DOE/EA 1116

Environmental Assessment

Kalina Geothermal Demonstration Project
Steamboat Springs, Nevada

Prepared by:
U.S. Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401

With assistance from:
Dames & Moore
633 Seventeenth Street
Suite 2500
Denver, Colorado 80202

March 1999

DISCLAIMER

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Finding of No Significant Impact
for
Kalina Geothermal Demonstration Project
Steamboat Springs, Nevada

AGENCY: Department of Energy, Golden Field Office

ACTION: Finding of No Significant Impact

SUMMARY: The Department of Energy (DOE) has prepared an Environmental Assessment (EA) to provide the DOE and other public agency decision makers with the environmental documentation required to take informed discretionary action on the proposed Kalina Geothermal Demonstration project. The EA assesses the potential environmental impacts and cumulative impacts, possible ways to minimize effects associated with partial funding of the proposed project, and discusses alternatives to DOE actions. The DOE will use this EA as a basis for their decision to provide financial assistance to Exergy, Inc. (Exergy), the project applicant. Based on the analysis in the EA, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human or physical environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement is not required and DOE is issuing this Finding of No Significant Impact (FONSI).

COPIES OF THE EA ARE AVAILABLE FROM:

Deborah Turner

DOE/GO NEPA Compliance Officer

U.S. Department of Energy

1617 Cole Boulevard

Golden, CO 80401

(303) 275-4746

FOR FURTHER INFORMATION ON THE DOE NEPA PROCESS CONTACT:

Carol Borgstrom, Director

Office of NEPA Policy and Assistance

U.S. Department of Energy

100 Independence Avenue

Washington D.C. 20585

(202) 586 4600 or (800) 472-2756

BACKGROUND: Exergy, a private, for - profit company, is proposing to construct and operate a 6-megawatt (MW), advanced binary, geothermal power plant. The development of this power plant includes a single geothermal production well and a single injection well, as well as ancillary facilities [such as on-site access road(s) and electric transmission lines interconnected to existing geothermal power plants]. The proposed site to be developed is approximately 16 kilometers (km) [(10 miles (mi)] southeast of Reno in Washoe County, Nevada. The proposed geothermal power plant and associated components are known as the Kalina Geothermal Demonstration Project (KGDP). The proposed KGDP would be located on a private leasehold within the jurisdiction of Washoe County. The KGDP project would be located within the Steamboat Springs Unit Area in the Steamboat Springs Known Geothermal Resource Area.

A solicitation was issued by the DOE entitled "Demonstration of Economic Benefits of Improved Electrical Power Generating Systems for Geothermal Applications." Exergy submitted an application to this solicitation in which it offered to construct advanced binary geothermal power plant utilizing the Kalina Cycle System 11 (KCS11) at the Steamboat site. The DOE involvement would be to assist in the partial funding of the power plant. After a competitive process, Exergy was selected for a potential award. To support a decision to fund the proposed action, DOE prepared this EA to identify and evaluate potential environmental impacts from the construction and operation of the KGDP electric power plant.

PROPOSED ACTION: The proposed action consists of DOE providing financial assistance for a portion of the construction and operation of a 6-megawatt (net) geothermal power plant which includes one geothermal production well, one injection well, and ancillary facilities such as on-site access road(s) and interconnected to electric transmission lines to existing geothermal power plants. DOE's role in the proposed action would be limited to providing funding assistance for the construction and testing of the KCS11 equipment. Although DOE would review project activities, DOE would have no responsibility for construction supervision or facility operations.

ENVIRONMENTAL IMPACTS: The EA for the proposed demonstration project assessed environmental impacts on hydrologic resources, cultural resources, biological resources, socioeconomics, land use, geology, and impacts from upset conditions. Impacts to the hydrologic resource were evaluated with respect to the high and moderate reservoirs, groundwater and surface manifestations. The project is not expected to adversely impact any features of the geothermal resource.

A cultural resources investigation identified two sites of interest located within the project lease boundaries. A concurrence was made by the State Historic Preservation Office and the Western Office of the Advisory Council on Historic Preservation that no adverse effect would occur as a result of the construction or operation of the proposed action.

The Biological Assessment identified the Steamboat buckwheat, an endangered plant species within the project lease boundaries. However, the Steamboat buckwheat is not within the project disturbance area, and would not be impacted by the construction or operation of the proposed action. The U.S. Fish and Wildlife Service has concurred with the findings in the EA that the proposed action would not adversely effect the Steamboat buckwheat.

Project demands for construction and operational labor would be small and could be met from the local labor pool. As planned, the proposed action would not represent unfair or unequal treatment of low income or minority populations as required by E.O. 12898.

The total land disturbance is estimated to be approximately 3.4 hectares (ha) (8.4 acres). The proposed action is consistent with existing land use plans and is compatible with the existing adjacent land uses.

Potential impacts to public health and safety associated with the proposed action were assessed. Accidental ammonia releases and geothermal brine were modeled for operations and were determined to have no adverse off-site effects to human health or the surrounding environment. Project design features, compliance with the operation/maintenance program and adherence with specific regulatory requirements, would further reduce potential impacts.

ALTERNATIVES CONSIDERED:

No Action: Under the no action alternative, DOE would not fund the demonstration of the proposed KGDP. As a result of implementing the no action alternative, the commercial viability of this renewable energy technology, the energy efficiencies, and cost savings of the KCS11 would not be demonstrated at the project site.

DETERMINATION: Based on the information in the EA, DOE determines that the proposed action, *Kalina Geothermal Demonstration Project*, does not constitute a major Federal Action significantly affecting the quality of the human or physical environment, within the meaning of the National Environmental Policy Act. Therefore, the preparation of an environmental impact statement is not required, and DOE is issuing this FONSI.

Issued in Golden, Colorado, this 22 day of February 1999.

Frank M. Stewart, Manager

U.S. Department of Energy

Golden Field Office

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Appendices

ACRONYMS AND ABBREVIATIONS

ACEC	Area of Critical Environmental Concern
amsl	above mean sea level
ASME	American Society of Mechanical Engineers
bgs	below ground surface
BLM	Bureau of Land Management
C	Celsius
CFR	Code of Federal Regulations
cm	centimeters
CPI	Caithness Power, Inc.
DOE	U.S. Department of Energy
EA	Environmental Assessment
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
Exergy	Exergy, Inc
F	Fahrenheit
ft	feet
FWC	Far West Capital Inc.
gpm	gallons per minute
ha	hectares
in	inches
KCS11	Kalina Cycle System 11
KGDP	Kalina Geothermal Demonstration Project
KGRA	Known Geothermal Resource Area
km	kilometers
kW	kilowatts
LOC	levels of concern
lpm	liters per minute
m	meters

MCL	maximum contaminant limits
mi	miles
MSA	Metropolitan Statistical Area
MW	megawatt
NDOW	Nevada Department of Wildlife
NHPA	National Historic Preservation Act
NNNPS	Northern Nevada Native Plant Society
NRHP	National Register of Historic Places
ppm	parts per million
psi	per square inch
psig	per square inch gauge
RC	Rankine Cycle
SPPC	Sierra Pacific Power Corporation
TDS	total dissolved solids
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

This Environmental Assessment (EA) has been prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality Regulations for implementing NEPA (40 CFR Parts 1500-1508), the U.S. Department of Energy's (DOE's) NEPA Implementing Procedures codified in 10 CFR Part 1021, and other DOE NEPA guidance documents. This EA reflects the independent judgement of the DOE, the federal lead agency for the proposed action.

The DOE has entered into a cooperative agreement with Exergy, Inc (Exergy) who is teamed with Far West Capital Inc. (FWC) and Western Power Investments to demonstrate the viability of an innovative electric power production process using a moderate temperature geothermal source. The process, known as the Kalina Cycle System 11 (KCS11), is expected to be up to 40 percent more efficient than conventional geothermal power plants. The proposed action would be developed at the Steamboat Springs Known Geothermal Resource Area (KGRA) located approximately 16 kilometers (km) [10 miles (mi)] southeast of Reno, Nevada. The KGRA contains high and moderate temperature geothermal reservoirs, groundwater that may or may not exhibit geothermal characteristics, and surface manifestations (steam vents). The geothermal resource area was originally explored in 1975 and production of electricity from this resource began in December 1985.

DOE has historically supported development and implementation of processes that convert geothermal heat to electricity. In 1993, the DOE issued a solicitation titled "Demonstration of Economic Benefits of Improved Electrical Power Generating Systems for Geothermal Applications." After a competitive proposal process, DOE selected Exergy to receive financial assistance to demonstrate the economic and operational benefits of the KCS11. Financial support from DOE has allowed innovative technologies such as the KCS11 to demonstrate their viability leading to subsequent commercialization. To support a decision to fund the proposed action, DOE has prepared this EA to identify and evaluate potential environmental impacts from the construction and operation of the electric power plant.

OVERVIEW OF THE PROPOSED ACTION

The proposed Federal action consists of partial funding assistance for the construction and operation of a privately owned 6-megawatt (net) geothermal power plant which includes one geothermal production well, one injection well, and ancillary facilities such as on-site access road(s) and interconnected to electric transmission lines to existing geothermal power plants. DOE's role in the proposed action would be limited to providing funding assistance for the construction and

testing of the KCS11 equipment. The proposed KGDP will be a privately owned and operated electric generation facility. Although DOE would review project activities, DOE would have no responsibility for construction supervision or facility operations. The project would take approximately 14 months to complete, using an estimated 75 to 100 construction workers. It is anticipated that approximately 11 full-time workers would be required to operate the proposed facility. The total land disturbance is estimated to be approximately 3.4 hectares (ha) (8.4 acres).

The only alternative Federal action to the proposed KGDP would be no funding action This would result in no federal funding assistance for the KGDP which most likely would result in the facility not being built. Under the no action alternative, the efficiencies and cost savings associated with the KCS11 technology would not be realized and DOE would not be fulfilling its mission to support this type of technology. Improving the efficiency of current geothermal power plant technology is limited by the power plant design and heat transfer properties of the working fluids.

ENVIRONMENTAL ANALYSIS SUMMARY

This EA for the proposed Kalina Geothermal Demonstration Project considered potential environmental effects to the following environmental categories:

- Socioeconomics
- Land Use
- Geology
- Hydrology
- Biological Resources
- Cultural Resources
- Risk of Upset

Analyses of the potential impacts in each of these environmental categories were analyzed. The EA provides a summary of these analyses. Potential environmental effects have been reduced by project design features or incorporating mitigation measures. Chapter 7 summarizes each environmental category, potential environmental impacts, and associated mitigation measures.

Based on notice of preparation of this EA, there were some concerns regarding cultural resources, sensitive biological resources, and the geothermal resource itself. Based on studies addressing each of these concerns and an evaluation of construction and operational activities, no adverse impacts are anticipated for these resources.

The Biological Assessment identified the Steamboat Buckwheat, an endangered plant species within the project boundaries. However, the Steamboat Buckwheat is not within the project disturbance area, and would not be impacted by the construction or operation of the proposed action. Mitigation measures have been incorporated to protect the Steamboat Buckwheat outside the protected area. In addition, the Department of Energy is supporting a study on the critical habitat of the Steamboat Buckwheat. The U.S. Fish and Wildlife Service, Nevada Office has concurred with a no adverse effect determination.

A cultural resources investigation identified two sites of interest, the Sinter Quarry and Steamboat Ditch, partially located within the project boundaries. The proposed location of the injection well would be relatively nearby the Steamboat Ditch. Neither construction nor operation of the well is expected to impact the Steamboat Ditch. The portion of the Sinter Quarry located within the project boundaries could be impacted by well construction. The lithic scatter could either be avoided or collected and preserved through the State Museum. The Nevada State Historic Preservation Office and the Advisory Council on Historic Preservation have reviewed this project and have concurred with a no adverse effect determination.

Impacts to the hydrologic resource were evaluated with respect to the high and moderate reservoirs, groundwater influenced and not influenced by geothermal fluids, and surface manifestations. The proposed action is not expected to adversely impact any features of the geothermal resource. However, proper placement of the injection well within the moderate temperature reservoir would be crucial to the success of the project. Based on information regarding the hydrology and geology of the area, the well(s) could be sited and operated without adverse impact to the geothermal features.

CHAPTER 1
DESCRIPTION OF THE PROJECT

1.1 PROJECT OVERVIEW

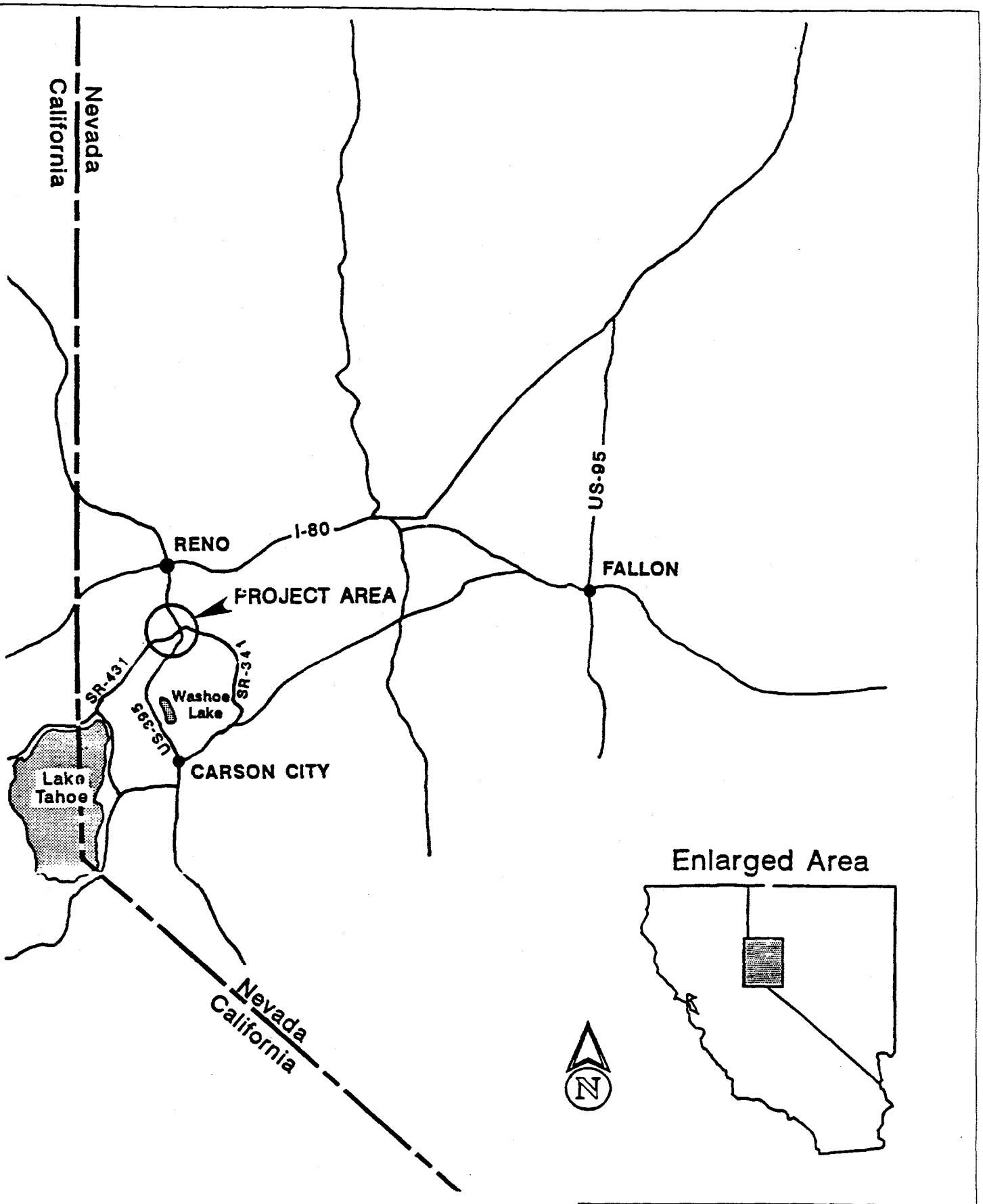
Exergy, Inc (Exergy), proposes to construct and operate a 6-megawatt (MW), advanced binary, geothermal power plant. The development of this power plant includes geothermal production and injection wells, as well as ancillary facilities [such as on-site access road(s) and electric transmission lines interconnected to existing geothermal power plants]. The proposed site to be developed is approximately 16 kilometers (km) [(10 miles (mi)] southeast of Reno in Washoe County, Nevada. The proposed geothermal power plant and associated components, using the KCS11 technology, are known as the Kalina Geothermal Demonstration Project (KGDP).

The proposed KGDP would be located on a private leasehold known as the Harvey (formerly "Giusti") parcel within the jurisdiction of Washoe County. The Harvey parcel is approximately 24 hectares (ha) (60 acres) in Section 29 of Township 18 North, Range 20 East. Figure 1-1 is a regional map and Figure 1-2 is an area map showing the project location in relation to the Steamboat Springs area.

1.2 PROJECT BACKGROUND

A solicitation was issued by The U.S. Department of Energy (DOE) entitled "Demonstration of Economic Benefits of Improved Electrical Power Generating Systems for Geothermal Applications." Exergy submitted an application to demonstrate the economic benefits of an advanced binary geothermal power plant utilizing the Kalina Cycle System 11 (KCS11). After a competitive process, Exergy was selected for a potential award. To support a decision to fund the proposed action, DOE prepared this Environmental Assessment (EA) to identify and evaluate potential environmental impacts from the construction and operation of the KGDP electric power plant.

The KGDP project would be located within the Steamboat Springs Unit Area in the Steamboat Springs Known Geothermal Resource Area (KGRA). The geothermal reservoir is located at a depth of approximately 150 to 460 meters (m) [500 to 1,500 feet (ft)] below ground surface (bgs) and produces hot geothermal fluid (commonly referred to as brine). The geothermal resource area was originally explored at the site in 1975 and production of electricity from this resource began in December 1985. Existing geothermal power production in the immediate area comes from FWC's

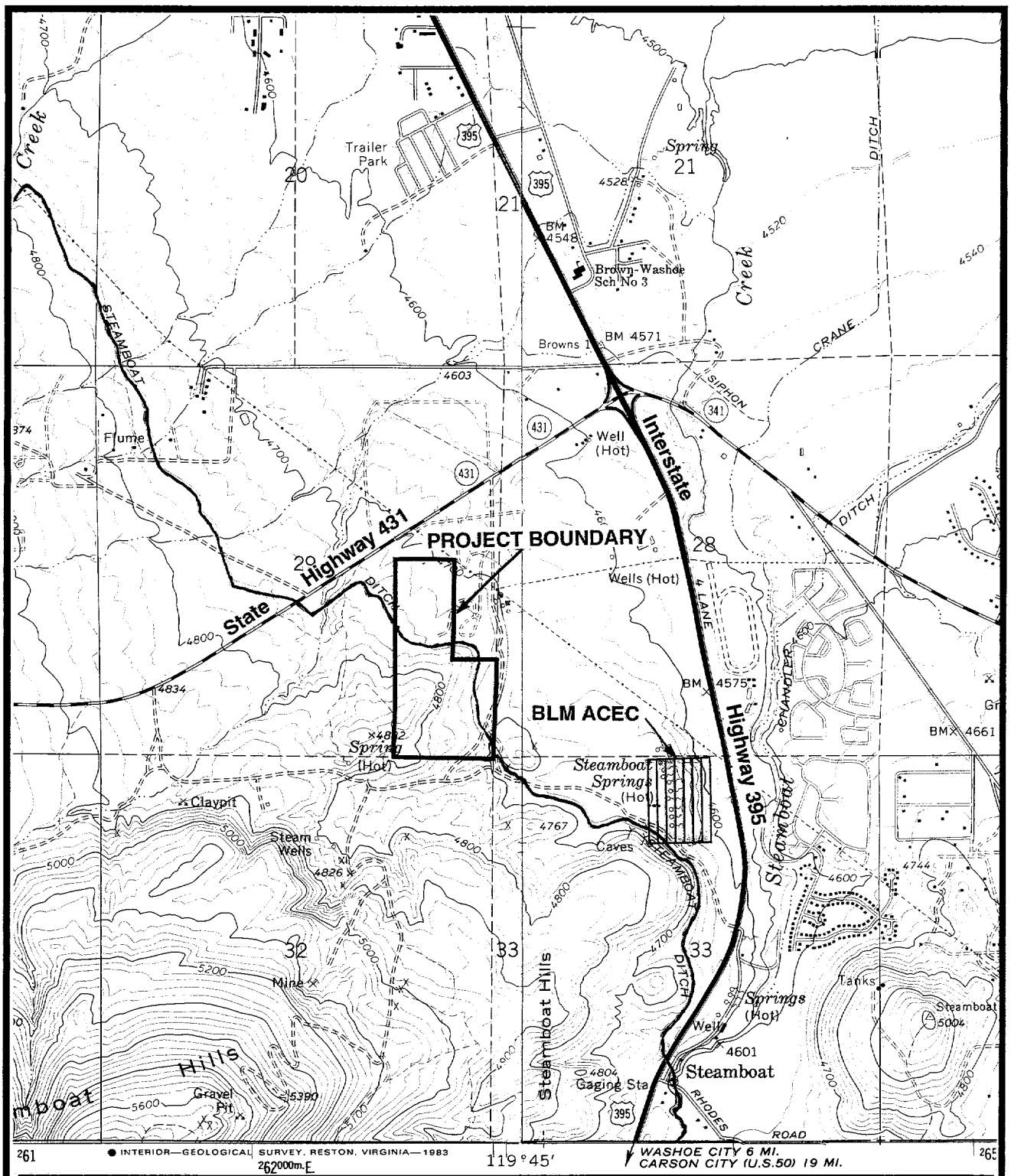


Source: Dames & Moore

Department Of Energy
Kalina Geothermal Demonstration Project

Regional Map

JOB NO. 02245-103	Dames & Moore	DATE 1/26/95
FILE NAME Off103/fig1-1		FIGURE NO. 1-1
DESIGN/ DRAFT		



0 1 mile

0 1 kilometer

BASEMAP: USGS 7.5 Minute Topographic Quadrangles:
Mt. Rose NE, NV 1982 (photorevised)
Steamboat, NV 1982 (photorevised)

Department Of Energy
Kalina Geothermal Demonstration Project

Project Location Map

JOB NO. 02245-103	Dames & Moore	DATE 1/26/95
FILE NAME Ofl103/fig1-2		FIGURE NO. 1-2
DESIGN/ DRAFT		

DAMES & MOORE

adjacent 10.8 MW (nameplate) binary plant (Steamboat I/IA) and 24 MW (nameplate) binary plant (Steamboat II/III). The electricity generated from these power plants is sold under a long-term power purchase agreement with Sierra Pacific Power Company (SPPC). In addition, Caithness Power, Inc. (CPI) operates a 12.5 MW single flash unit located south of the proposed project.

1.3 PROJECT PURPOSE AND NEED

Part of DOE's mission is to support the development of new energy sources and the enhancement of existing energy production technologies. With support from DOE, innovative technologies such as the KCS11 can be demonstrated as viable, leading to subsequent commercialization. DOE's role in the proposed action would be limited to providing partial funding assistance for the construction and testing of the KCS11 equipment. Although DOE would review project activities, DOE would have no responsibility for construction supervision or facility operations.

Developers of the KCS11 technology have recently proven the capabilities of their process at a 3 MW power plant which received waste heat from a liquid sodium plant in Canoga Park, California. Based on this demonstration, it is believed that the KCS11 process may be as much as 40 percent more energy efficient and lower in operating costs than conventional geothermal binary plants. With support from DOE, the developers of the KCS11 would be able to demonstrate the viability of their system.

1.4 PROJECT DESCRIPTION

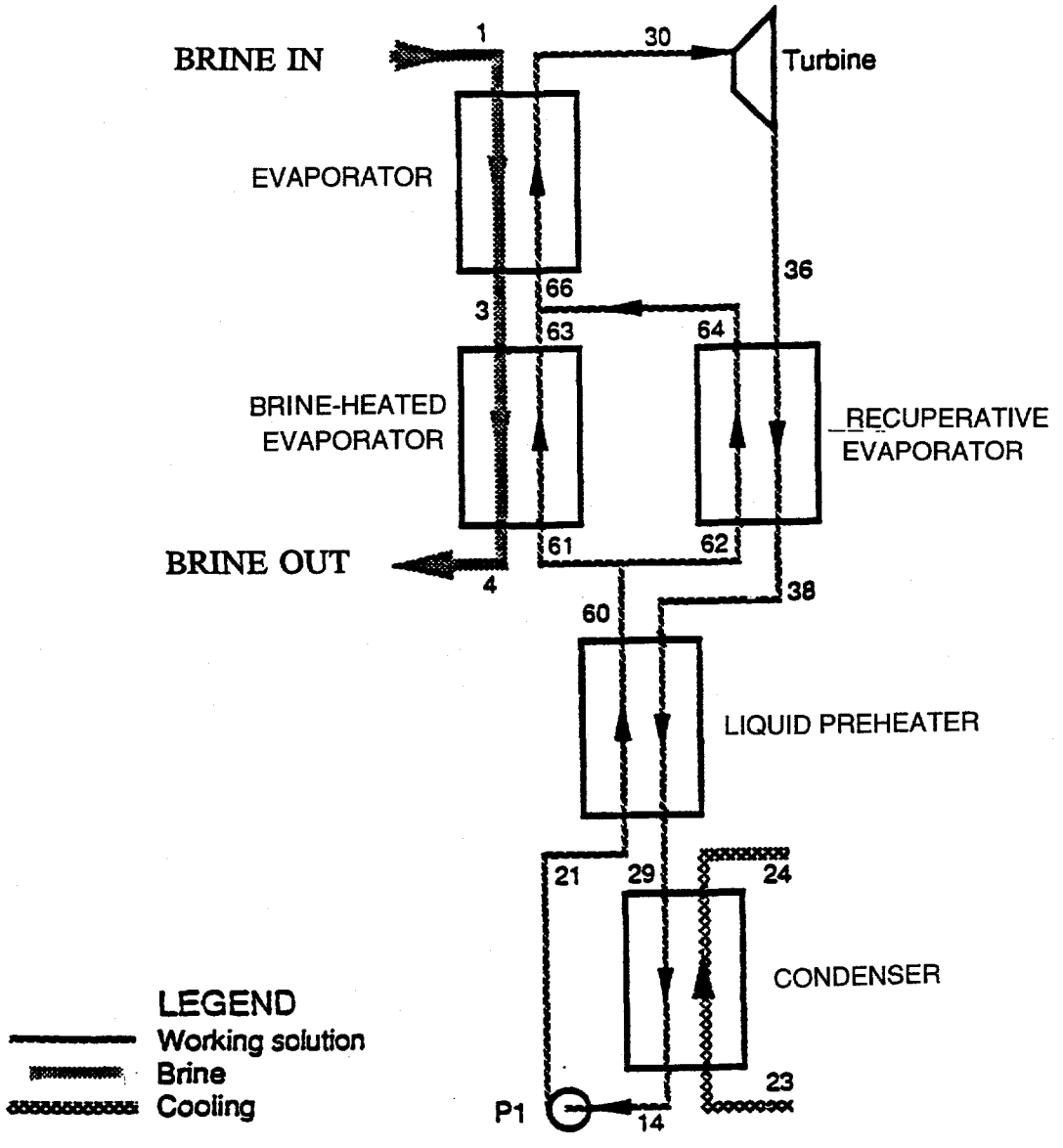
The proposed KGDP would consist of a 6 MW (net), advanced binary, skid mounted geothermal power plant, with associated geothermal production and injection wells, and ancillary facilities [such as on-site access road(s) and interconnections to electric transmission lines]. As currently proposed, the ownership of the KGDP would consist of a partnership among Far West Capital, Inc. (FWC), Exergy, and Western Power Investments (WPI). The project would be operated by SB Geo, an affiliate of FWC, and current operator of FWC's SB I/IA, II and III power plants. The KGDP has an expected operational life of approximately 30 years. The KCS11 process is briefly explained below.

1.4.1 KALINA CYCLE PROCESS DESCRIPTION

The proposed KCS11 technology is similar to conventional binary geothermal binary power plant processes in that heat from geothermal fluid is used to vaporize a working fluid which is circulated within the power cycle and eventually expanded in a turbine/generator producing power (electric generation). A conventional binary geothermal power plant uses hydrocarbon as its working fluid and does not utilize any regenerative heating. That is, the heat exiting the turbine is transferred to the environment through the condensers. The KCS11 uses an ammonia water solution as the working fluid and utilizes recuperative heat exchangers to preheat and partially vaporize a substantial portion of the working fluid. Therefore, less brine is required to produce the same amount of electricity, meaning fewer wells need to be drilled and maintained. The KGDP is expected to be up to 40 percent more efficient.

The working fluid for the KGDP would be recirculated within a "closed-loop" system through the following major components: a brine-heated evaporator and superheater turbine(s), two recuperative heat exchangers where heat from turbine exhaust is used to preheat and vaporize incoming working fluid, and an air-cooled condenser. A conceptual process flow diagram of the proposed action is shown in Figure 1-3.

As shown in Figure 1-3, working fluid (in liquid form) exits the condenser and is pumped at high pressure to a liquid preheater. After exiting the liquid preheater, the working fluid is split into two streams: one enters the brine-heated evaporator while the second stream enters the recuperative evaporator. The partially vaporized stream then leaves the recuperative evaporator and is sent back to the brine evaporator. Both streams then flow through the evaporator where vaporization of the working fluid is completed and superheating occurs. The superheated vapor enters the turbine. It is the vaporized working fluid expanded in the turbine which is connected to an electrical generator that produces electrical power. The spent vapor leaving the turbine immediately begins condensing in the recuperative evaporator which returns and provides heat (hence the term recuperative) to vaporize the working fluid.



Department Of Energy Kalinas Geothermal Demonstration Project			
Conceptual Flow Diagram			
JOB NO. 02245-103	Dames & Moore	DATE 1/26/95	
FILE NAME Off103/fig1-3		FIGURE NO. 1-3	
DESIGN/ DRAFT			

1.4.2 PROJECT COMPONENTS

The KGDP power plant, using the KCS11 technology, would include the following major components and systems:

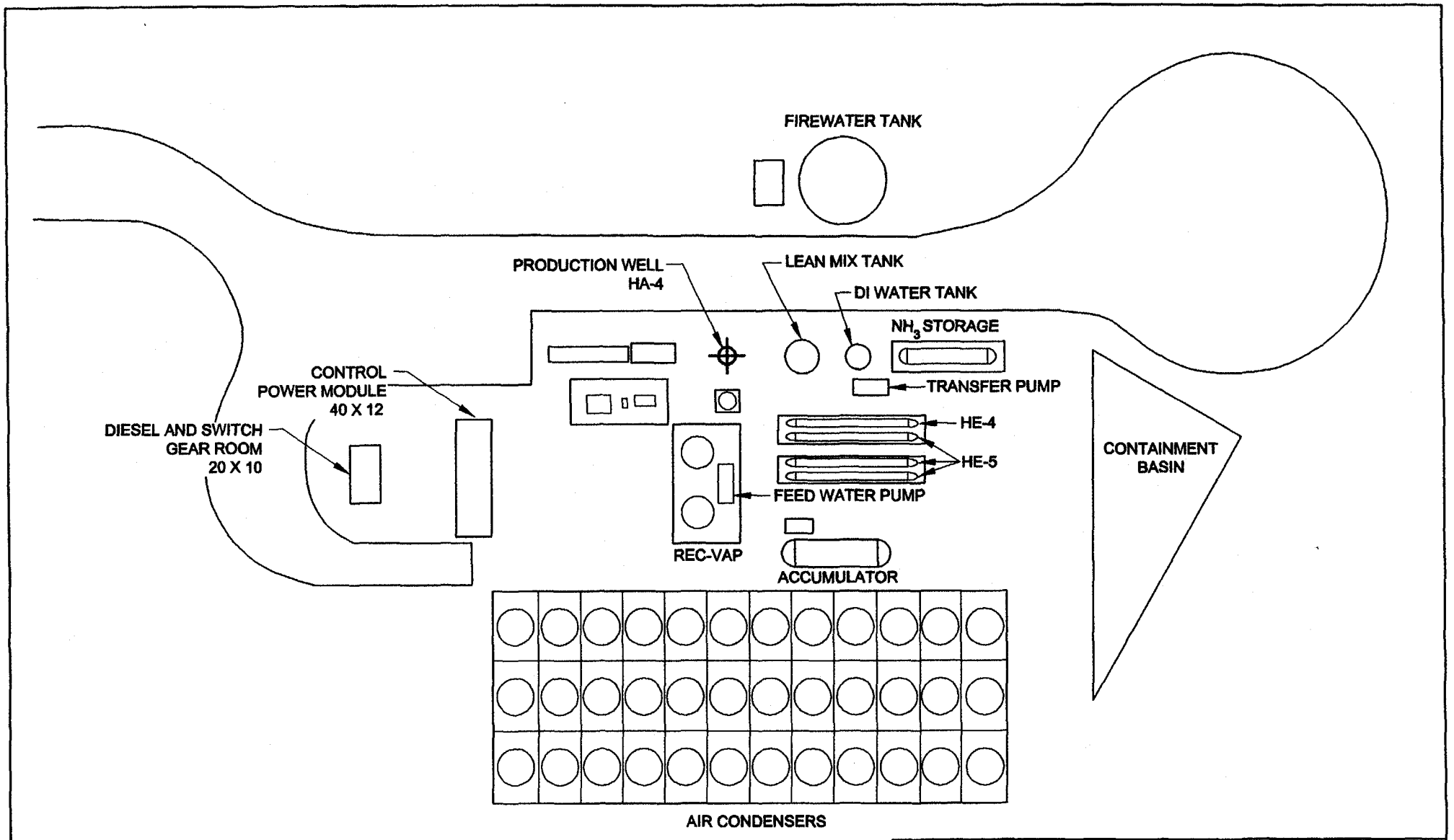
- Site foundations, buildings, and structures (skid mounted units);
- Brine supply and return system;
- Turbine generator(s) aqua-ammonia heat recovery system;
- Aqua-ammonia heat liquid system;
- Aqua-ammonia heat acquisition system;
- Ammonia make-up system;
- Feedwater make-up system;
- Cooling water system;
- Spent aqua-ammonia system;
- Electrical systems; and
- A fire protection system.

Figure 1-4 is a conceptual simulation of the proposed action. A detailed description of the proposed power plant components is in Appendix A.

1.5 CONSTRUCTION ACTIVITIES

Since the KGDP cannot use federal funding for construction until the NEPA process is completed and approved, only conceptual engineering has been completed for the siting and construction of the proposed power plant. However, the following general construction information was obtained from the project proponents so that potential environmental effects could be identified.

KGDP construction would occur over an 14 month period, beginning upon receipt of all necessary permits. All construction activities including site preparation, foundations, equipment installation, piping erection, electrical, and instrumentation work and building erection would be completed during the 14 month period. It is anticipated that many of these activities would be performed concurrently by multiple contractors. Work would typically be performed between the hours of 8 a.m. and 5 p.m., Monday through Friday. Night-time or weekend construction is not proposed.



KALINA GEOTHERMAL
DEMONSTRATION PROJECT

CONCEPTUAL POWER PLANT LAYOUT

JOB NO. 308221185556	DAMES & MOORE GROUP — A DAMES & MOORE GROUP COMPANY	DATE	1/99
FILE NAME SITEMAP2		FIGURE NO.	1 - 4
DESIGN/DRAFT MLB			

An estimated 75 to 100 construction workers would be hired to complete the KGDP facilities. The labor force would be comprised of qualified Nevada state-licensed contractors. Preference would be given to locally based companies depending on availability of appropriate labor skills.

The proposed KGDP power plant (refer to Appendix A, Figure A, Conceptual Equipment Arrangement) would occupy approximately 2 ha (5 acres) of land on the southern half of the project area. The power plant will be located adjacent to a previously drilled production well (HA-4). In addition, construction of the proposed action would require the installation of an injection well (see Figure 1-5). The injection well, located approximately 610 m (2,000 ft) from the power plant, would be drilled to a depth of approximately 920 m (3,000 ft). Also, on-site roads to and from the power plant and the wells would result in approximately 0.56 ha (1.4 acres) of ground disturbance. No new site access roads are proposed as part of the project. Access to and from the site would be provided by an existing gravel road.

In general, disturbance from construction of the KGDP would result in approximately 2 ha (5 acres) from the power plant, 0.5 ha (1.25 acres) from the injection well right-of-ways and .57 ha (1.4 acres) for maintenance of roads. Table 1-1 shows the estimated land requirement for construction activities.

To support construction activities, temporary utility lines (i.e., water and electric) would be laid from existing lines to the construction area. Potable water would be supplied through a bottled water supplier. Provisions would be made for fuel storage (gasoline and diesel) during the construction period.

1.6 OPERATION ACTIVITIES

The KGDP process and the operational characteristics of the major components are described in Sections 1.4.1 and Appendix A, respectively. This section addresses other operational activities and general operational information.

To operate the facility, SB Geo would retain a permanent on-site crew of operators and supervisors. There would be a power plant supervisor, a maintenance supervisor and eight operators including an administrative assistant.

Various chemicals would be stored and used to meet the operational requirements of the power plant. The following is an inventory of chemicals which would be stored in various quantities on-site: ammonia, sulfuric acid, diesel fuel, flammable liquids such as paint and solvents, toxic

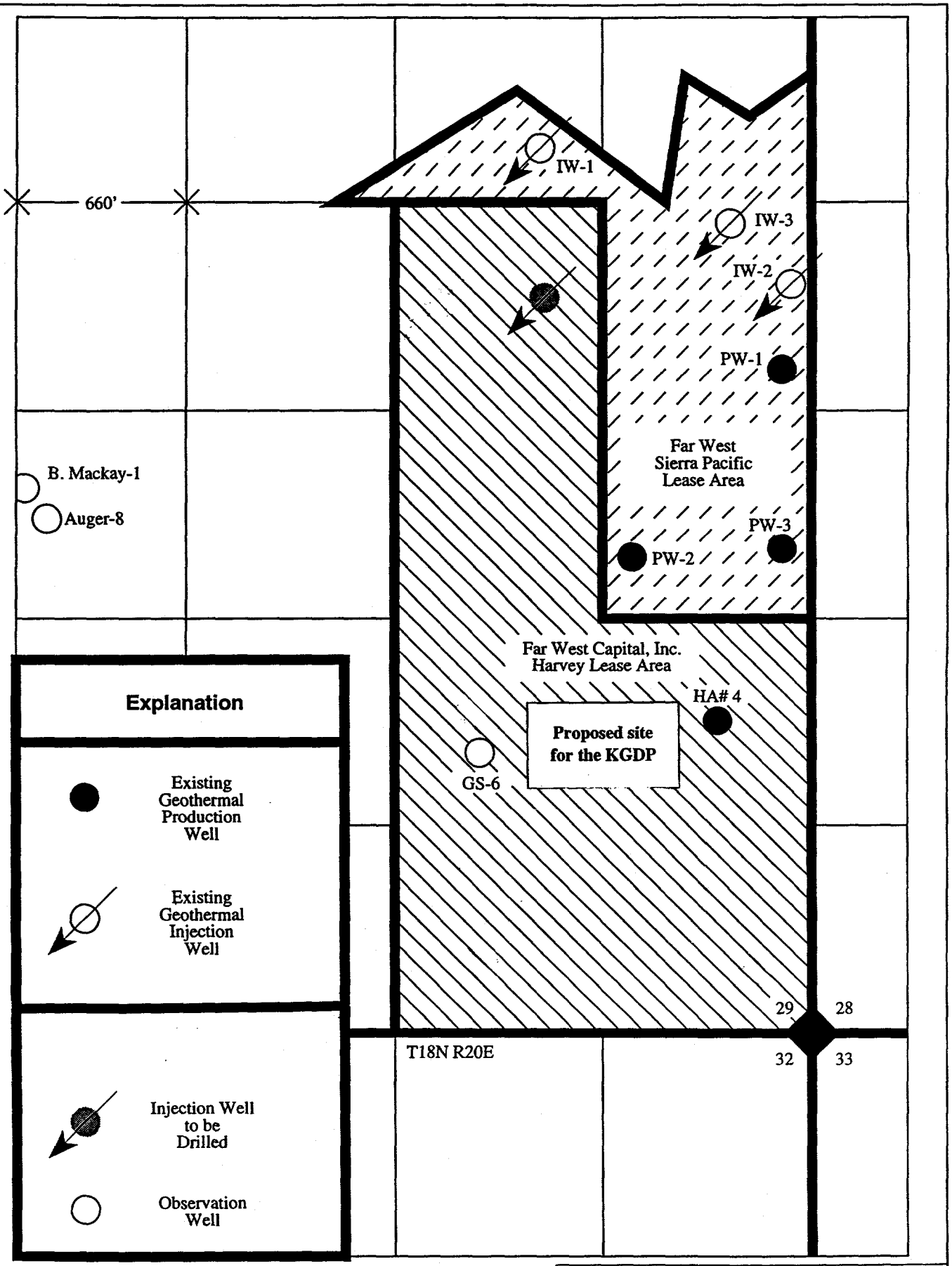

IW-1
660'
IW-3
IW-2
PW-1
Far West
Sierra Pacific
Lease Area
B. Mackay-1
Auger-8
PW-3
PW-2
Far West Capital, Inc.
Harvey Lease Area
HA# 4
Proposed site
for the KGDP
GS-6
Explanation
Existing
Geothermal
Production
Well
Existing
Geothermal
Injection
Well
Injection Well
to be
Drilled
Observation
Well
29
28
T18N R20E
32
33
Scale
500'
Source: Exergy, Inc.
Detail of FWC Harvey Lease and
Proposed Location of Production and
Injection Wells
Dames & Moore
1-5

Table 1-1
Land Requirement for Construction of the Project

Project Facility	Area of Disturbance ha (acres)	Notes
Power Plant and Production Well	2 (5)	Assume worst case
Injection Well	.80 (2.0)	Assume area for wells, pipeline, roads
Construction/Maintenance Roads	0.57 (1.4)	Required for access to on-site wells
Total area required for construction (±)	**3.37 (8.4)**	--

liquids such as cable cleaner, degreasing liquids, lube/waste oils and antifreeze. All chemicals would be stored above-ground in accordance with applicable regulations and with appropriate spill control features.

Solid wastes generated during routine operations and maintenance would include dirty/oily rags, used air and lube filters, miscellaneous maintenance materials, and daily trash. Solid waste would be collected in the appropriate containers and hauled away weekly by licensed haulers, for disposal at an appropriate local landfill. Liquid waste would be predominantly spent aqua-ammonia, solvents, spent oils, periodic equipment cleaners and sanitary waste. Aqua-ammonia waste would be collected, transported off-site, treated, and either disposed of or recycled by a licensed operator in accordance with applicable regulations. Other liquid waste would be collected and stored onsite, recycled if possible, and the remainder transported and disposed of as prescribed by law.

Access to and from the site would be provided by an existing gravel road. There is no plan for developing other roads or access to the site.

CHAPTER 2
PROJECT ALTERNATIVES

2.1 NO ACTION

Under the no action alternative, DOE would not fund the construction and testing of the proposed KGDP. Therefore, the only options available to DOE is to either fund the KGDP or to not fund it. As a result of implementing the no action alternative, the commercial viability of this renewable energy technology, energy efficiencies, and cost savings of the KCS11 would not be demonstrated.

CHAPTER 3
AFFECTED ENVIRONMENT

3.1 SOCIOECONOMICS

This section responds to Executive Order (E.O.) 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." E.O. 12898 requires Federal agencies to identify and address environmental effects of their projects on minority and low-income populations. This EA evaluated potential effects from project-related activities on areas of minority or low-income populations.

Socioeconomic issues which are relevant to the proposed action are effects to the existing social and economic conditions in the project region. The following subjects are addressed: population, economy, and housing.

Since 1980, the three political jurisdictions of Reno, Sparks, and Washoe County, the Reno/Sparks Metropolitan Statistical Area (MSA) have experienced moderate employment, population, and housing supply growth. The Reno/Sparks MSA growth has been part of a state-wide trend. Nevada has been one of the fastest growing states in the nation over the last decade. It is expected to continue to be among the states with the fastest growth in jobs, income, and population through 2000 (Nevada Development Authority et al., 1991; 1994). During the next 5 to 20 years, it is expected that growth will continue in Washoe County, but at a slower rate (Washoe County, 1997).

3.1.1 POPULATION

The ethnic and racial composition of the entire population of Reno/Sparks MSA in 1990 was approximately: 83 percent White; 9 percent Hispanic; 4 percent Asian; 2 percent Native American; and 2 percent Black. This ethnic distribution is relatively comparable to the overall population in Washoe County (Washoe County, 1997).

During the past 10 years, the population of the Reno/Sparks MSA has grown from 183,845 to 257,120, an increase of approximately 72 percent. Annual population change has ranged from 4.5 percent to 3.0 percent between 1970 to 1990. Population growth in the Reno/Sparks MSA is projected at an annual rate of 2.1 percent for the remainder of the decade (Economic Development Authority of Western Nevada, 1995a).

3.1.2 ECONOMY

The tourism-related services have been the primary employment-generating sector in the Reno/Sparks MSA economy. In recent years the economy has diversified with new industries contributing substantially to local employment. The "Services" business sector, which is inclusive of the hotel gaming/recreation industry, is the largest single sector of the local economy, supplying approximately 40 percent of the employment opportunities. Employment opportunities for the "Trade" and "Government" employment sectors are approximately 23 percent and 14 percent, respectively. The public utilities sector, referred to as "TCPU", Manufacturing, and finance-related industries each account for approximately 5 percent to 6 percent of the local employment. The construction industry accounts for approximately 5 percent of the local employment. The mining industry supplies approximately 1 percent of the jobs in the Reno/Sparks MSA (Nevada Employment Security Research Bureau, 1996).

According to the U.S. Bureau of the Census, the 1991 per capita income in the Reno/Sparks MSA was $22,561, which is higher than the Nevada State average of $20,249 (U.S. Bureau of the Census, 1992). According to the Economic Development Authority of Western Nevada (1995a/b), the median household income in the Reno/Sparks MSA was $32,561 which is slightly higher than the Nevada State average of approximately $31,011.

3.1.3 HOUSING

Increases in population have resulted in a range of housing demands. The number of housing units in the county grew to approximately 112,193 in 1990. Of these, 49.3 percent were owner-occupied, 41.9 percent were renter-occupied, and 8.8 percent were vacant (Environmental Management Associates, 1993). The median selling price of a home in the Reno/Sparks area in 1993 was approximately $116,700 (Economic Development Authority of Western Nevada, 1995b).

3.2 LAND USES

This section describes the existing land uses in and around the project site. The proposed action is located in unincorporated Washoe County in the Steamboat Springs KGRA. According to Washoe County assessor parcel maps, the project site is known as the Harvey Leasehold (formerly "Giusti") parcel occupying approximately 24.3 ha (60.2 acres). The Harvey parcel is maintained as a private leasehold within the jurisdiction of Washoe County. The existing land use designation for the project site is identified as A1 - A4, allowing geothermal development under a Special Use Permit granted by Washoe County.

Development in the immediate area of the project site is limited to uses dependent on the Steamboat Springs KGRA. Two existing geothermal power plants (Steamboat I/IA and II/III) are located on the Towne Leasehold parcel east of and adjacent to the project site. SPPC, the local electric utility purveyor, owns and operates electric energy facilities adjacent to the northern-half of the project site. The Bureau of Land Management (BLM) occupies a 16-ha (40-acre) parcel adjacent to the southern half of the project site. The remainder of the project site is surrounded by the 86-ha (213-acre) Redfield parcel. In addition, the Steamboat Hills Project, a 12.5 MW geothermal power plant operated by CPI, is located approximately 0.8 km (0.5 mi) south of the project site, has been in operation since 1988. Other land uses within close distance of the project site include livestock grazing, transportation-related uses, mineral resource extraction, electric transmission line easements, and vehicle-orientated recreation. According to a site reconnaissance, the closest residential community to the project site is approximately 1,400 m (4,600 ft).

The BLM maintains a 16-ha (40-acre) parcel as an Area of Critical Environmental Concern (ACEC) approximately 366 m (1,200 ft) from the southeastern project site boundary (refer to Figure 1-2). The Steamboat ACEC was created by the BLM to preserve and protect the geothermal and geothermal-related features found in the vicinity. A Recreation and Public Purpose lease from the BLM has been signed by Washoe County to develop a park with interpretive sites and recreational facilities within the Steamboat ACEC (BLM, 1993).

3.3 GEOLOGY

This section summarizes the geologic resources of the proposed action area based on the following sources.

- The detailed mapping of the Steamboat Springs area by Thompson and White in United States Geological Survey (USGS) Papers, "Geologic Survey Professional Papers 458-A through 458-D," (D.E. White, et al, 1979); and

- Numerous observation, production and injection wells drilled for geothermal exploration, several gravity and magnetic surveys have been conducted to delineate subsurface characteristics.

The project area is located on the northern flank of the Steamboat Hills which is part of the larger Steamboat Hills structural block. The structural block is uplifted relative to the areas east, north, and west. The northeast trending Steamboat Hills are located at the beginning of the Nevada Basin and Range Physiographic Province. The gross structure of the Steamboat Hills is one of

folded volcanic rock intruded by cretaceous (estimated at 135 and 65 million years ago) granodiorite. This intruded sequence is overlain by volcanic rocks, younger sediments, and alluvial deposits. The granodiorite represents the oldest rock unit in the northeast Steamboat Hills, originating in the Jurassic-Cretaceous age (estimated at 150 to 80 million years old). Additional rhyolytic intrusions (magma consisting of rhyolite) occurred within the recent past and may be the heat source for the geothermal system.

The alluvial sands, gravels, and boulder conglomerates are the youngest deposits in the area and represent debris eroded from rocks in the mountains west of the project area. These deposits are about 30.5 to 91 m (100 to 300 ft) thick in the lease area and thin to the south towards bedrock outcrops but thicken to the north and east into the South Truckee Meadows area. At the project site there are abundant silica sinter in the alluvium deposited from ancient hot springs which once flowed in this vicinity. The sinter cements the unconsolidated alluvium into a hard rock with much lower porosity and permeability than the alluvium in the surrounding South Truckee Meadows area.

From rock outcrops it is apparent that there has been faulting and fracturing in the granodiorite. These features are also exhibited in subsurface drill cuttings as protomylonite and calcite veins (fracture fillings) in rock fragments. These north-northeastern trending faults and fractures act as conduits for the geothermal fluid. Geothermal surface manifestations along these fractured areas include hot springs and mud volcanoes.

3.4 HYDROLOGY

This section describes each hydrologic component of the project area and the interactions among them. Components of the Steamboat Springs hydrologic system consist of precipitation and surface waters, groundwater, and geothermal fluids (moderate and high temperature). Within each of these, the hydrology and water chemistry varies spatially as a result of interaction between each component as well as the differences in source and recharge, effects of processes such as mixing and boiling, and different degrees of usage.

3.4.1 PRECIPITATION AND SURFACE WATER

Precipitation in the project region is highest in late fall, winter, and spring (October through April), averaging 18.26 centimeters (cm) [7.19 inches (in)] per year at nearby Reno. The relatively low precipitation is augmented by surface water runoff from nearby mountains. Perennial and intermittent streams including Whites Creek, Thomas Creek, Galena Creek, and Steamboat Creek

drain the Carson Range and provide recharge to the groundwater and geothermal water reservoirs in the Steamboat Hills area.

In 6 out of the last 10 years, annual precipitation has been below normal in Reno. As a consequence, stream flows have been lower than normal for this period. The low precipitation and reduced stream flows are providing less than normal recharge to the groundwater basin.

3.4.2 GROUNDWATER

For this EA, groundwater refers to the non-saline groundwater resources in the vicinity of Steamboat Hills, as there appears to be little or no groundwater on the Steamboat Hills proper. The quality of groundwater may be affected adversely by increasing water usage, infiltration of agricultural drainage, or inflow of geothermal waters. Increased water usage can decrease the amount of available groundwater and thus concentrate dissolved solids. Agricultural drainage can introduce nitrates to the groundwater from the application of fertilizers. The inflow of geothermal waters into groundwater can decrease water quality by introducing high concentrations of chlorides and boron. Some groundwater wells may yield a portion of geothermal water (high chloride concentration).

3.4.2.1 Groundwater Elevations – To the north and northwest of Steamboat Hills numerous groundwater wells are used for domestic supply and irrigation. Groundwater elevations decrease from west to east toward Steamboat Creek. Groundwater elevations in wells monitored by CPI and FWC range from about 1,419 m (4,656 ft) above mean sea level (amsl) near the northwest of Steamboat Hills to approximately 1,370 m (4,497 ft) amsl near Steamboat Creek.

Groundwater elevations in Pleasant Valley south of Steamboat Hills are generally higher than those north of Steamboat Hills. The groundwater elevations for these wells are between 1,457 m (4,780 ft) amsl and 1,405 m (4,610 ft) amsl. In general, groundwater elevations decrease down the valley axis toward the northeast.

3.4.2.2 Groundwater Geochemistry and Temperature – The following section discusses the groundwater chemistry and temperature characteristics in the project region.

North to Northwest of Steamboat Hills – The quality of shallow groundwater in the area north to northwest of Steamboat Hills is good. Although some water temperatures are warm, they show none of the chemical components typical of deep geothermal fluid. Samples from wells completed in the alluvial deposits flanking the Carson Range contain total dissolved solids (TDS) of less than 350 milligrams/kilograms (mg/kg) and less than 5 mg/kg of chloride. Heavy metal

concentrations are below detection levels. The groundwater wells in this area are probably recharged from local precipitation. Despite the fact that water levels vary seasonally, the water quality is consistently good. This consistency suggests that geothermal fluids are not impacting the groundwater in this area.

Steamboat Valley – North-Northeast of Steamboat Hills and East of Steamboat Creek – The shallow aquifers north to northeast of Steamboat Hills and east of Steamboat Creek contain varying amounts of geothermal fluid. Geothermal fluids contain high TDS and heavy metals which could make it inappropriate for domestic uses, and high boron concentrations which are detrimental for some agricultural uses.

The chemistry of water from these wells does appear to have a seasonal variation. The lowest TDS corresponds with the lowest chloride concentrations and lowest temperatures, consistent with the lowest geothermal contribution. These conditions usually occur in the late summer and lag the surface water quality highs by several months. Water from these wells may be acceptable for domestic use, although the TDS rarely meets the EPA's primary drinking water standards of 500 mg/kg.

Pleasant Valley – The groundwater from Pleasant Valley is moderate (acceptable for both domestic and agricultural use) and could be characterized as sodium bicarbonate water. The absence of chloride, boron, and high TDS suggests that there is no influence of geothermal fluids in these groundwater aquifers. However, nitrate concentrations of up to 20 mg/kg indicate that agricultural activities in the area may have had a significant influence on the groundwater quality in the Pleasant Valley area.

3.4.2.3 Recent Trends – Groundwater elevations in the Steamboat Hills vicinity have generally declined over the last 10 years. Previous studies attributed much of this decline to below average precipitation and increased utilization of groundwater resources in South Truckee Meadows. Declines appear to begin before the years of low precipitation. Below average precipitation appears to affect seasonal variations but cannot be directly linked to the long term declines.

3.4.2.4 Groundwater Wells with a Geothermal Component – There are some groundwater wells that exhibit a geothermal component, manifested by higher temperature water and decreased water quality (higher TDS, chloride). Wells north of Steamboat Hills that have a geothermal component generally show trends that are similar to the groundwater wells in the area. However, in wells that exhibit a predominant geothermal component, water level declines generally exceed the declines in groundwater wells north of Steamboat Hills. These declines appear to be related in part to geothermal utilization. In addition, water elevations in wells that contain

geothermal fluid are approximately 18 m (60 ft) higher than adjacent wells that do not tap into geothermal waters. This suggests that the groundwater system and the geothermal system are not directly connected; therefore, it is difficult to link groundwater utilization to water level declines in wells tapping geothermal waters. In some mixed wells, however, the geothermal component has increased as water levels decline, suggesting that the declines are related to declines in groundwater recharge to these mixed aquifers.

3.4.3 GEOTHERMAL FLUIDS

The Steamboat Hills geothermal system is a moderate to high temperature ≤ 235° C (455° F), liquid dominated, fracture controlled geothermal system. Two areas of this system are being used for power production. One area is higher in temperature 199° to 235° C (390° to 455° F) and is hereinafter referred to as the high temperature system. The other area is slightly lower in temperature 160° to 168° C (320° to 335° F) and is hereinafter referred to as the moderate temperature system.

This section discusses geothermal fluids in the high temperature system beneath the CPI leases, the moderate temperature system accessed by the FWC wells, and geothermal surface manifestations at the main and lower terraces. Although the resource is centered in the Steamboat Hills, outflow from the geothermal system is observed in a number of wells north of Steamboat Hills that tap geothermal fluids and mix in varying degrees with the groundwater.

Geothermal fluids have been encountered at surface elevations [1,422 m (4,665 ft) amsl at the Main Terrace)] to elevations approximately 762 m (2,500 ft) amsl in the deepest geothermal production wells. The high temperature zone becomes shallower and cools to the northeast. The water quality of these fluids is unacceptable for domestic, agricultural, and most industrial uses except for electrical production. TDS, chloride, arsenic, and fluoride levels are all above the EPA's maximum contaminant limits (MCL) for drinking water.

3.4.3.1 High Temperature Geothermal Fluids – The high temperature system refers to the deeper [>610 m (2,000 ft) bgs] and hotter [>199° C (390° F)] fluids observed in deep wells drilled in the southern portion of the geothermal system. The high temperature system was characterized using CPI geothermal observation (monitoring wells) for water level trends. In December of 1993, CPI stated that reservoir conditions in the deep high-temperature reservoir have remained constant since starting production in 1988.

The chemistry of the high-temperature geothermal fluids consists of concentrations of sodium ranging from 600 to 620 mg/kg, chloride ranging from 700 to 740 mg/kg, boron from 25 to 40 mg/kg, and arsenic from 1 to 3 mg/kg.

3.4.3.2 Moderate Temperature Geothermal Fluids – The moderate temperature geothermal system [160°to 168° C (320°to 335° F)] was characterized using the FWC geothermal monitoring wells on the Towne and Harvey leases for water level trend analysis. Data from Towne lease production and injection wells provide rate and temperature trend analysis. Geothermal monitoring well data show average water level declines of more than 1.8 m (6 ft) per year in the FWC area since September 1992. This is equivalent to a pressure decline of about 2 kg/cm^2 [3 pounds per square inch (psi)] per year.

The water chemistry of the moderate temperature fluids is similar to that of the high temperature fluids, but exhibits slightly higher chloride, boron, and metal concentrations.

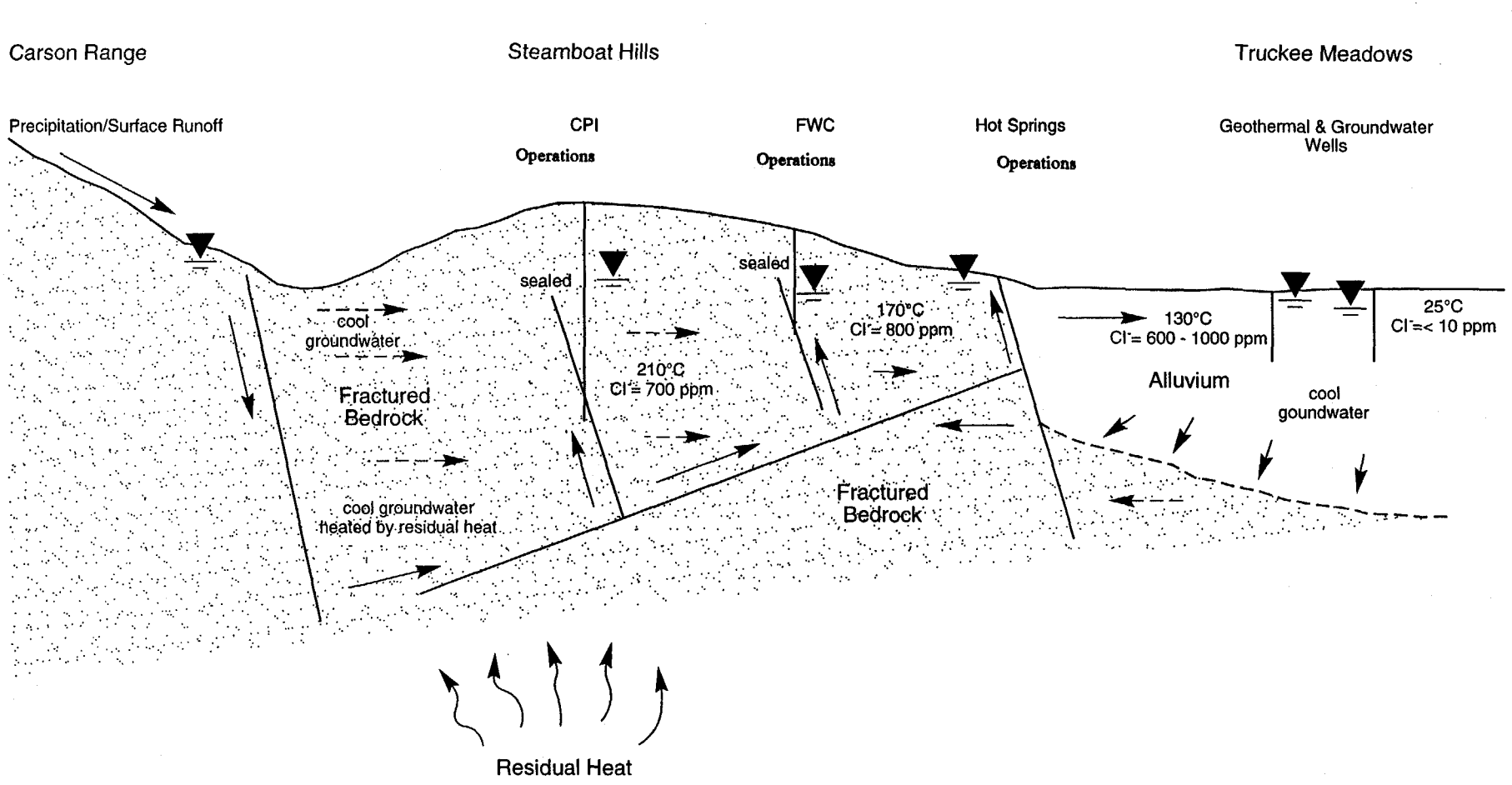
3.4.3.3 Geothermal Surface Manifestations – Before 1988, the primary surface manifestations were hot springs, hot spring deposits, hydrothermal alteration (e.g., acidic alteration, sulfur deposits), and geyser activity as described by White (1968), Sorey and Colvard (1992), and others. The most dramatic surface manifestations presently include the main terrace steam vents and the remnant siliceous sinter deposits. The steam vent activity is reported to be increasing toward the south end of the main terrace.

Current water levels within the area where hot springs used to flow are below measurable depths. Therefore, the water levels of nearby shallow wells are used to indicate water levels in the shallowest part of the geothermal system.

Because no geothermal manifestations are currently flowing at the surface and have not been since 1988, neither current nor recent chemistry is known.

3.4.4 INTERACTION AMONG HYDROLOGIC COMPONENTS

The conceptual model showing the communication and interaction among the major fracture system, the geothermal system, the regional groundwater system, and surface recharge is presented in Figure 3-1. Precipitation and surface waters provide recharge to groundwater resources in the alluvium (silt deposits) and to the geothermal reservoir in the fractured bedrock. Cold groundwater flows into fractured bedrock and is heated to form geothermal waters, or mixes with existing geothermal waters. Geothermal waters move upward along fractures to form the geothermal reservoirs. Boiling during migration causes the observed chemical and temperature differences



The figure shows the major components of the system, precipitation/surface water, groundwater, and geothermal water. Precipitation and surface water provides recharge to the groundwater and geothermal waters. Geothermal waters occur along fractures in bedrock. Groundwater occurs in alluvium and intermixed with geothermal waters in fractured bedrock. The major fractures provide hydraulic control. The three major components of the system are all interconnected to some extent. Water elevation (▼) differences between geothermal waters and groundwater, however, indicate that local barriers to flow exist.

Department of Energy
Kalina Geothermal Demonstration Project

Conceptual Model of Steamboat Hills Hydrogeologic System

JOB NO. 02245-103	Dames & Moore	DATE 10/13/95
FILE NAME Off103\hydrgeo.dwg		FIGURE NO. 3-1
DESIGN/ DRAFT		

between the geothermal reservoirs. Locally, adjacent to fractures, geothermal waters flow into alluvium and mix with groundwater or flow into surface waters. Although local barriers may exist between nearby fractures or between units within the alluvium, no major large scale flow barriers are presented. All of the components of the hydrological system appear to communicate and interact at various levels.

3.5 BIOLOGICAL RESOURCES

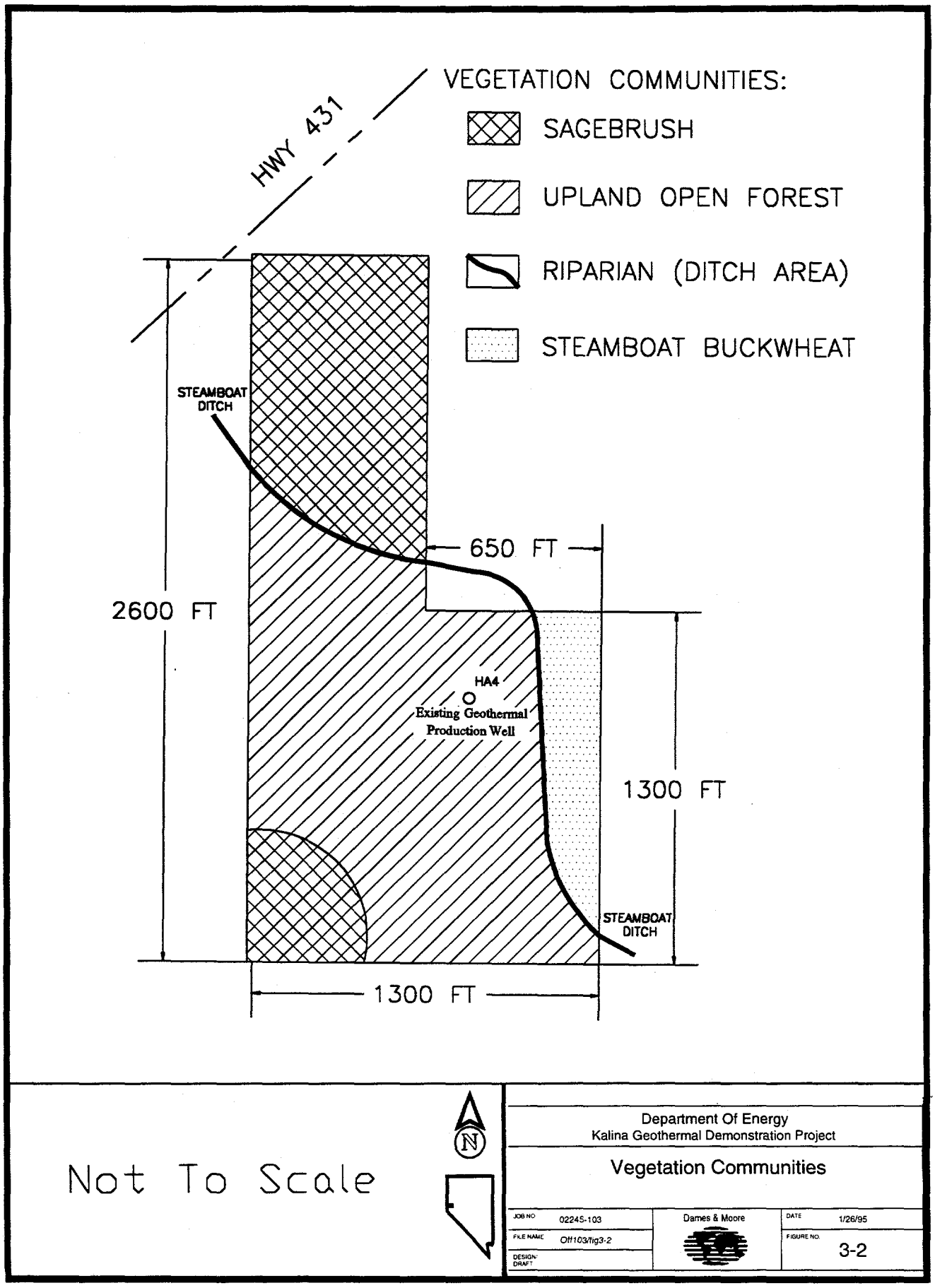
To assess the extent and quality of vegetation types and wildlife habitats, the amount of habitat disturbance, and the potential occurrence of sensitive species, field reconnaissance surveys were conducted for a biological assessment (Dames & Moore, 1993 and 1997). Data on the occurrence of sensitive species were obtained from the U.S. Fish and Wildlife Service (USFWS), BLM and The Nature Conservancy. Specific sources of information used in this analysis are provided in the biological assessment of the proposed project.

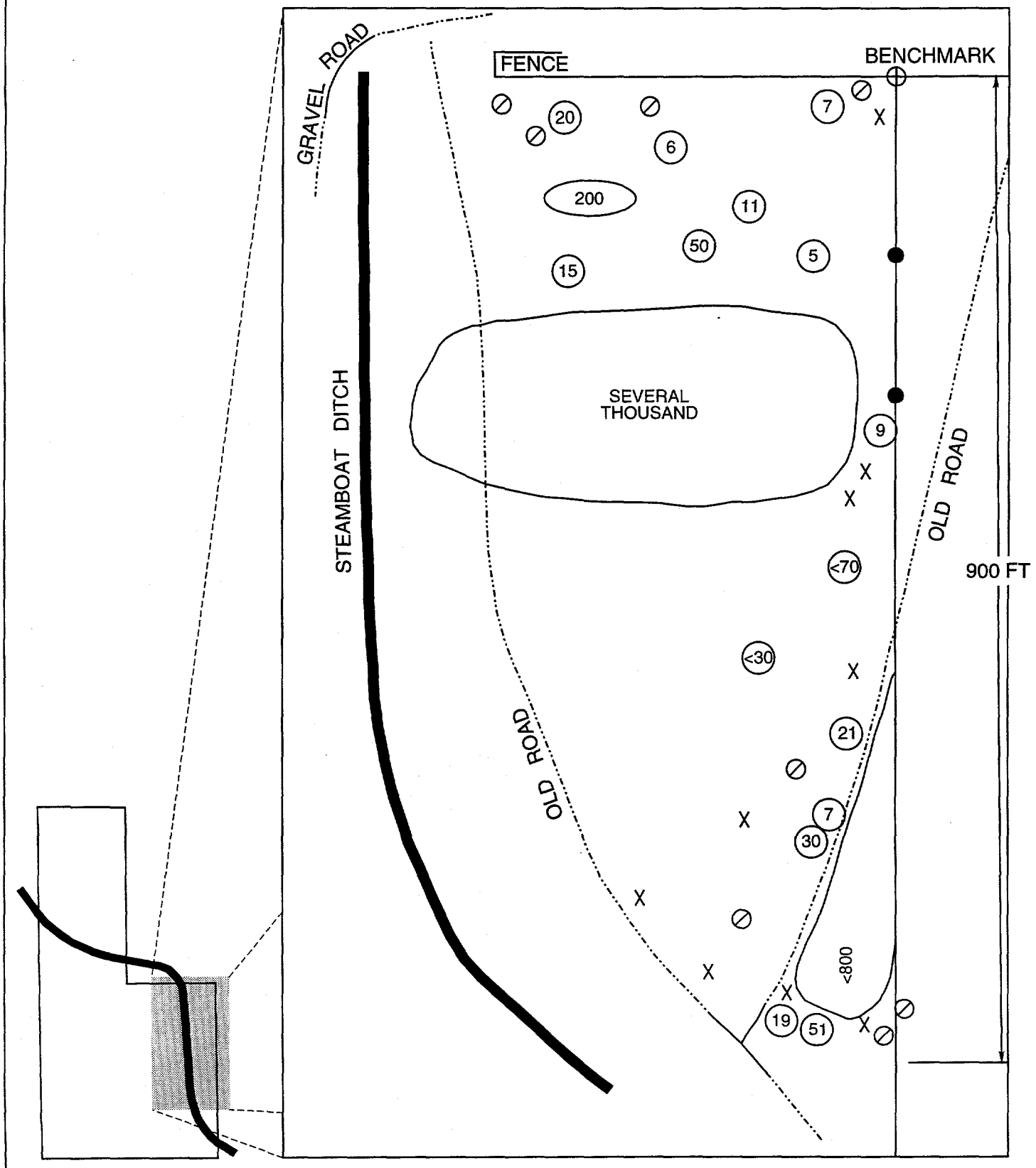
3.5.1 BOTANICAL RESOURCES

Vegetation at the project site consists of several distinct communities as depicted in Figure 3-2. These communities vary in species composition and amount of ground cover. Vegetation in the northern and southwestern portions of the project site consist of moderate-to-dense sagebrush community type which is dominated by big sagebrush (*Artemisia tridentata*). Common species of this association include bitterbrush (*Purshia tridentata* var. *tridentata*), Nevada ephedra (*Ephedra nevadensis*), and common snakeweed (*Gutierrezia sarothrae*). The central portion of the project site consists of an upland open forest characterized by ponderosa pine (*Pinus ponderosa*) and single-leaf pinyon (*Pinus monophylla*). Associated understory plants include bitterbrush, big sagebrush, Nevada ephedra, cheatgrass (*Bromus tectorum*), and Wrights buckwheat (*Eriogonum wrightii*).

As shown in Figure 3-2, the project site is dissected by the Steamboat Ditch. The Steamboat Ditch conveys flowing water for irrigation purposes during the summer months. Riparian vegetation (found adjacent to riverbanks) occurs along the banks of the ditch, dominated by medium-sized cottonwood trees (*Populus tremuloides*), willows (*Salix* sp.) and russian olive (*Elaeagnus angustifolia*). Understory species observed include wild rose (*Rosa woodsii*), bulrush (*Scirpus* sp.), rushes (*Juncus* sp.), and sedges (*Carex* sp.).

The eastern portion of the project site was identified as habitat of the Steamboat buckwheat (*Eriogonum ovalifolium* var. *williamsiae*) as shown in Figure 3-3. Associated plant species in this


VEGETATION COMMUNITIES:
SAGEBRUSH
UPLAND OPEN FOREST
RIPARIAN (DITCH AREA)
STEAMBOAT BUCKWHEAT
HWY 431
STEAMBOAT DITCH
650 FT
2600 FT
HA4
Existing Geothermal Production Well
1300 FT
STEAMBOAT DITCH
1300 FT
Not To Scale
N
Department Of Energy
Kalina Geothermal Demonstration Project
Vegetation Communities
JOB NO 02245-103
FILE NAME Off103/fig3-2
DESIGN/DRAFT
Dames & Moore
DATE 1/26/95
FIGURE NO. 3-2



X = 1 Plant

⊘ = 2-4 Plants

(#) = Populations > 4 Plants

● = Power Pole

N

Department of Energy
Kalina Geothermal Demonstration Project

Population Map of Eriogonum ovalifolium var. williamsiae

JOB NO. 02245-103	Dames & Moore	DATE 10/16/95
FILE NAME Off103/fig3-3.dwg		FIGURE NO. 3-3
DESIGN/ DRAFT		

area included Wrights buckwheat and cheatgrass. A few single-leaf pinyon and big sagebrush were also observed in this area.

3.5.2 WILDLIFE RESOURCES

The fauna observed or identified during field surveys was composed of small rodents, lagomorphs, larger mammals and birds. Characteristic mammalian species observed or identified included ground squirrel (*Spermophilus townsendii*), black-tailed hare (*Lepus californicus*), coyote (*Canis latrans*), and mule deer (*Odocoileus hemionus*). Avifauna (birds) observed was limited to scrub jay (*Aphelocoma coerulescens*).

3.5.3 SENSITIVE BIOLOGICAL RESOURCES

Sensitive plant and animal species in Nevada consist of legally protected species, federal candidates for listing, and species of special concern. Protected species include those federally listed as threatened or endangered (U.S. Fish and Wildlife Service, 1989 and 1998), and/or state-listed as protected, rare, or endangered (Nevada Administrative Code Section 503.010 et seq.)

Endangered and threatened species are protected under the Endangered Species Act of 1973, as amended. Endangered status provides protection for any species in danger of extinction throughout all or a significant portion of its range. Threatened status provides protection for any species likely to become endangered within the foreseeable future throughout all or portions of its range. (U.S. Fish and Wildlife Service, 1989 and 1998).

Sensitive animal species protected by the state are listed as endangered or rare by the Nevada Board of Wildlife Commissioners. Other protection of sensitive animal species include game and furbearer species protected by the Nevada Department of Wildlife (NDOW) (Nevada Department of Wildlife, 1991).

The Northern Nevada Native Plant Society (NNNPS) recognizes several categories of sensitive plant species (Morefield and Knight, 1991). These include in decreasing order of rarity and vulnerability: 1) species recommended for federal listing; 2) "watch list" plants; and 3)"other rare plants"

3.5.3.1 Sensitive Botanical Species – Two plants of special concern are known to occur or may potentially occur in the project area. The federally-listed endangered Steamboat buckwheat (Category 1) occurs in dry soils to the east of the Steamboat Ditch (see Figure 3-3). This species is

naturally confined to the sinter soils of the Steamboat Springs area. Sinter is a chemical or mineral sediment or crust deposited by a spring or surface venting of geothermal fluids. Steamboat Buckwheat is a low growing perennial forming compact mats ranging in size from 5 to 20 cm (2 to 8 in) across. The small oval leaves are densely covered with short greenish-white hairs, turning brown at the leaf margins as the leaf matures. Most plants identified during the field reconnaissance grew in open areas on east-facing slopes. It is estimated that up to 10,000 plants occur on this portion of the project site. Populations ranged from small groups of one to four plants to several thousands. Figure 3-3 shows the distribution of the Steamboat Buckwheat.

Altered andesite buckwheat (*Eriogonum lobbii* var. *robustum*), a candidate species for federal protection (Category 2), potentially occurs in the Steamboat Springs area. The multi-branched tufted perennial grows on barren slopes and is generally associated with big sagebrush, single-leaf pinyon, ponderosa pine, and jeffrey pine (*Pinus jeffreyi*) (Mozingo and Williams, 1980).

3.5.3.2 Sensitive Wildlife Species – Two wildlife species of special concern may potentially occur in the project area. The bald eagle (*Haliaeetus leucocephalus*), a federally-listed threatened species (Category 1), may occur in the project area as an occasional winter visitor, but actual locations have not been documented (JBR Consultants Group, 1991) and are not expected because of unfavorable habitat present in the project area or at the project site. The peregrine falcon (*Falco peregrinus*), a federally-listed endangered species (Category 1), may occur as a transient species, but is rarely observed because of unfavorable habitat present in the project area or project site. Peregrine Falcons prefer rocky steep cliffs for nesting; therefore, nesting activities are not expected to occur within the project boundaries.

3.6 CULTURAL RESOURCES

Cultural resources are defined as buildings, sites, structures, or objects which may have historical, architectural, archaeological, cultural, or scientific importance by the National Historic Preservation Act (NHPA). Numerous federal laws and regulations seek to protect and provide for the management of cultural resources. This section summarizes previous cultural resource reconnaissance surveys in the project area. Specific sources and additional information on the cultural resource assessment are in the cultural resources reconnaissance survey for the project site.

A traditional cultural property, defined generally as one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. The Washoe Indian Tribe of Nevada and California was

consulted to determine if there were any traditional cultural properties within the project site. The Steamboat Springs area was commonly used by the Washoe people in the winter. The geothermal hot springs would be used for warmth, to wash clothes and for health benefits that come from bathing in geothermal springs. The sinter quarry would have been used to obtain materials for tools and weapons. However, it is DOE's understanding as a result of interactions with the Washoe Indian Tribe of Nevada and California, that there are no traditional cultural properties within the project area.

Because of intensive development in the southern Truckee Meadows and Steamboat Springs area, the Steamboat Springs geothermal site has been the subject of many cultural resource investigations. A total of 20 research projects have been undertaken within a 1.6-km (1-mi) radius of the project area, and over 32 sites have been previously documented. Two sites of specific interest, the Sinter Quarry and Steamboat Ditch, are partially located within the project boundaries (see Figure 3-4). Both of these sites have been nominated for inclusion on the National Register of Historic Places (NRHP). The cultural resources of these sites are described in the following sections.

3.6.1 SINTER QUARRY SITE

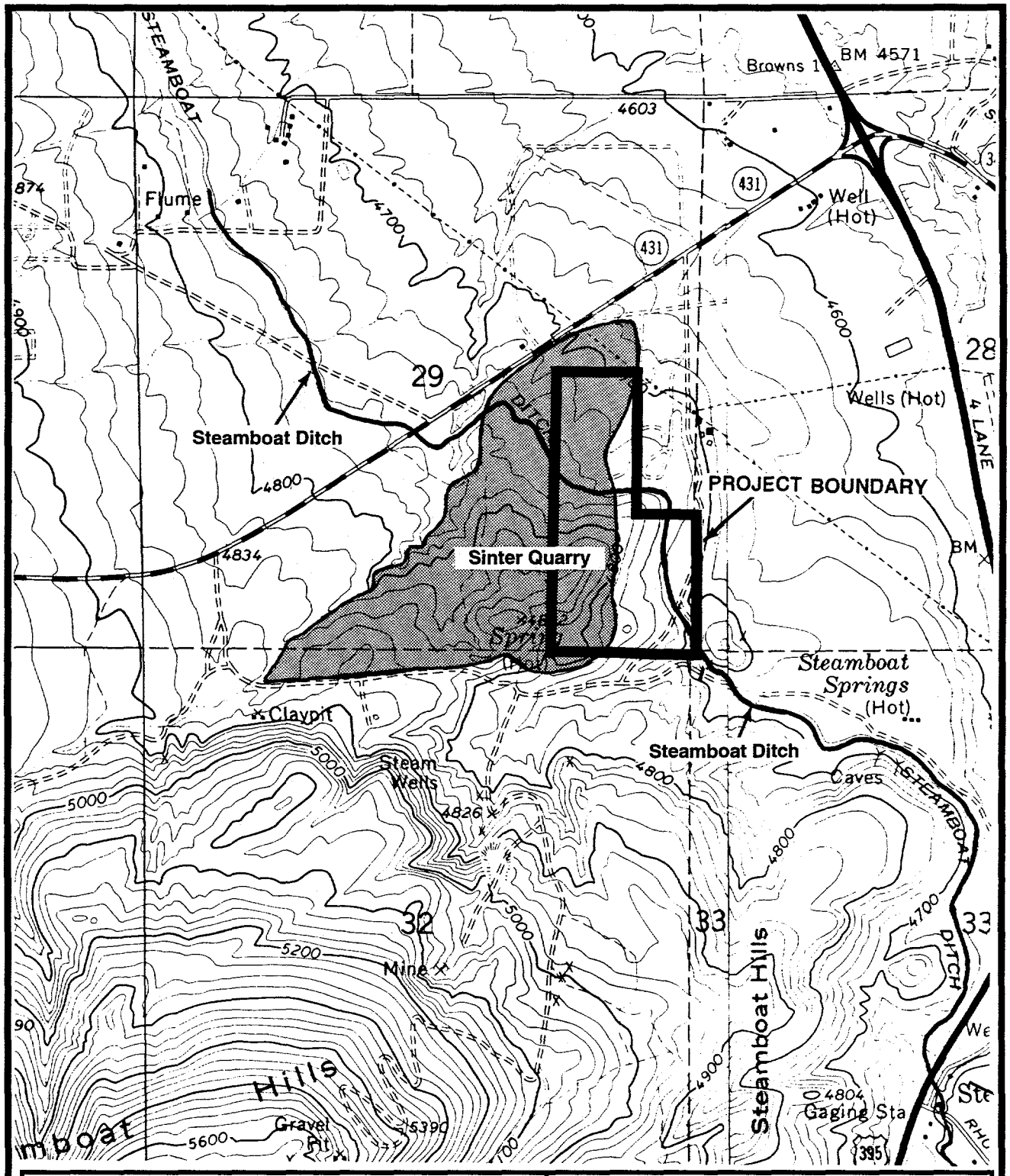
According to Clay and Furnis (1986), the Sinter Quarry site is a large and complex site containing primary bedrock quarry areas, secondary quarry areas, possible habitation areas, and numerous lithic reduction loci. The uniqueness of prehistoric use of sinter as a lithic resource and the rare nature of the deposits make this site culturally significant.

The Sinter Quarry site has been investigated by several researchers, most recently by Burke (1987) and Blair (1987). The site, while encompassing an area greater than the project boundary, consists of three fairly large and distinct locations, two of which intersect the project area. Of these two loci, one locus is located in the southwestern part of the project area, while the other is located in the northern most section of the project area.

3.6.2 STEAMBOAT DITCH

The Steamboat Ditch is a 54.4 km (34 mi) irrigation ditch that was built from May 1878 to July 1880 by 115 Chinese laborers (Clay and Furnis, 1986). The ditch, which is still in use today, was considered eligible for placement on the NRHP by Clay and Furnis for the following reasons:

- The ditch is intact
- It was known to have been promoted and supported by local prominent citizens



0 .5 mile

0 .5 kilometer

BASEMAP: USGS 7.5 Minute Topographic Quadrangles:
Mt. Rose NE, NV 1982 (photorevised)
Steamboat, NV 1982 (photorevised)

Department Of Energy
Kalina Geothermal Demonstration Project

Location Map of Sinter Quarry and Steamboat Ditch

JOB NO. 02245-103	Dames & Moore	DATE 10/13/95
FILE NAME Off103/fig3-4		FIGURE NO. 3-4
DESIGN/ DRAFT		

DAMES & MOORE

CHAPTER 4
ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

4.1 CONSTRUCTION-RELATED IMPACTS

4.1.1 SOCIOECONOMICS

The construction of the proposed facility would generate temporary employment opportunities which is considered a beneficial effect of the proposed action. The composition and size of the work force needed to build the project would vary with construction phase, depending on the need for specific labor skills, size of each construction phase, and scheduling of construction phases. The total time for project construction is estimated to be approximately 14 months.

The construction labor force would be qualified contractors licensed by the State of Nevada. The estimated peak work force during construction is estimated to be 75 to 100 workers. Preference would be given to local companies. Therefore, the project is not expected to generate a major influx of new employees. The construction labor force would not represent a significant increase in the permanent or visitor population to the Reno/Sparks MSA; therefore, impacts on community facilities and services would be negligible.

Approximately 30 to 40 percent of the total project costs is expected to be paid in worker wages. As a large portion of the labor and materials are expected to be supplied locally, the project would have a beneficial impact on the local economy. Approximately 30 percent of total project costs would be funded by the DOE; there would be no adverse financial impact on the local economy.

The potential effects of the proposed action on minority and low income groups was evaluated during the environmental impacts analyses conducted for this EA. The proposed action is not expected to result in unfair or unequal treatment of any group within the community, including minority or low income groups. The following discussion provides a summary of environmental justice considerations, as required by E.O. 12898.

The proposed action would be located in a relatively isolated area of Washoe County. The nearest community to the proposed action is the Reno/Sparks MSA. Based on available socioeconomic data, the proposed action would be constructed within areas with annual per capita income of approximately $22,561 and a median household income of $32,561. In comparison to state averages, both economic indicators are higher than state averages. As demonstrated by the

statistical data provided in Section 3.1.1, the Reno/Sparks MSA is not predominantly comprised of minority or disadvantaged groups. Consequently, the proposed action would not be expected to result in unfair or unequal treatment of any ethnic, religious, handicapped or gender-oriented sector of the Reno/Sparks MSA. As the proposed action would not result in adverse socioeconomic impacts, no mitigation measures are proposed.

4.1.2 LAND USE

Implementation of the proposed action would be consistent with the existing Washoe County land use plan which designates the use of the project site for geothermal development. Project construction would require approximately 14 months to complete. During this time, potential short-term construction impacts may occur (i.e., increase in traffic and noise, etc.) However, even with these potential impacts, the proposed action would not conflict with any existing or planned land uses because of its location, its use of existing access, and the fact that all project components/facilities would be developed within the project boundaries or be developed within current easements. Land use impacts from construction activities are not expected. Since land use impacts are not expected as a result of construction activities, no mitigation measures are proposed.

4.1.3 GEOLOGY

Approximately 3.4 ha (8.4 acres) would be cleared and graded during site preparation. These impacts are not expected to effect the on-site geology (i.e., change geologic substructures). Wind erosion of soils would be decreased by treating the soil during construction activities. Since impacts related to geology or soils are not expected, no mitigation measures are proposed.

4.1.4 HYDROLOGY

Construction at the project site is limited to approximately 3.4 ha (8.4 acres). Short-term exposure of the disturbance area may effect surface runoff. Since construction would only last a short term (approximately 14 months), significant impacts to absorption rates, drainage patterns, surface runoff, or water quality is not expected. No mitigation measures are proposed.

4.1.5 BIOLOGICAL RESOURCES

4.1.5.1 Botanical Resources – Permanent impacts to vegetation in the study area would consist mainly of loss of upland open forest and, to a lesser extent, sagebrush from construction of the proposed action. Because of the abundant amount of upland open forest and sagebrush found

within the project region and that these vegetation communities are not considered unique, this loss is not considered significant.

4.1.5.2 Wildlife Resources – Because wildlife occurring in the existing habitats are relatively low in abundance and diversity, construction activities would be expected to result in removing or displacing low numbers of common and characteristic animals and habitat features. Most of the wildlife species would relocate outside of the construction area. Some displaced animals may return to project disturbance areas over time. Overall, impacts to common and characteristic wildlife due to construction of the proposed action would not be significant.

4.1.5.3 Sensitive Biological Resources – Potential impacts to Steamboat buckwheat and Altered andesite buckwheat due to construction of activities associated with this project are described in a biological assessment (Dames & Moore, 1993 and 1997) and are summarized below.

Direct impacts to the Steamboat Buckwheat would not be expected to occur since all proposed power plant development would occur west of the Steamboat Ditch, the opposite side of the Steamboat Buckwheat habitat. Since construction-related activities would avoid disturbance to any areas of this habitat, direct impacts associated with construction of the proposed action are not anticipated. Moreover, with the incorporation of the mitigation measures potential direct impacts to the Steamboat Buckwheat would not be expected.

Direct impacts to the Altered andesite would not occur since the project site is devoid of the species.

4.1.5.4 Mitigation Measures – The following mitigation measures would be employed to reduce or avoid potential impacts to the Steamboat Buckwheat.

- Stockpiling soils, storing equipment, and parking construction vehicles would be maintained in a designated staging area which already lack significant stands of vegetation.

- Prior to construction activities, on-site Steamboat Buckwheat habitat would be fenced by a qualified biologist, and construction workers would be instructed to avoid the plants.

The U.S. Fish and Wildlife Service, Nevada Office concurs with the DOE determination that the proposed project is not likely to adversely affect the Steamboat Buckwheat. Their concurrence is based upon the following:

1) "The Steamboat Buckwheat does not occur within the 10-hectare area of project disturbance, and would not be directly impacted by construction or operation of the proposed action..

2) "An analysis of potential shallow thermal water table declines in the Steamboat Springs area resulting from the proposed project indicate that the only possible change to the hydrologic system would be a decline in the water temperatures related to injection breakthrough.

3) "An analysis of cumulative effects from past, present, and future geothermal production projects on shallow thermal groundwater declines in the Steamboat Springs area conclude that any potential impact from the proposed project would be insignificant based upon the proper placement of production and injection wells, and the negligible increase in withdrawal from the shallow thermal water table. . ."

4.1.6 CULTURAL RESOURCES

Although the Sinter Quarry occupies roughly two-thirds of the project area, the distinct loci being recommended for eligibility on the NRHP consist of debris that is scattered widely throughout the individual sites. While conceptual plans for the power plant and ancillary components would be designed to avoid these resources, construction activities could result in the destruction of resources. Potential adverse impacts to the Sinter Quarry could be mitigated with the implementation of mitigation measures described in Section 4.1.6.1.

The Steamboat Ditch is a readily identifiable linear feature that traverses the northern portion of the project area. Based on the conceptual design of the facility, it is anticipated that only one injection well would be proximate to the Steamboat Ditch. By implementing recommendations from the various cultural resource surveys done for the proposed action and action area, the Steamboat Ditch would be avoided completely. Based on avoidance of the Steamboat Ditch and implementation of mitigation measures to protect the resource, adverse impacts to this resource are not expected.

4.1.6.1 Mitigation Measures – To ensure there are no adverse impacts on the Steamboat Ditch and the culturally significant parts of the Sinter Quarry, the following mitigation measures are proposed:

- Monitoring by an archaeologist during all ground disturbance activities.
- Placing facilities along already existing roads and disturbed areas
- Instructing work crews on Nevada and federal Antiquities Laws

If avoidance of all resources cannot be achieved, an archaeologist would be responsible for characterizing and collecting the resource and preserving it through the State Museum. Depending upon the nature of the resource, exploratory excavations may be employed to determine the extent of the resource and to collect identified resources. Since the Steamboat Ditch is a fixed cultural resource the collection of cultural resources would apply only to the Sinter Quarry.

The Nevada State Historic Preservation Office and the Advisory Council on Historic Preservation concurs with the DOE determination that the proposed undertaking would not pose an adverse effect to the Sinter Hill Quarry or the Steamboat Ditch. Their concurrence is based upon the following:

> "Although the segment of the Steamboat Ditch in vicinity of the project area have experienced some visual disturbance as a result of the recent construction of a production well, road, and earthen pad, the profile of the proposed geothermal demonstration building would be more prominent than the previous disturbance mentioned in the report. The SHPO notes that the pad for the proposed facility has already been constructed without federal involvement. The proposed facility will be skid-mounted and possibly temporary in nature. The facility will also be painted to blend with the surroundings. Any alterations to the existing culvert crossing (replacement or reinforcement) will be confined to the existing disturbed crossing area will not adversely affect the functioning or setting of the Steamboat Ditch."

Although there are no Traditional Cultural Properties within the project area, the Washoe Tribe is concerned with possible subsurface artifacts within the Gusti lease area. Therefore, the Washoe Tribe will be notified at least 15 days in advance of any ground disturbance activities and be invited on site to observe the operation.

4.2 OPERATION-RELATED IMPACTS

4.2.1 SOCIOECONOMICS

Operation of the proposed action would require a total daily work force of approximately 11 personnel. Skilled labor required for operation of the proposed action is currently available in the county, and is expected to continue to be available throughout the project lifetime. The full labor complement could be supplied from the Reno/Sparks MSA depending on the availability of appropriate labor skills. As a result of the relatively small amount of workers required to operate the facility and available labor resources in the immediate project area, importation of workers would not be anticipated and operation of the facility would not result in impacts on population growth.

Because no importation of workers would be expected for operation of the proposed action, no increased need for permanent housing would be anticipated, and no impact to permanent housing would result. As the proposed action would not result in adverse socioeconomic impacts, no mitigation measures are proposed.

4.2.2 LAND USE

The proposed action would not preclude access or operation of existing or future uses in the project vicinity. The structural and system design of the power plant would reduce operational noise to acceptable levels. Implementation of the proposed action would not preclude the function of any adjacent land uses. Therefore, no adverse impacts to land uses are expected from operations.

As discussed in Section 4.2.4 (Hydrology), operation of the proposed action would not be expected to significantly effect the geothermal resource in the Steamboat Springs area and would not preclude the function of BLM's ACEC. Since land use impacts are not expected as a result of operational activities, no mitigation measures are proposed.

4.2.3 GEOLOGY

No potential geologic hazards have been identified that would cause significant impacts to the project. Because of the lack of topography on the project site, structural impacts associated with slope instability or landslides would not occur. No unique or unusual geologic resources are known to exist within the project site. Previous reports published by the USGS have listed the general properties of soils that occur within the project site. Based on available data, the potential for liquefaction (ground failure), subsidence, or other earthquake-related hazards is not expected. Since no significant impacts to the geologic and soil resources are expected with the proposed action, no mitigation measures are proposed.

4.2.4 HYDROLOGY

This section discusses an evaluation of the Steamboat Hills hydrologic system completed in February 1995 by Dames & Moore.

As described in Section 1.4.1, binary geothermal power plants extract heated geofluid from the earth, use the heat from the fluid and then reinject the liquid into the earth at cooler temperatures. The series of extractions and injections are carried out within the context of a complexly fractured hydrologic system where groundwater, surface water, high and moderate temperature reservoirs, and

surface manifestations all potentially interact. The degree of interaction is dependent upon the orientation of and distance between fractures, and the established direction of fluid flow. The proposed action may have the potential to affect the chemistry, temperature, and water level (reservoir pressure) of the hydrologic system.

4.2.4.1 High Temperature Systems (CPI Reservoir Production) – The high temperature and moderate temperature reservoirs appear to be connected by sharing a common source of geothermal fluid (Dames & Moore, 1995). The commonality of the geothermal fluid source is suggested by fluid chemistry and the location of the heat source. This common source of geothermal fluid probably occurs in fractured rock at elevations below current development of either the high or moderate temperature reservoirs.

These two reservoirs appear to have separate upflow zones which occur within the fractured rock. The separation between the upflow zones is sufficient to allow boiling and cooling of the moderate temperature reservoir. Therefore, although these reservoirs appear to share a common source of geothermal fluid, there do not appear to be connections within the fractured zones. Such connection would have to be along fractures which represent the only significant permeability within the development zone. It is unlikely that such fractures would be discovered because the KGDP would not lie on the main fracture trend (northeasterly) through the high temperature reservoir.

After a complete review of all available information, there is no indication that the reservoir pressure or temperature in the deeper, high temperature reservoir being developed by CPI would be adversely affected by the KGDP. This conclusion is based on the following: the HA-4 well, which will be the production well for the KGDP, has been in operation and supporting the SB II & III power plant since September 1998. Operation of the HA-4 production well does not appear to be affecting the existing CPI operations. Therefore, it is not expected that operation of the KGDP (to be located in the moderate temperature reservoir) would affect temperatures or pressures in the high temperature reservoir. Furthermore, in geothermal systems the high temperature reservoir typically impacts the lower temperature reservoir because it is usually closer to the source, and impacts to the heat source reservoir could be transferred to the connected reservoirs.

4.2.4.2 Moderate Temperature Systems (FWC and KGDP Reservoir Production) – Within the moderate temperature system, existing data has shown that there is a potential for connection between injection and production wells within the fracture network. As a result, cooler injection water breaks through to the production zone and lowers the temperatures of produced water. For example, observation of existing effects from FWC operations to moderate temperature reservoir suggest that the only significant change to the system is a decline in water temperature

levels that are likely related to injection breakthrough. It is standard practice in the geothermal industry for reservoir engineers to determine a suitable location and depth for the injection well that would reduce the chance for breakthrough, or allow enough time for the injected water to be reheated by the surrounding rock before it recirculates to the production well. Proper placement of the KGDP injection well would reduce any potential impacts to both existing FWC operations or the proposed KGDP. Based on the relatively small amount of production and injection well operations from the KGDP and the proper placement of the injection well, adverse impacts to the moderate temperature system are not expected.

4.2.4.3 Hot Springs/ACEC – Liquid flow at the Steamboat Springs hot springs has been absent since the late 1980s. While the exact cause of this is still unknown, it is thought to be from be a combination of increased groundwater use, geothermal development, and a regional drought which occurred over the same period of time that the hot springs stopped flowing. Because the KGDP's production and injection well operations would only be a small addition to existing operations, it is not expected that their operation would have any noticeable affect to already diminished water levels. There are numerous fractures within this system, so it is possible for a fracture to connect the injection well with water reservoirs beneath the former hot springs. However, this is considered unlikely because the fractures in the Steamboat Springs area are generally north to northeast trending, while the hot springs are typically east of these fractures. Based on the relatively small amount of production and injection operations from the KGDP and the direction of the fractures, adverse impacts to the ACEC are not expected.

Given sufficient time after termination of geothermal development activities, it appears that the current and proposed geothermal development would not prevent the return of hot spring features. However, groundwater usage and irrigation practices may have to be managed to allow the local water table to rise. If the flow of the hot springs is in some part connected to regional groundwater recharge, the return of hot spring features may be dependent on suitable weather cycles. The development of lower water elevation in the vicinity of hot spring or steam vent features in the near term could cause changes to the subsurface plumbing (such as sealing due to boiling-related mineral deposition) that would prevent future hot spring activity from matching historic hot spring activity in the main terrace area.

4.2.4.4 Regional Thermal and Cold Groundwater – Data from the Steamboat Hills hydrology assessment (Dames & Moore, 1995) show that there is no potential effect of the proposed action on groundwater in areas north to northwest or south (Pleasant Valley) of the project area. In areas east and northeast of the Steamboat Hills, the proposed action may produce minor effects such as diminished water quality (increased chloride, boron, and arsenic) or changes in temperature and

possibly water levels if outflow from the geothermal system is affected. The precise potential for these effects is not predictable without interference testing and tracer testing of the proposed injection wells.

As indicated by chloride, boron, and arsenic ratio trend plots (Dames & Moore, 1995), the current impact of geothermal fluids on groundwater quality in Pleasant Valley or north to northwest of Steamboat Hills appears negligible. For groundwater in these areas, the proposed action is not expected to effect groundwater quality unless a new path of communication between the geothermal system and these areas is developed. Since these areas are upgradient or cross-gradient of the geothermal outflow zone, it is unlikely that the small increase in utilization of the moderate temperature reservoir system would produce a change in outflow sufficient enough to affect these wells.

Trends in groundwater quality have stabilized in areas where groundwater is a mixture of cold and thermal fluid, north to northwest and west-northwest of Steamboat Hills. Based on all data currently available, the proposed action is not expected to directly affect these wells.

Several groundwater wells northeast of the Steamboat Hills have shown an increase in the geothermal component. These wells could be affected if the water quality, or quantity, of the existing outflow changes. Because the chemistry of the KGDP's injectate is approximately equal to the chemistry of produced water in the exploited area of the outflow zone, water quality of the outflow is not expected to change as a result of the proposed action. However, the quantity of geothermal component in a given mixed water aquifer may change if the location of the outflow changes. For example, if excessive drawdown in some parts of the geothermal field induces boiling, resulting in carbonate sealing of the outflow fractures, the flow of geothermal fluid to aquifers intersected by these wells could be reduced. Since the proposed action could affect reservoir pressures by producing and injecting in different wells, the location of the outflow may be affected. According to all available data reviewed to date, current geothermal reservoir exploitations have possibly affected only two groundwater wells suggesting that significant effects from the proposed action are not likely.

4.2.5 BIOLOGICAL RESOURCES

4.2.5.1 Botanical and Wildlife Resources – No operational impacts to botanical or wildlife resources at the project site are expected. No mitigation measures are proposed.

4.2.5.2 Sensitive Biological Resources – As described in the biological assessment, the moisture requirements of the Steamboat Buckwheat are unknown; the plant could utilize precipitation runoff or "perched shallow groundwater." According to Williams (1982), concern was expressed that drilling for geothermal fluids may change the moisture regime and possibly soil composition required for the Steamboat Buckwheat. Sinter soils evidently necessary for the Steamboat Buckwheat are dependent on or were formed by venting or discharge of geothermal fluids and minerals. However, as described in Section 4.2.4, Hydrology, significant impacts to the groundwater system from the proposed action are not expected. Therefore, potential indirect impacts to the Steamboat Buckwheat from operation-related activities of the proposed action are not expected. Since no significant operational impacts to biological resources are expected, mitigation measures are not proposed. It should be noted that while mitigation is not being proposed and is not required by the U.S. Fish and Wildlife Service, the DOE is funding research in order to advance the understanding of the critical habitat of the Steamboat Buckwheat.

4.2.6 CULTURAL RESOURCES

During operation of the proposed action, no new ground disturbance would occur. Potential impacts from disturbance or destruction to cultural resources are not expected. No mitigation measures are proposed.

4.3 RISK OF UPSET

Potential impacts to public health and safety associated with the proposed action would be limited to upset conditions resulting from accidental releases from on-site ammonia storage tanks and transferring geothermal brine at the power plant. An accidental release resulting from an ammonia storage tank failure is considered significant if it would adversely affect the health and safety of the surrounding populations. Dames & Moore completed a detailed risk assessment to evaluate potential impacts from an accidental ammonia release (Dames & Moore, 1994). The results from this analysis are presented in the following sections. An evaluation of potential impacts from transferring geothermal brine to and from the power plant is also provided.

4.3.1 ACCIDENTAL RELEASES OF AMMONIA MATERIALS

A risk analysis was conducted to evaluate the possible hazards associated with the storage and handling of anhydrous ammonia at the proposed facility, and the potential impact it could have on the surrounding area due to accidental releases. The purpose of this analysis was to identify the maximum possible risk to the surrounding areas from use of ammonia under a worst-case scenario.

As part of this analysis, a number of scenarios were developed based on an evaluation of possible events that could cause off-site consequences (Dames & Moore, 1994). All of these scenarios were evaluated initially on a qualitative basis. The two worst-case scenarios that were judged to have the largest release volume and thus the greatest potential off-site consequences were evaluated in further detail for this study. The detailed evaluation assessed the nature of impacts caused by these scenarios on a quantitative basis. The two scenarios are summarized in the following sections.

4.3.1.1 Scenario 1: Liquid Line Failure – The first accident scenario identified a failure of the 3.8 cm (1.5-in) liquid outlet line from the ammonia tank before the hot well where the anhydrous ammonia is converted to its aqueous state, upstream of the nearest shutdown/isolation valve located at a maximum distance of about 30 m (98 ft) from the tank. Usually, the moment such a failure occurs, the excess flow valve located in the tank would be activated, shutting off the liquid flow. However, for the purposes of this scenario (worst-case), it is assumed that the excess flow valve also fails simultaneously on demand resulting in an unrestricted liquid flow from the tank.

Based on engineering design, the pressurized storage tank would have a standard relief valve rated at approximately 300 pounds per square inch gauge on top of the tank to compensate for vapor pressure build-up within the tank. As shown in Figure 4-1, a failure below the liquid line constitutes a more critical impact than a vapor phase release. Thus, short of a catastrophic failure event resulting in instantaneous disintegration of the tank, the postulated scenario conceives a fairly substantial failure event which may generate an off-site consequence.

Catastrophic line failure rate for a full bore size is predicted to be $1x10^{-7}$ (1 in 10,000,000 chance) per meter-year for the 3.8 cm (1.5-in) line. For a maximum distance of about 30 m (98 ft), the corresponding failure frequency is predicted to be $3x10^{-6}$ per year. The failure rate for the excess flow valve is predicted to be 0.01 per usage. Thus, the cumulative probability of both the line failure and the excess valve failure is estimated to be $3x10^{-8}$ per year (1 in 33,330,000 chance), or extremely unlikely to incredible.

4.3.1.1 Scenario 2: Loss of Ammonia Containment Due to Catastrophic Tank Failure – The second accident scenario identified for this risk analysis assumes catastrophic failure of the pressurized anhydrous ammonia storage vessel, resulting in an instantaneous release of the entire contents of the tank to the environment. This scenario was postulated to generate the worst off-site consequence. The failure rate for such an event is predicted to be $1x10^{-6}$ per year. The assigned probability is supported by the range of failure frequency estimates for pressurized ammonia storage vessel catastrophic failure rates (Dames & Moore, 1994). This scenario may have more critical off-

- LIQUID RELEASE AT VESSEL
  - Crack/Flaw
  - External Impact
  - Corrosion
  - Sabotage
- LIQUID RELEASE AT LOADING LINE

  Excess Flow Valve Fails
  - Hose Break
  - External Impact
  - Vaporizer Failure
  - Corrosion

  Gasket Leak at Vaporizer
- VAPOR RELEASE AT VESSEL
  - Crack/Flaw
  - External Impact
  - Corrosion
  - Tank
- VAPOR RELEASE AT VAPOR LOADING LINE

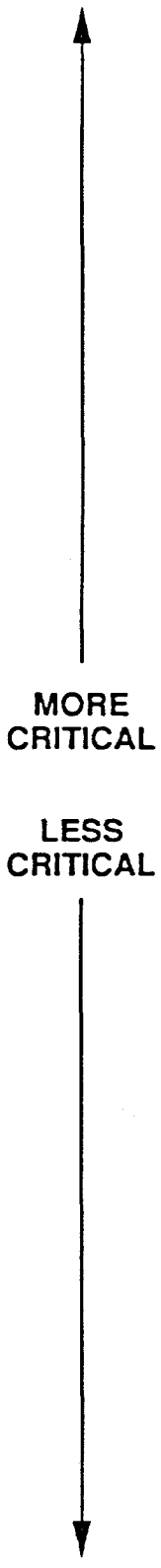
  Excess Flow Valve Fails
  - Hose Break
  - Corrosion
- VAPOR RELEASE AT TANK PRESSURE RELIEF VALVE
  - Overpressurization to Fire
  - Overpressurization to Overfill
- VAPOR RELEASE AT VAPOR LINE

  Upstream of Solenoid Valve
  - Gasket Leak
  - Spontaneous Rupture/Crack
  - External Impact

  Downstream of Solenoid Valve
  - Spontaneous Rupture
  - External Impact
- VAPOR RELEASE AT UNIT INTERFACE

  Upstream of Pressure Regulator
  - Gasket Leak

  Downstream of Pressure Regulator
  - Spontaneous Rupture



Department Of Energy
Kalina Geothermal Demonstration Project

General Ranking of Severity of Anhydrous Ammonia Releases

JOB NO. 02245-103	Dames & Moore	DATE 1/26/95
FILE NAME Off103/fig4-1		FIGURE NO. 4-1
DESIGN/ DRAFT		

site consequence, it has a higher probability of occurrence based on the selected failure frequency values. This could be explained by the fact that in the first scenario, the individual probabilities of the occurrence of both catastrophic line failure ($3x10^{-6}$ per year) and excess flow valve failure (0.01 per year) have been coupled.

4.3.2 ANALYSIS OF SCENARIOS

This section explains the model used to analyze release rates for the two scenarios. Ammonia release rates for both scenarios along with the conditions at the point of release are presented in the risk assessment (Dames & Moore, 1994). Also, the two release scenarios were modeled to assess potential off-site impacts and exposure to the surrounding population.

The objective of the modeling analysis was to provide a worst-case estimate of the zone of vulnerability for a given release scenario and meteorological condition. An air dispersion model was used to estimate downwind ammonia concentrations resulting from the release scenarios. The model was developed by Lawrence Livermore Laboratory to simulate dispersion of dense gas releases. This model was selected for use because of its ability to simulate dense cloud effects on dispersion as well as the capability of assessing a horizontal jet.

Three levels of concern (LOC) were selected to identify potential impacts associated with an accidental release of anhydrous ammonia. These levels were based on the Emergency Response Planning Guideline (ERPG) levels 1, 2, and 3. These levels were selected to represent adverse but not significant (levels 1 and 2) and significant health effects (level 3). These LOCs are defined as follows:

- ERPG-1: Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing more than mild transient adverse health effects or without perceiving a clearly defined objectionable odor.

  ERPG-1 identifies a level that does not pose a health risk to the community but above which would be noticeable due to objectionable odor or mild irritation. In the event that a small, non-threatening release has occurred, facility management could notify the community that they may notice an odor or slight irritation but levels are below those which could cause health effects.

- ERPG-2: Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

  Above ERPG-2 and below ERPG-3, for some members of the community, there may be significant adverse health effects and/or symptoms that could impair an individual's ability to take protective action. These symptoms might include severe eye irritation, respiratory irritation, or pronounced muscular weakness.

- ERPG-3: Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

  The ERPG-3 level is a worst-case planning level above which there is the possibility of some members of the community developing life-threatening health effects. This level should be used by facility management to determine if a chemical release has the potential to reach this level in the community and to mitigate the potential for release (Dames & Moore, 1994).

Ammonia health effects criteria for various averaging times are presented in Table 4-1. The values shown were used to assess consequences of the ammonia release scenarios.

Table 4-1
Health Effects Criteria

Averaging Period (minutes)	ERPG-3 Concentration (ppm)	ERPG-2 Concentration (ppm)	ERPG-1 Concentration (ppm)
60	1,000	200	25
30	1,414	283	35
15	2,000	400	50
5	3,464	693	87

Table 4-2 presents a summary description of the closest sensitive receptors and Table 4-3 presents ammonia concentrations at sensitive receptors (closest residence and educational facility) which would result under the two scenarios considered.

Table 4-2
Distance and Direction of Sensitive Receptors

Description of Sensitive Population	Direction From Storage Tank	Distance (m)
Population Center (west edge of Steamboat)	East	1,400
Galena High School and Nearby Residential Area	Northwest	2,000
Population Center (north edge of Steamboat Valley)	North	2,400
Population Center (north edge of Pleasant Valley)	South-southwest	2,600
Pleasant Valley School	South-southwest	4,300

As shown in Table 4-2, the closest sensitive population is located approximately 1,400 m (4,593 ft) east of the proposed project. However, the proposed project is also located within 1,400 m (4,593 ft) of isolated residences and businesses. With respect to the sensitive population centers listed in Table 4-2, Table 4-3 summarizes predicted ammonia concentrations at each of the sensitive receptor locations.

Results of the ammonia risk assessment show the worst case accidents for the liquid line failure and the catastrophic tank failure to be 30-minutes and 5-minutes, respectively. These averaging periods were chosen to evaluate the worst case conditions based on the type of accident and the amount of ammonia concentration expected at those locations.

4.3.2.1 Scenario 1: Liquid Line Failure – As shown in Table 4-3, expected concentrations at the west edge of Steamboat, the Galena High School/residential area, and the north edge of Steamboat Valley would exceed the ERPG-2 level. Some members of the population may experience health effects or symptoms that could impair ability to take protective action. Impacts would be considered adverse but not significant since potential concentrations at these locations are below the ERPG-3 levels. Concentrations expected at Pleasant Valley School and the north end of Pleasant Valley are below the ERPG-2 level, yet above the ERPG-1 level. Some members of the population may notice an odor or slight irritation with exceedance of ERPG-1, but would not experience health effects.

4.3.2.2 Scenario 2: Loss of Ammonia Containment Due to Catastrophic Tank Failure – As shown in Table 4-3, expected concentrations at the west edge of Steamboat, the Galena High School/residential area, the north edge of Steamboat Valley, and Pleasant Valley are above the ERPG-2 level but below the ERPG-3 level. Impacts would be considered adverse but not significant since potential concentrations at these locations are below the ERPG-3 levels. Concentrations at Pleasant Valley school are expected to be below the ERPG-2 level, but above the ERPG-1 level.

Under typical cases instead of worst cases off-site impact would likely be reduced since release rates did not consider engineering controls such as the dilution in ammonia concentrations due to the applied water from a fire monitor; effects of local terrain; and air flow around obstacles. Each of these factors would have a certain dilution effect on the concentration of the released ammonia resulting in a much less severe impact offsite.

To prevent the occurrence of Scenario 2 which could result in a significant offsite consequence, a number of safety features would be implemented for the proposed action. These features include the installation of an ammonia monitor at the tank site to provide an early warning of any ammonia leak, and pressure testing of the ammonia tank to detect any potential defect in the tank that could cause failure. With implementation of these safety measures, no significant adverse impacts to off-site sensitive receptors are anticipated.

Table 4-3
Summary of Ammonia Concentrations Predicted at Sensitive Population Locations

	Population Center (west edge of Steamboat)	Galena High School and Nearby Residential Area	Population Center (north edge of Steamboat Valley)	Population Center (north edge of Pleasant Valley)	Pleasant Valley School
Scenario Concentrations 1 (ppm) Represents 30-min average	556	350	283	256	123
Scenario Concentrations 2 (ppm) Represents 5-min average	1,690	1,063	821	724	333

Since ammonia concentrations would not exceed the ERPG-3 level, adverse off-site impacts associated with human health risk of upset are not expected. No mitigation measures are recommended.

4.3.3 ACCIDENTAL RELEASES OF GEOTHERMAL BRINE

The DOE recognizes that there is a potential for an accidental release of geothermal brine during construction and operation of the geothermal wells. Potential accidental release scenarios include loss of control at the wellhead (blowout), well casing failure, or pipeline rupture. Potential impacts from a release at the KGDP would be limited to geothermal fluid entering the Steamboat Creek via the Steamboat Ditch.

Wellhead blowouts could occur during exploratory drilling, well field development, and plant operation. However, because the wells used for the KGDP would operate at relatively low pressures, a blowout is considered very unlikely.

A well casing failure could occur from ground subsidence, seismic events, or corrosion from geothermal fluid. Historically, subsidence has not been a problem in the Steamboat Hills well fields. Although a seismic event is considered unlikely during the operational life of the KGDP, the pipeline would be seismically qualified and constructed according to industry standards. The most likely cause of casing failure would be corrosion from the geothermal fluid. The consequences would be similar to those of a pipeline rupture discussed in the following paragraphs.

The most plausible scenario for an accidental release of geothermal fluid is a pipeline rupture. To assess the impacts from such an accident, a calculation was used to estimate the quantity of water that could enter the Steamboat Creek. The calculation considered:

- flow rate from a ruptured pipeline
- time needed to actuate valves and pumps
- percentage of fluid that would flash
- percentage of fluid that would percolate into soil

Based on these considerations, an estimated 3,785 liters (1,000 gallons) of geothermal fluid could potentially enter the creek via the ditch from an accidental pipeline rupture.

The Steamboat Creek, located approximately 1.6 km (1.0 mi) downstream from the project site is typically sodium chloride-bicarbonate type water. Water quality varies seasonally with TDS concentrations ranging from < 500 mg/l to > 2,000 mg/l. During the dry season, water quality in the creek decreases as the water evaporates, concentrating dissolved solids. Naturally occurring geothermal outflow, similar in composition to the geothermal fluid that would be used at the KGDP, is thought to be responsible for the presence of sodium chloride. The average TDS from the KGDP

production well fluid is less than 2,200 mg/l (Dames & Moore, 1995), the main contributors being sodium, chloride, and bicarbonate. According to the Federal Water Master office, the Steamboat Ditch does not provide irrigation water to the area between the project site and its confluence with the Steamboat Creek (Boyer, 1995).

In the event of an accidental pipeline rupture, and assuming that the Steamboat Ditch is dry, the released geothermal fluid is expected to dissipate through percolation and evaporation before reaching the Steamboat Creek. In the event of an accidental rupture, and assuming that some of the production well fluid reaches the Steamboat Creek via the ditch, the geothermal brine is not expected to affect the water quality because the brine constituents (TDS, sodium, chloride) are similar to what the creek currently receives from natural geothermal outflow. If the ditch has flowing water, the released geothermal fluid would be expected to sufficiently mix with the existing water to reach chemical and thermal equilibrium before entering the Steamboat Creek (Boyer, 1995). In either case, the accidental release of geothermal fluid is not expected to adversely affect the water quality in the Steamboat Creek.

CHAPTER 5
ENVIRONMENTAL IMPACTS OF THE NO ACTION ALTERNATIVE

Under the no action alternative, the project site most likely would not be disturbed from the proposed project. As described in Chapter 1 (Project Purpose and Need), the project's primary purpose and need is the ability to demonstrate the viability of the KCS11. The no action alternative would not provide the federal funding for construction, which would most likely result in the KGDP not being built. Therefore, the commercial viability of this renewable energy technology, energy efficiencies, and cost savings of the KCS11 would not be demonstrated.

Under the no action alternative, the existing environmental setting described in Chapter 3 would remain. As such, the environmental impacts identified with the proposed project would be eliminated.

CHAPTER 6
CUMULATIVE IMPACTS

This section examines the cumulative environmental effects to the Steamboat Springs Geothermal area that could result from implementation of the KGDP. Cumulative impacts are defined as impacts that result from the incremental impact of an action when added to other actions. Cumulative impacts could result from individually minor but collectively significant actions taking place over a period of time. DOE is not aware of any ongoing or planned activities in the area.

6.1 SOCIOECONOMICS

The purposed KGDP would not result in any cumulative or long-term impacts associated with the socioeconomic setting. Moreover, the proposed action could provide a benefit to the local Reno/Sparks socioeconomic environment with the creation of jobs, procurement of materials, and its contribution to the local tax base.

6.2 LAND USE

The proposed KGDP would increase active geothermal production land uses within Washoe County. The proposed KGDP is an allowable use as identified in Washoe County's land use guidance document. The proposed action is compatible with the surrounding land uses. No cumulative impacts to land uses would result from the implementation of the KGDP.

6.3 GEOLOGY

The proposed action would not contribute to extensive terrain alterations or modifications to the geologic processes (i.e., soil erosion). Since the proposed action does not involve any adverse impacts, cumulative or long-term impacts are not expected.

6.4 HYDROLOGY

This section presents the cumulative hydrogeologic impacts to the existing operations of the high and the moderate temperature geothermal systems.

6.4.1 HIGH TEMPERATURE GEOTHERMAL SYSTEM

As discussed in Section 4.2.4.1, there is no indication that the reservoir pressure or temperature of the deeper high temperature area would be impacted by the proposed action. This conclusion is based on the KGDP representing only a small amount of reservoir water being withdrawn from the moderate temperature system. Therefore, cumulative impacts are not expected as part of the proposed action.

6.4.2 MODERATE TEMPERATURE GEOTHERMAL SYSTEM

As discussed in Section 4.2.4.2, there appears to be a low potential for the proposed action to impact the shallow moderate temperature geothermal system. This conclusion is based on the relatively small amount of production and injection well operations from the KGDP and the proper placement of the injection well. Based on this conclusion and no other projects being proposed which would use the moderate temperature system, cumulative impacts to the moderate temperature geothermal system are not expected.

6.4.3 REGIONAL THERMAL AND COLD GROUNDWATER

As discussed in Section 4.2.4.4, the potential adverse impacts of the proposed action on groundwater is negligible in the project area. Since the proposed action is not expected to adversely affect these groundwater resources, cumulative impacts are not expected.

6.5 BIOLOGICAL RESOURCES

Past and present development within the Steamboat Springs area has eliminated or reduced sensitive habitats and reduced the number of sensitive species, resulting in cumulative effects to biological resources. No sensitive habitats or species have been identified within the project disturbance area. No sensitive species or sensitive habitat would be impacted by the proposed KGDP; therefore, it would not contribute to cumulative impacts on habitats or species.

6.6 CULTURAL RESOURCES

The Sinter Quarry and Steamboat Ditch were identified within the project boundaries during a cultural resources reconnaissance survey (Dames & Moore, 1993). Both of the resources have been nominated for inclusion on the NRHP. Under federal regulations, proposed actions are required

to avoid or mitigate impacts to cultural resources. Based on the conceptual location of the project facilities (avoiding identified resources) and the implementation of mitigation measures, adverse impacts to cultural resources are not expected; therefore, the KGDP would not contribute to cumulative or long-term impacts.

6.7 RISK OF UPSET

There are no cumulative or long-term impacts associated with risk of upset for the proposed KGDP because there are no known anticipated increases in risks from accidental releases from hazardous material from other actions.

CHAPTER 7
AGENCY/ORGANIZATION CONSULTATION AND PERMIT REQUIREMENTS

7.1 LIST OF AGENCIES AND PERSONS CONSULTED

The following agencies were consulted in the preparation of this EA.

- United States Department of the Interior, Bureau of Land Management:

  Dave Loomis – Lahontan Area Manager, Carson City District Office
  Richard Hoops – Physical Scientist, Reno District Office

- State of Nevada, Department of Conservation and Natural Resources, Divisions of:

  Environmental Protection
  State Lands
  Water Resources

- State of Nevada, Division of Minerals

- State of Nevada, Department of Museum, Library, and Arts - State Historic Preservation Office

  Alice M. Baldrica, Deputy State Historic Preservation Officer
  Eugene Hattori, Archaeologist

- Federal Water Masters Office - Reno, Nevada Office

  Jeff Boyer, Hydrologist

JBR Consultants Group, Sandy, Utah.

FWC, Bill Price, Steamboat Springs, Nevada.

7.2 KALINA GEOTHERMAL DEMONSTRATION PROJECT-PERMIT REQUIREMENTS

The following list of agency permits (Table 7-1) are expected to be required for construction and operation of the proposed project.

Table 7-1
KGDP Permit List

Requirement	Anticipated Timeframe (days)	Public Notice Requirements (days)
U.S. Government		
Federal Energy Regulatory Commission		
Qualifying Facility Status	30	None
State of Nevada		
Division of Environmental Protection		
Injection Well Permits	30 to 180	30
Stormwater Discharge (construction phase only)	2 days prior to construction	None
Division of Water Resources		
Water Appropriation	120 to 180	30
Department of Minerals		
Well Field Permit	30 to 90	30
Public Service Commission		
UEPA Permit to Construct	60 to 80	45
Division of Occupational Safety and Health		
Permit to Operate a Pressure Vessel	Prior to installing any pressure vessels	None
Washoe County		
Air Quality Authorization to Construct	90	60
Building Permit	Varies	None
Special Use Permit (Project of Regional Significance)	120	Various*

Note: Meetings with local Citizen's Advisory Boards, and public hearings before the Washoe County Planning Commission and the Truckee Meadows Regional Planning Commission.

CHAPTER 8
REFERENCES

Blair, Lynda. 1987. *A Cultural Resource Investigation of a Proposed Hydrothermal Installation at Sinter Hill Quarry (26WA1413), Steamboat Hills, Washoe County, Nevada.* Ms. on file Environmental Research Center, University of Nevada, Las Vegas.

Burke, Thomas. 1987. *Addendum to Cultural Resource Investigation of the Steamboat Hills Geothermal 110 kV Transmission Line, Washoe County, Nevada: Intensive Inventory of the Sinter Hill Quarry and Adjacent Areas.* Ms. on file with Archaeological Research Services, Inc., Virginia City, Nevada.

Clay, V.L. and Furnis, C.L. 1986. *Cultural Resource Investigation of the Steamboat Hills Geothermal 110 kV Transmission Line, Washoe County, Nevada.* Ms. on file with Archaeological Research Services, Inc., Virginia City, Nevada.

Dames & Moore. December 1994. *Ambient Air Quality Analyses, Accidental Releases, Anhydrous Ammonia Storage Tank*, Proposed Geothermal Project, Steamboat, Nevada. Chicago, IL: Dames & Moore.

_____. October 27, 1994. *A Reconnaissance Survey of the Proposed Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hills, Washoe County, Nevada.* Las Vegas, NV: Dames & Moore.

_____. November, 1993. *Biological Assessment of the Proposed Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hills, Washoe County, Nevada.* Las Vegas, NV: Dames & Moore.

_____. December, 1997. *Biological Assessment Update of the 1993 Biological Update.* Santa Barbara, CA: Dames & Moore.

_____. February 1, 1995. *Evaluation of the Steamboat Hills Hydrological System - Potential Effects of the Proposed Expanded Development.* San Francisco, CA: Dames & Moore

Economic Development Authority of Western Nevada. 1995a. Population Fact Sheet.

Economic Development Authority of Western Nevada. 1995b. Lifestyle Fact Sheet.

Environmental Management Associates. Yankee/Caithness Joint Venture, L.P. Steamboat Hills Geothermal Project, Plan of Operation/Plan of Utilization Amendment for Geothermal Fluid Rate Increase, Environmental Assessment NV920-9201 prepared for Bureau of Land Management, Reno, Nevada, September 1993.

Exergy, Inc. June, 1993. *Installation of an Advanced Binary Geothermal Demonstration Plant Using the Kalina Cycle.* Volume 1 - Technical Volume. Revision 1. Proposal to U.S. Department of Energy National Renewable Energy Laboratory. Hayward, California.

JBR Consultants Group, 1991. Environmental Report for Steamboat #2 and #3 Geothermal Project, Steamboat Development Corporation. June 1991.

Morefield, J.D. and Knight, T.A., eds., 1991. *Endangered, Threatened, and Sensitive Vascular Plants of Nevada.* Nevada State Office of the Bureau of Land Management, Reno, Nevada.

Mozingo, H.N. and M. Williams, 1980. *Threatened and Endangered Plants of Nevada.* An illustrated manual. U.S. Fish and Wildlife Service, Portland, Oregon, and U.S. Bureau of Land Management, Nevada State Office, Reno, Nevada. 168 pp.

Nevada Department of Wildlife. 1991. General Provisions. NAC 503.010-503.090.

Nevada Development Authority, and First Interstate Bank. 1991, 1994 and 1996.

Nevada Employment Security Research Bureau. 1994. General Employment Information.

Sorey, M.L. and Colvard, E.M., 1992. *Factors affecting the Decline in Hot-Spring Activity in the Steamboat Springs Area of Critical Environmental Concern*, Washoe County, Nevada. U.S. Geological Survey Administrative Report for the Bureau of Land Management. Menlo Park, California.

U.S. Department of Energy, NREL Area Office, 1992. Demonstration of Economic Benefits of Improved Electrical Power Generating Systems for Geothermal Applications. Number PS02-92CH10516.

U.S. Bureau of the Census. 1992. General Population Characteristics. Nevada.

U.S. Fish and Wildlife. 1989. USFWS List of Endangered and Threatened Wildlife and Plants. ER 101:1501-1527.

_____ 1997. *Personal Communications with Staff members.* Reno, NV.

Washoe County. 1995. Washoe County Demographic Information. 1994. Population and Housing Data. EDAWN.

_____ 1997. *Washoe County Demographic Information.* Personal Conversation.

White et al. 79.

White, D.E., 1968. *Hydrology, Activity and Heatflow of the Steamboat Springs Thermal System*, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-C, p. 109.

Williams, M.J, 1982. Status Report. *Eriogonum Ovalifolium Var. Williamsiae* (Reveal). Submitted to U.S. Fish and Wildlife Service, Portland, OR. 30 pp.

APPENDIX A

POWER PLANT COMPONENTS

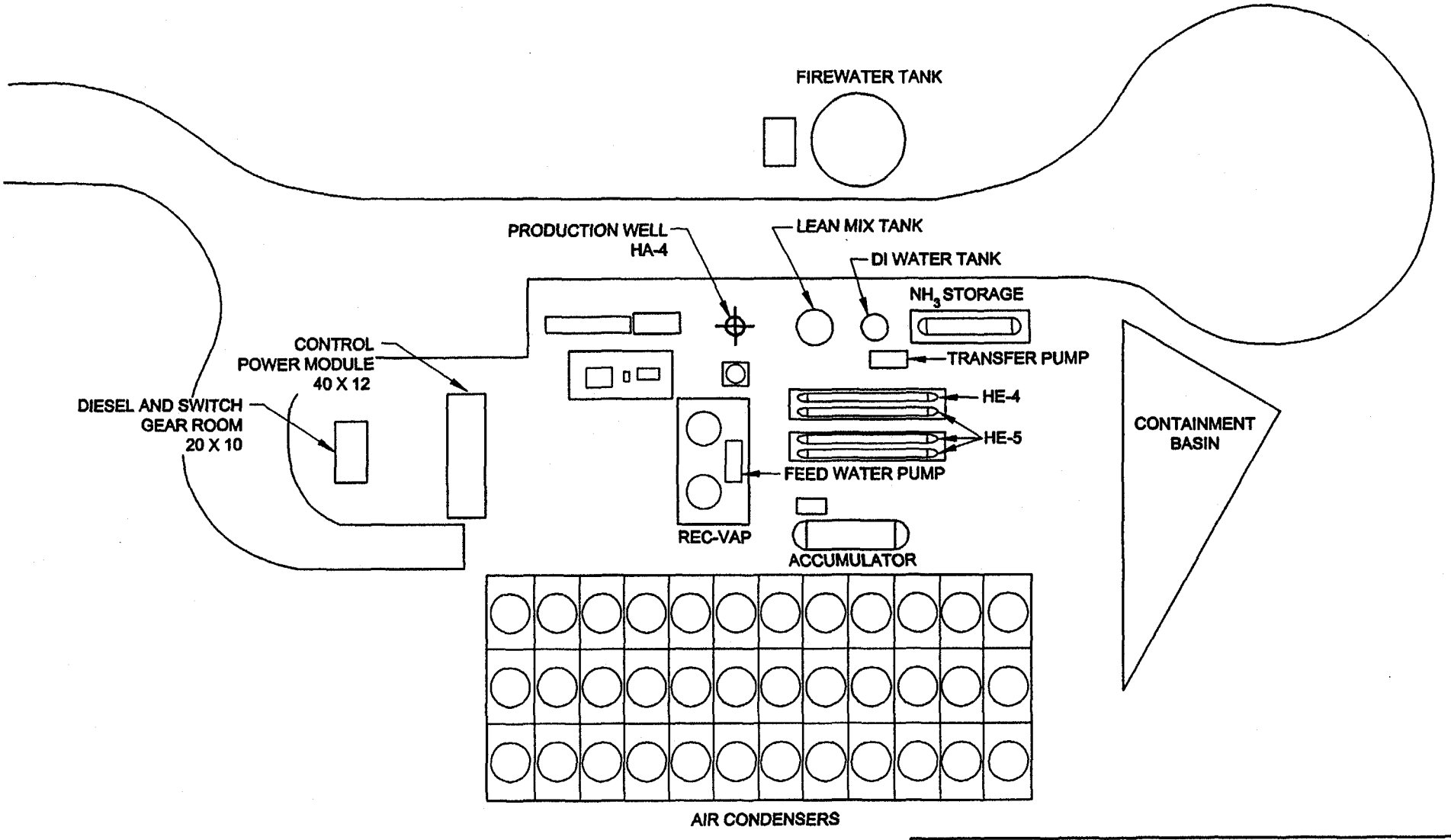
APPENDIX A

Figure A is a conceptual site layout depicting the major plant components.

Control/Power Module: The control building would be a one-story level, metal clad steel framed building with concrete masonry interior partitions. The approximate size would be 3.6 m by 12 m (12 ft by 40 ft). The building would house the control room office, toilet (septic), and a kitchenette.

Brine Supply and Return System: An existing production well, HA-4, will be utilized and supply all of the geothermal fluid to the power plant. The production well will extract approximately 9,500 liters per minute (lpm) [2,500 gallons per minute (gpm)] of geothermal brine. One injection well, would be installed to recycle spent geothermal fluid back into the underground reservoir. Estimated temperatures of the spent geothermal fluid would be approximately 71°C (160°F). The injection well would be gravity fed, eliminating the need for electrical pumps.

Turbine Generator: The turbine generator would be a skid mounted turbine and air cooled synchronous generator. A complete lube oil unit, and special weather/sound enclosure for outdoor installation would be provided. The proposed turbine-generator would produce an average 7,500 kilowatts (kW) of gross power output. Auxiliary systems provided with the turbine generator include: inlet air filtration, lube oil cooling, generator air cooling, fire protection, sound enclosure, and computer controls.



KALINA GEOTHERMAL
DEMONSTRATION PROJECT

CONCEPTUAL POWER PLANT LAYOUT

JOB NO. 308221185556	DCM GROUP DAMES & MOORE A DAMES & MOORE GROUP COMPANY	DATE 1/99
FILE NAME SITEMAP2		FIGURE NO. A
DESIGN/ DRAFT MLB		

Aqua-Ammonia Heat Recovery System: The aqua-ammonia heat recovery system consists of equipment and piping to accept the working fluid from the turbine exhaust to the air cooled condenser inlet. Included in the system are the recuperator and economizer heat exchangers. These exchangers recover a major portion of the energy remaining in the turbine exhaust and transfer it to the aqua-ammonia liquid feed before entry to the brine evaporators and superheaters.

Recuperator (HE-3): The recuperator would be used to recover some of the energy from the turbine exhaust by vaporizing a portion of the working fluid liquid feed on its way to the superheater.

Economizer (HE-2): The economizer (located between the recuperator and condenser) would be used to recover additional energy from the turbine exhaust. The recovered energy would be used to pre-heat all of the condensate working fluid feed on its way to the recuperator and brine evaporators.

Aqua-Ammonia Liquid System: The aqua-ammonia fluid liquid system consists of equipment and piping to completely condense the working fluid vapor leaving the economizer, and provide condensate feed to the evaporator and recuperator. Equipment included in the system are an air cooled condenser, condensate hotwell, and condensate feed pumps.

Air Cooled Condenser: The air cooled condenser would effect complete condensation of the working fluid exhaust from the turbine, which was partially condensed in the recuperator, and the economizer. The condenser is anticipated to be direct dry (or air cooled) utilizing multiple, electric motor-driven cooling fans. This design would not require make-up water or blowdown water discharges necessary with wet cooling towers. The air cooled condenser design for aqua-ammonia also allows direct condensing to take place at subfreezing ambient temperatures.

Condensate Hotwell: The condensate hotwell would accumulate the condensed working fluid from the condenser and provide storage for the condensate feed pumps.

Condensate Feed Pumps: Two condensate feed pumps would be provided to pump working fluid through the economizer, recuperator and evaporator. The pumps would be sealed to minimize fugitive emissions of ammonia. Constant speed electric motors would be used to drive the pumps.

Aqua-Ammonia Heat Acquisition System: The aqua-ammonia heat acquisition system consists of equipment and piping to vaporize and superheat the working fluid using the hot brine heat source. Equipment included in the system are evaporator heat exchangers, superheater heat exchangers, and a moisture separator.

Evaporator (HE-4): The evaporator would be used to provide primary vaporization of the working fluid flowing from the economizer. Energy for vaporization comes from hot brine. Working fluid from the evaporator would be combined with flow from the recuperator and continue to the superheater. Brine flows from the superheater to the evaporator and finally back to the injection system (refer to earlier discussion).

Superheater (HE-5): The superheater would provide the required amount of heat to the vaporized working fluid prior to entering the turbine. Energy for superheating would come from the hot brine. Working fluid vapor supplied to the superheater comes from the evaporator and recuperator.

Moisture Separator: A moisture separator would be installed directly upstream of the turbine to remove any moisture present during unit start up or moisture resulting from a system upset.

Ammonia Make-Up System (Area 1800): The ammonia make-up system would provide for the storage and transfer of ammonia for cycle fluid make-up and/or adjustment of ammonia concentration in the cycle. Ammonia would be purchased and shipped to the site by tanker trucks. Ammonia would be stored in an on-site storage tank and added directly to the condensate hotwell as required.

Ammonia Storage Tank/Transfer Pump: One ammonia storage tank would be provided for storing ammonia. This tank would have a capacity of approximately 30,283 liters (8,000 gallons). The tank would be a horizontal American Society of Mechanical Engineers (ASME) designed pressure vessel. One or two transfer pumps would be provided to pump make-up ammonia directly to the condensate hotwell as required.

Feedwater Make-Up System (Area 1900): The feedwater make-up system would provide for the storage, deaeration and transfer of treated water for cycle fluid make-up and/or adjustment of ammonia concentration in the cycle. Demineralized water would be purchased, trucked to the site and stored in a storage tank until needed for make-up. A deaerator unit would be provided as required to remove air and gases from the feedwater prior to it being added to the cycle. A transfer pump would pump the water directly to the aqua-ammonia condensate hotwell.

Feedwater Storage Tank: The feedwater storage tank would be approximately 38,000 liters (10,000 gallons) for condensate make-up to the cycle. It would be nitrogen blanketed, lined carbon steel.

Feedwater Transfer Pump: One or two condensate transfer pumps would be provided to pump make-up feedwater directly to the aqua-ammonia condensate hotwell.

Cooling Water System: The cooling water system (air cooling, water exchangers, cooling water surge tank, and associated pumps) would provide cooling water to various plant equipment such as the turbine lube oil coolers, generator coolers, and air compressors. The system would be "closed-loop." The cooling medium is planned to be a glycol-water solution to prevent freezing during winter operation. The solution would be cooled by air cooled heat exchangers.

Spent Aqua-Ammonia System: The spent aqua-ammonia system would provide for the blowdown and storage and for off-site shipment of working fluid blowdown from the cycle as a result of system upset, or for adjustment of ammonia concentration in the working fluid. Working fluid blowdown from the cycle would be sparged inside a blowdown tank containing an aqua-ammonia/water solution. The solution in this tank would dilute the ammonia from the cycle blowdown thereby dropping its pressure and making it harmless. As the concentration of ammonia

in this water increases, the solution would be transferred to a second tank where it would be stored until the tank is full. Once full, it would be loaded onto a tanker truck for offsite shipment. It is anticipated that this spent aqua-ammonia would be sold as a feed stock for agricultural fertilizer or an industrial process neutralizer.

Aqua-Ammonia Blowdown Tank: The aqua-ammonia blowdown tank would receive blowdown from the cycle. The tank would have a capacity of approximately 253,623 liters (67,000 gallons). The tank would be kept under a nitrogen blanket slightly above atmospheric pressure. A series of spray bars would be installed within the tank to "knock down" any high pressure ammonia vapor discharging from the turbine or evaporator relief valves.

Spent Aqua-Ammonia Tank: This tank would receive aqua-ammonia from the blowdown tank via the aqua-ammonia transfer pump. The tank would have a capacity of approximately 189,271 liters (50,000 gallons). The tank would be kept at atmospheric pressure.

Electrical Systems/Interconnection: The electrical system located in the switchyard would be comprised of one main (step-up) transformer, one auxiliary transformer, switchgear and metering devices. Other electrical systems include a 480-volt power supply and control standby power, circuit protection, grounding, lighting, and communications system.

Fire Protection System: The fire protection system would be designed to detect, suppress and prevent fires from spreading. Additionally, the fire water system would be utilized to suppress ammonia emissions by water spray under upset conditions. The fire protection system would consist of a fire water storage tank, pumps, distribution piping, hydrants, hose stations, fixed spray systems and fire detection systems. The systems would be in conformance with National Fire Protection Association requirements. The source of water for the fire system would be transported to the site by truck.

Fire Water Storage Tank/Package: The fire water storage tank would provide two hours of storage capacity. The fire water package would include one electrical driven and one-engine driven fire water pump both rated at approximately 1,893 lpm (500 gpm). A skid-mounted weather enclosure, and all necessary piping and controls would also be provided.

APPENDIX B

U.S. FISH AND WILDLIFE SERVICE CORRESPONDENCE

United States Department of the Interior

FISH AND WILDLIFE SERVICE

NEVADA FISH AND WILDLIFE OFFICE
1340 FINANCIAL WAY, SUITE 234
RENO, NEVADA 89502

October 26, 1998
File No. 1-5-98-I-178

Frank M. Stewart, Manager
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

Dear Mr. Stewart:

Subject: Informal Consultation on the Kalina Geothermal Demonstration Project, Steamboat Springs, Washoe County, Nevada,

This is in response to your letter dated April 28, 1998, wherein you conclude that the proposed Kalina Geothermal Demonstration Project is not likely to adversely affect the Steamboat buckwheat (*Eriogonum ovalifolium* var. *williamsiae*), a plant listed as endangered under the Endangered Species Act of 1973, as amended. On June 11, 1998, after review of the supporting documentation provided in your letter, we requested additional information on the potential adverse effects of the project on the buckwheat. We are now in receipt of your August 26, 1998, response to our information request.

The proposed Kalina Demonstration Project is being conducted to demonstrate the viability of the Kalina Cycle System 11 (KCS11) process using a moderate temperature geothermal source. The proposed action consists of constructing and operating a 5-megawatt (net) geothermal power plant which includes one geothermal production well, one injection well, and ancillary facilities such as on-site access roads and electric transmission lines interconnected to existing geothermal power plants. The project would be operated by SB Geo, an affiliate of Far West Capital, and current operator of Far West Capital's SBI/IA, II, and III power plants. The Department of Energy's role in the proposed action is limited to providing funding assistance for the construction and testing of the KCS11 equipment.

Based on our review of all the available information, we concur with your determination that the proposed project is not likely to adversely affect the Steamboat buckwheat. Therefore, formal consultation under section 7 of the Act is not required. Our concurrence is based on the following:

1) Steamboat buckwheat does not occur within the 10-hectare area of project disturbance, and would not be directly impacted by construction or operation of the proposed action. If any activities were to have potential to impact existing populations or habitat, they would be managed in accordance with the Steamboat buckwheat Management Plan prepared by SB Geo, Inc. and The Nature Conservancy.

2) An analysis of potential shallow thermal water table declines in the Steamboat Springs area resulting from the proposed project indicate that the only possible change to the hydrologic system would be a decline in water temperatures related to injection breakthrough. With proper placement of injection wells there should be no appreciable change in water temperature. We understand that SB Geo has an ongoing, intensive monitoring program that will detect temperature changes in project wells.

3) An analysis of cumulative effects from past, present, and future geothermal production projects on shallow thermal groundwater declines in the Steamboat Springs area concluded that any potential impact from the proposed project would be insignificant based on the proper placement of production and injection wells and the negligible increase in withdrawal from the shallow thermal water table. Your letter of August 26, 1998, further discusses the available data on production well fluid levels that support the basis for concluding that geothermal production does not cause groundwater reservoir declines if fluids are reinjected back into the ground. Again, we understand that SB Geo's monitoring program will detect groundwater declines. Annual results of the monitoring program should be provided to the U.S. Fish and Wildlife Service by December 31.

4) Your letter of August 26, 1998, provides additional information on possible interrelated and interdependent actions resulting from a pipeline recently constructed by Western Power Investments, Inc., to increase the flow of geothermal brine to the SB GEOII/III facilities located adjacent to the Kalina Project. As defined by the Fish and Wildlife Service's section 7 implementing regulations, interrelated actions are "those that are part of a larger action and depend on the larger action for their justification", and interdependent actions are "those that have no significant independent utility apart from the action that is under consideration." This determination is of interest to us because construction of this pipeline resulted in disturbance of Steamboat buckwheat plants and habitats.

Your letter states that the pipeline was constructed to test well flow conditions and supply fluids to the existing SB GEO II/III power plant facilities. The pipeline was not constructed for use in operating the Kalina facility, although it will be used occasionally to move fluids to Kalina during maintenance of Kalina's production well (for one to three weeks in a three year period). Based on this information, the pipeline appears to be neither interrelated nor interdependent upon the Kalina facility.

This response constitutes informal consultation under regulations promulgated in 50 CFR § 402, which establish procedures governing interagency consultation under section 7 of the Act. If the project changes from the description provided, if monitoring shows significant changes in groundwater levels or temperatures, or if new biological information becomes available concerning listed or candidate species which may be affected by the project, your agency should reinitiate consultation with the Service.

In a meeting between the Service, DOE, and the Kalina project proponents on July 2, 1998, we expressed our concerns for the continued survival of the Steamboat buckwheat, and inquired about the availability of DOE funding to aid species recovery. As discussed, we are concerned with the prospects for long-term survival of the Steamboat buckwheat, given past and current development activities in the Steamboat Hills, which have destroyed plants and habitat and contributed to habitat fragmentation. We are also concerned with the recent decline in the geothermal groundwater table which is preventing further development of the sinter substrates required by the buckwheat. Our concerns are further discussed in the enclosed document entitled "Research Needs for Development of a Long-Term Management Plan for Steamboat Buckwheat."

Your office recently identified a small DOE funding source to study habitat requirements of the Steamboat buckwheat. While mitigation is not required to complete consultation on the Kalina project, this funding will assist us in collecting critically important information on Steamboat buckwheat. We are very appreciative of DOE's support in contributing to our efforts to conserve and recover the Steamboat buckwheat.

Please contact Janet Bair at (702) 861-6300, if you have questions or require additional information about this consultation process. We look forward to our ongoing collaboration in conservation of the Steamboat buckwheat.

Sincerely,

Allan R. Foster

for Robert D. Williams
Field Supervisor

Enclosure

cc:
State Forester Firewarden, Nevada Division of Forestry, Carson City, Nevada
(Attn: Pete Anderson)
Mr. William Price, Western Power Investments, Inc., Reno, Nevada

Research Needs for Development of a Long-Term Management Plan for Steamboat buckwheat

Janet Bair
U.S. Fish and Wildlife Service
Nevada Fish and Wildlife Office
Reno Nevada

August 6, 1998

Introduction

Steamboat buckwheat (*Eriogonum ovalifolium* var. *williamsiae*), is a plant known to occur only in the Steamboat Hills, in southern Washoe County, Nevada. This rare subspecies of buckwheat is associated with silicious sinter substrates derived from surface discharge of hot spring waters saturated with amorphous silica. The U.S. Fish and Wildlife Service listed the Steamboat buckwheat as an endangered species under the Endangered Species Act of 1973, as amended, in 1986. The habitat of Steamboat buckwheat has been subject to various disturbances, particularly in the last few decades, with development of geothermal power production facilities, expansion of the highway, disturbance adjacent to the highway, and commercial and non-commercial development. Such activities have resulted in habitat loss and fragmentation, as well as loss of potential sites for development of new habitat.

The Steamboat buckwheat Recovery Plan was finalized in 1995. Recovery plans identify and recommend implementation of reasonable actions which are believed necessary to recover and/or protect federally listed species. Due to a lack of available recovery options, the plan could not identify actions that would result in delisting of the Steamboat buckwheat, therefore, the recovery objective in 1995 was to improve the status of the plant so that reclassification to threatened status would be appropriate. The plan recommends reclassification to threatened status once the following have been completed:

1. Development and implementation of protective conservation easements, fee acquisitions, or land exchanges to secure habitat under private ownership,

2. Development and implementation of cooperative agreements to secure habitat on Federal and State highway easement lands, and

3. Development of cooperative management plans for all habitat.

Development and implementation of conservation agreements and management plans for endangered species is best accomplished with a sound biological basis to support future actions

such as land acquisition and conservation easements. However, the available biological information on Steamboat buckwheat habitat requirements is presently incomplete or inconclusive. We have identified the following research questions to assist us in developing a long-term management plan for the species.

a. Evaluation of Soil Parameters Influencing the Distribution of Steamboat Buckwheat

The available information indicates that the distribution of Steamboat buckwheat is determined by the occurrence of sinter substrates. Steamboat buckwheat is one of the first species to establish populations on sinter substrates as they are leached of high concentrations of soluble chemicals. As soil development proceeds on the sinter substrates through accumulation of blowing soil and addition of organic matter through decay of plant materials, other plant species invade these sites and compete with the buckwheat for available space and nutrients. Steamboat buckwheat is not believed to occur on deep or alluvial soils (CH2M Hill 1986).

Chemical soil analyses were conducted in 1986 on sites where Steamboat buckwheat does and does not occur in an attempt to define factors determining its distribution (CH2M Hill 1986). These analyses found no apparent relationship between abundance of Steamboat buckwheat and the chemical parameters sulfur, magnesium, calcium, carbonates, pH, and nitrogen, and only a weak relationship between plant abundance and concentration of sodium, sulfate, potassium, chloride, and alkalinity.

Studies are needed to enhance the existing information on the edaphic requirements of Steamboat buckwheat. We specifically require information on soil factors that limit or enhance growth in the Steamboat Hills area, and an understanding of why the subspecies is restricted to growth on sinter. We also require an understanding of why the plant has been found growing on soil materials brought in from elsewhere for establishing roadbeds overlaying its habitat.

b. Potential for Long-term Maintenance of Suitable Habitat for the Species

Deposition of siliceous material by the hot springs has not occurred since cessation of surface flows of the hot springs in the late 1980s. As a result, the sinter substrates providing habitat for Steamboat buckwheat are not being formed. Eventually, the existing sinter will become weathered to the extent that other plant species can invade and out-compete Steamboat buckwheat. Because the hot springs are not anticipated to produce surface flow in the future, the most recently deposited siliceous materials (located in areas adjacent to hot spring vents) will weather and become available for colonization by Steamboat buckwheat. In the short-term, this may provide more habitat for the plant than what would have been available if the hot springs continued to flow into these areas (BLM 1993). However, without additional formation of sinter, the availability of habitat will diminish over time, and eventually cease to exist.

One idea recently discussed among species biologists as a means to perpetuate the habitat for the Steamboat buckwheat is establishment of an experimental site where new sinter substrate could

be artificially established by simulating surface flow of geothermal fluids on to the ground surface. We are specifically interested in (a) laboratory testing to assess the feasibility of creating suitable habitat, and (b) establishment of a long-term test plot in the Steamboat Hills area to demonstrate management potential in the field.

Literature Cited

Bureau of Land Management. 1993. Yankee Caithness Joint Venture, L.P. (Caithness) and Caithness Power Inc. (CPI), plan of operation/plan of utilization amendment for geothermal fluid rate increase. Preliminary Environmental Assessment NV920-9201.

CH2M Hill. 1986. Factors affecting the distribution of *Eriogonum ovalifolium* var. *williamsiae* at Steamboat Springs. Unpublished manuscript to Western States Geothermal Company, October 1986.

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

August 26, 1998

Mr. Robert D. Williams
Field Supervisor
Fish and Wildlife Service
Nevada Fish and Wildlife Office
1340 Financial Way, Suite 234
Reno, Nevada 89502

Dear Mr. Williams:

SUBJECT: KALINA CYCLE GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, WASHOE COUNTY, NEVADA - REQUEST FOR ADDITIONAL INFORMATION

Reference: File No. 1-5-98-I 178

The Department of Energy's (DOE) Golden Field Office (GO) has entered into a Cooperative Agreement with Exergy, Inc. to demonstrate the economic benefits of the Kalina cycle geothermal power plant. Exergy has partnered with Western Power Investments, Inc. (WPI) who owns and operates existing geothermal power plants in Steamboat, Nevada. However, before the DOE funds can be fully committed to this project, an environmental assessment (EA) must be completed. In November, 1993, GO began an EA in connection with the subject geothermal demonstration project. At that time, GO submitted a Biological Assessment and requested a formal Section 7 consultation. In December 1993, your office requested additional information in order to conduct the formal consultation. In April 1998, we responded to your information request with additional information including an update project description. As noted in our April 1998 letter, the project has been re-scaled from the original 12 megawatt facility to a 5 megawatt skid-mounted unit. In June 1998, your office completed the review of all the information that has been supplied and indicated that there were two issues that were unclear. Additional information was requested on 1) the issues of interdependence with an existing well and newly constructed pipeline, and 2) the potential for the use of the geothermal fluids to indirectly impact the sinter substrate which is believed to be the habitat for the Steamboat buckwheat. This letter provides clarification on these two issues.

Issue 1: Interdependence with the newly constructed pipeline. In May 1998, WPI constructed a new pipeline that connected an existing but unused well, designated Hot Air #1 (HA1), with the power plant operations at the SB GEO II /III facilities. The purpose for installing this pipeline was to increase the flow of geothermal brine to the SB GEO II/III power plant, and to test the

well flow conditions. The flow from HA1 will supply all of the geothermal fluids to the Kalina Geothermal Demonstration project. Your office is concerned that the newly installed pipeline is connected with or dependant on the Kalina Geothermal Demonstration project.

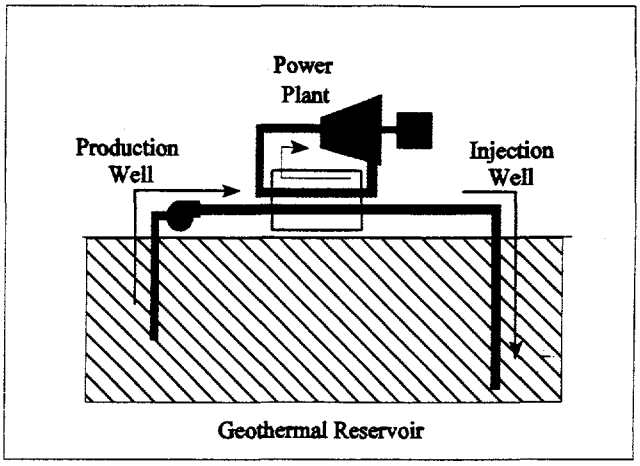
The pipeline that was constructed is not related to the proposed project that would receive funding from DOE. Our recipient has other business activities at this same location that are not dependent on or related to the proposed Kalina Geothermal Demonstration project. The pipeline was permitted through the appropriate agencies and is currently supplying geothermal fluids to their existing SB GEO II/III power plant facilities. The well that is supplying the fluids is an existing well that was installed and brought into production for these same business activities that involved the construction of the pipeline.

The Kalina Geothermal Demonstration project would be located immediately adjacent to the existing HA1 well pad location. The HA1 well will provide all of the geothermal brine for the Kalina demonstration project. When the Kalina power plant is operating, the pipeline connecting HA1 to the SB GEO II/III power plant, will not be used. The Kalina power plant is expected to be up to 40% more efficient that the existing technology for power produced from the same geothermal fluids. Therefore, WPI has made a business decision that during the time the HA1 pump is being serviced, the pipeline will transfer brine from SB II/III to the Kalina Power Plant to keep the plant operational. This represents a potential for the pipeline to be used approximately 1 - 3 weeks during a 3 year period.

DOE's continued involvement in the development and demonstration of the Kalina project as well as the operation of the Kalina unit is not dependent on the pipeline. Similarly, the Kalina project could be terminated and the pipeline would continue to supply geothermal fluids to the existing SB GEO II/III facilities. Based on these facts, GO does not believe that the Kalina Geothermal Demonstration project and the newly constructed pipeline are considered interdependent or interrelated as defined in the implementing regulations of Section 7 of the Endangered Species Act.

Issue 2 - Potential indirect impact to the sinter substrate from the use of the geothermal fluids.

It has been suggested that the sinter substrate, which the Steamboat Buckwheat lives within, is dependent upon the geothermal fluids within this area, and that the volume of geothermal fluids that are being pumped from the reservoir may have a long term effect on the sinter substrate. The power plants operated and owned by Far West Capital are binary plants (the Kalina cycle plant is also a binary plant). The figure shows a simplified diagram of how a geothermal binary power plant works. The geothermal fluid (brine) is pumped up and out of the ground, at approximately 325°F, to the power plant. The brine heats a separate working fluid that is processed through a turbine to make the electricity. The exits the power plant at approximately 160°F and is then returned to the ground through an injection well. Each gallon of Geothermal



Geothermal Binary Power Plant

Brine that is pumped out of the ground is injected back into the ground. The question to be asked is, is there any communication between the fluids that are injected, with the fluids that are being pumped out. The geology at the Steamboat Known Geothermal Resource Area is a series of interconnected fractures or cracks in the non-porous rock. Water flows through these cracks and is heated by the surrounding rock. The wells that have been drilled intersect these fractures. Far West Capital has conducted tracer tests to learn the extent to which the injected brine is returned to the production pump area. The tracer test consists of inserting a trace element into the injection well flow. Through monitoring the production wells for signs of the trace element we can learn how fast, and how much of the injected fluid returns to the production well, and therefore learn if there is recirculation within the reservoir. The first tests, conducted in 1992, showed a high degree of circulation throughout the well field. A second tracer test began in July 1998 and data is not yet available. In addition, Far West Capital maintains logs of the production well fluid levels. During the time when an area drought existed, the well fluid levels were slowly declining. However, over the past few years of normal and above normal precipitation, the well fluid levels have increased. Based on the above facts which support that the geothermal reservoir is not being depleted, DOE does not believe that the Kalina Geothermal Demonstration project has an indirect impact to the sinter substrate from the use of the geothermal fluids.

In June 1998, representatives of GO visited the Reno F&WL office to discuss the above two issues. During this meeting it was stated that your staff concurred with our determination that this project would not have any direct impacts to the Steamboat buckwheat or its habitat. The only concerns were related to the two issues noted above. Based on the information previously supplied and the clarifications provided in this letter, GO feels that the proposed project is not likely to adversely affect the Steamboat Buckwheat or modify its critical habitat. Although GO does not feel that this project will have an adverse affect, we are interested in obtaining information related to the endangered Steamboat Buckwheat plant and supporting the work of the Fish and Wildlife Service to protect threatened or endangered species. Therefore, DOE will provide some limited funds to conduct studies on the critical habitat of the Steamboat Buckwheat. In support of this study, it is GO's understanding that WPI will cooperate with F&WL for access to the site. GO has encouraged Exergy and WPI to continue this cooperation. The arrangement for these funds will be handled under separate cover from our office.

Please direct any questions to the attention of our NEPA Compliance Officer, Deborah A. Turner. Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788 or email deborah_turner@nrel.gov. Project specific issues should be directed to Jeffery L. Hahn, Project Manager, at (303) 275-4775. Thank you for your continued interest in our proposed project.

Sincerely,

Frank M. Stewart

Frank M. Stewart
Manager, Golden Field Office

Attachment(s):
As Stated

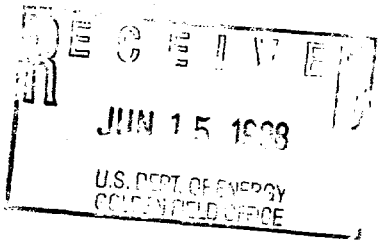
cc w/attachments:
Ms. Janet Bair, FWL/Reno
Ms. D. Turner, DOE-GO
Mr. J. Hahn, DOE-GO
Mr. D. Lowery, Dames & Moore
Mr. B. Price, SB GEO

United States Department of the Interior

FISH AND WILDLIFE SERVICE

NEVADA FISH AND WILDLIFE OFFICE
1340 FINANCIAL WAY, SUITE 234
RENO, NEVADA 89502

June 11, 1998
File No. 1-5-98-I-178



Frank M. Stewart, Manager
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

Dear Mr. Stewart:

Subject: Kalina Geothermal Demonstration Project, Steamboat Springs, Washoe County, Nevada

This responds to your letter of April 28, 1998, wherein you request our comments on the predecisional draft environmental assessment for the Kalina Geothermal Demonstration Project. Your letter indicates that the Department of Energy's (DOE) Golden Field Office has determined that the proposed project is not likely to adversely affect the Steamboat buckwheat (*Eriogonum ovalifolium* var. *williamsiae*), a plant listed as endangered under the Endangered Species Act of 1973, as amended (ESA), or modify its critical habitat. **Please note that critical habitat has not been designated for Steamboat buckwheat. Based on the information provided thus far, we believe the proposed action and associated direct and indirect effects may affect the Steamboat buckwheat. We are writing to request additional information on the proposed project.**

As stated in the draft environmental assessment, The Kalina Demonstration Project is being conducted through a cooperative agreement with Exergy, Inc., teamed with Far West Capital, Inc. and Western Power Investments to demonstrate the viability of the Kalina Cycle System 11 (KCS11) process using a moderate temperature geothermal source. The proposed action consists of constructing and operating a 5-megawatt (net) geothermal power plant which includes one geothermal production well, one injection well, and ancillary facilities such as on-site access roads and electric transmission lines interconnected to existing geothermal power plants. The project would be operated by SB Geo, an affiliate of Far West Capital, and current operator of Far West Capital's SBI/IA, II, and III power plants. DOE's role in the proposed action is limited to providing funding assistance for the construction and testing of the KCS11 equipment.

According to the draft EA and your letter of April 28, 1998, the project is not likely to adversely affect the Steamboat buckwheat for the following reasons:

1) Steamboat buckwheat does not occur within the 10-hectare area of project disturbance, and would not be directly impacted by construction or operation of the proposed action. Any activities that could have potential to impact existing populations or habitat would be managed in accordance with the Steamboat buckwheat Management Plan prepared by SB Geo, Inc. and The Nature Conservancy.

2) An analysis of potential shallow thermal water table declines in the Steamboat Springs area resulting from the proposed project indicate that the only possible significant change to the hydrologic system would be a decline in water temperatures related to injection breakthrough. The potential for this change would be minimized through proper placement of injection wells. Combined with the "relatively small increase in production", potential impacts to the shallow thermal water table would be minimized.

3) An analysis of cumulative effects from past, present, and future geothermal production projects on shallow thermal groundwater declines in the Steamboat Springs area concluded that any potential impact from the proposed project would be minimal based on the proper placement of production and injection wells and the small increase in withdrawal from the shallow thermal water table.

Based on the information provided to date, we do not concur with your conclusion that the proposed action is not likely to adversely affect the Steamboat buckwheat. Our concerns are as follows:

1) Regulations implementing Section 7 of the ESA specify the possible effects of interrelated and interdependent actions and their direct and indirect effects be evaluated and considered in determining whether or not the proposed project may affect an endangered species.

Steamboat Development Corporation recently constructed portions of a pipeline that resulted in adverse effects on Steamboat buckwheat in an area adjacent to the proposed project site. This pipeline was intended to connect an existing geothermal well located near the proposed Kalina site to the existing geothermal power plant facilities operated by SB Geo. Based on telephone conversations between our respective staffs on June 4,1998, this existing geothermal well will eventually be used for the Kalina facilities, while the pipeline may at some point be used by the Kalina facility to deliver geothermal fluids to the facility while maintenance is performed on the well. We request that you provide additional information on whether or not use of the well and pipeline constitutes an interdependent/interrelated action and its direct and indirect effects as discussed in the

enclosure. If this use is an interdependent/interrelated action, then we believe that the Kalina project may affect the buckwheat. Under these circumstances, we request that DOE initiate formal consultation under the ESA.

2) We currently believe it possible that the Steamboat buckwheat may be significantly impacted by the cessation of surface hot spring flow which produces the sinter substrate habitat needed for plant growth. If this is true, then any additional geothermal watertable drawdown may enhance the current situation. As previously stated, you have concluded that the Kalina project effect on the geothermal water table would be "minimal." We request your further analysis and conclusions on (a) whether or not the Kalina project, in addition to other projects impacting groundwater levels, would result in groundwater drawdown beyond the current baseline and (b) whether or not changes in water temperature from injection would alter surface manifestations that contribute to formation of habitat. If there would be additional groundwater drawdown or temperature changes beyond the existing baseline that would alter the ability of the system to produce sinter substrates, than we believe that the proposed project may affect the Steamboat buckwheat. If this is true, we request that DOE initiate formal consultation under the ESA.

Your response to these concerns should help to determine whether or not the Steamboat buckwheat may be affected by the proposed action. If the proposed action may affect the Steamboat buckwheat, then your response to us should request formal consultation under section 7 of the ESA. We appreciate the assistance and cooperation of your staff in this consultation process thus far. Please contact Janet Bair at (702) 861-6300, if you have questions or require additional information.

Sincerely,

Robert D. Williams
Field Supervisor

Enclosures

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

April 28, 1998

David Harlow
United States Department of the Interior
Fish and Wildlife Service
4600 Kietzke Lane, Building C-125
Reno, Nevada 89502-5093

Dear Mr. Harlow:

SUBJECT: PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KALINA GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-116)

Reference: File No. 1-5-93-F-327

In November, 1993, The Department of Energy's Golden Field Office (GO) began an environmental assessment (EA) in connection with the subject geothermal demonstration project. At that time, GO submitted a Biological Assessment and requested a formal Section 7 consultation. In December 1993, your office requested additional information in order to conduct the formal consultation. Since we received your information request, project concerns not related to the environmental analysis caused delays in the original schedule. These issues have since been resolved and GO is now ready to move forward with the final decisions regarding the proposed project. The project has been re-scaled from the original 12 megawatt facility to a five megawatt skid-mounted unit. Based on the redesigned project, GO believes that formal consultation is no longer necessary for this proposed project. GO would like to request that our initial request for formal consultation be converted to a request for informal consultation. The additional information requested by your office related to specific project location and analysis of direct and cumulative effects on the shallow thermal water table is being provided with this transmittal.

Enclosed please find the Predecisional Draft Environmental Assessment for the subject project which contains information related to your request including maps detailing the location of the proposed project footprint and the surrounding environmental features. An additional map showing the location of the project footprint specifically in relation to the Steamboat Buckwheat populations and habitat is also being enclosed. All identified Steamboat Buckwheat populations are located on the eastern side of the Steamboat ditch. Linear disturbances will consist of above ground pipelines and roadways between the project site and the well locations. These linear disturbances will be to the west of the Steamboat Ditch and the Steamboat Buckwheat populations. Any activities that have the potential to impact existing populations or habitat of the Steamboat Buckwheat will be managed in accordance with provisions in the "Steamboat Buckwheat Management Plan" prepared by SB Geo, Inc. and The Nature Conservancy.

An analysis of potential shallow thermal water table declines in the Steamboat Springs geothermal area which may result from the proposed project was the second item requested. As part of the Environmental Assessment, GO commissioned a study of the Steamboat Hills Hydrologic System. The results of this study indicate that there may be a potential connection between injection and production wells within the shallow thermal water table through the fracture network. Observation of existing effects from SB Geo operations suggest the only significant change to the system is a decline in water temperature levels that are likely related to injection breakthrough. Proper placement of the injection wells, consistent with standard geothermal industry practices, combined with the relatively small increase in production and injection from the proposed project would minimize any potential impact to the shallow thermal water table. A copy of the final report entitled *Evaluation of the Steamboat Hills Hydrologic System - Potential Effects of the Proposed Expanded Development* is also being enclosed for your information.

An analysis of cumulative effects from past, present, and future geothermal production projects on shallow thermal water declines in the Steamboat Springs geothermal area was the last item requested. As indicated above, any potential impact from the proposed project will be minimal based on the proper placement of production and injection wells and the small increase in withdrawal from the shallow thermal water table. The analysis conducted accounted for past projects prior to evaluating the impacts from the proposed project. There are no other planned developments of this lease and, therefore, no future projects to be included in the impact analysis.

Based on the information contained in the Biological Assessment for the Proposed Geothermal Demonstration project at the Steamboat Springs Geothermal Site, the Biological Assessment Update, the Steamboat Development Corporation/Nature Conservancy Steamboat Buckwheat Preservation Plan and the Predecisional Draft Environmental Assessment for the Kalina Geothermal Demonstration Project, GO feels that the proposed project is not likely to adversely affect the Steamboat Buckwheat or modify its critical habitat.

The draft EA is being provided to your office for review with comments due to Deborah A. Turner, NEPA Compliance Officer. In addition, copies of previous letters, the Biological Assessment and Update, and the Steamboat Development Corporation/Nature Conservancy Steamboat Buckwheat Preservation Plan are being enclosed for your reference. Comments are being requested from other parties by close of business May 12, 1998. Deborah will be contacting your office within the next couple of days to discuss your decision regarding the withdrawal of the formal consultation request for this project.

Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788 or e-mail deborah_turner@nrel.gov. Project specific issues should be directed to Jeffery L. Hahn, Project Manager, at (303) 275-4775. Thank you for your continued interest in our proposed project.

Sincerely,

for Frank M. Stewart
Manager

Enclosures:
As noted

cc w/o enclosures:
Janet Bair, F&WL
Jeff Hahn, GO
Deborah Turner, GO
Dan Lowery, D&M

United States Department of the Interior

FISH AND WILDLIFE SERVICE
NEVADA ECOLOGICAL SERVICES STATE OFFICE
4600 Kietzke Lane, Building C-125
Reno, Nevada 89502-5093

December 10, 1993
File No. 1-5-94-F-46

Dr. Paul K. Kearns
Acting Manager
Department of Energy,
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

Dear Dr. Kearns:

Subject: Request for Formal Section 7 Consultation for the Proposed Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hills, Washoe County, Nevada

On December 3, 1993, we received your correspondence dated November 30, 1993, requesting initiation of formal consultation under section 7 of the Endangered Species Act of 1973, as amended, concerning effects to Steamboat buckwheat (*Eriogonum ovalifolium* var. *williamsiae*), from the proposed Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hills, Washoe County, Nevada. Upon receipt of adequate information to initiate formal consultation, regulations require that the Fish and Wildlife Service (Service) conclude formal consultation within 90 days of initiation and deliver a biological opinion to the Federal agency within 45 days of concluding formal consultation (50 CFR § 402.14(e)). We have assigned your request File Number 1-5-93-F-327. Please refer to this file number in future correspondence.

The Service has determined that the information provided in the Biological Assessment for this project is insufficient for us to initiate formal consultation. Please provide the following information so that we may initiate and conclude consultation in a timely manner.

1. A map showing locations of all surface-disturbing project features (including linear surface disturbances), in relation to Steamboat buckwheat populations and habitat.

2. An analysis of potential shallow thermal water table declines in the Steamboat Springs geothermal area which may result from the project.

3. Analysis of cumulative effects from past, present, and future geothermal production projects on shallow thermal water declines in the Steamboat Springs geothermal area.

Should you have any questions, please contact Janet Bair at (702) 784-5227.

Sincerely,

David L. Harlow
State Supervisor

cc:
Assistant Regional Director, Ecological Services, Fish and Wildlife Service, Portland, Oregon

Jun

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Carson City District Office
1535 Hot Springs Rd., Ste. 300
Carson City, NV 89706-0638

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

1617 (NV-03337)

Jeff Hahn
Department of Energy
1617 Cole Blvd
Golden, Colorado 80401

NOV 09 1993

Dear Mr. Hahn:

We understand that the Department of Energy is involved in a demonstration project for an advanced binary geothermal plant adjacent to the Steamboat Geyser Basin Area of Critical Environmental Concern south of Reno, Nevada. The project would involve recapturing heat losses from the turbine. It would use a solution of ammonia and water. The plant would produce 12 mw of electricity, 40% more efficiently than current binary plants. The project is indirectly tied to a new 24 mw conventional power plant through Far West Geothermal's financing arrangements. DOE's current concerns involve potential impacts to the Steamboat Buckwheat and cumulative impacts to the geothermal reservoir.

We have an additional concern that needs to be addressed in the NEPA analysis for this proposal. Direct indirect and cumulative impacts to the hydrothermal features of the Steamboat Geyser Basin Area of Critical Environmental Concern need to be fully analyzed. This should include potential short term impacts from altering the "plumbing" of the geyser system and from changing the temperature, pressure and/or gas content of the hydrothermal fluids. Long term impacts on the temperature of the system from cumulative use of the geothermal resource should also be analyzed.

Please send all information regarding this proposal to me at the above address. Please call David Loomis at 702 883-1496 if you have any questions about our concerns.

Sincerely yours,

James M. Phillips
Lahontan Area Manager

APPENDIX C

STATE HISTORIC PRESERVATION OFFICE CORRESPONDENCE

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

December 9, 1998

CONCUR

DEC 22 1998

Advisory Council on Historic Preservation
Western Office

Advisory Council on Historic Preservation
12136 West Bayaud Avenue, Suite 330
Lakewood, Colorado 80228

SUBJECT: KALINA CYCLE GEOTHERMAL POWER PLANT DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-116)

The Department of Energy's (DOE) Golden Field Office (GO) has entered into a financial assistance agreement with Exergy, Incorporated to demonstrate the economic benefits of the Kalina cycle geothermal power plant. Exergy has partnered with Western Power Investments, Incorporated (WPI) who operates existing geothermal power plants in Steamboat, Nevada. The DOE has found this project to be technically feasible. However, the National Environmental Policy Act prohibits federal agencies from taking action that would potentially have an adverse impact on the environment until after a decision has been made. Therefore, before federal funds can be fully committed and before construction activities can begin, an environmental assessment (EA) must be completed. In November 1993, GO initiated an EA in connection with the subject geothermal demonstration project. However, project concerns not related to the EA have caused significant delays. These concerns have since been resolved and DOE is now ready to consider the final decisions regarding the proposed project. In April 1998, GO provided a copy of the predecisional draft EA and a Cultural Resources Reconnaissance Survey of the Proposed Geothermal Demonstration Project, dated November 1993 to the Nevada State Historic Preservation Office (SHPO). Additional and updated information was provided on November 9, 1998. In response, the Nevada SHPO concurred with our determination of a "no adverse affect" on November 23, 1998.

This letter contains the updated information that was provided to the Nevada SHPO.

Traditional Cultural Properties

The area of concern for this project is a 60 acre parcel known as the "Gusti" lease. Within this area, there are no Traditional Cultural Properties (TCP's). GO has consulted with the Washoe Tribe Cultural resource coordinator, Mr. William Dancing Feather. However, we have not been able to secure a written response from Mr. Dancing Feather. A memorandum to file is attached that documents interactions with the Washoe Tribe. It is our understanding that the Gusti lease does not contain any TCP's. However, the Washoe Tribe is concerned with possible subsurface artifacts in the Gusti lease area. The Steamboat Springs area was commonly used by the Washoe people in the winter. The geothermal hot springs would be used for warmth, to wash clothes and for health benefits that may come from bathing in geothermal springs. In addition, the sinter quarry may have been used to obtain materials for tools and weapons. In order to facilitate their

interest and concern for subsurface artifacts, the Washoe Tribe will be notified at least 15 days in advance of any ground disturbance activities and be invited on site to observe that operation.

Archaeological Report

Attached to this letter is a copy of the updated report titled, *A Cultural Resources Reconnaissance Survey of the Proposed Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hills, Washoe County, Nevada*, that provides additional information including the updated Intermountain Antiquities Computer System (IMACS) site forms. The report provides a detailed assessment of and recommendations for both the Sinter Hill Quarry and the Steamboat Ditch.

The area of potential effect has been reduced to the pre-existing disturbed area related to the production well and is located at the eastern boundary of the Sinter Quarry. The Kalina cycle demonstration project has been reduced from a twelve (12) megawatt plant as originally planned to a five (5) megawatt skid mounted power plant. The footprint of the plant has also been reduced and placed adjacent to the existing production well. The injection well is planned to be within the boundary of the Sinter Quarry, although the exact location has not been decided. The following steps will be taken to ensure compliance for a "no adverse effect" situation:

1. Monitoring by an archaeologist during all ground disturbance activities;
2. Placement of facilities along already existing roads and disturbance areas;
3. Crews to be instructed on Nevada and Federal Antiquities Laws.

In order to provide a compliance for a "no adverse effect" situation for the Steamboat Ditch, it is recommended that all construction activities be avoided within a five (5) meter area of the ditch and that the three steps set forth for the Sinter Quarry be followed for this site as well.

Aesthetic Analysis

The Steamboat Ditch and the Sinter Quarry are large and complex historic properties. The Steamboat Ditch covers a distance of 34 miles and the Sinter Quarry covers an area of approximately 220 acres. A detailed analysis has been included in the report mentioned above.

Within the project area, the Steamboat Ditch measures less than 0.75 miles. The ditch lies at the eastern boundary of the Area of Potential Effect (APE) and is only present for a distance of approximately 0.17 miles (900 feet). The APE is defined by the previously disturbed areas of the existing facilities. Present within this previously disturbed area is a geothermal well, an earthen pad, monitoring equipment within a monitoring station, a twenty-four (24) inch diameter pipeline, an access road to the pad from the north and a culvert within the ditch to provide a road crossing.

The Sinter Quarry is adjacent to the APE. The eastern aspect of the site overlooks the improvements of the geothermal facilities, Interstate 395, and the Truckee Meadows area.

The overall setting at the project site has already been impacted due to the presence and close proximity of the production well and the associated equipment, road and earthen pads. Other facilities and structures currently existing within the immediate vicinity of the project include three geothermal power plants (SB1, 2 and 3), two housing structures, and electrical substation. The installation and maintenance of the culvert has also caused effects to the ditch. The cut into the side of the hill to produce the earthen pad appears to not have effected the quarry. The addition of the power plant and air cooled condensers will be painted so as to blend into the surroundings. The Kalina cycle power plant is consistent with the current visual setting around the Steamboat Ditch.

Standard construction measures that will be employed to protect the Steamboat Ditch during upgrading of the access road include: Crews instructed on the Nevada and Federal Antiquities Laws, construction activities will be avoided within a five (5) meter area of the ditch when possible, the culvert will be structurally supported to prevent collapse and erosion, and standard soil erosion prevention measures such as a plastic barrier between the construction activities and the ditch.

With the mitigation measures mentioned above, GO has determined that the proposed Kalina cycle five (5) megawatt skid mounted geothermal power plant will pose "no adverse effect" to the Historic properties, namely the Steamboat Ditch and the Sinter Hill Quarry. Your concurrence to the DOE determination is requested. Please contact either Deborah Turner by phone - (303) 275-4746, fax - (303) 275-4788 or e-mail - deborah_turner@nrel.gov or Jeff Hahn by phone - (303) 275-4775, fax - (303) 275-4753 or e-mail - jeff_hahn@nrel.gov. An expeditious review and concurrence would be appreciate.

Sincerely,

Frank M. Stewart
Manager, Golden Field Office

Attachments: As stated

cc: Mr. Eugene Hattori, Nevada SHPO; w/o Attachments
Ms. Rebecca Palmer, Nevada SHPO; w/o Attachments

STATE OF NEVADA
DEPARTMENT OF MUSEUMS, LIBRARY AND ARTS
STATE HISTORIC PRESERVATION OFFICE
100 N. Stewart Street
Carson City, Nevada 89701-4285

BOB MILLER
Governor

JOAN G. KERSCHNER
Department Director

RONALD M. JAMES
State Historic Preservation Officer

November 23, 1998

Mr. Frank M. Stewart FMS
Golden Field Office
Department of Energy
1617 Cole Boulevard
Golden CO 80401-3393

RE: Kalina Geothermal Demonstration Project, Steamboat Springs, Nevada (DOE/EA-116)

Dear Mr. Stewart:

The Nevada State Historic Preservation Office (SHPO) reviewed the Department of Energy's (DOE) Section 106 (National Historic Preservation Act of 1966, as amended) documentation. We note that the scale of the proposed undertaking has been reduced and will be constructed within the existing, disturbed area. The SHPO concurs with the following proposed DOE measures to reduce potential impacts to the Sinter Hill Quarry Site (26Wa1412):

1. Monitoring by an archaeologist during all ground disturbing activities;
2. Placement of facilities along already existing roads and disturbed areas;
3. Crews to be instructed on Nevada and Federal Antiquities Laws.

The DOE determined that the proposed undertaking would not pose an adverse effect to the Sinter Hill Quarry Site (26Wa1412) and Steamboat Ditch (26Wa4583). The SHPO concurs with this determination for the following reasons:

> Although the segment of the Steamboat Ditch in vicinity of the project area have experienced some visual disturbance as a result of the recent construction of a production well, road, and earthen pad, the profile of the proposed geothermal demonstration building would be more prominent than the previous disturbances mentioned in the report. The SHPO notes that the pad for the proposed facility has already been constructed without federal involvement. The proposed facility will be skid-mounted and possibly temporary in nature. The facility will also be painted to blend with the surroundings. Any alterations to the existing culvert crossing (replacement or reinforcement) will be confined to the existing disturbed crossing area and will not adversely affect the functioning or setting of the Steamboat Ditch.

The SHPO concurs with the DOE's determination of No Adverse Effect for the subject undertaking.

Please include this letter with any submission sent to the Denver Office of the Advisory Council on Historic Preservation for their review. Their address is:

Advisory Council on Historic Preservation
12136 West Bayaud Avenue
Suite 330
Lakewood, Colorado 80228

Phone: (303) 969-5110
Fax: (303) 969-5115

If you have any questions concerning this correspondence, please feel free to contact Dr. Eugene Hattori by phone at (702) 687-6362.

Sincerely,

Alice M. Baldrica

Alice M. Baldrica, Deputy
State Historic Preservation Officer

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

November 9, 1998

Alice M. Baldrica
Deputy State Historic Preservation Officer
State of Nevada, Department of Museums, Library and Arts
State Historic Preservation Office
100 N. Stewart Street
Carson City, Nevada 89701-4285

Dear Ms. Baldrica:

SUBJECT: KALINA GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-116)

Reference: Letter to Frank M. Stewart, dated May 27, 1998

The Department of Energy's (DOE) Golden Field Office (GO) has enter into a financial assistance agreement with Exergy, Inc. to demonstrate the economic benefits of the Kalina cycle geothermal power plant. Exergy has partnered with Western Power Investments, Inc. (WPI) who operates existing geothermal power plants in Steamboat, Nevada. DOE has found this project to be technically feasible, but before federal funds can be fully committed and before construction activities can begin, an environmental assessment (EA) must be completed. In April 1998, GO provided a copy of the predecisional draft EA, a Cultural Resources Reconnaissance Survey of the Proposed Geothermal Demonstration Project, dated November 1993 to your office. In response, the referenced letter requested additional information.

Traditional Cultural Properties

It was requested that DOE address Traditional Cultural Properties (TCP's) in the inventory report and if present, determine eligibility and project effect upon them. It was also recommended that DOE consult the Washoe Tribe of Nevada and California to determine if they have information concerning TCP's within the proposed project area. The area of concern for this project is a 60 acre parcel known as the "Gusti" lease. Within this area, there are no TCP's. GO has consulted with the Washoe Tribe Cultural resource coordinator, Mr. William Dancing Feather. However, we have not been able to secure a written response from Mr. Dancing Feather. A GO memo to file is attached that documents interactions with the Washoe Tribe. It is our understanding that the Gusti lease does not contain any TCP's. However, the Washoe Tribe is concerned with possible subsurface artifacts in the Gusti lease area. The Steamboat Springs area was commonly used by the Washoe people in the winter. The geothermal hot springs would be used for warmth, to wash clothes and for health benefits that come from bathing in geothermal springs. The sinter quarry would have been used to obtain materials for tools and weapons. In order to facilitate

their interest and concern for subsurface artifacts, the Washoe Tribe will be notified at least 15 days in advance of any ground disturbance activities and be invited on site to observe that operation.

Archaeological Report

It was requested that DOE update the archaeological report to incorporate appropriate, recent archaeological and historic studies of the area, assess any impacts to the historic properties (26Wa1412 - Sinter Hill Quarry, and 26Wa4583 - Steamboat Ditch only), and provide updated IMACS forms addressing any additional site information. Attached to this letter is a copy of the updated report titled, *A Cultural Resources Reconnaissance Survey of the Proposed Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hills, Washoe County, Nevada*, that provides the requested information including the updated IMACS site forms. The report provides a detailed assessment of and recommendations for both the Sinter Hill Quarry and the Steamboat Ditch.

The area of potential effect has been reduced to the pre-existing disturbed area related to the production well and is located at the eastern boundary of the Sinter Quarry. The Kalina cycle demonstration project has been reduced from a 12 megawatt plant as originally planned to a 5 megawatt skid mounted power plant. The footprint of the plant has also been reduced and placed adjacent to the existing production well. The injection well is planned to be within the boundary of the Sinter Quarry, although the exact location is not known. However, with careful planning and preparation, adverse effects could be minimized or eliminated. The following steps have been outlined to provide compliance for a "no effect" situation:

1. Monitoring by an archaeologist during all ground disturbance activities.
2. Placement of facilities along already existing roads and disturbance areas.
3. Crews to be instructed on Nevada and Federal Antiquities Laws.

In order to provide a compliance for a "no effect" situation for the Steamboat Ditch, it is recommended that all construction activities be avoided within a five (5) meter area of the ditch and that the three steps set forth for the Sinter Quarry be followed for this site as well.

Aesthetic Analysis

It was requested that DOE include an aesthetic analysis of the proposed project. The Steamboat Ditch and the Sinter Quarry are large and complex historic properties. The Steamboat Ditch covers a distance of 34 miles and the Sinter Quarry covers an area of approximately 220 acres. A detailed analysis has been included in the report mentioned above.

Within the project area, the Steamboat Ditch measures less than 0.75 miles. The ditch lies at the eastern boundary of the APE and is only present for a distance of approximately 0.17 miles (900 feet). The APE is defined by the previously disturbed areas of the existing facilities. Present within this previously disturbed area is a geothermal well, an earthen pad, monitoring equipment within a monitoring station, a 24 inch diameter pipeline, an access road to the pad from the north and a culvert within the ditch to provide a road crossing.

The Sinter Quarry is adjacent to the APE. The eastern aspect of the site overlooks the improvements of the geothermal facilities, Interstate 395, and the Truckee Meadows area.

The overall setting at the project site has already been impacted due to the presence and close proximity of the production well and the associated equipment, road and earthen pads. Other facilities and structures currently existing within the immediate vicinity of the project include three geothermal power plants (SB1, 2 and 3), two housing structures, and electrical substation.The installation and maintenance of the culvert has also caused effects to the ditch. The cut into the side of the hill to produce the earthen pad and appears to not have effected the quarry. The addition of the power plant and air cooled condensers will be painted so as to blend into the surroundings. The Kalina cycle power plant is consistant with the current visual setting around the Steamboat Ditch.

Standard construction measures that will be employed to protect the Steamboat Ditch during upgrading of the access road include: Crews instructed on the Nevada and Federal Antiquities Laws, construction activities will be avoided within a five (5) meter area of the ditch when possible, the culvert will be structurally supported to prevent collapse and erosion, and standard soil erosion prevention measures such as a plastic barrier between the construction activities and the ditch.

With the mitigation measures mentioned above, GO has determined that the proposed Kalina cycle 5 megawatt skid mounted geothermal power plant will pose No Adverse Effect to the Historic properties, namely the Steamboat Ditch and the Sinter Hill Quarry. Your concurrence to the DOE determination, or additional comments is requested. Please contact either Deborah Turner by phone - (303) 275-4746, fax - (303) 275-4788 or e-mail - deborah_turner@nrel.gov or Jeff Hahn by phone - (303) 275-4775, fax - (303) 275-4753 or e-mail - jeff_hahn@nrel.gov. We would appreciate your response by November 20, 1998.

Sincerely,

Original Signed By

Frank M. Stewart
Manager, Golden Field Office

Attachments: As stated

cc: Mr. William Dancing Feather, Washoe Cultural Resource Coordinator; w/Attachments
Mr. Eugene Hattori, Nevada SHPO; w/o Attachments
Ms. Rebecca Palmer, Nevada SHPO; w/o Attachments

U. S. Department of Energy | Golden Field Office

memorandum

DATE: **October 29, 1998**

TO: **Steamboat Environmental Assessment File**

FROM: **Jeffrey L. Hahn, Deborah A. Turner**

SUBJECT: **Contacts with the Washoe Indian Tribe**

In a letter dated May, 27, 1998, the State of Nevada, Department of Museums, Library and Arts, State Historic Preservation Office (SHPO) recommended that the Golden Field Office (GO) consult with the Washoe Tribe of Nevada and California to determine whether or not they have "information concerning Traditional Cultural Properties within the area of potential effect." The letter named the cultural resource coordinator for the Washoe Tribe as Mr. William Dancing Feather.

A "draft" copy of the Steamboat Environmental Assessment (EA) was mailed (federal express) on June 12, 1998, to Mr. Dancing Feather along with a letter requesting a response that identified the Washoe Tribe's concerns, if any.

On June 18, 1998 Jeff Hahn called Mr. Dancing Feather's office and talked to Ms. Lynda Shoshone. Ms. Shoshone stated that she had not yet seen the draft EA, but that she would look for it, review it and respond. Jeff took the opportunity to briefly explain the project and described the location of the project. Ms. Shoshone expressed concern about the Steamboat Springs area. Jeff invited her and Mr. Dancing Feather to visit and tour the site.

On the afternoon of July 2, 1998, Deborah Turner and Jeffrey Hahn met with Washoe Indian Tribal representatives to tour the Steamboat site. Two members of the Washoe Cultural Resource Committee attended the tour, Ms. Lynda Shoshone and Ms. Jean McNicoll. Mr. Dancing Feather was unable to attend. The meeting began with general discussions about the cultural significance of the Steamboat area for the Washoe Tribe. Ms. McNicoll explained that the area was used in the winter for warmth, to wash clothes and for health benefits that come from bathing in geothermal springs. The sinter quarry would have been used to obtain materials for tools and weapons. We then reviewed the proposed project, described how a geothermal power plant works and then walked to the site where the power plant is expected to be built. After the tour, Ms. Shoshone stated that although they have concerns with the Steamboat area in general, their concern for this project would be limited to subsurface artifacts and that their concerns could be mitigated by having a Washoe Tribe representative present during ground disturbance. Ms. Shoshone stated that she would talk to Mr. Dancing Feather and send us a letter, formally stating their position.

Shortly after this time and before a letter could be secured, Ms. Shoshone left the Cultural

Resource Committee of the Washoe Tribe. Despite many phone calls, and voice-mail messages, GO has been unable to obtain any written response that details the Tribe's concerns.

In telephone conversations between Mr. Dancing Feather and Jeffrey Hahn, Jeff explained the concerns that Ms. Shoshone had after her site visit. In general, Mr. Dancing Feather agreed and stated his concerns were about the steamboat geothermal area and the sinter quarry where his ancestors would have found the materials to make arrowheads and other tools. Mr. Dancing Feather also mentioned a concern of possible burial sites, but after Ms. Shoshone toured the site, she had stated that the project area would not have been used for a burial site, since the sinter quarry was too hard to dig into. In addition, burial sites are considered sacred and the Washoe people would not have lived next to a burial site. The Steamboat Springs geothermal area was a gathering place, and they would use the geothermal springs for warmth during the winter.

The purpose of this memo-to-file is to document GO's interactions and discussions with the Washoe Indian Tribe. A copy of this memo is to be given to the Nevada SHPO in lieu of a letter from the tribe that would provide information concerning Traditional Cultural Properties within the area of potential effect.

Deborah A. Turner

Jeffrey L. Hahn

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

June 12, 1998

Mr. William Dancing Feather
Cultural Resource Coordinator
Washoe Tribe
919 U.S. 395 South
Gardnerville, NV 89410

Dear Mr. Dancing Feather:

SUBJECT: REQUEST FOR INPUT ON POTENTIAL TRADITIONAL CULTURAL PROPERTIES, STEAMBOAT SPRINGS, NEVADA

The United States Department of Energy (DOE) has been in contact with the Nevada State Historic Preservation Office (SHPO) in connection with a proposed project to demonstrate a geothermal process known as the Kalina cycle. The potential location of the demonstration is near Steamboat Springs, Nevada.

The SHPO recommended that we contact your tribe to determine if there are any Traditional Cultural Properties (TCP) in the vicinity of our proposed project location. A copy of our Predecisional Draft Environmental Assessment that describes the project, location and surrounding features is enclosed for your review. Please review the information contained in the draft EA document to aid in determining the location of the proposed project in relation to any nearby TCP. The map on page 1-2 shows the project location in relation to Reno, NV and Carson City, NV. The map on page 1-3 shows the project location in relation to the immediate surroundings (Interstate Highway 395). Should there be any TCP nearby, please let us know the specific location and the nature of any potential impacts you feel would result from our proposed project.

We would appreciate a response to our office by close of business July 3, 1998, stating that no TCP are present or describing the TCP and the potential impact from our project. Please direct any comments or questions to our NEPA Compliance Officer, Deborah A. Turner. Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788, email deborah_turner@nrel.gov or the above address. Thank you in advance for your interest in our proposed project.

Sincerely,

Christine A. Clarke

for Frank M. Stewart
Manager

Enclosure:
As Stated

cc w/o enclosures:
Deborah Turner, GO
Jeff Hahn, GO
Dan Lowery, D&M

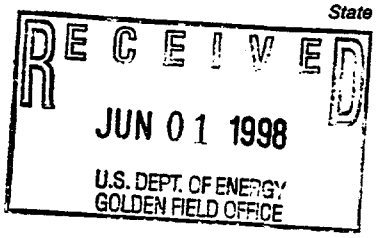
STATE OF NEVADA
DEPARTMENT OF MUSEUMS, LIBRARY AND ARTS
STATE HISTORIC PRESERVATION OFFICE
100 N. Stewart Street
Carson City, Nevada 89701-4285

BOB MILLER
Governor

JOAN G. KERSCHNER
Department Director

RONALD M. JAMES
State Historic Preservation Officer

May 27, 1998



Mr. Frank M. Stewart
Department of Energy
Goldman Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

RE: Kalina Geothermal Demonstration Project, Steamboat Springs, Nevada (DOE/EA-116).

Dear Mr. Stewart:

The Nevada State Historic Preservation Office reviewed your submission for the subject undertaking. We appreciate the inclusion of earlier supporting documentation and correspondence as well as the DOE's recognition of the sensitivity of the cultural resource location information. The SHPO concurs with the DOE's determination that the following sites are not eligible for the National Register of Historic Places under any of the Secretary of the Interior's standards:

SBGT-1; SBGT-2.
As per SHPO correspondence 2/3/95

The SHPO concurs with DOE's determination that the following sites are eligible for the National Register of Historic Places:

26Wa1413 (Sinter Hill Quarry)[1]
26Wa4583 (Steamboat Ditch)[2]
[1]Prehistoric component only, eligible under criterion D.; as per SHPO correspondence 2/3/95.
[2]Eligible under criteria A. & D.; as per SHPO correspondence 2/3/95

Over the past 4 years, increasingly greater emphasis is placed upon Traditional Cultural Properties (TCP's) in the Section 106 (National Historic Preservation Act of 1966, as amended) compliance process. We request that the DOE address TCP's in the inventory report and, if present, determine eligibility and project effect upon them. We recommend that the DOE also consult with the Washoe Tribe of Nevada and California to determine whether or not they have information concerning TCP's within the area of potential effect. The cultural resource coordinator for the Washoe Tribe is Mr. William Dancing Feather (702.883.1446), 919 U.S. 395 South, Gardnerville, NV 89410.

Because the inventory is over 4 years old and given the rapid development of the nearby suburban area, we request that the DOE update the archaeological report to incorporate appropriate, recent archaeological and historic studies of the area, assess any impacts to the historic properties (26Wa1413 and 26Wa4583 only) that occurred during this period, and provide an IMACS update site form addressing any additional site information, especially reassessing site condition and

National Register eligibility as it is relates to present site condition. The format for this site form and other report information can be obtained through our department's web page (www.clan.lib.nv.us). Because updating the report and site form will require field observations by a qualified archaeologist, we recommend that the archaeologist map any non-contributing elements of 26Wa1413 that would be suitable for constructing the injection well site, including access roads, and also provide a buffer for the contributing elements of the archaeological site.

In addition to the comments on the archaeological components within the APE, we also have some questions concerning the effect of the undertaking on the Steamboat Ditch. Because the property is eligible for listing on the National Register under criterion A., reducing impacts to the setting of the site is an important consideration.

The EA did not contain an aesthetic analysis. What will the visual effect of this facility be on the setting of the Steamboat Ditch? What other facilities or structures currently existing within the immediate vicinity of the project? Both the setting and the physical integrity of a segment in the near vicinity of the APE have been determined to be intact. Is the setting intact here? If so, will the proposed undertaking pose an effect to this element of integrity? The submission also contains no description of the "standard measures" that will be employed to protect the Steamboat Ditch during upgrading of the access road.

The SHPO cannot concur with the DOE's determination of No Adverse Effect at this time for the following reasons:

-The location of the injection well is clearly within the boundaries of 26Wa1413, a site that the DOE determined eligible for the National Register of Historic Places under criterion D.

-The nature of project impacts to the Steamboat Ditch are unknown, at this time.

Please contact Eugene Hattori 702.687.6362 for questions concerning the archaeological site and contact Rebecca Palmer 702.687.5138 for questions concerning the Steamboat Ditch.

Sincerely

Eugene M. Hattori

for Alice M. Baldrica, Deputy
State Historic Preservation Officer

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

April 28, 1998

Alice M. Baldrica
Department of Museums, Library and Arts
Capitol Complex
100 Stewart Street
Carson City, NV 89710

Dear Ms. Baldrica:

SUBJECT: PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KALINA GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-1116) AND DETERMINATION OF PROJECT EFFECT ON CULTURAL RESOURCES

In February 1994, the Golden Field Office (GO) contacted your office regarding the proposed subject project. In January 1995, we submitted the requested updated Intermountain Antiquities Computer System (IMAC) sheets. In February 1995, your office responded with a request for our determination and a request for a project specific map. Copies of these letters, the Cultural Resources Reconnaissance Survey of the Proposed Geothermal Demonstration Project and the updated IMAC sheets are enclosed for your reference. Since our early 1995 transmittal, the proposed project has been on hold pending resolution of issues not related to the environmental analysis.

The Department of Energy (DOE) has determined that the following sites are not eligible for nomination to the National Register under any of the Secretary's criteria:

SBGT-1 (Historic Trash Scatter)
SBGT-2 (Historic Trash Scatter)

DOE has determined that the following sites are eligible for nomination to the National Register of Historic Places:

26Wa1413 (Sinter Hill Quarry)[1], 26Wa4583 (Steamboat Ditch)[2]

---

[1]Prehistoric component only; eligible for nomination under criterion d.
[2]Eligible for nomination under criteria a & d.

Only a portion of the Sinter Hill Quarry (26Wa1413) site is located within the proposed project boundaries. The non-contributing site elements are located throughout the Sinter Hill Quarry site.

The production well is an existing well that is located outside the boundaries of the Sinter Hill Quarry site. The injection well that will be installed would be within the boundaries of the Sinter Hill Quarry site. The exact location of the injection well will not be known until final detailed design is completed. The power production facility will not be located within the boundaries of the Sinter Hill Quarry site. Ground disturbance from the installation of the well would be minimal. Similarly, the operation of the wells and the power production facility would not produce any significant disturbance to the ground. Therefore, there would be no adverse effect to the Sinter Hill Quarry site.

The Steamboat Ditch (26Wa4583) was built between 1878 and 1880 by Chinese laborers with the purpose of providing irrigation waters to the Reno area. The Steamboat Ditch has been used for this purpose since its completion in 1880. The proposed project will involve the use of geothermal fluids to produce power and therefore will involve one production well and one injection well. These wells are noted on the enclosed map. This system is intended to be a closed loop system and would not involve surface discharge of geothermal fluids. The potential exists for leaks around joints or line failures that would result in limited quantities of geothermal fluids to be spilled in the project area. A significant portion of any spilled fluid is expected to evaporate immediately as the average temperature of the geothermal fluid is approximately 335^{0}F. Any remaining portion of the geothermal fluids that do not evaporate is expected to flow in the direction of the landscape and percolate into the soil. Given the proposed location of one of the wells and the land contours, a limited quantity of fluid has the potential to drain into the Steamboat Ditch. During the portion of the year that the Steamboat Ditch is used for irrigation waters, the geothermal fluid would mix with the existing flow with no anticipated impact. During the portion of the year the Steamboat Ditch is not used, the geothermal fluid would enter the ditch and percolate into the soil. Therefore, there would be no adverse effect to the Steamboat Ditch.

There is an existing gravel road that transects the Steamboat Ditch approximately 0.65 miles from State Route 431. This road would require upgrading to facilitate transportation to and from the proposed project location. The upgrade would be conducted to avoid any short and long term impact to the Steamboat Ditch. During the construction phase, standard measures would be employed to protect the Steamboat Ditch. The design will allow continued flow of irrigation waters through the Ditch. Therefore, there would be no adverse effect to the Steamboat Ditch.

The enclosed map shows the location of the wells and footprint of the skid mounted power production unit in relation to the Sinter Hill Quarry and Steamboat Ditch features. This figure is not being included in any of the publicly available documents consistent with requirements to protect the specific locations of cultural resource features. GO has determined that the proposed project will pose No Adverse Effect to the Historic properties noted above.

The Predecisional Draft Environmental Assessment is also being enclosed for review by your office with comments due to Deborah A. Turner, NEPA Compliance Officer. Comments have been requested from other organizations by close of business May 12, 1998. Deborah will contact your office within the week to discuss a response time consistent with your guidelines for

project with determinations of eligibility already in place. Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788 or e-mail deborah_turner@nrel.gov. Thank you for your continued interest in our proposed project.

Sincerely,

Christine A. Stark
for Frank M. Stewart
Manager

Enclosure:
As Stated

cc w/o enclosure:
Eugene Hattori, SHPO
Jeff Hahn, GO
Deborah Turner, GO
Dan Lowery, D&M

STATE OF NEVADA
DEPARTMENT OF MUSEUMS, LIBRARY AND ARTS
STATE HISTORIC PRESERVATION OFFICE
Capitol Complex
100 Stewart Street
Carson City, Nevada 89710

BOB MILLER
Governor

JOAN G. KERSCHNER
Department Director

RONALD M. JAMES
State Historic Preservation Officer

February 3, 1995

Frank M. Stewart
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, CO 80401-3393

SUBJECT: Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hill, Washoe Co., Nevada.

Dear Mr. Stewart:

The Nevada State Historic Preservation Office (SHPO) reviewed the proposed undertaking. The SHPO would concur with a Department of Energy determination that the following sites are eligible for nomination to the National Register of Historic Places:

26Wa1413 (Sinter Hill Quarry)[1]; 26Wa4583 (Steamboat Ditch)[2].

---

[1]Prehistoric component only; eligible under criterion d.
[2]Eligible under criteria a & d.

The SHPO would concur with a DOE determination that the following sites are not eligible for nomination to the National Register under any of the Secretary's criteria:

SBGT-1; SBGT-2.

If the DOE does not agree with these determinations please provide your determinations of eligibility. The data for these determinations were obtained from the consultant's site forms accompanying your transmittal dated January 31, 1995. We also note that there may be some non-contributing site elements within site 26Wa1413 boundaries. These elements should be explicitly identified (with justification) on a project map when you submit a determination of project effect.

Please also be aware that, because the Steamboat Ditch determined eligible under the Secretary's criteria a., DOE must consider project effects as per 36 CFR Part 800.9b. The impact of the proposed project upon the setting and integrity of that historic property must be considered in your determination.

We will await the DOE's determination of project effect once the details of construction are known. We are also enclosing SHPO guidelines to assist you with future submissions.

Please contact Eugene Hattori at (702) 687-6362 if you have any questions regarding the archaeological site and format for the determination of project effect. Contact Dr. Julie Nicoletta at (702) 687-5138 if you have any questions concerning the Steamboat Ditch.

Sincerely,

Alice M. Baldrica

Alice M. Baldrica, Deputy
State Historic Preservation Officer

encl.

January 24, 1995

Mr. Eugene Hattori
State Historic Preservation Office
Department of Conservation and Natural Resources
Division of Historic Preservation and Archaeology
100 South Stewart Street
Capital Complex
Carson City, NV 89710

Dear Mr. Hattori:

SUBJECT: ADDITIONAL CULTURAL RESOURCES INFORMATION FOR THE STEAMBOAT SPRINGS GEOTHERMAL SITE, STEAMBOAT HILLS, WASHOE COUNTY, NEVADA

As you are aware, the Department of Energy (DOE) is preparing an Environmental Assessment to support its decision-making regarding a proposed Geothermal Demonstration Project located in Steamboat Hills, Washoe County, Nevada. DOE submitted to your office a Cultural Resources Reconnaissance Survey (November 1993) as well as a formal statement regarding the proposed action and the cultural resources at the site. As described in the Survey, the two sites of concern are the Steamboat Ditch (26Wa4583) and the Sinter Quarry (26Wa1413).

In response to your letter of February 22, 1994, the DOE has prepared and is submitting updated Intermountain Antiquities Computer System (IMACS) sheets for resources surveyed within the proposed project area. As requested, the determinations for eligibility for the Sinter Quarry and the Steamboat Ditch have been completed with respect to the Secretary of the Interior's National Register criteria (36 CFR 60).

With respect to providing specific site drawings and plans, only conceptual drawings are available at this time. Detailed plans would incorporate all mitigation measures previously described, including design revisions, to avoid the identified resources and prevent adverse effects.

Please review the attached IMACS sheets. Should you have any additional questions or concerns, please contact Deborah Turner of my staff at (303) 275-4746.

Sincerely,

Frank M. Stewart
Manager

Enclosures:
As Stated

cc: T. Anderson, Dames & Moore

Concur: DAT, JMB
Response Date: None
File #: 8.1.4.9.3.2 - Steamboat EA

N:\USERS\PUBLIC\SHPO3.WPD

BOB MILLER
GOVERNOR

STATE OF NEVADA

JOAN G. KERSCHNER
DIRECTOR

RONALD M. JAMES
STATE HISTORIC PRESERVATION OFFICER

DEPARTMENT OF MUSEUMS, LIBRARY, AND ARTS
STATE HISTORIC PRESERVATION OFFICE
Capitol Complex
Carson City, Nevada 89710

February 22, 1994

Dr. Paul Kearns
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, CO 80401-3393

SUBJECT: Cultural Resources Survey of the Proposed Geothermal Demonstration Project at the Steamboat Springs Geothermal Site, Steamboat Hill, Washoe Co., Nevada.

Dear Dr. Kearns:

The Nevada State Historic Preservation Office (SHPO) reviewed the proposed undertaking. The SHPO has no record of formal determinations of eligibility for either property. Neither of the cultural resources surveys conducted by Clay and Furnis (1986) and Matranga and Rodman (1983) went through Section 106 consultation. The SHPO requests that the Department of Energy submit updated IMACS site inventory forms for both properties along with determinations of National Register eligibility. Please ensure that the justification for eligibility is fully completed with reference to the Secretary of the Interior's National Register criteria.

Please also be aware that, for sites determined eligible under the Secretary's criteria a. - c., DOE must consider project effects as per 36 CFR Part 800.9b. For example, if the Steamboat Ditch is an eligible property under criteria a. - c., then a 5 m. buffer between it and a building or other structure might not qualify for an exception to the criteria of adverse effect.

For our review of project effect, we also request more details regarding the nature of the undertaking. Are there any construction drawings or plans that might assist our review?

Please contact me at (702) 687-6362 if you have any questions regarding the archaeological site. Contact Dr. Julie Nicoletta at (702) 687-5138 if you have any questions concerning the Steamboat Ditch.

Sincerely,

Eugene M. Hattori
Archaeologist

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393
February 8, 1994

Alice M. Baldrica
Deputy State Historic Preservation Officer
Department of Conservation and Natural Resources
Division of Historic Preservation and Archaeology
100 South Stewart Street Capital Complex
Carson City, NV 89710

SUBJECT: CULTURAL RESOURCES SURVEY OF THE PROPOSED GEOTHERMAL DEMONSTRATION PROJECT AT THE STEAMBOAT SPRINGS GEOTHERMAL SITE, STEAMBOAT HILLS, WASHOE COUNTY, NEVADA

Dear Ms. Baldrica:

The United States Department of Energy (DOE) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) to support its decision-making regarding a proposed Geothermal Demonstration Project at the subject site. The proposed action under consideration would utilize a new technology for the conversion of geothermal energy to electrical energy that is expected to be as much as 40 percent more efficient than currently demonstrated technologies. The new facility, including production and injection wells, would be located adjacent to the existing geothermal production facilities at Steamboat Springs.

As a part of its evaluation process, and in compliance with the National Historic Preservation Act (NHPA), DOE contracted the services of Dames & Moore to conduct a variety of site characterization activities included a Cultural Resources Reconnaissance Survey. The results of this survey were forwarded to your Office in December 1993 and is currently held by Mr. Gene Hattori of your staff. During recent conversations with Gene, we became aware of your need for a formal statement from DOE regarding the proposed action and the cultural resources at the proposed site. This letter constitutes that formal statement.

DOE reviewed, concurred with, and has adopted the contents of Dames & Moore's Cultural Resources Survey prior to its submittal to your office. The Department understands that two sites that have been nominated for inclusion in the NRHP are within the bounds of the project area. These two sites are the Sinter Quarry (26Wa1413) and the Steamboat Ditch (26Wa4583). Figure 4 in the Dames & Moore report, and included here for your reference, shows the coincidence of the proposed project boundaries and the two nominated sites. The Dames & Moore survey and those of previous investigators of the area determined that the Sinter Quarry site, while encompassing an area greater than the proposed project site, consists of three fairly distinct loci (422-1, -2, and -3), two of which (422-1 and -3) occur on the project site. The Steamboat Ditch is a readily identifiable linear feature crossing the proposed project site.

If the proposed projected is implemented, DOE will assure that the project managers would take all steps necessary including design revisions, to avoid identified resources and prevent adverse effects. As shown on Figure 4, significant areas of the proposed project site are not coincident with the noted resources. Further, as documented by the surveys, significant area exists within the mapped boundaries of the Sinter Quarry that contain no discernable archaeological resources. Therefore, it is anticipated that avoidance would be easily achieved. To assure the success of this mitigation, DOE will assure that the project managers will implement the following

measures prior to and during construction:

- Locating facilities along existing roads and disturbed areas.
- Instructing all construction crews about Nevada and Federal Antiquities Laws.
- Monitoring by an archaeologist during all construction activities.

If avoidance of all resources cannot be achieved, the project archaeologist will be responsible for characterization and collection of the resource and its preservation in coordination with the State Museum. Depending upon the nature of the resource, exploratory excavations may be employed to determine the extent of the resource and collect identified resources.

DOE believes by requiring avoidance or recovery of archaeological resources, the proposed action would not cause an adverse effect to the nominated resources. As characterized by the Dames & Moore Reconnaissance Survey and previous assessments, the nature and extent of the identified resources would easily accommodate the avoidance approach. DOE requests that the Nevada State Historic Preservation Officer review the Cultural Resources Reconnaissance Survey report as adopted by the DOE and render a conclusion regarding potential for adverse impacts to the nominated NRHP sites. DOE will incorporate the documentation of our consultations as an appendix to the EA. Please contact Deborah Turner, 303/275-4746 or Jeff Hahn, 303/275-4775, of my staff for further information.

Sincerely,

Paul Kearns, Ph.D.
Acting Manager

Enclosure:
As Stated

BOB MILLER
Governor

STATE OF NEVADA

JOHN P. COMEAUX
Director

DEPARTMENT OF ADMINISTRATION

Capitol Complex
Carson City, Nevada 89710
Fax (702) 687-3983
(702) 687-4065

May 13, 1998

Deborah Turner
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado 80401

Re: DOE/EA 1116 SAI NV #E1998-126
Project: Kalina Geothermal Demonstration Project at Steamboat Springs

Dear Ms. Turner:

Enclosed are the comments from the Nevada Divisions of Minerals and Environmental Protection concerning the above referenced project. These comments constitute the State Clearinghouse review of this proposal as per Executive Order 12372.

Please address these comments or concerns in your final decision. Please put

Nevada Division of Minerals
400 West King Street, Suite 106
Carson City, NV 89703

on the mailing list for all DOE sponsored geothermal projects in Nevada, as they are our primary geothermal permitting agency.

Please also note that the Clearinghouse is set up to get state agency input in the scoping stage of a project, as well as commenting on draft documents; we would be happy to help the draft be proactive, rather than the draft revisions be reactive.

If you have questions, please contact me at 687-6366.

Sincerely,

Maud Naroll

Maud Naroll
Nevada State Clearinghouse

Enclosures

NEVADA STATE CLEARINGHOUSE

Department of Administration
Budget and Planning Division
209 East Musser Street, Room 200
Carson City, Nevada 89701-4298
(702) 687-4065
fax (702) 687-3983

RECEIVED
MAY 0 4 1998
Div. of Minerals

DATE: April 30, 1998

Governor's Office	Legislative Counsel Bureau	Conservation-Natural Resources
Agency for Nuclear Projects	Information Technology	Director's Office
Business & Industry	Emp. Training & Rehab Research Div.	State Lands
Agriculture	PUC	Environmental Protection
Energy	Transportation	Forestry
Minerals	UNR Bureau of Mines	Wildlife
Economic Development	UNR Library	Region 1
Tourism	UNLV Library	Region 2
Fire Marshal	Historic Preservation	Region 3
Human Resources	Emergency Management	Conservation Districts
Aging Services	Washington Office	State Parks
Health Division		Water Resources
Indian Commission		Water Planning
Colorado River Commission		Natural Heritage
		Wild Horse Commission

Nevada SAI # E1998-126
Project: Kalina Geothermal Demonstration Project at Steamboat Springs

__ Yes __ No Send more information on this project as it becomes available.

CLEARINGHOUSE NOTES:
Enclosed, for your review and comment, is a copy of the above mentioned project. Please evaluate it with respect to its effect on your plans and programs the importance of its contribution to state and/or local areawide goals and objectives; and its accord with any applicable laws, orders or regulations with which you are familiar.

Water Resources, here is your copy. DOE reports sending copies directly to the rest of you. Please fax your comments directly to Deborah Turner at DOE: (303) 275-4788 by May 12,1998, with a copy to the Clearinghouse. Please let me know soon if DOE's short deadline is too short for your office.. Use the space below for short comments. If significant comments are provided, please use agency letterhead and include the Nevada SAI number and comment due date for our reference. Questions? Maud Naroll, 687-6366.

THIS SECTION TO BE COMPLETED BY REVIEW AGENCY:

___No comment on this project	___Conference desired (See below)
___Proposal supported as written	___Conditional support (See below)
X Additional information below	___Disapproval (Explain below)

AGENCY COMMENTS:

The Nevada Division Of Minerals (NDOM) has reviewed the draft Environmental Assessment and has no concerns relative to NDOM's regulatory mission. However I would suggest the Nevada Division of Environmental Protection's (NDEP) Bureau of Air Quality, provide written comments relative to pages 4-10 through 4-16 regarding the accidental release of ammonia materials.

NDOM would also like to request the DOE Geothermal Office place us on on your mailing list for all projects that are DOE supported in Nevada.

As a point of clarification the NDOM is not part of the Department of Conservation and Natural Resources, nor were we consulted with as depicted on page 7-1 "List of Agencies and Persons Consulted". The NDOM is the primary agency for all geothermal permitting in Nevada and is within the Department of Business and Industry.

Please contact John Snow Geothermal Program Manager at (702) 687-5050 if you have any questions.

J. H. Snow — Minerals — 5/11/98

Signature — Agency — Date

s:\shardat\clear\clear.doc

PETER G. MORROS, Director
L.H. DODGION, *Administrator*
(702) 687-4670
TDD 687-4678
Administration
Mining Regulation and Reclamation
Water Pollution Control
Facsimile 687-5856

STATE OF NEVADA
BOB MILLER
Governor

Waste Management
Corrective Actions
Federal Facilities
Air Quality
Water Quality Planning
Facsimile 687-6396

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL PROTECTION

333 W. Nye Lane, Room 138
Carson City, Nevada 89706-0851

May 12, 1998

CLEARINGHOUSE COMMENTS

NDEP # 1998-111
SAI NV # E1998-126

TITLE: Predecisional Draft EA for Kalina Geothermal Demonstration Project at Steamboat Springs, Nevada (DOE/EA-1116)

The Division of Environmental Protection has reviewed the aforementioned State Clearinghouse item and has the following comments:

The proposed project will require an air quality permit for surface disturbance from the Washoe County Health District's Air Pollution Control District. Since other emissions from operation were not defined in the document, the applicant should be aware that other air quality permits may be necessary. The applicant will need an underground injection permit from the Division of Environmental Protection's Bureau of Water Pollution Control. In addition, a stormwater permit will be required. It is the concern of the Bureau as to how the operator is going to ensure that accidental releases of the reinjected brine will not occur. It appears that the amount of anhydrous ammonia on site will trigger the threshold for highly hazardous substances. This is the State of Nevada's Chemical Accident Prevention Program. The project applicant will need to register with the Division of Environmental Protection's Bureau of Waste Management.

David R. Cowperthwaite
Clearinghouse Coordinator
Division of Environmental Protection

DAT

BOB MILLER
Governor

STATE OF NEVADA

JOHN P. COMEAUX
Director

DEPARTMENT OF ADMINISTRATION
Capitol Complex
Carson City, Nevada 89710
Fax (702) 687-3983
(702) 687-4065

May 15, 1998

FAX – Hard Copy Follows

Deborah Turner
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado 80401

Re: DOE/EA 1116 SAI NV# E1998-126

Project: Kalina Geothermal Demonstration Project at Steamboat Springs

Dear Ms. Turner:

Enclosed is an additional comment from the Nevada Division of Water Resources that was received after our previous letter to you. Please incorporate this comment into your decision making process. If you have any questions, please contact me at (702) 687-6366.

Sincerely,

Maud Naroll

Maud Naroll
Nevada State Clearinghouse/SPOC

Enclosure

NEVADA STATE CLEARINGHOUSE

Department of Administration
Budget and Planning Division
209 East Musser Street., Room 200
Carson City, Nevada 89701-4298
(702) 687-4065
fax (702) 687-3983

DATE: April 30, 1998

Governor's Office	Legislative Counsel Bureau	Conservation-Natural Resources
Agency for Nuclear Projects	Information Technology	Director's Office
Business & Industry	Emp. Training & Rehab Research Div.	State Lands
Agriculture	PUC	Environmental Protection
Energy	Transportation	Forestry
Minerals	UNR Bureau of Mines	Wildlife
Economic Development	UNR Library	Region 1
Tourism	UNLV Library	Region 2
Fire Marshal	Historic Preservation	Region 3
Human Resources	Emergency Management	Conservation Districts
Aging Services	Washington Office	State Parks
Health Division		Water Resources
Indian Commission		Water Planning
Colorado River Commission		Natural Heritage
		Wild Horse Commission

Nevada SAI # E1998-126
Project: Kalina Geothermal Demonstration Project at Steamboat Springs

__ Yes __ No **Send more information on this project as it becomes available.**

CLEARINGHOUSE NOTES:

Enclosed, for your review and comment is a copy of the above mentioned project. Please evaluate it with respect to its effect on your plans and programs; the importance of its contribution to state and/or local areawide goals and objectives; and its accord with any applicable laws, orders or regulations with which you are familiar.

Water Resources, here is your copy. DOE reports sending copies directly to the rest of you. Please fax your comments directly to Deborah Turner at DOE: (303) 275-4788 by **May 12,1998,** with a copy to the Clearinghouse. Please let me know soon if DOE's short deadline is too short for your office.. Use the space below for short comments. If significant comments are provided please use agency letterhead and include the Nevada SAI number and comment due date for our reference. Questions? Maud Naroll, 687-6366.

THIS SECTION TO BE COMPLETED BY REVIEW AGENCY:

____No comment on this project
____Proposal supported as written
____Additional information below
____Conference desired (See below)
____Conditional support (See below)
____Disapproval (Explain below)

AGENCY COMMENTS:

The state engineer permits of record to support this project are numbers 62521, 63288-T and 63534. These provide for a specific amount of consumptive use of geothermal fluids if any is necessary. The Project as described in this Environmental Assessment describes full injection of cooled fluids for reservoir pressure support and this office agrees that would be the prudent approach to developing the resource.

Thomas K. Gallagher, P.E. Nevada Division of Water Resources 5/13/98

Signature s shardat clear clear doc Agency Date

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

April 28, 1998

Distribution List

SUBJECT: PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KALINA GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-1116)

In 1993, the Department of Energy (DOE) issued a solicitation entitled "Demonstration of Economic Benefits of Improved Electrical Power Generating Systems for Geothermal Applications." The Kalina Cycle System 11 (KCS11) project proposed by Exergy, Inc. was selected as a potential recipient to receive financial assistance from DOE. Immediately following this selection, DOE began an environmental assessment (EA) in connection with the subject geothermal demonstration project. Since that time, project concerns not related to the environmental analysis caused delays in the original schedule. These issues have since been resolved and DOE is now ready to move forward with the final decisions regarding the proposed project.

The proposed project involves the construction and operation of a five Megawatt skid-mounted unit that will demonstrate the KCS11 system. The proposed project site is adjacent to the existing Steamboat power plant facilities owned by Far West Capital Inc., located approximately 16 kilometers (10 miles) southeast of Reno, Nevada. The proposed project would be located on the Harvey parcel. The enclosed Predecisional Draft Environmental Assessment (EA) for the Kalina Geothermal Demonstration Project, Steamboat Springs, Nevada contains a summary of the project, a description of the existing environmental features and a discussion of the potential impacts that may result from the proposed project.

The draft EA document is being provided to your office for review with comments due to Deborah A. Turner, NEPA Compliance Officer, by close of business May 12, 1998. Our office coordinated this 14 day review period with a representative of the Nevada State Clearinghouse with the understanding that DOE would provide draft documents directly to the attached list of potential interested state agencies. In addition to the state agencies on the attached list, the Fish & Wildlife Service, State Historic Preservation Office, Bureau of Land Management and other interested members of the public have been contacted regarding the proposed project.

Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788 or e-mail, deborah_turner@nrel.gov. Thank you in advance for your interest in our proposed project.

Sincerely,

for Frank M. Stewart
Manager

Enclosure:
As Stated

cc w/enclosure:
Maud Naroll, Nevada Clearinghouse

cc w/o enclosures:
Deborah Turner, GO
Jeff Hahn, GO
Dan Lowery, D&M

DISTRIBUTION LIST FOR PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KALINA GEOTHERNAL DEMONSTRAION PROJECT, STEAMBOAT SPRINGS, NEVADA

Ms. Maud Naroll
Nevada State Clearinghouse
Department of Administration
Capitol Complex
209 East Musser Street, Rm 200
Carson City, NV 89701-4298

Mr. John Snow
Division of Minerals
400 West King Street, Suite 106
Carson City, NV 89701

Ms. DeeAnn Parsons
Energy Office
1050 East William, Suite 435
Carson City, NV 89706

Mr. David Cowperthwaite
Environmental Protection
123 West Nye Lane, Rm 138
Carson City, NV 890706-0851

Ms. Jeanne Reynolds
Public Utilities Commission
727 Fairview Drive
Carson City, NV 890701-5451

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

April 28, 1998

Mr. G. Martin Booth III
President
Geothermal Development Associates
251 Ralston Street
Reno, NV 89503

SUBJECT: PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KALINA GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-1116)

In 1993, the Department of Energy (DOE) issued a solicitation entitled "Demonstration of Economic Benefits of Improved Electrical Power Generating Systems for Geothermal Applications." The Kalina Cycle System 11 (KCS11) project proposed by Exergy, Inc. was selected as a potential recipient to receive financial assistance from DOE. Immediately following this selection, DOE began an environmental assessment (EA) in connection with the subject geothermal demonstration project. Since that time, project concerns not related to the environmental analysis caused delays in the original schedule. These issues have since been resolved and DOE is now ready to move forward with the final decisions regarding the proposed project.

The proposed project involves the construction and operation of a five Megawatt skid-mounted unit that will demonstrate the KCS11 system. The proposed project site is adjacent to the existing Steamboat power plant facilities owned by Far West Capital Inc., located approximately 16 kilometers (10 miles) southeast of Reno, Nevada. The proposed project would be located on the Harvey parcel. The enclosed Predecisional Draft Environmental Assessment (EA) for the Kalina Geothermal Demonstration Project, Steamboat Springs, Nevada contains a summary of the project, a description of the existing environmental features and a discussion of the potential impacts that may result from the proposed project.

In December 1994, your organization contacted our office to request information related to this proposed project. Jeff Hahn, Project Manager, provided information regarding the project in relation to the Nevada Department of Transportation activities in the area of the Harvey parcel. The draft EA document is being provided to your organization for information.

Should you have comments, please provide them to Deborah A. Turner, NEPA Compliance Officer, by close of business May 12, 1998. Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788 or e-mail, deborah_turner@nrel.gov. Thank you in advance for your interest in our proposed project.

Sincerely,

for Frank M. Stewart
Manager

Enclosure:
As Stated

cc w/o enclosures:
Deborah Turner, GO
Jeff Hahn, GO
Dan Lowery, D&M

JLH

GEOTHERMAL DEVELOPMENT ASSOCIATES
251 RALSTON STREET • RENO, NEVADA 89503
PHONE (702) 322-0938 • FAX (702) 322-1320

December 30, 1994

Mr. Jeffrey L. Hahn
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401

Dear Mr. Hahn:

Re: Request for Technical and Economic Information
Kalina Cycle Demonstration Plant
Cooperative Agreement
Instrument No. DE-FC36-94GO10006

With reference to our telephone conversation of December 28, this letter is a formal request for information related to the Kalina Cycle Demonstration Plant project, Cooperative Agreement, Instrument No. DE-FC36-94G01006, Amendment No. A000, signed September 26, 1994.

Geothermal Development Associates ("GDA") has been retained by the Nevada Department of Transportation ("NDOT") to perform geothermal rights damage analysis for certain properties at Steamboat Springs, Nevada, for the Department's legal division. Attached is a copy of a map titled, Land Lease Map (Highway 395 from Mt. Rose Highway), dated June 17, 1993, which shows the NDOT Land Acquisition Area taking two portions of a 60-acre parcel labeled, the "Harvey" property. It is our understanding that the Kalina plant project will be located on the Harvey property (also commonly known as the Guisti property).

GDA submitted a report entitled, Impact Assessment Report for Harvey, J. L. Trustee - 014.636, 014.958 & 014.958PE, A Geologic, Engineering and Economic Analysis of Potential Damages to the Geothermal Rights, dated July 13, 1993, to NDOT on this property. Included as part of this report were analyses and calculations based on geothermal binary power plants of the type and design presently in operation in the immediate area of the Harvey parcel at Steamboat Springs, Nevada.

In mid-1994, GDA was asked by NDOT to prepare an amendment to the aforementioned report, which was to include updated and additional information pertinent to the geothermal rights damage analysis and conclusions. In order to

complete this work, GDA will need geologic, engineering and economic information on the Kalina project, which according to the September 26, 1994, Oil & Gas Journal:

> "U. S. Department of Energy chose the Kalina cycle from Exergy Inc., Hayward, Calif., in competition to find a geothermal power plant design for the future. The process increases plant performance 40-50% for geothermal heat sources that are liquid dominated. A $7.189 million grant, awarded as part of the competition, will help construct a 12,400 kw geothermal power plant at Steamboat, Nev., 10 miles south of Reno."

The geothermal power plant project anticipated by Far West in 1993 for the Harvey property was larger in capacity, with a probable design similar to the newer 24 MW binary plant at Steamboat Springs, and with a wellfield designed to support that plant.

It is obvious that the development plans have changed very materially. GDA must have adequate technical, economic, and other information on the planned Kalina cycle plant and the supporting wellfield in order to complete its analysis of potential damages to the geothermal rights related to the Harvey property.

Specifically requested are the following:

Wellfield-Related The planned location, design and specifications, total depth, and depth of production and injection zones or intervals of the wells and drill holes; the planned location, design and specifications for all pipelines; and the budgeted costs for each of the planned wells and drill holes and pipelines systems. A map, drawn to scale, showing the planned well and drill hole surface locations and the bottom hole location of each, if not a vertical hole; and the pipeline systems.

Kalina Plant-Related A description and specifications of the Kalina power plant and ancillary facilities, including the interconnection to the Sierra power grid. A map, drawn to scale, showing the location and size of the principal components of the power plant, ancillary facilities, and the interconnection to the Sierra grid. The budgeted costs for each of these items, as well as the total budged cost, as provided to DOE.

Project Financial and Power Sales Contract Information Far West, the Harvey geothermal rights lessee, and the owners of the Harvey property geothermal rights, are parties of interest to the project. GDA will need to know the nature of their interest in the project in order to determine potential damages.

Project Schedule What is the anticipated date of plant commissioning; and/or the anticipated date that electricity generated from the plant will be delivered to the power grid on a regular commercial basis?

Power Sales Contract At some point in time there must be a power sales contract with a power purchasing entity, normally a utility, for the sale of electricity generated from the Kalina plant. Does a signed contract exist? If so we would like a copy of that contract. If one does not exist, is one being negotiated, and with whom?

It is GDA's wish to obtain adequate information on this project which will enable us to make a fair, accurate, and impartial assessment of the potential damages. GDA is not interested in obtaining copies of or having access to technical information which is proprietary to Exergy, Inc.

If there are any questions regarding any aspect of this letter request, please call me or the attorney representing NDOT relative to this project:

Michael G. Chapman
955 S. Virginia Street, Suite 104
Reno, Nevada 89502
(702) 827-1866

Thank you for your attention to this matter. I will be in contact with you in a couple of weeks to discuss this request and gain an understanding as to when this information will be made available.

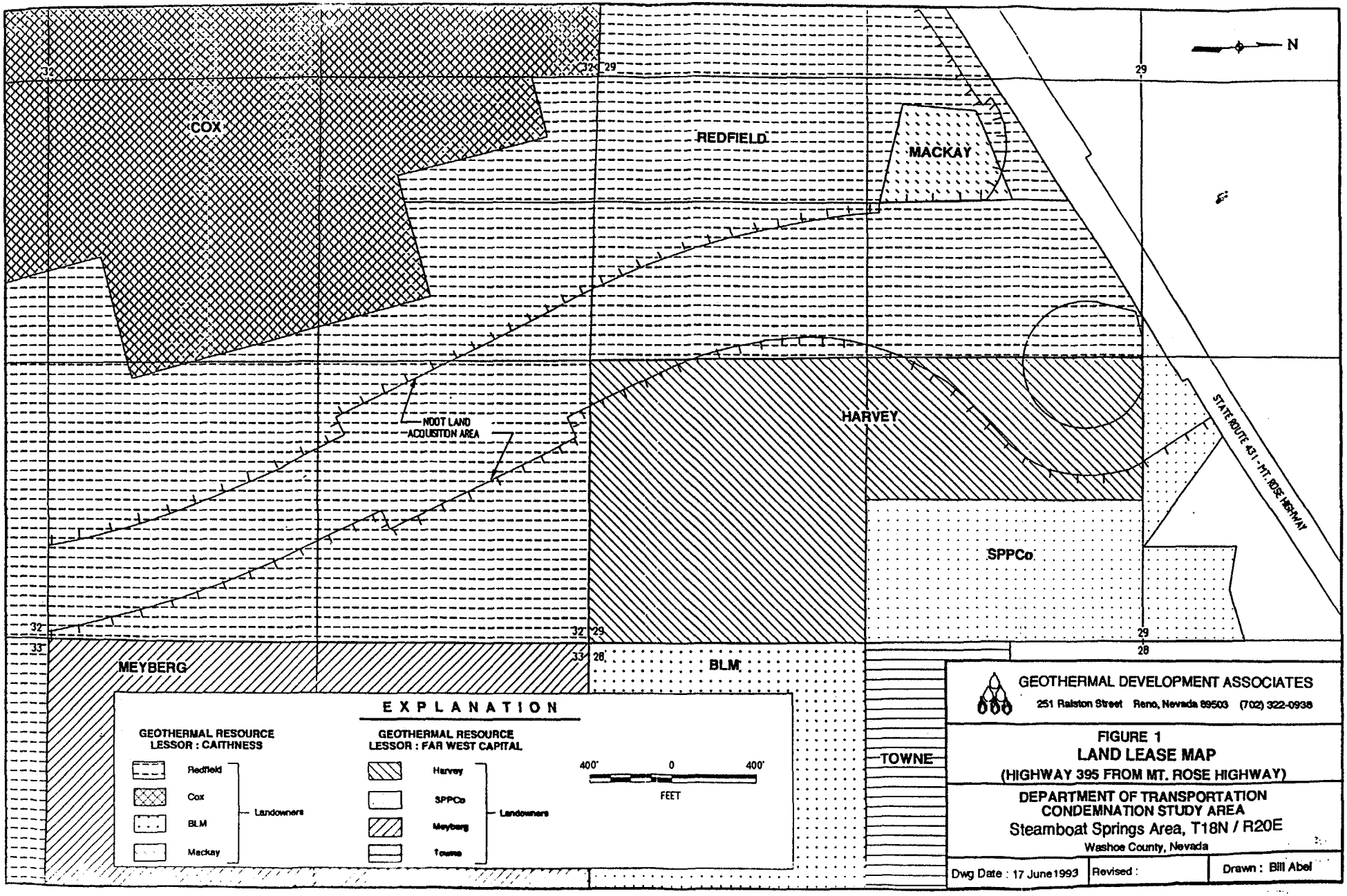
Sincerely,
GEOTHERMAL DEVELOPMENT ASSOCIATES

G. Martin Booth III
President

GMB/sb

Enclosure

xc: Michael G. Chapman



GEOTHERMAL DEVELOPMENT ASSOCIATES
251 Ralston Street Reno, Nevada 89503 (702) 322-0938

FIGURE 1
LAND LEASE MAP
(HIGHWAY 395 FROM MT. ROSE HIGHWAY)

DEPARTMENT OF TRANSPORTATION
CONDEMNATION STUDY AREA
Steamboat Springs Area, T18N / R20E
Washoe County, Nevada

Dwg Date : 17 June 1993	Revised :	Drawn : Bill Abel

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

April 28, 1998

James M. Phillips
U.S. Department of the Interior
Bureau of Land Management
1535 Hot Springs Road, Suite 300
Carson City, NV 89706-0638

Dear Mr. Phillips:

SUBJECT: PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KALINA GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-1116)

Reference: 1617 (NV-03337)

In November, 1993, The Department of Energy's Golden Field Office (GO) began an environmental assessment (EA) in connection with the subject geothermal demonstration project. As part of our evaluation process, Jeffery Hahn of our office contacted your office to request input regarding the proposed project. In November 1993, your office provided written concerns related to direct, indirect, and cumulative impacts on the hydrothermal features of the Steamboat Geyser Basin Area of Critical Environmental Concern. Copies of both of these letters are enclosed for your reference. Since we received your letter, project concerns not related to the environmental analysis caused delays in the original schedule. These issues have since been resolved and GO is now ready to move forward with the final decisions regarding the proposed project. The project has been re-scaled from the original 12 megawatt facility to a five megawatt skid-mounted unit.

The Predecisional Draft Environmental Assessment (EA) for the Kalina Geothermal Demonstration Project, Steamboat Springs, Nevada contains a summary description of the hydrology and the potential impacts from this proposed project to the system. As part of the potential impact analysis for the draft EA, GO commissioned a study of the Steamboat Hills Hydrologic System. Our full analyses of the hydrologic system is contained in the enclosed final report entitled *Evaluation of the Steamboat Hills Hydrologic System - Potential Effects of The Proposed Expanded Development.* These potential impacts noted in the final report were based on the original 12 Megawatt facility design. Therefore, any potential impacts from the re-designed project would be less then those projected in the original analysis.

The draft EA document is being provided to your office for review with comments due to Deborah A. Turner, NEPA Compliance Officer, by close of business May 12, 1998.

Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788 or e-mail deborah_turner@nrel.gov. Project specific issues should be directed to Jeffery L. Hahn, Project Manager at (303) 275-4775. Thank you for your continued interest in our proposed project.

Sincerely,

for Frank M. Stewart
Manager

Enclosures:
As Stated

cc w/o enclosures:
David Loomis, BLM
Richard Hoops, BLM
Jeff Hahn, GO
Deborah Turner, GO
Dan Lowery, D&M

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Carson City District Office
1535 Hot Springs Rd., Ste. 300
Carson City, NV 89706-0638

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

1617 (NV-03337)

NOV 09 1993

NOV 09 1993

Jeff Hahn
Department of Energy
1617 Cole Blvd
Golden, Colorado 80401

Dear Mr. Hahn:

We understand that the Department of Energy is involved in a demonstration project for an advanced binary geothermal plant adjacent to the Steamboat Geyser Basin Area of Critical Environmental Concern south of Reno, Nevada. The project would involve recapturing heat losses from the turbine. It would use a solution of ammonia and water. The plant would produce 12 mw of electricity, 40% more efficiently than current binary plants. The project is indirectly tied to a new 24 mw conventional power plant through Far West Geothermal's financing arrangements. DOE's current concerns involve potential impacts to the Steamboat Buckwheat and cumulative impacts to the geothermal reservoir.

We have an additional concern that needs to be addressed in the NEPA analysis for this proposal. Direct indirect and cumulative impacts to the hydrothermal features of the Steamboat Geyser Basin Area of Critical Environmental Concern need to be fully analyzed. This should include potential short term impacts from altering the "plumbing" of the geyser system and from changing the temperature, pressure and/or gas content of the hydrothermal fluids. Long term impacts on the temperature of the system from cumulative use of the geothermal resource should also be analyzed.

Please send all information regarding this proposal to me at the above address. Please call David Loomis at 702 883-1496 if you have any questions about our concerns.

Sincerely yours,

James M. Phillips
Lahontan Area Manager

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

April 28, 1998

Barbara Bishop Gollan
Vice President - Resource
Caithness Resources, Inc.
The Grace Building, 1114 Avenue of the Americas
New York, NY 10036-7790

Dear Ms. Gollan:

SUBJECT: PREDECISIONAL DRAFT ENVIRONMENTAL ASSESSMENT FOR THE KALINA GEOTHERMAL DEMONSTRATION PROJECT, STEAMBOAT SPRINGS, NEVADA (DOE/EA-1116)

In your letter to Mr. Jeff Hahn, dated December 1, 1993, you listed several concerns about the possible development of a Kalina cycle geothermal power plant by Far West Capital at Steamboat Springs, Nevada. In October 1996, Jeff provided a written response addressing your concerns. These responses are reiterated below. This project has been delayed due to the difficulty in obtaining a long term power purchase agreement. An Environmental Assessment (EA) has been developed in accordance with the requirements of the National Environmental Policy Act (NEPA). The purpose of this letter is to transmit the Predecisional Draft EA for the project.

Your letter expressed the following concerns:

1. Drainage of the geothermal resource under the 40 acre BLM lease parcel may occur which could prevent Yankee/Caithness Joint Venture L.P. (YCJVLP) planned future development. YCJVLP holds a 40 acre BLM lease adjacent to the area leased and developed by Far West.

2. Potential impacts the proposed development may have to the BLM managed Area of Critical Environmental Concern (ACEC) and the federally listed endangered steamboat buckwheat. The ACEC is a 40 acre parcel of public land designated to preserve and protect both the hot springs and geysers at Steamboat Springs and is located near the project area.

3. The availability of sufficient resources for the planned expansion.

4. Involvement of Caithness in the planning and decisions related to expansions which may have a potential impact on the ACEC and/or the resource under the BLM lease held by YCJVLP.

Response

Before addressing the above concerns, it is fitting that our response be prefaced with the following facts. The project that DOE is involved with is the development of a 12 megawatt advanced binary geothermal power plant that utilizes the Kalina cycle. Any other development planned or proposed was not considered or evaluated. The lease area to be developed under this project is known as the Harvey (formerly Giusti) Lease.

1. Drainage of the geothermal resource under the 40 acre BLM lease parcel may occur which could prevent Yankee/Caithness Joint Venture L.P. (YCJVLP) planned future development. YCJVLP holds a 40 acre BLM lease adjacent to the area leased and developed by Far West.

We can appreciate Caithness' concerns regarding future development on the 40 acre BLM lease and whether further exploitation of the resource can be accommodated. However, this EA cannot resolve this issue. The EA can only evaluate and predict the consequences of this proposed action.

The Environmental Assessment prepared for the Kalina geothermal demonstration project evaluated the geothermal resource for the needs of the power plant in question. That is, the EA did not predict the amount of geothermal fluid that the reservoir could support to prevent excessive draw down or to maintain the moderate temperature. However, the EA did conclude that based upon the relatively small amount of production and injection well operations in the proposed project, and the proper placement of the injection well, adverse impacts to the moderate temperature system is not expected.

2. Potential impacts the proposed development may have to the BLM managed Area of Critical Environmental Concern (ACEC) and the federally listed endangered Steamboat Buckwheat. The ACEC is 40 acre parcel of public land designated to preserve and protect both the hot springs and geysers at Steamboat Springs and is located near the project area.

Liquid flow at the Steamboat Springs hot springs has been absent since the late 1980's. While the exact cause of this is still unknown, it is thought to be from a combination of a regional drought, increased domestic and agricultural groundwater use and geothermal development, all of which occurred over the same period of time that the hot springs stopped flowing. The Steamboat geothermal system consists of numerous fractures, so it is possible for a fracture to connect the injection well with water reservoirs beneath the hot springs area. However, this is considered unlikely because the fractures in the Steamboat area are generally north to northeast, while the hot springs are typically east of these fractures. Because the Kalina geothermal demonstration project production and injection well operations would only be a small addition to existing operations, it is not expected to have any noticeable affect to already diminished water levels.

There is a potential for plant operations and construction activities to impact the Steamboat Buckwheat indirectly and/or directly. Sinter soils, evidently necessary for the Steamboat Buckwheat, are dependent on or were formed by venting or discharge of geothermal fluids and minerals. However, significant impacts to the groundwater system from the proposed action are not expected. Therefore, potential indirect impacts to the Steamboat Buckwheat from operation related activities of the proposed action are not expected. The Steamboat Buckwheat is not within the project disturbance area and would not be directly impacted by the construction or operation of the proposed action.

3. The availability of sufficient resource for the planned expansion.

The Kalina geothermal demonstration project utilizes the Kalina Cycle System 11 process which utilizes regenerative heat exchangers to pre-heat and partially vaporize the ammonia-water working fluid. The regenerative heating accounts for 40% of the heat transferred to the working fluid. Therefore, less geothermal brine is required to produce the same amount of energy than would be required from a power plant that does not utilize any regenerative heating. The operations currently exploiting the moderate temperature resource include a total of 44 MW of binary power plants operated by Far West Capital. The operation of the Kalina geothermal demonstration project would only represent approximately 12 percent of the flow being withdrawn from the moderate temperature reservoir (as opposed to the high temperature resource currently being exploited by YCJVLP). It is expected that operation of the proposed project would not adversely affect temperatures or pressures significantly in the moderate temperature resource.

4. Involvement of Caithness in the planning and decisions related to expansions which may have a potential impact on the ACEC and/or the resource under the BLM lease held by YCJVLP.

Bringing Far West Capital and Caithness together for the purpose of planning the future development of private and federal land on the Steamboat Springs Known Geothermal Area cannot be accomplished through an EA. The purpose of the EA is to assess potential environmental impacts the proposed project may have.

The draft EA is being provided to your organization for review with comments due to Deborah A. Turner, NEPA Compliance Officer, by close of business May 12, 1998.

Deborah can be reached by phone (303) 275-4746, fax (303) 275-4788 or e-mail deborah_turner@nrel.gov. Project specific issues should be directed to Jeffery L. Hahn, Project Manager, at (303) 275-4775.

Sincerely,

for Frank M. Stewart
Manager

Enclosure:
As Stated

cc w/o enclosure:
Jeff Hahn, GO
Deborah Turner, GO
Dan Lowery, D&M

CAITHNESS

Caithness Resources, Inc.
The Grace Building
1114 Avenue of the Americas
New York, New York 10036-7790

December 1, 1993

Mr. Jeff Hahn
Department of Energy
1617 Cole Blvd.
Golden, CO 80401

Subject: Issues of concern regarding plans for a DOE Kalina Cycle demonstration plant on the Far West leases at Steamboat Springs, NV

Dear Jeff:

This letter is in response to your informal verbal request for a letter outlining Caithness's concerns regarding the planned expansion of the Far West geothermal plant at Steamboat. It is our understanding that DOE has awarded a contract to Exergy Inc. to construct a 12 MW Kalina cycle binary power demonstration plant, that DOE will contribute funds for part of the 12 MW plant construction cost, and that this will be part of a total 30 MW planned expansion.

As you are aware, Yankee/Caithness Joint Venture L.P. holds a significant lease position on the Steamboat resource which encompasses both BLM and private acreage. YCJVLP owns and operates a 12.5 MW single flash unit which located on the hill above the Far West project. YCJVLP also holds a 40 acre BLM lease which adjoins the area now developed by Far West.

Although the Steamboat field which the YCJVLP development is on was unitized by Philips, the private leases held by Far West do not participate in the unit. This means that the reservoir produced by Far West is not defined by their lease boundaries and therefore very likely extends onto leases held by YCJVLP. The two operators, as you know, manage their production and injection operations as two separate and unrelated reservoirs. There are several issues, both environmental and resource related, which should be of concern to the DOE with respect to their involvement with expansion of the Far West facilities. While DOE's participation may be simply an issue of funding, it seems reasonable to assume that there should be some concern about the existence of sufficient resource and the potential environmental issues and impacts which will be related to the proposed plan.

To date, all of the Far West development has taken place on

Telephone: (212) 921-9099 • Fax: (212) 921-9239

private land and has therefore been subject only to the environmental regulations required by the state PSC. They have not come under federal review with respect to the environmental issues related to the BLM managed Area of Critical Environmental Concern (ACEC), located on the main sinter terrace near the Far West project. The 40 acre parcel of public land was designated to preserve and protect both the hot springs and geysers at Steamboat Springs and the federally listed endangered steamboat buckwheat.

The BLM's Carson City District Office, which has jurisdiction over the ACEC, has been extremely adamant about assessing and monitoring the potential for impacts to the thermal manifestations and the endangered steamboat buckwheat within the ACEC related to development of the underlying geothermal resource. Because YCJVLP is the only operator subject to federal regulations and review, we have borne the brunt of BLM scrutiny and requirements related to these concerns. The fact that Far West has been outside their jurisdiction has been a point of frustration for them. The involvement of DOE, a federal agency, in the proposed expansion of the Far West project will trigger, for the first time, the need for a NEPA document. It is not unreasonable to expect that the federal agencies will take full advantage of the means by which to comment on the additional geothermal development on property adjacent to the ACEC, especially since they had no ability to comment on the first 30 MWs developed.

Another issue which will most likely be raised in light of the planned additional development is the impact of current and planned development on the 40 acre BLM lease YCJVLP holds located adjacent to the Far West development. The BLM has already made a formal request for information which would demonstrate whether or not this lease is being drained by the current production from Far West wells which border the parcel on three sides. Additional development will certainly increase the BLM's concern, as well as our own, that this lease is being affected by Far West production.

The final and probably most significant issue which we feel should be of concern to DOE with regard to their involvement in the planned expansion, is the availability of sufficient resource. There are significant differences in the resource models which have been proposed for the Steamboat Springs geothermal system. We feel that it is unclear whether there is sufficient resource in the moderate temperature portion of the resource developed by Far West to support another 30 MW of production, particularly without producing more fluid from the YCJVLP leases.

The DOE has already drilled a deep slimhole on the Far West leases. The data from this hole has not been made available to

YCJVLP, and most likely will not be until after the data has been analyzed. It seems likely that this data has been made available to the Far West technical staff, since they were present during the drilling. This DOE funded data would obviously be of use and interest to YCJVLP as well as Far West to help define the geothermal system and revise the resource models. Certainly, this data will help determine the potential effects of further development of the moderate temperature portion of the Steamboat resource by Far West.

If the DOE continues to be involved in the development of the Far West leases at Steamboat, it would seem appropriate to involve Caithness in the planning and decisions related to expansion which may have a potential impact on the ACEC and/or the resource under the BLM lease held by YCJVLP.

We appreciate the opportunity to state our concerns at this time.

Sincerely,

Barbara Bishop Gollan
Vice President - Resource

November 1, 1993

Susan Petty
Susan Petty, Inc – Consultant to Calpine
654 Glenmont Avenue
Solana Beach, CA 92075

Subject: Request for Questions, Concerns and/or Comments on the Development of the Steamboat Geothermal Resource.

Dear Susan:

The Department of Energy (DOE) and Exergy, Inc. are cooperatively working toward building an advanced binary geothermal power plant at Steamboat Springs, Nevada. The power plant will utilize the "Kalina Cycle" with a water-ammonia mixture as the working fluid. The purpose of this project is to demonstrate the economic benefits of the this new type of power plant.

In an effort to address all concerns relating to the development of the Steamboat Springs area by Far West Capital, please send your questions, concerns and/or any comments to:

Attn: Jeff Hahn
DOE - Golden Field Office
1617 Cole Blvd.
Golden, Colorado 80401

Please send your questions, concerns and or comments so that they arrive at the above address on or before Friday, November 12, 1993.

Thank you again for spending time with Ellen Morris and myself on Tuesday afternoon at the Geothermal Resource Council. The sketch that you drew and the discussions that we had during that hour have helped me a lot.

Please don't hesitate to call me at (303) 275-4775 if you have any questions about the above request.

Sincerely,

Jeffrey L. Hahn
Project Engineer
U.S. Dept. of Energy