NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

FACT SHEET

(Pursuant to NAC 445A.874)

Permittee Name: **Enel North America, Inc.** Type of Project: **Aquifer Storage & Recovery**
Project Name: **Still Water Geothermal** Address: **4785 Lawrence Lane**
Permit Action: **UIC Permit** **Stillwater, NV 89406**
Permit Number: **UNEV70013** Injection Wells (#): **Fifteen (15)**

A. Description of Injection well

Location: Up to fifteen (15) injection wells to be located at the Stillwater I & II Geothermal facility in the following sections:

Sections 1, 2 and 12, T.19N., R.30E.; Sections 5, 6, 7, 8 and 18, T.19N., R.31E.; Sections 35 and 36, T.20N., R.30E.; Sections 19, 28, 29, 30, 31, 32 and 33, T.20N., R.31E., M.D.B&M.

Injection Well Locations:

Well Name/No.	Well Location (M.D.B.&M., Churchill County, Nevada)	Longitude	Latitude
17-31	SW ¼ SW ¼ of Section 31, T20N, R31E	118° 33' 19" W	39° 33' 06" N
21-31	NW ¼ NW ¼ of Section 31, T.20N., R.31E	118° 33' 13" W	39° 33' 46" N
24-7	SW ¼ NW ¼ of Section 7, T 19N, R31E	118° 33' 08" W	39° 31' 39" N
11-1	NW ¼ NW ¼ of Section 1, T.19N., R.30E.	118° 34' 26" W	39° 32' 52" N
34-7	SW ¼ NE ¼ of Section 7, T.19N., R.31E	118° 32' 49" W	39° 31' 41" N
54-7	SW ¼ NE ¼ of Section 7, T.19N., R.31E.	118° 32' 39" W	39° 31' 43" N
63-7	SW ¼ NE ¼ of Section 7, T.19N., R.31E.	118° 32' 38" W	39° 31' 47" N
26-7	NW ¼ SW ¼ of Section 7, T.19N., R.31E.	118° 33' 09" W	39° 31' 25" N
28-36	NE ¼ SW ¼ of Section 36, T.20N., R.30E.	118° 34' 06" W	39° 32' 59" N
16-7	Approved for Construction		
84-12	Approved for Construction		
17-36	Approved for Construction		

In addition to injection, the applicant uses an evaporation/infiltration pond to dispose of geothermal fluids produced during test and maintenance procedures. Basins are utilized at existing injection wells for emergency or maintenance procedures.

Characteristics:
The injectate consists of geothermal fluid which has been passed through a binary power generating plant. The system is air-cooled and no cooling tower blow down fluid is produced. Chemical additives are not routinely used, although tracer dye tests, and special treatments are occasionally approved by the Division. The injectate also contains minor quantities of lubricating fluids from production well pumps. The injectate has a slightly alkaline pH and a TDS content of approximately 4500 mg/l with sodium and chloride being major constituents. Geothermal fluids typically have elevated levels of boron, lithium, fluoride, arsenic and slightly elevated levels of silica. Geothermal injectate fluid very occasionally exceeds the secondary Maximum Contaminant Level guidelines for iron (historic high of 1.02 mg/l); however, monitoring data do not indicate that groundwater is being degraded, and in general, receiving waters and the

shallower waters are high in iron. Sampling procedures or lab procedures could account for iron variability. Since historic analyses for iron are somewhat limited, and iron values in injectate and monitoring wells erratic, iron levels will be monitored by the Division more closely in the future. The non-condensable gas content of the reservoir fluid is low. The following concentrations of constituent gases were measured from injectate samples taken on October 26, 1995: CO_2 - 137 mg/l, CH_4 - 5.19 mg/l, and H_2S - 1.28 mg/l.

Table 1 – Injectate / Receiving Water Comparison

Constituent (units)	Stillwater Injectate (1/3/08)	Receiving Water-Injection Well 63-7 (10/07) T.D. = 1651 ft.	Receiving Water - Injection Well 28-36 (4/08) T.D. = 2310 ft.
pH	7.02	6.71	8.64
TDS (mg/L)	4200	3200	4800
As (mg/L)	0.031	0.031	0.036
Sb (mg/L)	0.0063	0.0071	0.0073
Ba (mg/L0	0.18	5.2**	0.93**
Be (mg/L)	<0.0010	<0.0010	<0.0010
HCO_3	85	120	68
B (mg/L)	20	15##	21##
Cd (mg/L)	<0.0010	<0.0010	<0.0010
Ca (mg/L)	67	51##	140
Cr (mg/L)	<0.0050	<0.0050	0.0088
Cu (mg/L)	<0.050	5.5	<0.050
F (mg/L)	3.9	6.5	5.6
Fe (mg/L)	0.50	0.98	2.6
Pb (mg/L)	<0.0025	<0.010	<0.010**
Mn (mg/L)	0.030	0.036	0.11
Mg (mg/L)	<0.50	0.60	2.0
Hg (mg/L)	<0.00010	0.0033	0.0026
Ni (mg/L)	<0.010	<0.010	<0.010
NO_3 (mg/L)	<1.0	<1.0	<1.0
K (mg/L)	100	42	56
Na (mg/L)	1600	1300##	1500##
SO_4 (mg/L)	170	160	230
Tl (mg/L)	0.0012	<0.0010	<0.0010
Zn (mg/L)	<0.010	0.012	0.016

** Reported value is estimated; the sample matrix interfered with the analysis

Spike recovery not calculated. Sample concentration >4x the spike amount; therefore, the spike could not be adequately recovered.

Average production rate during 2007 was 5552 gallons per minute (gpm). Average injection temperatures ranged from 169 deg F to 185 deg F.

B. Synopsis

General:

Enel Stillwater, LLC operates a binary geothermal power generation facility within the Stillwater - Soda Lake Known Geothermal Resource Area near Fallon, Nevada (Location Maps,

Attachments 1& 2). The plant has been in operation since 1989. This plant (Stillwater I) is scheduled for shutdown and de-commissioning in September of 2008. A new binary geothermal power generation facility (Stillwater II) is currently under construction and scheduled for completion in December of 2008. The applicant has applied for a renewal for their existing area permit as described under section A to support this new facility. The new project's net electrical output is expected to be approximately 30 MW, but full operation design capacity is 48 MW (gross nameplate). The geothermal fluid is delivered to the power plant from the geothermal production wellfield at approximately 300 deg. F to 320 deg. F. The fluid is distributed to heat exchangers that vaporize liquid isobutane. The resulting isobutane vapor powers turbine generators. The cooling system uses air cooling to condense the vaporized isobutane back to a liquid.

Currently there are six operating, or on standby status, production wells with one additional scheduled for pump installation. There are 9 operating, or on standby status, injection wells. The injection zone comprises Tertiary sedimentary and volcanic rocks between 788 and 4519 feet below the surface. The following table outlines injection well completion dates, depths, and injection intervals.

Table 2 – Well Construction

Well Name/No.	Injection Authorization Date	Total Well Depth (ft)	Injection Interval (ft)
17-31	12/88	2,920	904 – 2,885
21-31	09/91	4,522	1496 – 4,519
24-7	10/89	2,862	1335 – 2,825
34-7	11/05	1,460	850 - 1,200
54-7	04/06	1,400	1,120 - 2,080
11-1	Pending	2,109	1,068 - 2,109
63-7	01/08	1,650	739 - 1,650
26-7	01/08	1,710	583 - 1,710
28-36	Pending	2,100	1,120 - 2,080

Total depth of the production wells range from 1303 feet to 2672 feet. Production appears to be from discrete fractures, and the production zones range from 1500 feet to 4500 feet, based on known data. Injection is into or below currently utilized production zones. Above depths of about 900 feet are semi-confining clay-rich sediments which impede hydraulic communication between the geothermal reservoir and more near-surface aquifers. The shallow aquifer system is non-potable and generally of similar or higher TDS content than the production fluids and injectate.

An expansion of the injection well field was undertaken beginning in 2005 with the drilling of wells 34-7 and 54-7. An additional expansion took place in late 2007 and 2008 with the drilling of wells 11-1, 63-7, 26-7, and 28-36. All wells are scheduled to be piped in and receive final approval for operation by the 4th quarter of 2008.

Geologic Setting/Hydrogeology/Geothermal Characteristics:
The Stillwater geothermal resource area is situated within the Carson Sink north-northeast trending graben structure which is filled with up to 10,000 feet of Tertiary-Quaternary sediments and volcanic rock. The area is underlain in downward succession by Pleistocene Lake Lahontan and post-Lake Lahonton Holocene sediments about 900 feet thick, interbedded sedimentary and volcanic rocks (basalt flows and intermediate ash flow and lithic tuffs) of Tertiary and Quaternary age, and pre-Tertiary igneous and sedimentary rocks.

The uppermost sediment sequence extends from the surface to a depth of 600 to 800 feet and

consists primarily of interlayered and intertonguing clay, silt and sand. This clay-rich unit, as a whole, forms the low permeability cap that limits movement of geothermal fluid from the underlying, altered and fracture-permeable, geothermal reservoir into shallower formations.

A study by the U.S. Geological survey characterized the shallow aquifers within the upper part of the Lahonton sediments. Water table conditions exist to about 30 feet, below which confined conditions prevail. Recent measurements of the water table aquifer near the plant site ranged from 7 to 12 feet below surface. At least two confined aquifers occur within the upper 210 feet of the sedimentary sequence. A strong upward hydraulic gradient exists due to surface evapotranspiration and (limited) upward movement of geothermal fluids. Lateral hydraulic conductivities are much greater than vertical hydraulic conductivities and lateral flow velocities generally exceed vertical flow velocities. Flow in the shallow aquifers is northward to northeastward toward the Stillwater Wildlife Management area and the terminal Carson Sink Playa. The most volumetrically important recharge component is infiltrated irrigation water from the Newlands Project, with smaller amounts of recharge from standard mountain-front recharge, and up flowing thermal water.

The Stillwater geothermal system is defined at the surface by an elliptically-shaped heat flow anomaly trending north-northeast and covering approximately 57 square miles. The axis of the anomaly corresponds closely with a north-northeast-trending, active fault system that offsets basement rock. Two major earthquakes (magnitude of 6) occurred along this fault system in 1954. Geothermal fluids migrate upward along this fault system until they reach a depth of approximately 700 to 1000 feet, and then spread laterally along permeable sand layers, below the low permeability cap. Within the operating Stillwater Geothermal system, reservoir fluid circulation is reported to be convectively driven from north to south, opposite the flow direction of overlying aquifers and surface flows. Heat transfer in the semi-impermeable cap rocks is primarily by conductance, and to a lesser extent by fault-controlled upflow. Measured shallow domestic wells exhibit warm to hot water. Recorded temperatures include 151 deg. F from a 64 foot deep well, and temperatures in the 200 deg. F range from wells with total depths between 200 and 500 feet. Domestic wells in the area are not used for drinking water. The nearest residence to the Stillwater power plant is located approximately 1750 feet to the southeast.

2005 & Later Changes:
Since start-up, the plant has been operating without any major upsets, and no major incidents harmful to the environment have occurred. Since the last renewal, semi-annual and annual geochemical sampling of 3 monitoring wells and the injectate fluid has shown consistent chemistry, and no degradation of groundwater or surface water due to the geothermal plant operation. Previously reported geothermal fluid volumes and physical characteristics, fluid releases/spills, and plant/well activities will continue to be monitored and reported, with the permit insuring that appropriate communication exists between the Division and the permittee, in order to protect groundwater beneficial uses and avoid any harm to the surrounding environment.

An expansion of the injection field was undertaken in 2005 with the addition of wells 34-7 and 54-7. With the Stillwater II project the injection field was again expanded in late 2007 and 2008 with the drilling of wells 11-1, 63-7, 26-7, and 28-36. All wells are scheduled to be piped in and receive final approval for operation by late summer of 2008.

C. Receiving Water Characteristics

Geothermal fluids are injected back into the geothermal reservoir. On the average, injection is at or below production intervals. The TDS concentration of the geothermal reservoir increases moderately with depth. The injection process therefore should not degrade waters, unless unanticipated or unpermitted constituents are added to the injectate. TDS values in the geothermal reservoir fluids range from about 4500 to 7800 mg/l, with the major constituents being sodium and chloride. In general, monitoring and baseline data indicate that TDS concentrations above the geothermal reservoir range between 4000 and 5000 mg/l; however, four shallow monitoring wells at the main pond, east of the power plant, have historically yielded samples with TDS

concentrations from 13,800 to 42,160 mg/l. These samples were collected prior to any discharge to the pond. The dissolved solids concentration of shallow ground water in the Stillwater area decreases with depth. Higher TDS near the surface is a function of evapotranspiration, in combination with leached salt influx from agricultural drainage recharge. Concentrations increase during periods of drought, and seasonally, as a function of irrigation flows. Current shallow groundwater TDS values are in the 8000 to 10000 mg/l range, with high arsenic values (to 191 ppb), and variable iron values to over 2 mg/l. Discharge of geothermal fluids to containment basins, or occasional minor unscheduled surface discharge due to leaks or unlikely accidents should therefore not degrade groundwater quality.

D. Procedures for Public Comment

The Notice of the Division's intent to reissue a permit authorizing the facility to inject into the ground water of the State of Nevada subject to the conditions contained within the permit, will be sent to the *Reno Gazette Journal* and *Lahonton Valley News* for publication no later than August 1, 2008. The notice will be mailed to interested persons on our mailing list (see Attachment A). Anyone wishing to comment on the proposed permit can do so in writing for a period of 30 days following the date of the public notice.

All written comments received during the comment period will be retained and considered in the final determination. A public hearing on the proposed determination can be requested by the applicant, any affected state, any affected interstate agency, the regional administrator of EPA or any interested agency, person or group of persons.

Any public hearing determined by the Administrator to be held must be conducted in the geographical area of the proposed discharge or any other area the Administrator determines to be appropriate. All public hearings will be conducted in accordance with NAC 445A.238.

The final determination of the Administrator may be appealed to the State Environmental Commission pursuant to NRS 445A.605.

E. Proposed Determination

The Division has made the tentative determination to modify and reissue the permit contingent upon comments received during the public comment period and the public hearing. If no significant negative impacts due to injection are identified during this process, it is the intent of the Division to reissue the permit.

F. Proposed Effluent Limitations and Special Conditions

See Part I.A. of the permit.

G. Rationale for Permit Requirements

Verification that the quality of fluid discharged to the injection well(s) remains constant. Confirmation that fluids disposal does not adversely affect the existing hydrologic regime or biologic resources, including the nearby Stillwater Wildlife Management Area.

Prepared by: Russ Land
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