

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION**

ORDER R7-2011-0053

**WASTE DISCHARGE REQUIREMENTS
FOR
ORNI 21 LLC, OWNER
HIGHLINE GEOTHERMAL EXPLORATION PROJECT
WELLFIELD MUD SUMPS/CONTAINMENT BASINS**

Salton Sea Known Geothermal Resource Area (KGRA) - Imperial County

The California Regional Water Quality Control Board, Colorado River Basin Region (Regional Water Board), finds that:

1. ORNI 21, LLC (the Discharger), a division of Ormat Nevada, Inc., proposes drilling six (6) geothermal exploration wells on land owned by private individuals and various companies. Table 1 – Proposed Wells Sites Land Information, attached hereto and made part of this Order by reference, lists land owners and the legal description of parcels to be used for the drilling project. The geothermal wells will be used to evaluate the geothermal resources in the area for commercial use. The wells are located within or just outside the Salton Sea Known Geothermal Resource area (KGRA), north of the town of Niland. The address for ORNI 21, LLC, and Ormat Nevada, Inc., is 6225 Neil Road, Reno, NV 89511.
2. This Board Order regulates the handling and disposal of drilling wastes generated by the Discharger during geothermal well drilling, testing, and maintenance in the vicinity of the Salton Sea KGRA.
3. The Discharger reports that the exploration project will initially consist of six (6) geothermal wells and six (6) mud sumps. Locations of the proposed wells are shown on Attachment A, which is made part of this Order by reference. All geothermal well drilling performed by the Discharger within the Salton Sea KGRA will be regulated under this Order.
4. The Discharger submitted a Report of Waste Discharge, dated July 29, 2011, for the Highline Geothermal Exploration Project (Project).
5. The Project will consist of well pad construction, geothermal exploration drilling, testing and waste handling and disposal. A typical mud sump configuration is shown on Attachment B. A typical well pad configuration is shown on Attachment C. The attachments are made part of this Order by reference.
6. The wells will be drilled to locate, sample, test, and monitor seismic fracture-based targets. Technical data obtained from the wells will be used to determine if the geothermal resource is commercially viable.

7. Definition of terms used in this Board Order:

- a. **Facility** – The entire parcel of property where the Discharger’s or related geothermal, industrial, and drilling activities **are** conducted.
- b. **Waste Management Unit (WMUs)** – Mud sumps/containment basins are WMUs.
- c. **Discharger** – The term “Discharger” means any person who discharges waste that could affect the quality of the waters of the State, and includes any person who owns the land, waste management unit, or who is responsible for the operation of a waste management unit. Specifically, the terms “discharger” or “dischargers” in this Board Order means ORNI 21, LLC.

Geothermal Drilling Wastes

- 8. The following wastes are generated during construction, operation, and maintenance of geothermal exploration wells:
 - a. **Geothermal brine** – Previous drilling projects in the area of the Salton Sea KGRA show that geothermal brines are hot saline solutions that contain Total Dissolved Solids (TDS) up to 235,000 mg/L. Based on nearby geothermal projects, major constituents of the brine are predicted to be the following:

Anticipated Chemical Composition of Produced Fluids

Constituent	Concentration (ppm)
Beryllium	ND ¹
Ammonium	369
Sodium	50,169
Magnesium	39
Aluminum	ND ^{1,2}
Potassium	12,784
Calcium	24,584
Chromium	ND ¹
Manganese	983
Iron	1,180
Nickel	ND ¹
Copper	4
Zinc	320
Rubidium	69
Strontium	443
Silver	ND ¹

Anticipated Chemical Composition of Produced Fluids

Constituent	Concentration (ppm)
Cadmium	1
Antimony	1
Cesium	12
Barium	177
Mercury	ND ¹
Lead	79
Bicarbonate	69
Nitrate	ND ¹
Fluorine	20
Sulfur Monoxide	98
Chlorine	137,670
Arsenate	20
Selenate	ND ¹
Bromine	89
Iodine	10
Silicon Dioxide	433
Carbon Dioxide	3,309
Boric Acid	1,800
Hydrogen Sulfide	15
Ammonia	59
Methane	10
Total Dissolved Solids	235,000

ND = Not Detected

¹ Several of the constituents listed as ND have been detected in brine from this resource, although the quantities may be present at trace levels.

² Aluminum is known to be present in measurable quantities in brine from this resource.

Source: AECOM, 2009

- b. **Drilling muds with additives** – Drilling mud is inert mineral clay such as bentonite clay. Drilling mud additives may include sodium bicarbonate, soda ash, drilling soap, organic polymers, wood fibers, graphite, cottonseed hulls, walnut shells and cement. Drilling mud additives do not render the drilling mud hazardous when used according to manufacturer’s specifications.

- c. **Drill cuttings (rock)** – small rock fragments pulverized during drilling and forced to the surface by drilling mud, aerated mud, and/or air.

Drilling Waste Containment (WMUs)

9. The Discharger proposes to contain geothermal brine generated during drilling, testing, or maintenance by discharging into large portable tanks. The number of tanks required will be determined as drilling proceeds. Geothermal brine will be returned to the geothermal resource via injection, or properly disposed of off-site into permanent, Class II surface impoundments constructed pursuant to the regulatory standards specified in Title 27 of the California Code of Regulations (Title 27).
10. Drilling muds and rock cuttings generated during well drilling, testing, or maintenance will be discharged to mud sumps/containment basins designed to temporarily (less than one year) contain the material while drying. The six mud sumps are temporary containment ponds that will be decommissioned and removed subsequent to completion of the well construction activities. The mud sumps will be lined impoundments employing a 40-mil synthetic liner. The liner will be placed on 6 inches of compacted clay to hydraulically isolate the mud sump from the underlying groundwater table. Nominal sump dimensions will be 250 feet long by 100 feet wide by 7 feet deep, with 2 feet of freeboard. Attachment B shows the design of the mud sumps.

Drilling Waste Disposal

11. Liquid wastes produced from drilling, testing, and maintenance of geothermal wells will be contained in portable tanks (the number of tanks required will be determined as drilling proceeds) and returned to the geothermal resource, or will be properly disposed of off-site into permanent Class II surface impoundments constructed pursuant to Title 27 standards.
12. Solids discharged to mud sumps/containment basins are classified as designated waste and must be removed off-site and disposed of in accordance with applicable federal, state, and county regulations.

Surface Water

13. Surface water in the area of the Salton Sea KGRA consists of canals and agricultural drains operated and maintained by the Imperial Irrigation District.
14. The Discharger has determined that the Facility is not located in a 100-year flood zone.

Regional Groundwater

15. The regional groundwater flow direction within the Imperial Valley is toward the Salton Sea, a closed basin with a surface elevation of approximately 225 feet below sea level. The Salton Sea KGRA is located approximately 120 feet below sea level; groundwater flows in a general northwest direction.

Local Groundwater

16. The Discharger reports that shallow groundwater in the area of the Facility occurs approximately 6-8 feet below ground surface due to the agriculture tile system.

17. Groundwater depth, gradient, and quality in the area of the Salton Sea KGRA may be influenced, at times, by irrigation of adjacent agricultural fields, and by recharge from nearby canals.

Regional Geology

18. The Highline Geothermal Exploration Project is located within the Salton Trough area of southeast California. The Salton Trough is a tectonically active zone containing numerous faults associated with the San Andreas Fault Zone. The site is located on the north central portion of the trough, and is underlain by deltaic and lacustrine formations associated with the Colorado River delta. Bedrock in this part of the Salton Trough is approximately three miles below ground surface.

Climate

19. Climate in the region is arid. Climatological data obtained from 1951 to 1980 indicate an average seasonal precipitation of 2.5 inches, and an average annual pan evaporation rate greater than 100 inches.
20. The wind direction follows two general patterns:
 - a. Seasonally from fall through spring, prevailing winds are from the west and northwest. Most of these winds originate in the Los Angeles basin, and tend to decrease the humidity in the Salton Sea area.
 - b. Summer weather patterns are dominated by intense heat induced low-pressure areas that form over the interior desert, drawing air south of the Facility, which typically increases the humidity in the Salton Sea area.

Basin Plan

21. The Water Quality Control Plan for the Colorado River Basin Region (Basin Plan) designates the beneficial uses of ground and surface waters in this region.
22. The Highline Geothermal Exploration Project is located within the Imperial Hydrological Unit.

The beneficial uses of groundwater in the Imperial Hydrological Unit are:

- a. Municipal Supply (MUN)*
- b. Industrial Supply (IND)

* With respect to the MUN designation, the Basin Plan states: "At such time as the need arises to know whether a particular aquifer which has no known existing MUN use should be considered as a source of drinking water, the Regional Board will make such a determination based on the criteria listed in the 'Sources of Drinking Water Policy' in Chapter 2 of the Basin Plan. An indication of MUN for a particular hydrologic unit indicates only that at least one of the aquifers in that unit currently supports a MUN beneficial use. For example, the actual MUN usage of the Imperial Hydrologic Unit is limited only to a small portion of that ground water unit."

23. The beneficial uses of surface waters in the area of the Highline Geothermal Exploration Project are as follows:
- a. Imperial Valley Drains
 - i. Freshwater Replenishment (FRSH)
 - ii. Water Contact Recreation (RECI)
 - iii. Non-contact Water Recreation (RECII)
 - iv. Warm Freshwater Habitat (WARM)
 - v. Wildlife Habitat (WILD)
 - vi. Preservation of Rare, Threatened, or Endangered Species (RARE)

 - b. All American Canal System
 - vii. Municipal (MUN)
 - viii. Agricultural (AGR)
 - ix. Aquaculture Supply (AQUA)
 - x. Freshwater Replenishment (FRSH)
 - xi. Industrial (IND)
 - xii. Groundwater Recharge (GWR)
 - xiii. Water Contact Recreation (RECI)
 - xiv. Non-Contact Water Recreation (RECII)
 - xv. Warm Freshwater Habitat (WARM)
 - xvi. Wildlife Habitat (WILD)
 - xvii. Hydropower Generation (POW)
 - xviii. Preservation of Rare, Threatened, or Endangered Species (RARE)

Storm Water

24. Federal regulations for storm water discharges were promulgated by the United States Environmental Protection Agency (USEPA) on November 16, 1990 (40 CFR Parts 122, 123, and 124). These regulations required discharges of storm water to surface waters associated with construction activity, including clearing, grading, and excavation activities (except operations that result in disturbance of less than five (5) acres of total land area and which are not part of a larger common plan of development or sale) to obtain a National Pollutant Discharge Elimination System (NPDES) permit and to implement Best Conventional Pollutant Control Technology and Best Available Technology Economically Achievable to reduce or eliminate storm water pollution. (40 CFR 122.26(b)(14)(x).) On December 8, 1999, federal regulations promulgated by USEPA (40 CFR Parts 9, 122, 123, and 124) expanded the NPDES storm water program to include, in pertinent part, storm water discharges from construction sites that disturb a land area equal to or greater than one acre and less than five acres, or is part of a larger common plan of development or sale (small construction activity). (40 CFR 122.26(b)(15).)
25. To comply with these federal requirements, the State Water Resources Control Board (State Water Board) adopted in 1999 Water Quality Order No. 99-08-DWQ (NPDES) General Permit No. CAS000002, "Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity" (Construction General Permit). The Construction General Permit specifies WDRs for discharges of storm water associated with construction activity that results in a land disturbance of one acre or more or is part of a larger common plan of development or sale. The Construction General

Permit specifies certain construction activities that are exempted from coverage. Because these exemptions do not apply to the Discharger's proposed construction activity and because this activity will result in a land disturbance of more than 1 acre, the Discharger is subject to the Construction General Permit requirements.

26. On September 2, 2009, the State Water Board adopted a new Construction General Permit (CGP) to replace Order No. 99-08-DWQ. The new CGP, Order No. 2009-0009-DWQ (NPDES No. CAS000002), became effective on July 1, 2010. The website link to this new CGP is as follows:

<http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2009/wqo/wqo2009_0009_dwq.pdf>.

Anti-Degradation Policy

27. State Water Resources Control Board (State Water Board) Resolution No. 68-16 ("Policy with Respect to Maintaining High Quality Waters of the State"; hereafter Resolution No. 68-16) requires a Regional Water Board in regulating the discharge of waste to maintain high quality waters of the state (i.e., background water quality) until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect beneficial uses, and will not result in water quality less than that described in plans and policies (e.g. violation of any water quality objective). The discharge is required to meet waste discharge requirements that result in the best practicable treatment or control of the discharge necessary to assure pollution or nuisance will not occur, and the highest water quality consistent with maximum benefit to the people will be maintained.

CEQA

28. The County of Imperial, acting as the Lead Agency under the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.), prepared an Initial Study/Negative Declaration for the proposed Highline Geothermal Exploration project. On September 14, 2011, prior to approving the project, the County of Imperial certified that the Initial Study/Negative Declaration prepared for the proposed project was completed in compliance with CEQA; the Initial Study/Negative Declaration was presented to the Imperial County Planning Commission, and that decision-making body reviewed and considered the information contained in the Initial Study/Negative Declaration prior to approving the project; and the Initial Study/Negative Declaration reflects the County's independent judgment and analysis. In September 2011, the County filed a notice of determination of its decision to approve the project. As a Responsible Agency under CEQA, the Regional Water Board has considered the Negative Declaration and the potential impacts to water quality identified and addressed by the County of Imperial. The Regional Water Board has concluded that compliance with these waste discharge requirements will prevent any significant adverse impacts to water quality.

Notification

29. The Regional Water Board has notified the Discharger and all known interested agencies and persons of its intent to adopt waste discharge requirements for said discharge, and has provided them with an opportunity for a public meeting, and to submit comments.
30. The Regional Water Board, in a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED, that in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, the Discharger shall comply with the following:

A. Discharge Specifications

1. The treatment or disposal of wastes at this Facility shall not cause pollution or nuisance as defined in Section 13050 of Division 7 of the California Water Code.
2. Waste material at this Facility must be contained at all times.
3. Containment of waste shall be limited to the areas designated for such activity. Any revision or modification of the waste containment area, or change in operation that alters the nature and constituents of the waste produced, must be submitted in writing to the Regional Water Board Executive Officer for review. The Regional Water Board Executive Officer must approve of the proposed change before the change in operation or modification of the designated area is implemented.
4. Prior to drilling a new well at the Facility, other than those shown on Attachment A, the Discharger shall notify, in writing, the Regional Water Board Executive Officer of the proposed change.
5. Any substantial increase or change in volume of material to be discharged under these Waste Discharge Requirements (WDRs) must be submitted in writing to the Regional Water Board Executive Officer for review. The Regional Water Board Executive Officer must approve of the proposed change before the change in discharge volume is implemented.
6. Liquid or solid geothermal waste discharged to tanks shall be contained at all times.
7. A minimum freeboard of two-feet shall be maintained in mud sumps/containment basins at all times.
8. Following well completion, residual solids and semisolids contained in tanks shall be tested for constituents listed in Monitoring and Reporting Program R7-2011-0053, and for any additional constituents requested by the Regional Water Board Executive Officer (if any). Disposal of this material shall be in accordance with applicable laws and regulations based on analytical results of sampling and analysis.

9. Prior to removing solid material discharged to mud sumps/containment basins, the material shall be tested for constituents listed in Monitoring and Reporting Program R7-2011-0053, and for any additional constituents requested by the Regional Water Board Executive Officer (if any). Disposal of this material shall be in accordance with applicable laws and regulations based on analytical results of sampling and analysis.
10. Public contact with material containing geothermal wastes shall be precluded through fences, signs, or other appropriate alternatives.
11. Mud sumps/containment basins shall be constructed, operated and maintained to ensure their effectiveness, in particular:
 - a. Erosion control measures shall be implemented;
 - b. Liners in mud sumps/containment basins shall be maintained to ensure proper function, and
 - c. Solid material shall be removed from mud sumps/containment basins in a manner that minimizes the likelihood of damage to the liner.
12. Upon ceasing operation at the facility, all waste, natural geologic material contaminated by waste, and surplus or unprocessed material, shall be removed from the site and disposed of in accordance with applicable laws and regulations.
13. Surface drainage from tributary areas or subsurface sources, shall not contact or percolate through waste discharged at this site.
14. The Discharger shall use the constituents listed in Monitoring and Reporting Program R7-2011-0053, attached hereto and made part of this Order by reference, and revisions thereto as "Monitoring Parameters".
15. The Discharger shall implement the attached Monitoring and Reporting Program R7-2011-0053 and revisions thereto to detect at the earliest opportunity any unauthorized discharge of waste constituents from the Facility, or any impairment of beneficial uses associated with (or caused by) discharges of waste to the mud sumps/containment basins.
16. Water used for the process and site maintenance shall be limited to the amount necessary for the process, dust control, and for cleanup and maintenance.
17. The Discharger shall not cause or permit the release of pollutants or waste constituents in a manner that could cause or contribute to a condition of contamination, nuisance, or pollution.

B. Prohibitions

1. Geothermal wells shall be drilled to minimize mixing of drilling mud and cuttings with geothermal brine. Only a small amount of brine may commingle with drilling mud, primarily brines in that part of the formation displaced by the drill bit. Geothermal brine shall not be discharged into mud sumps/containment basins. Standing fluid observed in mud sumps/containment basins (if any) shall be removed immediately, stored in portable

- tanks, and returned to the geothermal resource, or properly disposed of off-site into permitted, Class II surface impoundments constructed pursuant to Title 27 standards.
2. The discharge of solid geothermal waste to mud sumps/containment basins, as a final means of disposal, is prohibited unless authorized by the Regional Water Board Executive Officer.
 3. The Discharger shall not cause degradation of any groundwater aquifer or supply water.
 4. The discharge of waste to land not owned or controlled by the Discharger is prohibited.
 5. Use of geothermal brine or drilling muds for dust control on access roads or well pads is prohibited.
 6. The discharge of hazardous or designated wastes to areas other than a waste management unit authorized to receive such waste is prohibited.
 7. Permanent (longer than one year) disposal or storage of drilling waste to mud sumps/containment basins is prohibited, unless authorized by the Regional Water Board Executive Officer.
 8. All mud sumps/containment basins must be lined. Drilling waste shall not penetrate the lining during the containment period.
 9. Direct or indirect discharge of geothermal drilling wastes in mud sumps/containment basins or tanks to surface water or surface drainage courses (including canals, drains, or subsurface drainage systems) is prohibited, except as allowed under an appropriate NPDES permit.
 10. The Discharger shall neither cause nor contribute to the contamination or pollution of groundwater via the release of waste constituents.

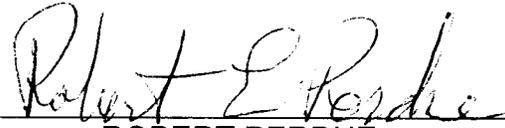
C. Provisions

1. The Discharger shall comply with Monitoring and Reporting Program R7-2011-0053 and future revisions thereto, as specified by the Regional Water Board Executive Officer.
2. Unless otherwise approved by the Regional Water Board Executive Officer, all analyses shall be conducted at a laboratory certified for such analyses by the California Department of Public Health. All analyses shall be conducted in accordance with the latest edition of "Guidelines Establishing Test Procedures for Analysis of Pollutants," promulgated by the U.S. Environmental Protection Agency.
3. Prior to any change in ownership of this operation, the Discharger shall transmit a copy of these WDRs to the succeeding owner/operator, and forward a copy of the transmittal letter to the Regional Water Board Executive Officer.
4. Prior to any modification that would result in a material change in the quality or quantity of discharge, or material change in the location of the discharge, the Discharger shall report all pertinent information in writing to the Regional Water Board Executive Officer, and obtain revised waste discharge requirements before implementing the modification.

5. Synthetic liner placement and welding must be certified by the installer to verify factory requirements were satisfied, and no damage occurred during placement. Certification must be submitted, in writing, to the Regional Water Board Executive Officer, prior to use of the temporary mud sump/containment basin, or equivalent system approved by the Regional Water Board's Executive Officer.
6. The Discharger shall ensure that all site-operating personnel are familiar with the content of these WDRs, and shall maintain a copy of these WDRs at the site.
7. These WDRs do not authorize violation of any federal, state, or local laws or regulations.
8. The Discharger shall allow the Regional Water Board, or an authorized representative, upon presentation of credentials and other documents, as may be required by law, to:
 - a. Enter upon the premises regulated by these, or the place where records must be kept under the conditions of these WDRs;
 - b. Have access to and copy, at reasonable times, any records that shall be kept under the condition of this Board Order;
 - c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under these WDRs; and
 - d. Sample or monitor at reasonable times, for the purpose of assuring compliance with these WDRs or as otherwise authorized by the California Water Code, any substances or parameters at this location.
9. The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control, and related appurtenances, that are installed or used by the Discharger to achieve compliance with these WDRs. Proper operation and maintenance also includes adequate laboratory controls, and appropriate quality assurance procedures.
10. The Discharger shall comply with the following:
 - a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity;
 - b. The Discharger shall retain records of all monitoring information, copies of all reports required by these WDRs, and records of all data used to complete the application of the these WDRs, for a period of at least five years from the date of the sample, measurement, report or application. This period may be extended by the Regional Water Board Executive Officer at any time;
 - c. Records of monitoring information shall include:
 - i. The date, exact place(s), and time of sampling or measurement(s);
 - ii. The individual(s) who performed the sampling or measurement(s);
 - iii. The date(s) analyses were performed;
 - iv. The individual(s) responsible for reviewing the analyses;
 - v. The results of such analyses; and

- d. Monitoring must be conducted according to test procedures described in the Monitoring and Reporting Program, unless other test procedures have been approved by the Regional Water Board Executive Officer.
11. The Discharger is the responsible party for these WDRs, and the Monitoring and Reporting Program for the Facility. The Discharger shall comply with all conditions of these WDRs. Violations may result in enforcement action, including Regional Water Board Orders or court orders that require corrective action or impose civil monetary liability, or modification or revocation of these WDRs by the Regional Water Board Executive Officer.
12. The Discharger shall furnish, under penalty of perjury, technical monitoring program reports submitted pursuant to the specifications provided by the Regional Water Board Executive Officer. Specifications are subject to periodic revision as may be warranted.
13. The monitoring reports shall be certified to be true and correct, and signed, under penalty of perjury, by an authorized official of the company.
14. The Discharger's construction activity is subject to the new CGP, which became effective on July 1, 2010, since that activity is scheduled to commence after adoption of this Board Order. To obtain coverage, the Discharger is required to electronically file Permit Registration Documents (PRDs), which includes a Notice of Intent (NOI), Storm Water Pollution Prevention Plan (SWPPP), and other compliance-related documents required by the CGP and mail the appropriate permit fee to the State Water Board.
15. These WDRs do not convey property rights of any sort, or any exclusive privileges; nor does it authorize injury to private property, invasion of personal rights, or infringement of federal, state, or local laws and regulations.
16. These WDRs may be modified, rescinded, or reissued for cause. The filing of a request by the Discharger to modify, or rescind or reissue these WDRs does not stay any WDR condition. Likewise, notification of planned changes or anticipated noncompliance does not stay any WDR condition. Causes for modification include: changes in land application plans, sludge use, or disposal practices; or promulgation of new regulations by the State or Regional Water Boards, including revisions to the Basin Plan.
17. Within thirty days of the adoption of these WDRs, the Discharger shall submit to the Regional Water Board Executive Officer a list of surface landowners (including responsible contact's names, addresses, and phone numbers) for all land containing existing or proposed facilities and/or appurtenances related to the operation of this Geothermal Power Project. This list will be used to contact responsible parties if corrective action measures become necessary due to a release of pollutants to the environment.

I, Robert Perdue, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, Colorado River Basin Region, on November 17, 2011.

A handwritten signature in black ink, reading "Robert E. Perdue", written over a horizontal line.

ROBERT PERDUE
Executive Officer