ELKO JUNIOR HIGH SCHOOL
GEOTHERMAL OBSERVATION WELL
ELKO, NEVADA

August 18, 1986

Project No. 86-392

Prepared for:

ELKO COUNTY SCHOOL DISTRICT

Prepared by:

WILLIAM E. NORK, INC.

William E. Nork

WILLIAM E. NORK, Inc.

Reno, Nevada 89503

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WILLIAM E. NORK, Inc.
Reno, Nevada 89503

1.Ø SUMMARY AND CONCLUSIONS

1. A 239 feet deep Geothermal Observation Well was drilled and tested at the Elko Junior High School, Elko, Nevada.

2. Drill cuttings and an electric log of the 35Ø feet deep borehole indicated that the portion of the borehole below a depth of approximately 23Ø feet was not sufficiently permeable to justify completion below this depth. This portion of the borehole was backfilled with drill cuttings and abandoned.

3. Pumping and injection test results indicate that the observation well is capable of accepting between 5Ø and 6Ø gallons per minute if it were to be utilized as an injection well. This quantity is roughly equivalent to the off-season and base flow for the district heating system.

4. Test data indicate that the observation well is not fully developed. Additional development procedures are recommended to improve the injectivity of the well. Conversion to and use as an injection well is contingent upon approval by the appropriate regulatory agencies.

5. Injection at an average of approximately 86,4ØØ gallons per day (constant rate of 6Ø gpm) of thermal effluent at this site will result in minimal impact on the chemical quality of ground water discharged from nearby city wells. Total dissolved solids is expected to increase from aproximately 48Ø to 494 mg/l and iron may increase from Ø.Ø1 to Ø.16 mg/l.

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2.Ø INTRODUCTION

A Geothermal Observation Well (GOW-1) was drilled at the Elko Junior High School in the NE 1/4 NW 1/4 of Section 11, Township 34 N., Range 55 E. within the storm-water detention impoundment northwest of the school building. Permission to drill the observation well was granted under State of Nevada Department of Minerals Permit No. 83.

The purpose of the observation well was to provide data necessary to assist in a rational evaluation of the feasibility and potential impacts of injecting thermal effluent into the alluvial aquifer beneath the school. The chemical quality of this effluent is good. It meets state and federal drinking water standards with the exception of elevated iron and the presence of detectable concentrations of hydrogen sulfide gas.

The alluvial aquifer in the vicinity of Elko is exploited by the City of Elko as its sole source of water supply. The observation well was conceived to alleviate deficiencies in the available data regarding the nature of the aquifer in this area. The site was selected principally on the driller's description of the formation materials penetrated by the Elko Junior High School production geothermal well drilled at this site. The driller indicated a significant thickness of potentially permeable geologic materials at this site.

The 24Ø feet deep observation well was drilled by R.D. Reynolds Drilling in the month of July, 1986. It was constructed so as to comply with State of Nevada regulations governing injection wells in the event it was found to be technically feasible to dispose of the thermal effluent in this manner and the disposal alternative was approved by the governing state agencies.

The observation well was subjected to a series of pumping and injection tests which were orchestrated by WILLIAM E. NORK, INC. The results of this investigative effort is summarized in this technical report.

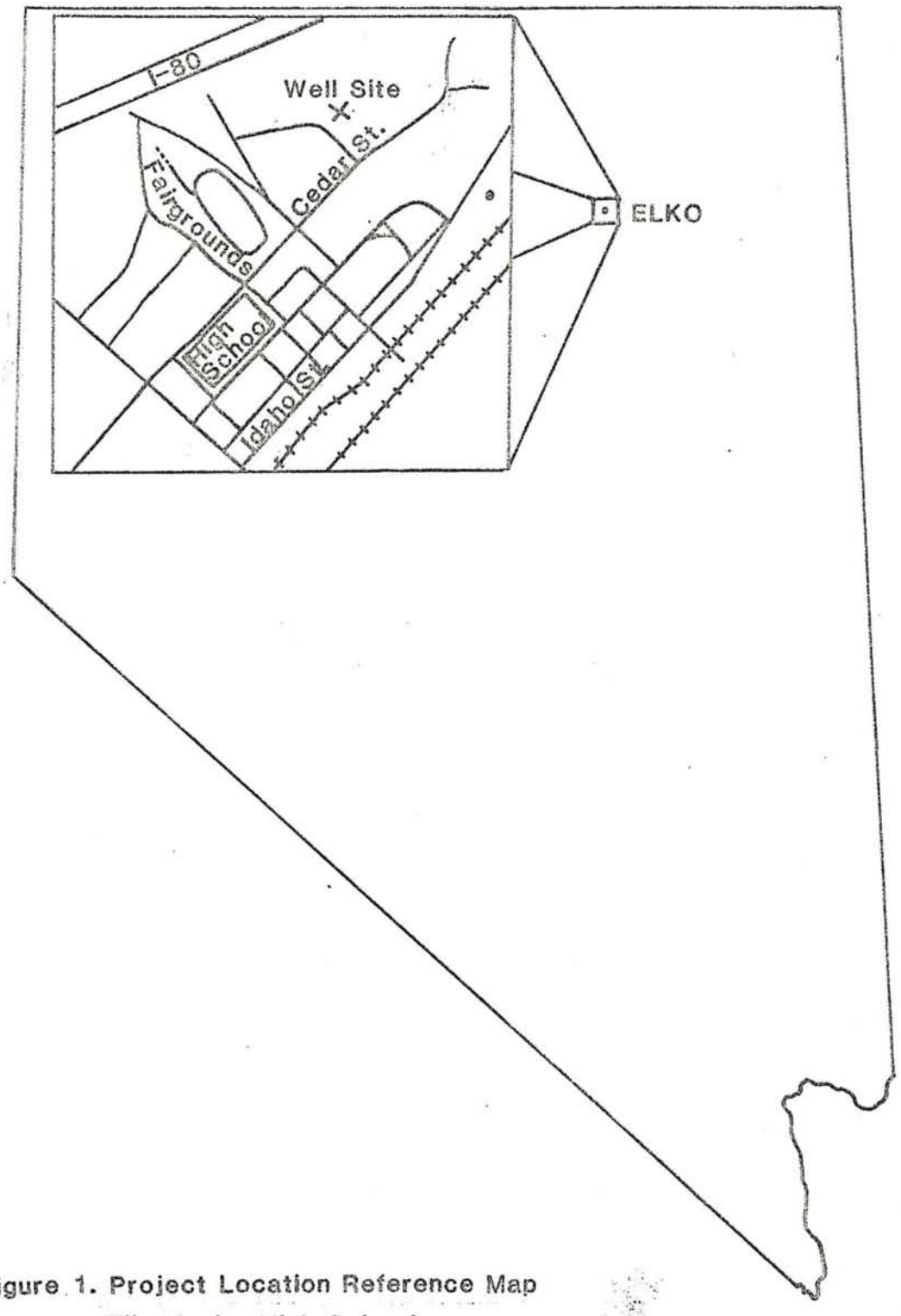


Figure 1. Project Location Reference Map
Elko Junior High School
Elko County, Nevada

3.Ø WELL CONSTRUCTION SUMMARY

A nominal 12-inch diameter borehole was drilled to the target depth of 35Ø feet between July 15 and 21, 1986. The borehole penetrated alluvial deposits comprising poorly sorted sand, gravel, silt and clay with a few thin sand and gravel beds (Appendix A). On the basis of the lithologic log, it was apparent that the well could not accommodate an average injection rate of 15Ø gpm necessary to be considered a complete success as a possible injection well. To substantiate this field interpretation, an electric borehole geophysical log was run on July 22 (Appendix B). The log corroborated the preliminary evaluation. As a consequence, the original well design was modified to take advantage of every potentially permeable bed encountered in the well no matter how thin and eliminated geologic materials below a depth of 23Ø feet which were evaluated as unproductive.

Drilling deeper than the 35Ø feet target depth was ruled out on the basis of a comparison between the observaton well E-log with the E-log of the test hole drilled nearby by Reynolds. To do so would have likely encountered progressively lower permeability deposits as evidenced by the test hole log.

Final well design is illustrated in Figure 2.

Following installation of the well casing, an artificial gravel envelope was emplaced in the annular space between the perforated casing and the formation walls. The well was then developed by jetting and surging with high pressure air. Jetting was followed by swabbing the well with a surge block utilizing a cable-tool rig in an attempt to maximize the hydraulic efficiency of the well. This additional stage of development was added when it became apparent that jetting was insufficiently violent to remove the fines from the formation and that additional development utilizing the relatively small test pump dictated by the probable yield of the well could not adequately surge the well. Development procedures were completed July 3Ø, 1986.

Installation of the cement sanitary seal was delayed until after the completion of the aquifer stress tests. The purpose of this delay was to enable pulling the well casing prior to abandonment of the observation well should it be considered unsuccessful. Testing results (Section 4.Ø) indicated that the observation well was partially successful. As a result, the seal was emplaced August 12, 1986 by pumping a cement slurry from the top of the gravel pack to land surface (Appendix C), completing all construction activities.

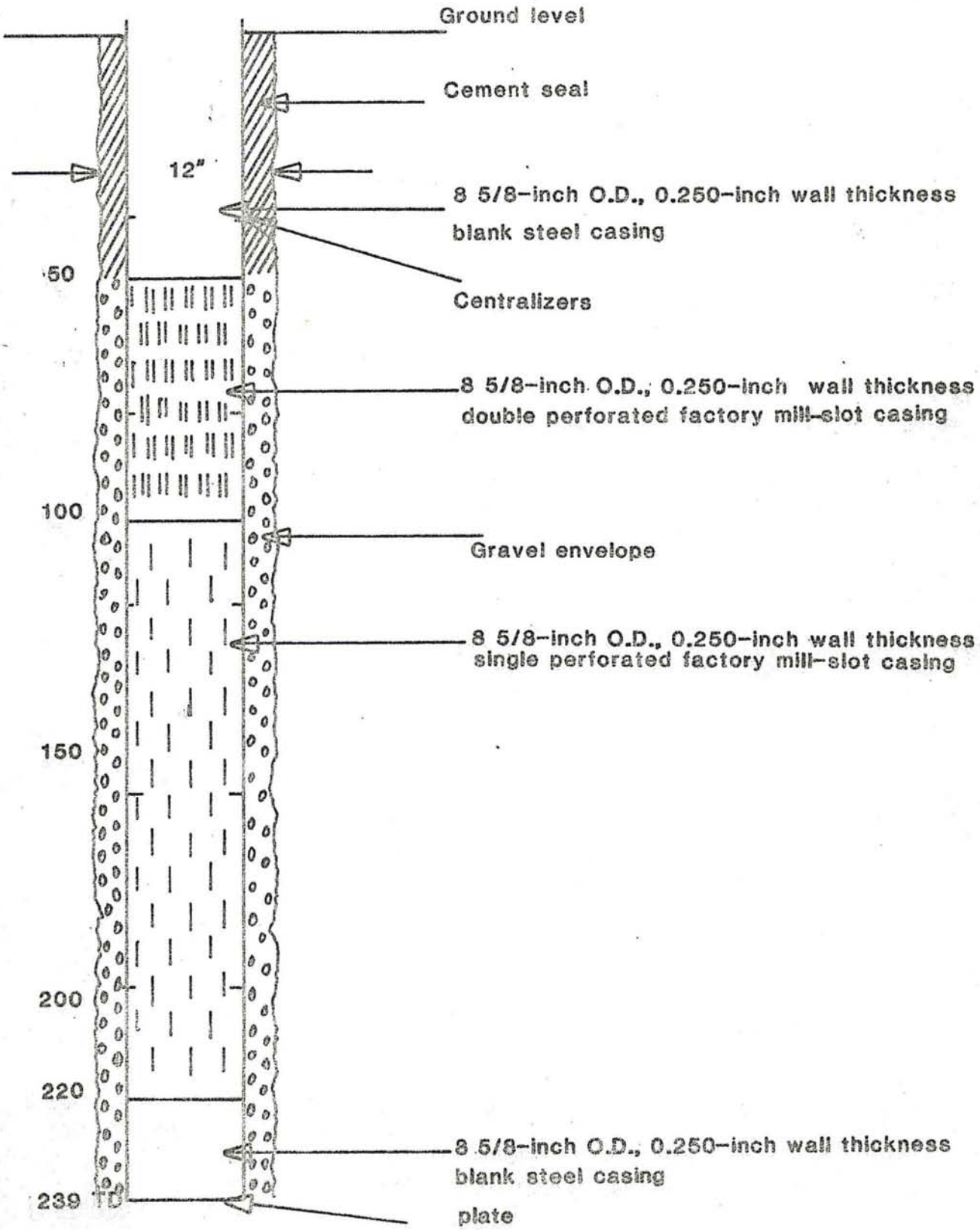


Figure 2. Elko Junior High School Geothermal Observation Well Construction Diagram.

4.Ø AQUIFER STRESS TESTS

Immediately upon completion of well development, a five horsepower submersible test pump was installed in the well. The testing sequence comprised a 12-hour step-drawdown test, 24-hour constant-discharge test and a 24-hour injection test, separated by suitable recovery periods. Testing results are summarized below. Field data sheets are provided in Appendix D.

4.1 STEP-DRAWDOWN TESTING

A 12-hour duration step-drawdown pumping test comprising three-four-hour steps was conducted July 3Ø-31, 1986.

Step	Discharge Q (gpm)	Duration t (minutes)	Drawdown s (feet)	Specific Capacity C_s (gpm/ft)
I	15	24Ø	6.51	2.3
II	3Ø	24Ø	11.34	2.6
III	6Ø	24Ø	27.52	2.2

Test data are plotted in Figure 3. From the drawdown and specific capacity data (Figure 4) it is apparent that the well was not fully developed by the end of the step-drawdown test. It is recommended that additional development be performed to increase the injectivity of the well, should it be approved as an injection well.

4.2 CONSTANT-DISCHARGE TESTING

Following a recovery period of 12 hours, a 24-hour duration constant-discharge pumping test was initiated. Results are summarized below.

> Static water level prior to testing was 94.7Ø feet below the measuring point (M.P. = top of stilling well). Testing commenced 18ØØ hrs 7/31/86. Pumping rate was held constant at 5Ø gpm. Pumping was terminated at 18ØØ hours 8/1/86. Pumping water level at the conclusiion of the test was 1Ø9.6 feet below M.P., a drawdown of 14.93 feet. Recovery of water levels in the well were monitored for a period of 12 hours, at which time water levels had recovered 95 percent.

Drawdown and residual drawdown (a.k.a. recovery) data are plotted in Figures 5 and 6. The transmissivity of the aquifer was calculated utilizing the Cooper-Jacob approximation of the Theis equation.

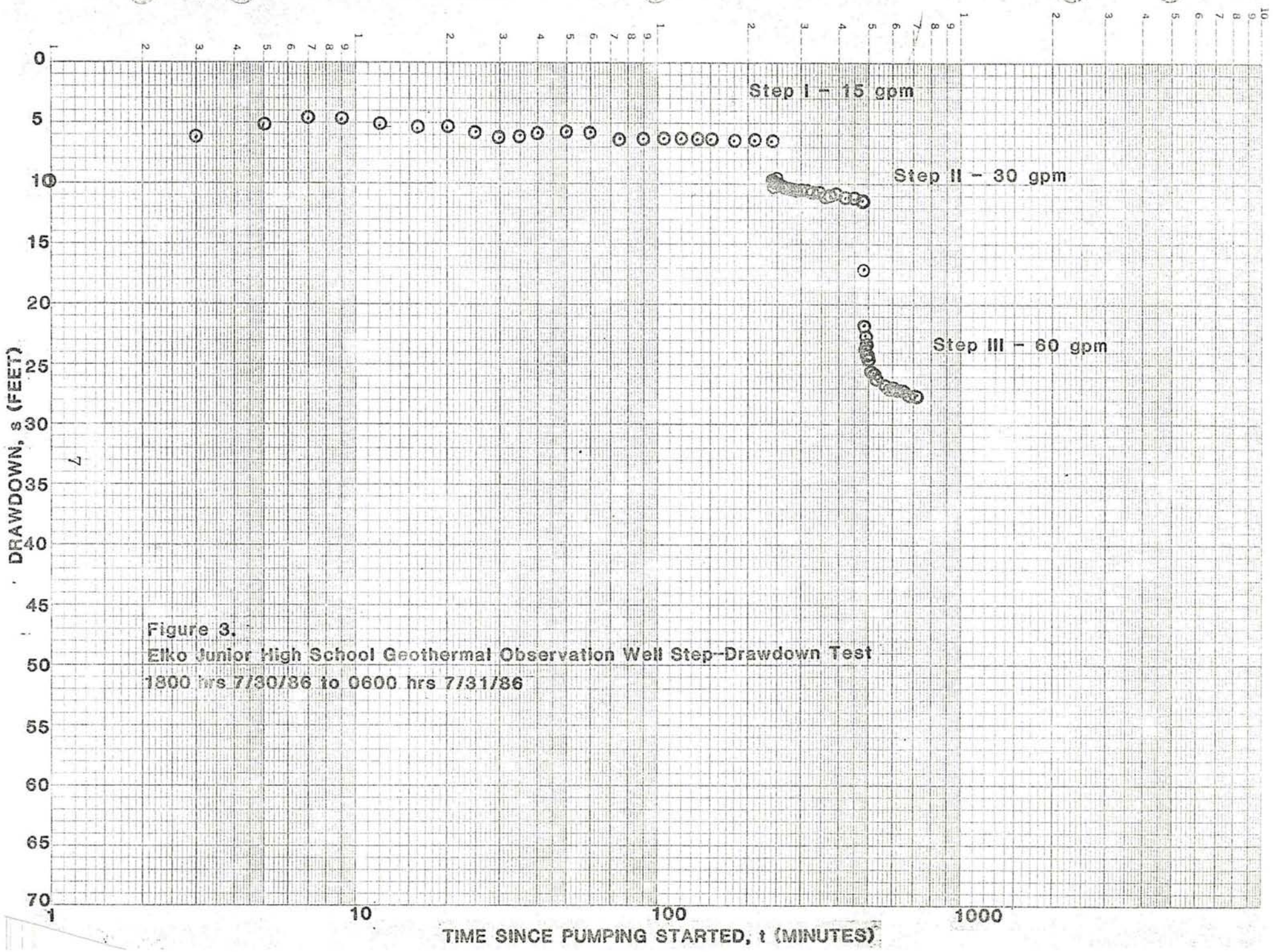


Figure 3.
Elko Junior High School Geothermal Observation Well Step-Drawdown Test
1800 hrs 7/30/86 to 0600 hrs 7/31/86

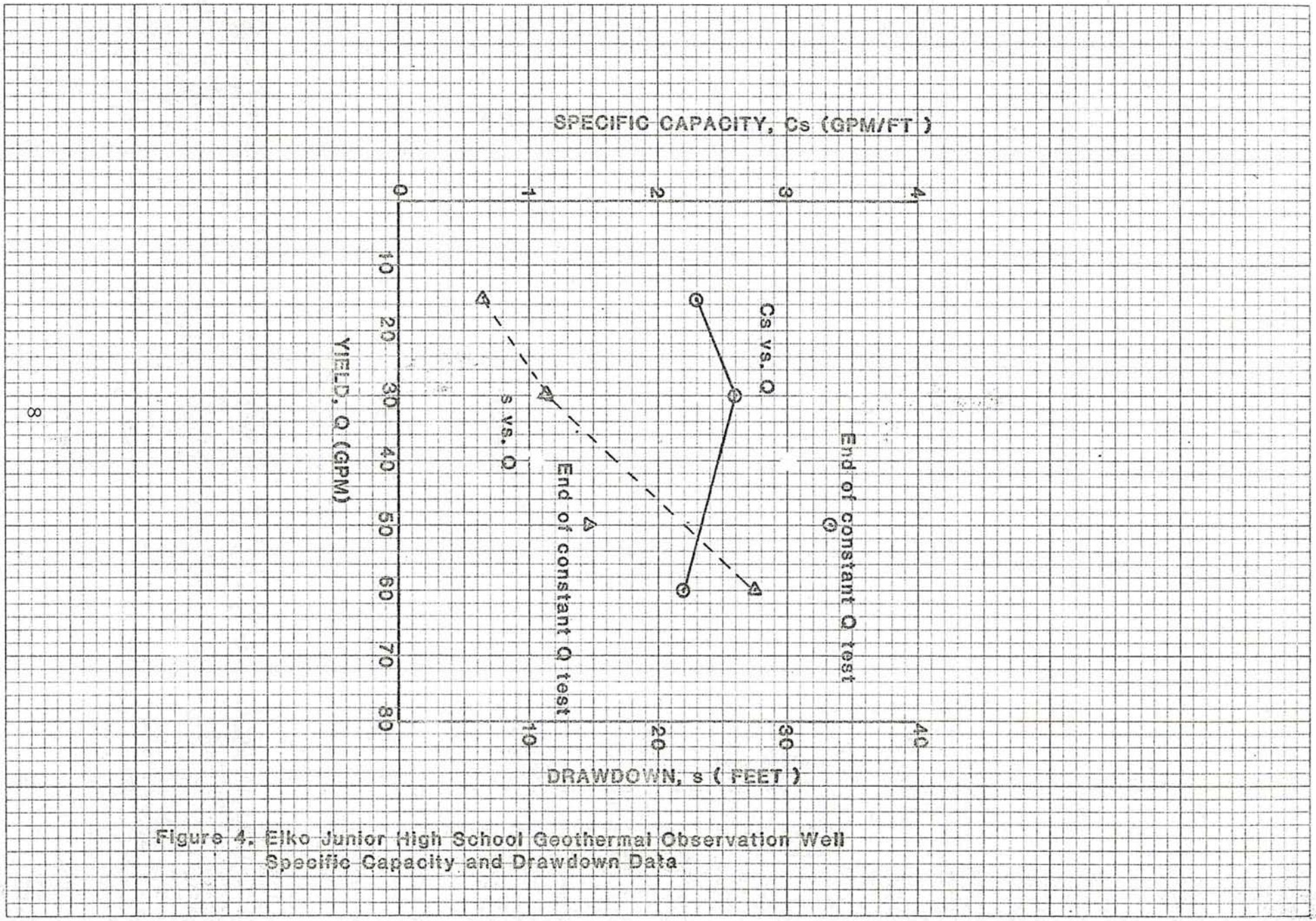


Figure 4. Elko Junior High School Geothermal Observation Well Specific Capacity and Drawdown Data

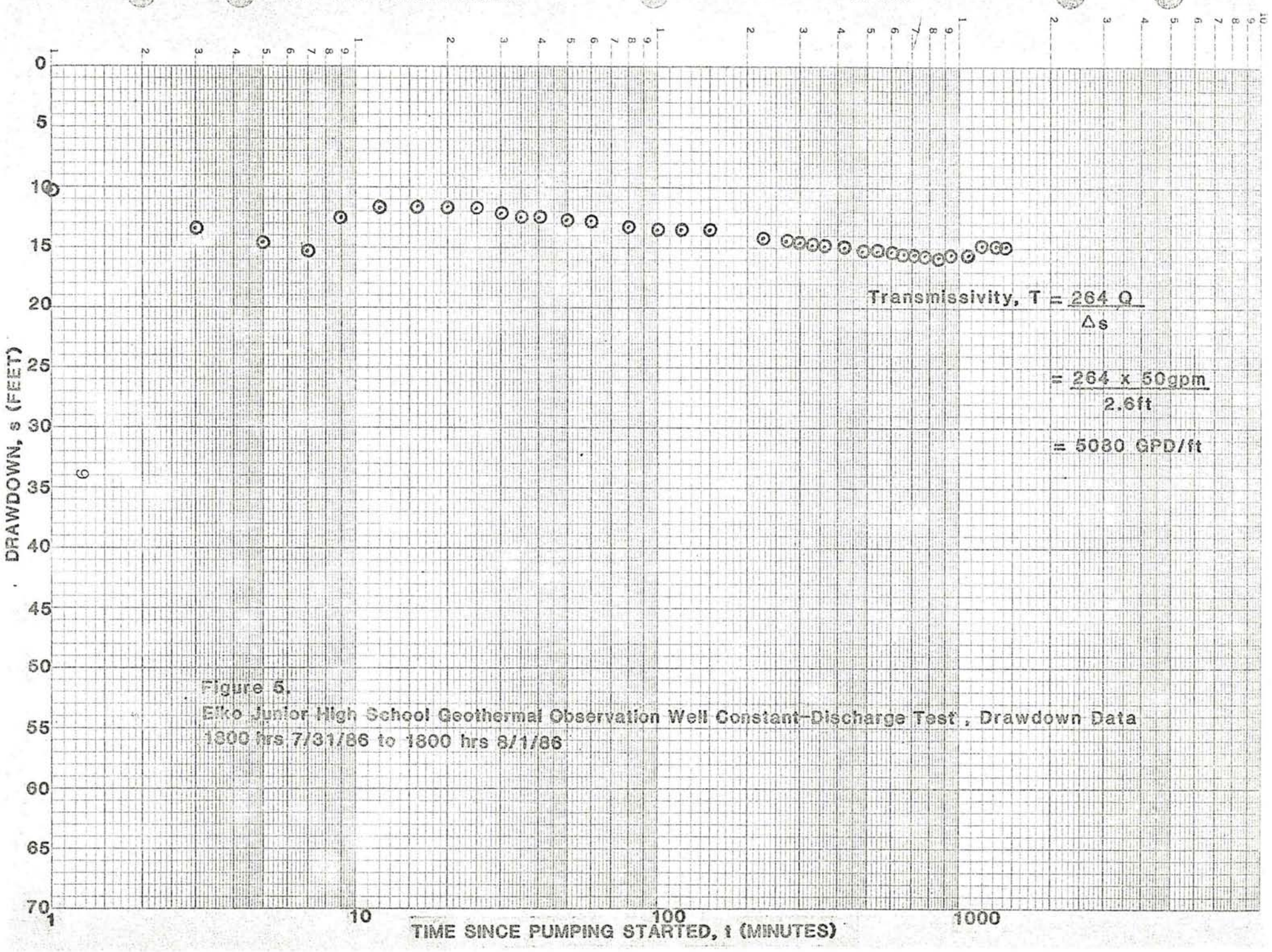


Figure 5.
Elko Junior High School Geothermal Observation Well Constant-Discharge Test , Drawdown Data
1800 hrs 7/31/86 to 1800 hrs 8/1/86

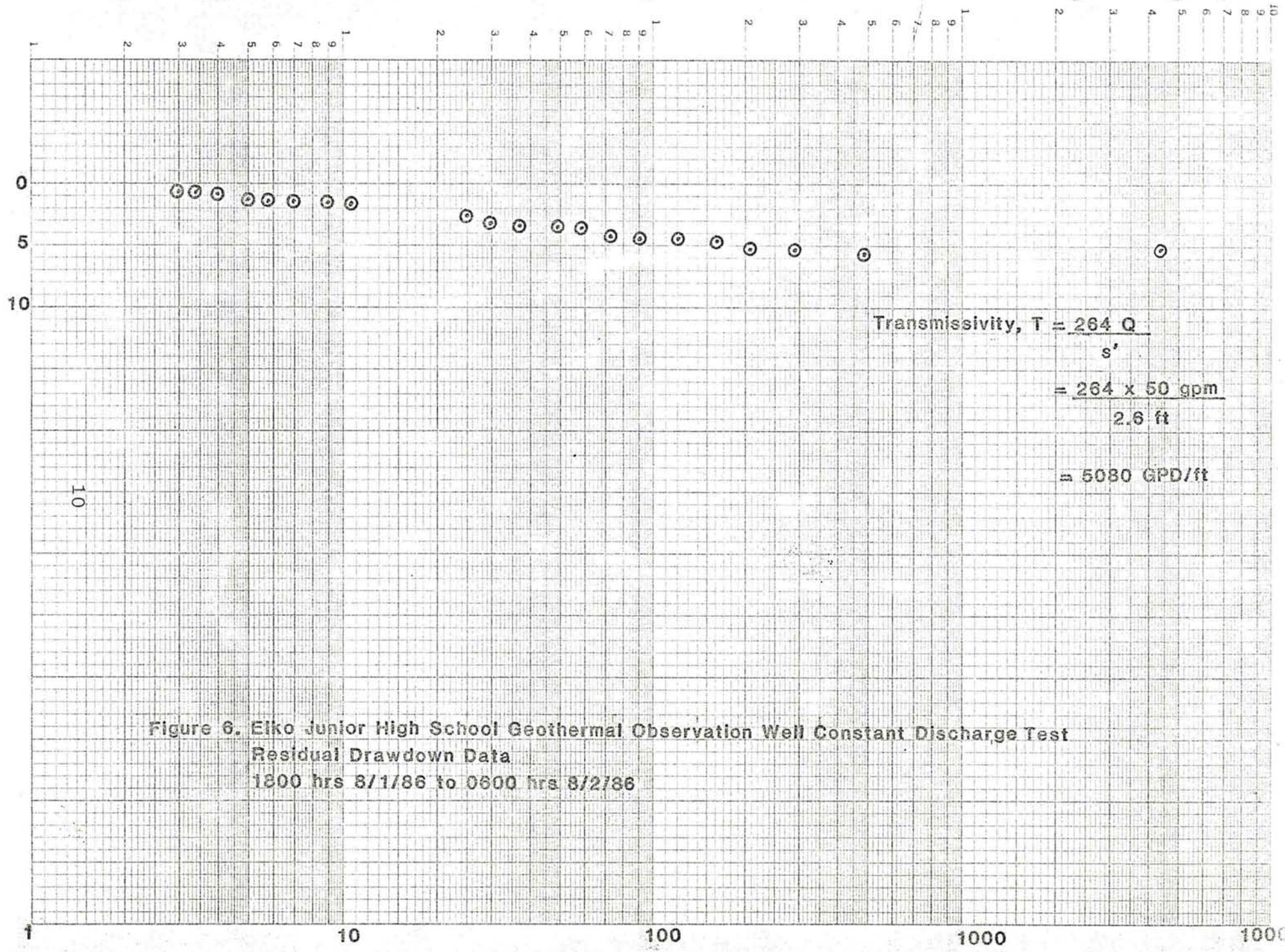


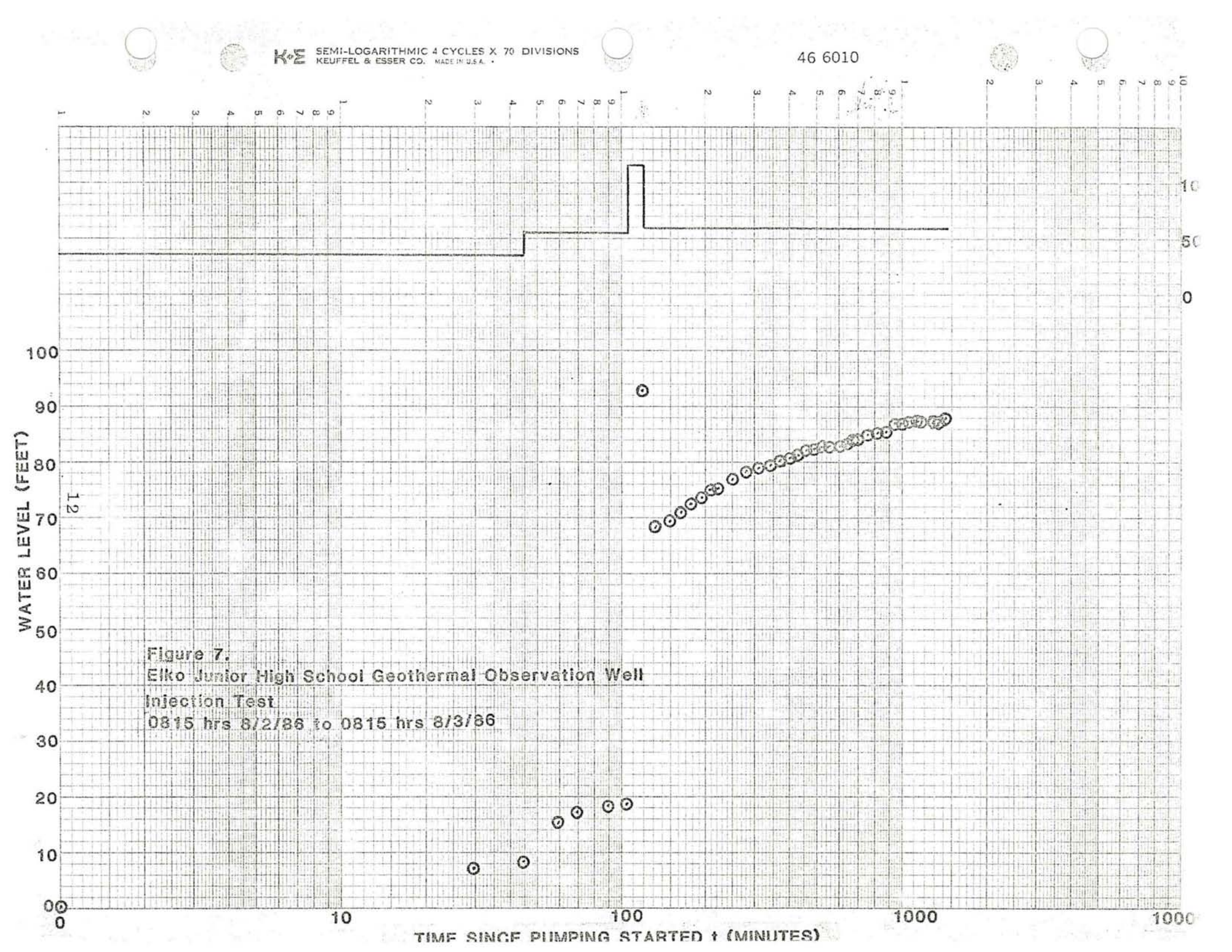
Figure 6. Elko Junior High School Geothermal Observation Well Constant Discharge Test
Residual Drawdown Data
1800 hrs 8/1/86 to 0600 hrs 8/2/86

Data	Transmissivity (GPD/ft)
Drawdown	5,080
Residual-drawdown	5,080

This value is consistent with the value of approximately 17,000 GPD/ft for the transmissivity of the alluvial aquifer, a value advanced from available data, when the lesser thickness of the aquifer penetrated by the observation well is taken in account. A value for the coefficient of storage could not be calculated due to the absence of a suitable observation well. It is likely that it is approximately 0.001, a value typical of semi-confined aquifers.

4.3 INJECTION TEST

Following completion of the recovery portion of the constant-discharge test, a 24-hour duration injection test was conducted. The injection rate varied between 37.2 and 114.1 gpm, averaging 60.5 gpm for the entire test. At the conclusion of the test, the water level within the well had risen to within approximately 7.2 feet below land surface. Test data are summarized in Figure 7.


K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6010
WATER LEVEL (FEET)
TIME SINCE PUMPING STARTED t (MINUTES)
0
10
100
1000
1000
Figure 7.
Elko Junior High School Geothermal Observation Well
Injection Test
0815 hrs 8/2/86 to 0815 hrs 8/3/86

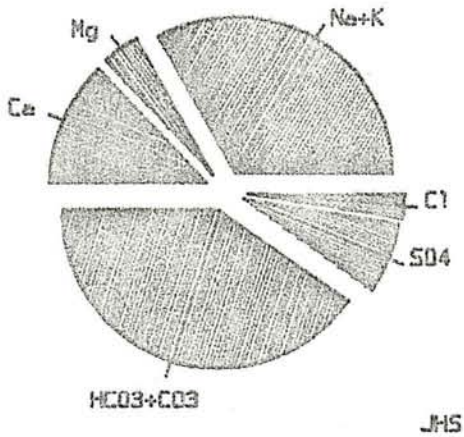
5.Ø WATER CHEMISTRY

A water sample for chemical analysis was collected at the conclusion of the constant-discharge pumping test. Results of the analysis are listed below and compared with water chemistry data for City Well No. 12 and the Elko Junior High School Geothermal Well.

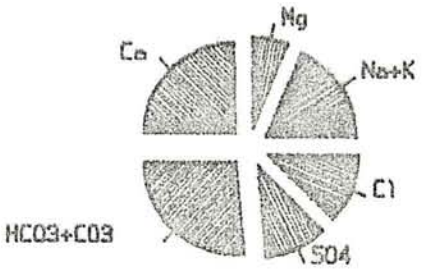
Table 1. Water chemistry data.

Sample source	EJHS Geothermal Well	City Well No. 12	Geothermal Observation Well	Drinking Water Standard
TDS	645	481	481	1ØØØ
pH	6.45	7.74	7.8	
Ca	68.9	7Ø 3.49 4%0	69	
Mg	12.5	11 0.795 12.9	1Ø	15Ø
Na	18Ø	5Ø 2.175 30.9	5Ø	
K	36.5	18 0.460 6.5	17	
		7.030		
HCO_3	5ØØ.2	21Ø 3.442 53.1	194	
CO_3	<Ø.Ø1	Ø	Ø	
SO_4	71	7Ø 1.457 22.5	57	5ØØ
Cl	18	56 1.579 24.4	75	5ØØ
NO_3	Ø.Ø3	13.6	13.7	45
F	1.86	Ø.25	Ø.2	~~1.8~~ 0.6
		0.078		
As	Ø.ØØ3	Ø	Ø.ØØ5	Ø.Ø5
Ba	Ø.25	*	<Ø.4	1.Ø
B	Ø.986	*	Ø.2	
Cd	<Ø.ØØ1	*	<Ø.Ø1	Ø.Ø1
Cr	<Ø.ØØ1	*	<Ø.Ø2	Ø.Ø5
Cu	<Ø.Ø1	*	<Ø.Ø2	1.Ø
Pb	<Ø.ØØ1	*	<Ø.Ø5	Ø.Ø5
Fe	1.8	Ø.Ø1	Ø.Ø8	1.8
Mn	Ø.Ø3	Ø	Ø.Ø9	Ø.1
Hg	<Ø.ØØØ5	*	<Ø.ØØØ5	Ø.ØØ2
Se	<Ø.ØØ1	*	<Ø.ØØ5	Ø.Ø1
Ag	<Ø.ØØ1	*	<Ø.Ø1	Ø.Ø5
Zn	Ø.ØØ9	*	Ø.56	5.Ø
$SiØ_2$	77.8	*	75	
H_2S	Ø.6			

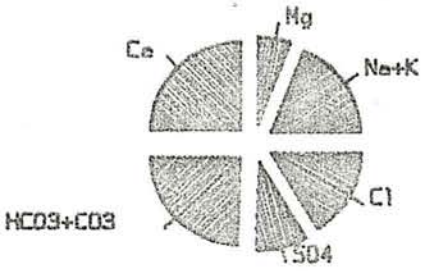
The gross similarity of the water from the various sources is graphically depicted in Figure 8.



JHS



CITY#12



GOV-1

0 15 30

SCALE OF RADII
(TOTAL OF EQUIVALENTS
PER MILLION)

NOTE ERROR (IF ANY) IN CATION/ANION
BALANCE HAS BEEN REMOVED

PROJECT: ELKO JHS FILE: 392 LOCATION: ELKO NV	PIE DIAGRAMS SHOWING WATER QUALITY
WILLIAM E. NORK, INC.	FIGURE:8

6.0 IMPACT ON NEARBY WELLS

The City of Elko derives its water supply from numerous wells completed in the alluvial deposits. In the vicinity of the Junior High School they are approximately 400 to 550 feet deep. A total of four wells, numbers 10A, 12, 13 & 14 are located within one-half mile down gradient of the Junior High School site (refer to Figure 9).

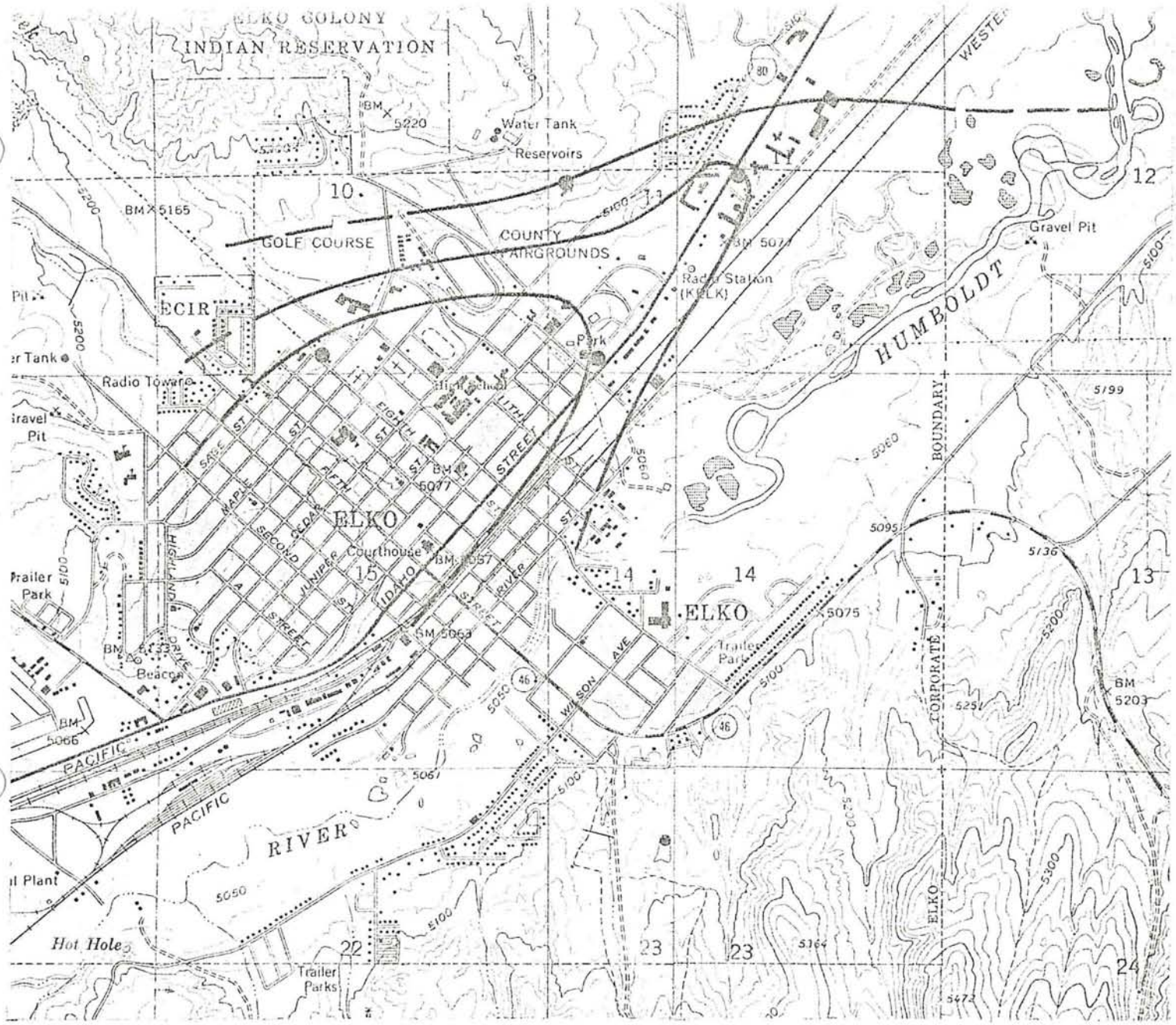
Considering the number of wells that have been drilled by the City, there is little readily available data. However, some information regarding the hydrogeologic regime of the alluvial aquifer can be gleaned from the city records. Pumping test data from Well No. 14 suggest an aquifer transmissivity of approximately 17,000 GPD/ft. Specific capacity data from other wells yield similar values and suggests that the aquifer is somewhat uniform in overall character in the vicinity of the Junior High School. The value of transmissivity from the geothermal observation well is reasonably consistent with this value considering the fact that it penetrates less of the aquifer and allowing for some heterogeneity of the alluvial deposits.

Water level information suggest a southerly to southeasterly direction of ground water flow immediately beneath the site (Figure 9). These data indicate a well defined trough of depression beneath Elko caused by the withdrawals by the city wells. Moreover, they suggest a hydraulic connection with the Humboldt River. That is, unless there is a source of recharge to the aquifer such as the river, drawdowns experienced by city wells should be much greater than that allowed by the available data.

To test these hypotheses, drawdowns in the aquifer were simulated utilizing average monthly discharges from the city wells (for 1985), the transmissivity from the Well No. 14 test (17,000 GPD/ft), and a recharge boundary coincidental with the Humboldt River in the analytical model VARFLOW (IDO, 1984). Input for the model are listed in Appendix E. The general shape of drawdown contours (Figure 10) agreed with those drawn from the available information and appears to support the model of the aquifer suggested by the available data.

It follows then, that any thermal effluent injected into the alluvial aquifer tapped by the city wells will ultimately flow toward these nearby wells. To examine the impact on the chemical quality of the ground water discharged by the city wells, consider the following:

1. Wells No. 12 and 14 discharged an average of 1,066,406



Scale

1 : 24,000

EXPLANATION

Well (water level reported)

water level contour (feet above sea level)

Figure 9. Well site locations and water level elevations in the vicinity of the Elko Junior High School

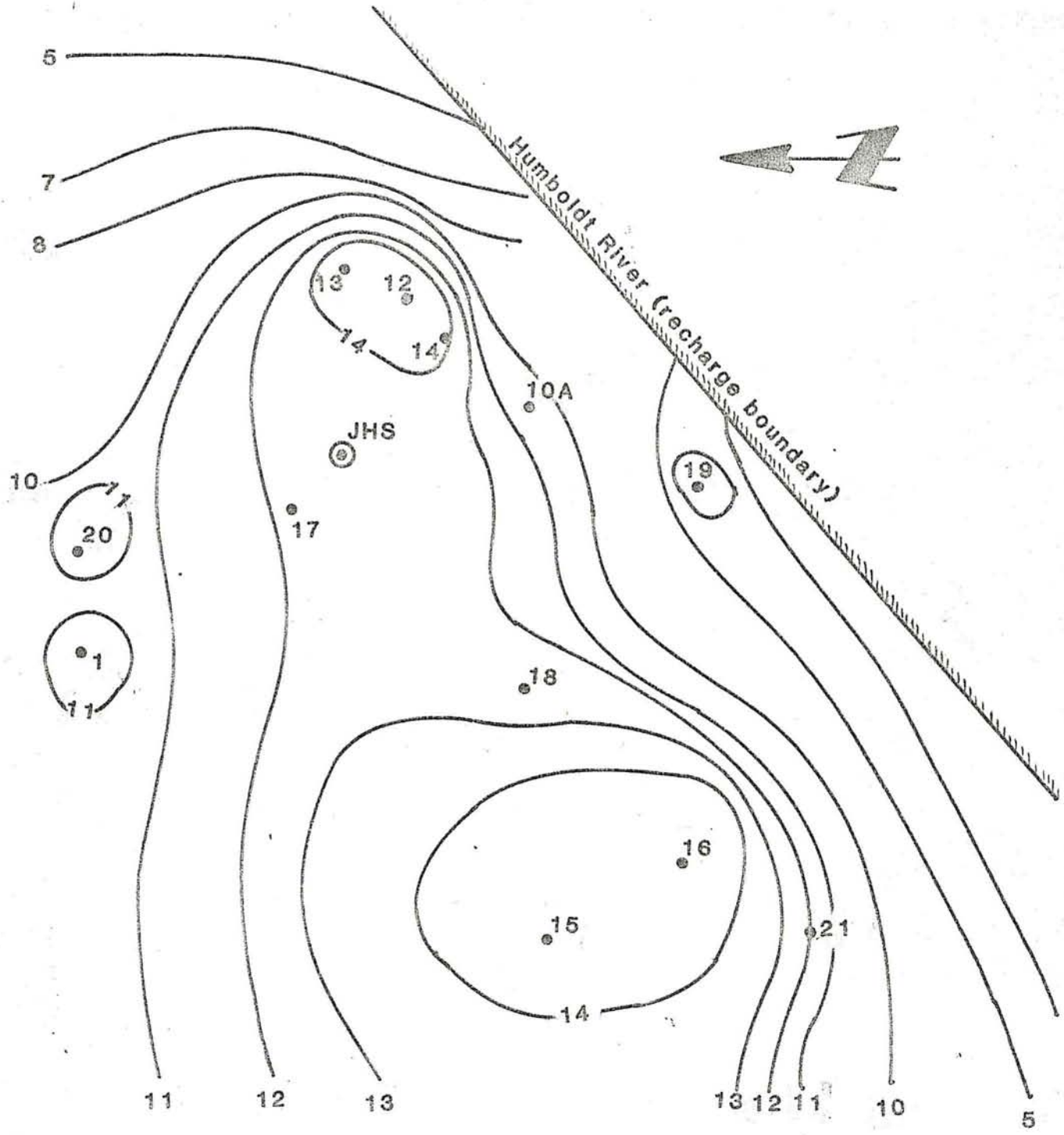


Figure 10. Computed drawdown due to city pumpage in the vicinity of the Elko Junior High School

gallons per day (GPD) in 1985.

2. The injectivity of the Geothermal Observation Well is 86,400 GPD.

3. The concentration of iron in the discharge of Wells No. 12 and 14 is 0.01 mg/l.

4. The concentration of iron in the thermal effluent is 1.8 mg/l.

Assuming that no dispersion or mixing takes place in the aquifer, the concentration of iron in the discharge of Wells No. 12 and 14 may approach

$$C = \frac{(86{,}400 \text{ GPD} \times 1.8 \text{ mg/l}) + (980{,}000 \times 0.01 \text{ mg/l})}{1{,}066{,}406 \text{ GPD}}$$

$$= 0.16 \text{ mg/l}$$

which is well below the drinking water standard.

The Total Dissolved Solids can likewise be evaluated, assuming

1. TDS of city water is approximately 480 mg/l.

2. TDS of effluent is 650 mg/l.

Substituting this value into the mixing equation yields a concentration,

$$C = \frac{(86{,}400 \text{ GPD} \times 650 \text{ mg/l}) + (980{,}000 \text{ GPD} \times 480 \text{ mg/l})}{1{,}066{,}406 \text{ GPD}}$$

$$= 494 \text{ mg/l}$$

which is a very insignificant increase. Since the chemical nature of the alluvial and thermal waters is similiar, no noticeable change in the character of the drinking water will occur (WEN, INC., 1985).

Because the thermal effluent will disperse and the plume will be spread out further by other city wells, any increase in TDS and iron will be less than that predicted above.

The need for a more rigorous analysis such as two- or three-dimensional numerical computer modelling is not warranted due to the small potential impact suggested by the worst-case discussed above.

7.Ø SOURCES OF INFORMATION

IDO, 1982. Low-to-moderate temperature hydrothermal reservoir engineering handbook; U.S. Department of Energy Idaho operations Office, IDO-1Ø099, Vol. II.

Nork, William E. Inc., 1985. Junior High School geothermal well; private consulting report prepared for the Elko County School District.

Other sources:

City of Elko; well logs, pumping test and water chemistry data, and monthly pumpage records for city wells.

APPENDIX A

LITHOLOGIC LOG

LOG OF BOREHOLE

BOREHOLE Elko Junior High G.O.W. #1 PAGE 1 of 5

LOC. or COORDS. Elko Jr. High School

GROUND ELEV. 5140'

TOTAL DEPTH 239'

BORE HOLE DIAM. 12"

DRILLER Ray Reynolds Drilling Co.

RIG Schramm, T-64 HB

BIT(S) 12"

FLUID Mud Rotary

	START	FINISH
DATE	7-15-86	7-21-86
TIME	930/am	500/pm

GEOPHYS LOG ✓ YES __ NO

HOW LEFT

PROJECT Elko Junior High School G.O.W. #1

LOCATION Elko Junior High

LOGGED BY TKS

DEPTH	PENETRATE	CIRC. RET.	CIRC. LOSS	A-LIFT Q (gpm)	MATERIAL	SYMBOL	DESCRIPTION AND COMMENTS
							whole drilled to depth of 45' BEFORE my ARRIVAL - (No samples taken)
- 5'	60'/hr						Sample Taken from flushing hole - gravels & clays 50/50 TOO mixed to id- correctly. Sample at 45'
- 10'							
- 15'							
- 20'							
- 25'							
- 30'							
- 35'							
- 40'							
- 45'	↓ 60'/hr						Sample shows minor amounts of gravel, intermixed with clays - hole may yet be showing cuttings from 1st 45'. Rock chips are angular up to 0.5cm Long - 50% clays UPon (Further ID appears to be a mudstone or siltstone)
- 50'							Mudstone - minor gravels -
- 55'							MUDstone - minor gravels, clays
- 60'							clays, more gravels, Bits of black shale
		L	Loss 5gpm				- 62' hit gravels Some fluid losses
- 65'							gravel, fine grained, well sorted, angular minor amounts of clays
- 70'			5gpm				down to 70' @ 1125/pm - gravels, ≤ 1/8" well sorted, qtz, shale, FOSSILS, Fine grained

LOG OF BOREHOLE

BOREHOLE ELKO JHS PAGE 2 of 5

LOC. or COORDS. ELKO JUNIOR HIGH SCHOOL
DRILLER Ray Reynolds
GROUND ELEV. 5140
TOTAL DEPTH 350'
BOREHOLE DIAM. 12"
RIG Schramm T-64-HB
BIT(S) 12"
FLUID MUD, water

	START	FINISH
DATE	7-15-86	7-21-86
TIME	9 30/am	5 00/pm

GEOPHYS LOG ✓ YES NO
HOW LEFT

LOCATION
LOGGED BY
PROJECT

DEPTH	PENETRATE	CIRC. RET.	CIRC. LOSS Q (gpm)	A-LIFT	MATERIAL	SYMBOL	DESCRIPTION AND COMMENTS
75'	60'/hr		10 gpm		gravels		gravels, ≤ 1/8" well sorted, angular - fine grained Heavy fluid losses - (R.R.) - "5-10 gpm.
80'							gravels - getting coarser ≤ 1/4", minor clays
85'	50'/hr						gravels - ≤ 1/4" angular to rounded, more clay rig penetration slowing a little
90'		✓ poss mud plug			gravels		gravels - finer grained again ≤ 1/8" minor clays. ADDED 1 BAG MUD * 12 00/noon
95'	60'/hr						gravel, minor clays - no change - fluid loss negligable
100'							gravel - no apparent Δ, fluid loss now negligable
105'		✓ poss mud plug					gravel, coarser ≤ 1/4", minor clays, ¾ bits to well rounded. moderate fluid loss again - gravel size seems to be increasing w/ depth
110'	30'/hr						quit for lunch - 12 15/pm ADD 1 BAG MUD - gravel, 5% clays - penetration slowed here: poss indication of clay beds
115'					increasing clay content		gravel, coarse ≤ 1/4", clays - (40% ±)
120'							clays, coarse gravels (40% ±) penetration still @ 30'/hr or less, gravels slightly finer
125'			loss of 3 gpm		gravel		122' state change - fluid loss minor to negligable, fluid loss ≈ 3-4 gpm est. gravel - coarse grained ≤ 1/4" 30% clays; decreasing
130'	30'/hr		5-6 gpm				angular shape. most grains ≈ 1/8" to 1/16" gravel - medium grained 1/8" a less angular to sub-rounded. minor amounts of clay fluid loss increasing 5-6 gpm est.
135'					gravels		gravel, angular to sub rounded - minor clays fluid loss ≈ 4-5 gpm
140							gravels, up to 1/4", angular to sub rounded, clays increasing - up to ≈ 30%
							NOTE: clays are reddish brown in color -

LOG OF BOREHOLE

BOREHOLE ELKO JHS. PAGE 3 of 5

LOC. or COORDS. ELKO JHS. DRILLER Ray Reynolds -

GROUND ELEV. 5140 TOTAL DEPTH 350' BOREHOLE DIAM. 12"

RIG Schramm T-64 HB BIT(S) 12" FLUID MUD Rotary

	START	FINISH
DATE	7-15-86	7-21-86
TIME	9³⁰/am	5⁰⁰/pm

GEOPHYS LOG / YES NO HOW LEFT

LOCATION LOGGED BY PROJECT

DEPTH	PENETRATE	CIRC. RET.	CIRC. LOSS	A-LIFT Q (gpm)	MATERIAL	SYMBOL	DESCRIPTION AND COMMENTS
					gravels		ADD ½ BAG MUD - PENETRATION MAY BE SLOWER DUE TO TYPE OF BIT AND FACT THAT PRESSURE FROM MUD IS PUSHING BIT UP ?? NO MAJOR LITHOLOGICAL Δ's SINCE 62' DEPTH
145'	30'/hr.						gravel, angular, up to ¼", 30% clays or less, fluid loss negligable.
							148' - ½ BAG MUD ADDED -
150'			3 to 4 gpm		gravels & clays		gravel, angular up to ¼", 50% clays ±, fluid loss minor, 3 to 4 gpm
155'					gravels & clays		gravels, angular to subrounded, up to ⅜"; 50% clays, minor fluid loss
160'			3 to 4 gpm				gravels, ¼ to subrounded, minor clays, 20% or less penetration up slightly - Fluid loss 5-6 gpm EST.
			5-6 gpm				
165'					gravels minor clays		gravels, ¼ to subrounded, minor amounts of clay ≤ 20% NOTE: Clays are reddish brown silty clays (NOT BENTONITE)
170'	30'/hr		2-3 gpm		gravels minor clays		gravels ¼ to subrounded, minor amounts of clay ≤ 20%
175'			2-3 gpm		gravel & Reddish Brn clays		gravels ANGULAR TO SUBROUNDED, UP TO 25% clays very little lithological change Penetration slowed. Fluid loss 2-3 gpm
180'	20'/hr		2-3 gpm				gravels - angular to subrounded, Fluid loss - 2-3 gpm, clays in minor amounts 10-15%
185'	20'/hr		3-4 gpm		gravel / clay mix		gravels ¼ to subrounded - clays 50% / less clay stringers in between gravel beds however NO penetration changes occurring to suggest this —
190'							gravels - fine grained - BENTONITE shown in sample NOT particularly representative -
195'			≤1 gpm (measured)				gravels, ¼ to subrounded, minor amounts red silty clays.
200'	60'/hr						gravels —, ¼ to subrounded 1/8" or less, 20% clays. -
205'			≤1 gpm				gravels, fine grained 1/16" or less, less clays ± 10%
210'							gravels - ⅛" or less, ¼ to sub (clays 15% ±)
215'			2+ gpm				gravels - " " NO change.

LOG OF BOREHOLE

BOREHOLE JHS - ELKO PAGE 4 of 5

LOC. or COORDS. ELKO JHS. DRILLER Roy Reynolds

GROUND ELEV. 5140

TOTAL DEPTH 350'

BOREHOLE DIAM. 12"

RIG Schramm T-64-HB

BIT(S) 12"

FLUID MUD

	START	FINISH
DATE	7-15-86	7-21-86
TIME	9³⁰/AM	5°°/PM

GEOPHYS LOG ✓ YES __ NO

HOW LEFT

LOCATION

LOGGED BY

PROJECT

DEPTH	PENETRATE	CIRC. RET.	CIRC. LOSS (gpm)	A-LIFT (gpm)	MATERIAL	SYMBOL	DESCRIPTION AND COMMENTS
220'	60'/hr		2 gpm		gravels		Gravels, 1/8" or less, ¢ to subrounded - 20% clays. at 218 rig indicated poss clay. bed for 3-4" poss indication of separate lithologies -
225'	↓		2 gpm		"		gravels, 1/8" or less, ¢ to subr, 10-15% clays No penetration rate change - no Δ in fluid losses
230'	↓						gravels, 1/8" ±, ¢ to subrounded, 10% clays - NO Δ.
235'	50'/hr		1 gpm				gravels, 1/8", ¢ to subrounded, clays up to 30% ± penetration down a little, fluid loss ± 1 gpm
240'	↓		1+ gpm		gravels & clays.		gravels ≤ 1/8", 35-40% clays, no Δ in penetration or fluid losses.
245'	30'/hr		2-3 gpm*				* mud getting thick again - Penetration decrease NOT due to lithological changes - fluid losses increasing due to cleaning of mud tanks.
250'	30'/hr		2 gpm		gravels		245 - gravel ≤ 1/8", silty clays 20% ±, clays still reddish brown w/m, wor amounts of sand size particles
255'	30'/hr		1-2 gpm		gravels		gravel ≤ 1/8" ¢ to subrounded, 10-15% clays, reddish brown silty clays (sticky)
260'	30'/hr		2 gpm				gravels, ≤ 1/8", ¢ to subrounded, 10% clays, NO Δ in penetration or fluid losses
265'	↓		1-2 gpm				gravels ≤ 1/8", 10% clays
270	↓		2 gpm		gravels		gravels, slightly larger ≤ 3/16", 5-10% clays.
275'							NO change (Office call during this period)
280'							gravels, 20% clays
285'	↓		2 gpm				gravels, ≤ 1/4", ¢ to subrounded, 15% clays No penetration or fluid Δ's.
290'	↓		1-2 gpm				gravels ≤ 3/16, 20% clays, No changes

LOG OF BOREHOLE

BOREHOLE ELKO JNS PAGE 5 of 5

LOC. or COORDS. ELKO JUNIOR HIGH School

GROUND ELEV. 5140

TOTAL DEPTH 350'

BOREHOLE DIAM. 12"

DRILLER Ray Reynolds Drilling Co.

RIG Schramm T-64 HB

BIT(S) 12"

FLUID MUD (Bentonite/water)

	START	FINISH
DATE	7-15-86	7-21-86
TIME	9:30 AM	5:00 PM

GEOPHYS LOG ✓ YES __ NO

HOW LEFT

LOCATION

LOGGED BY

PROJECT

DEPTH	PENETRATE	CIRC. RET.	CIRC. LOSS	A-LIFT Q (gpm)	MATERIAL	SYMBOL	DESCRIPTION AND COMMENTS
295'	30"/hr		2 gpm				gravels ≤ 1/4", 15-20% clays, fluid loss slightly increased. penetration unchanged
300'	↓		2 gpm				gravels ≤ 1/4", 25% clays, gravels are ¢ to subrounded – increasing clay content
305	↓		2 gpm				gravels ≤ 1/8" 25% clays – (Red silty)
310	↓		1-2 gpm				gravel, ≤ 3/16" 20% clays – RED BROWN SILTY clays, NO MAJOR LITHOLOGICAL changes.
315'							gravels ≤ 1/8" 15% clays – Red Brown
320'							FINE gravels ALMOST A SAND
325'							Gravels, coarse ≤ 1/8",
330'							gravels, 20% clays NO change from 300 area
335'							gravels, ≤ 1/8", ¢ to subrounded, 15% clays.
340"							gravels " " Appears to be sandier, less silty, less cohesive
345							gravels – NO apparent Δ, 15% clays.
350'							" " No change in lithologies –
360'							gravels, 15-20% clays.
370							gravels ≤ 1/8", clays – 10% reddish brown, NOT as cohesive or prominent but still present.
374							

APPENDIX B

GEOPHYSICAL LOG

INCORPORATED

ELECTRIC WELL LOG

COMPANY ELKO COUNTY SCHOOL DISTRICT

WELL JR. HIGH OBSERVATION #7 (EGO-1)

FIELD ELKO

COUNTY ELKO STATE NEVADA

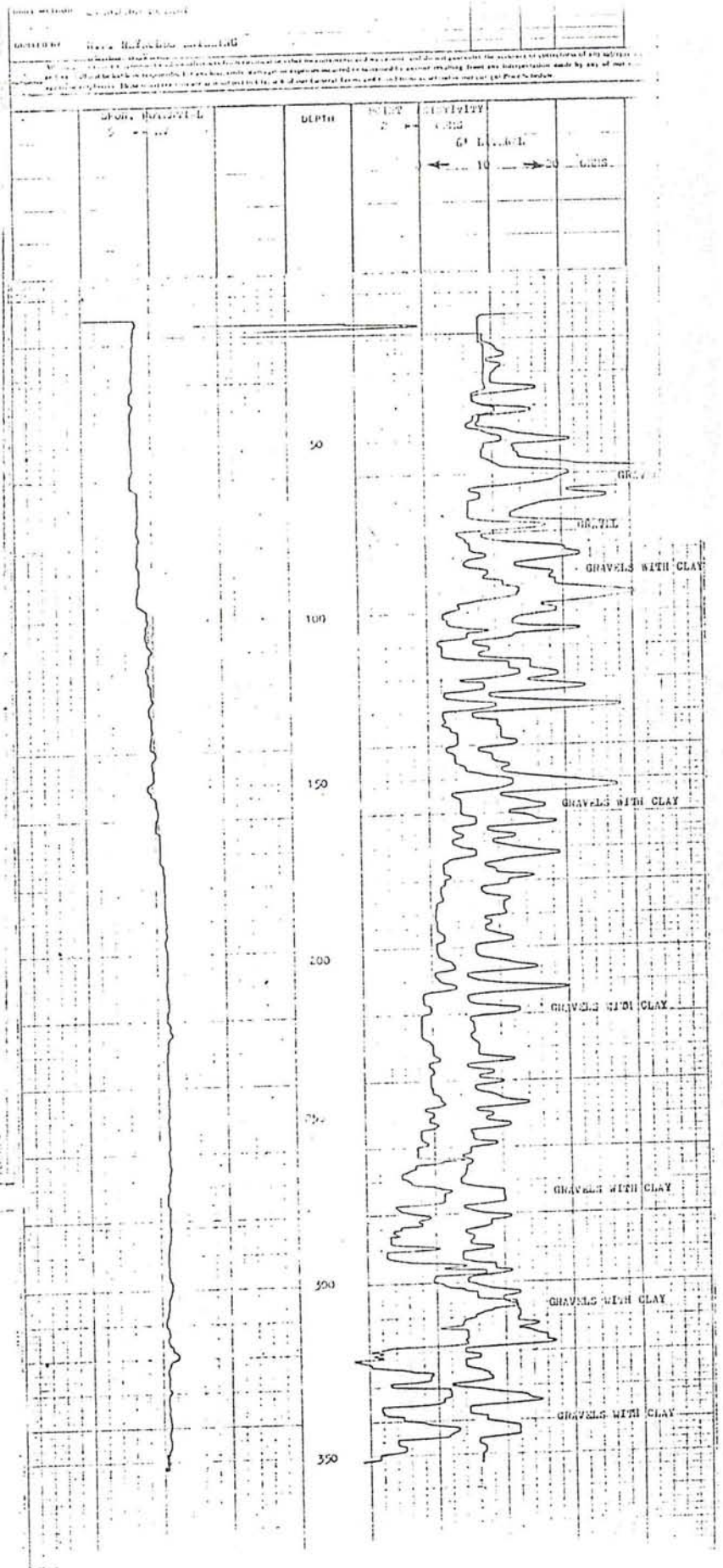
LOCATION: BEHIND JR. HIGH

Sec. ____ Twp. ____ Rge. ____

TYPE LOG: SP, PR, 6' LATERAL

...nent Datum	GROUND L.W.L	Elev.	Elev.: K. B.
...asured From	G.L.	0 Ft. Above Perm. Datum	D. F.
...Measured From	G.L.		G. L.
	JUL. 22, 1986		
	1		
- Driller	360 ft.	"	"
- GHD	352	"	"
g Inter.	260	"	"
Inter.	12	"	"
— Driller	in. @	in. @	in. @
— GHD	"	"	"
	12 in. to 360'	in. to "	in. to "
	in. to "	in. to "	in. to "
	in. to "	in. to "	in. to "
...id In Hole	clay gel		
...mple	air		
	bad		
	dull	"	"
Visc.			
Fluid Loss	ml	ml	ml
...eas. Temp.	@ °F	@ °F	@ °F
...leas. Temp.	@ °F	@ °F	@ °F
...leas. Temp.	@ °F	@ °F	@ °F
...ce Circ.	1 hr.	hr.	hr.
...Speed	45 ft/min.	ft/min.	ft/min.
...e and No.	combo 5		
	3		
	Cambria		
...o.	4320		
...d By	Kenny Nen	Inspecta Geo Logist	
...ed By	Jack Glynn		

Box 418 Tehachapi, California 93561 (805) 822-4101



APPENDIX C

CONSTRUCTION SUMMARY

PROJECT 86-

LOCATION Elko Jr. High School

PERSONNEL TKG

LOCATION OR COORDS: Elko Jr. High

ELEVATION: GROUND LEVEL

TOP OF CASING

DRILLING SUMMARY:

TOTAL DEPTH 239'

BOREHOLE DIAMETER 12"

DRILLER Ray Reynolds

RIG Schramm T-64-HB

BIT(S) 12¼"

DRILLING FLUID mud, water, (Rotary)

SURFACE CASING

WELL DESIGN:

BASIS: GEOLOGIC LOG YES GEOPHYSICAL LOG YES

CASING STRING(S): C=CASING S=SCREEN

+2.5'	50'	C1			
50'	100'	S1			
100'	220'	S2			
220'	239'	C2			

CASING: C1 8⅝" O.D. x 0.250

C2 8⅝" O.D x 0.250

C3

C4

S1 Double perf 8⅝" O.D. x 0.250'

S2 Single per 8⅝" O.D. x 0.250"

S3

S4

CENTRALIZERS Every 2 lengths of casing N 40' Apart

FILTER MATERIAL gravel, ≥¼" No shales or carbonates.

CEMENT Neat Cement & Bentonite

OTHER

CONSTRUCTION TIME LOG:

TASK	START DATE	START TIME	FINISH DATE	FINISH TIME
DRILLING:				
12.25" Diameter	7-15	9:30 am	7-21	5:00 pm
GEOPHYS. LOGGING:	7-22	11:00 Am	7-22	1:00 pm
CASING:				
8⅝" O.D, 0.250"	7-25	11:00 Am	7-25	5:00 pm
WALL THICKNESS				
FILTER PLACEMENT:	7-25	5:00 pm	7-25	6:00 pm
	7-26	9:30 am	7-26	2:00 pm
CEMENTING:				
DEVELOPMENT:	7-25	5:00 pm	7-30	5:00 pm
OTHER:				

WELL DEVELOPMENT:

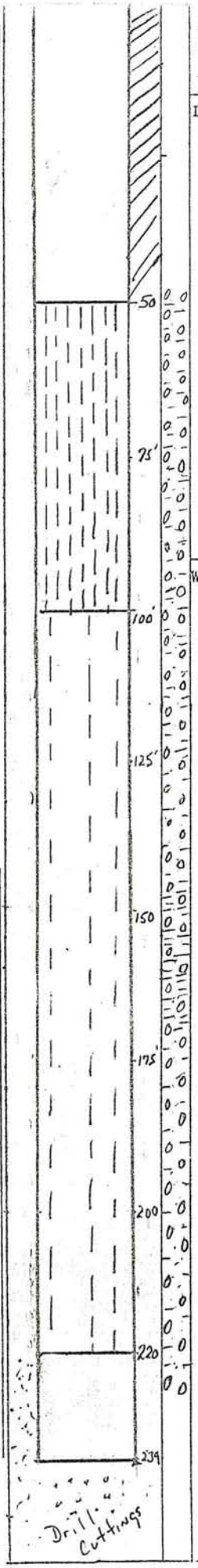
7-25-86 1 hr

7-26-86 5 hrs - press. air

7-29-86 Surge Block 8 hrs.

COMMENTS:

Borehole drilled to 350 feet Back filled to 239 feet. Blank casing from 239 to 220' Single perforated casing from 220 to 100 feet. Double perforated casing from 100 to 50'. Blank casing from 50 feet to +1.5' above land surface.



APPENDIX D

FIELD DATA SHEETS

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS G.O.W. #1

TYPE OF PUMPING TEST STEP-DRAWDOWN
(PUMPING) / RECOVERY DATA
M.P. FOR WATER LEVELS TOP OF STILLING WELL (+1.58')
DISTANCE FROM PUMPING WELL
LOCATION ELKO JUNIOR HIGH SCHOOL

(PUMPING) / OBSERVATION WELL
OTHER OBSERVATION WELL (S)

PUMP ON: DATE 7-30 TIME 1800
PUMP OFF: DATE 7-31 TIME 0600

CLOCK TIME	ELAPSED TIME (minutes)		t/t'	WATER LEVEL MEASUREMENT (feet)		PUMPING RATE (gpm)		REMARKS
	t	t'		92.65	(s) or s'	15 gpm	Q	
1800	0			92.65		40		40 gpm MURKY WATER ADJUST FLOW
1801	1			102.20	9.55	15		ADJUST FLOW
1803	3			98.70	6.05	"		MURKY
1805	5			97.70	5.05	"		
1807	7			97.59	4.94	"		WATER CLEARING
1809	9			97.51	4.86	"		
1812	12			97.69	5.04	"		ADJUST FLOW, WATER CLEARING
1816	16			98.11	5.46	"		
1820	20			98.10	5.45	"		ADJUST FLOW
1825	25			98.56	5.91	"		WATER CLEAR 64°F
1830	30			98.67	6.02			EC. = 600 ppm
1835	35			98.65	6.00			ADJUST FLOW
1840	40			98.56	5.91	15 gpm		T = 63°F, CLEAR
1850	50			98.50	5.85			
1900	60			98.57	5.92			
1915	75			98.69	6.04			WATER CLEAR, (600 ppm = E.C.)
1930	90			98.74	6.09			WATER CLEAR, 64°F, E.C = 600 ppm.
1945	105			98.81	6.16			clear
2000	120			98.86	6.21			
2015	135			98.94	6.29			T = 65°F, 600 ppm = EC.
2030	150			98.95	6.30			
2100	180			99.01	6.36			EC = 600 ppm, T = 65°F
2130	210			99.07	6.42			
2200	240			99.16	6.51	30 gpm		Pump increased to 30 GPM.

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS. G.O.W. # 1

TYPE OF PUMPING TEST STEP DRAWDOWN
(PUMPING)/RECOVERY DATA
M.P. FOR WATER LEVELS TOP OF STILLING WELL
DISTANCE FROM PUMPING WELL
LOCATION ELKO JUNIOR HIGH SCHOOL

(PUMPING)/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 7-30 TIME 1800
PUMP OFF: DATE 7-31 TIME 0600

CLOCK TIME	ELAPSED TIME (minutes) t	ELAPSED TIME (minutes) t'	t/t'	WATER LEVEL MEASUREMENT (feet) 92.65	WATER LEVEL MEASUREMENT (feet) s. or s'	PUMPING RATE (gpm)	PUMPING RATE (gpm) Q	REMARKS
2201	1/241			103.00	10.35	30 gpm		
2203	3/243			102.45	9.80	"		
2205	5/245			102.42	9.77	"		CLEAR
2207	7/247			102.43	9.78	"		
2209	9/249			102.56	9.91	"		
2212	12/252			102.65	10.00	"		
2215	15/255			102.66	10.01	"		CLEAR
2218	18/258			102.75	10.10	"		
2221	21/261			102.83	10.18	"		
2225	25/265			102.93	10.28	"		T=62°F, E.C.=500 ppm
2230	30/270			102.98	10.33	"		
2235	35/275			103.07	10.42	"		
2240	40/280			103.08	10.43	"		CLEAR
2250	50/290			103.16	10.51	"		
2300	60/300			103.27	10.62	"		
2315	75/315			103.39	10.74	"		
2330	90/330			103.51	10.86	"		CLEAR
2345	105/345			103.56	10.91	"		
2400	120/360			103.68	11.03	"		T=62°F E.C.=600 ppm
0015	135/375			103.63	10.98	"		CLEAR
0030	150/390			103.83	11.18	"		
0100	180/420			103.88	11.23	"		
0130	210/450			103.99	11.34	"		T=62°F EC.=600 ppm METALS SAMPLE TAKEN

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO IHS G.O.W. # 1

TYPE OF PUMPING TEST STEP-DRAWDOWN
(PUMPING)/RECOVERY DATA
M.P. FOR WATER LEVELS TOP OF STILLING WELL
DISTANCE FROM PUMPING WELL
LOCATION ELKO IHS

(PUMPING)/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 7-30 TIME 1800
PUMP OFF: DATE 7-31 TIME 0600

CLOCK TIME	ELAPSED TIME (minutes) t	ELAPSED TIME (minutes) t'	t/t'	WATER LEVEL MEASUREMENT (feet) 92.65	WATER LEVEL MEASUREMENT (feet) s or s'	PUMPING RATE (gpm)	PUMPING RATE (gpm) Q	REMARKS
0200	240/480			103.99	11.34			CLEAR
0201	1/481			109.80	17.15	50		Δ FLOW RATE 50-60 gpm
0203	3/483			113.83	21.18	60		MURKY WATER.
0205	5/485			115.20	22.55			
0207	7/487			115.81	23.16	60		
0209	9/489			116.28	23.63			
0212	12/492			116.68	24.03			cloudy WATER
0216	16/496			117.11	24.46	60		
0220	20/500			117.42	24.77			slightly clouded
0225	25/505			117.72	25.07			CLEAR
0230	30/510			118.30	25.65			
0240	40/520			118.48	25.83			CLEAR
0250	50/530			118.88	26.23			
0300	60/540			119.11	26.46			T= 61°F, E.C. = 500 ppm
0315	75/555			119.23	26.58			CLEAR
0330	90/570			119.44	26.79			
0345	105/585			119.62	26.97			
0400	120/600			119.57	26.92			
0415	135/615			119.82	27.17			61°F, E.C. = 500 ppm
0430	150/630			119.63	26.98			
0500	180/660			120.01	27.36			CLEAR,
0530	210/690			120.29	27.52			
0600	240/720			120.17	27.52			PUMP OFF!

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS G.O.W. #1

TYPE OF PUMPING TEST STEP-DRAWDOWN
PUMPING/(RECOVERY) DATA
M.P. FOR WATER LEVELS TOP OF STILLING well
DISTANCE FROM PUMPING WELL
LOCATION ELKO JUNIOR HIGH SCHOOL

PUMPING/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 7-31 TIME 0600
PUMP OFF: DATE 7-31 TIME

CLOCK TIME	ELAPSED TIME (minutes) t	ELAPSED TIME (minutes) t'	t/t'	WATER LEVEL MEASUREMENT (feet)	s. or s'	PUMPING RATE (gpm)	Q	REMARKS
0605	5 / 725	5		101.85				66.6 % RECOVERED
0610	10 / 730			100.92				70.0 %
0615	15 / 735			100.17				72.7 %
0620	20 / 740			99.65				74.6 %
0630	30 / 750			98.87				77.4 %
0645	45 / 765			98.13				80.1 %
0700	60 / 780			97.61				82.0 %
0730	90 / 810			95.11				91.1 %
0800	120 / 840			94.70				92.5 % Recovered
1800				94.70				92.5 % Recovered.

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS. G.O.W. #1

TYPE OF PUMPING TEST CONSTANT DISCHARGE
(PUMPING)/RECOVERY DATA
M.P. FOR WATER LEVELS TOP OF STILLING well (+1.58')
DISTANCE FROM PUMPING WELL
LOCATION ELKO JUNIOR HIGH SCHOOL

(PUMPING)/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 7-31 TIME 1800
PUMP OFF: DATE 8-1 TIME 1800

CLOCK TIME	ELAPSED TIME (minutes)		t/t'	WATER LEVEL MEASUREMENT (feet)		PUMPING RATE (gpm)		REMARKS
	t	t'		94.70	(s) or s'	50	Q	
1800	1			105.00	10.3	60		60 gpm - ADJUST FLOW
1803	3			108.08	13.38	60		ADJUST FLOW (DECREASE)
1805	5			109.37	14.67	60		" " "
1807	7			109.91	15.21	60		" " "
1809	9			107.03	12.33	50		FLOW CLEAR
1812	12			106.42	11.72			
1816	16			106.32	11.62	50		CLEAR
1820	20			106.36	11.66			
1825	25			106.61	11.91	50		T=62°F, E.C.=750 mhos
1830	30			106.78	12.08			
1835	35			107.08	12.38			
1840	40			107.09	12.39			CLEAR
1850	50			107.41	12.71			
1900	60			107.57	12.87			
1920	80			107.91	13.21			
1940	100			108.19	13.49			
2000	120			108.24	13.54	50		T=62°F, E.C.=750 mhos
2030	150			108.30	13.60			
2100	180							
2147	227			108.86	14.16			CLEAR
2200	240							
2230	270			109.08	14.38			T=61°F, E.C.=800 mhos
2300	300			109.38	14.68			
2330	330			109.55	14.85	50		
2400	360			109.61	14.91	50		T=63°F, E.C.=800 μmhos, pH=7.29

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS G.O.W. # 1

TYPE OF PUMPING TEST CONSTANT DISCHARGE
(PUMPING)/RECOVERY DATA
M.P. FOR WATER LEVELS TOP OF STILLING WELL
DISTANCE FROM PUMPING WELL
LOCATION ELKO JHS.

(PUMPING)/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 7-31 TIME 1800
PUMP OFF: DATE 8-1 TIME 1800

CLOCK TIME	ELAPSED TIME (minutes) t	ELAPSED TIME (minutes) t'	t/t'	WATER LEVEL MEASUREMENT (feet) 94.7	WATER LEVEL MEASUREMENT (feet) s or s'	PUMPING RATE (gpm)	PUMPING RATE (gpm) Q	REMARKS
0100	420			109.73	15.03	50		
0200	480			109.90	15.20	"		T=63°F, EC=800 μmohs pH=7.29
0300	540			109.95	15.25	"		
0400	600			110.01	15.31	"		T=63°F, EC=750 μmohs
0500	660			110.09	15.39	"		
0600	720			110.20	15.50	"		T=62°F E.C.=750 μmohs
0700	780			110.33	15.63	"		clear
0820	860			110.43	15.73	50		
1000	960			110.15	15.45	"		clear
1200	1080			110.38	15.68	"		T=63°F, E.C.=750 μmohs
1400	1200			109.65	14.95	"		
1600	1320			109.64	14.94	"		T=64°F, E.C.=600 μmohs
1800	1440			109.63	14.93	50		Pump OFF Begin Recovery

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS G.O.W. #1

TYPE OF PUMPING TEST CONSTANT DISCHARGE
PUMPING/(RECOVERY) DATA
M.P. FOR WATER LEVELS TOP OF STILLING WELL
DISTANCE FROM PUMPING WELL
LOCATION ELKO JUNIOR HIGH SCHOOL

PUMPING/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 8-1 TIME 1800
PUMP OFF: DATE 8-2 TIME 0600

CLOCK TIME	ELAPSED TIME (minutes) t	ELAPSED TIME (minutes) t'	t/t'	WATER LEVEL MEASUREMENT (feet) 94.7	WATER LEVEL MEASUREMENT (feet) s or s'	PUMPING RATE (gpm)	PUMPING RATE (gpm) Q	REMARKS
1801	1/1441	1	1441	99.80	5.1			
1803	3/1443	3	481	100.29	5.59			
1805	5/1445	5	289	100.09	5.39			
1807	7/1447	7	207	99.79	5.09			
1809	9/1449	9	161	99.62	4.92			
1812	12/1452	12	121	99.32	4.62			
1816	16/1456	16	91	99.07	4.37			
1820	20/1460	20	73	98.77	4.07			
1825	25/1465	25	59	98.37	3.67			
1830	30/1470	30	49	98.37	3.67			
1840	40/1480	40	37	97.98	3.28			
1850	50/1490	50	30	97.80	3.10			
1900	60/1500	60	25	97.29	2.59			
1915	75/1515	75	20					
1930	90/1530	90	17					
1945	105/1545	105	14.7					
2000	120/1560	120	13					
2030	150/1590	150	10.6	96.39	1.69			
2100	180/1620	180	9	96.33	1.63			
2130	210/1650	210	7.8					
2200	240/1680	240	7	96.07	1.37			
2300	300/1740	300	5.8	95.94	1.24			
2400	360/1800	360	5	95.83	1.13			
0200	480/1920	480	4	95.67	.97			
0615	735/2175	735	3.0	95.48	.78			

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS GOW #1

TYPE OF PUMPING TEST INJECTION
(PUMPING)/RECOVERY DATA
M.P. FOR WATER LEVELS TOP OF STILLING WELL
DISTANCE FROM PUMPING WELL
LOCATION ELKO JHS

(PUMPING)/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 8-2-86 TIME 0815
PUMP OFF: DATE 8-3-86 TIME 0815

CLOCK TIME	ELAPSED TIME (minutes) t	ELAPSED TIME (minutes) t'	t/t'	WATER LEVEL MEASUREMENT (feet) 95.00	WATER LEVEL MEASUREMENT (feet) s. or s'	PUMPING RATE (gpm) Q	PUMPING RATE (gpm) Q	REMARKS
0815	0			95.00	0			
0840	25			87.50				
845	30			87.34	7.66'		37.2	
0900	45			86.83	8.17		34.1	ΔQ (INCREASED FLOW)
0915	60			79.30	15.7		70.5	
0930	75			77.70	17.3		51.6	
0945	90			76.90	18.1		56.4	
1000	105			76.29	18.71		53.8	ΔQ (Increased flow)
1015	120			1.9	93.1		114.07	ΔQ (decreased flow)
1030	135			26.35	68.6		65.25	
1045	150			25.71	69.3		63.03	
1100	165			23.58	71.4		62.33	
1115	180			22.26	72.7		66.82	
1130	195			21.09	73.9		62.03	
1145	210			20.02	75		61.43	
1200	225			19.21	75.8		61.14	
1230	255			17.80	77.2		60.8	
1300	285			16.69	78.3		58.5	
1330	315			15.87	79.1		60.4	
1400	345			15.35	79.6		59.9	
1430	375			14.82	80.2		60.1	
1500	405			14.21	80.8		60.3	
1530	435			13.35	81.65		60.7	
1600	465			12.71	82.29		61.5	
1630	495			12.46	82.5		60.9	
1700	525			12.25	82.75		61.0	
1730	555			11.99	83.0		61.0	

Project No. 392

PUMPING TEST DATA

WELL NO. ELKO JHS GOW# 1

TYPE OF PUMPING TEST INJECTION
PUMPING/RECOVERY DATA
M.P. FOR WATER LEVELS TOP OF STILLING WELL
DISTANCE FROM PUMPING WELL
LOCATION ELKO JHS.

PUMPING/OBSERVATION WELL
OTHER OBSERVATION WELL(S)

PUMP ON: DATE 8-2-86 TIME 0815
PUMP OFF: DATE 8-3-86 TIME 0815

CLOCK TIME	ELAPSED TIME (minutes)		t/t'	WATER LEVEL MEASUREMENT (feet)		PUMPING RATE (gpm)		REMARKS
	t	t'			s or s'		Q	
1800	585			11.47	83.5		61.0	
1830	615			11.55	83.4		60.7	
1900	645			11.14	83.86		60.1	
1930	675			10.82	84.20		60.2	
2000	705			10.75	84.25		60.2	
2100	765			10.06	84.9		60.4	
2200	825			9.68	85.3		60.2	
2300	885			9.18	85.8		60.2	
2400	945			8.31	86.7		61.3	
0100	1005			8.10	86.9		60.2	
0200	1065			7.76	87.2		59.9	
0330	1155			7.14	87.86		61.7	
0400	1185			7.20	87.92		61.3	
0600	1300			7.66	87.3		61.5	
0700	1360			7.44	87.6		60.9	
0800	1420			7.02	88.0		60.5	
0815	1435			7.04	87.9		60.3	PUMP OFF

APPENDIX E

INPUT FOR VARFLOW MODEL

Number of discharging wells = 9

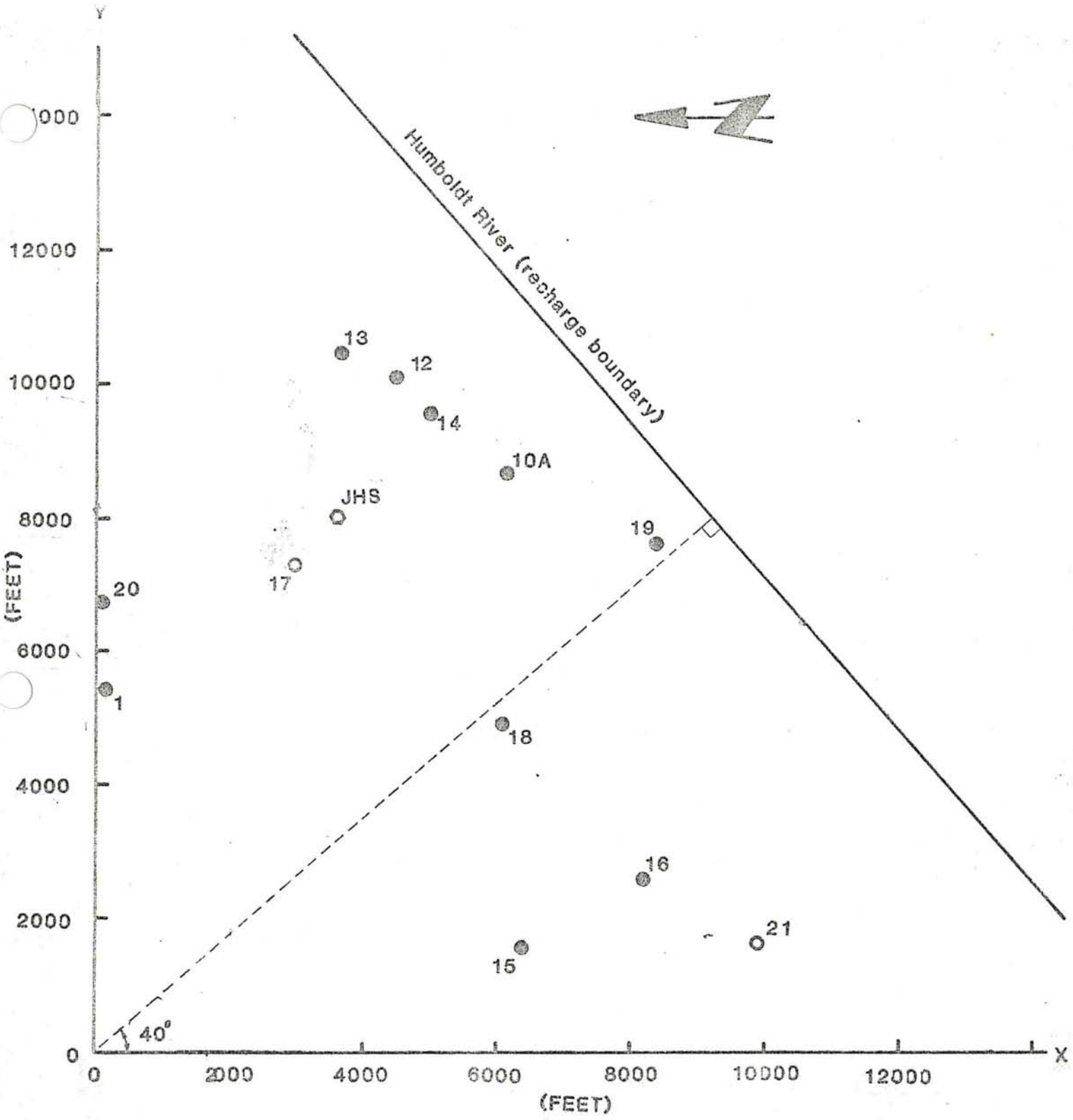
City of Elko Well Number	Coordinates X	Y
1	200	5400
20	100	6700
13	3700	1050
12	4500	10500
10A	6100	8700
19	8300	7600
18	6100	4900
15	6400	1500
16	8200	2500

Transmissivity = 2,273 FT^2/day

Coefficient of Storage = 0.001

Recharge boundary located 12,200 feet from origin

Angle between X-axis and normal to boundary = 40 degrees



VARFLOW Model Layout

● City Well used in simulation

WILLIAM E. NORK, Inc.

Reno, Nevada 89503

Pumping Schedule

Time since simulation started (days)	Discharge rate (cubic feet/day)
City Well No. 1	
Ø - 9Ø	Ø
9Ø - 12Ø	1Ø,415
12Ø - 15Ø	19,Ø25
15Ø - 18Ø	26,728
18Ø - 21Ø	3Ø,458
21Ø - 24Ø	33,822
24Ø - 27Ø	4,335
27Ø - 3ØØ	8,198
3ØØ - 36Ø	Ø
City Well No. 2Ø	
Ø - 6Ø	Ø
6Ø - 9Ø	1,128
9Ø - 12Ø	32,618
12Ø - 15Ø	5Ø,578
15Ø - 18Ø	111,992
18Ø - 21Ø	88,516
21Ø - 24Ø	116,738
24Ø - 27Ø	35,856
27Ø - 3ØØ	2,161
3ØØ - 36Ø	Ø
City Well No. 13	
Ø - 15Ø	Ø
15Ø - 18Ø	94,77Ø
18Ø - 21Ø	91,933
21Ø - 24Ø	9Ø,956
24Ø - 27Ø	31,186
27Ø - 36Ø	Ø
City Well No. 12	
Ø - 3Ø	1Ø5,8Ø8
3Ø - 6Ø	95,439
6Ø - 9Ø	91,655

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90 - 120	101,230
120 - 150	102,296
150 - 180	95,861
180 - 210	97,231
210 - 240	96,817
240 - 270	95,914
270 - 300	101,529
300 - 330	97,978
330 - 360	101,604

City Well No. 10A

0 - 30	20,495
30 - 60	20,132
60 - 90	21,265
90 - 120	46,375
120 - 150	55,755
150 - 180	53,379
180 - 210	38,780
210 - 240	34,509
240 - 270	48,523
270 - 300	41,837
300 - 330	36,183
330 - 360	22,323

City Well No. 19

0 - 30	83,873
30 - 60	82,450
60 - 90	111,298
90 - 120	136,978
120 - 150	155,597
150 - 180	147,473
180 - 210	149,894
210 - 240	26,597
240 - 270	0
270 - 300	988
300 - 330	0
330 - 360	0

City Well No. 18

0 - 150	0
150 - 180	38,298
180 - 210	104,608
210 - 240	9,886
240 - 360	0

City Well No. 15

Ø - 3Ø	54,4Ø1
3Ø - 6Ø	72,281
6Ø - 9Ø	52,528
9Ø - 12Ø	78,428
12Ø - 15Ø	83,343
15Ø - 18Ø	83,611
18Ø - 21Ø	61,856
24Ø - 27Ø	6Ø,476
27Ø - 3ØØ	38,387
3ØØ - 33Ø	31,72Ø
33Ø - 36Ø	24,698

City Well No. 16

Ø - 15Ø	Ø
15Ø - 18Ø	21,271
18Ø - 21Ø	83,Ø99
21Ø - 24Ø	8Ø,388
24Ø - 27Ø	83,261
27Ø - 3ØØ	83,924
3ØØ - 33Ø	81,681
33Ø - 36Ø	84,8ØØ

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