SO_x), respectively, which are products of the combustion of fuel. NO_x and SO_x emission sources can elevate local NO_2 and SO_2 concentrations, and both are regional precursor compounds to particulate matter. As described above, NO_x is also an ozone precursor compound and can affect regional visibility. (NO_2 is the "whiskey brown-colored" gas readily visible during periods of heavy air pollution.) Elevated concentrations of these compounds are associated with increased risk of acute and chronic respiratory disease.

  SO_2 and NO_2 emissions can be oxidized in the atmosphere to eventually form sulfates and nitrates, which contribute to acid rain. Large power facilities with high emissions of these substances from the use of coal or oil are subject to emissions reductions under the Phase I Acid Rain Program of Title IV of the 1990 CAA Amendments. Power facilities with individual equipment capacity of 25 MW or greater that use natural gas or other fuels with low sulfur content are subject to the Phase II Acid Rain Program of Title IV. The Phase II program requires facilities to install continuous emissions monitoring systems (CEMS) in accordance with 40 CFR Part 75 and report annual emissions of SO_x and NO_x. The Acid Rain Program provisions do not apply to the Project as it will not use fossil fuels as the energy source for the PGF operations.

- **Lead—**Gasoline-powered automobile engines used to be the major source of airborne lead in urban areas. Excessive exposure to lead concentrations can result in gastrointestinal disturbances, anemia, and kidney disease, and, in severe cases, neuromuscular and neurological dysfunction. The use of lead additives in motor vehicle fuel has been eliminated in California and lead concentrations have declined substantially as a result.

In addition to the above criteria pollutants, greenhouse gas (GHG) emissions are of global concern. Although there are no ambient air quality standards for GHGs, they are regulated by both the California Air Resources Board (CARB) and the EPA.

GHGs include the following pollutants:

- **Carbon Dioxide—**Carbon dioxide (CO_2) is a naturally occurring gas, as well as a by-product of burning fossil fuels and biomass, land-use changes, and other industrial processes. It is the principal anthropogenic GHG that affects the Earth's radiative balance.

- **Methane—**Methane (CH_4) is a GHG with a global warming potential (GWP) most recently estimated at 25 times that of CO_2.[1] CH_4 is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.
- **Nitrous Oxide—**Nitrous oxide (N_2O) is a GHG with a GWP most recently estimated at 298 times that of CO_2. Major sources of N_2O include soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
- **Hydrofluorocarbons—**Hydrofluorocarbons (HFCs) are compounds containing only hydrogen, fluorine, chlorine, and carbon. HFCs have been introduced as a replacement for the chlorofluorocarbons identified as ozone-depleting substances.
- **Perfluorocarbons—**Perfluorocarbons (PFCs) are compounds containing only fluorine and carbon. Similar to HFCs, PFCs have been introduced as a replacement for chlorofluorocarbons. PFCs are also used in manufacturing and are emitted as by-products of industrial processes. PFCs are powerful GHGs.
- **Sulfur Hexafluoride—**Sulfur hexafluoride (SF_6) is a colorless gas soluble in alcohol and ether, and is slightly soluble in water. It is a very powerful GHG used primarily in electrical transmission and distribution systems, as well as dielectrics in electronics.

Climate change refers to any significant change in measures of climate, such as average temperature, precipitation, or wind patterns over a period of time. Climate change may result from natural factors, natural processes, and human activities that change the composition of the atmosphere and alter the surface and features of the land. Significant changes in global climate patterns have recently been associated with global warming, an average increase in the temperature of the atmosphere near the Earth's surface, attributed to accumulation of GHG emissions in the atmosphere. GHGs trap heat in the atmosphere, which in turn heats the surface of the Earth.

Some GHGs occur naturally and are emitted to the atmosphere through natural processes, while others are created and emitted solely through human activities. The emission of GHGs through the combustion of fossil fuels (i.e., fuels containing carbon) in conjunction with other human activities, appears to be closely associated with global warming. According to the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment, it is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations.

Emissions of HFCs or PFCs are not expected for the Project. Therefore, the Project impact assessment is focused only on the potential impacts from emissions of CO_2, CH_4, N_2O, and SF_6, reported as carbon dioxide equivalent (CO_2e) emissions.

5.1.6 Existing Air Quality

The NAAQS and CAAQS, as previously described, establish the level for which air pollution is considered detrimental to public health or welfare. If a pollutant concentration in an area is lower than the established standard, the area is classified as being in "attainment" for that pollutant. If the pollutant concentration meets or exceeds the standard (depending on the specific standard for the individual pollutants), the area is classified as a "nonattainment" area. If there is not enough data available to determine whether the standard is exceeded in an area, the area is designated as "unclassified." Table 5.1-3 presents the ICAPCD attainment/nonattainment status with respect to both the CAAQS and NAAQS.

[1] GWP is a measure of how much a given mass of GHG is estimated to contribute to global warming and is a relative scale that compares the mass of one GHG to that same mass of CO_2.

Table 5.1-3. ICAPCD Attainment Status

Pollutant	Averaging Time	Federal Status	State Status
Ozone	1-hour	Unclassified/Attainment	Nonattainment
	8-hour	Nonattainment (Marginal)	Nonattainment
CO	All	Unclassified/Attainment	Unclassified/Attainment
NO_2	All	Unclassified/Attainment	Unclassified/Attainment
SO_2	All	Unclassified/Attainment	Unclassified/Attainment
PM_{10}	All	Attainment (Maintenance)	Nonattainment
$PM_{2.5}$	All	Unclassified/Attainment	Unclassified/Attainment
Sulfates	24-hour	No NAAQS	Unclassified/Attainment
Lead	All	Unclassified/Attainment	Unclassified/Attainment
H_2S	1-hour	No NAAQS	Unclassified/Attainment
Vinyl Chloride	24-hour	No NAAQS	Unclassified/Attainment
Visibility Reducing Particles	8-hour	No NAAQS	Unclassified/Attainment

Sources: ICAPCD 2023, EPA 2023f, CARB 2023f

The closest and most representative monitoring data to the Project site are from the following monitoring stations, as shown in Figure 5.1-1:

- Niland-English Road (AQS ID: 60254004) [7.6 miles from Project]: 24-hour PM10 concentrations (2019-2021) and ozone concentrations (2019)
- Brawley-220 Main Street (AQS ID: 60250007) [13.8 miles from Project]: 24-hour PM2.5 concentrations (2019-2021), and annual PM2.5 concentrations (2019-2020)
- El Centro-9th Street (AQS ID: 60251003) [26.1 miles from Project]: annual PM2.5 concentrations (2021), ozone concentrations (2020-2021), 1-hour NO2 concentrations (2019-2021), and annual NO2 concentrations (2020-2021)
- Calexico-Ethel Street (AQS ID: 60250005) [34.6 miles from Project]: annual NO2 concentrations (2019), 1-hour SO2 concentrations (2019-2021), 24-hour SO2 concentrations (2019-2021), 1-hour CO concentrations (2019-2021), and 8-hour CO concentrations (2019-2021).

Table 5.1-4 provides a summary 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 5.1-1
Nearby Ambient Air Monitoring Stations
Black Rock Geothermal Project
Imperial County, California

Jacobs

Table 5.1-4. 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}	µg/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
$PM_{2.5}$	µg/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

Sources: CARB 2023d and EPA 2023d

Notes:

AAM = annual arithmetic mean

ppb = part(s) per billion

The maximum representative background concentrations for the most recent 3-year period (2019-2021) are summarized in Table 5.1-5. 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 5.1-5.

Table 5.1-5. Background Air Quality Data

Pollutant and Averaging Time	Background Value ($\mu g/m^3$) [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 $\mu g/m^3$ 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.

5.1.7 Environmental Analysis – Emissions Evaluation

5.1.7.1 Project Operation

Criteria pollutant emissions from the Project are delineated in the following sections, while emissions of TACs are delineated in Section 5.9. Backup data for both the criteria pollutant and TAC operational emission calculations are provided in Appendix 5.1A.

As shown, installation and operation of the Project will not result in emissions greater than the NSR or PSD thresholds for any criteria pollutants and, as such, the Project will be considered a minor NSR source for NO_x, CO, VOC, and $PM_{10}/PM_{2.5}$ under federal and ICAPCD rules. The Project will not trigger the requirements of the federal PSD program since the emissions of one or more criteria pollutants will not exceed the 250 tpy PSD major source applicability thresholds. The applicability determination for PSD is based on the worst-case annual emissions, including commissioning.

5.1.7.1.1 Facility Operational Profile

The emissions calculations presented in this analysis represent the highest potential emissions based on the proposed operational scenarios. The hourly, daily and annual emissions for all criteria pollutants are based upon a series of worst-case assumptions for each pollutant. The intent is to envelop the Project emissions based upon all possible operating profiles provided in Appendix 5.1A and summarized below.

Throughout a typical year, the facility may operate in one of the following PGF-related operating scenarios:

- Commissioning (Only during the first production year)
- Flow Back and Testing Activities

- Cold Startup
- Warm Startup
- Shutdown
- Routine Power Generation Operation (With or without emission control downtime)

The PGF steam-related emissions will be emitted through one or more sources, depending on the operation type of the power generation system. Emission points for this system include a mobile testing unit (MTU) that is temporarily deployed at each well head, a production testing unit (PTU) which is located on top of the warm-up AFT, a rock muffler (RM), and the cooling tower cells (seven total). Details of where the emissions occur from each operation are provided in Section 5.1.7.1.2.

In addition to the PGF operations, air emissions will occur through the operations of one diesel fire water pump, one 2.7 MW diesel-fired emergency generator, three 3.49 MW diesel-fired emergency generators, gas-insulated equipment, and operations and maintenance (O&M) equipment and vehicles, which may travel both on and offsite.

A summary of each operating condition and the associated annual hours of operation is included in Table 5.1-6 below.

Table 5.1-6. Facility Operating Summary

Project Operations		First Production Year	Subsequent Production Year with Startups, Shutdowns and Emission Control Downtime	Subsequent Production Year without Startups, Shutdowns and Emission Control Downtime
Production Well Flow Back		120	120	0
Production Well Testing		1,200	0	0
Injection Well Flow Back		168	168	0
Injection Well Testing		1,680	0	0
Commissioning	Well Warm-up	120	0	0
	Production Line and Equipment Warm-up	48	0	0
	Steam Blow	240	0	0
	Turbine Preheat and Auxiliary Loop	48	0	0
	Turbine Load Test	72	0	0
	Turbine Performance Test	48	0	0
Cold Startup	Well Warm-up	120	120	0
	Production Line and Equipment Warm-up	32	32	0
	Turbine Preheat and Auxiliary Loop	24	24	0
	Auxiliary Equipment Startup	12	12	0
	Functional Trip Test	6	6	0
	Gradual Steam Delivery to Turbine	6	6	0
Warm Startup	Step 1 (Geothermal Steam sent to RM)	200	200	0
	Step 2 (Gradual Diversion of Steam from RM to Turbine)	200	200	0

Project Operations		First Production Year	Subsequent Production Year with Startups, Shutdowns and Emission Control Downtime	Subsequent Production Year without Startups, Shutdowns and Emission Control Downtime
Shutdowns		200	200	0
Routine Power Generation Operation	With Controls	3,816	7,272	8,760
	Sparger Bypass	200	200	0
	Biological Oxidation Box Bypass	200	200	0
Total Operating Hours		8,760	8,760	8,760

The goal of this air quality analysis is to present a worst-case operating condition for the Project, but there could be other scenarios with different numbers of starts and run-time hours. Thus, the Project proposes that the facility-wide limits be based on total short-term and annual emissions rather than operational hours as the worst-case operating scenario per pollutant can vary based upon the type of plant operations. Operational monitoring along with analytical and periodic source testing requirements will establish a compliance method to allow for monthly tracking, at a minimum, of all emissions at the Project. Specifically, the following operations will be monitored:

- Hours of operation for each operating condition, including:
  - Warm startup
  - Cold startup
  - Shutdown
  - Commissioning
  - Routine operations
  - Biological oxidation box bypass
  - Sparger bypass
  - Flow back and testing operations
  - Generator and fire pump operation
- Total steam flows through each of the operational systems

Analytical data from testing performed at the facility will be used to speciate the emissions of NCGs and cooling tower discharge to develop emissions from the respective hours of operation from those sources. Engine emissions from the emergency generators and fire pump would be tracked through run logs for compliance with the ICAPCD-issued operating permit(s).

For example, the maximum annual emissions of NO_x at 0.53 tpy would establish the facility's PTE. The Project would propose and accept hourly, daily and annual emission limits for this pollutant, but would propose that the permit not contain any limit on the number of hours of operation as the established emission limits would be monitored monthly. In this way, the facility operational profiles would be solely based on PTE rather than hours which would allow for a flexible response to changing power market conditions. Thus, the short-term and annual emissions limits would establish the facility PTE rather than the individual operational profiles. This type of emissions and compliance strategy is not new and has been implemented on numerous projects to which the CEC has issued Licenses, as well as District permits.

The maximum hourly emissions are based upon the worst-case hourly emissions expected from any source at the facility during any operating profile, considering both controlled and uncontrolled profiles. The maximum daily emissions assume 24 hours of operation of the worst-case hourly emissions scenario with the exception of the fire pump and emergency generators. The fire pump and emergency generators are assumed to operate no more than one and two hours per day, respectively, for maintenance and testing purposes. Additionally, maintenance and testing operations of the emergency generators would be limited to no more than two units per day.

The worst-case annual emissions are presented in Table 5.1-7. With the exception of H_2S, these emissions are based upon the highest emissions for each pollutant as derived from the operating scenarios presented above for both the first year of operation, including commissioning, and subsequent years of operation that do not include commissioning activities. For H_2S, only the worst-case subsequent year of operation was considered.

Table 5.1-7. Significant Emissions Threshold Summary

Pollutant	Project Cumulative Increase (tpy) [a]	Attainment Status		Major Source Thresholds (tpy)			Exceeds Major Source Thresholds?		
		Federal	State	PSD [b]	NSR [b]	Title V [c]	PSD	NSR	Title V
NO_x	0.53	Y	Y	250	100	100	N	N	N
SO_2	<0.01	Y	Y	250	--	100	N	--	N
CO	2.55	Y	Y	250	--	100	N	--	N
PM_{10}	7.97	Y	N	250	--	70	N	--	N
$PM_{2.5}$	4.79	Y	Y	250	100	100	N	N	N
VOC (ozone)	0.93	N	N	250	100	100	N	N	N
H_2S	33.3 [d]	--	Y	--	--	100	--	--	N
HAPs	2.52 [e]	--	--	--	--	25	--	--	N
CO_2	50,861	--	--	75,000	--	--	N	--	--

[a] Unless otherwise noted, emissions represent the maximum emissions of either the commissioning year or a subsequent operating year, including operation of the diesel-fueled emergency generators and fire pump, but do not include O&M activities which are not subject to permitting.

[b] These thresholds are specified both by the EPA and in ICAPCD Rule 207.

[c] These thresholds are specified in ICAPCD Rule 900.

[d] H_2S emissions represent the maximum emissions of a non-commissioning year.

[e] Only combined hazardous air pollutant (HAP) emissions are presented as they are already less than the single HAP Title V major source threshold of 10 tpy.

Note:

-- = Not applicable and/or no standard

Based on the emissions presented in Table 5.1-7, the Project will be a minor NSR source as defined by ICAPCD Rule 207(D)(4) and will not be subject to ICAPCD requirements for emission offsets for criteria pollutants and toxics. The Project owner has prepared an air quality emissions and impact analysis in Section 5.1.10 for the pollutants shown in Table 5.1-7 to comply with the requirements of the ICAPCD and CEC.

Based on the emissions presented in Table 5.1-7, the Project will not itself trigger Title V permitting requirements. However, if the proposed Project is later connected to the existing Applicant-owned geothermal plants to share geothermal fluid and steam, Title V applicability will be reassessed. Operating air permits for the Project will be applied for and obtained through ICAPCD in accordance with all applicable federal, state, and local regulations.

5.1.7.1.2 Emission Estimates

Operation of the proposed process and equipment systems will result in emissions to the atmosphere of criteria pollutants, GHGs, and TACs.[2] Criteria pollutant emissions will consist primarily of NO_x, CO, VOCs, SO_x, PM_{10}, $PM_{2.5}$, and H_2S. GHG emissions may include CO_2, CH_4, N_2O, and SF_6, all presented as CO_2e

[2] Note that the EPA designates a subset of TACs as hazardous air pollutants (HAPs).

emissions based on their GWP. TACs will consist of a combination of toxic gases and toxic particulate matter species. Table 5.1-8 lists the pollutants that may potentially be emitted from Project operations.

Table 5.1-8. Potentially Emitted Pollutants

Criteria Pollutants	GHGs	Toxic Air Contaminants [b]		
NO_x	CO_2e [a]	Ammonia	DPM	1,3-Butadiene
CO		Arsenic	Radon	Acetaldehyde
VOC		Mercury	Copper	Acrolein
SO_x		Aluminum	Manganese	Benzene
$PM_{10/2.5}$		Antimony	Nickel	Ethylbenzene
H_2S [a]		Barium	Selenium	Formaldehyde
Lead [a]		Beryllium	Silica	Naphthalene
		Cadmium	Silver	Propylene
		Chromium	Vanadium	Toluene
		Cobalt	PAHs (excluding naphthalene)	Xylene
		Zinc		

[a] H_2S, lead, and some GHGs are also classified as TACs.

[b] Although the Project is also expected to emit argon, hydrogen, lithium, nitrogen, and strontium, they are not classified as TACs by the Office of Environmental Health Hazard Assessment and CARB and have not been included in this analysis.

Notes:

DPM = diesel particulate matter

PAHs = polynuclear (or polycyclic) aromatic hydrocarbons

The operational emissions estimation methodology for the Project was developed in coordination with the latest available data and engineering design. Details of the specific methodology for each of the operational sources are included below:

- **Steam and NCG-related Processes**: Emissions were estimated based upon analytical data from other geothermal power plants in the area. The analytical data used in the analysis consists of a speciated breakdown of concentrations from a NCG sample, and system inlet and outlet operations from the geothermal system's geothermal steam flows. The Project's geothermal steam flows vary in pressure and are categorized as high, standard, and low pressure, each of which has an assumed NCG concentration. The NCG and system inlet/outlet analytical data are applied to production well estimated steam flows for the Project to determine a total mass of species through the geothermal system. During processing and condensing of the geothermal steam, a portion of the species remain in gas phase and are routed through the sparger installed inside the cooling tower basin; the remaining condensed fluid portion of the species are routed through the biological oxidation box and then overflows to the cooling tower. The mass throughputs of these species are used in coordination with estimated control efficiencies and process-specific correction factors to estimate emissions. The methodology is applied to emissions of criteria pollutants, GHGs, and TACs.
- **Cooling Towers**: Criteria pollutant, GHG, and TAC emissions were estimated based upon two input streams: the NCG condensate/fluid within the cooling towers and the gaseous NCG vented into the cooling towers from the PGF steam. The gaseous NCG stream was characterized using analytical data from other geothermal power plants in the area. All constituents except mercury, arsenic, and H_2S are assumed to directly pass through in the gas phase as emissions on a mass basis. It is assumed that mercury and arsenic are not emitted through the cooling towers in the gaseous NCG because they are expected to cool into either liquid or solid form and remain in the cooling tower basin, where they are then incorporated into the cooling tower condensate/fluid emissions calculations. H_2S emissions from the NCG stream are assumed to split between the gas phase and the condensate/fluid phase prior to reaching the cooling towers at a ratio of 60 to 40 percent, respectively.

  Liquid-based emissions are the result of NCG condensate and make-up water input into the cooling towers for circulation. Particulate matter emissions from the circulating water were estimated using predicted permit limits of total dissolved solids (TDS). A particle size distribution was applied to TDS emissions to determine PM_{10} and $PM_{2.5}$ emissions. As outlined in the CARB California Emissions Inventory Data and Reporting System database, 70 percent of total particulate matter was assumed to be PM_{10} and 42 percent of total particulate matter was assumed to be $PM_{2.5}$ (SCAQMD 2006). With the exception of ammonia, TAC and VOC emissions were calculated using the cooling tower circulating water and make-up water flow rates. Specifically, VOC emissions were developed by applying hot well analytical data from other geothermal power plants in the area to the Project's estimated hot well flow rates. One-hundred percent of the VOC emissions in the hot well condensate are assumed to be emitted through the cooling towers. Non-volatile TAC emissions were developed by applying blowdown analytical data from other geothermal power plants in the area to the Project's cooling tower circulating water flow rates and emitted in the form of drift. Ammonia emissions from the fluid portion of the cooling towers were developed assuming a mass balance between the ammonia entering the cooling towers (in the form of hot well condensate) and leaving the cooling towers (in the form of blowdown). Specifically, hot well and blowdown analytical data from other geothermal power plants in the area were used with Project-specific hot well and blowdown flow rates to determine the amount of ammonia remaining in the cooling towers after blowdown, which is assumed to be emitted through the cooling tower shrouds.

- **Diesel Fire Pump**: Criteria pollutant emissions from the diesel fire pump engine were estimated based upon vendor-provided data for a Tier 2-certified unit, with the exception of SO_2. SO_2 emissions were estimated based upon a mass balance wherein all sulfur in the fuel (assumed as ultra-low sulfur diesel) is assumed to be emitted as SO_2. GHG emissions from the engine were calculated consistent with 40 CFR Part 98 methodology. TAC emissions were estimated based upon *AP-42* methodology (EPA 1996).
- **Diesel-fired Emergency Generators**: Criteria pollutant emissions from the four diesel-fired emergency generators were estimated based upon vendor-provided data, with the exception of SO_2. SO_2 emissions were estimated based upon a mass balance wherein all sulfur in the fuel (assumed as ultra-low sulfur diesel) is assumed to be emitted as SO_2. GHG emissions from the generators were calculated consistent with 40 CFR Part 98 methodology. TAC emissions were estimated based upon *AP-42* methodology (EPA 1996). The vendor-provided data indicate that the engines will be compliant with Tier-4 emission rates through the use of a selective catalytic reduction (SCR) control device, diesel particulate filter, and diesel oxidation catalyst. As such, TAC emissions were assumed to be controlled by up to 80 percent. Ammonia slip from the SCR is assumed to have a 5 parts per million (ppm) slip through the exhaust.
- **Insulating Gas Emissions:** Emissions from the selected insulating gas were estimated based upon California's *Regulation for Reducing Greenhouse Gas Emissions from Gas-Insulated Equipment* (California Code of Regulations [CCR], Title 17, Section 95353, Tables 4 and 5) for data years through 2034.
- **O&M Equipment**: Emissions were estimated using construction equipment emission factors, horsepower, and load factors from the *CalEEMod User's Guide* (ICF 2022).
- **O&M Vehicles:** Emissions from vehicle exhaust and idling were calculated using emission factors from EMFAC2021.
- **Criteria Pollutant Emissions.** Tables 5.1-9 through 5.1-16 present data on the criteria pollutant emissions expected from the facility equipment and systems under worst-case operating scenarios.

For each pollutant, the maximum hourly and annual PTE is presented in Appendix 5.1A and in the tables below. The presented maximum hourly PTE does not occur during the entire duration of the event. Additional details of the hour breakdown for each event are included in Appendix 5.1A.

Table 5.1-9. Maximum Emissions – Well Testing and Commissioning

Pollutant	Production Flow Back Testing [a]		Production Well Testing [b]		Injection Flow Back Testing [c]		Injection Well Testing [b]		Commissioning [d]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	--	--	--	--	--	--	--	--	--	--
CO	--	--	--	--	--	--	--	--	--	--
VOC	0.02	<0.01	0.10	0.06	0.02	<0.01	0.10	0.08	0.18	0.05
$PM_{10}/PM_{2.5}$	--	--	--	--	--	--	--	--	--	--
SO_x	--	--	--	--	--	--	--	--	--	--
H_2S	7.72	0.46	31.3	18.8	7.72	0.65	31.3	26.3	56.1	10.8
HAPs	0.08	<0.01	0.33	0.20	0.08	0.01	0.33	0.27	0.58	0.16
Ammonia	0.34	0.02	1.37	0.82	0.34	0.03	1.37	1.15	136	12.1
CO_2e	1,580	94.8	6,412	3,847	1,580	133	6,412	5,386	11,489	3,132

[a] Emissions emitted from the MTU during commissioning and the PTU during non-commissioning operations.

[b] Emissions emitted from the MTU.

[c] Emissions emitted from the PTU.

[d] Emissions emitted at varying rates between the PTU, RM, and cooling towers.

Notes:

-- = Pollutant not emitted

< = less than

Table 5.1-10. Maximum Emissions – Startup and Shutdown

Pollutant	Cold Startup [a]		Warm Startup [b]		Shutdown [c]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	--	--	--	--	--	--
CO	--	--	--	--	--	--
VOC	0.18	0.01	0.18	0.03	0.20	0.02
$PM_{10}/PM_{2.5}$	--	--	--	--	--	--
SO_x	--	--	--	--	--	--
H_2S	56.1	3.27	56.1	8.50	61.7	6.17
HAPs	0.58	0.04	0.58	0.10	0.64	0.06

Pollutant	Cold Startup [a]		Warm Startup [b]		Shutdown [c]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
Ammonia	136	3.01	136	7.20	2.71	0.27
CO_2e	11,489	765	11,489	1,969	12,633	1,263

[a] Emissions emitted at varying rates between the PTU, RM, and cooling towers.

[b] Emissions emitted at varying rates between the RM and cooling towers.

[c] Emissions emitted from the RM.

Note:

-- = Pollutant not emitted

Table 5.1-11. Maximum Emissions – Power Generation Operation

Pollutant	Routine Operations [a]		Sparger Bypass [b]		Biological Oxidation Box Bypass [b]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	--	--	--	--	--	--
CO	--	--	--	--	--	--
VOC	0.18	0.79	0.18	0.02	0.18	0.02
PM_{10}	1.81	7.94	1.81	0.18	1.81	0.18
$PM_{2.5}$	1.09	4.77	1.09	0.11	1.09	0.11
SO_x	--	--	--	--	--	--
H_2S	2.30	10.1	34.8	3.48	23.6	2.36
HAPs	0.58	2.52	0.58	0.06	0.58	0.06
Ammonia	138	605	138	13.8	138	13.8
CO_2e	11,489	50,320	11,489	1,149	11,489	1,149

[a] Annual emissions for routine power generation operations conservatively assume an estimated 8,760 hours of operation without any startups, shutdowns, or emission control downtime. These emissions are emitted from the cooling towers.

[b] Emissions emitted from the cooling towers. Sparger bypass emissions include emissions from normal cooling tower operation and biological oxidation box bypass emissions include emissions from normal sparger operation, as both the sparger and biological oxidation box systems operate independently and emit through the cooling towers.

Note:

-- = Pollutant not emitted

Table 5.1-12. Maximum Emissions – Ancillary Operations

Pollutant	Fire Pump [a]		2.7 MW Emergency Generator [a]		3.49 MW Emergency Generator [a]		O&M Equipment and Vehicles [b]		Gas-Insulated Equipment [c]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	1.78	0.04	3.99	0.10	5.15	0.13	3.74	0.66	--	--
CO	0.42	0.01	20.8	0.52	26.9	0.67	4.17	1.14	--	--
VOC	0.05	<0.01	1.13	0.03	1.46	0.04	0.46	0.09	--	--
PM_{10}	0.06	<0.01	0.18	<0.01	0.23	0.01	0.14	0.03	--	--
$PM_{2.5}$	0.06	<0.01	0.18	<0.01	0.23	0.01	0.12	0.02	--	--
SO_x	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	--	--
H_2S	--	--	--	--	--	--	--	--	--	--
HAPs	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.14 [d]	0.03 [d]	--	--
Ammonia	--	--	0.28	0.01	0.34	0.01	--	--	--	--
CO_2e	131	3.27	3,942	98.6	4,949	124	1,322	258	15.6	68.4

[a] Emissions emitted from source-specific locations.

[b] Emissions emitted from mobile sources including roadway fugitive dust.

[c] Emissions emitted as fugitives.

[d] HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.

Note:

-- = Pollutant not emitted

< = less than

Table 5.1-13. Summary – Project Operation Hourly Emissions

Pollutant	Hourly Emissions (lbs/hr)			
	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [c]
NO_x	--	1.78	19.5	3.74
CO	--	0.42	102	4.17
VOC	0.20	0.05	5.52	0.46
PM_{10}	1.81	0.06	0.87	0.14
$PM_{2.5}$	1.09	0.06	0.87	0.12
SO_x	--	<0.01	<0.01	0.01
H_2S	61.7	--	--	--
HAPs	0.64	<0.01	0.04	0.14 [d]
Ammonia	138	--	1.29	--
CO_2e	12,633	131	18,790	1,338

[a] Steam system emissions during routine operation (i.e., excluding commissioning) are emitted from the PTU, RM, or cooling towers.

[b] Emissions include those from one 2.7 MW generator and three 3.49 MW generators.

[c] Emissions include those associated with gas-insulated equipment and O&M equipment and vehicles.

[d] HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.

Note:

-- = Pollutant not emitted

Table 5.1-14. Summary – Project Operation Annual Emissions

Pollutant	First Year Annual Emissions (tpy) [c]				Subsequent Year Annual Emissions with Startups, Shutdowns and Emission Control Downtime (tpy)				Subsequent Year Annual Emissions without Startups, Shutdowns and Emission Control Downtime (tpy)			
	Steam System[a]	Fire Pump	Emergency Generators[b]	O&M[d]	Steam System[a]	Fire Pump	Emergency Generators[b]	O&M[d]	Steam System[a]	Fire Pump	Emergency Generators[b]	O&M[d]
NO_x	--	0.04	0.49	0.66	--	0.04	0.49	0.66	--	0.04	0.49	0.66
CO	--	0.01	2.54	1.14	--	0.01	2.54	1.14	--	0.01	2.54	1.14
VOC	0.64	<0.01	0.14	0.09	0.76	<0.01	0.14	0.09	0.79	<0.01	0.14	0.09
PM_{10}	3.82	<0.01	0.02	0.03	6.96	<0.01	0.02	0.03	7.94	<0.01	0.02	0.03
$PM_{2.5}$	2.29	<0.01	0.02	0.02	4.17	<0.01	0.02	0.02	4.77	<0.01	0.02	0.02
SO_x	--	<0.01	<0.01	<0.01	--	<0.01	<0.01	<0.01	--	<0.01	<0.01	<0.01
H_2S	85.2	--	--	--	33.3	--	--	--	10.1	--	--	--
HAPs	2.06	<0.01	<0.01	0.03 [e]	2.42	<0.01	<0.01	0.03 [e]	2.52	<0.01	<0.01	0.03 [e]
Ammonia	316	--	0.03	--	540	--	0.03	--	605	--	0.03	--
CO_2e	40,808	3.27	470	326	48,295	3.27	470	326	50,320	3.27	470	326

[a] Steam system emissions are emitted from the PTU, RM, or cooling towers.

[b] Emissions include those from one 2.7 MW generator and three 3.49 MW generators.

[c] First year annual emissions include commissioning activities with the remaining year routine operations.

[d] Emissions include those associated with gas-insulated equipment and O&M equipment and vehicles.

[e] HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.

Note:

-- = Pollutant not emitted

< = less than

Tables 5.1-15 and 5.1-16 present a summary of the hourly emissions for the worst-case operational scenario for each of the Project's emission sources and a summary of the facility-wide PTE, respectively.

Table 5.1-15. Worst-Case Hourly Emissions by Source or Point of Release

	Maximum Hourly Emissions (lbs/hr)						
Pollutant	PTU	MTU	RM	Cooling Tower & Sparger	Fire Pump	Emergency Generators [a]	O&M [b]
NO_x	--	--	--	--	1.78	19.5	3.74
CO	--	--	--	--	0.42	102	4.17
VOC	0.06	0.10	0.20	0.18	0.05	5.52	0.46
SO_x	--	--	--	--	<0.01	<0.01	0.01
PM_{10}	--	--	--	1.81	0.06	0.87	0.14
$PM_{2.5}$	--	--	--	1.09	0.06	0.87	0.12
H_2S	19.3	31.3	61.7	58.4	--	--	--
HAPs	0.20	0.33	0.64	0.58	<0.01	0.04	0.14 [c]
Ammonia	0.85	1.37	2.71	138	--	1.29	--
CO_2e	3,944	6,412	12,633	11,489	131	18,790	1,338

[a] Emissions include those from one 2.7 MW generator and three 3.49 MW generators.

[b] Emissions include those associated with gas-insulated equipment and O&M equipment and vehicles.

[c] HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.

Note:

-- = Pollutant not emitted

Table 5.1-16. Facility-wide Potential to Emit

Pollutant	Hourly Operation (lbs/hr)	First Year of Operation (tpy)	Subsequent Year of Operation with Startups, Shutdowns and Emission Control Downtime (tpy)	Subsequent Year of Operation without Startups, Shutdowns and Emission Control Downtime (tpy)
CO	106	3.69	3.69	3.69
NO_x	25.0	1.19	1.19	1.19
VOC	6.22	0.86	0.98	1.01
PM_{10}	2.89	3.87	7.01	7.99
$PM_{2.5}$	2.14	2.34	4.22	4.81
SO_x	0.01	<0.01	<0.01	<0.01
H_2S	61.7	85.2	33.3	10.1
HAPs	0.82	2.06	2.42	2.52
Ammonia	139	316	540	605
CO_2e	32,891	41,608	49,095	51,119

The operational profiles presented above include scenarios for the first operating year, including plant commissioning and testing activities; a subsequent operating year without commissioning and testing activities but with all proposed startups, shutdowns, and emission control downtime; and a subsequent operating year assuming 8,760 hours of routine power generation operation (i.e., without any startups, shutdowns, or emission control downtime). The commissioning and testing activities are included in the facility-wide PTE to conservatively capture the Project's worst-case air quality impacts and emissions for permitting purposes.

GHG Emissions. Operational emissions of CO_2e will be primarily from the geothermal fluid in the RPF, onsite diesel combustion from emergency generators and the fire water pump, and insulating gas emissions from the high voltage circuit breaker. The worst-case annual estimate of CO_2e emissions from operation of the Project is 51,119 tpy (45,642 metric tons [MT] per year), with specific source details provided in Tables 5.1-9 through 5.1-16. These estimates were calculated using the emission factors, GWPs, and methodology previously specified. Additional detail is provided in Appendix 5.1A.

TAC Emissions. Operational emissions of TACs will result from multiple Project sources, including geothermal fluid in the RPF and mobile/stationary combustion activities. Combined HAP emission estimates are summarized in Tables 5.1-9 through 5.1-16, with individual TAC estimates included in Section 5.9. Section 5.9 also provides a detailed discussion and quantification of TAC emissions from Project operation, as well as the results of the health risk assessment (HRA).

5.1.7.1.3 Significance Criteria for Operation

Table 5.1-17 presents the Project emissions for comparison to ICAPCD's regional air quality significance thresholds for operation, as derived from the ICAPCD California Environmental Quality Act (CEQA) guidance (ICAPCD 2017). In the absence of a GHG operational threshold of significance, South Coast Air Quality Management District's (SCAQMD) *Interim CEQA Significance Threshold for Stationary Sources, Rules and Plans* was used for this analysis (SCAQMD 2008).

Table 5.1-17. ICAPCD CEQA Significance Thresholds for Operation

Pollutant	Project Operational Emissions [b]	Operational Thresholds
NO_x	70.6 lbs/day	137 lbs/day
VOC	19.4 lbs/day	137 lbs/day
PM_{10}	46.5 lbs/day	150 lbs/day
$PM_{2.5}$	28.9 lbs/day	550 lbs/day
SO_x	0.10 lbs/day	150 lbs/day
CO	237 lbs/day	550 lbs/day
Odors	--	Project creates an odor nuisance at a distance greater than 1 mile from the facility
CO_2e	45,642 MT/year [a]	10,000 MT/year

Source: ICAPCD 2017, SCAQMD 2008

[a] Over 98 percent of the Project's total CO_2e emissions result from the processing of geothermal fluid.

[b] Emissions include those associated with gas-insulated equipment and O&M equipment and vehicles.

Note:

-- = Not applicable and/or no standard

As shown, operational emissions from all Project activities are not expected to exceed the daily threshold values of significance for criteria pollutants. Although the Project's operational emissions do exceed the annual significance threshold for GHG emissions, the Project's GHG emissions are the direct result of geothermal steam processing for electricity generation, which is an activity encouraged in the Imperial County Regional Climate Action Plan (Ascent 2021). Additionally, the GHG emissions from the non-geothermal processing activities, including stationary combustion, would be only 714 MT CO_2e per year, which is less than the threshold. Therefore, the Project would likely result in less-than-significant impacts with respect to operational emissions.

5.1.7.2 Project Construction

The construction phase of the Project is expected to take approximately 29 months, with a few months on both ends for equipment delivery and demobilization. Construction is anticipated to begin in second quarter 2024. The overall Project staffing schedule is displayed in Table 2-9. The construction schedule is based on two, 10-hour shifts per day, during which construction equipment may operate up to 10 hours per shift, and a 7 days-per-week work week.[3] Separate contractors working in parallel with the Project's construction and startup schedule will construct offsite utilities.

Several areas in the vicinity of the Project site will be available for equipment and materials laydown, storage, construction equipment parking, small fabrication areas, and office trailers. The proposed construction laydown areas are outlined in Section 2. 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, well piping, spools, electrical components, switchyard apparatus, and building parts. Sufficient space is provided to accommodate equipment preventive and in-storage maintenance activities such as moving, shaft rotation, connecting, lubricating, and heating. Site access will be controlled for personnel and vehicles. A security fence will be installed around the site boundary, including the laydown areas. Security personnel will be onsite.

Construction-related issues and emissions at the Project site are consistent with issues and emissions encountered at any construction site. Compliance with the provisions of the following permits and plans will generally result in minimal site emissions:

- Grading permit
- Construction site provisions of the site's Storm Water Pollution Prevention Plan (SWPPP)
- ICAPCD-issued ATC, which will require compliance with the provisions of all applicable fugitive dust rules that pertain to the Project's construction phase

5.1.7.2.1 Emission Estimates

The construction emissions estimation methodology for the Project were developed in coordination with the latest available data and engineering design. Details of the specific methodology for each of the construction emissions sources are included below:

- **Construction Equipment**: Emissions were estimated using construction equipment emission factors, horsepower, and load factors from the *CalEEMod User's Guide* (ICF 2022). Default CalEEMOD emission factors were assumed for off-highway trucks and small equipment (i.e., equipment with a power rating of less than 25 horsepower); Tier 4 final emission factors were assumed for all other construction equipment.

- **On-Road Vehicles:** Emissions from vehicle exhaust and idling were calculated using emission factors from EMFAC2021.

- **Fugitive Dust Emissions:** Emissions from fugitive dust activities including grading, truck dumping/loading, and travel on paved and unpaved roadways were estimated based upon factors developed using methodology from the *CalEEMod User's Guide* (ICF 2022). As appropriate, fugitive dust emissions will be mitigated up to 74 percent by watering every 2.1 hours, per the *CalEEMod User's Guide* (ICF 2022).[4]

- **Paving Emissions:** Emissions from paving activities were estimated based upon factors developed using methodology from the *CalEEMod User's Guide* (ICF 2022).

  Emissions will occur from both onsite and offsite activities during the construction phase of the Project. Onsite emissions will include operations of construction-related equipment, pickup trucks, fugitive dust, and paving. Emissions occurring offsite will include construction equipment for the drilling and

[3] Although staffing assumes a 7 day-per-week work week, the construction emissions assume a more typical schedule of up to 23 work days per month.

[4] The control efficiency established by the *CalEEMod User's Guide* is based on watering three times per 8-hour shift, or every 2.1 hours (ICF 2022).

construction of offsite wells and well pads, on-road vehicles for worker commutes and material/equipment deliveries, fugitive dust from road dust, and paving emissions associated with the paving of roadways to the Project.

Onsite and offsite Project emissions from construction have been divided into two categories: (1) vehicle and construction equipment exhaust; and (2) fugitive dust from vehicle and construction equipment, including grading and truck loading/dumping during Project construction.

- **Criteria Pollutant Emissions.** The following criteria pollutant emissions have been calculated: NO_X, SO_2, VOC, CO, PM_{10}, and $PM_{2.5}$. It is expected that large stockpiles of earthen materials would not be present during Project construction; therefore, wind-blown fugitive dust emissions from earthen stockpiles were assumed to be negligible.

Daily and annual construction emissions were estimated based on the number and type of construction equipment, the number of heavy-duty trucks, and the workforce projected for each month of construction. It was conservatively assumed that the construction activities would occur 20 hours per day across the two, 10-hour shifts and 23 days per month. The maximum daily emissions occur during month 12 for all pollutants except PM_{10}, which peaks during month 18. The maximum annual construction emissions for all pollutants occur between months 10 and 21, which is calendar year 2025.

The maximum daily and annual criteria pollutant emissions from the combined onsite and offsite construction activities are presented in Table 5.1-18. The detailed emission calculations for construction are provided in Appendix 5.1D.

Table 5.1-18. Project Construction Criteria Pollutant Emissions

Construction Emissions	NO_X	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$
Average Daily Emissions (lbs/day)	119	480	49.5	1.19	23.6	18.4
Maximum Annual Emissions (tpy)	23.6	96.7	9.47	0.23	4.46	3.51

GHG Emissions. GHG emissions from Project construction were calculated using the same methodology used for criteria pollutants. The maximum daily and annual GHG emissions from the combined onsite and offsite construction activities are presented in Table 5.1-19. The detailed emission calculations for construction are provided in Appendix 5.1D.

Table 5.1-19. Project Construction Greenhouse Gas Emissions

Construction Emissions	CO_2	CH_4	N_2O	CO_2e
Average Daily Emissions (MT/day)	45.6	<0.01	<0.01	45.7
Maximum Annual Emissions (MT/year)	18,005	0.72	0.14	18,066

TAC Emissions. Construction-related emissions of TACs will result from the Project's mobile source combustion activities during the construction phase. See Section 5.9 for a detailed discussion and quantification of TAC emissions from Project construction, as well as the results of the HRA.

5.1.7.2.2 Mitigation Measures for Construction

Construction activities are known to result in impacts due to fugitive dust and other emissions that may result in adverse impacts to air quality. The Project owner will comply with all required fugitive dust mitigation measures consistent with ICAPCD Regulation VIII and the CEQA Guidelines. The required mitigation measures to be implemented by the Project owner during Project construction include the following (ICAPCD 2017):

- All disturbed areas, including bulk material storage which is not being actively utilized, shall be effectively stabilized and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by using water, chemical stabilizers, dust suppressants, tarps or other suitable material such as vegetative ground cover.

- All onsite and offsite unpaved roads will be effectively stabilized and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering, except as otherwise provided for by Rule 801.
- All unpaved traffic areas 1 acre or more with 75 or more average vehicle trips per day will be effectively stabilized and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.
- The transport of bulk materials shall be completely covered unless six inches of freeboard space from the top of the container is maintained with no spillage and loss of bulk material. In addition, the cargo compartment of all haul trucks is to be cleaned and/or washed at delivery site after removal of bulk material.
- All track-out or carry-out will be cleaned at the end of each workday or immediately when mud or dirt extends a cumulative distance of 50 linear feet or more onto a paved road within an urban area.
- Movement of bulk material shall be stabilized prior to handling or at points of transfer with application of sufficient water, chemical stabilizers or by sheltering or enclosing the operation and transfer line.
- The construction of any new unpaved road is prohibited within any area with a population of 500 or more unless the road meets the definition of a temporary unpaved road. Any temporary unpaved road shall be effectively stabilized, and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.
- Use alternative fueled or catalyst equipped diesel construction equipment, including all off-road and portable diesel-powered equipment to the extent feasible.
- Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes as a maximum.
- Limit, to the extent feasible, the hours of operation of heavy-duty equipment and/or the amount of equipment in use.
- Replace fossil fueled equipment with electrically driven equivalents (provided they are not run via a portable generator set).

Additional mitigation measures are available in ICAPCD's CEQA Guidelines for construction as discretionary or enhanced measures and may be implemented at the request of the CEC or ICAPCD.

5.1.7.2.3 Significance Criteria for Construction

Table 5.1-20 presents the ICAPCD's regional air quality significance thresholds currently being implemented for construction, as derived from the ICAPCD's CEQA Guidelines (ICAPCD 2017), as well as a comparison to the Project's construction emissions. In the absence of a GHG construction threshold of significance, SCAQMD's CEQA threshold of significance was used (SCAQMD 2019).

Table 5.1-20. ICAPCD Construction CEQA Significance Thresholds

Pollutant	Project Construction Emissions	Construction Thresholds
NO_x	119 lbs/day	100 lbs/day
VOC	49.5 lbs/day	75 lbs/day
PM_{10}	23.6 lbs/day	150 lbs/day
$PM_{2.5}$	18.4 lbs/day	--
SO_x	1.19 lbs/day	--
CO	480 lbs/day	550 lbs/day
CO_2e	18,066 MT/year	10,000 MT/year

Source: ICAPCD 2017, SCAQMD 2019

Note:

-- = Not applicable and/or no standard

As shown, construction emissions from all onsite and offsite Project activities are not expected to exceed the significance thresholds except for NO_2 and GHGs (CO_2e). An exceedance of the significance thresholds does not necessarily indicate the Project would have significant impacts, but does indicate the need for additional analysis. For NO_2, atmospheric dispersion modeling was performed, in accordance with the methodology presented in Section 5.1.9, to demonstrate that Project construction would not exceed either the NAAQS or CAAQS. Based on the results presented in Section 5.1.10.2, the Project would have less-than-significant impacts with respect to criteria pollutants.

For GHGs, one must also consider the Project's conformance with regional climate action plans. Although the Project's construction GHG emissions exceed the significance threshold, those short-term emissions are necessary to support the construction of a new geothermal steam processing facility for electricity generation, which is an activity encouraged in the Imperial County Regional Climate Action Plan (Ascent 2021). Once built, the Project will also support the State's goals of increasing renewable energy resources and reducing GHG emissions. Therefore, the Project is expected to have a potentially less-than-significant impact with respect to GHGs.

5.1.8 Best Available Control Technology Evaluation

ICAPCD does not have BACT guidelines. To evaluate if the Project meets the BACT requirements, BACT guidelines published by other air districts in California, CARB, and the EPA for cooling tower particulate matter emissions and geothermal power plant H_2S emissions were reviewed.

5.1.8.1 BACT for Cooling Tower Particulate Matter Emissions

The San Joaquin Valley Air Pollution Control District's (SVJAPCD) BACT Guideline for cooling towers is to use High Efficiency Cellular Type Drift Eliminators (0.0005 percent drift rate) (SJVAPCD 2018), which is consistent with listings from EPA's Reasonably Available Control Technology (RACT)/ BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse.[5] There are no BACT guidelines or listings from other air districts for cooling towers. The cooling tower of the proposed Project would be designed to have 0.0005 percent drift eliminator and thus satisfies the BACT requirements.

5.1.8.2 BACT for H_2S Emissions

Currently, there are no applicable BACT listings for H_2S emissions from geothermal power plant operations. However, ICAPCD approved a BACT analysis for a similar facility in 2017. This approved BACT analysis utilized a sparger system for H_2S removal from the gas stream and a biological oxidation box to oxidize the fluid phase H_2S into elemental sulfur and or sulfates with destruction and removal efficiencies (DRE) of 90 percent and 90 percent (CalEnergy 2017), respectively. The proposed Project would utilize this same H_2S treatment system consisting of a sparger and a biological oxidation box to remove H_2S from the geothermal stream. The proposed sparger system and biological oxidation box are expected to operate with a minimum DRE of 96.5 percent and 95 percent, respectively. The proposed Project would use up-to-date technologies and the H_2S control system is typical in geothermal power plant designs that have been permitted in other air districts and in other states.

5.1.8.3 Summary

The particulate matter emissions from the cooling tower and the H_2S emissions from the geothermal stream are subject to BACT requirements. Table 5.1-21 summarizes the proposed BACT for the Project's cooling tower particulate matter emissions and the H_2S emissions from the geothermal stream.

[5] Available online at https://www.epa.gov/catc/ractbactlaer-clearinghouse-rblc-basic-information.

Table 5.1-21 Proposed BACT

Pollutant	Applicable BACT from Guidelines	Project Proposed BACT
$PM_{10}/PM_{2.5}$	High Efficiency Drift Eliminator at 0.0005%	High Efficiency Drift Eliminator at 0.0005%
H_2S	90% DRE with a combination sparger and biological oxidation box	H_2S sparging and biological oxidation box with greater than 96.5% and 95% control efficiency, respectively

As shown in Table 5.1-21, the cooling tower meets the BACT requirements for particulate matter because it will be equipped with a high efficiency drift eliminator with 0.0005 percent drift. While there is no published BACT for H_2S from the proposed Project, H_2S emissions will be controlled with a sparger and biological oxidation box system with 96.5 and 95 percent control efficiency, respectively, consistent with a similar project's BACT analysis within ICAPCD for H_2S abatement. As such, the Project meets the BACT requirements under ICAPCD Rule 207.

5.1.9 Environmental Analysis – Air Quality Impact Analysis Methodology

An ambient air quality impact analysis was conducted to compare ground-level impacts resulting from the Project's operation- and construction-related emissions with established federal and state ambient air quality standards. This section describes the methodology used in developing both the magnitude and spatial extent of the ground-level concentrations resulting from the Project's emissions.

Potential air quality impacts were evaluated consistent with the approved Air Quality Modeling Protocol, as described herein. A copy of the approved Air Quality Modeling Protocol is included in Appendix 5.1C. In addition to what is presented in the approved Air Quality Modeling Protocol, criteria pollutant impacts from the Project's construction phase were also evaluated, as specifically requested by the CEC. All input and output modeling files have been provided to the ICAPCD and CEC under separate cover.

5.1.9.1 Dispersion Model Selection and Options

The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) (Version 22112) was used for this ambient air quality impact analysis, as recommended in the EPA's Appendix W, *Guideline on Air Quality Models* (EPA 2017a). AERMOD is a steady-state Gaussian plume model that simulates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. This model is recommended for short-range (less than 50 kilometers) dispersion from the source.

AERMOD incorporates the plume rise model enhancement (PRIME) algorithm for modeling building downwash and is designed to accept input data prepared by two specific preprocessor programs, AERMOD meteorological data processor (AERMET) and AERMOD terrain processor (AERMAP). AERMOD was run with the following technical options:

- Direction-specific building downwash
- Regulatory default options unless otherwise specified herein
- Rural dispersion characteristics
- Actual receptor elevations and hill height scales obtained from AERMAP (Version 18081)

Default model options for temperature gradients, wind profile exponents, and calm processing, which includes final plume rise, stack-tip downwash, and elevated receptor (complex terrain) heights option were used in this modeling analysis.

The following subsections present details of other inputs required for dispersion modeling with AERMOD.

5.1.9.1.1 Meteorological Data

Five years of AERMET-processed meteorological data were obtained from the CARB Hotspots Analysis and Reporting Program (HARP) AERMOD Meteorological Files webpage[6] for the Imperial County Airport (KIPL, WBAN ID: 03144). The 5 years of data were processed by CARB with AERMET Version 19191 for 2015 through 2018 and 2021. The years 2019 and 2020 were not included in the meteorological data set because they were likely determined to be incomplete by CARB. The data set was selected based on completeness, similar surrounding land use as the plant site and proximity to the facility, as shown in Figure 5.1-2. Wind speeds and directions for this data set are presented in the wind rose in Figure 5.1-3. The average wind speed for the 5-year period was 3.45 meters per second (m/s).

5.1.9.1.2 Receptor Grid Selection and Coverage

The ambient air boundary was defined by the fence line surrounding the facility. The selection of receptors in AERMOD was as follows:

- Discrete receptors every 25 meters (m) around the ambient air boundary (i.e., fence line)
- 25-m spacing from the fence line to 500 m from grid origin
- 100-m spacing from beyond 500 m to 1,000 m from the fence line
- 250-m spacing from beyond 1,000 m to 5,000 m from the fence line
- 500-m spacing from beyond 5,000 m to 10,000 m from the fence line

All receptors and source locations were expressed in the Universal Transverse Mercator North American Datum 1983, Zone 11 coordinate system. U.S. Geological Survey National Elevation Dataset terrain data was used in conjunction with the AERMAP preprocessor (Version 18081) to determine receptor elevations and terrain maxima.

Concentrations within the facility fence line were not calculated. Figure 5.1-4 displays the receptor grids used in the modeling assessment.

5.1.9.1.3 Ambient Air Boundary

The ambient air boundary is defined by the property line that surrounds the Applicant-owned property within which non-authorized personnel access is precluded. The ambient air boundary for the Project facility is represented in Figure 5.1-5.

5.1.9.1.4 Building Downwash

Building influences on the air dispersion of emissions from point source stacks were calculated by incorporating the EPA Building Profile Input Program for use with the PRIME algorithm (BPIP-PRIME). Stack heights, building locations, and building dimensions were obtained from the most currently available architectural plans and onsite measurements. Stacks located on or adjacent to buildings were given base elevations of said buildings. A list of the buildings and their coordinates is included in Appendix 5.1B.

As part of this analysis, a good engineering practice (GEP) stack height screening was performed to determine which stack height should be used in the modeling. The GEP stack height is defined as the height in which the plume dispersion from the stack is not influenced by building downwash. This GEP stack height is calculated as the lesser of the following two criteria:

- 65 m
- The sum of the maximum building height for which the stack is in the area of influence plus 1.5 times the lesser of the building height or projected building width

[6] Available online at https://ww2.arb.ca.gov/resources/documents/harp-aermod-meteorological-files.

Figure 5.1-2
Meteorological Data Station Location
Black Rock Geothermal Project
Imperial County, California

Jacobs

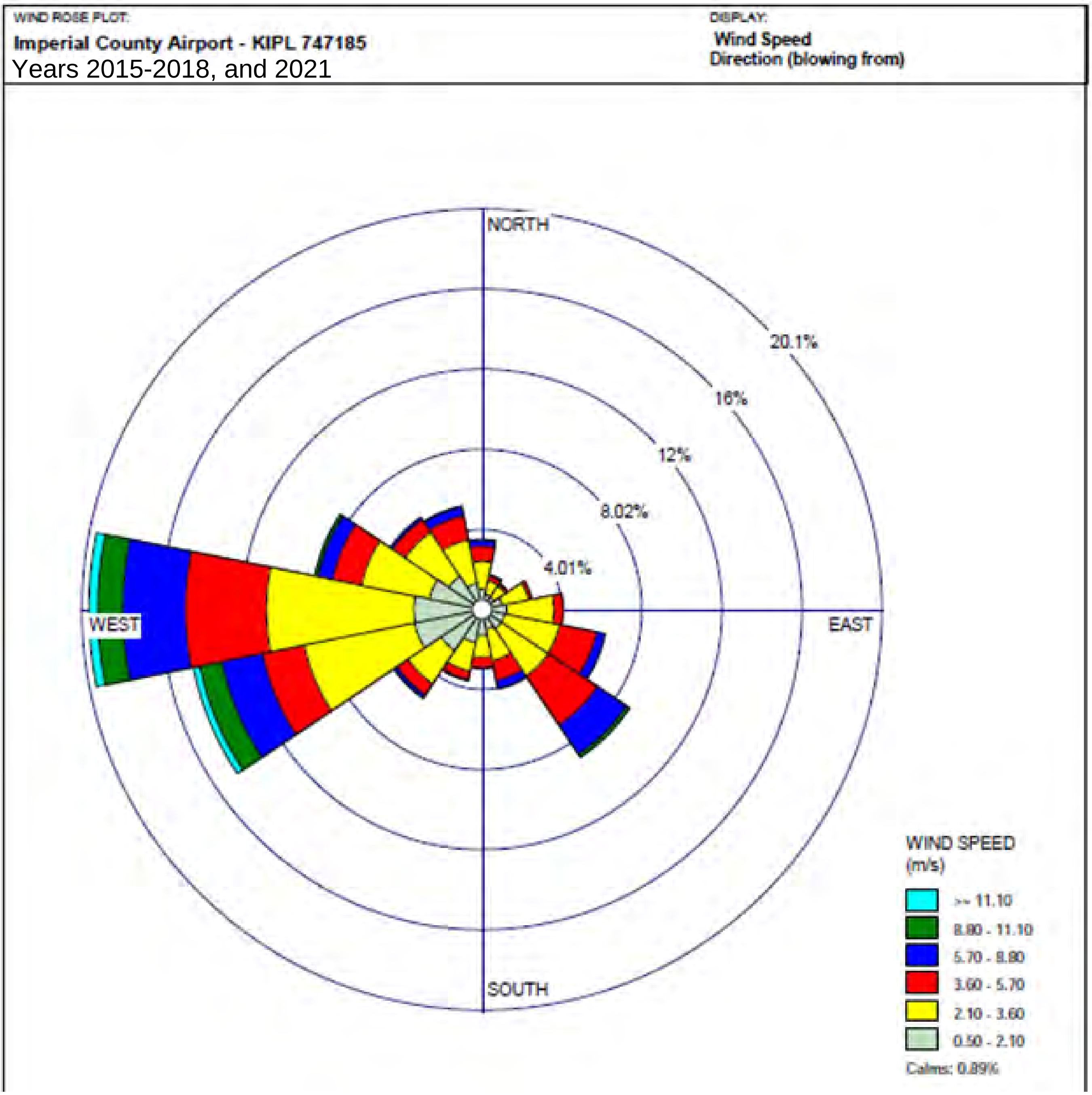


Figure 5.1-3
Meteorological Data Wind Rose
Black Rock Geothermal Project
Imperial County, California

Jacobs

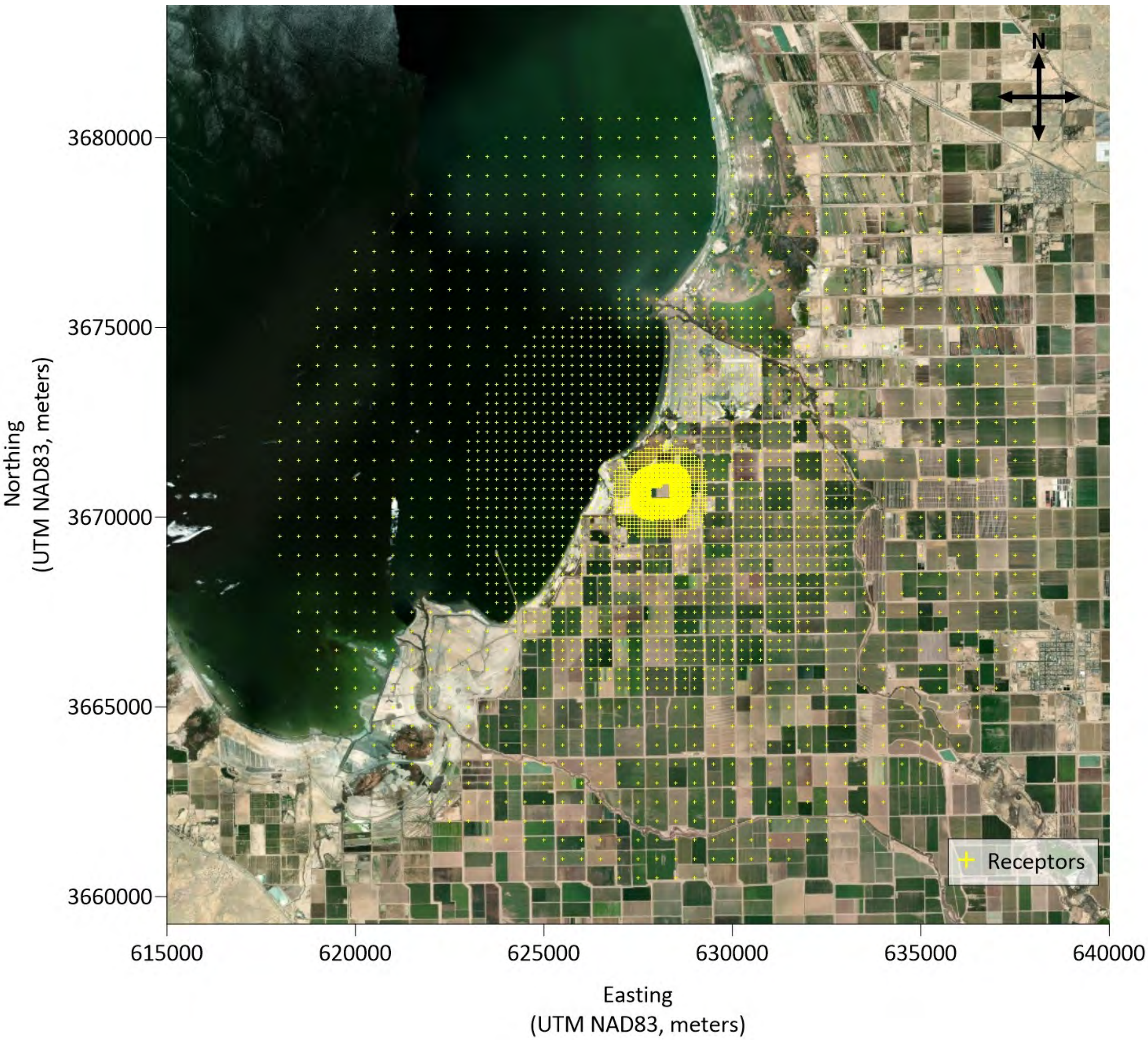


Figure 5.1-4
Dispersion Modeling Receptor Grid
Black Rock Geothermal Project
Imperial County, California

Jacobs

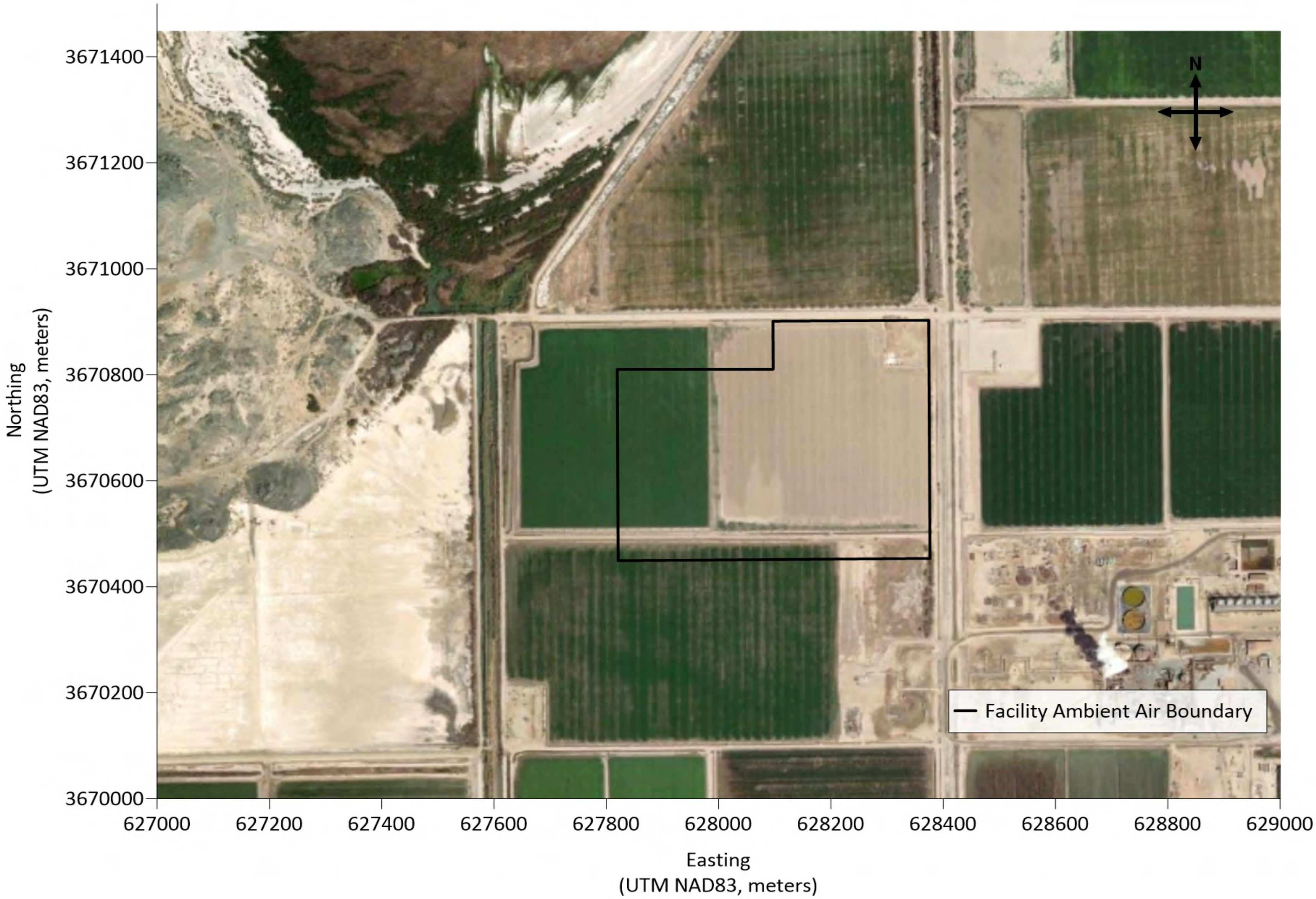


Figure 5.1-5
Facility Ambient Air Boundary
Black Rock Geothermal Project
Imperial County, California

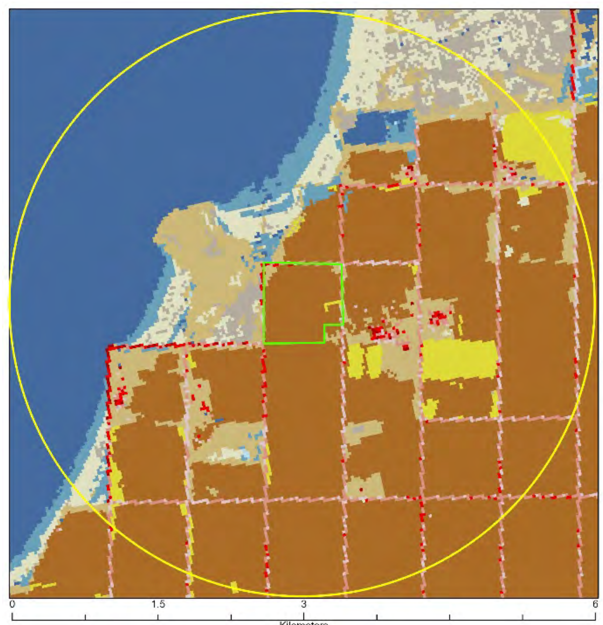
Jacobs

The stack heights used in this dispersion modeling analysis were the actual stack height or the GEP stack height, whichever is less as calculated by AERMOD.

5.1.9.1.5 Rural versus Urban Option

The land use surrounding the facility was evaluated for classification as either urban or rural. A land use analysis was performed following the Auer land use methodology (Auer 1978) using the most recent available land use data. Land use data within a 3-kilometer radius for the site was obtained from the U.S. Geological Survey's 2019 National Land Cover Database (NLCD), as shown below. This data set classified land use for individual 30- by 30-m cells into 15 primary land use categories for the Project site. Of the 15 land use categories in the 2019 NLCD data set, the following two categories are considered urban for dispersion modeling purposes:

- **Developed, Medium Intensity (NLCD Code 23)—**This classification includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover.
- **Developed, High Intensity (NLCD Code 24)—**This classification includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial spaces. Impervious surfaces account for 80 to 100 percent of the total cover.



Land Use Color	Land Use Code ID No.	Land Use Description	Cell Count	% Land Category
	11	Open Water	13,821	28.30%
	21	Developed, Open Space	604	1.24%
	22	Developed, Low Intensity	1,074	2.20%
	23	Developed, Medium Intensity	272	0.56%
	24	Developed, High Intensity	84	0.17%
	31	Barren Land	2,156	4.41%
	52	Shrub/Scrub	4,099	8.39%
	71	Herbaceous	2,289	4.69%

Land Use Color	Land Use Code ID No.	Land Use Description	Cell Count	% Land Category
	81	Hay/Pasture	1,231	2.52%
	82	Cultivated Crops	21,743	44.52%
	90	Woody Wetlands	35	0.07%
	95	Emergent Herbaceous Wetlands	1,433	2.93%

If more than 50 percent of the area within 3 kilometers is classified as urban land use, the URBAN option may be used for AERMOD modeling of the facility. The analysis showed that less than 1 percent of the land within a 3-kilometer radius of the facility may be classified as urban; therefore, the URBAN option in AERMOD was not used in the dispersion modeling analysis.

5.1.9.2 Source Characterization

The Project's worst-case operation- and construction-related emissions of criteria pollutants, GHGs, and TACs are presented in Section 5.1.7 and, unless otherwise noted, were used for modeling based upon the applicable pollutant and standard. Details of the source specific model inputs are provided in the following subsections.

5.1.9.2.1 Project Operation

The modeled sources for Project operation include the cooling towers, diesel-fired emergency generators, diesel fire water pump, PTU, and RM. Details of the source specific model inputs and modeled emission rates are presented below and included in Appendix 5.1B. The operational source layout for the modeling is included in Figure 5.1-6.

Emissions from O&M equipment and vehicles were not modeled as those operations are infrequent, varied spatially throughout the Project site, and assumed to have a negligible impact on ground-level concentrations relative to the Project's other emission sources.

Cooling Towers. The cooling towers were modeled as a point source in AERMOD with the stack diameter, height, flow rate, temperature, drift eliminator efficiency and location based upon the latest design data. Each of the specific cooling tower stack parameters used in the modeling analysis is presented in Table 5.1-22. As stated in Section 5.1.7, the cooling towers represent emissions from the cooling tower process as well as the sparger. The modeled emission rates are included in Appendix 5.1B.

Table 5.1-22. Modeling Parameters – Cooling Tower [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
CT1	-68.58	12.98	10.63	311.76	7.91
CT2	-68.58	12.98	10.63	311.76	7.91
CT3	-68.58	12.98	10.63	311.76	7.91
CT4	-68.58	12.98	10.63	311.76	7.91
CT5	-68.58	12.98	10.63	311.76	7.91
CT6	-68.58	12.98	10.63	311.76	7.91
CT7	-68.58	12.98	10.63	311.76	7.91

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

Note:

K = degrees Kelvin

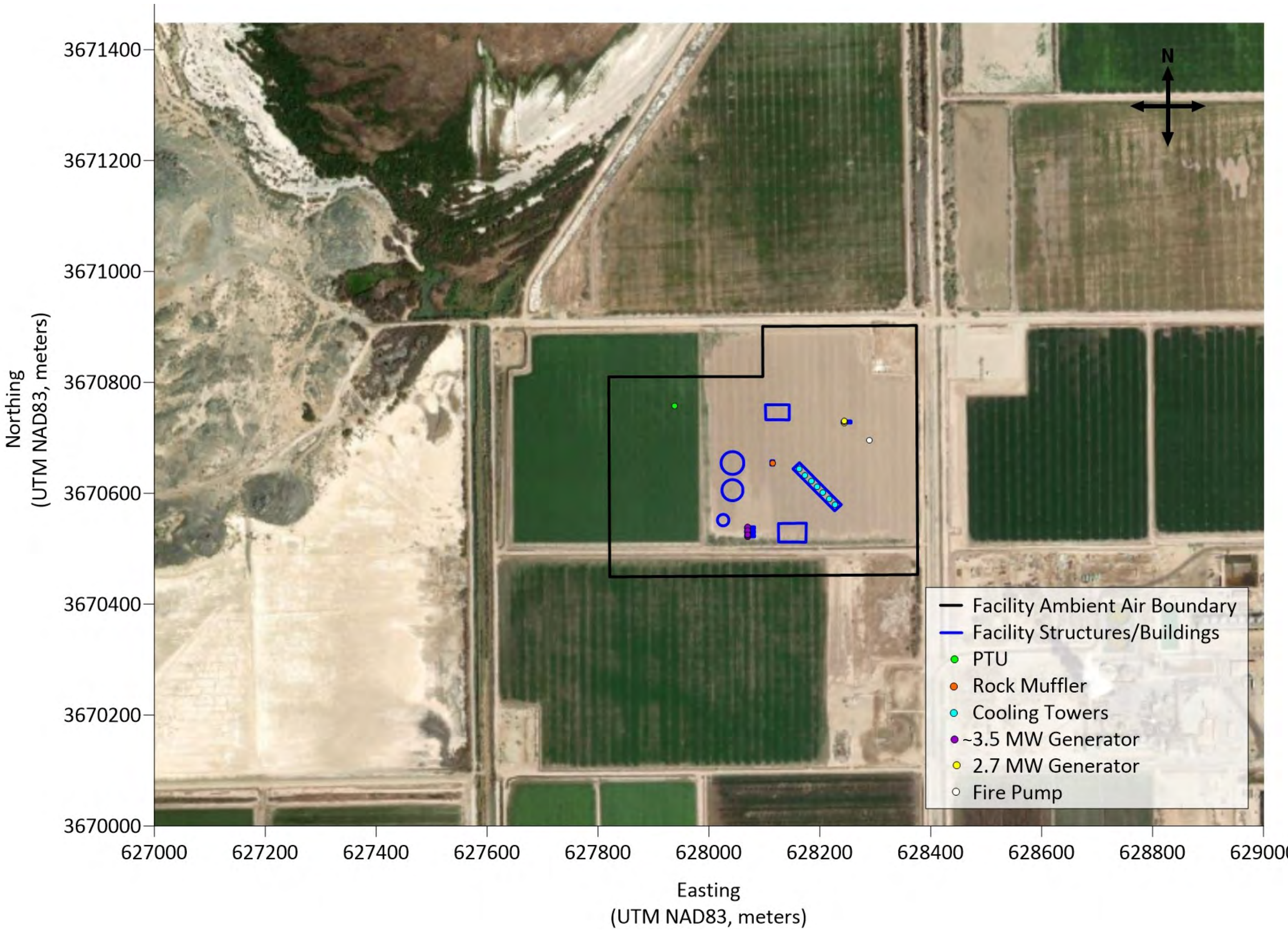


Figure 5.1-6
Operational Source Layout
Black Rock Geothermal Project
Imperial County, California

Jacobs

Diesel-fired Emergency Generators and Diesel Fire Water Pump. The diesel-fired emergency generators and diesel fire water pump were modeled as point sources in AERMOD with the stack diameter, height, flow rate, temperature, and location based on the design data provided by the vendors. Generators 1 through 4 are equipped with Tier 4 emission controls which each vent through three stacks; therefore, each generator is represented by three stacks with emissions and flow evenly distributed between them. Each of the specific stack parameters used in the modeling analysis is presented in Table 5.1-23. For purposes of modeling, the fire pump is assumed to operate one hour per day and the generators are assumed to operate up to 2 hours per day and once per 8-hour period, all of which are conservatively assumed to potentially occur within the same day. The modeled emission rates are included in Appendix 5.1B.

Table 5.1-23. Modeling Parameters – Emergency Diesel Engines [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
FPUMP	-68.58	4.60	0.15	665.00	53.30
G1_1	-68.58	6.22	0.32	763.15	38.08
G1_2	-68.58	6.22	0.32	763.15	38.08
G1_3	-68.58	6.22	0.32	763.15	38.08
G2_1	-68.58	6.26	0.32	748.15	46.36
G2_2	-68.58	6.26	0.32	748.15	46.36
G2_3	-68.58	6.26	0.32	748.15	46.36
G3_1	-68.58	6.26	0.32	748.15	46.36
G3_2	-68.58	6.26	0.32	748.15	46.36
G3_3	-68.58	6.26	0.32	748.15	46.36
G4_1	-68.58	6.26	0.32	748.15	46.36
G4_2	-68.58	6.26	0.32	748.15	46.36
G4_3	-68.58	6.26	0.32	748.15	46.36

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

For purposes of the 1-hour NO_2 standard, emergency engines in this analysis were classified as intermittent sources because they have less than 500 hours per year of operation according to EPA (EPA 2011). As a result, the annual average hourly emission rate for each engine was used in the 1-hour averaging period NO_2 modeling analysis, rather than the maximum hourly emission rate, consistent with EPA's *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS Memorandum* (EPA 2011).

Geothermal Steam Flashing Activities. Onsite operations may include the direct release of geothermal steam to the atmosphere through the PTU or the RM. Each of these operations will include the release of hot steam from defined structures and areas within the Project site. As a result of the heated nature of the steam and defined release point, each source was modeled as a point source in AERMOD. The temperature of the geothermal fluid for the PTU was conservatively assumed at 100°C (373.15 degrees Kelvin [K]) with the conservative average operational flow of 250,000 pounds per hour converted to a volumetric flow rate based upon the density of water vapor at 100°C (373.15 K), according to source specifications. Source parameters for the RM were developed based upon vendor provided data. The MTU was not included in this modeling analysis due to its use at various (i.e., temporary) well locations throughout the Project site for only a limited number of hours. Additionally, the emissions from MTU operation would be minimal and less than emissions from the PTU and RM. Each of the specific stack parameters used in the modeling analysis is presented in Table 5.1-24. The modeled emission rates are included in Appendix 5.1B.

Table 5.1-24. Modeling Parameters – Geothermal Steam Flashing Sources [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
RMP (Rock Muffler)	-68.58	7.32	7.35	400.35	4.75
PTU	-68.58	18.29	2.24	373.15	13.43

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

5.1.9.2.2 Project Construction

The Project's construction-related emissions would include combustion emissions from mobile sources, including diesel construction-type equipment and onsite vehicles, and fugitive dust emissions. The onsite equipment and vehicle exhaust emissions were evenly distributed over the construction area. These combustion-related emissions were modeled as a grid of point sources with a horizontal stack release spaced approximately 25 m apart over the entire construction area. The horizontal release type is an AERMOD option which negates mechanical plume rise. This conservative approach was used because it is unknown whether all construction equipment and vehicles will have vertically oriented exhaust stacks. The exhaust parameters for each point source were estimated based upon data for typical construction equipment.

Fugitive dust emissions from roadways, grading activities, and material loading/unloading were characterized as a single area-poly source within the property, with a 10-m buffer from the nearest property boundary and assuming a ground-level release. This approach is conservative for modeling ground-level fugitive emissions with no initial vertical dimension and assumes grading activities would not continuously occur within 10 m of the proposed facility fence line.

Each of the specific stack parameters used in the modeling analysis for combustion and fugitive dust emission sources are presented in Tables 5.1-25 and 5.1-26, respectively. The modeled emission rates are included in Appendix 5.1D. The construction source layout for the modeling is included in Figure 5.1-7.

Table 5.1-25. Modeling Parameters – Construction Combustion Sources [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
Point_1 through Point_352	Varies [b]	4.60	0.13	533	18.0

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

[b] Source-specific elevations were calculated with AERMAP and are included in Appendix 5.1D.

Table 5.1-26. Modeling Parameters – Construction Fugitive Dust Sources [a]

Source ID	Elevation (m)	Release Height (m)	Initial Vertical Dimension (m)
AREA_1	-70.1	0	0

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

5.1.9.3 Additional Model Selection

In addition to AERMOD and its pre-processor AERMAP, several other EPA and CARB models and programs were used to quantify pollutant impacts on the surrounding environment based on the emission sources operating parameters and their locations. The models used were BPIP-PRIME (Version 04274) and the AERSCREEN (Version 15181) dispersion model for fumigation impacts. These models, along with options for their use and how they are used, are discussed below.

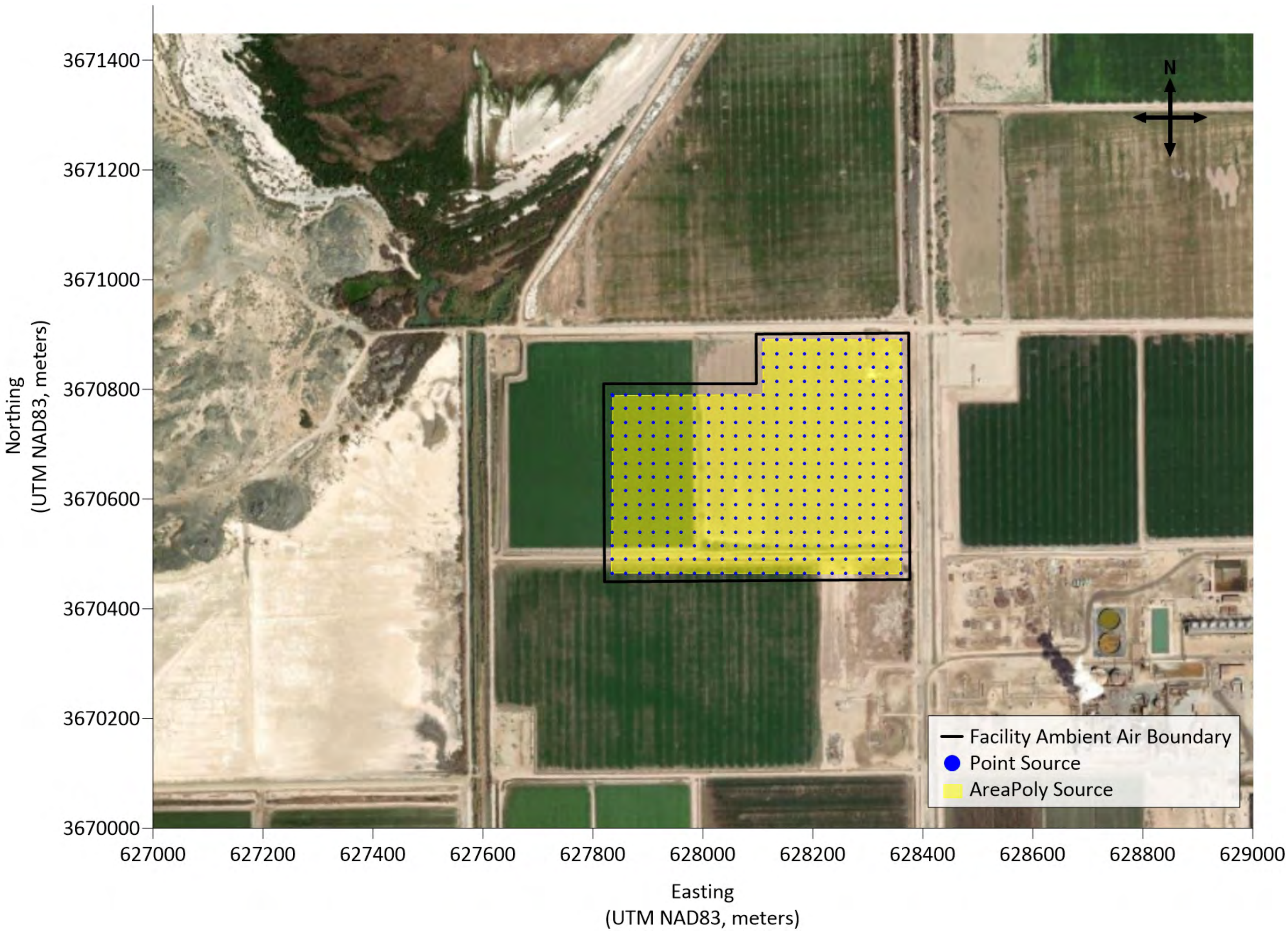


Figure 5.1-7
Construction Source Layout
Black Rock Geothermal Project
Imperial County, California

The AERSCREEN model was used to evaluate inversion breakup fumigation impacts for all short-term averaging periods (24 hours or less). The methodology outlined in EPA-454/R-92-019 (EPA 1992a) was followed for this analysis. The fumigation concentrations were then compared to the maximum AERSCREEN concentrations under normal dispersion for all meteorological conditions. Because the Project's fumigation impacts were less than the AERSCREEN maxima, as described in Section 5.1.10.1.2, additional analyses were not required.

5.1.9.4 Oxides of Nitrogen Modeling Methodology and Chemistry

The *Guideline on Air Quality Models*, Appendix W to 40 CFR Part 51 (EPA 2017a) recommends a tiered screening approach to characterize the conversion of total NO_X from the Project to NO_2. A Tier 1 approach assumes a 100 percent conversion of total NO_X to NO_2 and is typically overly conservative. The Tier 2 approach allows for the use of the Ambient Ratio Method 2 (ARM2). The Tier 1 and Tier 2 options do not require agency approval.

For this analysis, the Tier 2 approach was selected using the ARM2 model with a default in-stack ratio of 0.5 and a default out-of-stack ratio of 0.9.

5.1.9.5 Cumulative Source Analysis

Per CEC requirements, a cumulative impacts analysis for the Project's typical operating mode will be conducted for any pollutants which exceed the Class II Significant Impact Levels (SILs). Impacts from the Project will be combined with 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 NSR or CEQA permitting process).[7] The stationary emissions sources included in the cumulative impacts assessment will be limited to new or modified sources (individual emission units) that would cause a net increase of 5 tpy or more per modeled criteria pollutant. Therefore, VOC sources, equipment shutdowns, permit-exempt equipment registrations, rule compliance, permit renewals, or replacement/upgrading of existing systems will not be included in the cumulative impacts analysis. TAC emissions will also be excluded from the cumulative impacts analysis. The facilities with cumulative sources identified for inclusion in the air quality impacts analysis are presented in Table 5.1-27.

Table 5.1-27. Cumulative Impacts Assessment – Facility List

CUP-0011	Project Name	Applicant	Area-Location	Phase
13-0031	Wilkinson Solar Farm	8 Minute Energy	Niland	Pending Construction
13-0032	Lindsey Solar Farm	8 Minute Energy	Niland	Pending Construction
17-0014	Midway Solar Farm IV	8 Minute Energy	Calipatria	Pending Construction
18-0040	Ormat Wister Solar	Omi 22 LLC/Ormat	Niland	Under Construction
21-0021	Hell's Kitchen Geothermal Exploration Project	Controlled Thermal Resources	Niland	Entitlement Process
20-0008	Energy Source Mineral ALTiS	Energy Source Minerals	Imperial County	Pending Construction

The cumulative air quality impacts analysis will be performed using the same modeling methodology presented in Section 5.1.9.1. The fence lines for the cumulative sources will not be included in the modeling analysis as they do not define the ambient boundary for modeling purposes.

The maximum predicted cumulative impacts will represent the impact at the receptor location identified as the maximum receptor for each pollutant required to have a cumulative impacts assessment. The maximum modeled concentrations from the analysis will then be added to representative background

[7] Existing sources are not included in the cumulative impacts assessment as their emissions are assumed to be accounted for with the ambient air background concentrations.

concentrations, and the results compared to the applicable CAAQS and NAAQS for each pollutant required to be included in the cumulative impacts assessment.

The Applicant will compile a source list for the facilities identified in Table 5.1-27, making conservative assumptions as necessary, and provide the source list to CEC staff for review and comment. Specifically, the Applicant would value input on the appropriateness of excluding specific sources (sources with negligible emissions, administrative permit amendments with no increase in air emissions, and VOC sources) and selecting the modeled scenarios. Following receipt of CEC staff's comments, the source list will be finalized and a cumulative air quality impact analysis will be prepared within 30 days of the application being deemed complete.

5.1.9.6 H_2S Methodology

H_2S in the ambient air near the Salton Sea is subject to episodic events that result in concentrations which temporarily exceed the CAAQS of 0.03 parts per million (ppm). These episodic events of H_2S exceedances are well known and largely due to biogenic sources and activity (SCAQMD 2021). As a result, monitoring data in the region may not be representative for use in a CAAQS modeling analysis.

Specifically, the 1-hour H_2S CAAQS was adopted in 1969 for purposes of odor control and not for protection of public and environmental health. People have experienced eye irritation at concentrations of 50 ppm which is much greater than the CAAQS of 0.03 ppm (CARB 2022b). Therefore, temporary exceedances of the H_2S CAAQS would not result in elevated exposure of the public and environment to H_2S health-related risks but would be characterized as a nuisance and an odor impact.

As a result of the Project location and nature of the standard, H_2S is analyzed similarly to nuisance related impacts caused by odorous compounds. Specifically, the 1-hour H_2S analysis will follow the ICAPCD's methodology for assessing odor-related impacts, as presented in Section 4.6(b) of the CEQA Air Quality Handbook, which states that H_2S emissions may result in impacts that would not be significant except as a nuisance. Table 3 of the Guidelines provides screening distances for odor impacts, which is 1 mile for all facility types (ICAPCD 2017).

The Project's non-routine operations, including commissioning, startup, shutdown, and downtime of emission controls, would occur infrequently throughout the year and were not included in the H_2S modeled scenarios. As such, the H_2S results presented below reflect emissions associated with only routine power generation operations, which are anticipated to occur no less than 80 percent of the year. The non-routine operational conditions would occur for unknown durations randomly during the year and are difficult to predict with any reasonable certainty given their impacts have a strong dependence on meteorological conditions. At similar geothermal power plants operated by the Applicant, these non-routine operations occur for less than 50 percent of the time used to estimate emissions for this Project (in other words, this analysis is conservative with regards to the frequency and duration of non-routine operations). The potential for these infrequent events to occur during meteorological conditions hindering dispersion is expected to be minimal.

The nearest residences and sensitive receptors are located greater than 1 mile away from the Project location. Given the location of these receptors and the ICAPCD's CEQA Guidelines, the 1-hour H_2S modeling analysis will not include any receptors within 1 mile of the Project. Any potential impacts within this 1-mile radius would not be considered nuisance-related and not expose any nearby residences or sensitive receptors to any potential nuisances.

5.1.9.7 Model Outputs

Maximum short-term and annual impacts were used for determining compliance with all CAAQS, since these standards are never to be exceeded. The same maximum impacts were also conservatively used for assessing compliance with the following NAAQS: 1-hour and 8-hour CO (high, second-highs allowed); 1-hour SO_2 (5-year average of the 99th annual percentiles of the 1-hour daily maximum allowed); 3-hour and 24-hour SO_2 (high, second-highs allowed); and 24-hour PM_{10} (sixth high over 5-years allowed). These same maximum impacts were also conservatively used for comparison to the NAAQS SILs. For 1-hour NO_2, the 5-year average of the annual 1-hour maxima and 98th annual percentiles of the 1-hour daily maximum were used for assessing compliance with the SIL and NAAQS, respectively. For 24-hour $PM_{2.5}$, the 5-year average of the annual 24-hour maxima and 98th annual percentiles were used for assessing compliance with the SIL and NAAQS, respectively. Finally, for annual $PM_{2.5}$, the 5-year average of the annual impacts was used for assessing compliance with both the SIL and NAAQS.

5.1.10 Environmental Analysis – Air Quality Impact Analysis Results

The following sections present the results of the air quality impact analyses for determining the changes to ambient air quality concentrations in the Project region as a result of Project construction and operation. Cumulative multi-source modeling assessments, which are used to analyze impacts from the Project plus nearby new or modified sources, will be performed at a later date following consultation with the appropriate agencies and per the methodology described in Section 5.1.9.5.

5.1.10.1 Project Operation

5.1.10.1.1 Ambient Air Quality Standards

Based on the Section 5.1.9.7 delineation of modeled results to applicable standards, modeled operational impacts were compared with the SILs, NAAQS, and CAAQS. To determine the magnitude and location of the maximum impacts for each pollutant and averaging period, the AERMOD model was used with all 5 years of meteorological data. All maximum facility impacts occurred well inside the fine gridded receptors with 25-m spacing. Therefore, additional 25-m refined receptor grids were not required.

The secondary formation of $PM_{2.5}$ and ozone from their precursors was also accounted in the Project's operational impacts based upon EPA Maximum Emission Rates of Precursors (MERPS) View Qlik[8] and EPA Methodology. Specifically, secondary impacts were calculated and added to the respective modeled results. The calculated secondary impact results are presented in Table 5.1-28.

Table 5.1-28. Operation Air Quality Impact Results – Secondary Emissions from Precursors

Pollutant	Precursor	Modeled Precursor Emission Rate (tpy)	Modeled Secondary Impact Concentration (µg/m^3) [a]	Project Emissions (tpy)	Project Secondary Impact Concentration (µg/m^3)
24-Hour $PM_{2.5}$	NO_x	500	0.025	1.19	<0.01
	SO_2	500	0.077	<0.01	<0.01
Annual $PM_{2.5}$	NO_x	500	0.001	1.19	<0.01
	SO_2	500	0.002	<0.01	<0.01
8-Hour Ozone	NO_x	500	0.84	1.19	<0.01
	VOC	500	0.06	1.01	<0.01

[a] The modeled secondary impacts were obtained from the Los Angeles County hypothetical source with a 10-m stack height.

The Project will not result in any direct emissions of ozone and, as seen in Table 5.1-28, the secondary impacts of ozone from its Project-emitted precursors of NO_x and VOC are less than 0.01 microgram per cubic meter (µg/m^3). This secondary ozone impact is well below the SIL of 1 part per billion (ppb) and the Project would not cause or contribute to a violation of the NAAQS. As a result, no further analysis of ozone is presented.

As can be seen in Table 5.1-29, facility impacts are less than the EPA's SILs for all pollutants and averaging periods except $PM_{2.5}$. For pollutants and averaging periods with a predicted concentration that

[8] Available online at https://www.epa.gov/scram/merps-view-qlik.

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. Imperial County and CEC will receive the cumulative analysis under separate cover.

Table 5.1-29. Operation Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2 [a]	5-year average of 1-hour yearly maxima (NAAQS)	1.21	7.55	No
	Annual maximum	0.04	1.00	No
Ozone	8-hour maximum	0.01	1.96	No
CO	1-hour maximum	1,427	2,000	No
	8-hour maximum	119	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	3.19	5.00	No
	Annual maximum	0.36	1.00	No
$PM_{2.5}$	5-year average of 24-hour yearly maxima (NAAQS)	1.59	1.20	Yes
	5-year average of annual concentrations (NAAQS)	0.20	0.20	Yes

Note:

-- = Not applicable and/or no standard

The Project's maximum modeled concentrations are conservatively compared to the CAAQS and NAAQS, regardless of the SIL results, in Table 5.1-30. As shown, maximum combined impacts (modeled plus background) are less than all the CAAQS and NAAQS except for the PM_{10} CAAQS. The modeled exceedances of the PM_{10} CAAQS are due to high background concentrations, which already exceed the CAAQS (the area is already designated as a nonattainment area for the PM_{10} CAAQS). As noted above, the facility is already projected to have maximum impacts less than the SILs for both 24-hour and annual PM_{10} (the only pollutant with background concentrations above the ambient air quality standard). Thus, the Project would not significantly contribute to current exceedances of the PM_{10} CAAQS.

Table 5.1-30. Operation Air Quality Impact Results – Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Conc. (µg/m^3)	Background Conc. (µg/m^3)	Total Conc. (µg/m^3)	CAAQS (µg/m^3)	NAAQS (µg/m^3)	Exceeds Standard?
NO_2*	1-hour maximum (CAAQS)	141	105	246	339	--	No
	5-year average of 1-hour yearly 98th percentiles (NAAQS)	1.04	65.2	66.2	--	188	No
	Annual maximum	0.04	17.4	17.4	57	100	No

Pollutant	Averaging Period	Maximum Conc. (μg/m^3)	Background Conc. (μg/m^3)	Total Conc. (μg/m^3)	CAAQS (μg/m^3)	NAAQS (μg/m^3)	Exceeds Standard?
H_2S	1-hour maximum (CAAQS)	18.8	--	18.8	42	--	No
CO	1-hour maximum (CAAQS and NAAQS)	1,427	5,266	6,693	23,000	40,000	No
	8-hour maximum (CAAQS and NAAQS)	119	3,549	3,668	10,000	10,000	No
SO_2	1-hour maximum (CAAQS and NAAQS)	<0.01	22.5	22.5	655	196	No
	3-hour maximum (NAAQS)	<0.01	22.5	22.5	--	1,300 [a]	No
	24-hour maximum (CAAQS and NAAQS)	<0.01	7.10	7.10	105	365	No
	Annual maximum (NAAQS)	<0.01	1.10	1.10	--	80	No
PM_{10}	24-hour maximum (CAAQS) [b]	3.19	241.3	244	50	--	Yes
	24-hour average high-sixth-high (NAAQS)	2.48	142	144	--	150	No
	Annual maximum (CAAQS) [b]	0.36	39.8	40.2	20	--	Yes
$PM_{2.5}$	5-year average of 24-hour yearly 98th percentiles (NAAQS)	1.21	21.0	22.2	--	35	No
	Annual maximum (CAAQS)	0.21	9.40	9.61	12	--	No
	5-year average of annual concentrations (NAAQS)	0.20	8.67	8.87	--	12.0	No

[a] Secondary standard.

[b] The PM_{10} CAAQS are not applicable as the area is designated as nonattainment.

Note:

-- = Not applicable and/or no standard

5.1.10.1.2 Fumigation Analysis

Fumigation analyses with the EPA Model AERSCREEN (Version 21112) were conducted for inversion breakup conditions based on EPA guidance given in EPA-454/R-92-019 (EPA 1992b). Shoreline fumigation impacts were additionally assessed as the nearest distance to the shoreline of any large bodies of water is within 3 kilometers with the Salton Sea located less than 1,000 m to the west and northwest of the Project. Since AERSCREEN is a single point source model, only one representative cooling tower stack was modeled as it represents the Project's only source with a stack height greater than 10 m that emits criteria pollutants. Other AERSCREEN inputs included the cooling tower building data, cooling tower stack parameters, the minimum and maximum observed temperature values used by the ICAPCD for generating the Imperial County Airport meteorological data (27°F and 122°F [-3°C and 50°C], respectively), default seasonal and land cover data for cultivated land and average moisture, a minimum fence line distance of 125 m, rural dispersion conditions, no flagpole receptors, a minimum wind speed of 2.5 m/s with a 10-m anemometer height, and flat terrain. Impacts were initially evaluated for unitized emission rates (1.0 pound per hour).

The results of the fumigation analysis in AERSCREEN indicated no meteorological hours fit the fumigation criteria; therefore, no fumigation calculations were possible. This is the result of the fact that no hours meeting the stability and wind speed criteria were present, causing AERCREEN to issue a notice that no hours meet the criteria. Based upon these facts, no fumigation impacts are expected to occur from the Project.

5.1.10.1.3 Nitrogen and Particulate Deposition Impacts

The proposed Project may result in emissions of nitrogenous compounds such as NO_X and NH_3. Nitrogen oxide gases (NO and NO_2) convert to nitrate particulates in a form that is suitable for uptake by most plants and could promote plant growth and primary productivity. Coastal salt marshes are a common natural habitat in the vicinity of the Project where nitrogen deposition may occur. The critical load for atmospheric nitrogen deposition into coastal wetlands is difficult to establish because wetlands subject to tidal exchange have open nutrient cycles. In addition, nitrogen loading in wetlands is often affected by sources other than atmospheric deposition (Morris 1991). Various studies that have examined nitrogen loading in intertidal salt marsh wetlands have found critical loads to range from between 63 and 400 kilograms per hectare per year (kg $ha^{-1}yr^{-1}$) (Caffrey et al. 2007; Wigand et al. 2003). The wetlands near the Project are not expected to be sensitive to atmospheric nitrogen deposition as the impacts would likely be minimal compared to agricultural runoff nitrogen loading.

Regardless, a deposition analysis was performed using AERMOD with the options and inputs as described in Section 5.1.9.1. In addition, the following data were used/assumed for this analysis:

- AERMOD wet and dry deposition options. Depositional rates and parameters were based upon nitric acid (HNO_3) which, of all the depositing species, has the highest affinity for impacts to soils and vegetation and tendency to stick to what it is deposited on.
- Dry deposition land use characteristics were developed using satellite aerial imagery for each 10-degree increment within a 3-kilometer radius surrounding the Project.
- Dry deposition seasonal categories were assigned based upon historical meteorological trends for the region.
- NO_X and NH_3 were assumed to be 100 percent converted into atmospherically-derived nitrogen at the release point, where applicable, rather than allowing for the conversion of NO_X and NH_3 to occur over distance and time within the atmosphere, which is more realistic.
- Maximum settling velocities were selected to produce conservative deposition rates.

Emissions of depositional nitrogen were conservatively calculated as a complete conversion of in-stack NO_X and NH_3 from each of the combustion sources. This was done by multiplying the nitrogen mass fraction of each of the pollutants by the respective average annual emissions. Accordingly, modeled impacts will overstate potential effects.

The dry deposition algorithms in AERMOD include land use characteristics and some dry gas deposition resistance terms based on five seasonal categories and nine land use categories. The seasonal categories for each month of modeling are as follows:

- Midsummer: April, May, June, and July
- Autumn: August, September, and October
- Late Autumn/Winter without snow: November, December, and January
- Transitional Spring: February and March

Land use categories are used within AERMOD to calculate dry deposition of the emitted nitrogen compounds. For example, in areas of lush vegetation, the gaseous nitrogen compounds would have a higher uptake and, therefore, dry deposition would be higher at these areas than in bodies of water or urban areas with fewer trees. A determination for land use categories used in the analysis was conducted using satellite aerial imagery for which each 10-degree increment within a 3-kilometer radius surrounding the Project was defined as either grassy suburban area or unforested wetland.

AERMOD also requires the input of wet and dry depositional parameters based on the nitrogen-containing species being emitted. For this analysis, it was conservatively assumed that all nitrogen emitted was in the form of HNO_3, as HNO_3 is the most aggressive species with regards to deposition. Based on the above, over-predictive modeling approach, the maximum modeled annual deposition averaged over the wetlands was 608 kg $ha^{-1}yr^{-1}$. The Project's nitrogen deposition impacts are not expected to significantly contribute to nitrogen loading on coastal marshes because of several factors, including the fact that the area surrounding the Project is not a densely vegetated coastal marsh land and that depositional nitrogen formation requires time for the chemical reaction to occur. Because the predominate wind patterns (west to east) in the Project vicinity, among other factors, will result in a majority of the potential air quality impacts occurring away from the Project site and nearby wetlands, time and distance will reduce ground-level concentrations contributing to nitrogen deposition.

Particulate emissions will be controlled by diesel exhaust particulate filtration and the exclusive use of ultra-low sulfur diesel fuel for stationary combustion sources and high-efficiency drift eliminators for the cooling towers. The deposition of PM_{10} can affect vegetation through either physical or chemical mechanisms. Physical mechanisms include the blocking of stomata so that normal gas exchange is impaired, as well as potential effects on leaf adsorption and reflectance of solar radiation. Information on physical effects is limited, presumably in part because such effects are slight or not obvious except under extreme situations (Lodge et al. 1981). Given the emission controls incorporated into the Project design and modeled particulate impacts, no additional mitigation measures are required.

5.1.10.2 Project Construction

Based on the Section 5.1.9.7 delineation of modeled results to applicable standards, modeled construction impacts were compared with the SILs, NAAQS, and CAAQS. To determine the magnitude and location of the maximum potential impacts for each pollutant and averaging period, the AERMOD model was used with all 5 years of meteorological data. All modeled maximum facility impacts occurred well inside the fine gridded receptors with 25-m spacing. Therefore, additional 25-m refined receptor grids were not necessary.

The secondary formation of $PM_{2.5}$ and ozone from their precursors were also accounted in the Project's construction impacts based upon EPA MERPS View Qlik and EPA Methodology (EPA 2019). Specifically, secondary impacts were calculated and added to the respective modeled results. The calculated secondary impact results are presented in Table 5.1-31.

Table 5.1-31. Construction Air Quality Impact Results – Secondary Emissions from Precursors

Pollutant	Precursor	Modeled Precursor Emission Rate (tpy)	Modeled Secondary Impact Concentration (µg/m^3) [a]	Project Emissions (tpy)	Project Secondary Impact Concentration (µg/m^3)
24-Hour $PM_{2.5}$	NO_x	500	0.025	23.6	<0.01
	SO_2	500	0.077	0.23	<0.01
Annual $PM_{2.5}$	NO_x	500	0.001	23.6	<0.01
	SO_2	500	0.002	0.23	<0.01
8-Hour Ozone	NO_x	500	0.84	23.6	0.04
	VOC	500	0.06	9.47	<0.01

[a] The modeled secondary impacts were obtained from the Los Angeles County hypothetical source with a 10-m stack height.

The Project construction will not result in any direct emissions of ozone and, as seen in Table 5.1-31, the secondary impacts of ozone from its Project-emitted precursors of NO_x and VOC are 0.04 µg/m^3. This secondary ozone impact is well below the SIL of 1 ppb such that the Project would not cause or contribute to a violation of the NAAQS. As a result, no further analysis of ozone is necessary.

As can be seen in Table 5.1-32, potential 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. Imperial County and CEC will receive the cumulative analysis under separate cover.

Table 5.1-32. Construction Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maxima (NAAQS)	56.1	7.55	Yes
	Annual maximum	10.2	1.00	Yes
Ozone	8-hour	0.03	1.96	No
CO	1-hour maximum	116	2,000	No
	8-hour maximum	93.2	500	No
SO_2	1-hour maximum	0.31	7.86	No
	3-hour maximum	0.28	25.0	No
	24-hour maximum	0.15	5.00	No
	Annual maximum	0.11	1.00	No
PM_{10}	24-hour maximum	5.60	5.00	Yes
	Annual maximum	1.11	1.00	Yes
$PM_{2.5}$	5-year average of 24-hour yearly maxima (NAAQS)	1.00	1.20	No
	5-year average of annual concentrations (NAAQS)	0.22	0.20	Yes

Note:

-- = Not applicable and/or no standard

The Project's maximum modeled concentrations are compared to the CAAQS and NAAQS in Table 5.1-33. As shown, maximum combined impacts (modeled plus background) are less than all the CAAQS and NAAQS except for the PM_{10} CAAQS. 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. 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 Table 5.1-20, 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.

Table 5.1-33. Construction Air Quality Impact Results – Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	CAAQS (µg/m^3)	NAAQS	Exceeds Standard?
NO_2	1-hour maximum (CAAQS)	56.7	105	162	339	--	No
	5-year average of 1-hour yearly 98th percentiles (NAAQS)	54.7	65.2	120	--	188	No
	Annual maximum	10.2	17.4	27.6	57	100	No
CO	1-hour maximum (CAAQS and NAAQS)	116	5,266	5,382	23,000	40,000	No
	8-hour maximum (CAAQS and NAAQS)	116	3,549	3,665	10,000	10,000	No
SO_2	1-hour maximum (CAAQS and NAAQS)	0.31	22.5	22.8	655	196	No
	3-hour maximum (NAAQS)	0.28	22.5	22.8	--	1,300	No
	24-hour maximum (CAAQS and NAAQS)	0.15	7.10	7.25	105	365	No
	Annual maximum (NAAQS)	0.11	1.10	1.21	--	80.0	No
PM_{10}	24-hour maximum (CAAQS) [b]	5.60	241.3	247	50.0	--	Yes
	24-hour average high-sixth-high (NAAQS)	4.75	142	147	--	150	No
	Annual maximum (CAAQS) [b]	1.11	39.8	40.9	20.0	--	Yes
$PM_{2.5}$	5-year average of 24-hour yearly 98th percentiles (NAAQS)	0.86	21.0	21.9	--	35.0	No
	Annual maximum (CAAQS)	0.22	9.40	9.62	12.0	--	No
	5-year average of annual concentrations (NAAQS)	0.22	8.67	8.89	--	12.0	No

[a] Secondary standard.

[b] The PM_{10} CAAQS are not applicable as the area is designated as nonattainment.

Note:

-- = Not applicable and/or no standard

5.1.11 Laws, Ordinances, Regulations, and Statutes

Table 5.1-34 presents a summary of federal, state, and local air quality LORS deemed applicable to the Project. Specific LORS related to air quality and climate change are discussed in greater detail in Sections 5.1.11.1 and 5.1.11.2, respectively.

Table 5.1-34. Summary of LORS – Air Quality

LORS	Purpose	Regulating Agency	Project Conformance
Federal Regulations (EPA)			
CAA Amendments of 1990, 40 CFR Part 50	Establishes ambient air quality standards for criteria air pollutants.	EPA Region IX	The modeling analysis for the Project presented in Section 5.1.10 demonstrates the Project will not cause or contribute to a violation of the state or federal ambient air quality standards during even the worst-case operating profile, except for H_2S and 24-hour and annual $PM_{2.5}$. The Project will not exceed the H_2S CAAQS when considering only routine operations and treating H_2S as a nuisance with a 1-mile exclusion zone. Although the Project meets the NAAQS for 24-hour and annual $PM_{2.5}$, a cumulative impacts analysis will be performed to demonstrate compliance when considering the cumulative impact of nearby sources.
40 CFR Part 51 (NSR) (ICAPCD Rule 207)	Requires preconstruction review and permitting of new or modified stationary sources of air pollution to allow industrial growth without interfering with the attainment and maintenance of ambient air quality standards.	ICAPCD with EPA Region IX oversight	Requires NSR permitting for construction of specified stationary sources. NSR applies to pollutants for which ambient concentration levels are higher than the NAAQS. The NSR requirements are implemented at the local level with EPA oversight (ICAPCD Rule 207). An ATC and permit to operate (PTO) will be obtained from ICAPCD prior to construction of the Project. As a result, the compliance requirements of 40 CFR 51 will be met.
40 CFR Part 52 (PSD)	Allows new sources of air pollution to be constructed, or existing sources to be modified in areas classified as attainment, while preserving the existing ambient air quality levels, protecting public health and welfare, and protecting Class I Areas (e.g., national parks and wilderness areas).	ICAPCD with EPA Region IX oversight	The PSD requirements apply on a pollutant-specific basis to any project that is a new major stationary source or a major modification to an existing major stationary source. ICAPCD classifies an unlisted source (which is not in the specified 28 source categories) that emits or has the PTE 250 tpy of any pollutant regulated by the CAA as a major stationary source. For listed sources, the threshold is 100 tpy. NO_x, VOC, or SO_2 emissions from a modified major source are subject to PSD if the cumulative emission increases for either pollutant exceeds 40 tpy. ICAPCD Rule 207 additionally outlines a significant increase as 15 tpy of PM_{10}. In addition, a modification at a nonmajor source is subject to PSD if the modification itself would be considered a major source. In May 2010, EPA issued the GHG permitting rule officially known as the "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule" (GHG Tailoring Rule), in which EPA defined six GHG pollutants (collectively combined and measured as CO_2e) as NSR-regulated pollutants. Under the GHG Tailoring Rule, new projects that emit GHG pollutants above certain threshold levels would be subject to PSD permitting beginning in July 2011. However, in July 2014, the U.S. Supreme Court ruled that EPA could not regulate GHG emissions alone. As a result, new sources with a GHG PTE equal to or greater than 75,000 tpy of CO_2e are no longer required to obtain a PSD permit specifically for GHG emissions. If the new source would require a PSD permit as a result of criteria pollutant PTE, a BACT analysis to evaluate GHG emissions control would still be required. The Project is a geothermal-powered PGF and would not be considered one of the 28 listed source categories. Therefore, the emission rates were compared to the 250-tpy threshold. As shown in Section 5.1.7, the emission increases from the Project would not exceed the 250-tpy threshold. Therefore, the Project would not be subject to PSD.

LORS	Purpose	Regulating Agency	Project Conformance
40 CFR Part 60 Subpart IIII (NSPS) (ICAPCD Regulation XI)	Establishes national standards of performance for new or modified stationary compression ignition internal combustion engines.	ICAPCD with EPA Region IX Oversight	The Project will include four diesel-fired emergency generators and one diesel fire pump which are subject to operations, maintenance, and emissions requirements of this subpart. The Project's diesel engines will be operated and maintained as per the manufacturer specifications. The emergency generators will be Tier 4 compliant, meaning their emissions will not exceed any of the emission limitations of this subpart. The fire pump will be Tier 2 compliant and will be certified to emission rates that meet the requirements of this subpart.
40 CFR Part 70 (Title V) (ICAPCD Regulation IX)	CAA Title V Operating Permits Program.	ICAPCD with EPA Region IX Oversight	The Title V Operating Permits Program requires the issuance of operating permits that identify all applicable federal performance, operating, monitoring, recordkeeping, and reporting requirements. The requirements of 40 CFR Part 70 apply to facilities that are subject to NSPS requirements and are implemented at the local level through ICAPCD Regulation IX. According to Regulation IX, Rule 903, a facility would be required to submit a Title V application if the facility has a PTE greater than 100 tpy of any regulated air pollutant except GHGs or if the HAP PTE is greater or equal to 25 tpy for combined HAPs and 10 tpy for individual HAPs. A Title V application is only required for GHGs if the facility has a PTE greater than 100,000 tpy CO_2e. The Project will not exceed any Title V thresholds itself, excluding commissioning years. However, if the Project is later connected to the existing Applicant-owned geothermal plants to share geothermal fluid and steam, Title V applicability will be reassessed. All permitting will be conducted through ICAPCD and compliant with their rules and regulations.
40 CFR Part 64 (Compliance Assurance Monitoring [CAM] Rule)	Establishes onsite monitoring requirements for emission control systems.	ICAPCD with EPA Region IX Oversight	Requires facilities to monitor the operation and maintenance of emissions control systems and report any control system malfunctions to the appropriate regulatory agency. If an emission control system is not working properly, the CAM Rule also requires a facility to take action to correct the control system malfunction. The CAM Rule applies to emissions units with uncontrolled PTE levels greater than applicable major source thresholds. Emission control systems governed by Title V operating permits requiring continuous compliance determination methods are generally compliant with the CAM Rule. The only emission controls for the Project include H_2S, which is not a pollutant applicable to major source thresholds. Therefore, the unabated Project emissions presented in Section 5.1.7 would not exceed the major source thresholds and the CAM rule would not be applicable.
40 CFR Part 63 (HAPs, Maximum Available Control Technology [MACT])	Establishes national emission standards to limit emissions of HAPs or air pollutants identified by EPA as causing or contributing to the adverse health effects of air pollution but for which NAAQS have not been established from facilities in specific categories.	ICAPCD with EPA Region IX Oversight	Establishes emission standards to limit emissions of HAPs from specific source categories for major HAP sources. Sources subject to 40 CFR Part 63 requirements must either use the MACT, be exempted under 40 CFR Part 63, or comply with published emission limitations. Projects would be subject to the 40 CFR Part 63 requirements if the HAP PTE is greater or equal to 25 tpy for combined HAPs and 10 tpy for individual HAPs. As shown in Section 5.1.7, the Project would not exceed the major source thresholds for HAPs (10 tpy for any one pollutant or 25 tpy for all HAPs combined). Therefore, the Project would be less than the 40 CFR Part 63 applicability threshold.

LORS	Purpose	Regulating Agency	Project Conformance
State Regulations (CARB)			
California Health & Safety Code (CHSC), Section 41700	Prohibits emissions in quantities that adversely affect public health, safety, businesses, or property.	ICAPCD with CARB Oversight	The CEC Conditions of Certification and the ICAPCD ATC processes are developed to ensure that no adverse public health effects or public nuisances result from operation of the Project.
Senate Bill 32 – California Global Warming Solutions Act of 2016 (SB 32)	Aims to reduce carbon emissions within the state by approximately 40 percent from 1990 levels by the year 2030.	ICAPCD with CARB Oversight	Requires CARB to develop regulations to limit and reduce GHG emissions. As a geothermal-powered PGF, this Project will support the emission reduction goals of SB 32.
17 CCR, Article 5	Establishes GHG limitations, reporting requirements, and a Cap and Trade offsetting program.	CARB	CARB has promulgated a Cap and Trade regulation that limits or caps GHG emissions and requires subject facilities to acquire GHG allowances. The Project GHG emissions have been estimated, and the Project owner will report emissions and acquire allowances and offsets consistent with these regulations if required.
California Senate Bill 1368 – Emissions Performance Standards (SB 1368)	Limits long-term investments in baseload generation by the state's utilities to power plants that meet an emissions performance standard jointly established by the CEC and the California Public Utilities Commission (CPUC).	CEC with CARB Oversight	The Project is considered a baseload facility subject to this regulation with GHG emissions that satisfy this requirement, emitting 138 pounds CO_2 per megawatt-hour[9] compared to the threshold of 1,100 pounds CO_2 per megawatt-hour.
California Assembly Bill 617– Community Air Protection Plan (AB 617)	Establishes community air monitoring and emission reduction plans to reduce exposure in communities most impacted by air pollution.	ICAPCD with CARB Oversight	The Project is not located in a community identified in AB 617. The Project will comply with all applicable ICAPCD emissions reporting requirements and rules and regulations.

[9] Calculated as 46,619 tpy CO_2 x 2,000 pounds per ton / 77 MW-net / 8,760 hours per year.

LORS	Purpose	Regulating Agency	Project Conformance
Local Regulations (ICAPCD)			
Rule 201	Defines the types and permits required.	ICAPCD	An ATC and PTO will be obtained from ICAPCD prior to construction of the Project.
Rule 204	Outlines the information required for inclusion in a permit application.	ICAPCD	Requires permit applications to include sufficient information to allow ICAPCD's determination of compliance with applicable rules. The Project will include all required information from this Application for Certification (AFC) in the ICAPCD ATC/PTO application.
Rule 207	Establishes pre-construction review requirements for new or modified stationary sources.	ICAPCD	An ATC and PTO will be obtained from ICAPCD prior to construction of the Project.
Rule 208	Permits inspection of permitted sources by ICAPCD.	ICAPCD	The Project will be available for ICAPCD inspection upon notification.
Rule 400	Limits NO_X emissions from fuel burning equipment.	ICAPCD	The Project's emergency generators and fire pump emissions do not exceed the ICAPCD Rule 400 limit of 140 lbs/hr, as shown in Section 5.1.7.
Rule 400.3	Limits NO_X and CO emissions from fuel burning equipment.	ICAPCD	The Project's emergency generators will be Tier 4 compliant equipment with NO_X emission rates well below the ICAPCD Rule 400.3 limit of 90 ppm. The fire pump is not subject to this Rule as it will operate 50 hours per year or less for maintenance and testing or in an emergency situation to protect human life and public health.
Rule 401	Limits visible emissions.	ICAPCD	Rule 401 prohibits visible emissions other than water vapor as dark as or darker than Ringlemann No. 1 for periods greater than 3 minutes in any hour. Visible emissions from the Project would result from particulate emissions from the cooling tower and stationary internal combustion engines. All sources will be operated according to manufacturer specifications to minimize visibility impacts due to inadequate combustion and excess particulate emissions.
Rule 403	Establishes air contaminant maximum emission rates for particulate matter.	ICAPCD	The Project is exempt from this rule as it operates only emergency diesel generators and a fire pump as combustion sources. The power generation activities are steam-powered and are, therefore, not applicable combustion sources.
Rule 405	Limits sulfur compound emissions.	ICAPCD	Rule 405 limits sulfur compound emissions to no more than 0.2 percent by volume from any source and combusted diesel fuels must be less than 0.5 percent by weight. The primary Project sulfur compound emissions will be H_2S, which will be monitored through analytical testing of the NCG and cooling towers to confirm Rule 405 standards are not exceeded. All diesel fuel combusted at the Project will be ultra-low sulfur diesel with a sulfur content not to exceed 15 ppm by weight.
Rule 407	Prohibits public nuisances.	ICAPCD	The Project will obtain an ATC and PTO from ICAPCD which will confirm Project operations do not cause public nuisance.

LORS	Purpose	Regulating Agency	Project Conformance
Rule 800	Establishes fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will minimize fugitive dust emissions to the extent feasible. In addition, a Storm Water Pollution Prevention Plan will be developed to further minimize fugitive dust emissions during construction and operation.
Rule 801	Establishes construction and earthmoving fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible. The Project will also prepare and file a Dust Control Plan with ICAPCD, as required.
Rule 803	Establishes carry-out and track-out fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible.
Rule 804	Establishes open area fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible.
Rule 805	Establishes paved and unpaved roads fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible.
Regulation IX (Title V)	Implements the operating permit requirements of Title V of the CAA as amended in 1990.	ICAPCD	The Project will consult with ICAPCD regarding permit applicability and apply for a Title V air permit if required.
Rule 1001	Implements federal NESHAP provisions of 40 CFR Part 61.	ICAPCD	The Project is not subject to Rule 1001 as there are no applicable 40 CFR Part 61 subparts listed in Rule 1001, Section D.
Rule 1002	Implements CARB's Airborne Toxic Control Measures (ATCM) provisions.	ICAPCD and CARB	The Project will implement best management practices during construction, consistent with Section 5.1.7.2.2, which will comply with all applicable construction-related ATCM provisions. The Project operations will include stationary internal combustion engines which will be fired using ultra-low sulfur diesel with a sulfur content not to exceed 15 ppm by weight.
Rule 1003	Establishes cooling tower emissions limits and hexavalent chromium provisions.	ICAPCD	The Project will not dose cooling tower circulating water with chromium containing compounds. Additionally, analytical data of the cooling tower condensate will be collected, as required by this rule, to ensure chromium levels do not exceed Rule 1003 levels of 0.15 milligrams per liter. A cooling tower compliance plan will also be submitted to the ICAPCD, as required, to ensure compliance with this rule.
Regulation XI (NSPS)	Implements federal NSPS provisions of 40 CFR Part 60.	ICAPCD	The Project will comply with all applicable NSPS regulations, as stated in the 40 CFR Part 60 LORS entry above.

5.1.11.1 Specific LORS Discussion – Air Quality

5.1.11.1.1 Federal LORS

The EPA implements and enforces the requirements of many of the federal air quality laws. EPA has adopted the following stationary source regulatory programs in its effort to implement the requirements of the CAA, each of which are described below:

- New Source Performance Standards (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- PSD
- NSR
- Title V: Operating Permits Program

National Standards of Performance for New Stationary Sources–40 CFR Part 60, Subpart IIII. The NSPS program provisions limit the emissions of criteria pollutants from new or modified facilities in specific source categories. The applicability of these regulations depends on the equipment size or rating; material or fuel process rate; and/or the date of construction, or modification. Reconstructed sources can be affected by NSPS as well.

Subpart IIII establishes emission and operational limits of criteria pollutants for new stationary compression ignition engines. All stationary diesel engines installed and operated at the Project will be compliant with operational and emission provisions in Subpart IIII specific to their respective engine types.

National Emission Standards for Hazardous Air Pollutants–40 CFR Part 63. The NESHAP program provisions limit HAP emissions from existing major sources of HAP emissions in specific source categories. The NESHAP program also requires the application of MACT to any new or reconstructed major source of HAP emissions to minimize those emissions. Subpart ZZZZ will be applicable to the Project's stationary diesel combustion engines (fire pump and emergency generators). Subpart Q will not be applicable to the proposed cooling tower as chromium-based water treatment will not be used in its operations.

Prevention of Significant Deterioration Program–40 CFR Parts 51 and 52. The PSD program requires the review and permitting of new or modified major stationary sources of air pollution to prevent significant deterioration of ambient air quality. PSD applies only to pollutants for which ambient concentrations do not exceed the corresponding NAAQS. The PSD program allows new sources of air pollution to be constructed, and existing sources to be modified, while maintaining the existing ambient air quality levels in the Project region and protecting Class I areas from air quality degradation. The Project is not expected to trigger the PSD permitting requirements.

New Source Review–40 CFR Parts 51 and 52. The NSR program requires the review and permitting of new or modified major stationary sources of air pollution to allow industrial growth without interfering with the attainment of NAAQS. NSR applies to pollutants for which ambient concentrations exceed the corresponding NAAQS. The Project's air quality impact analysis complies with all applicable NSR provisions, as shown in Section 5.1.10.

Title V – Operating Permits Program–40 CFR Part 70. The Title V Operating Permits Program requires the issuance of operating permits that identify all applicable federal performance, operating, monitoring, recordkeeping, and reporting requirements. Title V applies to major facilities, acid rain facilities, subject solid waste incinerator facilities, and any facility listed by EPA as requiring a Title V permit. The proposed facility will not be subject to Title V permitting itself. However, if the proposed Project is later connected to the existing Applicant-owned geothermal plants to share geothermal fluid and steam, Title V applicability will be reassessed.

5.1.11.1.2 State LORS

CARB's jurisdiction and responsibilities fall into the following five areas: (1) implement the state's motor vehicle pollution control program; (2) administer and coordinate the state's air pollution research program; (3) adopt and update the CAAQS; (4) review the operations of the local air pollution control districts (APCDs) to ensure compliance with state laws; and (5) review and coordinate preparation of the State Implementation Plan (SIP). Some key programs which support the above responsibilities, as applicable to the Project, are described below.

Assembly Bill 617 – Community Air Protection Program. AB 617 establishes the Community Air Protection Program (CAPP) to focus on reducing exposure in communities most impacted by air pollution. The CAPP establishes community-wide air monitoring and emission reduction programs as well as provides funding to incentivize early actions to deploy cleaner technologies in the affected communities.

Air Toxic "Hot Spots" Act – California Health & Safety Code Sections 44300-44384. The Air Toxics "Hot Spots" Information and Assessment Act requires the development of a statewide inventory of TAC emissions from stationary sources. The program requires affected facilities to: (1) prepare an emissions inventory plan that identifies relevant TACs and sources of TAC emissions; (2) prepare an emissions inventory report quantifying TAC emissions; and (3) prepare an HRA, if necessary, to quantify the health risks to the exposed public. Facilities with significant health risks must notify the exposed population, and in some instances must implement risk management plans to reduce the associated health risks. The Project's compliance with this program is detailed in Section 5.9.

Public Nuisance – California Health & Safety Code Section 41700. Prohibits the discharge from a facility of air pollutants that cause injury, detriment, nuisance, or annoyance to the public, or which endanger the comfort, repose, health, or safety of the public, or that damage business or property.

Airborne Toxic Control Measure for Stationary Compression Ignition Engines – 17 CCR Section 93115. This ATCM is aimed at reducing DPM and criteria pollutant emissions from stationary diesel-fueled compression ignition engines through fuel requirements, operational restrictions, and emission limits. The ATCM applies to points of sale of stationary compression ignition engines for use in California except portable engines, engines for motive power, auxiliary engines on marine vessels, and agricultural wind machines.

5.1.11.1.3 Local LORS – ICAPCD

The ICAPCD is responsible for implementing regulations at the local level which minimize air emissions for purposes of complying with federal standards. Key regulations applicable to the Project are summarized below.

ICAPCD Regulation II – Permits. ICAPCD Regulation II establishes the basic framework for acquiring permits to construct and operate from the air district. The AFC will be the basis for the District's Determination of Compliance. A separate ATC application will be submitted to the ICAPCD. The ATC application, for the purposes of maintaining consistency with the AFC, will be similar in scope and detail, and will contain the required District permit application forms.

ICAPCD Regulation VIII – Fugitive Dust Rules. Regulation VIII implements multiple fugitive dust requirements to limit particulate emissions. The ATC application to be filed with the ICAPCD will comply with all required fugitive dust rules and requirements through implementation of the best management practices identified in Section 5.1.7.2.2.

ICAPCD Regulation IX – Federal Operating Permit Program. Regulation IX (Title V Permits) implements the federal operating permit program at the local District level. The ATC application to be filed with the ICAPCD will contain all the required application forms.

ICAPCD Regulation X – Air Toxic Control Measures. Regulation X (ATCM) incorporates by reference the provisions regarding air toxic emissions including federal NESHAPs, CARB ATCMs, and specific limits for cooling towers operations. The Project will comply with all ATCMs and other operational limitations.

ICAPCD Prohibitory or Source-Specific Rules. Relevant ICAPCD prohibitory or source-specific rules include the following:

- **Rule 400 – Fuel Burning Equipment:** Establishes limits for NO_X emissions from stationary sources. Rule 400 prohibits NO_X emissions of 140 pounds or greater per hour from stationary fuel burning equipment. Stationary fuel burning operations at the Project are not expected to exceed 140 pounds per hour of NO_X.
- **Rule 400.3 – Internal Combustion Engines:** Establishes emission limitations for NO_X and CO from internal combustion engines greater than 50 horsepower. Internal combustion emissions from the Project will not exceed the emission limitations in Rule 400.3(C).
- **Rule 401 – Opacity of Emissions:** Prohibits discharges to the atmosphere of any air contaminant other than water darker than No. 1 on the Ringlemann Chart or similar obstruction for a period greater than three minutes in any hour. Emissions from the Project are not expected to cause high opacity plumes other than water vapor discharge.
- **Rule 403 – General Limitations on the Discharge of Air Contaminants:** Establishes limits for air contaminant emissions for multiple operation types. Section (B)(2) is relevant to Project's proposed sources, as it limits air contaminant concentrations in standardized gas flows. The Project's proposed sources will not exceed the emission limitations for any air contaminant.
- **Rule 405 – Sulfur Compounds Emission Standards, Limitations, and Prohibitions:** Establishes limits for the sulfur emissions from all sources. Rule 405 limits the sulfur content of emissions to not exceed 0.2 percent by volume. The rule additionally specifies fuel sulfur content limitations of 0.5 percent by weight for fluid and solid fuels and emissions not to exceed 500 ppm by volume or 200 pounds per hour for fuel burning equipment. All diesel fuel combusted by the Project during construction and operations will be ultra-low sulfur diesel not to exceed 15 ppm sulfur.
- **Rule 407 – Nuisances:** Restricts discharges of air contaminants at any quantity that cause injury, detriment, nuisance, or annoyance to a considerable number of persons or the general public.

5.1.11.2 Specific LORS Discussion – Climate Change and Global Warming

State law defines GHGs to include the following: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6 (California Health and Safety Code Section 38505[g]). The most common GHG that results from human activity is CO_2, followed by CH_4 and N_2O. Key federal, state, and local legislative actions associated with GHG emissions and climate change are described below.

5.1.11.2.1 Federal Legislative Action

Executive Order 13423, signed by President George W. Bush on May 14, 2007, directed the EPA and Department of Transportation (DOT) to establish regulations to reduce GHG emissions from on-road and non-road motor vehicles and non-road engines by 2008. In 2009, the National Highway Traffic Safety Administration (NHTSA) finalized a rule regulating fuel efficiency and GHG emissions from cars and light-duty trucks for model year 2011 and further expanded the rule to model years 2012 through 2016 in 2010.

On December 19 2007, the EPA passed the Energy Independence and Security Act of 2007, that aims to reduce GHG emissions at a national level and strengthen the initiatives established by Executive Order 13423 (EPA 2007). The act's two key measures include the following: 1) increasing the supply of alternative fuel sources through mandatory Renewable Fuel Standards by requiring fuel producers to use at least 36 billion gallons of biofuel in 2022, and 2) establishing a target of 35 miles per gallon of fuel efficiency for a combined fleet of cars and light-duty trucks by model year 2020. The act also required the NHTSA to establish a fuel economy program for both medium and heavy-duty trucks and a fuel economy standard for work trucks.

On October 30, 2009, the EPA published the Mandatory Reporting Rule (codified in 40 CFR Part 98), that requires mandatory reporting of GHG emissions from large sources and suppliers in the U.S. (EPA 2023c). In general, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, facilities that inject CO_2 underground, users of electrical transmission and distribution equipment, and facilities that emit 25,000 MT or more per year of CO_2e emissions are required to submit annual reports to the EPA. Despite the Project's annual emissions exceeding 25,000 MT CO_2e per year, the Project does not include large stationary sources, supply operations, electrical transmission and distribution equipment containing more than 17,820 pounds of SF_6 and PFCs, or other covered processes; therefore, GHG mandatory reporting would not apply to the Project.

On December 7, 2009, the EPA Administrator signed two findings regarding GHGs in direct response to the U.S. Supreme Court's decision in *Massachusetts v. EPA* (No. 05-1120). The first finds that the current and projected concentrations of the six key well-mixed GHGs in the atmosphere (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) threaten the public health and welfare of current and future generations. The second finds that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare (EPA 2023b).

On June 3, 2010, the EPA promulgated the final GHG Tailoring Rule (75 Federal Register [FR] 31514). The GHG Tailoring Rule established clear applicability thresholds for stationary source emitters of GHGs under PSD and Title V regulations. In general, any new stationary source with GHG emissions of 100,000 tpy CO_2e or greater became subject to both PSD review and the Title V program. On June 23, 2014, the U.S. Supreme Court issued a decision prohibiting the EPA from considering GHG emissions when determining PSD review and Title V program applicability (*Utility Air Regulatory Group v. EPA*, No. 12-z1146). Per the U.S. Supreme Court decision, the EPA may continue to require GHG emission limitations in PSD and Title V permits, if PSD review and the Title V program are triggered by emissions of criteria pollutants (EPA 2023e). Because no stationary sources of this magnitude are associated with the Project, PSD and Title V regulations would not apply to the Project.

In 2010, the Obama Administration issued a memorandum directing the DOT, Department of Energy (DOE), EPA, and NHTSA to develop additional standards regarding fuel efficiency and GHG emissions reduction, clean fuels, and advanced vehicle infrastructure. In response to this memorandum, EPA and NHTSA proposed coordinated federal GHG and fuel economy standards for light-duty vehicles for model years 2017 through 2025. The proposed standards are projected to achieve 163 grams per mile of CO_2 in model year 2025, on an industry fleetwide average basis. This standard is equivalent to 54.5 miles per gallon if achieved solely through fuel efficiency. The final rule was adopted in 2012 for model years 2017 through 2021 only. On April 2, 2018, EPA determined that the proposed standards for model years 2022 through 2025 were not appropriate and required revision (EPA 2017b). In response, NHTSA is currently drafting language to further tighten fuel economy standards by increasing fuel efficiency by 8 percent annually for model years 2024 through 2026 and increasing the estimated fleetwide average by 12 miles per gallon for model year 2026, relative to model year 2021 (NHTSA 2021). Additionally, in December 2021, EPA revised the light-duty vehicle emissions standards for model years 2023 through 2026 to provide for more stringent emission reductions. These emission reductions would result in an estimated reduction of three billion tons of GHG emissions through 2050 (EPA 2023a).

In addition to the cars and light-duty truck regulations described above, the EPA and NHTSA developed fuel economy and GHG standards for medium- and heavy-duty trucks for model years 2014 through 2018 in 2011 (EPA & NHTSA 2023). The standards for CO_2 emissions and fuel consumption are specific to three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. This regulatory program is expected to reduce GHG emissions and fuel consumption for the affected vehicles by 6 to 23 percent over the 2010 baselines.

In August 2016, EPA and NHTSA adopted the phase two program related to the fuel economy and GHG standards for medium- and heavy-duty trucks. The phase two program will apply to model years 2018 through 2027 vehicles with certain trailers and model years 2021 through 2027 for semi-trucks, large pickup trucks, vans, and all types and sizes of buses and work trucks. The final standards are expected to lower CO_2 emissions by approximately 1.1 billion MT and reduce oil consumption by up to 2 billion barrels over the lifetime of the vehicles sold under the program (EPA & NHTSA 2023). Note that this and other mobile source-oriented regulatory policies described in this section will have little effect on the Project as fuel economy requirements are most often implemented at the manufacturer level rather than by the end-user. However, availability of more fuel-efficient vehicles would have the positive effect of lowering criteria pollutant and GHG emissions associated with the Project's vehicle trips.

5.1.11.2.2 State Legislative Action

In response to the transportation sector accounting for more than half of California's CO_2 emissions, AB 1493 was passed in July 2002, requiring CARB to establish GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined to be vehicles that are primarily used for non-commercial personal transportation within the state. Specifically, AB 1493 required that CARB set GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. CARB adopted the standards in September 2004 which will reduce GHG emissions by approximately 22 percent in the near-term (2009 through 2012), as compared to emissions from the 2002 fleet, and by approximately 30 percent in the mid-term (2013 through 2016).

The framework for regulating GHG emissions in California falls under the implementation requirements of the Global Warming Solutions Act of 2006 (referred to as AB 32), which was signed into law by the California State Legislature in 2006 and updated by Senate Bill 32 (SB 32). AB 32 required CARB to design and implement emission limits, regulations, and other measures such that statewide GHG emissions are reduced in a technologically feasible and cost-effective manner to 1990 levels by 2020. The statewide 2020 emissions limit was 431 million MT CO_2e; CO_2 emissions account for approximately 90 percent of this value (CARB 2023c). In 2016, SB 32 provided a post-2020 GHG emission reduction target of 40 percent below 1990 levels by 2030.

Issued on January 18, 2007, Executive Order S-1-07 sets a declining Low Carbon Fuel Standard for GHG emissions measured in CO_2e grams per unit of fuel energy sold in California. The goal of the Low Carbon Fuel Standard is to reduce the carbon intensity of California passenger vehicle fuels by at least 10 percent by 2020. Carbon intensity is a measurement of the amount of GHG emissions in the lifecycle of a fuel, including extraction/feedstock production, processing, transportation, and final consumption, per unit of energy delivered. The regulation, adopted by CARB in April 2009, is expected to increase the production of biofuels, including those from alternative sources, such as algae, wood, and agricultural waste. The Low Carbon Fuel Standard was amended in 2011, 2015, and most recently in 2018, all of which strengthen the implementation and carbon benchmarks through 2030 to help achieve the statewide emission targets of AB 32 and SB 32.

In December 2007, CARB adopted the first regulation pursuant to AB 32, which requires mandatory reporting of GHG emissions from large emitting facilities, suppliers, and electricity providers. This regulation was significantly revised to better align with EPA's Mandatory Reporting Rule; the revised regulation became effective January 1, 2013. The current regulation, which includes additional minor revisions to accommodate the Cap and Trade Program, became effective January 1, 2015 (CARB 2023e). CARB adopted the California Cap and Trade Program on October 20, 2011. Under the California Cap and Trade Program, covered entities have had an obligation to secure GHG allowances and/or offsets since 2013; fuel suppliers have had an obligation to secure GHG allowances and/or offsets since 2015 (CARB 2023b). The California Cap and Trade Program will be in effect until at least December 31, 2030, through the 2017 adoption of AB 398 (Climate Action Reserve 2017). As a geothermal electricity generation source with emissions greater than 10,000 MT CO_2e per year, the Project would be required to report emissions from non-exempt sources[10] under 17 CCR Section 95101(a)(1)(B)(7). The facility would not, however, be subject to the Cap and Trade Program as the facility's fugitive emissions from geothermal steam processing do not count towards a covered compliance obligation, as defined in 17 CCR Section 95852.2(b)(1), making the facility's covered emissions (i.e., insulating gas) less than 25,000 MT CO_2e per year.

[10] Stationary combustion emissions from the Project's diesel fire water pump and diesel-fired emergency generators are not subject to GHG emissions reporting per the exclusions provided in 17 CCR Section 95101(f).

In 2008, SB 375 was signed into law, addressing GHG emissions associated with the transportation sector through regional transportation and sustainability plans. Specifically, SB 375 requires CARB to adopt regional GHG reduction targets for the automobile and light-duty truck sector for 2020 and 2035. Once adopted, regional metropolitan planning organizations (MPOs) are responsible for preparing a Sustainable Communities Strategy, to be included within their Regional Transportation Plan, which forecasts a regional development pattern that will achieve, if feasible, SB 375's GHG reduction targets. If a Sustainable Communities Strategy is unable to achieve the GHG reduction target, an MPO must prepare an Alternative Planning Strategy demonstrating how the GHG reduction target would be achieved through alternative development patterns, infrastructure, or additional transportation measures or policies.

The first Climate Change Scoping Plan, a plan required by AB 32, was also approved in 2008. This plan, which is to be updated at least every five years, includes a suite of policies to help the State achieve its GHG targets, in large part leveraging existing programs whose primary goal is to reduce harmful air pollution. The currently operative plan is the 2022 Scoping Plan, which assesses progress towards achieving the SB 32 2030 target and lays out a path to achieve carbon neutrality by 2045 (CARB 2023a).

In January 2012, CARB approved the Advanced Clean Cars program, a new emissions-control program for model years 2015 through 2025. The program presents a single coordinated package that includes elements for emission reductions of GHGs and smog- and soot-causing pollutants, promotion of clean cars, and providing fuels for clean cars. To improve air quality, CARB has implemented new emission standards to reduce smog-forming emissions beginning with 2015 model year vehicles. It is estimated that cars will emit 75 percent less smog-forming pollution in 2025 than the average new car sold in 2012. To reduce GHG emissions, CARB, in conjunction with the EPA and NHTSA, has adopted new vehicle GHG standards for model years 2017 through 2025; the new standards are estimated to reduce GHG emissions by 40 percent in 2025, as compared to model year 2012. The Zero Emissions Vehicle (ZEV) program will act as the focused technology of the Advanced Clean Cars program by requiring manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles for model years 2018 through 2025. The Advanced Clean Cars II Program (ACCII) was approved in 2022, which developed rules and standards for vehicle model years 2026 through 2035. The ACCII will rapidly scale down emissions of light-duty passenger cars, pickup trucks, and sport utility vehicles by amending the Zero-Emission Vehicle Regulation to require an increasing number of zero-emission vehicles and amending the Low-Emission Vehicle Regulation to increase the stringency of standards for gasoline cars and heavier passenger trucks (CARB 2022a).

Executive Order B-16-12 was also issued in 2012 and directs state entities under the Governor's direction and control to support and facilitate the development and distribution of ZEVs. This Executive Order also sets a long-term target of reaching 1.5 million ZEVs on California's roadways by 2025, effectively reducing GHG emissions from the transportation sector to 80 percent below 1990 levels by 2050. In furtherance of this Executive Order, the Governor convened an Interagency Working Group on ZEVs that has published multiple reports regarding the progress made on the penetration of ZEVs in the statewide vehicle fleet.

In 2015, SB 350 was signed into law, establishing new clean energy, clean air, and GHG reduction goals for 2030 and beyond. Specifically, SB 350 increases California's renewable electricity procurement goal from 33 percent by 2020 to 50 percent by 2030. SB 100, signed into law in 2018, requires California utilities to reach 50 percent renewable resources by December 31, 2026, and 60 percent by December 31, 2030. SB 100 also establishes policy that renewable energy resources and other zero-carbon resources supply 100 percent of all retail sales of electricity by December 31, 2045. As a renewable energy resource, the Project will support achievement of these goals.

AB 1236, signed into law in October 2015, requires a city, county, or city and county to approve applications for the installation of electric vehicle charging stations. The intent of AB 1236 is to implement the timely and cost-effective installation of electric vehicle charging stations, each of which meets specified statewide standards.

Under AB 32, CARB, as the principal state agency in charge of regulating sources of GHG emissions in California, has been tasked with adopting regulations for the reduction of GHG emissions. The effects of this proposed Project are evaluated based both upon the quantity of GHG emissions and whether the Project implements reduction strategies identified in the 2022 Scoping Plan.

5.1.11.2.3 Local Legislative Action

In 2021, Imperial County published the Imperial County Regional Climate Action Plan. This regional climate action plan helps establish goals for sustainability and GHG reductions across Imperial County to meet the goals established at the state level in AB 32, SB 32, and Executive Orders B-30-15 and S-3-05. To meet these targets, the plan calls for multiple sectors to implement reduction measures such as carpool, increased efficiency of new building construction, and the encouragement to procure energy from geothermal sources. The proposed Project will serve to directly support this Regional Climate Action Plan by providing another source of geothermal electricity for use in the region (Ascent 2021).

5.1.12 Agency Jurisdiction and Contacts

Table 5.1-35 presents the contact information for each agency contacted during the development of this Project which may exercise jurisdiction of air quality issues and permitting.

Table 5.1-35. Agency Contacts for Air Quality

Air Quality Concern	Agency	Contact
Public exposure to air pollutants	CEC	Mr. Joseph Hughes Air Resources Supervisor 1 California Energy Commission 715 P Street Sacramento, CA 95814 Phone: 916-980-7951 E-mail: Joseph.Hughes@energy.ca.gov
	ICAPCD	Jesus Ramirez APC Division Manager 150 S. 9th Street El Centro, CA 92243-2839 Phone: 442-265-1800 E-mail: jesusramirez@co.imperial.ca.us

5.1.13 Permit Requirements and Schedules

An ATC application and Dust Control Plan is required in accordance with the ICAPCD's rules. The ATC application submitted to the ICAPCD will consist of the Project Description, Air Quality, and Public Health sections of the AFC and appropriate Appendices, plus the ICAPCD application forms. In addition, the ICAPCD Title V forms will also be included in the application package, if required. The Dust Control Plan will consist of the Project Description and Air Quality sections of this AFC in addition to a summary of the Project conformance plan for ICAPCD Rule 801, Section F.

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5.9 Public Health

This section describes and evaluates the potential public health effects from construction and operation of the Black Rock Geothermal Project (BRGP or "Project"). Section 5.9.1 provides an overview of the Project. Section 5.9.2 describes the affected environment. Section 5.9.3 presents the analysis of public health effects of construction and operation of the power plant and associated facilities. Section 5.9.4 discusses potential other public health concerns associated with the Project, including hazardous materials, odors, electromagnetic fields (EMFs), and Legionella from cooling tower operations. Section 5.9.5 discusses potential cumulative health effects. Section 5.9.6 presents proposed mitigation measures to avoid or minimize any adverse impacts. Section 5.9.7 presents applicable laws, ordinances, regulations, and standards (LORS). Section 5.9.8 provides agency contacts. Section 5.9.9 presents permit requirements and schedules. Section 5.9.10 contains references cited or consulted in preparing this section. Appendices 5.9A and 5.9B contain supporting data for the operational and construction public health analyses, respectively.

5.9.1 Project Overview as it Relates to Public Health

The Project consists of a proposed geothermal Resource Production Facility (RPF), a Power Generation Facility (PGF), and associated facilities in Imperial County, California. Figure 1-1 shows the Project regionally, and Figure 1-4 depicts the Project area, including proposed gen-tie line and pipelines. The Project will be owned by Black Rock Geothermal LLC (Project owner or "Applicant"), along with the associated gen-tie). A complete description of the Project is presented in Section 2.

Air will be the dominant pathway for public exposure to chemical substances released by Project construction and operation. Airborne construction-related emissions will consist primarily of combustion by-products from onsite, diesel-fired construction equipment and vehicles. Airborne operation-related emissions will consist primarily of combustion by-products from four diesel-fired emergency generators and one diesel-fired water pump and those generated by the processing, condensing, and venting of geothermal fluid from the RPF. Potential health risks from public exposure to combustion emissions and geothermal fluid-related emissions were assessed by conducting a health risk assessment (HRA). Although exposure will occur almost entirely by direct inhalation, additional pathways were conservatively included in the HRA. The HRA was conducted in accordance with guidance established by the California Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (CARB).

Emissions with established California Ambient Air Quality Standards (CAAQS) or National Ambient Air Quality Standards (NAAQS), including nitrogen oxides (NO_x), carbon monoxide (CO), and fine particulate matter (PM_{10}/$PM_{2.5}$), are addressed in Section 5.1. However, some discussion of the potential health risks associated with these substances, in addition to the potential health risks associated with all toxic air contaminants (TACs), is presented in this section. Human health risks associated with the potential accidental release of stored acutely hazardous materials, such as ammonia, are discussed in Section 5.5.

5.9.2 Affected Environment

The Project site is located in a region of the Imperial Valley, southeast of the Salton Sea, characterized mostly by agriculture and geothermal power production, with more recent additions of utility scale solar power plants. The area surrounding the plant site is primarily agricultural land. The Imperial Valley is the southwest part of the Colorado Desert that merges northwestward into the Coachella Valley near the northern shore of the Salton Sea.

The PGF will be located on approximately 55 acres (plant site) of a 160-acre parcel (APN 020-110-008) (Township 11 South, Range 13 East, Section 33, NE 1/4 of SW 1/4) within the unincorporated area of Imperial County, California. The production wells will be located on the plant site and the injection wells will be located offsite. The plant site will include onsite and offsite laydown/parking areas, potentially a construction camp, and borrow pits. These construction laydown/parking areas, construction camp, and borrow pits also will be used by other Applicant-owned projects currently before the California Energy Commission (CEC) (the Elmore North Geothermal Project and Morton Bay Geothermal Project). The plant site is located northwest of the existing Vulcan Power Plant and the Hoch (Del Ranch) Power Plant.

The Project site is bounded by McKendry Road to the north, Boyle Road to the east, and Severe Road to the west. The town of Niland is approximately eight miles northeast of the plant site, and the town of Calipatria is approximately six miles southeast of the plant site. The Red Hill Marina County Park is approximately two miles east of the PGF. The Sonny Bono Wildlife Refuge Headquarters is approximately 0.75 mile northeast of the PGF. The Alamo River is approximately three miles southwest of the plant site, and the New River is approximately five miles southwest of the plant site.

Sensitive receptors are defined as groups of individuals that may be more susceptible to health risks due to chemical exposure. Schools, both public and private, day care facilities, convalescent homes, and hospitals are of particular concern. Although residences and worker receptors are not technically defined as "sensitive receptors" by OEHHA, they were conservatively analyzed as sensitive receptors in this analysis due to the lack of sensitive receptors near the facility, The nearby receptors of these types are included in Appendix 5.9A. The Project site is situated in Imperial County census tract 010102.1092, which has a population value of zero individuals per the 2020 census update (USCB 2022). Appendix 5.9A delineates data on the population by census tract within a six-mile radius of the Project site, as well as a comprehensive list of sensitive receptors analyzed in the HRA.

Statewide air quality and health risk data presented by CARB in the 2013 Almanac of Emissions and Air Quality (Almanac) show that, over the period from the mid-1990s through 2009, the average concentrations for the most prominent TACs have been substantially reduced; the associated statewide health risks are similarly showing a steady downward trend (CARB 2014). This statewide trend is expected to have occurred within the Salton Sea Air Basin (SSAB) as well. The Applicant is not aware of any recent (within the last five years) public health studies related to respiratory illnesses, cancers or related diseases concerning the local area within a six-mile radius of the Project site.

5.9.3 Environmental Analysis

The analysis of potential environmental effects on public health from construction and operation of the Project is presented in the following sections.

5.9.3.1 Risk Types

Three different types of risk were evaluated for this Project: cancer risk, non-cancer chronic risk, and non-cancer acute risk. Each of these risk types is described below.

Cancer Risk. Cancer risk is the probability or chance of contracting cancer over a human life span (assumed to be 30 years, which is equivalent to the projected Project lifetime). Carcinogens are not assumed to have a threshold below which there would be no human health effect. In other words, any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure, the lower the cancer risk (i.e., a linear, no threshold model). Under various state and local regulations, an incremental cancer risk greater than 10 in one million due to a project is considered to be a significant effect on public health. For example, the 10 in one million risk level is used by the Air Toxics Hot Spots (Assembly Bill [AB] 2588) program and Proposition 65 as the public notification level for air toxic emissions from existing sources. When evaluating cancer risks from a single facility, it is important to note that the overall lifetime risk of developing cancer for the average male in the United States is approximately 43 in 100, or 430,000 per million, and about 41 in 100, or 420,000 per million for the average female (NIH 2022). In California, from 2015 to 2019, the cancer incidence rates were 4,883 per million for males and 4,233 per million for females. The cancer death rates in California in the same period (2015-2019) were 1,775 per million for males, and 1,287 per million for females (NIH 2023).

An incremental lifetime cancer risk of 1×10^{-6} (one in a million) is typically used as a screening threshold of significance for potential exposure to carcinogenic substances in air. The incremental cancer risk level of one in one million, which has historically been judged to be an acceptable risk, originates from efforts by the Food and Drug Administration to use quantitative HRA for regulating carcinogens in food additives in light of the zero tolerance provision of the Delany Amendment (Hutt 1985). The associated dose, known as a “virtually safe dose,” has become a standard used by many policy makers and the lay public for evaluating cancer risks. However, a study of regulatory actions pertaining to carcinogens found that an acceptable risk level can often be determined on a case-by-case basis. This analysis of 132 regulatory decisions found that regulatory action was not taken to control estimated risks below one in a million, which are called *de minimis* risks. *De minimis* risks are historically considered risks of no regulatory concern. Chemical exposures with risks above 4×10^{-3} (four in ten thousand), called *de manifestis* risks, were consistently regulated. *De manifestis* risks are typically risks of regulatory concern. The risks falling between these two extremes were regulated in some cases, but not in others (Travis, et al. 1987).

Since risks at low levels of exposure cannot be quantified directly by either animal or epidemiological studies, mathematical models have estimated such risks by extrapolation from high to low doses. This modeling procedure is designed to provide a highly conservative estimate of cancer risks based on the most sensitive species of laboratory animal for extrapolation to humans. In other words, the assumption is that humans are as sensitive as the most sensitive animal species. Therefore, the true risk is not likely to be higher than risks estimated using unit risk factors and is most likely lower, and could even be zero.

Non-Cancer Risk. Non-cancer health effects can be classified as either chronic or acute. In determining the potential health risks of non-cancerous air toxics, it is assumed there is a dose of the chemical of concern below which there would be no effect on human health. The air concentration corresponding to this dose is called the Reference Exposure Level (REL). Non-cancer health risks are measured in terms of a hazard quotient, which is the calculated exposure of each contaminant divided by its REL. Hazard quotients for pollutants affecting the same target organ are typically summed with the resulting totals expressed as hazard indices for each organ system. A hazard index (HI) of less than 1.0 is considered to be an insignificant health risk. RELs used in the HI calculations of this HRA were those published in December 2022 by CARB/OEHHA (CARB 2022a).

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure, caused by chemicals accumulating in the body. Because chemical accumulation to toxic levels typically occurs slowly, symptoms of chronic effects usually do not appear until long after exposure commences. The lowest no effect chronic exposure level for a non-carcinogenic air toxic is the chronic REL. Below this threshold, the body is capable of eliminating or detoxifying the chemical rapidly enough to prevent its accumulation. Chronic hazard quotients are derived from modeling annual TAC emissions.

Acute toxicity is defined as adverse health effects caused by a brief chemical exposure of no more than 24 hours. For most chemicals, the air concentration required to produce acute effects is higher than the level required to produce chronic effects because the exposure duration is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all hazard quotients are typically summed to calculate the acute HI. One-hour average concentrations are divided by the acute RELs to obtain a hazard quotient for health effects caused by relatively high, short-term exposures to air toxics.

5.9.3.2 Significance Criteria

The Imperial County Air Pollution Control District (ICAPCD) does not have established health risk thresholds; therefore, this analysis has conservatively relied on the risk thresholds for the neighboring South Coast Air Quality Management District (SCAQMD), as presented in Table 5.9-1. These are consistent with the notification levels established by CARB for Imperial County under AB 2588 (CARB 2021).

Table 5.9-1. Health Risk Significance Threshold Levels for SCAQMD

Category	Risk Threshold	Source
Facility-wide	Incremental Cancer Risk $\geq 10 \times 10^{-6}$ Acute/Chronic HI $\geq$ 1.0 Cancer Burden $\geq$ 0.5	SCAQMD CEQA Handbook (SCAQMD 2019)

Note:

CEQA = California Environmental Quality Act

5.9.3.3 TAC Emissions

The following sections present the TAC emissions used in the HRA.

5.9.3.3.1 Project Operation

Environmental consequences associated with the operation of the Project are potential human exposure to chemical substances emitted to the air. The human health risks potentially associated with these chemical substances were evaluated in an HRA. The chemical substances potentially emitted to the air by the Project are listed in Table 5.9-2; details of the Project's emission sources are provided in Section 5.1.

Table 5.9-2. TACs Potentially Emitted by the Project

TACs [a, b]		
Lead	Zinc (Zn)	Acrolein
Hydrogen sulfide (H_2S) [c]	Diesel Particulate Matter (DPM)	Benzene
Ammonia (NH_3)	Radon	Ethylbenzene
Arsenic (As)	Copper (Cu)	Formaldehyde
Mercury (Hg)	Manganese (Mn)	Naphthalene
Aluminum (Al)	Nickel (Ni)	Propylene
Antimony (Sb)	Selenium (Se)	Toluene
Barium (Ba)	Silica (Si)	Xylene
Beryllium (Be)	Silver (Ag)	Carbon dioxide (CO_2)
Cadmium (Cd)	Vanadium (V)	Methane (CH_4)
Chromium (Cr)	PAHs (excluding naphthalene)	Nitrous oxide (N_2O)
Cobalt (Co)	Acetaldehyde	
	1,3-Butadiene	

[a] Although the Project is also expected to emit argon, hydrogen, lithium, nitrogen, and strontium, they are not classified as TACs by OEHHA and CARB and have not been included in this analysis.

[b] Although CO_2, CH_4, and N_2O are classified as greenhouse gases, OEHHA and CARB have assigned health risk values for them.

[c] Refer to Section 5.9.4.1.2 for a discussion of H_2S.

Note:

PAHs = polynuclear (or polycyclic) aromatic hydrocarbons

Table 5.9-3 presents the hourly TAC emissions from operation of the facility processes, per modeled emissions source. These hourly estimates for geothermal facility processes are based only on routine operation of the cooling tower, sparger, and biological oxidation box. This is because emissions resulting from the production testing unit (PTU), rock muffler (RM), and cooling tower/sparger/biological oxidation box bypass operations are limited, infrequent, and not to occur in the same hour as routine operation of the cooling tower, sparger, and biological oxidation box. The annual TAC emission estimates for geothermal facility processes are based on a routine production year (i.e., a year in which once-per-lifetime commissioning activities are not occurring). Table 5.9-4 presents annual TAC emissions from a routine operating year including startups, shutdowns, and emission controls downtime, whereas Table 5.9-5 presents annual TAC emissions from a routine operating year assuming no facility downtime and 8,760 hours of continuous power generation. Combustion emissions from the diesel fire water pump and four diesel-fired emergency generators are included in both scenarios.

Emissions resulting from operation and maintenance (O&M) activities, including construction vehicles and equipment, were not included in the HRA. These vehicles and equipment operate in limited capacity throughout the year in varying locations throughout or near the plant site. As such, they are not expected to significantly contribute to long-term health risk impacts.

Detailed emissions calculations are provided in Appendix 5.1A, per the methodology described in Section 5.1. A description of each modeled emissions source is also included in Section 5.1.

Table 5.9-3. Operational Hourly TAC Emissions Estimates

	Hourly Emissions (lbs/hr) per Emissions Source [a]			
Pollutant	Fire Pump	2.7 MW Generator	3.49 MW Generator [b]	CT [c]
Lead	--	--	--	1.03E-07
NH_3	--	2.77E-01	3.37E-01	1.97E+01
As	--	--	--	5.91E-06
Hg	--	--	--	3.08E-05
Benzene	7.46E-04	3.74E-03	4.69E-03	7.63E-02
Toluene	3.27E-04	1.35E-03	1.70E-03	4.34E-03
Ethylbenzene	--	--	--	8.02E-04
Xylenes	2.28E-04	9.30E-04	1.17E-03	7.97E-04
1,3-Butadiene	3.13E-05	--	--	--
Al	--	--	--	2.06E-06
Sb	--	--	--	1.65E-07
Ba	--	--	--	3.07E-06
Be	--	--	--	2.06E-08
Co	--	--	--	2.06E-08
Cd	--	--	--	4.11E-08
Total Chromium	--	--	--	1.03E-07
Cu	--	--	--	6.17E-08
V	--	--	--	1.03E-07
Mn	--	--	--	1.22E-05
Ni	--	--	--	2.34E-07
Se	--	--	--	2.35E-06
Si	--	--	--	1.03E-04
Ag	--	--	--	1.03E-07
Zn	--	--	--	1.52E-05
DPM	5.72E-02	1.79E-01	2.31E-01	--
Formaldehyde	9.44E-04	3.80E-04	4.77E-04	--
PAHs (unspeciated, excluding naphthalene)	--	--	--	--
Naphthalene	6.78E-05	6.26E-04	7.86E-04	--
Acetaldehyde	6.14E-04	1.21E-04	1.52E-04	--
Acrolein	7.40E-05	3.80E-05	4.77E-05	--

Pollutant	Hourly Emissions (lbs/hr) per Emissions Source [a] Fire Pump	2.7 MW Generator	3.49 MW Generator [b]	CT [c]
Propylene	2.06E-03	1.34E-02	1.69E-02	--
Radon [d]	--	--	--	1.32E-04
Acenaphthylene	4.05E-06	4.45E-05	5.58E-05	--
Acenaphthene	1.14E-06	2.26E-05	2.83E-05	--
Fluorene	2.34E-05	6.17E-05	7.74E-05	--
Phenanthrene	2.35E-05	1.97E-04	2.47E-04	--
Anthracene	1.50E-06	5.93E-06	7.44E-06	--
Fluoranthene	6.09E-06	1.94E-05	2.44E-05	--
Pyrene	3.82E-06	1.79E-05	2.24E-05	--
Benz(a)anthracene	1.34E-06	3.00E-06	3.76E-06	--
Chrysene	2.82E-07	7.37E-06	9.26E-06	--
Benzo(b)fluoranthene	7.93E-08	5.35E-06	6.72E-06	--
Benzo(k)fluoranthene	1.24E-07	1.05E-06	1.32E-06	--
Benzo(a)pyrene	1.50E-07	1.24E-06	1.55E-06	--
Indeno(1,2,3-cd)pyrene	3.00E-07	2.00E-06	2.50E-06	--
Dibenz(a,h)anthracene	4.66E-07	1.67E-06	2.09E-06	--
Benzo(g,h,l)perylene	3.91E-07	2.68E-06	3.36E-06	--
CO_2	1.30E+02	3.93E+03	4.93E+03	1.50E+03
CH_4	5.29E-03	1.59E-01	2.00E-01	5.78E+00
N_2O	1.06E-03	3.19E-02	4.00E-02	--

[a] Although speciated emissions are presented for the fire pump and generators, only DPM (as a surrogate) and NH_3 (where applicable) were modeled.

[b] The Project includes a total of three 3.49 MW generators.

[c] Emissions are per each of the seven cooling tower cells.

[d] Radon emissions presented in units of curies per hour.

Notes:

-- = Pollutant not emitted by source

CT = Cooling Tower, Sparger, and Biological Oxidation Box

lbs/hr = pound(s) per hour

MW = megawatt(s)

Table 5.9-4. Operational Annual TAC Emissions Estimates – Routine Operating Year Including Startups, Shutdowns, and Emission Controls Downtime

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a] Fire Pump	2.7 MW Generator	3.49 MW Generator [b]	PTU	RM	CT [c]
Lead	--	--	--	--	--	8.03E-04
NH_3	--	1.39E+01	1.69E+01	1.99E+02	1.46E+03	1.54E+05
As	--	--	--	1.54E-02	1.13E-01	4.61E-02
Hg	--	--	--	7.60E-01	5.59E+00	2.41E-01

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a] Fire Pump	2.7 MW Generator	3.49 MW Generator [b]	PTU	RM	CT [c]
Benzene	3.73E-02	1.87E-01	2.35E-01	4.31E+01	3.17E+02	5.90E+02
Toluene	1.64E-02	6.77E-02	8.50E-02	2.43E+00	1.79E+01	3.36E+01
Ethylbenzene	--	--	--	4.29E-01	3.15E+00	6.20E+00
Xylenes	1.14E-02	4.65E-02	5.84E-02	4.01E-01	2.95E+00	6.17E+00
1,3-Butadiene	1.56E-03	--	--	--	--	--
Al	--	--	--	--	--	1.61E-02
Sb	--	--	--	--	--	1.29E-03
Ba	--	--	--	--	--	2.40E-02
Be	--	--	--	--	--	1.61E-04
Co	--	--	--	--	--	1.61E-04
Cd	--	--	--	--	--	3.21E-04
Total Chromium	--	--	--	--	--	8.03E-04
Cu	--	--	--	--	--	4.82E-04
V	--	--	--	--	--	8.03E-04
Mn	--	--	--	--	--	9.51E-02
Ni	--	--	--	--	--	1.83E-03
Se	--	--	--	--	--	1.84E-02
Si	--	--	--	--	--	8.03E-01
Ag	--	--	--	--	--	8.03E-04
Zn	--	--	--	--	--	1.19E-01
DPM	2.86E+00	8.93E+00	1.15E+01	--	--	--
Formaldehyde	4.72E-02	1.90E-02	2.39E-02	--	--	--
PAHs (unspeciated, excluding naphthalene)	--	--	--	--	--	--
Naphthalene	3.39E-03	3.13E-02	3.93E-02	--	--	--
Acetaldehyde	3.07E-02	6.07E-03	7.62E-03	--	--	--
Acrolein	3.70E-03	1.90E-03	2.38E-03	--	--	--
Propylene	1.03E-01	6.72E-01	8.44E-01	--	--	--
Radon [d]	--	--	--	7.44E-02	5.47E-01	1.02E+00
Acenaphthylene	2.02E-04	2.22E-03	2.79E-03	--	--	--
Acenaphthene	5.68E-05	1.13E-03	1.42E-03	--	--	--
Fluorene	1.17E-03	3.08E-03	3.87E-03	--	--	--
Phenanthrene	1.18E-03	9.83E-03	1.23E-02	--	--	--
Anthracene	7.48E-05	2.96E-04	3.72E-04	--	--	--
Fluoranthene	3.04E-04	9.71E-04	1.22E-03	--	--	--
Pyrene	1.91E-04	8.94E-04	1.12E-03	--	--	--
Benz(a)anthracene	6.72E-05	1.50E-04	1.88E-04	--	--	--
Chrysene	1.41E-05	3.69E-04	4.63E-04	--	--	--
Benzo(b)fluoranthene	3.96E-06	2.67E-04	3.36E-04	--	--	--

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a] Fire Pump	2.7 MW Generator	3.49 MW Generator [b]	PTU	RM	CT [c]
Benzo(k)fluoranthene	6.20E-06	5.25E-05	6.59E-05	--	--	--
Benzo(a)pyrene	7.52E-06	6.19E-05	7.77E-05	--	--	--
Indeno(1,2,3-cd)pyrene	1.50E-05	9.98E-05	1.25E-04	--	--	--
Dibenz(a,h)anthracene	2.33E-05	8.34E-05	1.05E-04	--	--	--
Benzo(g,h,l)perylene	1.96E-05	1.34E-04	1.68E-04	--	--	--
CO_2	6.52E+03	1.96E+05	2.47E+05	8.46E+05	6.22E+06	1.16E+07
CH_4	2.65E-01	7.97E+00	1.00E+01	3.27E+03	2.40E+04	4.47E+04
N_2O	5.29E-02	1.59E+00	2.00E+00	--	--	--

[a] Although speciated emissions are presented for the fire pump and generators, only DPM (as a surrogate) and NH_3 (where applicable) were modeled.

[b] The Project includes a total of three 3.49 MW generators.

[c] Emissions are per each of the seven cooling tower cells.

[d] Radon emissions presented in units of curies per year.

Notes:

-- = Pollutant not emitted by source

lbs/yr = pound(s) per year

Table 5.9-5. Operational Annual TAC Emissions Estimates – Routine Operating Year Assuming No Facility Downtime and 8,760 Hours of Continuous Power Generation

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a] Fire Pump	2.7 MW Generator	3.49 MW Generator [b]	PTU [c]	RM [c]	CT [d]
Lead	--	--	--	--	--	9.01E-04
NH_3	--	1.39E+01	1.69E+01	--	--	1.73E+05
As	--	--	--	--	--	5.17E-02
Hg	--	--	--	--	--	2.70E-01
Benzene	3.73E-02	1.87E-01	2.35E-01	--	--	6.68E+02
Toluene	1.64E-02	6.77E-02	8.50E-02	--	--	3.80E+01
Ethylbenzene	--	--	--	--	--	7.02E+00
Xylenes	1.14E-02	4.65E-02	5.84E-02	--	--	6.98E+00
1,3-Butadiene	1.56E-03	--	--	--	--	--
Al	--	--	--	--	--	1.80E-02
Sb	--	--	--	--	--	1.44E-03
Ba	--	--	--	--	--	2.69E-02
Be	--	--	--	--	--	1.80E-04
Co	--	--	--	--	--	1.80E-04
Cd	--	--	--	--	--	3.60E-04
Total Chromium	--	--	--	--	--	9.01E-04
Cu	--	--	--	--	--	5.40E-04

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a] Fire Pump	2.7 MW Generator	3.49 MW Generator [b]	PTU [c]	RM [c]	CT [d]
V	--	--	--	--	--	9.01E-04
Mn	--	--	--	--	--	1.07E-01
Ni	--	--	--	--	--	2.05E-03
Se	--	--	--	--	--	2.06E-02
Si	--	--	--	--	--	9.01E-01
Ag	--	--	--	--	--	9.01E-04
Zn	--	--	--	--	--	1.33E-01
DPM	2.86E+00	8.93E+00	1.15E+01	--	--	--
Formaldehyde	4.72E-02	1.90E-02	2.39E-02	--	--	--
PAHs (unspeciated, excluding naphthalene)	--	--	--	--	--	--
Naphthalene	3.39E-03	3.13E-02	3.93E-02	--	--	--
Acetaldehyde	3.07E-02	6.07E-03	7.62E-03	--	--	--
Acrolein	3.70E-03	1.90E-03	2.38E-03	--	--	--
Propylene	1.03E-01	6.72E-01	8.44E-01	--	--	--
Radon [e]	--	--	--	--	--	1.15E+00
Acenaphthylene	2.02E-04	2.22E-03	2.79E-03	--	--	--
Acenaphthene	5.68E-05	1.13E-03	1.42E-03	--	--	--
Fluorene	1.17E-03	3.08E-03	3.87E-03	--	--	--
Phenanthrene	1.18E-03	9.83E-03	1.23E-02	--	--	--
Anthracene	7.48E-05	2.96E-04	3.72E-04	--	--	--
Fluoranthene	3.04E-04	9.71E-04	1.22E-03	--	--	--
Pyrene	1.91E-04	8.94E-04	1.12E-03	--	--	--
Benz(a)anthracene	6.72E-05	1.50E-04	1.88E-04	--	--	--
Chrysene	1.41E-05	3.69E-04	4.63E-04	--	--	--
Benzo(b)fluoranthene	3.96E-06	2.67E-04	3.36E-04	--	--	--
Benzo(k)fluoranthene	6.20E-06	5.25E-05	6.59E-05	--	--	--
Benzo(a)pyrene	7.52E-06	6.19E-05	7.77E-05	--	--	--
Indeno(1,2,3-cd)pyrene	1.50E-05	9.98E-05	1.25E-04	--	--	--
Dibenz(a,h)anthracene	2.33E-05	8.34E-05	1.05E-04	--	--	--
Benzo(g,h,l)perylene	1.96E-05	1.34E-04	1.68E-04	--	--	--
CO_2	6.52E+03	1.96E+05	2.47E+05	--	--	1.31E+07
CH_4	2.65E-01	7.97E+00	1.00E+01	--	--	5.06E+04
N_2O	5.29E-02	1.59E+00	2.00E+00	--	--	--

[a] Although speciated emissions are presented for the fire pump and generators, only DPM (as a surrogate) and NH_3 (where applicable) were modeled.

[b] The Project includes a total of three 3.49 MW generators.

[c] The PTU and RM do not operate during this emissions scenario; as a result, emissions are reported as zero.

[d] Emissions are per each of the seven cooling tower cells.

[e] Radon emissions presented in units of curies per year.

Notes:

-- = Pollutant not emitted by source

Criteria pollutant emissions from Project operation were shown in Section 5.1 to comply with the NAAQS and CAAQS. The Project will also include emissions control technologies necessary to meet the criteria pollutant emission standards specified in ICAPCD's rules. Offsets will not be required because the Project will not be a major source under the ICAPCD's New Source Review (NSR) rule. The NAAQS and CAAQS are intended to protect the general public with a wide margin of safety. Therefore, the Project's criteria pollutant emissions are not anticipated to have a significant effect on public health.

5.9.3.3.2 Project Construction

The construction phase of the Project is expected to take approximately 29 months, with a few months on both ends for equipment delivery and demobilization (followed by several months of startup and commissioning). During this time, strict construction practices that incorporate safety and compliance with applicable LORS will be followed (see Section 5.9.6). In addition, mitigation measures to reduce criteria pollutant emissions from construction activities will be implemented, as described in Section 5.1.

The primary air toxic pollutant of concern associated with construction activities is DPM generated during movement of onsite diesel-fueled construction equipment and vehicles. The total DPM exhaust emissions from construction activities, calculated in Appendix 5.1D per methodology presented in Section 5.1, were averaged over the 29-month construction period and spatially distributed in the area associated with the construction of the Project. These modeled emission rates are presented in Table 5.9-6.[1]

Table 5.9-6. Construction TAC Emissions Estimates

Pollutant	Exhaust Emissions Total (tons/Project)	Annualized (tpy) [a]	Per Emissions Source (lbs/yr) [b]
DPM	0.45	0.19	0.93

[a] Annualized emissions were calculated by averaging the total emissions over a 29-month construction period.

[b] The model includes 396 construction point sources.

Note:

tpy = ton(s) per year

5.9.3.4 Air Toxics Exposure Assessment Methodology

5.9.3.4.1 Project Operation

Emissions of toxic pollutants potentially associated with operations of the Project were estimated using emission factors approved by CARB and the U.S. Environmental Protection Agency (EPA) or representative analytical data from other geothermal power plants in the area, as detailed in Section 5.1 and Appendix 5.1A. Concentrations of these pollutants in air potentially associated with the Project were estimated using the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) dispersion modeling program, consistent with Section 5.1 methodology. Modeling allows the estimation of both short-term and long-term average concentrations in air for use in an HRA, accounting for site-specific terrain and meteorological conditions.

Health Risk Characterization. Health risks potentially associated with concentrations of carcinogenic air pollutants were calculated as estimated incremental lifetime cancer risks. The incremental lifetime cancer risk for a pollutant is estimated based on the concentration in air, breathing rates of the exposed person, inhalation cancer potency, oral slope factor, frequency and duration of exposure at the receptor, and age sensitivity factor.

Evaluation of potential non-cancer health risks from exposure to short-term and long-term concentrations in the air was performed by comparing modeled concentrations in air with the RELs. An REL is a

[1] Note that hourly emissions estimates were not required as there is no short-term health risk associated with exposure to DPM.

concentration in the air at or below which no adverse health effects are anticipated. RELs are based on the most sensitive adverse effects reported in the medical and toxicological literature. Potential non-cancer effects were evaluated by calculating a ratio of the modeled concentration in the air and the REL to develop the hazard quotient.

Health Risk Modeling Software. Risk characterization from toxics emitted by the facility was carried out according to the procedures specified by OEHHA guidance for both carcinogenic and non-carcinogenic risks (OEHHA 2015), as summarized above. As recommended by the 2015 OEHHA Guidance, a Tier 1 assessment was performed. The Tier 1 assessment is the most conservative of the four tier assessment methodologies identified in the OEHHA guidance and uses a standard point-estimate approach with standard OEHHA assumptions.

Residential and sensitive cancer risks were evaluated using the 30-year continuous exposure duration scenario and worker cancer risk was evaluated using the 25-year exposure duration (eight hours per day starting at age 16 years old), as recommended in the OEHHA guidance (OEHHA 2015). Based on the OEHHA guidance, the derived (adjusted) method in HARP2 was used for the cancer risk evaluation, which uses the 95th percentile breathing rate from the third trimester to two years and the 80th percentile inhalation rate from two years to 70 years for residential cancer risk assessments (CARB 2015). The 30-year and 25-year exposure durations for residential and commercial/industrial receptors, respectively, are obtained from the OEHHA guidance (OEHHA 2015).

The exposure pathways included for each risk scenario in this HRA are specified in Table . The dose-risk assessment values and RELs used to characterize health risks associated with modeled concentrations in the air, as well as from other pathways, were obtained from the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (CARB 2022a).

Table 5.9-7. Summary of HARP2 Exposure Pathways

Risk Analysis	Model Exposure Pathways	Intake Rate Percentile
Acute	Inhalation	Not applicable
Non-cancer Chronic	Inhalation Soil Ingestion Dermal Absorption Mother's Milk Homegrown Produce Beef/Dairy (Farming) Pig/Chicken/Egg (Farming)	Not applicable
Cancer	Inhalation Soil Ingestion Dermal Absorption Mother's Milk Homegrown Produce Beef/Dairy (Farming) Pig/Chicken/Egg (Farming)	Risk Management Plan (RMP) Using the Derived Method

Health Risk Impact Locations. Health risks were evaluated for a hypothetical point of maximum impact (PMI) located at the receptor with the highest impact. The hypothetical PMI is an individual assumed to be located at the PMI location, where the highest concentrations of air pollutants associated with the Project emissions are predicted to occur, based on the air dispersion modeling. This location was assumed to be equivalent to a residential receptor exposed for the maximum Project lifetime of 30 years. Human health risks associated with emissions from the Project are unlikely to be higher at any other location than at the location of the PMI. If there is no significant effect associated with concentrations in air at the PMI location, it is unlikely that there would be significant effects in any location in the vicinity of the Project. The highest offsite concentration location represents the PMI.

Health risks were also evaluated at the maximally exposed individual resident (MEIR), maximally exposed individual worker (MEIW), and maximally exposed sensitive receptor locations. These locations correspond to the location of a residence, industrial/commercial business, and sensitive receptor, respectively, with the highest health risk impact. A list of the nearby sensitive receptors, including residences, is included in Appendix 5.9A. It was conservatively assumed that most receptors within the receptor grid could represent a worker location.

Cancer Burden. To evaluate population risk, regulatory agencies have used the cancer burden as a method to account for the number of incremental cancer cases that could potentially occur in a population. The population burden can be calculated by multiplying the cancer risk at a census block centroid multiplied by the number of people who live in the census block, and summing the cancer cases across the zone of impact. A census block is defined as the smallest entity for which the Census Bureau collects and tabulates decennial census information; it is bounded on all sides by visible and non-visible features shown on Census Bureau maps. A centroid is defined as the central location within a specified geographic area.

Cancer burden is calculated on the basis of OEHHA (70-year) risks and is independent of how many people move in or out of the vicinity of an individual facility. The number of cancer cases is considered independent of the number of people exposed, within some lower limits of exposed population size, and the length of exposure (within reason). For example, if 10,000 people are exposed to a carcinogen at a concentration with a 1×10^{-5} cancer risk for a lifetime, the cancer burden is 0.1, and if 100,000 people are exposed to a 1×10^{-5} risk, the cancer burden is 1.0.

There are different methods that can be used as a measure of population burden. Another potential measure of population burden is based upon the number of individuals residing within a 1×10^{-6}, 1×10^{-5}, and/or 1×10^{-4} isopleth. The approach used for this Project is based on this method using the 1×10^{-6} isopleth distance and the estimated population values within that established radius. Appendix 5.9A presents the data assumptions used to calculate cancer burden for the Project.

5.9.3.4.2 Project Construction

Although construction-related emissions are considered temporary and localized, resulting in no long-term effects to the public, a screening HRA was conservatively conducted to estimate potential health risks associated with public exposure to DPM during the Project construction. The construction HRA estimated the rolling cancer risks for each 29-month period[2] during a 30-year exposure duration (starting with exposure during the third trimester), aligned with the expected construction duration, at the PMI, MEIR, MEIW, and maximally exposed sensitive receptor. The incremental cancer risks were estimated using the following:

- Equations 5.4.1.1 and 8.2.4A from the Air Toxic Hot Spots Guidance Manual for Preparation of Health Risk Assessments (OEHHA 2015) for residential exposure
- Equations 5.4.1.2A, 5.4.1.2B, and 8.2.4B from the Air Toxic Hot Spots Guidance Manual for Preparation of Health Risk Assessments (OEHHA 2015) for worker exposure
- The maximum annual ground-level concentrations used to estimate risk were determined through dispersion modeling with AERMOD
- The AERMOD modeling approach followed that used to prepare the criteria pollutant modeling analysis described in Section 5.1, except that the receptor grid included census and sensitive receptors (see Appendix 5.1B for the AERMOD setup)
- The construction emission estimates modeled are presented in Table 5.9-6, and were developed per the methodology provided in Section 5.1

[2] Although Project construction is expected to last only 29 months, a rolling 3-year (i.e., 36-month) period was conservatively used for determining cancer risks.

Chronic risks were also estimated for the PMI, MEIR, MEIW, and maximally exposed sensitive receptor, based on the same emission rates and ground-level concentrations described above. To calculate chronic risk, as characterized by an HI, the maximum annual ground-level concentration was divided by the DPM REL of 5 $\mu g/m^3$ (CARB 2022a).

5.9.3.5 Air Toxics Exposure Assessment Results

5.9.3.5.1 Project Operation

Estimates of the incremental lifetime cancer risk and non-cancer HIs associated with operational-related concentrations in air for the PMI, MEIR, MEIW, and maximally exposed sensitive receptor are presented in Table 5.9-8 for comparison to the SCAQMD's CEQA significance thresholds.[3] The results presented reflect the worst-case estimates of the two operational year scenarios previously described in Section 5.9.3.3.1. The locations associated with these impacts are presented in Figure 5.9-1.

As shown, predicted facility-wide impacts are below the cancer risk threshold of 10 in one million at all locations, including the PMI. These facility-wide cancer risks are less than significant given the PMI does not constitute a location that would present a potential for long-term exposure as it is typically located along the Project fence line. As described previously, human health risks associated with operational emissions from the Project are unlikely to be higher at any location other than that of the PMI. In fact, human health risks at locations other than that of the PMI are often significantly lower, as evidenced by the risks at the MEIR and maximally exposed sensitive receptor. Furthermore, incremental lifetime cancer risks higher than one in one million may or may not be of concern, depending upon several factors. These include the conservatism of assumptions used in risk estimation, size of the potentially exposed population, and toxicity of the risk-driving chemicals. Additionally, as described in Section 5.9.6, the diesel fire water pump, diesel-fired emergency generators, and cooling tower will be equipped with emission control technologies to minimize TAC emissions where feasible.

The facility-wide chronic and acute risk impacts are below the HI threshold of 1.0 at all locations. Therefore, the predicted health risks associated with Project operation are less than significant.

Table 5.9-8. Operation HRA Summary – Project

Receptor Type	Receptor #	UTM E (m)	UTM N (m)	Cancer Risk (per million)	Chronic HI	Acute HI
PMI	54 [a] 2,277 [b]	628,375.53 [a] 627,725.00 [b]	3,670,628.05 [a] 3,671,075.00 [b]	9.9	0.30	0.69
MEIR	5,612 [a, b]	629,090.70 [a, b]	3,671,844.15 [a, b]	0.25	0.01	0.27
MEIW	54 [a] 2,277 [b]	628,375.53 [a] 627,725.00 [b]	3,670,628.05 [a] 3,671,075.00 [b]	0.70	0.30	0.69
Maximally Exposed Sensitive Receptor	5,612 [a, b]	629,090.70 [a, b]	3,671,844.15 [a, b]	0.25	0.01	0.27

[a] Receptor number and coordinates associated with cancer and chronic analyses.

[b] Receptor number and coordinates associated with acute analyses.

Notes:

E = Easting

m = meter(s)

N = Northing

UTM = Universal Transverse Mercator

[3] ICAPCD does not have its own established significance thresholds for health risk impacts.

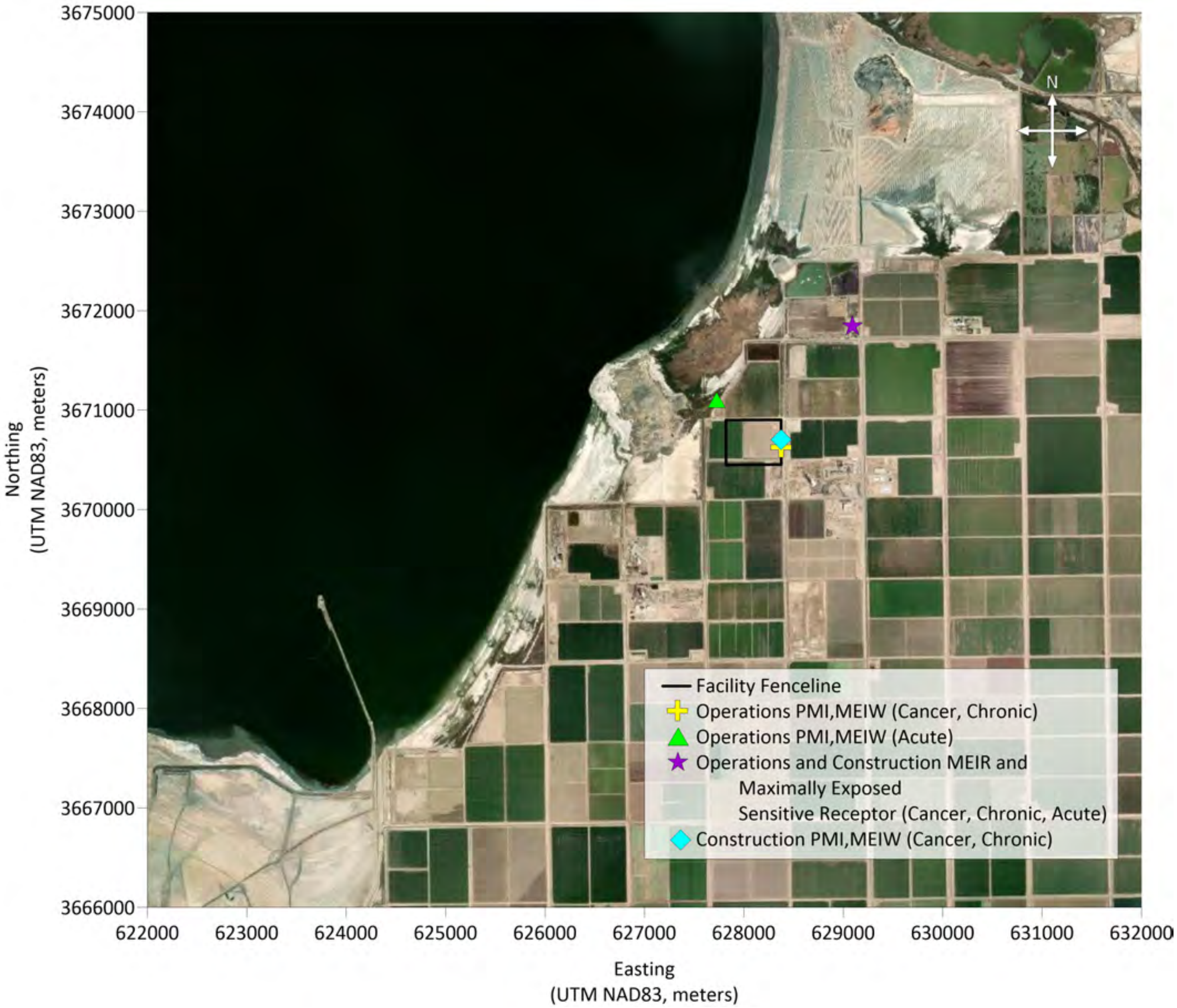

Figure 5.9-1
Facility Heath Risk Assessment Results Locations
Black Rock Geothermal Project
Imperial County, California

Jacobs

As described previously, human health risks associated with operational emissions from the Project are unlikely to be higher at any location other than that of the PMI. Therefore, the cancer risk for all individuals exposed to the Project's emissions would be lower (and in most cases, substantially lower) than 5.4 in one million. This is further supported by the estimated cancer burden of less than 0.001, which indicates that emissions from the Project would not be associated with any significant increase in cancer cases in the previously defined population. In addition, the cancer burden is less than the SCAQMD's significance threshold value of 0.5. As stated previously, the methods used in this calculation considerably overstate the potential cancer burden, further suggesting that Project emissions are unlikely to represent a significant public health effect in terms of cancer risk.

Detailed risk and hazard values provided in the HARP input and output files are included with this submission on compact disc and summarized in Appendix 5.9A.

5.9.3.5.2 Project Construction

Estimates of the facility-wide incremental lifetime cancer risk and chronic HI associated with construction-related concentrations in air for the PMI, MEIR, MEIW, and maximally exposed sensitive receptor are presented in Table 5.9-9, with locations presented in Figure 5.9-1. These risks are below the SCAQMD's CEQA significance thresholds of 10 in one million and one, respectively, with the exception of the PMI.[4] The construction period will be a finite duration, during which no long-term exposure is expected to occur at the PMI; therefore, it is not considered applicable for comparison to SCAQMD's CEQA significance thresholds. Therefore, predicted impacts associated with the finite construction activities are less than significant.

Table 5.9-9. Construction HRA Summary – Project

Receptor Type	UTM E (m)	UTM N (m)	Cancer Risk (per million)	Chronic HI	Acute HI
PMI	628,375.13	3,6707,02.92	25.3	0.02	--
MEIR	629,090.70	3,671,844.15	1.68	0.001	--
MEIW	628,375.13	3,6707,02.92	0.58	0.02	--
Maximally Exposed Sensitive Receptor	629,090.70	3,671,844.15	1.68	0.001	--

Note:
-- = Acute risk not estimated for construction activities

A cancer burden analysis was not performed for the construction phase of the Project as it is a temporary phase and will occur for no longer than 29 months. This duration is far less than the 70-year exposure period assumed for a cancer burden analysis. Therefore, it is assumed Project construction would have negligible impacts on cancer burden in the area.

Detailed risk and hazard values are provided in Appendix 5.9B and the air modeling input and output files are included with this submission on compact disc.

5.9.4 Other Public Health Concerns

5.9.4.1.1 Hazardous Materials

Hazardous materials may be used and stored at the Project site. The hazardous materials stored in significant quantities on-site and descriptions of their uses are presented in Section 5.5. Use of chemicals at the Project site will be in accordance with standard practices for storage and management of hazardous materials. Normal use of hazardous materials, therefore, will not pose significant risk to public health.

[4] ICAPCD does not have its own established significance thresholds for health risk impacts.

While mitigation measures will be in place to prevent releases, accidental releases that migrate off-site could result in potential effects to the public.

The California Accidental Release Prevention (CalARP) Program regulations and Code of Federal Regulations (CFR), Title 40, Part 68 under the Clean Air Act (CAA) establish emergency response planning requirements for acutely hazardous materials. These regulations require preparation of an RMP, which is a comprehensive program to identify hazards and predict the areas that may be affected by a release of a program-listed hazardous material. The Project will not be subject to these regulations because it is not expected to use any RMP-listed materials in quantities above the applicability thresholds.

5.9.4.1.2 Operational Odors

Project operation will result in emissions of hydrogen sulfide (H_2S), which is a known odorous compound. Specifically, the 1-hour H_2S CAAQS was adopted in 1969 for purposes of odor control and not for protection of public and environmental health. People have experienced eye irritation at concentrations of 50 parts per million (ppm). which is much greater than the CAAQS of 0.03 ppm (CARB 2022b). Therefore, temporary exceedances of the H_2S CAAQS would not result in elevated exposure of the public and environment to H_2S health-related risks but would be characterized as a nuisance and an odor impact.

As a result of the Project's location and nature of the standard, H_2S was analyzed similarly to nuisance related impacts caused by odorous compounds. Specifically, the 1-hour H_2S analysis follows the ICAPCD's CEQA Air Quality Handbook methodology for assessing odor-related impacts. Section 4.6(b) of the CEQA Air Quality Handbook states that H_2S emissions may result in impacts that would not be significant except as a nuisance if less than a specific screening distance from the point of release. Table 3 of the CEQA Air Quality Handbook further provides the respective screening distances for odor impacts, which is one mile for all facility types (ICAPCD 2017).

As shown in Figure 5.9-2, the nearest residences and sensitive receptors are located greater than one mile from the Project location. Given the location of these receptors and the ICAPCD CEQA guidelines, the 1-hour H_2S modeling analysis does not include any receptors within 1 mile of the Project. Any impacts within this one mile radius would be considered to be nuisance-related and not expose any nearby residences or sensitive receptors to any significant risk beyond potential nuisances.

The results of the dispersion modeling analysis, as presented in Section 5.1, indicate that the estimated routine operational impacts from the Project will be below the H_2S CAAQS at all receptors greater than one mile from the Project. Non-routine operations of the Project, including commissioning, startup, shutdown, and downtime of emission controls, would occur infrequently throughout the year and were not included in the modeled scenarios. These operational conditions would occur for unknown durations randomly during the year and are difficult to predict with any reasonable certainty given their strong dependence on meteorological conditions. The potential for these infrequent events to occur during meteorological conditions hindering dispersion is expected to be minimal.

The acute risk threshold for H_2S 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 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 H_2S. Therefore, this HRA does not analyze H_2S in the presented HARP2 modeling and associated health risk results.

5.9.4.1.3 EMF Exposure

EMFs occur independently of one another as electric and magnetic fields at the 60-hertz (Hz) frequency used in gen-tie lines, and both are created by electric charges. Electric fields exist when these charges are not moving. Magnetic fields are created when the electric charges are moving. The magnitude of both electric and magnetic fields falls off rapidly as the distance from the source increases (proportional to the inverse of the square of distance).

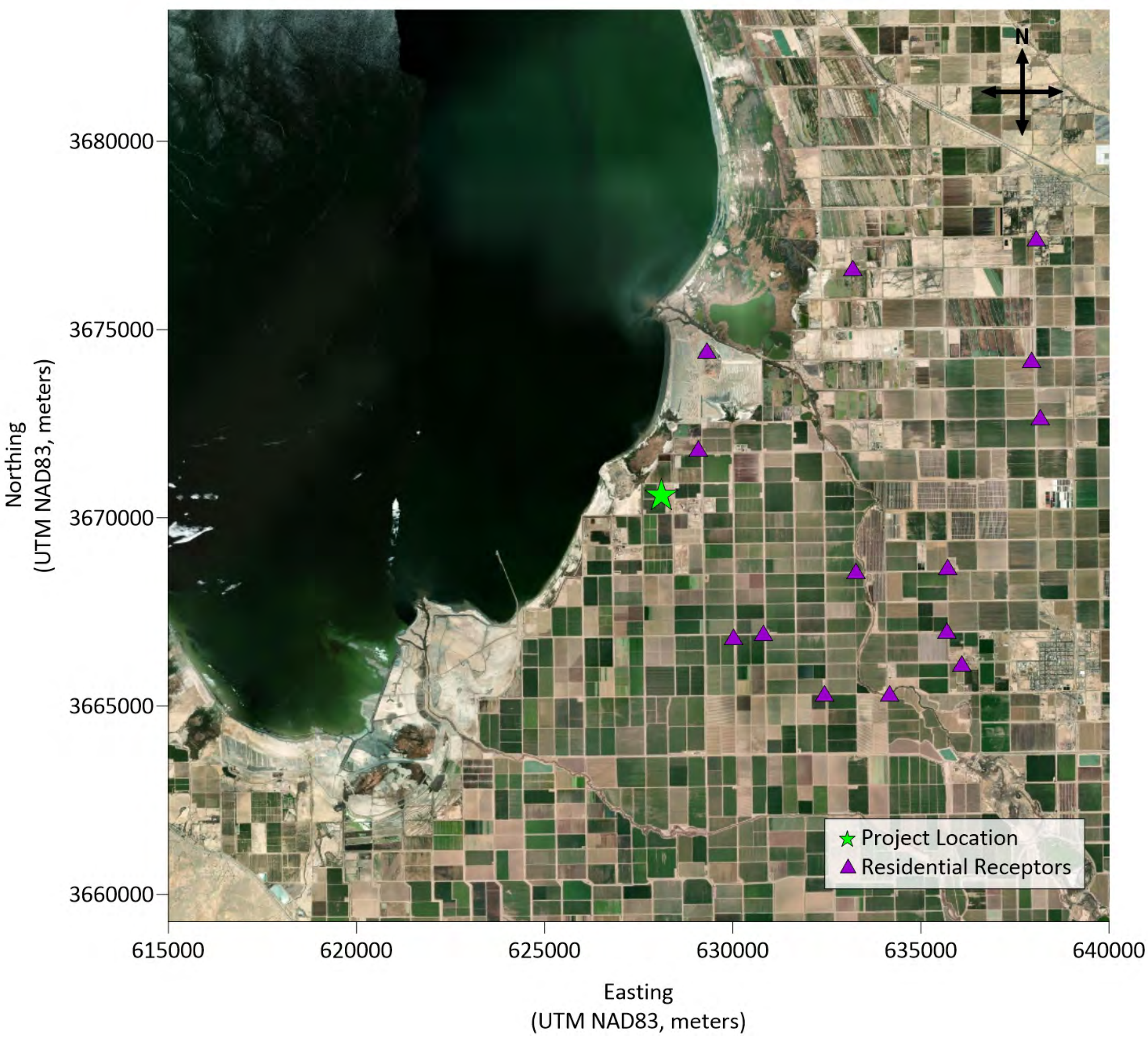

Figure 5.9-2
Nearby Residential Receptors
Black Rock Geothermal Project
Imperial County, California

Jacobs

Because the electric transmission lines do not typically travel through residential areas and based on findings of the National Institute of Environmental Health Sciences (NIEHS) (1999), EMF exposures are not expected to result in a significant effect on public health. The NIEHS report to the U.S. Congress found that “the probability that EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm” (NIEHS 1999).

Additional details regarding EMFs are included in Section 3.5.

5.9.4.1.4 Legionella

In addition to being a source of potential TACs, the possibility exists for bacterial growth to occur in cooling tower cells, including Legionella. Legionella is a bacterium that is ubiquitous in natural aquatic environments and is also widely distributed in man-made water systems. It is the principal cause of legionellosis, otherwise known as Legionnaires’ disease, which is similar to pneumonia. Transmission to people results mainly from inhalation or aspiration of aerosolized contaminated water. Untreated or inadequately treated cooling systems, such as industrial cooling tower cells and building heating, ventilating, and air conditioning systems, have been correlated with outbreaks of legionellosis.

Legionella can grow symbiotically with other bacteria and can infect protozoan hosts. This provides Legionella with protection from adverse environmental conditions, including making it more resistant to water treatment with chlorine, biocides, and other disinfectants. Thus, if not properly maintained, cooling water systems and their components can amplify and disseminate aerosols containing Legionella.

The State of California regulates recycled water for use in cooling tower cells in California Code of Regulations (CCR), Title 22, Section 60303. This section requires that, in order to protect workers and the public who may come into contact with cooling tower mists, chlorine or another biocide must be used to treat the cooling system water to minimize the growth of Legionella and other micro-organisms. This regulation does not apply to the Project since it does not intend to use reclaimed water for cooling purposes.

EPA published an extensive review of Legionella in a human health criteria document (EPA 1999). In this document, the EPA noted that Legionella may propagate in biofilms (collections of micro-organisms surrounded by slime they secrete, attached to either inert or living surfaces) and that aerosol-generating systems such as cooling tower cells can aid in the transmission of Legionella from water to air. EPA has inadequate quantitative data on the infectivity of Legionella in humans to prepare a dose-response evaluation. Therefore, sufficient information is not available to support a quantitative characterization of the threshold infective dose of Legionella. Thus, the presence of even small numbers of Legionella bacteria presents a risk – however small – of disease in humans.

In 2008, the Cooling Tower Institute (CTI) issued its revised report and guidelines for the best practices for control of Legionella (CTI 2008). To minimize the risk from Legionella, the CTI noted that consensus recommendations included minimization of water stagnation, minimization of process leads into the cooling system that provide nutrients for bacteria, maintenance of overall system cleanliness, the application of scale and corrosion inhibitors as appropriate, the use of high-efficiency mist eliminators on cooling tower cells, and the overall general control of microbiological populations. Good preventive maintenance is very important in the efficient operation of cooling tower cells and other evaporative equipment. Preventive maintenance includes having effective drift eliminators, periodically cleaning the system if appropriate, maintaining mechanical components in working order, and maintaining an effective water treatment program with appropriate biocide concentrations. The efficacy of any biocide in ensuring that bacteria, and in particular Legionella growth, is kept to a minimum is contingent upon a number of factors including but not limited to proper dosage amounts, appropriate application procedures, and effective monitoring.

In order to ensure that Legionella growth is kept to a minimum, thereby protecting both nearby workers as well as members of the public, an appropriate biocide program and anti-biofilm agent monitoring program would be prepared and implemented for the cooling tower cells associated with the Project.

These programs would ensure that proper levels of biocide and other agents are maintained within wet cooling tower water at all times, that periodic measurements of Legionella levels are conducted, and that periodic cleaning is conducted to remove bio-film buildup.

5.9.5 Cumulative Effects

The operational HRA indicates that the maximum cancer risk due to exposure to air toxics emitted by PGF operations will be approximately 9.9 in one million at the PMI, which is below the SCAQMD's "significant health risk" threshold of 10 in one million. The PMI's location represents the maximum possible cancer risk outside of the facility boundary. In actuality, 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 0.25, 0.70, and 0.25, respectively, which are also 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 1.0 at all receptor locations. Additionally, emission control technologies for key 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.

The construction HRA indicates that the maximum cancer risk due to exposure to air toxics emitted by PGF construction will be approximately 25.3 in one million at the PMI, which is above the SCAQMD's "significant health risk" threshold of 10 in one million. 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. In actuality, 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 1.68, 0.58, and 1.68, 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.

Based on modeling studies conducted by CEC staff for other projects, an analysis of a project's cumulative impacts is typically only required if the proposed facility is generally within less than 0.5 mile of another existing, major or large toxics emissions source. Region 2 is another geothermal power plant owned by the Applicant, which is located less than 0.5 mile northeast of the Project. However, Region 2 is not a major source of air toxic pollutants. There are no other existing, major or large toxics emissions sources within 0.5 mile of the Project. Therefore, a cumulative impacts analysis for potential health risks is not required.

5.9.6 Mitigation Measures

5.9.6.1 Project Operation

Emissions of TACs to the air due to Project operation will be minimized through the use of high-efficiency drift eliminators and H_2S sparging, which are considered best available control technology (BACT) for the Project's cooling towers and geothermal processes, respectively. The diesel-fired emergency generators will be Tier 4 certified engines, meaning DPM and criteria pollutant emissions will be minimized through the use of Tier 4 controls, including selective catalytic reduction, diesel particulate filtration, and a diesel oxidation catalyst.

The potential health risk impacts presented in Section 5.9.3.5.1 indicate that the Project will not have a significant impact when compared to the SCAQMD's significance thresholds.[5] As a result, additional mitigation measures are not required for the air toxic emissions from operation of the Project.

[5] ICAPCD does not have its own established significance thresholds for health risk impacts.

5.9.6.2 Project Construction

The construction activities from the Project would be finite and best available control techniques would be used throughout the 29-month construction period to control criteria pollutant and DPM emissions. Construction impacts would further be reduced with the implementation of the additional construction mitigation measures presented in Section 5.1.

The potential health risk impacts presented in Section 5.9.3.5.2 indicate that the Project will not have a significant impact when compared to the SCAQMD's significance thresholds. As a result, additional mitigation measures are not required for the air toxic emissions from construction of the Project.

5.9.7 Laws, Ordinances, Regulations, and Standards

The relevant LORS that affect public health and are applicable to the Project are identified in Table 5.9-10, along with the conformity of the Project to each listed LORS. Table 5.9-10 also summarizes the agencies responsible for regulating public health under each of the applicable LORS.

Table 5.9-10. Summary of LORS – Public Health

LORS	Purpose	Regulating Agency	Project Conformance
CAA Title III	Establishes a plan for achieving significant reductions in emissions of hazardous air pollutants from major sources.	EPA Region 9 CARB ICAPCD	Based on the HRA results presented in Section 5.9.3.5, the Project's cancer, chronic, and acute health risks do not exceed acceptable levels. Emissions of criteria pollutants will be minimized by applying BACT to the Project, where feasible. Facility will comply with applicable federal, state, and ICAPCD rules and regulations.
40 CFR Part 68 (RMP), 19 CCR Sections 2735.1 to 2785.1 (CalARP Program), and California Health and Safety Code (CHSC) Sections 25531 to 25541	Prevents or minimizes accidental releases of acutely hazardous substances that can cause serious harm to the public and the environment.	EPA Region 9 Department of Toxic Substances Control (DTSC) Imperial Certified Unified Program Agency (CUPA)	A vulnerability analysis will be performed to assess potential risks from a spill or rupture from any affected storage tank, if required. An RMP is not expected to be required.
CHSC Section 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	Provides notification of Proposition 65 chemicals.	OEHHA	The facility will determine Proposition 65 status and comply with all signage and notification requirements, as applicable. See Sections 5.5 and 5.15 for additional discussion regarding hazardous materials and water quality, respectively.

LORS	Purpose	Regulating Agency	Project Conformance
CHSC Sections 25500 to 25510	Establishes requirements for developing business and area plans relating to the handling and release of hazardous materials.	State Office of Emergency Services DTSC Imperial CUPA	An HMBP, including a hazardous materials inventory and emergency response plan, will be prepared for distribution to affected agencies, as required. Additionally, releases of hazardous materials will be immediately reported to affected agencies, as required. See Section 5.5 for additional discussion regarding hazardous materials.
CHSC Section 44300 to 44384 (Air Toxics "Hot Spots" Information and Assessment Act—AB 2588)	AB 2588 requires the development of a statewide inventory of TAC emissions from stationary sources. The program requires affected facilities to: (1) prepare an emissions inventory plan that identifies relevant TACs and sources of TAC emissions; (2) prepare an emissions inventory report quantifying TAC emissions; and (3) prepare an HRA, if necessary, to quantify the health risks to the exposed public. Facilities with significant health risks must notify the exposed population, and in some instances must implement RMPs to reduce the associated health risks.	CARB OEHHA ICAPCD	The Project will participate in the AB 2588 inventory and reporting program, as required and implemented by ICAPCD. Based on the HRA results presented in Section 5.9.3.5, cancer, chronic, and acute health risks do not exceed acceptable levels.
40 CFR Part 63 and ICAPCD Regulation X	Establishes National Emission Standards for Hazardous Air Pollutants (NESHAP). [a]	EPA Region 9 ICAPCD	The Project will comply with applicable NESHAP, including hexavalent chromium emissions from cooling towers and emissions from engines.
ICAPCD Rule 207	Requires preconstruction review and permitting of new or modified stationary sources of air pollution, including air toxics.	ICAPCD	An Authority to Construct and Permit to Operate will be obtained from ICAPCD prior to construction and operation of the Project, respectively. As a result, the Project will comply with the ICAPCD's permitting requirements.

[a] These are standards for air pollutants identified by the EPA as causing or contributing to the adverse health effects of air pollution but for which NAAQS have not been established.

HBMP = Hazardous Materials Business Plan

5.9.8 Agency Jurisdiction and Contacts

Table 5.9-11 presents the contact information for each agency contacted during the development of this Project which may exercise jurisdiction of public health issues and permitting.

Table 5.9-11. Agency Contacts for Public Health

Public Health Concern	Agency	Contact
Public exposure to air pollutants	CEC	Mr. Joseph Hughes Air Resources Supervisor 1 California Energy Commission 715 P Street Sacramento, CA 95814 Phone: 916-980-7951 E-mail: Joseph.Hughes@energy.ca.gov
	ICAPCD	Jesus Ramirez APC Division Manager 150 S. 9th Street El Centro, CA 92243-2839 Phone: 442-265-1800 E-mail: jesusramirez@co.imperial.ca.us

5.9.9 Permit Requirements and Schedules

Agency-required permits or plans related to public health may include an HMBP and an ICAPCD-issued Authority to Construct/Permit to Operate. These requirements are discussed in detail in Sections 5.5 and 5.1, respectively.

5.9.10 References

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