APPENDIX I

REASONABLE FORESEEABLE DEVELOPMENT SCENARIOS

Appendix I
Reasonable Foreseeable Development Scenarios (Minerals) (From the Winnemucca RMP Mineral Potential Report - BLM 2006a)

As part of the Winnemucca RMP Process a Mineral Potential Report was developed to analyze existing and potential development of mineral resources. This appendix includes reasonable development scenarios from that report for oil and gas resources, geothermal resources and solid leasable minerals.

I.1 OIL AND GAS REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

I.1.1 Development Potential Rankings

Development potential is not a prediction of precise future drilling locations and should not be used as a gauge of future interest or lack of interest in leasing. Oil and gas companies have numerous sources of proprietary data not available to the BLM (such as seismic data or internal geologic reports), which they use prior to making financial commitments to lease or drill. Therefore, even though an area is rated as very low development potential at this time with a low probability for any wells being drilled, a company may still be interested in leasing that area, should it be made available.

The analysis of potential for development of oil and gas resources within the Planning Area is based on bedrock geologic mapping, geophysical data and 47 oil and gas tests drilled in the Planning Area (**Table I-1**). The areas with potential for the occurrence of oil and gas resources within the Planning Area are shown on **Figure I-1**.

Figure I-1 is a map depicting development potential for oil and gas resources within the Planning Area. On this map development potential ranges from moderate to very low. As with the occurrence potential, there are no areas of "high" development potential within the Planning Area. High development potential areas occur only within proven producing petroleum provinces or in areas with a significant number of hydrocarbon "shows". Areas of moderate development potential have a significant thickness of sedimentary section present that includes possible source and reservoir rocks. These areas correspond to the USGS (1995) play areas.

Within the Planning Area, areas having a low potential for development typically have a thin sedimentary section present. They may also have limited source rock potential because of shallow burial and/or limited reservoir potential. Areas of low potential are also used to designate areas where there is insufficient data available to analyze the potential. Areas of low potential occur adjacent to areas of moderate potential in the Tertiary basin of the Western Great Basin Province.

An area of very low development potential lacks source or reservoir rocks or is an area predominantly underlain by metamorphosed or intrusive terrane. Areas of very low potential have no sedimentary source rock section thought to be capable of generating oil or gas and/or very limited reservoir potential.

TABLE I-1
SUMMARY OF OIL AND GAS DRILLING ACTIVITY TO 2004
WINNEMUCCA FIELD AREA, NEVADA

Operator Current Name	Lease Name	Name	Field Name	County Name	Permit #	Permit Date	Total Drilled	Dated Spud	Date Completion	Date Last Activity
BLACK ROCK O&G CO	GOVT	1	WILDCAT	HUMBOLDT		11/23/1921	800	12/3/1921	12/30/1921	12/1/1998
EARTH POWER PROD	N17278	45-14	WILDCAT	HUMBOLDT		9/20/1982	3703	9/30/1982	1/19/1983	12/1/1998
HUMBOLT ASSOC	ELLISON	2	WILDCAT	HUMBOLDT	383	6/16/1984	1020	6/26/1984	7/4/1984	12/1/1998
HUMBOLT ASSOC	ELLISON	1	WILDCAT	HUMBOLDT	268	11/4/1979	986	11/14/1979	7/3/1984	12/1/1998
SUN EXPL & PROD CO	KING LEAR-FEDERAL	1-17	WILDCAT	HUMBOLDT	347	4/7/1983	7931	4/17/1983	6/4/1983	12/1/1998
W PACIFIC RR CO	SULPHUR MP	474.67		HUMBOLDT		1909	970			
ARCO OIL & GAS CORP	ARCO TOBIN UNIT	1	WILDCAT	PERSHING	408	10/28/1984	2065	11/7/1984	12/6/1984	12/1/1998
CHEVRON U S A INC	KYLE-FEDERAL	84-2	WILDCAT	PERSHING		9/7/1980	2104	9/17/1980	10/11/1980	12/1/1998
EVANS BARTON LTD	KYLE SPRING	11-42A	WILDCAT	PERSHING	838	7/10/2001	607	7/24/2001		8/10/2004
EVANS BARTON LTD	KYLE SPRING	12-13D	WILDCAT	PERSHING	759	9/21/1995	1000	10/1/1995	6/1/1997	1/14/2004
EVANS BARTON LTD	KYLE SPRING	12-13	WILDCAT	PERSHING	730	8/2/1994	1162	8/12/1994	8/25/1994	1/23/2003
EVANS BARTON LTD	KYLE SPRING FED	11-14	WILDCAT	PERSHING	791	10/27/1996	2633	11/6/1996	6/1/1997	1/14/2004
EVANS DAVID M	KYLE SPRING	12-13	UNNAMED	PERSHING		10/27/1996	230	11/6/1996	11/6/1996	8/20/2003
EVANS DAVID M	KYLE SPRING FED	11-43	WILDCAT	PERSHING	821	7/13/1998	868	9/23/1998	12/20/2002	9/24/2004
EVANS DAVID M	KYLE SPRING FED	11-23	WILDCAT	PERSHING		5/12/1998	2020	8/1/2000	8/9/2000	5/30/2003
GETTY OIL COMPANY	FEDERAL	44-10	WILDCAT	PERSHING		3/3/1981	7964	3/13/1981	6/27/1982	12/1/1998
GETTY OIL COMPANY	FEE	14-22		PERSHING		3/3/1979	500	3/13/1979	3/14/1979	11/2/2001
GETTY OIL COMPANY	FEE	18-24		PERSHING		3/1/1979	500	3/10/1979	3/12/1979	11/2/2001
GETTY OIL COMPANY	FEE	17-24		PERSHING		2/28/1979	500	3/9/1979	3/10/1979	11/2/2001
GETTY OIL COMPANY	FEE	13-26		PERSHING		2/14/1979	500	2/24/1979	3/8/1979	11/2/2001
GETTY OIL COMPANY	FEE	6-6	WILDCAT	PERSHING		3/5/1979	500	3/15/1979	3/15/1979	12/1/1998
GETTY OIL COMPANY	FEE	15-21	WILDCAT	PERSHING		3/4/1979	500	3/14/1979	3/15/1979	12/1/1998
GETTY OIL COMPANY	FEE	16-22	WILDCAT	PERSHING		3/2/1979	500	3/12/1979	3/13/1979	12/1/1998
GETTY OIL COMPANY	FEE	10-34	WILDCAT	PERSHING		2/16/1979	500	2/26/1979	2/26/1979	12/1/1998
GETTY OIL COMPANY	FEE	11-23	WILDCAT	PERSHING		2/4/1979	500	2/14/1979	2/16/1979	12/1/1998
GETTY OIL COMPANY	FEE	5-8	WILDCAT	PERSHING		2/3/1979	500	2/13/1979	2/13/1979	12/1/1998
GETTY OIL COMPANY	FEE	4-16	WILDCAT	PERSHING		2/2/1979	500	2/12/1979	2/12/1979	12/1/1998
GETTY OIL COMPANY	FEE	7-4	WILDCAT	PERSHING		2/2/1979	500	2/12/1979	2/13/1979	12/1/1998
GETTY OIL COMPANY	FEE	3-10	WILDCAT	PERSHING		2/1/1979	500	2/11/1979	2/11/1979	12/1/1998
GETTY OIL COMPANY	FEE	1-12	WILDCAT	PERSHING		1/28/1979	500	2/7/1979	2/10/1979	12/1/1998
GETTY OIL COMPANY	FEE	2-2	WILDCAT	PERSHING		1/18/1979	500	1/28/1979	2/2/1979	12/1/1998
GETTY OIL COMPANY	FEE	8-34	WILDCAT	PERSHING		1/16/1979	500	1/26/1979	1/29/1979	12/1/1998
GETTY OIL COMPANY	FEE	9-34	WILDCAT	PERSHING		1/15/1979	500	1/25/1979	1/26/1979	12/1/1998
GETTY OIL COMPANY	FEE	12-26	WILDCAT	PERSHING		1/6/1979	400	1/16/1979	2/23/1979	12/1/1998
GETTY OIL COMPANY	IGH	2	COLADO	PERSHING		10/20/1979	1165	10/30/1979	11/18/1979	12/1/1998
OESI POWER		46-28M	HUMBOLDT	PERSHING	284	9/23/1991	260	10/3/1991	10/15/1991	12/1/1998
OUIDA OIL CO	DIXIE	1	WILDCAT	PERSHING	743	2/17/1995	4536	2/27/1995	5/24/1995	12/1/1998
PHILLIPS PETRLM CO	CAMPBELL	E-2	HUMBOLDT	PERSHING		12/27/1978	8061	1/6/1979	10/1/1979	12/1/1998
PHILLIPS PETRLM CO	CAMPBELL	E-1	WILDCAT	PERSHING		10/23/1977	1848	11/2/1977	12/10/1977	12/1/1998
TREGO WELL BLACK R DES	TREGO WELL			PERSHING			1500			
AMOR IV CORPORATION		32A-21	SAN EMIDIO DESERT	WASHOE		10/9/1988	1000	10/19/1988	10/26/1988	12/1/1998
CAITHNESS POWER		32-5	STEAMBOAT SPR	WASHOE	79	10/8/1987	3000	10/18/1987	11/8/1987	12/1/1998
CHEVRON GEOTHERMAL		28-32		WASHOE	67	3/11/1986	3031	3/21/1986	5/12/1986	12/1/1998
PHILLIPS PET-GULF	STEAMBOAT	1	WILDCAT	WASHOE		5/26/1979	3075	6/5/1979	7/16/1979	12/1/1998
PHILLIPS PETRLM CO	COX	I-1	WILDCAT	WASHOE		3/22/1981	3471	4/1/1981	7/1/1981	8/20/2003
SUNOCO ENRGY DEV CO	HOLLAND LIVESTOCK	1-2-FR		WASHOE		2/6/1979	5210	2/16/1979	4/26/1979	2/26/2002
SUNOCO ENRGY DEV CO	HOLLAND LIVESTOCK	1-15G	WILDCAT	WASHOE		12/7/1978	5871	12/17/1978	2/20/1979	12/1/1998

Notes:

Well Data compiled from: P I Dwights Winn FO RMP Washoe, Humboldt, Pershing 2/2005

NBMG, 2001, Oil and Gas Wells Drilled in Nevada (website: http://www.nbmg.unr.edu/lists/oil/oil.htm)

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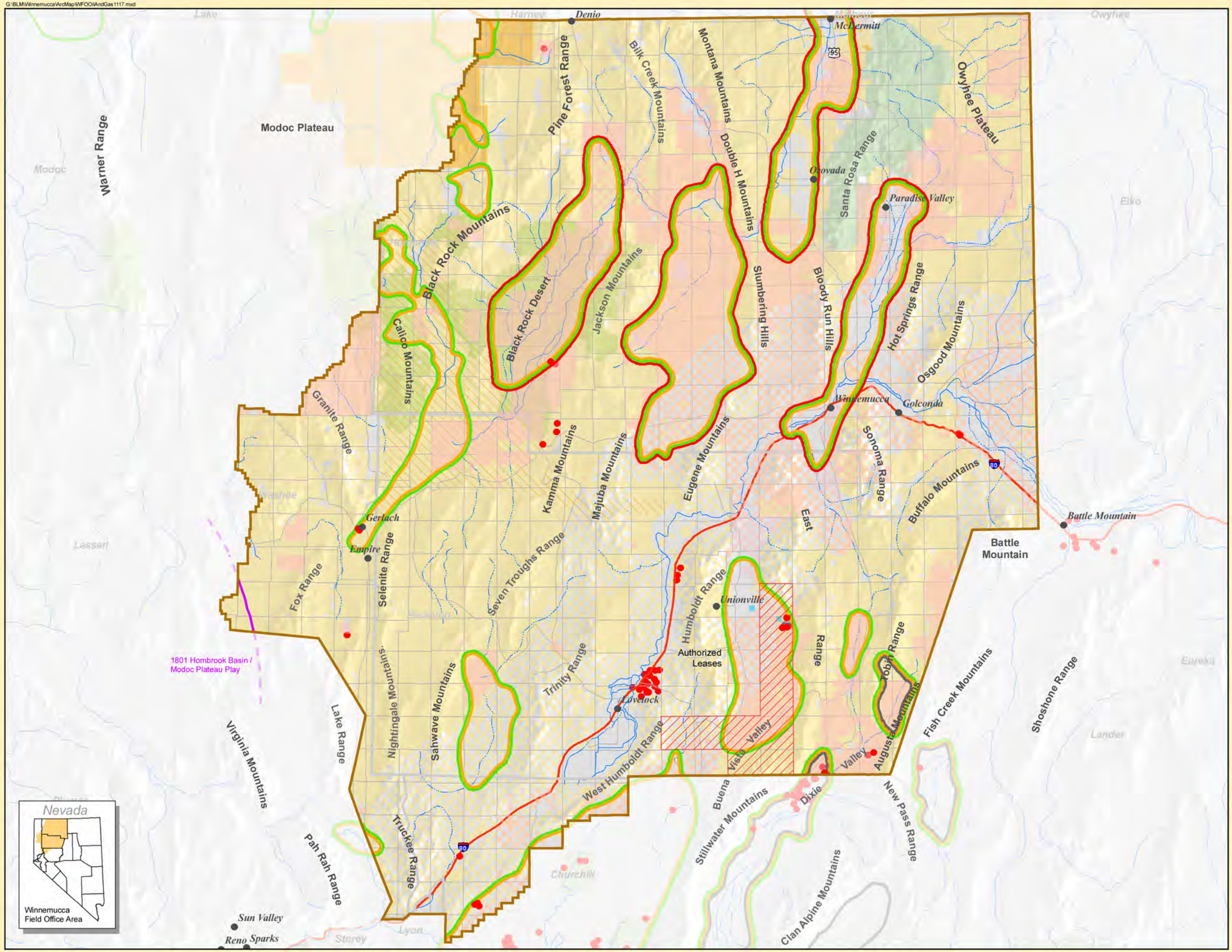

Oil and Gas Wells, Leases and USGS Plays
Mineral Assessment Report
Winnemucca Field Office
RMP Planning Area, Nevada
Figure I-1

I.1.2 Drilling Activity Forecast

In order for the BLM to be able to analyze the effects of oil and gas leasing, and possible impacts related to exploration, development, and cumulative effects, it is necessary to estimate how many wells industry might drill in the next 15 to 20 years within the WDO Planning Area. The following RFD scenario has been developed using historical oil and gas development, and oil "play" information from the US Geological Survey, potential development map (Figure 4.6) and other data from BLM files, and a number of other technical sources.

The Neogene Source Rock Play areas (**Figure I-1**, green outlined areas) have a moderate to high resource potential; that is, they have a high probability (0.8 to 1.0) of a suitable oil and gas charge occurring in the source rock (USGS, 1995). Even though the probability of occurrence of suitable reservoir rock and traps in the Neogene Basins Play areas (yellow outlined areas) is relatively low (0.2-0.5) (USGS 1995), it is estimated that as many as twelve wildcat wells (wells drilled in areas with no previous production) may be drilled in these Neogene Basins in the next 15 to 20 years. Many of the initial twelve wells would likely be located in the Buena Vista Valley and Kyle Springs areas (**Figure I-1**). Of these twelve wells it is estimated that 10 will be dry holes (no economically producible oil or gas is discovered). Dry holes would be plugged and abandoned with surface reclamation occurring shortly afterward.

It is further estimated that two of the wells drilled in the southeast portion of the Planning Area, probably in the vicinity of the relatively recent leasing activity and within the area nominated for Oil and Gas Competitive Leasing, will produce a discovery (**Figure I-1**). Each of the discovery wells would probably prompt additional step-out wells. A "step-out well" is a well drilled adjacent to or near a proven well to establish the limits and continuity of the oil or gas reservoir and/or to assist with production. It was estimated that a total of four (4) step-out wells would be drilled, two for each discovery. Finally, it is estimated one of the discoveries (including the two step-out wells) would have limited oil production and occur on BLM administered lands.

The general geographic areas within the Planning Area, where oil and gas exploration is predicted to occur are on **Figure I-1**. Each of the areas is associated with an area identified as a Neogene Basin or Neogene Source Rock Play area described above in the section entitled USGS Hydrocarbon Provinces and Plays. It is anticipated that the 12 projected wildcat wells would be drilled somewhere within the basin boundaries of these four play areas with discoveries likely in the Buena Vista Valley area (in the area currently nominated for Oil and Gas Completive Leasing (**Figure I-1, Table I-2**).

Table I-2
Drilling Activity Forecast (RFD)
Mineral Assessment Report Winnemucca District Office – EIS / RMP
RMP Planning Area

Area	Wildcat Wells	Discoveries	Step-out Wells	Commodity
Neogene Basins	12			
Buena Vista Valley Area		2	4	oil or gas
TOTAL	**12**	**2**	**4**	oil or gas

I.1.3 Surface Disturbance Impacts

Construction of temporary road access and a drilling location for each wildcat well may disturb about 6 acres for each wildcat well, or 72 acres for all the wildcat wells. No discoveries of commercial quantities of oil or gas are anticipated during the next 10 to 15 years.

This section of the Reasonable Foreseeable Development Scenario describes the anticipated disturbances associated with the Drilling Activity Forecast (**Table I-2**) predicted in the preceding section. **Table I-3** describes the tasks involved and the surface disturbances that are likely to result from the successful and unsuccessful drilling of wildcat wells, development or step-out drilling, and field production activities of the Winnemucca RFD drilling forecast. The number of acres of disturbance estimated relies on data derived from wildcat well drilling elsewhere within the Planning Area and on existing small scale production from fields developed elsewhere in Nevada. Reclaimed acres (regraded and seeded) are assumed to be stabilized after 2 years.

Table I-3
Estimated Cumulative Impacts of Oil and Gas Exploration and Development (RFD)
Mineral Assessment Report Winnemucca District Office – EIS / RMP
RMP Planning Area

Type of Disturbance	Required Tasks	Acres Disturbed Pre-Site Reclamation	Acres Disturbed Post-Site Reclamation
Ten (10) Unsuccessful Wildcat Wells	Well Site - Maximum area of 3.6 acres (about 380 ft. x 400 ft.) cleared per well pad.	35	0 (2 years)
	Access Roads – 40 ft. width x lineal footage (3.6 miles or 18,480 lineal feet) or about 17 acres per well site.	170	0 (2 years)
One (1) Well Drilled with a Gas Field Discovery Two (2) Step-out Wells Drilled with No Production because of distance to Gas Transmission Lines	- Gas field would be discovered in the Buena Vista Valley west of the East Range (Field would be approximately 3 square miles in surface area). - Compressor stations would normally be necessary along the feeder pipeline route but the distance to the main transmission line is too long, and the field is shut in. - Condensate, gas, and water separation would occur at the well sites, during production testing. Water disposal would be into a lined pit at the surface or water would be injected into the subsurface through a dry hole converted into a water disposal well. Gas would be flared. Condensate would be shipped by truck (1 truck every 4 days).	Not Applicable	Not Applicable
	1 discovery well - 2 additional step out wells per discovery well Well Site - Maximum area of 3.6 acres (about 380 ft. x 400 ft.) cleared per well pad.(3 wells total)	10.5	3.6 (2 years)
	Access Roads – 40 ft. width x lineal footage. • 1 at 17 acres (3.6 miles long) • 2at 7.3 acres (1.5 miles long)	31.6	16 7 (2 years)
	Pipelines – no production, none required - Trunk lines to existing transmission lines – 25 ft. width x lineal footage (35 miles long). - Field gathering pipelines will follow access roads and no additional disturbance will result.	0	0 (2years)

Table I-3 (continued)
Estimated Cumulative Impacts of Oil and Gas Exploration and Development (RFD)

Type of Disturbance	Required Tasks		Acres Disturbed Pre-Site Reclamation	Acres Disturbed Post-Site Reclamation
One (1) Oil Field Discovered and Brought into Small Scale Production	- An oil field is possible in the Kyle Springs area - Field would be approximately 1 ½ square miles in surface area. - Oil would be transported by truck to refining facility. - Oil, gas, and water separation would occur at the well sites. Water disposal would be into a lined pit at the surface or water would be injected into the subsurface through a dry hole converted into a water disposal well. Gas would be used on lease to separate oil and water and to heat oil. Gas not used on lease would be reinjected into the formation for pressure maintenance or would be vented / flared to the atmosphere. If sufficient gas quantities are produced this gas may also be captured and sold. For this analysis all unused gas is assumed to be reinjected for pressure maintenance.		Not Applicable	Not Applicable
	- 3 commercially productive wells (one discovery and two step-out wells)	Well Site - Maximum area of 3.6 acres (about 380 ft. x 400 ft.) cleared per well pad.	10.5	3.6 (2 years)
		Access Roads – 40 ft. width x lineal footage. • 1 at 17 acres (3.6 miles long) • 2 at 7.3 acres (1.5 miles long)	31.6	16 7 (2 years)
		Pipelines - Field gathering pipelines will follow access roads and no additional disturbance will result.	0	0

I.2 GEOTHERMAL REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

I.2.1 Introduction

In 2000, the DOE's Office of Energy Efficiency and Renewable Energy (EERE) initiated its *GeoPowering the West* program in an effort to dramatically increase the use of geothermal energy in the western United States (Geothermal-biz.com 2005 and U.S.DOE 2005). The goals of *GeoPowering the West* include doubling the number of states producing geothermal electricity to 8 by 2006, reducing the cost of geothermal power to 3 to 5 cents per kilowatt hour by 2007, and ultimately providing seven million homes with geothermal energy by 2010. In addition, in 1997, the Nevada legislature established a renewable energy portfolio standard. This standard requires that up to 15% of the total electricity sold would be derived form renewable energy resources. Considering the high potential for further geothermal development in Nevada, it seems quite likely that the state will experience substantial growth in the geothermal energy production industry. BLM Management action and scrutiny will be necessary to provide for future renewable energy growth while protecting sensitive resource values. Development of geothermal resources on federal lands, as described in Section 2.0, is subject to review under NEPA.

The following Reasonably Foreseeable Development Scenario (RFDS) for geothermal resources was developed in the *Geothermal Resources Leasing Programmatic EA* (BLM, 2005) in order to provide a reasonable estimate of anticipated exploration, development and production activity that might be expected over the next 20 years of developing geothermal resources of the Planning Area. Once the anticipated level of activity is determined the RFDS estimates the potential cumulative impacts of surface disturbance and other environmental impacts associated with geothermal development.

Initially the RFDS looks at the location of KGRAs, historical leasing patterns and geologic models to identify favorable and prospective areas for developing geothermal energy within the planning area. The *Geothermal Resources Leasing Programmatic EA* (BLM, 2005) identified at least three areas of varying potential within the Planning Area. These include (**Figure I-2):** 1) the six Known Geothermal Resource Areas (KGRAs); 2) areas with pending lease applications (typically in the vicinity of the KGRAs); and 3) areas identified by the geologic models as being Prospectively Valuable Areas (PVAs) with respect to geothermal development. In all, the largest area of potential within the Planning Area is included within the 13 PVAs that encompass approximately 1.9 million acres and include the six KGRAs (**Figure I-2**).

The Reasonably Foreseeable Development Scenario presented here envisions that over the next 20 years, exploration drilling would occur on all geothermal leases, some of which lead to more detailed exploration drilling, and a few of which lead to the discovery of geothermal resources capable of developing five 15 Megawatt Geothermal Power Plants. The 15-megawatt power plant is used as a typical size to estimate the amount of disturbance that could be involved for the RFD scenario. These calculations are meant to be used as an indicator of the impacts involved, not as a cap or bound on the size of any geothermal power plant development. The discussion below looks at the potential surface disturbances from this scenario, and then the other potential environmental impacts from development of the resources.

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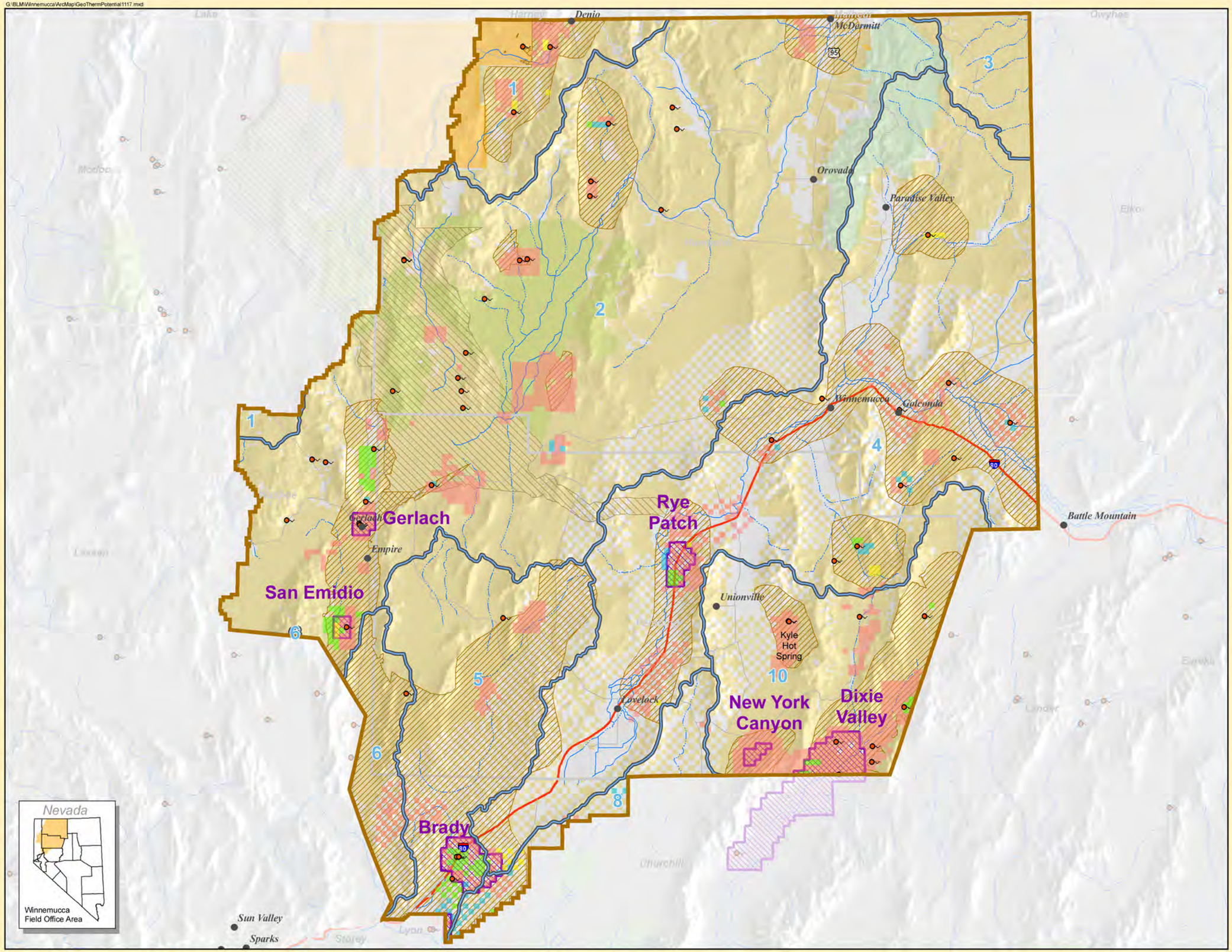

WFO Boundary
Interstate
State Highways
Local Roads
Perennial Stream
Intermittent Stream
County Boundaries

Surface Ownership

BLM Land
National Forest
Wilderness Area
Wildlife Refuge
National Conservation Area

Geothermal Assessment Areas

Known Geothermal Resource Area (KGRA)
Prospectively valuable areas as modified from Hoops 1991
Unleased lands within a KRGA
Authorized Leases
Cancelled Leases
Closed Leases
Pending Leases (lease data as of 5/06)
Hot Springs
Hydrographic Basins
As defined and numbered by the NV Division of Water Planning:

1 Northwest Region
2 Black Rock Region
3 Snake River Basin
4 Humboldt River Basin
5 West Central Region
6 Truckee River Basin
8 Carson River Basin
10 Central Region

No warranty is made by the Bureau of Land Management (BLM) for use of data for purposes not intended by BLM.

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Geothermal Potential Map
Mineral Assessment Report
Winnemucca Field Office
RMP Planning Area, Nevada
Figure I-2

I.2.2 Surface Disturbance

Exploration: During the exploration stage, surface disturbance is minimal with few adverse impacts until the decision is made to drill one or more exploration wells. An exploration-drilling impact evaluation is shown below (**Table I-4**) which lists the maximum degree of anticipated surface disturbance expected during this phase. .

Table I-4
Geothermal Exploration Drilling Disturbance
Mineral Assessment Report Winnemucca District Office – EIS / RMP
RMP Planning Area

Activity	Acres of Disturbance (Acres)	Units per Lease	Total Acres Disturbed Per Lease	Total Acres Disturbed with Two Leases Explored Per Year
Exploration Roads	1 acre/mile	3, ½ mile roads	1.5	3
Shallow Temperature Gradient or Exploration Flow Test Well (several 100 to several 1000 feet deep)	1 acre/drill site	3 drill sites	3.0	6
		TOTAL	**4.5**	**9**

If we assume that as many as three temperature gradient and/or exploration flow test wells would be drilled on each lease. This would disturb as much as three acres (one acre per drill site). Three new access roads, each a half-mile in length would disturb an additional 1.5 acres. Therefore, the total disturbance per lease is approximately 4.5 acres (**Table I-4**). Exploration drilling surface impacts are transitory in that unsuccessful exploration programs are abandoned and the surface impacts are reclaimed usually within a two year period. Successful exploration programs lead on through the development process frequently using the surface disturbances created during exploration for some of the development activities. To spite the fact that there may be numerous leases on which exploration drilling takes place, they would not all be drilled at the same time. If we assume that over the next 20 years 40 geothermal leases are drilled, a total of 120 exploration holes would be drilled. If we assume that these holes would be drilled evenly over the entire 20 year period, six holes would be drilled per year. If we further assume that unsuccessful exploration holes are reclaimed within a two year period, then there would never be more than 12 drill pads disturbed at any one time. **Table I-4** summarizes anticipated individual and cumulative impacts for the exploration drilling.

***Development*:** The following describes the construction activities required to develop five, 15-megawatt electrical power generating plants, associated wells, pipelines, roads, and electrical transmission lines. The number of wells includes those used for production, standby, and re-injection. Since development is likely to occur in about 5-megawatt increments over a period

of several years, the degree of surface disturbance at any given time is less than that presented in
Table I-5. Mitigation and enhancement would have occurred in some portions of the lease before additional portions of the lease are developed.

Table I-5
Surface Disturbance From Construction of a Geothermal Power Facility
Mineral Assessment Report Winnemucca District Office – EIS / RMP
RMP Planning Area

Facility or Feature	Facility or Features/Plant	Disturbed Acres Per Feature or Facility	Disturbed Acres for Overall Power Plant Infrastructure	Total Disturbed Acres for 5 Power Plant Facilities
Power Plant	1	30	30	150
Wells	6	5	30	150
Cooling Pond	1	5	5	25
Pipelines	3	5	15	75
Access Road (spurs)	3	7	21	105
Mainline Road	1	10	10	50
Transmission Line	1	10	10	50
TOTAL			**121**	**605**

***Schedule*:** The various time frames for a typical geothermal project are estimated as follows:

Exploration: 1 to 5 years
Development: 2 to 10 years
Production: 10 to 30 years (depending on construction time)

Up to six production or injection wells could be drilled on each lease. Each well pad would disturb approximately 5 acres, and a mainline road would disturb approximately 10 acres. Each of three pipelines would disturb approximately 5 acres and each of three access roads would disturb approximately 7 acres. A power plant would occupy approximately 30 acres, a disposal pond would disturb approximately 5 acres, and a 25-mile transmission line would disturb approximately 10 acres. Total surface disturbance for each plant for this phase of operation would total approximately 121 acres (**Table I-5**). Again, not all power plants would be constructed at the same time, and construction would likely be staged in 5-megawatt increments.

Until actual geothermal exploration and development begin, it is difficult to quantify the resource potential and possible future intensified production measures necessary to develop the resources. In order to assess environmental impacts resulting from an action as general as geothermal exploration, development, and production, it is necessary to assume given levels of intensities of such development.

I.3 SOLID LEASABLE MINERAL POTENTIAL

The potential for development of leasable industrial rocks and mineral resources of the WDO Planning Area are summarized below. These include the following: sodium minerals (including salt), and sulfur.

I.3.1 Sodium Minerals (salt)

There is good potential for the development of salt deposits in the Planning Area. The salt deposits occur in the playas of which the Planning Area has several. Although there is no current production of salt in the Planning Area, former salt mines include White Plains, Carson Sink, and Eagle Marsh in Churchill County and Buffalo Springs in Washoe County (Nash, 1996) (**Figure I-3, Table I-6**).

There are several mines that produced sulfur as a by product of gold and/or silver ores in the Planning Area. These include Sulfur in Humboldt County, Humboldt House (also known as Imlay) in Pershing County, and San Emidio in Washoe County (Papke and Castor, 2003; Tingley, 1998). Due to the high operating cost necessary for their development, and a technology generally incompatible with heap leach gold recovery operations at large gold mining operations, it is not likely that further large scale development of secondary sulfur mineral deposits will occur in Planning Area.

I.3.2 Sulfur

There is low potential for the development of fumarole-related, sulfur deposits in the WDO Planning Area. This is because fumarole environments have been thoroughly prospected for gold-silver-mercury deposits. Undiscovered deposits within 200 meters of the surface are predicted to either be small or buried by younger alluvium. Fumarole sulfur deposits tend to be small in size and can be rich in metals that are costly to remove. An economic deposit must be near an efficient transportation route (Nash, 1996).

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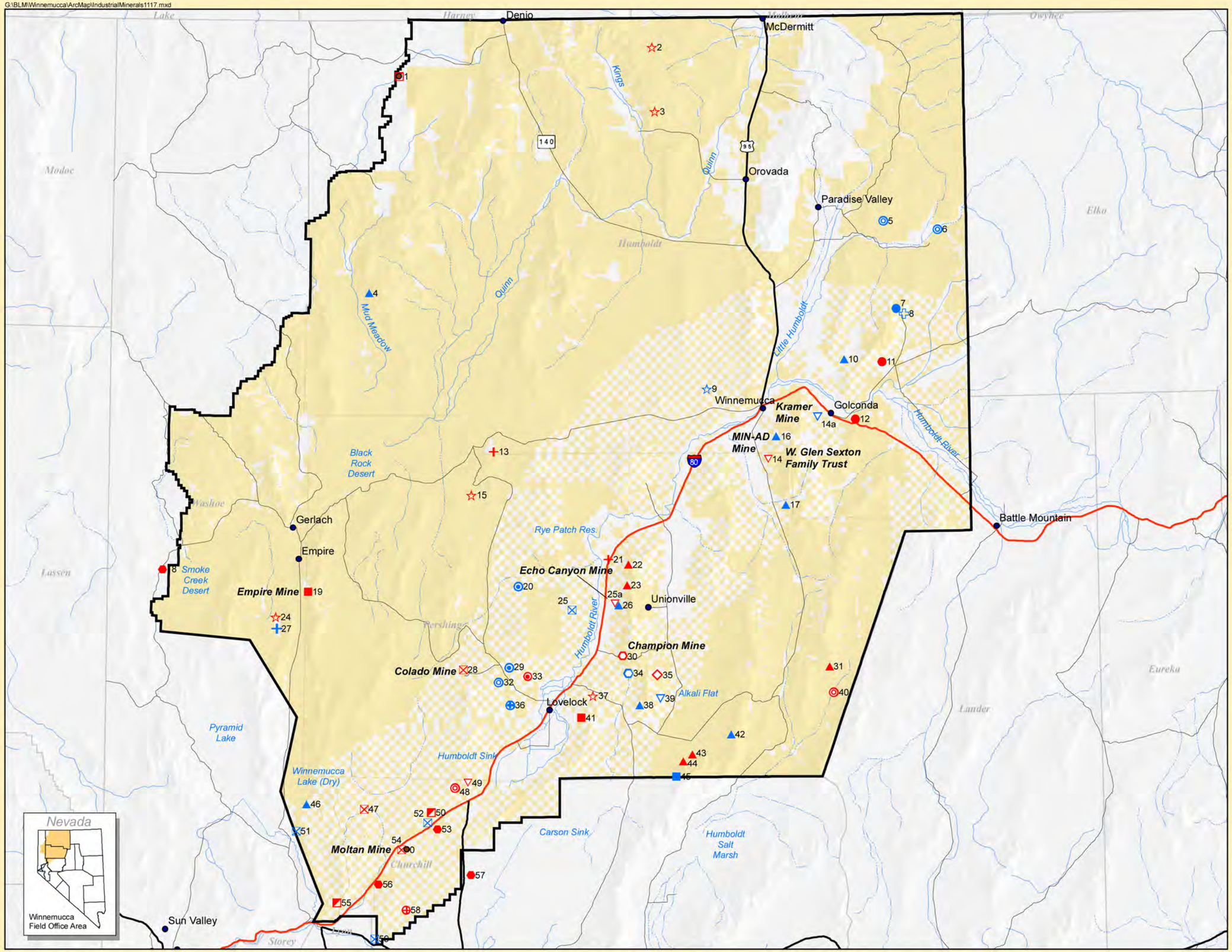

WFO Boundary
Interstate
State Highways
Local Roads
Perennial Stream
Intermittent Stream
County Boundaries
Bureau of Land Management

Active or Significant Past Production	No Significant Past Production	
		Aluminum minerals
		Barite
		Building stone
		Carbonate rocks
		Clay
		Diatomite
		Fluorspar
		Gypsum
		Perlite
		Pumice, pumicite or cinder
		Silica
		Sodium minerals
		Sulfur
		Talcose minerals
		Wollastonite
		Zeolite

After Nash 1996; Papke and Castor 2003; and Nevada Bureau of Miners and Geology 2004

No warranty is made by the Bureau of Land Management (BLM) for use of data for purposes not intended by BLM.

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Industrial Minerals
Mineral Assessment Report
Winnemucca Field Office
RMP Planning Area, Nevada
Figure I-3

Table I-6
Industrial Mineral Deposits of the Winnemucca FO Planning Area

Mineral Assessment Report Winnemucca District Office – EIS / RMP
RMP Planning Area

Commodity	Deposit # This Report	County	Mine Name	Deposit # Map #142*
Stone, Building	1	Humboldt	Virgin Valley (Wegman Quarry)	9
Clay	2	Humboldt	Bull Basin (Montana Mountains)	8
Clay	3	Humboldt	Disaster Peak	9
Fluorspar	4	Humboldt	Sunset	7
Zeolite	5	Humboldt	Spring Creek	11
Zeolite	6	Humboldt	Chimney Reservoir	12
Barite	7	Humboldt	Anderson	37
Wollastonite	8	Humboldt	Getchell	3
Clay	9	Humboldt	Barret Springs	10
Silica	10	Humboldt	Stone Corral	13
Barite	11	Humboldt	Redhouse	38
Barite	12	Humboldt	Horton – Little Britches	39
Sulfur	13	Humboldt	Sulphur	3
Carbonate	14	Pershing	W. Glen Sexton Mine	13
Silica	14a	Humboldt	Kramer Hill Mine	none
Clay	15	Pershing	Rosebud Canyon	27
Carbonate	16	Pershing	Min-Ad Mine East Range	14
Fluorspar	17	Pershing	Mammoth	34
Sodium Minerals	18	Washoe	Buffalo Springs	19
Gypsum	19	Pershing	Empire	20
Perlite	20	Pershing	North Trinity Range	16
Sulfur	21	Pershing	Humboldt House	4
Fluorspar	22	Pershing	Piedmont	35
Fluorspar	23	Pershing	Valery	36
Clay	24	Washoe	San Emidio	31
Diatomite	25	Pershing	Rye Patch	20
Limestone	25a	Pershing	Echo Canyon	In Permitting
Carbonate	26	Pershing	Humboldt Range	15
Sulfur	27	Washoe	San Emidio	5
Diatomite	28	Pershing	Colado (Velvet District)	21
Perlite	29	Pershing	Trinity Range	17
Aluminum Minerals	30	Pershing	Champion	3
Fluorspar	31	Pershing	Needle Peak	37
Zeolite	32	Pershing	Lovelock	24
Perlite	33	Pershing	Pearl Hill (Velvet District)	18
Aluminum Minerals	34	Pershing	Lincoln Hill	4
Talc Minerals	35	Pershing	Humboldt Range Pinite	13
Pumice	36	Pershing	Lovelock	13
Clay	37	Pershing	Coal Canyon Deposits	28

Fluorspar	38	Pershing	Emerald Spar	38
Carbonate	39	Pershing	Buffalo Mountain	16
Zeolite	40	Pershing	Jersey Valley	25
Gypsum	41	Pershing	Lovelock area	21

Table I-6 (continued)
Industrial Mineral Deposits of the Winnemucca FO Planning Area

Commodity	Deposit # This Report	County	Mine Name	Deposit # Map #142*
Fluorspar	42	Pershing	Susie	39
Fluorspar	43	Pershing	Nevada Fluorspar	40
Clay	44	Pershing	New York Canyon (Stoker)	29
Gypsum	45	Pershing	Corn Beef	22
Silica	46	Washoe	Winnemucca Lake	18
Diatomite	47	Churchill	Nightingale (Truckee Range)	1
Zeolite	48	Churchill	Trinity Range	1
Carbonate	49	Churchill	Ocala	1
Stone, Building	50	Churchill	Trinity Range	1
Diatomite	51	Washoe	Nixon	26
Diatomite	52	Churchill	Trinity	2
Sodium Minerals	53	Churchill	White Plains	1
Diatomite	54	Churchill	Moltan Mine Desert Peak (Hot Spring Mountain area)	3
Stone, Building	55	Churchill	Black Mountain	2
Sodium Minerals	56	Churchill	Eagle Marsh	4
Sodium Minerals	57	Churchill	Carson Sink	3
Pumice	58	Churchill	Posalite	2
Diatomite	59	Churchill	Black Butte	4

* Deposit number from Nevada Bureau of Mines and Geology Map 142 Industrial Minerals of Nevada.

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