

*Electromagnetic Survey Description for*

# **New York Canyon Geothermal Exploration and Development**

Prepared for  
**TGP Dixie Development Company, LLC**

Submitted to  
**Bureau of Land Management,  
Humboldt Field Office**

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## Introduction

TGP is proposing to conduct electromagnetic surveys to assist in the resource characterization of the New York Canyon geothermal resource lease area. Two alternative methods referred to as MT and E-scan are proposed for this electromagnetic survey and both options are described below under the Proposed Action. The general location for conducting this survey is T25N, R35E, Sections 1, 2, 3, 10, 11, 12, 14, 15, 35; T25N, R36E, Section 6; T26N, R35E, Section 36; T26N, R36E, Sections 31, and 32 (see Figure 1). TGP holds geothermal leases N-74854, N-7698, N-76299, N-76300, and N-76301 for this area. TGP is seeking approval by the BLM under a categorical exclusion prior to the start of the surveys scheduled for the end of July 2009 (outside of the migratory bird nesting season between March 15 and July 15). The surveys are anticipated to be completed by the end of October 2009 depending on the contractor's schedule.

The proposed action conforms to the Land Use Plan for the area, the Sonoma-Gerlach MFP (1982) as well as the Programmatic Environmental Impact Statement for Geothermal Leasing in Western U.S. 2008.

There is currently no existing environmental documentation for this area or proposed action and under CX Provision: 516 DM11.9 (B) "Approval of notices of intent to conduct geophysical exploration of oil, gas, or geothermal pursuant to 43 CFR 3150 or 3250 when no temporary or new road construction is proposed" and review of the Extraordinary Circumstances provided to the BLM with the TGP May 26, 2009 submittal of the general Project Description, none is expected to be required. Additional environmental consideration is addressed below.

## Proposed Action

TGP is proposing two alternative methods for conducting the surveys: the Spartan Magnetotelluric (MT) Logger Survey (Logger) method and the 3-D Resistivity Mapping (E-Scan) method, which are described in greater detail below. General guidelines for both types of surveys and crews include:

- TGP will adhere to BLM Standard Terms and Conditions for geophysical exploration as outlined in H-3150-1-Onshore Oil and Gas Geophysical Exploration Surface Management Requirements.
- There will be no scraping, blading, or grading of existing topography; vehicles will stay on existing roads whenever possible and single tracks where no roads exist. Roads will not be constructed for this project.
- Ground disturbance impacts will be minimized to the extent practicable. Sites where disturbance will take place will be restored to prior site conditions.
- Survey program would commence in late July 2009 (past the migratory bird nesting season between March 15 and July 15) and are anticipated to be completed by the end of October 2009 depending on the contractor's schedule.

### ***Alternative 1: Spartan Magnetotelluric (MT) Logger Methodology and Description of Work***

If this technology is chosen, the following field procedures will be used:

- TGP will have a geophysical team consisting of a geophysical processor, geophysicists/senior field technicians and field assistants totaling between 7-9 people in the field at one time.

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- The crew will have approximately three, four wheel drive trucks and/or ATVs on site to lay out the survey pattern (grid) and to place 6-12 Ref Tek 130-01 data loggers (or equivalent) on the ground for data collection. The data loggers are not connected by wires, which is an advantage in difficult terrain/topography.
- At each data logger location, 1-2 holes will be hand dug and the coils (approximately 1 inch in diameter and 3-4 feet long) will be placed in the earth where wind will not cause vibrations. After collecting the data, the holes will be back-filled by hand to resemble site conditions prior to disturbance.
- Approximately 100 sites will be distributed over a 1 km grid. The grid is laid out with a survey pattern in a square or rectangular shape.
- Site access and occupation periods will be between 12 hours and 24 hours at a time for installation and data collection. Data will be acquired at stations simultaneously to reduce overall time in the field.
- Magnetotelluric uses energy from electricity that travels through the ground and is measured at surface. Impacts to flora and fauna are not expected.
- The survey will be completed using two portable, 100 meter E-field antennae and three small low frequency magnetic field coils (or equivalent), running both a local remote and a distant remote readings. The distant remote readings will be taken from one of the vehicles located on an existing road.
- Sites having insufficient signal and occupation times of at least 12 hours may be repeated at the same sampling locations.
- In cases where inter-site remote referencing cannot be accomplished, the electric field measurements will be made with grounded dipoles using copper/copper sulfate non-polarizing electrodes or steel plate electrodes. Grounded dipoles are essentially the steel rods connected to the battery (or generator).
- The Spartan MT Logger Methodology survey will be completed within two to three weeks of site mobilization.

TGP will use the following instrumentation for the Spartan MT Logger survey. Photos of the equipment are shown in Figure 2:

- 1) Hand held Ref-Tek 130-01 data loggers or equivalent.
- 2) Low Frequency Magnetometer Coils: EMI model BF-4/ BF-7/ BF-21, Phoenix MTC-50 or equivalent. Each of these is less than 10 lbs and small enough to fit in a 4x1x1 ft box.
- 3) Steel plate or Copper sulphate/porous pot electrodes. (Less than 10 lbs and small enough to fit in a 3x2x2ft box).
- 4) All additional field equipment for conducting the surveys (GPS, cables, batteries).
- 5) Laptop computers.

### ***Alternative 2: E-Scan Methodology and Description of Work***

The 3-D resistivity mapping technology called E-SCAN is a very low impact survey method, which was developed as a means to acquire a systematic distribution of raw data across extreme terrain. If the E-SCAN technique is selected, the following field procedures will be used. An example aerial view of the E-SCAN output is provided in Figure 3.

- A crew of 4-5 people on ATVs place geophones 3 ft into the ground with ½ inch in diameter wide electrodes and connect them to wires above the ground. An electrical voltage is applied between electrodes to generate current. The wire is very light and leaves no mark on the ground.
- The geophones are laid out in a rectangular grid approximately 3.2 km by 6 km in size. The grid layout can be adjusted to avoid areas of concern.
- Once the grid is laid out, electrical current is in the ground for 1-1.5 minutes across the entire grid. These samples will be taken many times throughout the day over the course of no more than 4 weeks. No impacts to flora and fauna are expected.
- In resistivity survey, electric current is injected into the ground, and the resulting electrical potential field is sampled at the surface using hand held devices. .
- Using the 80486DX2/66 microcomputer or equivalent, it takes about 20 minutes to convert the data from an electrode survey grid.
- The E Scan survey will be completed within an estimated 20 days after site mobilization.

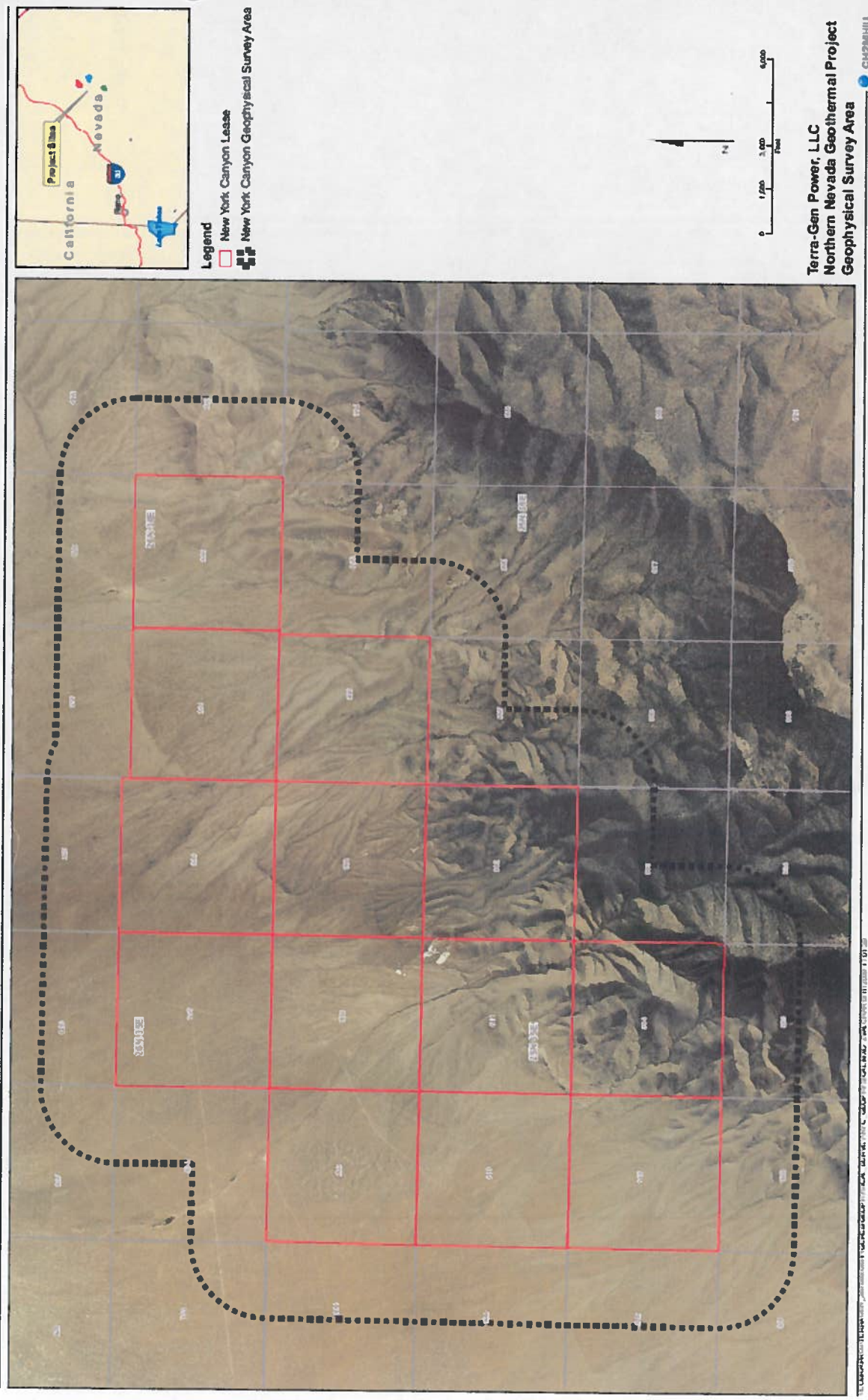
### **Needed Coordination/Consultation**

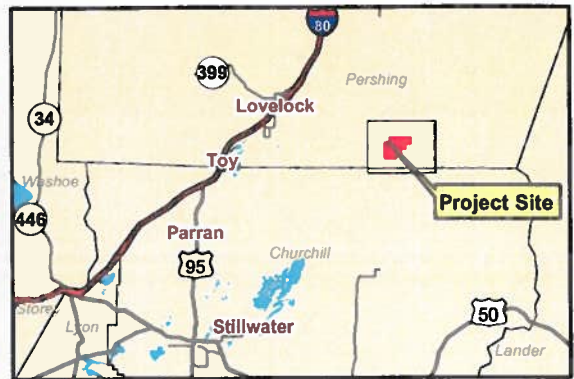
To determine whether geophysical site evaluations are actions consistent with the previously mentioned Categorical Exclusions, an environmental review was undertaken to determine whether any of the extraordinary circumstances/exceptions (516 DM 2, Appendix 2) exist that would preclude consideration of performing the resistivity surveys as a categorically excluded activity. This review was provided to the BLM with the TGP May 26, 2009 submittal of the general Project Description. No impacts were identified in the evaluation.

TGP will work with the BLM to avoid and minimize impacts to sensitive or particularly important resources. It is envisioned that prior to entering the area for exploration activity, BLM would issue a "notice to proceed" by email or regular mail.

The electromagnetic and resistivity surveys are not proposed to occur within the Migratory bird nesting season between March 15 and July 15. Therefore, a nesting survey is not proposed as part of this action.

# Figure 1: Location Map

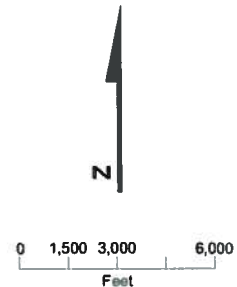




- New York Canyon Lease
- Geophysical Survey Area
- Township/Range Boundary
- Section Boundary

Lease Numbers:

- N-74854
- N-76298
- N-76299
- N-76300
- N-76301

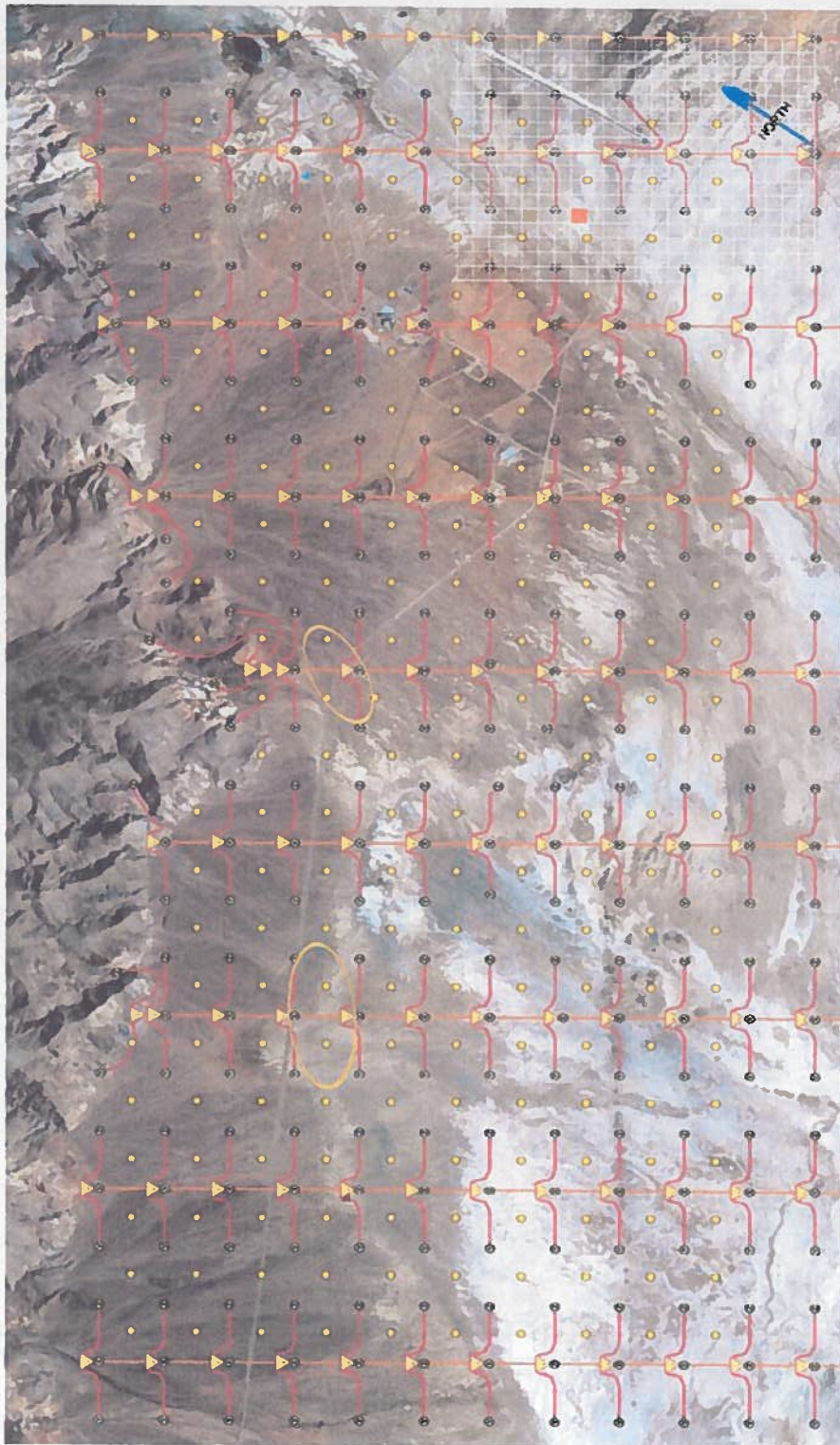


**Terra-Gen Power, LLC**  
**Northern Nevada Geothermal Project**  
**Geophysical Survey Area**

## Figure 2: Spartan Logger Survey Field Equipment



# Figure 3: E-SCAN Survey Aerial View



- 207 first-pass current injection electrodes on offset 400 m grid (includes optional ext. area)
- 260 combined measurement and current injection electrodes (includes optional ext. area)
- bi-directional digital 3-way switch
- duplex branch wire
- simplex electrode wire
- duplex main line wire

**NOTES:**

Current-only injection site potential fields are mapped by the installed E-SCAN measurement electronics and wiring system, providing 207 additional potential field mappings, each at a fraction of the cost of a conventional-grid shot (per Fig 2). The additional shots are patterned to specifically support the 8 deep uni-direction data subsets that will be individually inverted to improve resolution of narrow, deep linears.

**Figure 3** Adding 207 diagonally-offset "current-only" injection sites almost doubles the number of mapped potential fields, significantly increasing deep resolution.