

SUMMARY REPORT
OF
AVAILABILITY OF GEOTHERMAL DATA FOR
POTENTIAL DIRECT HEAT APPLICATION
IN NEVADA

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by

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INTRODUCTION

An assessment of available data on geothermal springs and wells was performed by first ascertaining which agencies both State and Federal maintain files which have water temperatures. The principle files are maintained by the Nevada Bureau of Mines and Geology, U. S. Geological Survey, and Water Resources Center - Desert Research Institute. The State Engineer's office maintains files of driller's logs. Requirements for completing driller's logs under subsection 5 states water temperature will be reported, if thermometer is unavailable an estimated temperature will be given as cold, warm or hot.

The second phase of the assessment of available data was to determine the quality of the data in each file. This was performed by inventory of files and by cross-correlating files by cursory examination. An estimate of the number of entries in the Nevada Bureau of Mines and Geology (NBMG) file with inferred temperatures that could be associated with confidence to replicate data was also made.

RESULTS

Geothermal data available on Nevada resides in several data banks. The principal sources are Nevada Bureau of Mines and Geology, U. S. Geological Survey, and Water Resource Center's Water Analysis Data System (WADS).

Table 1

Existing Data $>20^{\circ}\text{C}$ for Nevada in Principle Data Files

	Entries
NBMG	>1100
U.S.G.S. GEOTHERM	559
WRC-DRI	250*

*Increasing because of data derived from Lawrence Livermore Laboratory uranium study in Nevada.

At the inception of this study a cut-off temperature of 35°C was used. Subsequent discussion with ERDA, Division Geothermal Energy, HQ and Jim Swanson of the U. S. Geological Survey confirm that the cut-off temperature for geothermal waters for direct heat utilization is now 20°C. This lower value coincides with the Nevada Bureau of Mines and Geology's file and the U. S. Geological Surveys GEOTHERM file.

The inventory of existing data considered 35°C as the cut-off temperature and the subsequent tables and figures were prepared using the 35°C criteria. The number of data sheets in the NBMG file (>1100) is a factor of 2 greater than the number of entries (538) using the 35°C cut-off temperature. This factor probably applies to all parameters considered in this evaluation.

Data in the NBMG file for springs and wells >35°C were inventoried and such parameters as the completeness of the data, chemical analyses, flow rate (discharge) and depth of wells was considered. Table 2, (shown graphically in Figure 1) provides a tabular listing by county of data in the NBMG file.

Table 2 indicates that 78 percent of all springs and a slightly higher proportion of the wells (87%) have measured temperatures. Approximately one-half of all entries (51%) have chemical analyses. Approximately 50 percent of the entries have ancillary data such as flow rate, well depth and other remarks, 52%, 49% and 48% respectively.

A comparison was made between the NBMG geothermal file and the U. S. Geological Survey, Conservation Division, Geothermal Land Classification Map to ascertain the quality of data contained in separate data files. Table 3 is a comparison of the NBMG geothermal file and data presented on U. S. Geological Survey, Conservation Division, Geothermal Land Classification Map. Of the 196 springs and wells located on the Land Classification Map, 31 springs and 2 wells have disagreement in location, temperatures and/or type of occurrence, i.e.

GEOHERMAL DATA STATEWIDE
WITH TEMPERATURES >35°C
OR INDICATED AS HOT OR WARM

County	Spring	Well	Total Data Sheets	Chem. Analysis	Flow Rate	Depth	Other
Carson City	2(1)*	3(1)*	7	4	1	2	1
Churchill	5(11)	10(2)	28	5	10	8	23
Clark	(5)	3	8	2	0	3	4
Douglas	6	1	7	5	3	1	5
Elko	36(13)	5(3)	57	18	23	7	35
Esmeralda	7	1(1)	9	4	4	2	6
Eureka	33	9	42	24	22	5	22
Humboldt	55(11)	13	79	46	31	9	40
Lander	22(4)	5	31	16	16	2	21
Lincoln	4(1)	4(4)	13	7	2	5	6
Lyon	4	11(4)	19	12	6	10	7
Mineral	4(1)	6(1)	12	7	4	2	3
Nye	53(9)	20(2)	84	38	47	18	32
Pershing	27(5)	6(1)	39	19	14	2	21
Storey	1(mine)	-	1	-	-	-	1
Washoe	26(18)	45(2)	91	65	11	4	30
White Pine	7(3)	1	11	3	5	1	3
Total	292(82)	143(21)	538	275	199	81	260

* Temperature indicated as Hot or Warm

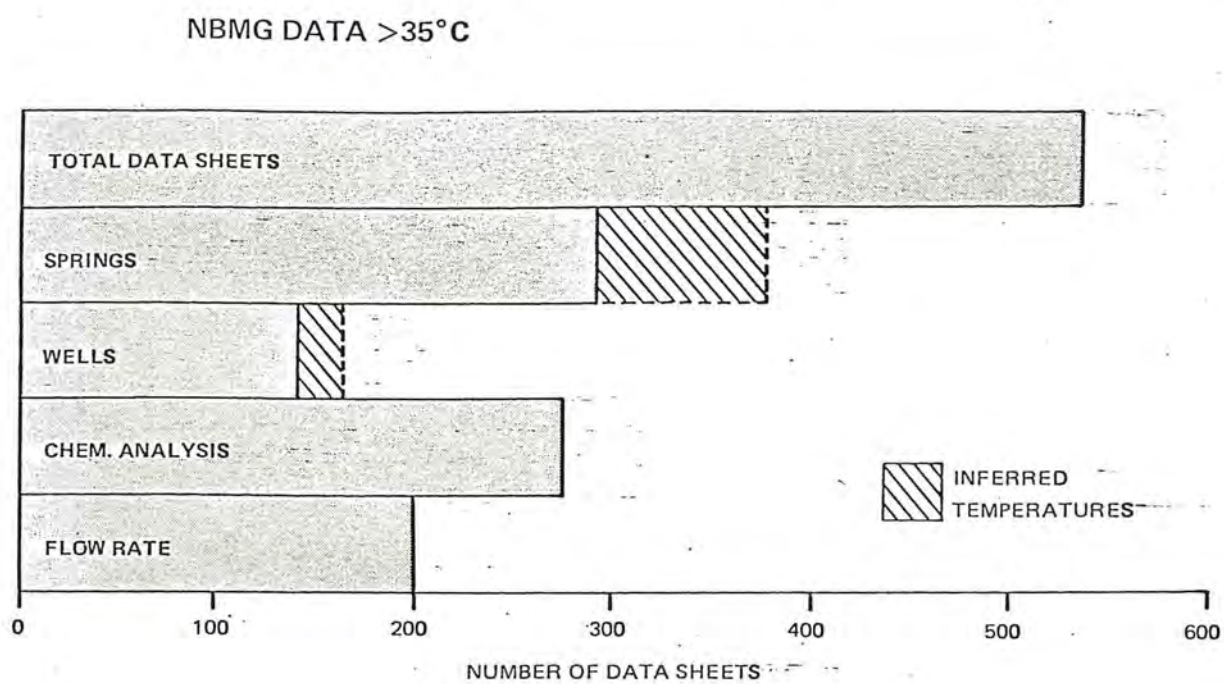


Figure 1. Graphic representation of the quantity and type of data in the NBMG Geothermal file.

COMPARISON OF NBMG AND U.S.G.S.
 CONSERVATION DIVISION GEOTHERMAL
 LAND CLASSIFICATION MAP

County	NBMG		USGS Geothermal Land Classification	
	Spring	Well	Spring	Well
Carson City	2(1)*	3(1)*	1(1)*	
Churchill	5(11)	10(2)	3(5)	
Clark	(5)	3	(3)	2
Douglas	6	1	2(2)	
Elko	36(13)	5(3)	15(8)	1(1)*
Esmeralda	7	1(1)	2(2)	1
Eureka	33	9	11(2)	
Humboldt	55(11)	13	18(11)	5(1)
Lander	22(4)	5	8(5)	1
Lincoln	4(1)	4(4)	2	3
Lyon	4	11(4)	2(4)	
Mineral	4(1)	6(1)	2(1)	2
Nye	53(9)	20(2)	10(8)	7
Pershing	27(5)	6(1)	7(3)	4
Storey	1(mine)	-	1	
Washoe	26(18)	45(2)	10(4)	7
White Pine	7(3)	1	5(3)	
Total	292(82)	143(21)	99(62)	33(2)

*Temperature indicated as hot or warm

spring or well. Twelve of the 31 springs have disagreement in location and 7 have disagreement in temperature. Three springs on the USGS map are wells in the NBMG geothermal files and 2 wells in Las Vegas Valley are apparently mislocated on the map.

It is apparent from the above comparison that many discrepancies between various sources of geothermal information exist. A further analysis was made on data within the NBMG geothermal file to ascertain the amount of additional data that will have to be generated to make the assessment of potential geothermal energy for direct utilization and production of a complete and comprehensive map. A cursory examination of those springs and wells which had inferred temperatures (hot or warm) was made to determine if they were replicate data and had measured temperatures or if they are located in an area which has measured temperatures. The findings of this cursory examination are presented in Appendix A. A total of 103 springs and wells within the NBMG geothermal file have inferred temperatures of these approximately 75 percent could not be associated with other data sheets with confidence. Further research, consulting the original references, large scale maps and in some cases field measurement of temperature will have to be made.

Considerable research and cross-referencing and correlation of existing data will have to be made on the Waring data to validate the location and temperatures of the described springs. There are approximately 30 data sheets in the NBMG geothermal file which are Waring references and will require further research to confirm the locations so that duplicate data or mislocated springs will not be included.

Duplication between NBMG data and that contained in GEOTHERM will probably not exceed 30 percent. All data on water with temperatures $>20^{\circ}\text{C}$ in the U. S. Geological Survey's Water Resources Division computer file have been incorporated

into GEOTHERM. The NBMG file contains only data of the Water Resources Division file that has been published or used in open-file reports. Also GEOTHERM contains many entries which are from the personal files of Don White, U. S. Geological Survey, Menlo Park. These data do not reside in the NBMG file. —

APPENDIX A

Examination of 103 Springs and Wells with Inferred Temperatures

NOTES ON INDICATED TEMPERATURES

Carson City

Well 6C Wells in same section have 112°F Temp.

Churchill

Spring 13 --- Waring, general location
 Spring (M) 14 No data
 Spring 15 Waring general location
 Spring 17 --- Waring, appears to be Dixie Hot Spring >100°F
 Spring 33 Waring, no data
 Well 36 Drill Hole to 3700' Temp. probably exceeds 100°F
 Spring 49 Waring, probably incorrectly located

Clark

Spring 12 If same as Spring 11 Temp=90°F Discharge 3240gpm
 Spring 36 Apparently 81°F from adjoining data w/same name
 Springs 95,96,97 No correlative data

Elko

Spring 26 --- Same location as Spring 25 Temp=194°F
 Well 29 Same location as Well 28 Temp=138°F
 Spring 31 --- No correlative data
 Spring 38 --- No correlative data
 Wells 41,44 --- No correlative data
 Spring 55 Spring 2 miles away Temp=102°F
 Spring 62 Spring in same section 70°F
 Spring 63 No correlative data
 Wells 70,71,72 Encountered hot water and were abandoned
 Springs 74,75 No correlative data
 Spring 78 No correlative data
 Springs 87,88 Are located near Spring 86 Temp=149°F

Esmeralda

Well 12 No correlative data

Humboldt

Spring 12 Other spring and wells in area 200°F
 Springs 19,20 No correlative data
 Springs 41,42,55 Waring ref. Location uncertain
 Spring 61 --- Waring ref. Location uncertain
 Spring 72 In Double Hot Springs area probably >94°F
 Springs 87,89 Location uncertain. No correlative data
 Spring 27 --- Well in same sect. 85°F
 Spring 29 --- Waring, location uncertain
 Spring 32 --- Waring, location uncertain. Indicated as hot
 Spring 43 --- Waring, location uncertain. Indicated as hot

Lincoln

Wells 12,17,20,21 Wells in area generally <90°F
 Spring 50 No correlative data
 Wells 37-42 Other wells in area >100°F

Mineral

Spring 1 - Waring location uncertain. Indicated as warm
 Well 2- - - No correlative data

Nye

Spring 1 No correlative data
 Spring 5,11 - - - >100°F personal knowledge
 Spring 27 - - - Probably <94°F from nearby data
 Spring 32 No correlative data
 Well 39 In Darrough Hot Spring area. Hot water cemented off.
 Spring 45 Waring, location uncertain
 Well 101 No correlative data
 Spring 102 - - - Waring, location uncertain. No temp.
 Springs 113,114 No data.

Pershing

Spring 4 - - - No data from nearby springs
 Spring 13 - - - Numerous springs, Waring location vague
 Spring 25 - - - No data. Location questionable
 Springs 36,38 - - - Probably >94°F, in area of high temp. Drill hole 41B
 >100°F near spring w/141°F.

Washoe

Spring 7 - - - >190°F Steamboat Springs area
 Spring 9 - - - >190°F Steamboat Springs area
 Spring 26 Waring, location uncertain.
 Spring 27 No data, map ref.
 Spring 28 Waring, location uncertain.
 Springs 30,31 - - - Waring, no data
 Spring 33 - - - Waring, no data
 Spring 34 - - - Waring, no data
 Spring 36 - - - Waring, no data
 Spring 38 No correlative temp. data
 Spring 39 - - - Waring, no data
 Spring 40 - - - Waring, no data
 Spring 46 - - - Waring, no data
 Springs 55,56 - - - Adjacent springs and wells >100°F
 Well 57
 Spring 94 - - - >100°F Carside
 Well 95 - - - ?>100°F by association in Moana area
 Well 98 - - - >100°F north of Steamboat Springs
 Spring 123 Remarks indicate boiling mud

White Pine

Spring 17 - - - Waring, poor location, no data
 Spring 27 - - - Waring, poor location, no data
 Spring 38 - - - Waring, poor location, no data

Lincoln

Wells 12,17,20,21 Wells in area generally <90°F
 Spring 50 No correlative data
 Wells 37-42 Other wells in area >100°F

Mineral

Spring 1 Waring location uncertain. Indicated as warm
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Spring 1 No correlative data
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 Well 39 In Darrough Hot Spring area. Hot water cemented off.
 Spring 45 Waring, location uncertain
 Well 101 No correlative data
 Spring 102 Waring, location uncertain. No temp.
 Springs 113,114 No data.

Pershing

Spring 4 No data from nearby springs
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 Springs 36,38 Probably >94°F, in area of high temp. Drill hole 41B
 >100°F near spring w/141°F.

Washoe

Spring 7 >190°F Steamboat Springs area
 Spring 9 >190°F Steamboat Springs area
 Spring 26 Waring, location uncertain.
 Spring 27 No data, map ref.
 Spring 28 Waring, location uncertain.
 Springs 30,31 Waring, no data
 Spring 33 Waring, no data
 Spring 34 Waring, no data
 Spring 36 Waring, no data
 Spring 38 No correlative temp. data
 Spring 39 Waring, no data
 Spring 40 Waring, no data
 Spring 46 Waring, no data
 Springs 55,56 Adjacent springs and wells >100°F
 Well 57
 Spring 94 >100°F Garside
 Well 95 ?>100°F by association in Moana area
 Well 98 >100°F north of Steamboat Springs
 Spring 123 Remarks indicate boiling mud

White Pine

Spring 17 Waring, poor location, no data
 Spring 27 Waring, poor location, no data
 Spring 38 Waring, poor location, no data