

FORM  
2

Rev  
10/24

# State of Colorado

## Energy & Carbon Management Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203  
Phone: (303) 894-2100 Fax: (303) 894-2109



Document Number:

404023428

**(SUBMITTED)**

Date Received:

12/31/2024

### APPLICATION FOR PERMIT TO

Drill     Deepen     Re-enter     Recomplete and Operate    Amend

TYPE OF WELL OIL  GAS  COALBE  GEOTHERMAL  OTHER: \_\_\_\_\_

Refile

ZONE TYPE SINGLE ZONE  MULTIPLE ZONES  COMMINGLE ZONES

Sidetrack

Well Name: GLADE Well Number: EAST

Name of Operator: OXY USA INC ECMC Operator Number: 66561

Address: PO BOX 173779

City: DENVER State: CO Zip: 80217-3779

Contact Name: Loryn Spady Phone: (720)9293504 Fax: ( )

Email: Loryn\_Spady@oxy.com

### FINANCIAL ASSURANCE FOR PLUGGING, ABANDONMENT, AND RECLAMATION

#### ECMC Financial Assurance

The Operator has provided or will provide Financial Assurance to the ECMC for this Well.

Surety ID Number (if applicable): 20230087

#### Federal Financial Assurance

In checking this box, the Operator certifies that it has provided or will provide at least this amount of Financial Assurance to the federal government for this Well. (Per Rule702.a.)

Amount of Federal Financial Assurance \$ \_\_\_\_\_

### WELL LOCATION INFORMATION

#### Surface Location

QtrQtr: NESE Sec: 2 Twp: 3N Rng: 66W Meridian: 6

Footage at Surface: 2134 Feet FSL 1146 Feet FEL

Latitude: 40.252551 Longitude: -104.738967

GPS Data: GPS Quality Value: 1.3 Type of GPS Quality Value: PDOP Date of Measurement: 12/03/2024

Ground Elevation: 4901

Field Name: WATTENBERG Field Number: 90750

Well Plan: is  Directional     Horizontal (highly deviated)     Vertical

If Well plan is Directional or Horizontal attach Deviated Drilling Plan and Directional Data.

#### Subsurface Locations

Top of Productive Zone (TPZ)

Sec: 2 Twp: 3N Rng: 66W Footage at TPZ: 2137 FSL 1188 FEL

Measured Depth of TPZ: 10558 True Vertical Depth of TPZ: 10556 FNL/FSL FEL/FWL

Base of Productive Zone (BPZ)										
Sec:	<u>2</u>	Twp:	<u>3N</u>	Rng:	<u>66W</u>	Footage at BPZ:	<u>2287</u>	FSL	<u>2376</u>	FWL
								FNL/FSL		FEL/FWL
Measured Depth of BPZ:			<u>20162</u>			True Vertical Depth of BPZ:			<u>20000</u>	
Bottom Hole Location (BHL)										
Sec:	<u>2</u>	Twp:	<u>3N</u>	Rng:	<u>66W</u>	Footage at BHL:	<u>2287</u>	FSL	<u>2376</u>	FWL
								FNL/FSL		FEL/FWL

### LOCAL GOVERNMENT PERMITTING INFORMATION

County: WELD Municipality: N/A

Is the Surface Location of this Well in an area designated as one of State interest and subject to the requirements of § 24-65.1-108 C.R.S.? Yes

Per §34-60-106(1)(f)(I)(A) C.R.S and §37-90.5-107(2)(b)(I) C.R.S, the following questions pertain to the Relevant Local Government approval of the siting of the proposed Oil and Gas or Geothermal Locations.

The Energy and Carbon Management Act and the Geothermal Resources Act provide that when "applying for a permit to drill," operators must include proof that they sought a local government siting permit and the disposition of that permit application, or that the local government does not have siting regulations.

Does the Relevant Local Government regulate the siting of Oil and Gas Locations, with respect to this Location?  Yes  No

If yes, in checking this box, I hereby certify that an application has been filed with the local government with jurisdiction to approve the siting of the proposed oil and gas location.

The disposition of the application filed with the Relevant Local Government is: Approved Date of Final Disposition: 12/11/2024

Comments: GLADE Pilot Project

### GEOTHERMAL

#### Well Overview

The following questions determine informational requirements based on Well type:

Which type of Geothermal Well is this? Select one of the following: Science Well

Will this well be constructed using cementing methodologies other than those listed in Rule 408.f? No

If Yes, what method will be used:

Please describe the cementing method to be used in detail:

Surface: Casing will be cemented using a pump and plug method with a 13.5 ppg lead cement and a 14.8 ppg tail cement. A water-based spacer will be pumped ahead of lead cement. Lead/tail interface is planned for 1850 ft MD. Cement will be pumped with excess to ensure cement to surface.

Intermediate: Casing will be cemented using a pump and plug method with a 12.5 ppg lead cement and a 13.2 ppg tail cement. A water-based spacer will be pumped ahead of lead cement. Lead/tail interface is planned for 7100 ft MD. Cement will be pumped with excess to ensure cement to surface. Additives will be used in the slurries to mitigate bradenhead pressure risks.

## Science Well Information

Please describe the timing, duration, and types of tests that may be run in the wellbore for scientific purposes:

The first well is currently planned for spud in early April 2025. All phases of drilling are expected to take 60 days per well, for a total planned duration of 120 days on the pad. This duration also includes the time required to perform an intercept between the two wellbores at their toes.

Upon completion of drilling and wellbore interception, testing may be conducted to evaluate the thermal potential and heat extraction capabilities. These tests could include running thermal logs to measure in-situ temperatures or setting up surface equipment to circulate fluid through the wellbores. Data collected during these tests, such as flow rates, temperatures, and heat extraction metrics, will be analyzed at the surface to assess the system's performance.

Please describe the reason for the scientific well and its potential future use:

Oxy aims to surpass the limits of current geothermal drilling technology by safely drilling two adjacent high-temperature geothermal wells (i.e., twin wells) at the GLADE location. These wells are part of a project funded under a Funding Opportunity Announcement (FOA) issued by the Department of Energy (DOE). The primary objective is to demonstrate the capability to penetrate deep into granitic basement rock at drilling rates and cycle times that could support economic viability for future geothermal projects.

Located in the Denver-Julesburg Basin, the wells are planned to be drilled to a target true vertical depth (TVD) of 20,000 feet, with downhole temperatures potentially approaching 572 °F. By integrating existing and novel drilling technologies, we aim to achieve a significant increase in daily drilling rates, surpassing 25%, well over well.

To achieve these objectives, we will deploy cutting-edge high-temperature downhole tools, implement advanced cloud-based real-time drilling optimization, and leverage technologies to reduce non-productive time, all while prioritizing operational safety. The twin-well design enables a robust comparative analysis of drilling performance both within and between wells, providing reliable insights into geothermal drilling equipment and best practices.

The future use of these wells remains uncertain. If the wells are successfully intercepted to create a closed-loop system, flow testing may be conducted using a small surface test facility. The twin-well design also provides flexibility for future applications, potentially supporting either enhanced geothermal systems (EGS) or advanced geothermal systems (AGS). However, any future use will depend on the results obtained during drilling and the availability of funding to support subsequent phases.

## SURFACE AND MINERAL OWNERSHIP AT WELL'S OIL & GAS OR GEOTHERMAL LOCATION

Surface Owner of the land at this Well's Oil and Gas Or Geothermal Location:  Fee  State  Federal  Indian

Mineral Owner beneath this Well's Oil and Gas Or Geothermal Location:  Fee  State  Federal  Indian

Surface Owner Protection Bond (if applicable): \_\_\_\_\_

Surety ID Number (if applicable): \_\_\_\_\_

## MINERALS DEVELOPED BY WELL

The ownership of all the minerals that will be developed by this Well is (check all that apply):

- Fee
- State
- Federal
- Indian
- N/A

## LEASE INFORMATION

Using standard QtrQtr, Section, Township, Range format describe one entire mineral lease as follows:

- \* If this Well is within a unit, describe a lease that will be developed by the Well.
  - \* If this Well is not subject to a unit, describe the lease that will be produced by the Well.
- (Attach a Lease Map or Lease Description or Lease if necessary.)

### SURFACE LEASE INFORMATION ONLY - MINERALS NOT APPLICABLE FOR GEOTHERMAL WELL

Township 3 North Range 66 West, 6th P.M.  
 Section 2: N/2 S/2  
 Weld County, Colorado  
 304 acres in Lease

Parcel No. 121102000017, S2 2-3-66 EXC LOTS A&B REC EXEMPT RE-2429  
 Parcel No. 121102000016, PT S2SW4 2-3-66 LOT B REC EXEMPT RE-2429

Total Acres in Described Lease: 304 Described Mineral Lease is:  Fee  State  Federal  Indian  
 Federal or State Lease # \_\_\_\_\_

## SAFETY SETBACK INFORMATION

Distance from Well to nearest:

Building: 1109 Feet  
 Building Unit: 1834 Feet  
 Public Road: 1142 Feet  
 Above Ground Utility: 1730 Feet  
 Railroad: 5280 Feet  
 Property Line: 527 Feet

### INSTRUCTIONS:

- Specify all distances per Rule 308.b.(1).
- Enter 5280 for distance greater than 1 mile.
- Building - nearest building of any type. If nearest Building is a Building Unit, enter same distance for both.
- Building Unit – as defined in 100 Series Rules.

## OBJECTIVE FORMATIONS

Objective Formation(s)	Formation Code	Spacing Order Number(s)	Unit Acreage Assigned to Well	Unit Configuration (N/2, SE/4, etc.)
GRANITE	GRNT		160	T3N-R66W: SEC 2: N/2S/2

Federal or State Unit Name (if appl): N/A

Unit Number: \_\_\_\_\_

### SUBSURFACE MINERAL SETBACKS

Enter 5280 for distance greater than 1 mile.

Is this Well within a unit? \_\_\_\_\_

If YES:

Enter the minimum distance from the Completed Zone of this Well to the Unit Boundary: \_\_\_\_\_ Feet

Enter the minimum distance from the Completed Zone of this Well to the Completed Zone of an offset Well within the same unit permitted or completed in the same formation: \_\_\_\_\_ Feet

If NO:

Enter the minimum distance from the Completed Zone of this Well to the Lease Line of the described lease: \_\_\_\_\_ Feet

Enter the minimum distance from the Completed Zone of this Well to the Completed Zone of an offset Well producing from the same lease and permitted or completed in the same formation: \_\_\_\_\_ Feet

### Exception Location

If this Well requires the approval of a Rule 401.c Exception Location, enter the Rule or spacing order number and attach the Exception Location Request and Waivers. \_\_\_\_\_

### SPACING & FORMATIONS COMMENTS

\_\_\_\_\_

### DRILLING PROGRAM

Proposed Total Measured Depth: 20162 Feet

TVD at Proposed Total Measured Depth 20000 Feet

Distance from the proposed wellbore to nearest existing or proposed wellbore belonging to another operator, including plugged wells:

Enter distance if less than or equal to 1,500 feet: 156 Feet  No well belonging to another operator within 1,500 feet

Will a closed-loop drilling system be used? Yes

Is H<sub>2</sub>S gas reasonably expected to be encountered during drilling operations at concentrations greater than or equal to 100 ppm? No If yes, attach an H<sub>2</sub>S Drilling Plan unless a plan was already submitted with the Form 2A per Rule 304.c.(10).

Will there be hydraulic fracture treatment at a depth less than 2,000 feet in this well? No

Will salt sections be encountered during drilling? No

Will salt based (>15,000 ppm Cl) drilling fluids be used? Yes

Will oil based drilling fluids be used? Yes

BOP Equipment Type:  Annular Preventor  Double Ram  Rotating Head  None

Beneficial reuse or land application plan submitted? No

Reuse Facility ID: \_\_\_\_\_ or Document Number: \_\_\_\_\_

## CASING PROGRAM

Casing Type	Size of Hole	Size of Casing	Grade	Wt/Ft	Csg/Liner Top	Setting Depth	Sacks Cmt	Cmt Btm	Cmt Top
CONDUCTOR	26	20	A53B	79	0	80	60	80	0
SURF	17+1/2	13+3/8	L80	54.5	0	2350	770	2350	0
1ST	12+1/4	9+5/8	P110ICY	47	0	10608	1700	10608	0

Conductor Casing is NOT planned

## POTENTIAL FLOW AND CONFINING FORMATIONS

Zone Type	Formation /Hazard	Top M.D.	Top T.V.D.	Bottom M.D.	Bottom T.V.D.	TDS (mg/L)	Data Source	Comment
Groundwater	Fox Hills and Shallower	17	17	472	472	501-1000	USGS	Depth from DWR
Confining Layer	Pierre Shale	473	473	671	671			
Groundwater	Upper Pierre Aquifer	672	672	1577	1577	501-1000	Electric Log Calculation	Controlled by samples
Confining Layer	Pierre Shale	1578	1578	4309	4309			
Hydrocarbon	Sussex	4310	4310	4609	4609			Productive
Confining Layer	Pierre Shale	4610	4610	7112	7112			
Hydrocarbon	Niobrara	7113	7113	7355	7355			
Hydrocarbon	Codell	7356	7356	7371	7371			
Confining Layer	Carlile	7372	7372	7409	7409			
Hydrocarbon	Greenhorn	7410	7410	7596	7596			
Confining Layer	Graneros Shale	7597	7597	7857	7857			
Hydrocarbon	Dakota	7858	7858	8034	8034			
Confining Layer	Morrison	8035	8035	8298	8298			
Groundwater	Entrada	8299	8299	8423	8423	>10000	USGS	
Confining Layer	Lykins	8424	8424	8958	8958			
Confining Layer	Blaine	8959	8959	9004	9004			Anhydrite
Groundwater	Lyons	9005	9005	9196	9196	>10000	USGS	
Groundwater	Lower Satanka	9197	9197	9362	9362	>10000	USGS	
Groundwater	Wolfcamp	9363	9363	9974	9974	>10000	USGS	
Groundwater	Fountain	9975	9975	10557	10555	>10000	USGS	
Geothermal	Precambrian Basement	10558	10556	20162	20000			Igneous/Metamorphic; *base MD/TVD is BHL per ECMC

## OPERATOR COMMENTS AND SUBMITTAL

Comments

PLEASE ENSURE ALL CORRESPONDENCE ASSOCIATED WITH THIS PERMIT GOES TO ANALYST AND DJREGULATORY EMAIL ADDRESSES, AS LISTED ON THIS PERMIT.

Offset well buffer description for the subject well has been included on this permit for review as an attachment labeled "Other."

Base of Productive Zone is the same as Bottom Hole Location.

The nearest offset wellbore permitted or completed in the same formation is GLADE WEST, DOC ID: 404023428.

**Project Overview:**

The GLADE project is a groundbreaking initiative to drill a first-of-its-kind, deep geothermal well pair in the Denver-Julesburg (DJ) Basin. These wells are part of a project funded under a Funding Opportunity Announcement (FOA) issued by the Department of Energy (DOE). The primary objective is to demonstrate the ability to penetrate deep into granitic basement rock at economically viable drilling rates, paving the way for the next generation of geothermal energy systems.

Currently, most geothermal projects worldwide focus on utilizing existing hydrothermal systems, where hot water is extracted from naturally occurring reservoirs. However, a new frontier of geothermal development is emerging with enhanced geothermal systems (EGS) and advanced geothermal systems (AGS). EGS involves creating artificial reservoirs by fracturing hot, dry rock and circulating fluid to extract heat, while AGS leverages conduction from hot rock to transfer heat without the need for a fluid reservoir. These systems are particularly well-suited for high-temperature, hard basement rock, but the high cost of drilling in such conditions has been a major barrier to widespread adoption.

The GLADE project aims to overcome this limitation by demonstrating the use of modern oilfield drilling technologies, combined with innovative wellbore cooling techniques, to significantly enhance rates of penetration (ROP) and extend time between equipment failures. By achieving these advancements, the project seeks to make deep geothermal systems more economically viable, enabling broader deployment in the renewable energy sector.

The project involves drilling two deep geothermal wells to a target true vertical depth (TVD) of 20,000 feet, with approximately 9,500 feet of drilling through granitic basement rock. Downhole temperatures may reach as high as 572 °F, presenting a significant technical challenge. The wells are designed with a spacing of approximately 300 feet in the granitic section to minimize thermal interaction during circulation and ensure efficient heat transfer. At the surface, the wellheads are positioned 100 feet apart to allow simultaneous operations, such as drilling one well while using the other for ranging and interception support.

To optimize drilling efficiency, the well paths will maintain a vertical trajectory to a depth of approximately 9,000 feet, minimizing torque and drag, side forces, and drill pipe fatigue. This design ensures mechanical stability and enhances the overall performance of drilling operations. The drilling program is scheduled to commence in April 2024, with a total planned duration of 120 days on location. This timeline includes the completion of both wells and the integration of ranging and intercept operations to connect the well toes. Establishing this connection between the wells will create a closed loop (AGS) system.

Through this ambitious effort, the GLADE project seeks to demonstrate the feasibility of drilling cost-effective, high-performance geothermal wells in challenging conditions, thereby contributing to the advancement of renewable energy technologies and the development of sustainable energy solutions for the future.

This application is in a Comprehensive Area Plan       No       CAP #: \_\_\_\_\_  
Oil and Gas Development Plan Name \_\_\_\_\_ OGDP ID#: \_\_\_\_\_  
Location ID: \_\_\_\_\_

I hereby certify all statements made in this form are, to the best of my knowledge, true, correct, and complete.

Signed: \_\_\_\_\_ Print Name: Loryn Spady

Title: Regulatory Analyst Date: 12/31/2024 Email: DJRegulatory@oxy.com

Based on the information provided herein, this Application for Permit-to-Drill complies with ECMC Rules, applicable orders, and SB 19-181 and is hereby approved.

ECMC Approved: \_\_\_\_\_ Director of ECMC Date: \_\_\_\_\_  
Expiration Date: \_\_\_\_\_

<b>API NUMBER</b>
05

### CONDITIONS OF APPROVAL, IF ANY LIST

All representations, stipulations and conditions of approval stated in the Form 2A for this location shall constitute representations, stipulations and conditions of approval for this Form 2 Permit-to-Drill and are enforceable to the same extent as all other representations, stipulations and conditions of approval stated in this Permit-to-Drill.

COA Type	Description
0 COA	

### Best Management Practices

No	BMP/COA Type	Description
1	Drilling/Completion Operations	Anti-Collision: Kerr-McGee will perform an anti-collision evaluation of all active (producing, shut in, or temporarily abandoned) offset wellbores that have the potential of being within one hundred fifty (150) feet of a proposed well prior to drilling operations for the proposed well. Notice shall be given to all offset operators within one hundred fifty (150) feet prior to drilling.

Total: 1 comment(s)

### ATTACHMENT LIST

Att Doc Num	Name
404032061	OTHER
404032456	WELL LOCATION PLAT
404032740	OFFSET WELL EVALUATION
404033078	DEVIATED DRILLING PLAN
404033082	DIRECTIONAL DATA

Total Attach: 5 Files

### General Comments

User Group	Comment	Comment Date
		Stamp Upon Approval

Total: 0 comment(s)