GW - 20

REPORTS

YEAR(S):

2 of 3

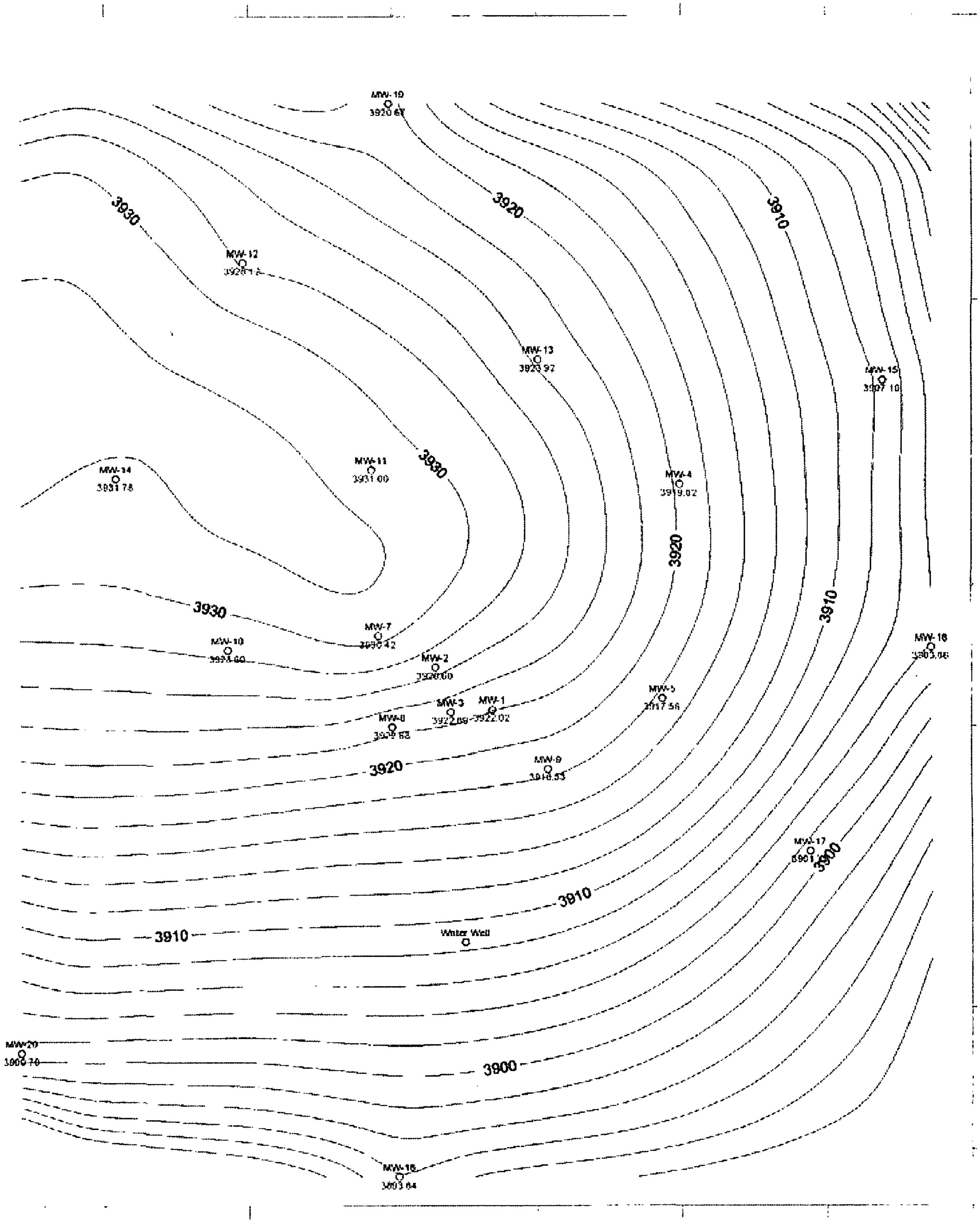
2004-2003

APPENDIX D

POTENTIOMETRIC MAPS

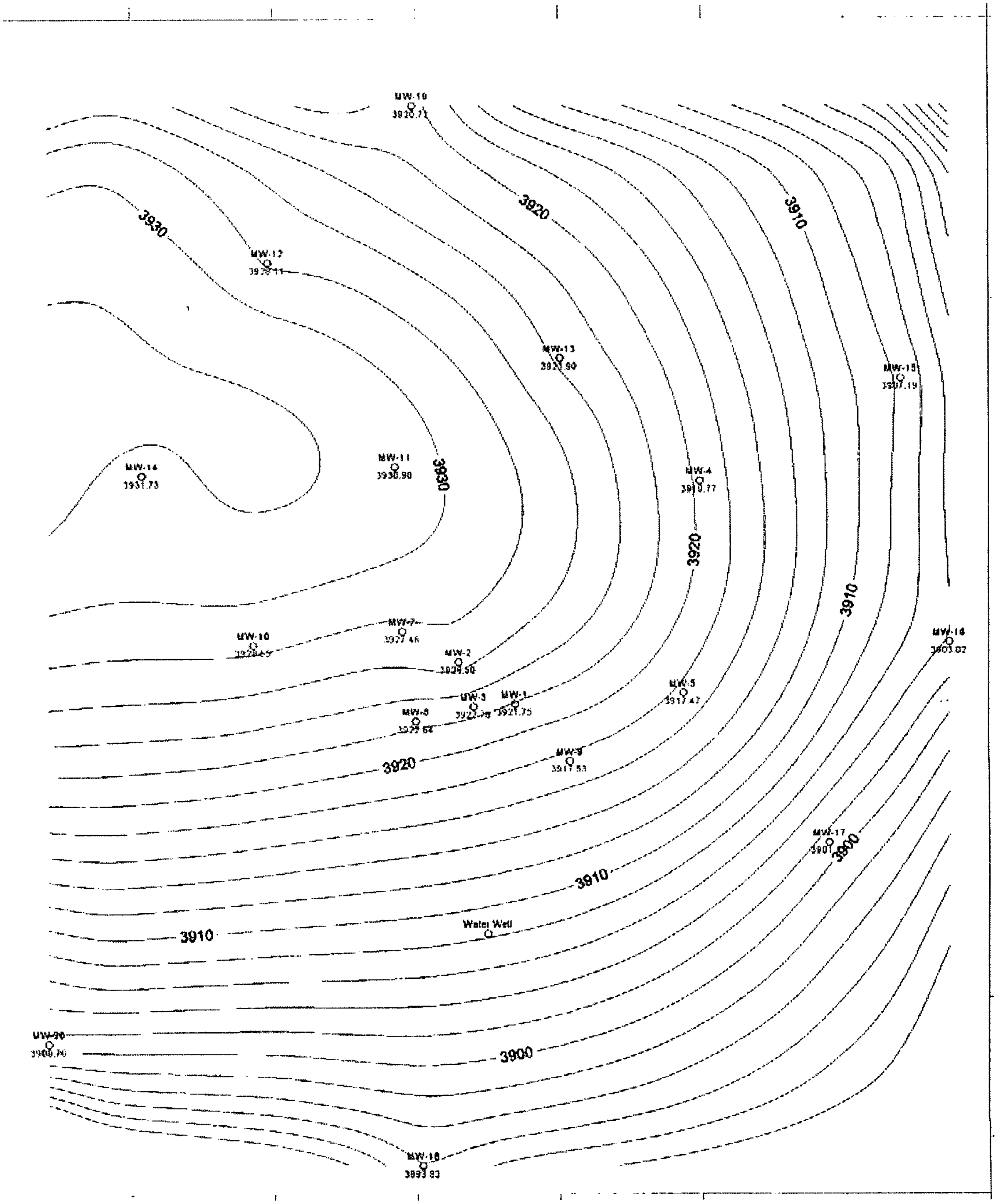
GROUNDWATER ELEVATION CONTOURS

April 5, 2004



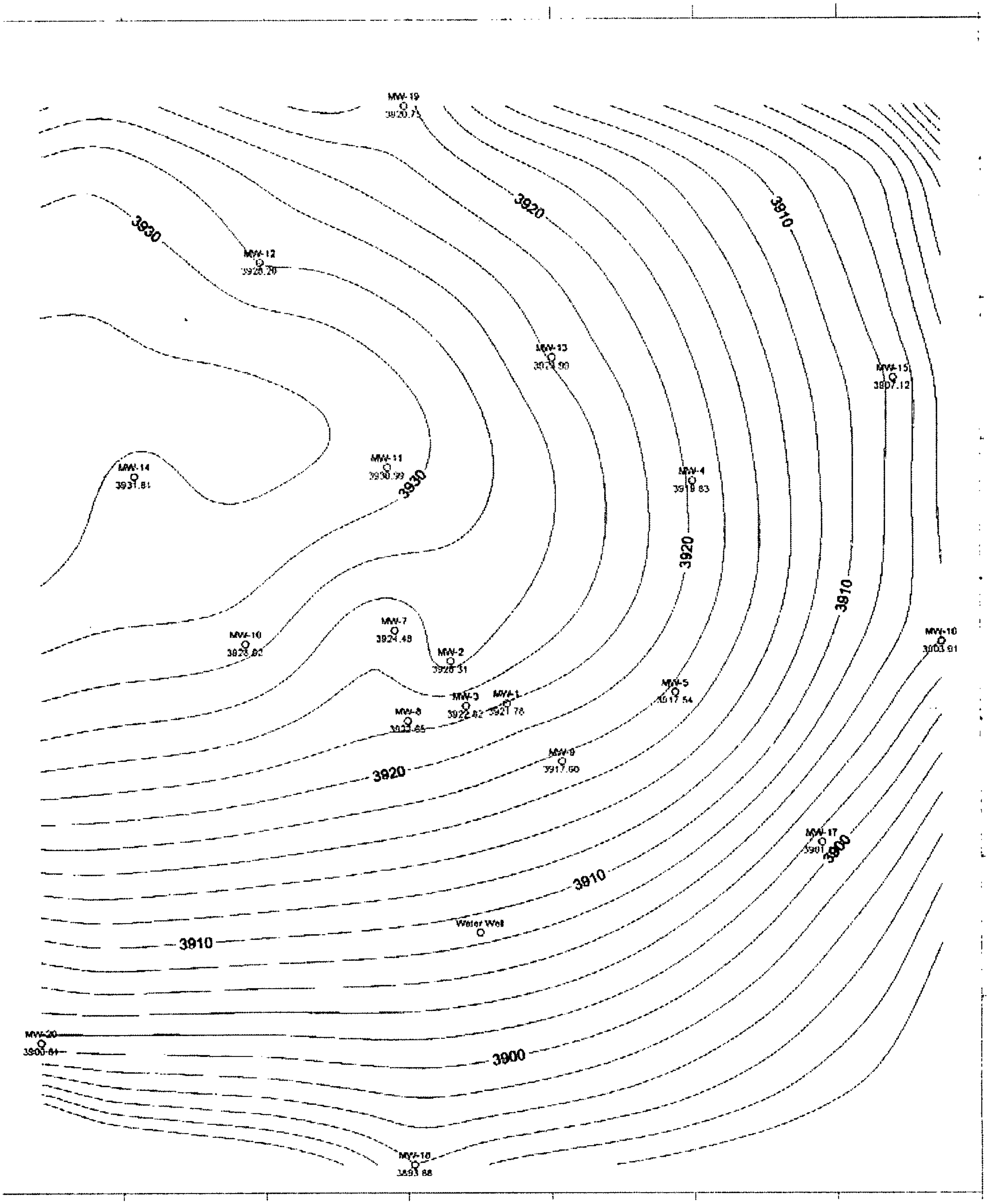
GROUNDWATER ELEVATION CONTOURS

May 5, 2004



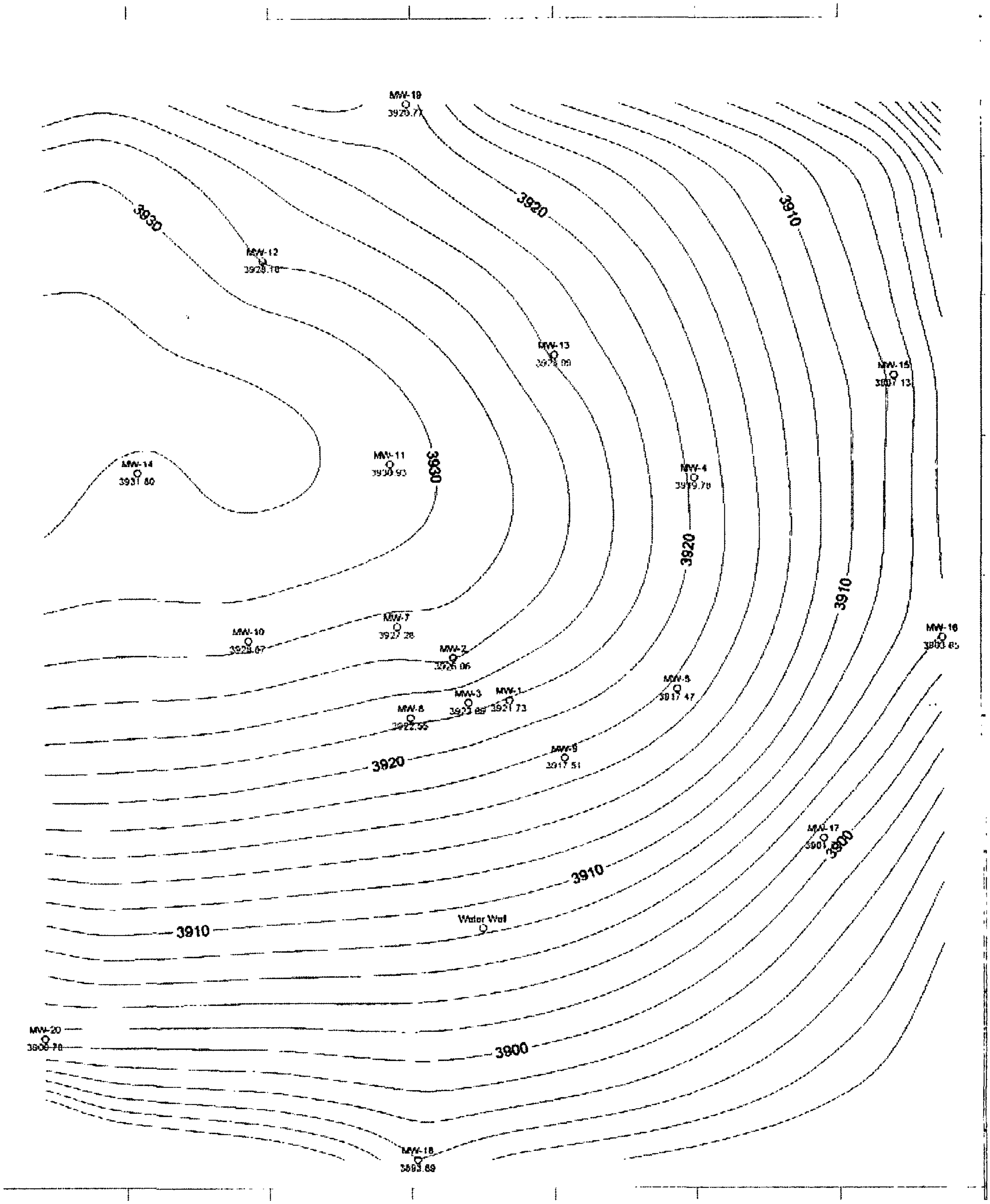
GROUNDWATER ELEVATION CONTOURS

May 24, 2004



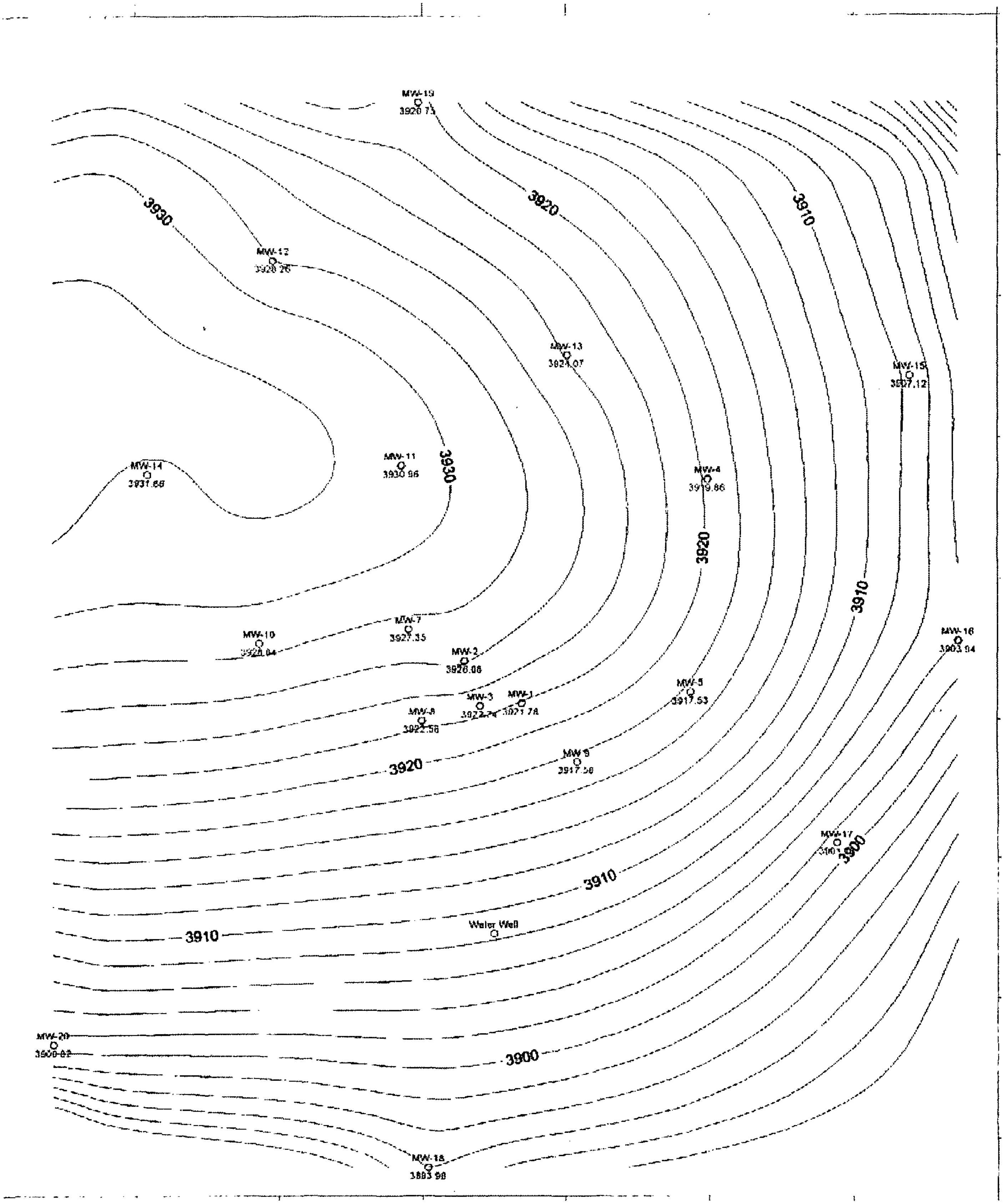
GROUNDWATER ELEVATION CONTOURS

June 1, 2004



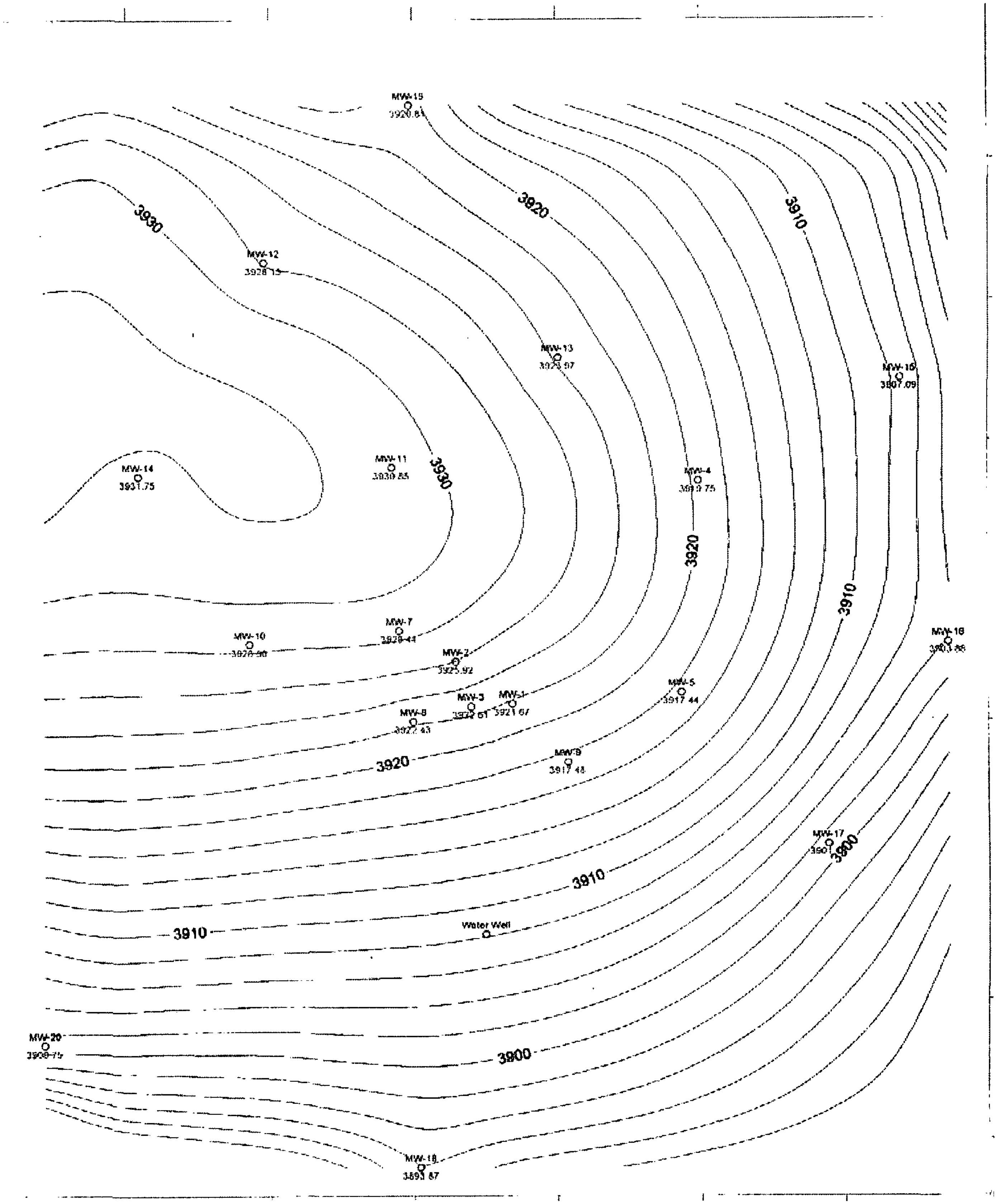
GROUNDWATER ELEVATION CONTOURS

JUNE 7, 2004



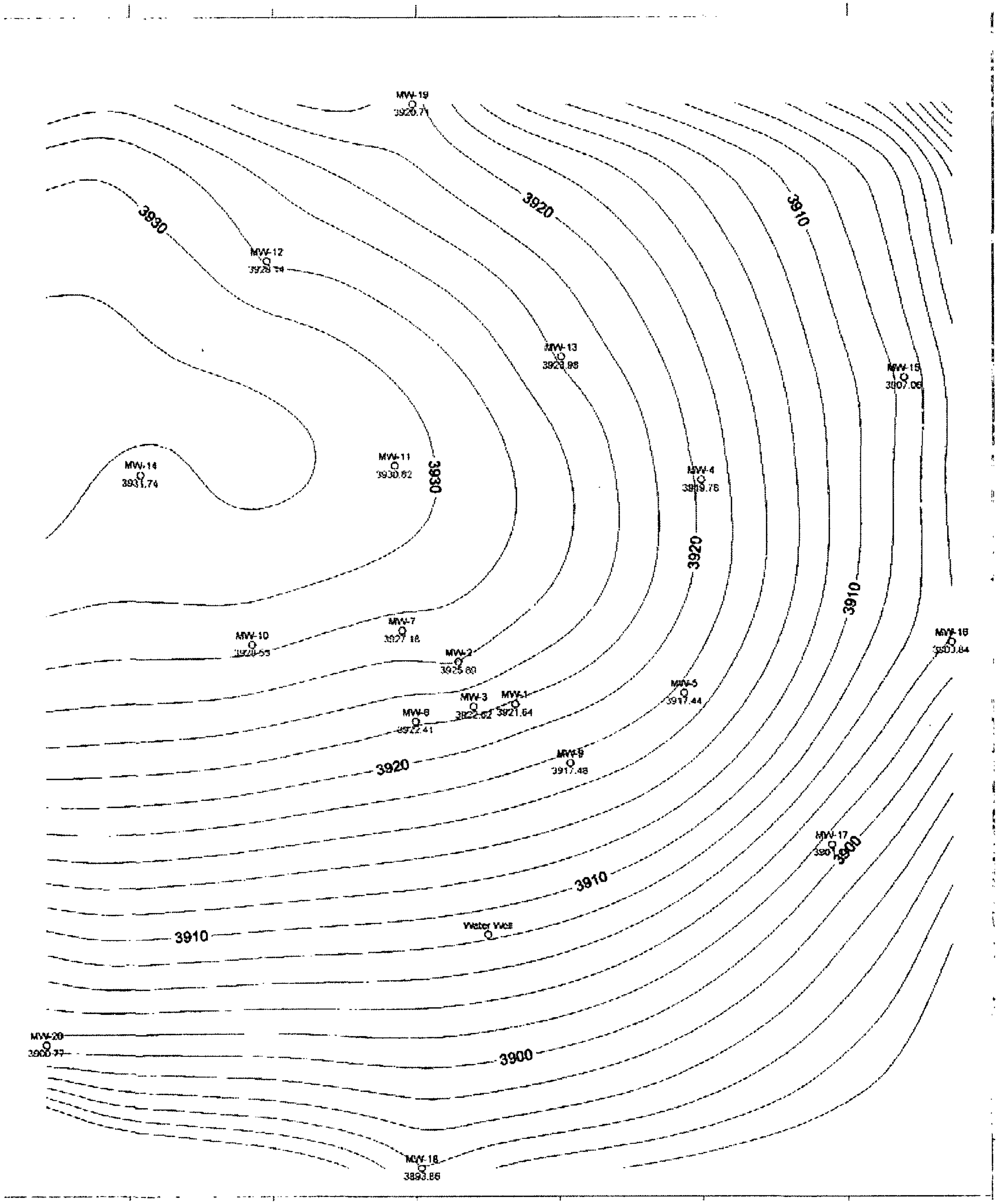
GROUNDWATER ELEVATION CONTOURS

June 15, 2004



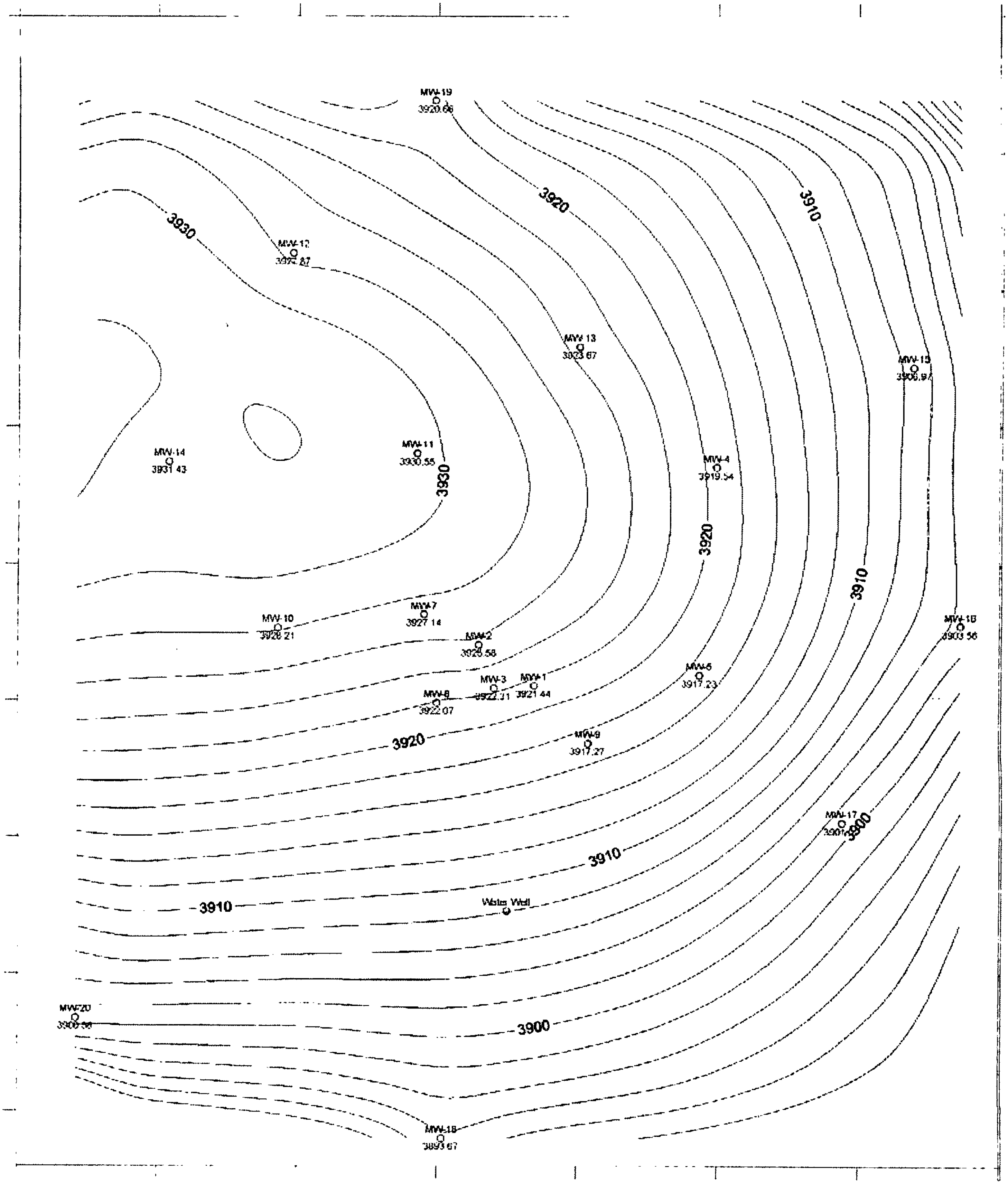
GROUNDWATER ELEVATION CONTOURS

June 21, 2004



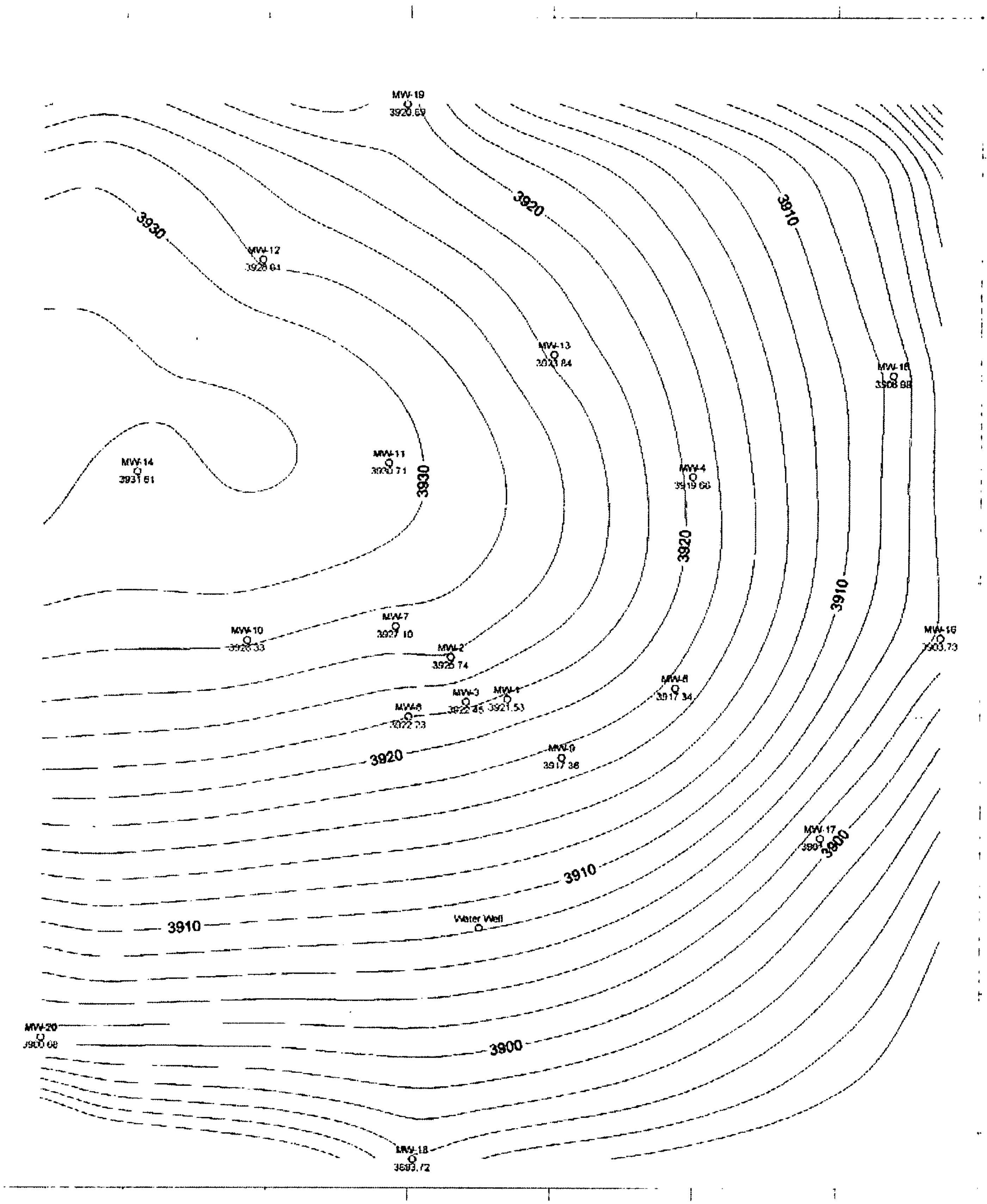
GROUNDWATER ELEVATIO CONTOURS

June 28, 2004



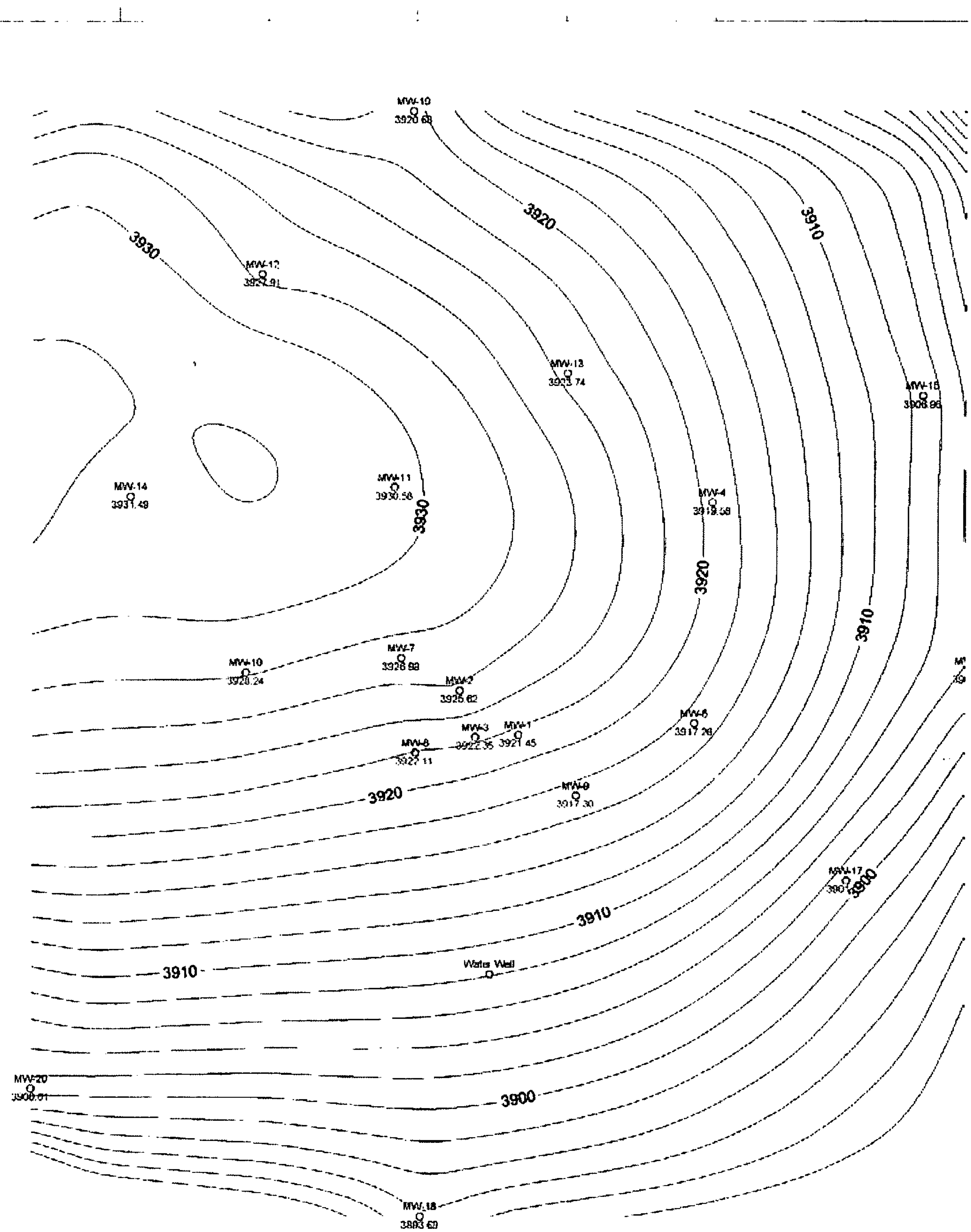
GROUNDWATER ELEVATION CONTOURS

July 6, 2004



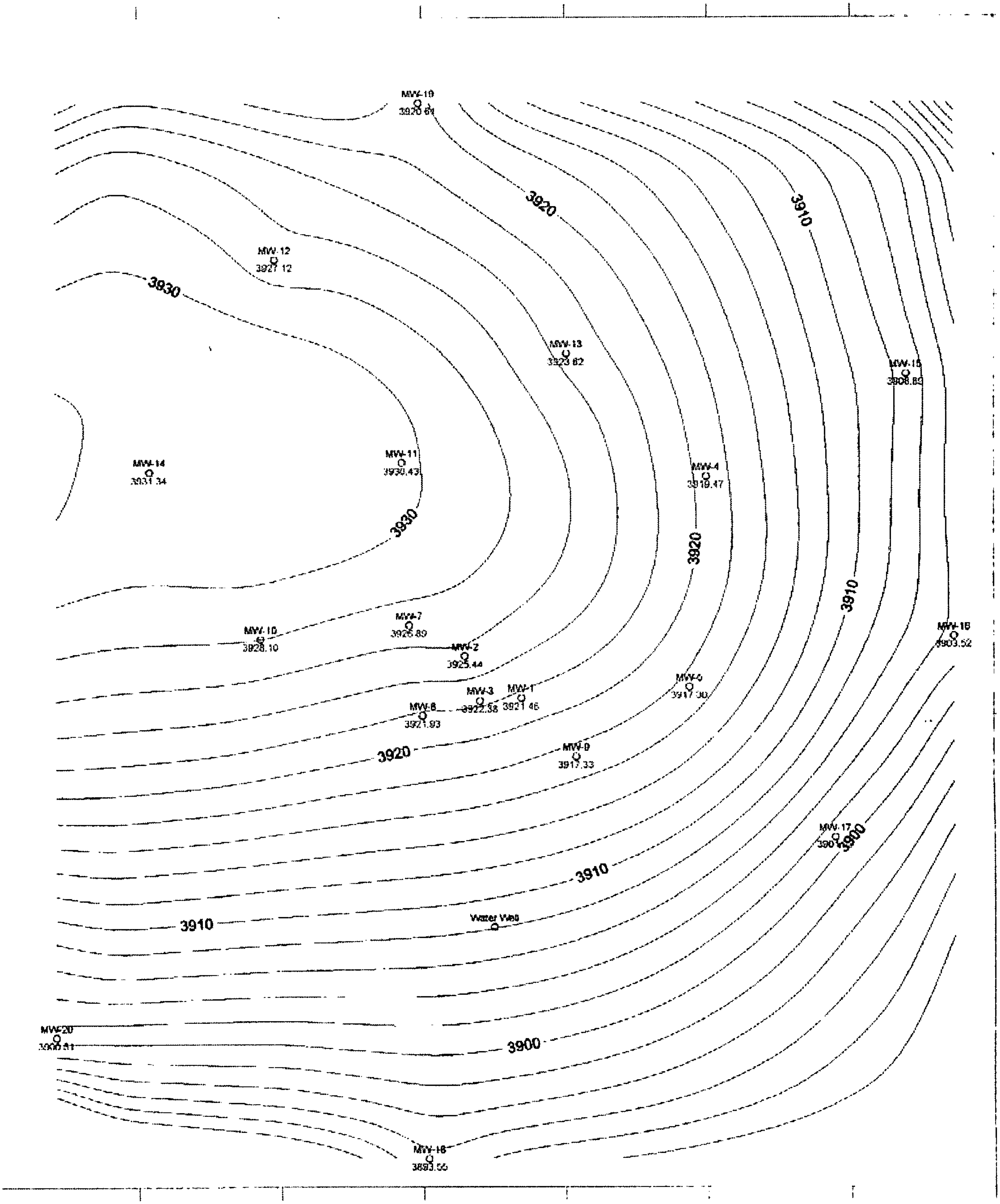
GROUNDWATER ELEVATION CONTOURS

July 12, 2004



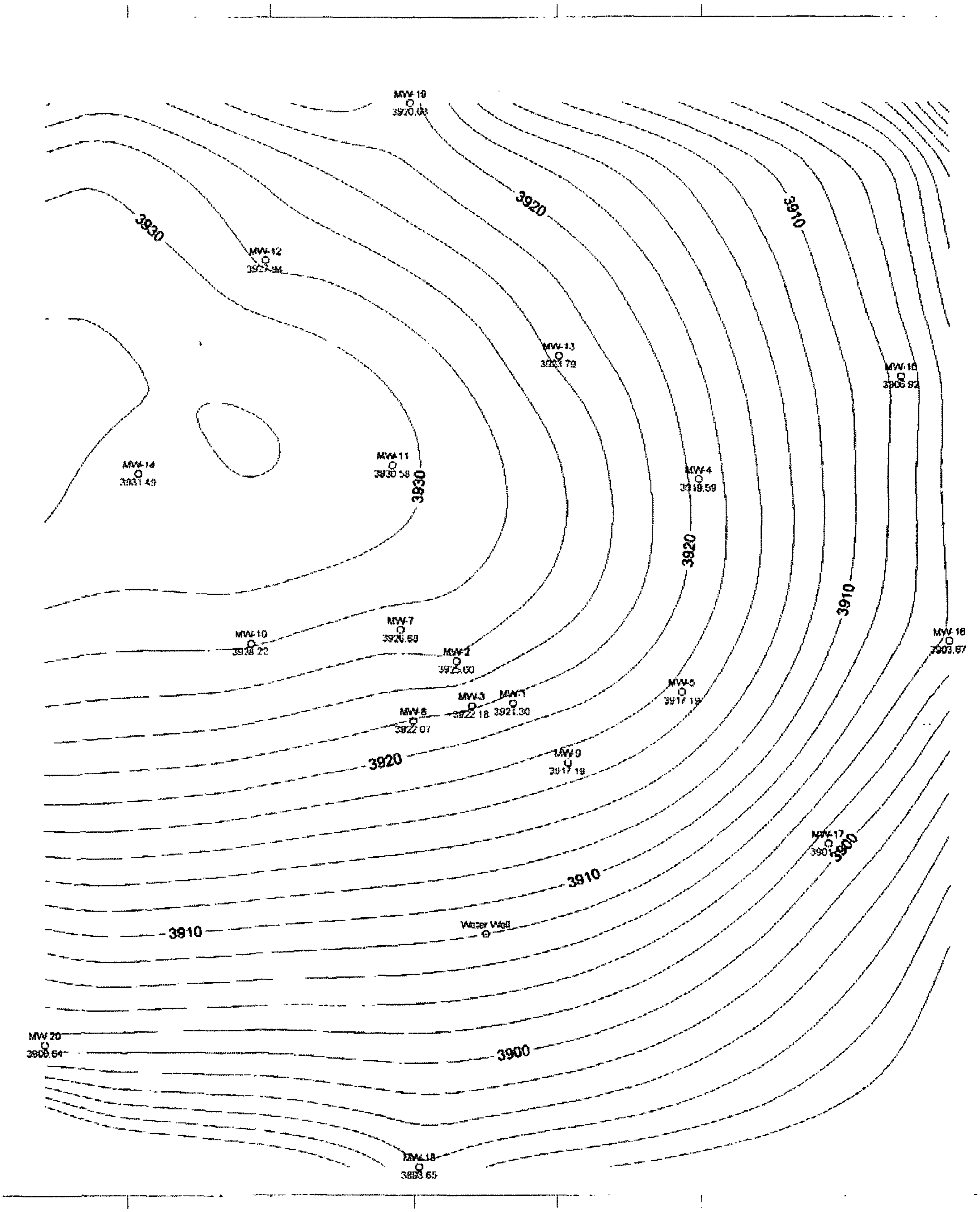
GROUNDWATER ELEVATION CONTOURS

July 19, 2004



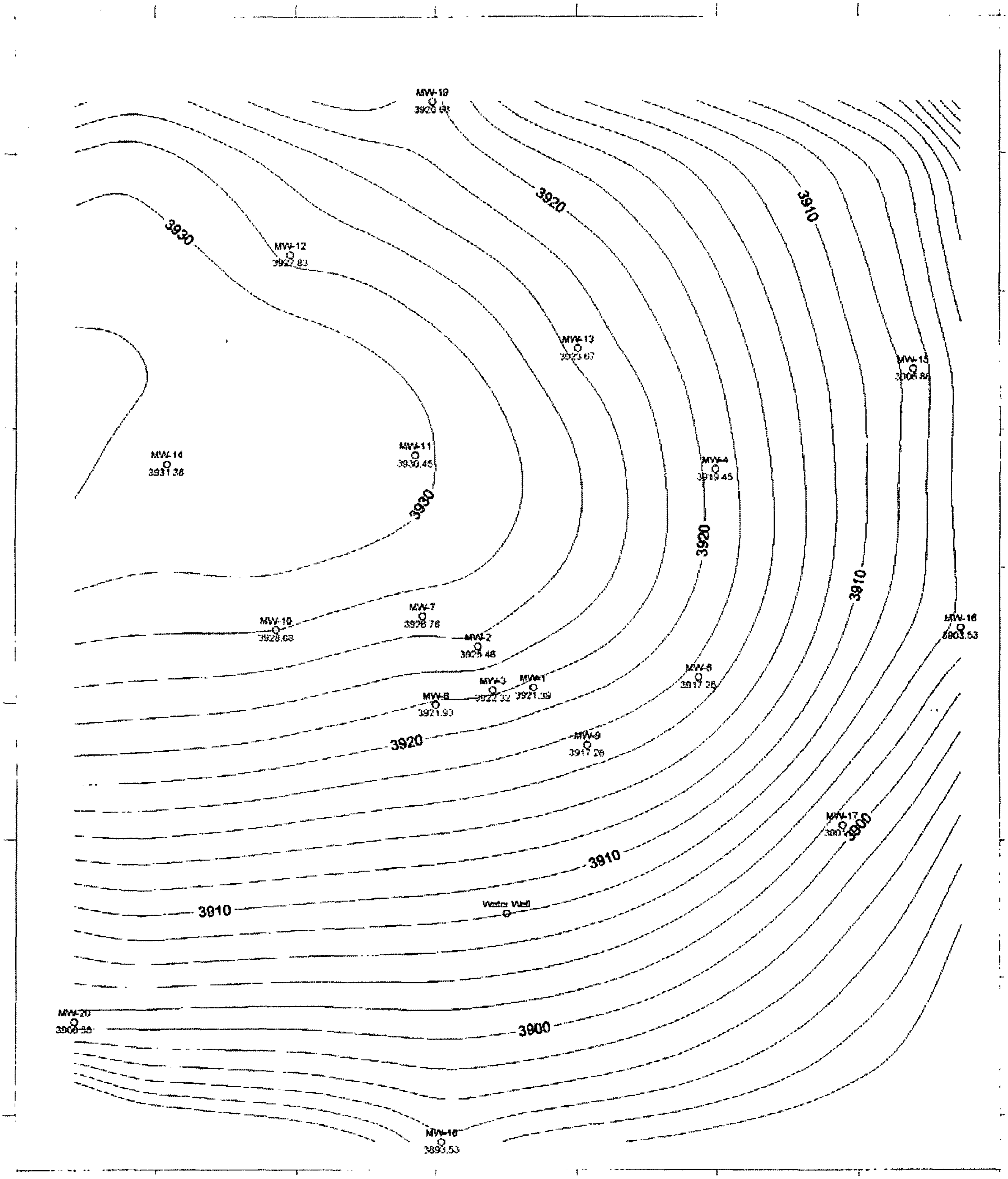
GROUNDWATER ELEVATION CONTOURS

July 26, 2004



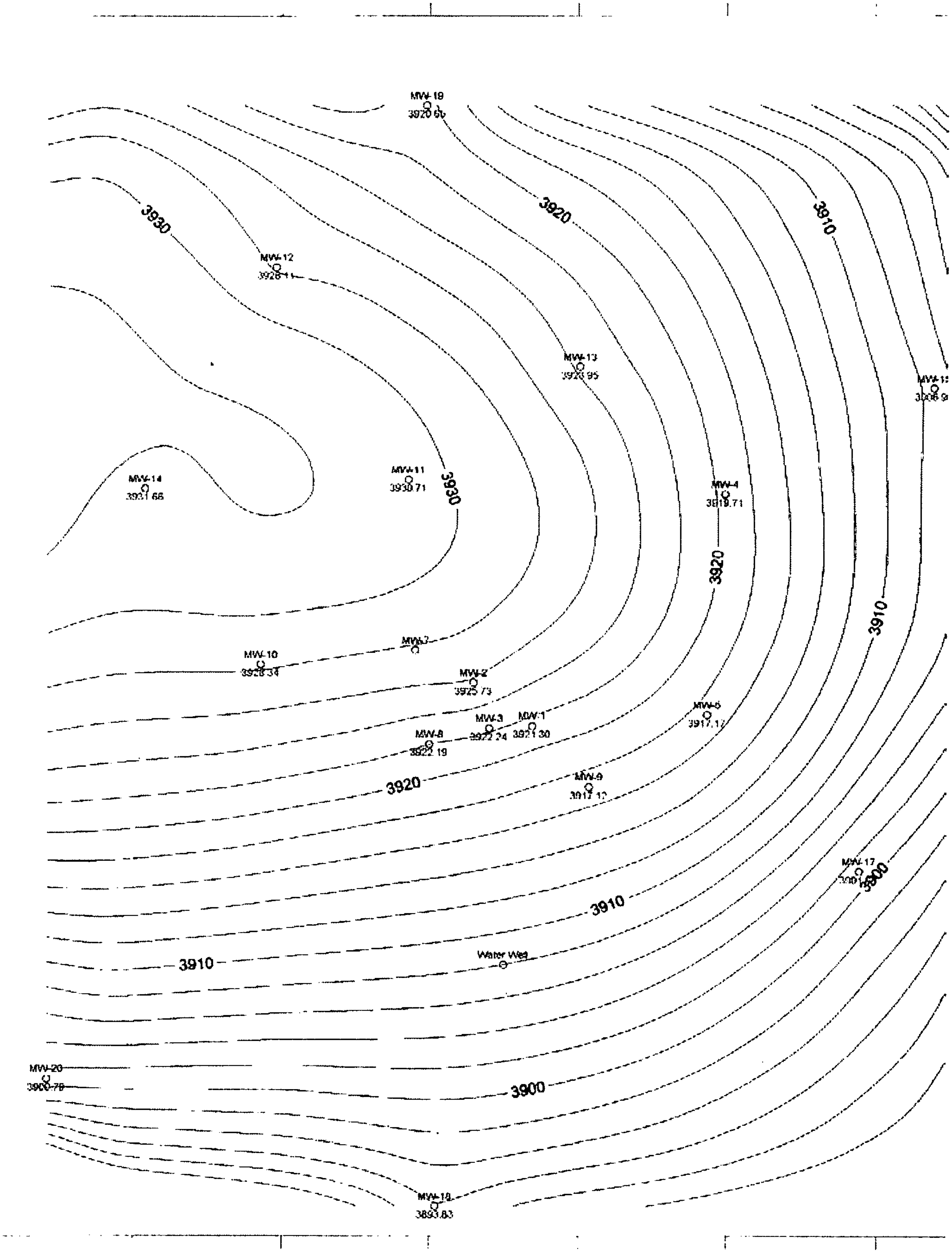
GROUNDWATER ELEVATION CONTOURS

August 2, 2004



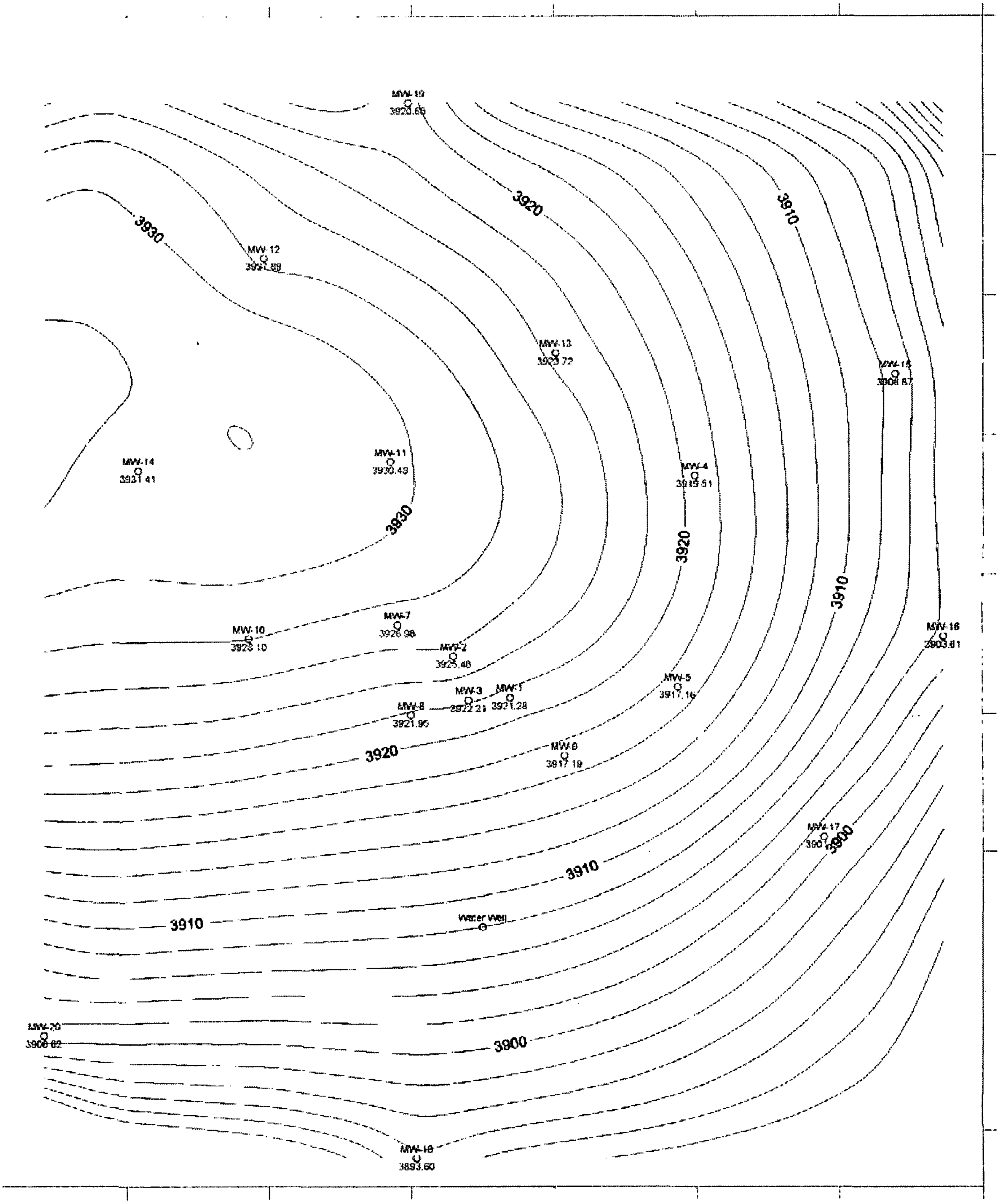
GROUNDWATER ELEVATION CONTOURS

August 10, 2004



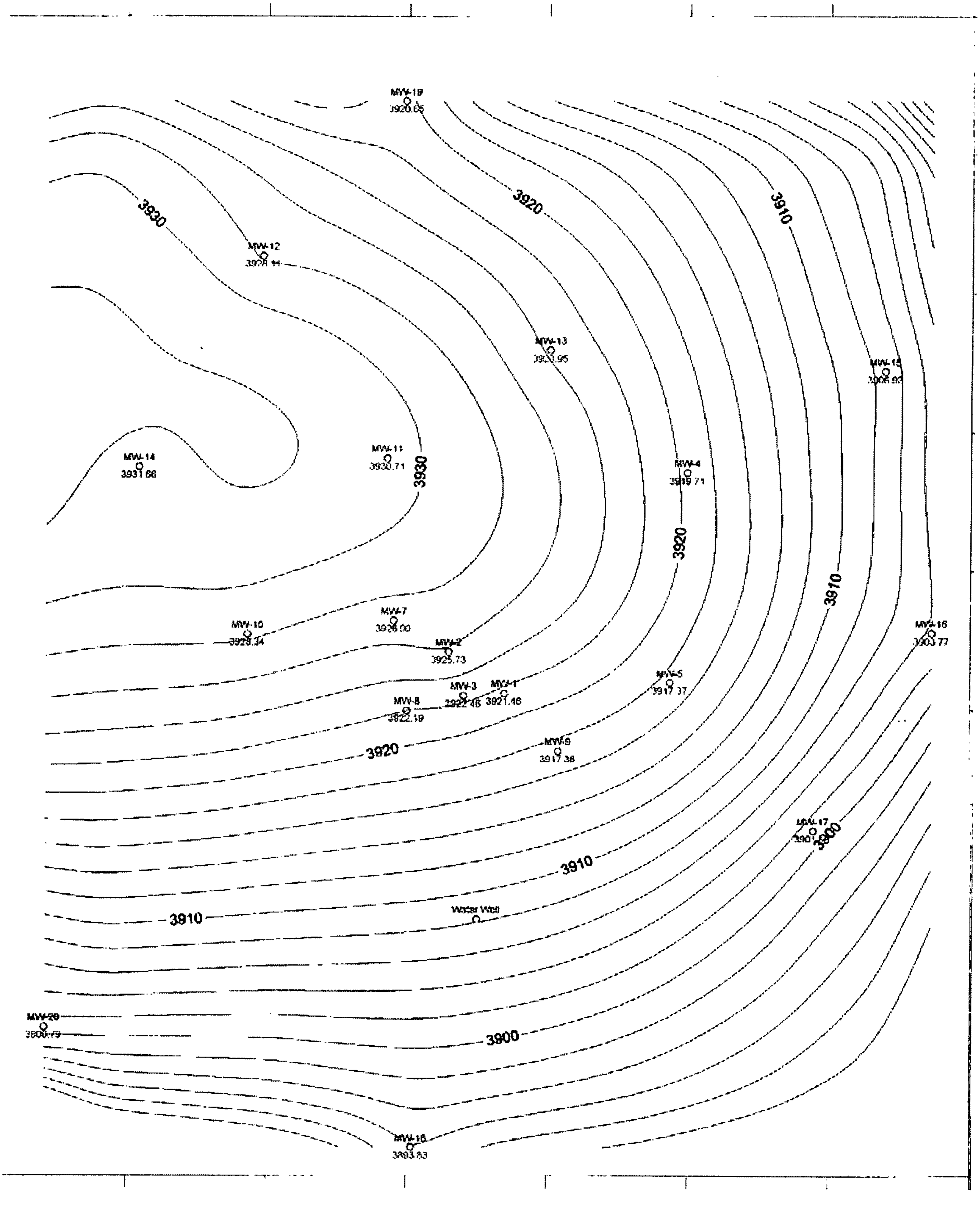
GROUNDWATER ELEVATION CONTOURS

August 16, 2004



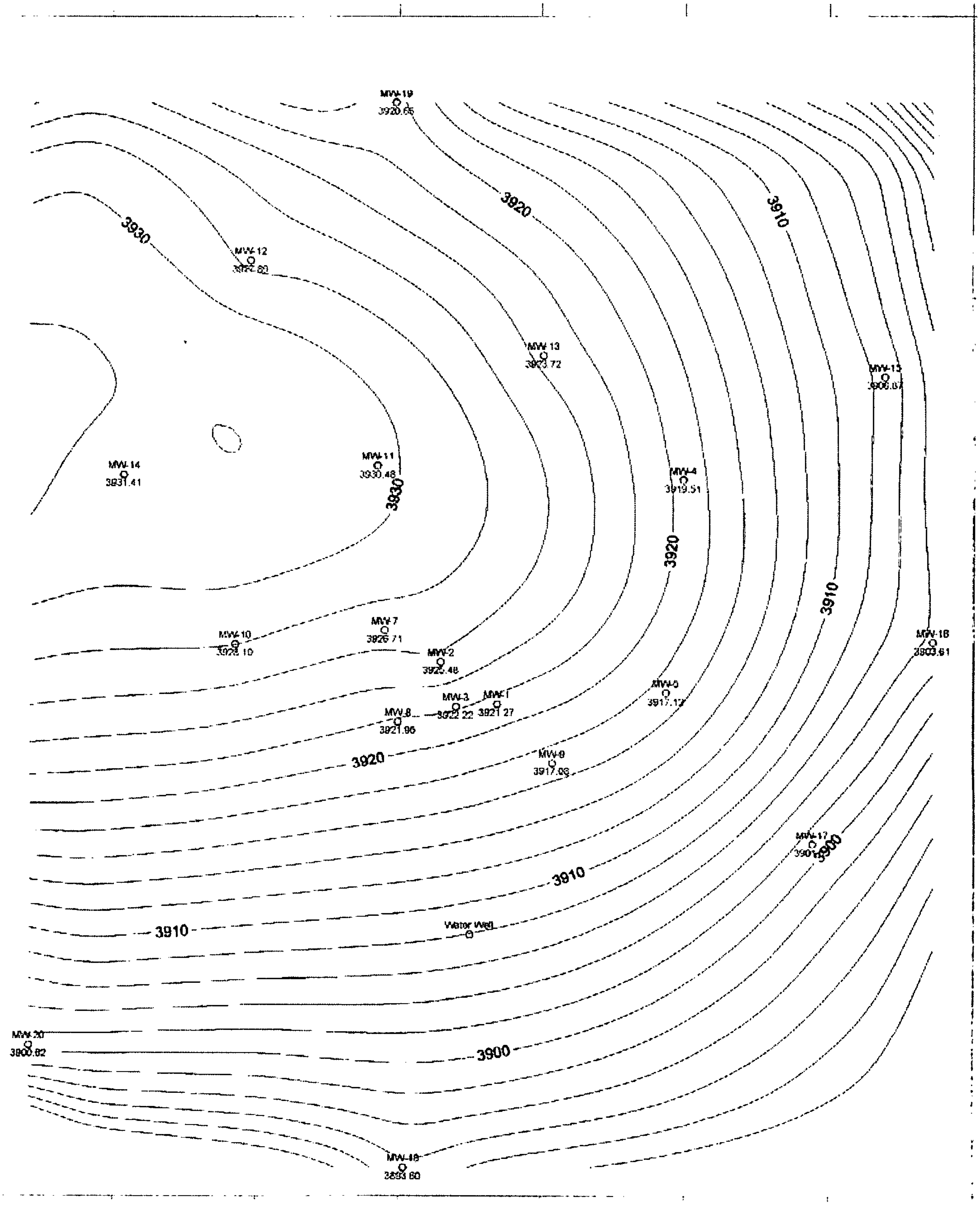
GROUNDWATER ELEVATION CONTOURS

August 23, 2004



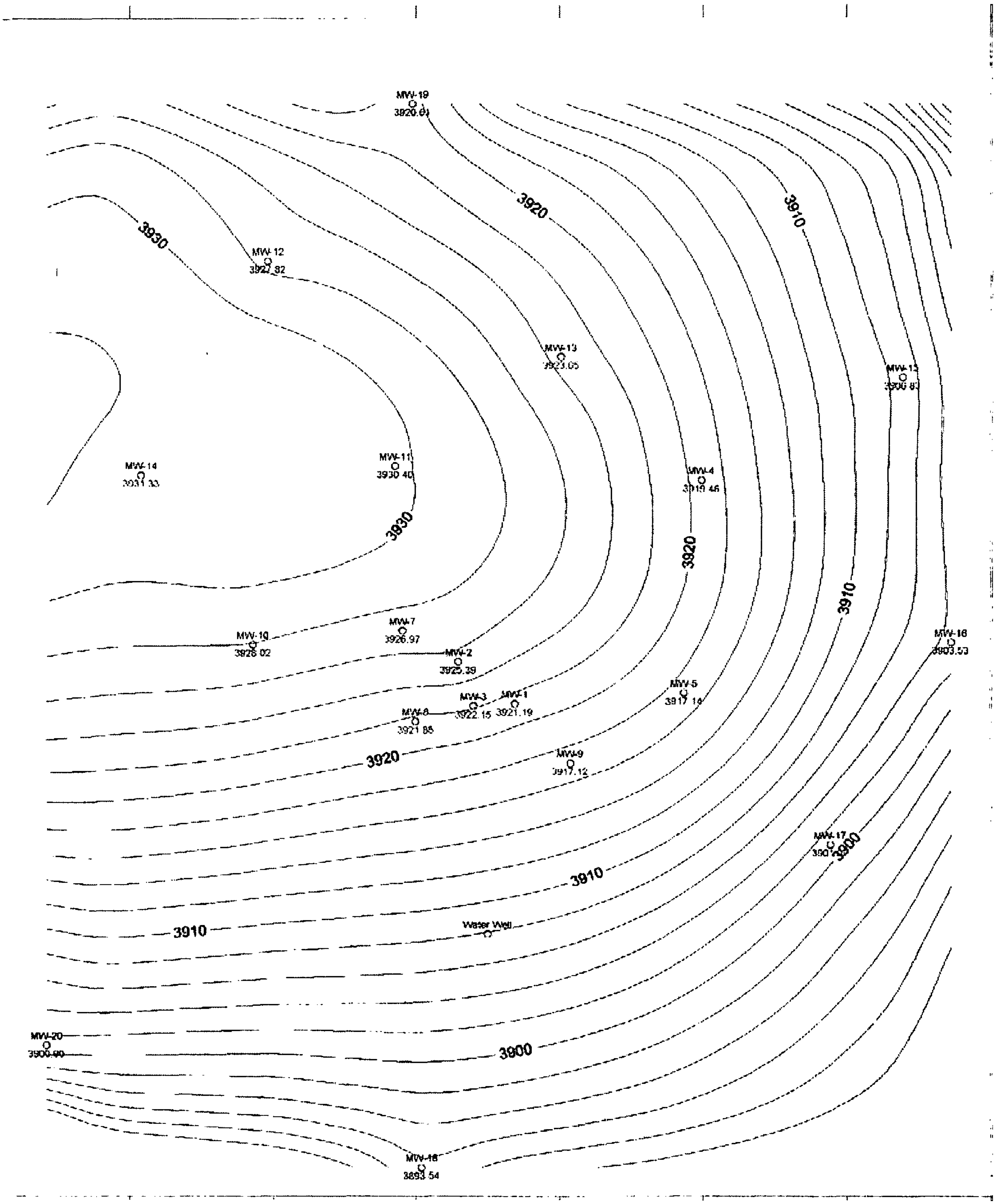
GROUNDWATER ELEVATION CONTOURS

August 30, 2004



GROUNDWATER ELEVATION CONTOURS

September 8, 2004



MAXIM TECHNOLOGIES INC®

10601 Lomas NE, Suite 106
Albuquerque, NM 87112
(505) 237-8440

January 15, 2003

RECEIVED
JAN 16 2003
Environmental Bureau
Oil Conservation Division

Mr. Wayne Price
Oil Conservation Division
NM Energy, Minerals, and Natural Resources Department
1220 South St. Francis Drive
Santa Fe, NM 87504

**RE: Interim Groundwater Investigation Report
September 2002 Work Completed at the
ConocoPhillips Maljamar Gas Plant
Maljamar, New Mexico
Maxim Project Nos. 2690032 & 2690033**

Dear Mr. Price:

On behalf of ConocoPhillips Inc. (ConocoPhillips), Maxim Technologies, Inc. (Maxim) is submitting this letter report to provide details and results of work completed during the week of September 16, 2002, at the Maljamar Gas Plant (Plant). The work followed Maxim's August 8, 2002, work plan and consisted of installation of six temporary monitor wells (MW-15, 16, 17, 18, 19 and 20). The new wells supplement a network of 13 existing monitor wells of which 4 (MW-10, 11, 12 and 13) are temporary wells and the rest are permanent wells. The monitor well network as it is currently configured is shown on Figure 1.

Prior to commencement of drilling, all sites were inspected by Mesa Field Services of Carlsbad, New Mexico, and found to be absent features of archaeological significance. Sites were cleared for buried lines by New Mexico One Call responders. Following installation of the new wells, depths to fluids and profiles of specific conductance (SC) of the groundwater columns at all monitor wells were measured. Groundwater samples were collected from all monitor wells that did not contain hydrocarbon product (condensate). This reports on results of these activities.

BACKGROUND

During six different drilling programs, ConocoPhillips has installed 19 monitor wells and one skimmer well (SK-1) at and near the Plant and has conducted three complete rounds of groundwater sampling at wells existing during sampling events. During the March 2002 drilling program, the absence of groundwater was noted approximately one-third mile to the northwest and west of the Plant's western fence line, delineating the western boundary of the groundwater system. The work that is the subject of this report was planned to similarly delineate the groundwater flow system to the north, northeast, east, southeast, south, and southwest of the Plant. Analysis of data accumulated to date has allowed Maxim to develop and refine a conceptual hydrogeologic model of the site vicinity, as presented below.

CONCEPTUAL MODEL

Boring data indicate the presence of a saturated zone comprised of sand, the upper surface of which is located between approximately 80 to 90 feet below ground surface (bgs). The sand contains groundwater that is potentiometrically mounded. From lithological observations made during drilling, the groundwater mound appears to be confined in the vicinity of the plant, but becomes unconfined with distance from the assumed center of the mound.

A condensate lens and dissolved hydrocarbon constituents have been observed on and in groundwater in monitor wells southwest of the Plant. In the vicinity immediately southwest of the Plant, the condensate lens appears to be pressed by the confined groundwater against the bottom surface of the upper confining shale. The location and thickness of the hydrocarbon lens are likely controlled by features such as the shape and dip of the lower surface of the upper confining shale.

In monitor wells completed through the condensate lens, the observed presence and thickness of the condensate is controlled by the position of the top of the well screen in relation to the position of the condensate-groundwater interface. MW-02, MW-08 and SK-1 are likely completed in the condensate lens. Although measurable condensate has not been observed to date in these wells, the absence may be attributed to the condensate-groundwater interface being positioned above the top of the well screens. Groundwater analytical results from the December 2001 sampling at MW-02 and MW-08 indicate highly elevated concentrations of dissolved hydrocarbon constituents at those monitor wells, supporting this line of reasoning.

In addition to hydrocarbon impacts, groundwater samples drawn from MW-12 north of the Plant, from MW-10 and MW-14 west of the Plant, from MW-18 and MW-20 south of the Plant, and from MW-16 east of the Plant contain elevated chloride and total dissolved solids (TDS) concentrations, suggesting additional density-driven stratification of fluids within the mound.

RESULTS

Drilling/Well Installation Program

During the week of September 16, 2002, six new temporary monitor wells, MW-15, 16, 17, 18, 19, and 20, were installed in the vicinity of the Plant (Figure 1). Split spoon sampling was attempted but failed, as the spoon was refused upon meeting the confining shale. For this reason holes were advanced using air rotary drilling. Wells were developed by bailing. Well locations were surveyed by Basin Surveys of Hobbs, New Mexico, on September 20, 2002. Boring/well completion logs for wells MW-15 through MW-20 are presented in Appendix A. Table 1 summarizes data for all monitor wells installed near the Plant to date.

Potentiometric Surface

Depths to fluids were measured on September 20, 2002. Groundwater elevations were corrected for the presence of condensate. The contoured potentiometric surface in the vicinity of the Plant is shown in Figure 2. The calculated average groundwater gradient is 0.016.

Specific Conductance

Specific conductance profiles were obtained for water columns in all monitor wells using a YSI® 6000 down hole sonde. In general, measurements were taken at two-foot increments starting at the first foot below the top of the water column; however, due to failure of the sonde pressure transducer, these increments were approximated. Results are presented in Figure 3, which shows profiles of specific conductance in milliSiemens per centimeter (mS/cm) profiles of water columns within all monitor wells. All data were normalized to the elevations of monitor well water columns in feet above mean sea level, and all data were corrected, if necessary, for discrepancies between approximated and actual total depths. Figure 3 shows that relatively high specific conductance was observed in groundwater at MW-10, MW-12, MW-18, and MW-20. Interfaces of increasingly saline groundwater were observed in the water columns of MW-10, MW-11, MW-12, and MW-14.

Well Sampling and Analytical Results

Thirteen monitor wells (MW-04 and MW-09 through MW-20) and one sanitary well (RA-10175) were sampled during the week of September 20, 2002. A duplicate sample was collected at MW-18. Because condensate was observed on the water columns of monitor wells MW-01, MW-03, MW-05, and MW-07 and assumed to be present in MW-02 and MW-08 due to high concentrations of dissolved petroleum constituents observed in December 2001 samples, those wells were not sampled during this sampling round. Well installations were completed on September 17 and 18, 2002, and newly installed wells were sampled on September 19, 2002. Samples were collected either with a dedicated bailer or by use of a MicroPurge® Low Flow Pump. Purge water was collected and drummed and disposed of per appropriate procedures. Field logs from groundwater sampling are presented in Appendix B. The pump and sampling apparatus were cleaned and rinsed between sampled wellheads.

Groundwater samples were collected and sent to Severn Trent Laboratories in Austin, Texas, for analysis for benzene, toluene, ethylbenzene and total xylenes (BTEX); calcium; iron; magnesium; manganese; sodium; bicarbonate and total alkalinity; bromide; chloride; sulfate; pH and TDS. Table 3 presents a summary of analytical results for BTEX, sodium, calcium, chloride and TDS from the September 2002 sampling event. The complete laboratory report is included as Appendix C.

PATH FORWARD/RECOMMENDATIONS

Maxim notes that condensate has not entered SK-1; hence, skimming for condensate removal planned for this well has been postponed. Maxim further notes that additional site characterization is necessary to promote success with this planned remedial effort (i.e., the appropriate path forward is to improve understanding of the precise positions and thicknesses of the confining shale and fluid-bearing zone).

Furthermore, Maxim notes that due to refusal of the split spoon during numerous push attempts this indicates that drilling methods are not sufficient to allow the detailed site characterization required to develop the necessary data. Therefore, Maxim recommends that down hole geophysical logging be performed using the existing monitor well network. A reasonable

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approach for developing these data is to log using gamma ray, which works well in cased holes and can be used to distinguish clays/shales from other rock types (Collier, Borehole Geophysical Techniques for Environmental and Groundwater Investigations, 2000). Additional geophysical tools may also be used in conjunction with gamma ray, as site and well conditions permit.

Maxim notes that the potentiometric map generated from all September 2002 water level elevations (Figure 2) shows a well-defined groundwater mound with a relatively uniform gradient field that emanates radially away from a point source toward the north, east, and south. To the west, groundwater was not encountered during the March 2002 drilling program. It is Maxim's opinion that the source of the groundwater mound is located within the area circumscribed by the 3,930-foot above mean sea level equipotential line shown on Figure 2, and recommends that this area, west of the Plant, be investigated using surface geophysical methods so the source can be located and stopped.

If you have any questions or comments regarding information containing in this report, please do not hesitate to contact me.

Sincerely,
MAXIM TECHNOLOGIES, INC.

Clyde L. Yancey

Clyde L. Yancey, P.G.
Senior Project Manager

Attachments: Figures
Tables
Appendix A - Boring Logs
Appendix B - Groundwater Sampling Logs
Appendix C - Laboratory Analytical Results

Cc: Neal Goates, ConocoPhillips RT, Houston, Texas
Joyce Miley, ConocoPhillips Gas & Power, Houston, Texas
Mark Bishop, ConocoPhillips NG&GP

Table 1. Summary of Monitor Well Data

Monitor Well	Status (Permanent or Temporary)	Install Date	HC Present: (Y/N) (If Y, Observed/Inferred)	Total Depth (feet bgs)	Diameter (inches)	Screened Interval (feet bgs)
MW-01	Permanent	6/21/00	Y Observed	97	2	72 - 92
MW-02	Permanent	9/28/00	Inferred	98	2	68 - 98
MW-03	Permanent	9/28/00	Y Observed	98	2	68 - 98
MW-04	Permanent	5/22/01	No	105	2	80 - 110
MW-05	Permanent	5/22/01	Y Observed	100	2	70 - 100
MW-07	Permanent	5/23/01	Y Observed	100	2	70 - 100
MW-08	Permanent	5/23/01	Inferred	100	2	70 - 100
MW-09	Permanent	5/23/01	N	100	2	70 - 100
MW-10	Temporary	12/5/01	N	97	2	74 - 94
MW-11	Temporary	12/4/01	N	120	2	98 - 118
MW-12	Temporary	12/4/01	N	120	2	99 - 119
MW-13	Temporary	12/3/01	N	127	2	105 - 125
MW-14	Permanent	3/20/02	N	120	4	80 - 120
MW-15	Temporary	9/17/02	N	130	2	100 - 130
MW-16	Temporary	9/17/02	N	130	2	100 - 130
MW-17	Temporary	9/17/02	N	100	2	80 - 100
MW-18	Temporary	9/17/02	N	110	2	90 - 110
MW-19	Temporary	9/17/02	N	120	2	100 - 120
MW-20	Temporary	9/18/02	N	120	2	80 - 100
SK-01	Permanent	3/21/02	Inferred	105	4	85 - 105

TABLE 2. ANALYTICAL RESULTS FROM SEPTEMBER 2002 SAMPLING EVENT

Sample Location	Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Sodium (mg/L)	Calcium (mg/L)	Chloride (mg/L)	TDS (mg/L)
MW-01	NS								
MW-02	NS								
MW-03	NS								
MW-04	9/18/01	**210**	ND	63	51	83.2	532	**455**	**954**
MW-05	NS								
MW-07	NS								
MW-08	NS								
MW-09	9/18/01	ND	ND	4.3	6.2	142	79.5	163	**741**
MW-10	9/17/01	ND	1.1	ND	5.1	604	757	**2,800**	**5,530**
MW-11	9/18/01	ND	ND	ND	4.1	50.2	439	**977**	**1,990**
MW-12	9/17/01	ND	ND	ND	ND	27,300	5930	**64,800**	**104,000**
MW-13	9/18/01	ND	ND	ND	4.3	56.8	329	219	**1,080**
MW-14	9/17/01	ND	1.2	ND	5.2	69.3	333	**569**	**1,960**
MW-15	9/19/01	9.0	4.3	1.9	3.6	54.4	241	180	**708**
MW-16	9/19/01	**15**	9.6	3.2	5.5	93.2	293	**376**	**1,190**
MW-17	9/19/01	**11**	2.6	ND	ND	135	495	**653**	**1,820**
MW-18	9/19/01	**11**	2.2	1.8	3.9	3,290	2360	**13,700**	**19,900**
MW-18-DUP	9/19/01	**10**	1.5	1.9	3.4	3,120	2350	**12,600**	**20,300**
MW-19	9/19/01	ND	ND	ND	ND	56.1	1370	140	**645**
MW-20	9/19/01	1.2	ND	ND	2.3	987	1470	**6,240**	**9,990**
WW-10175	9/19/01	ND	ND	ND	ND	148	185	**467**	**1,270**
Action Levels[1] (Bolded results exceed)		**10**	**750**	**750**	**620**			**250**[2]	**500**[2]

µg/L – Micrograms per liter

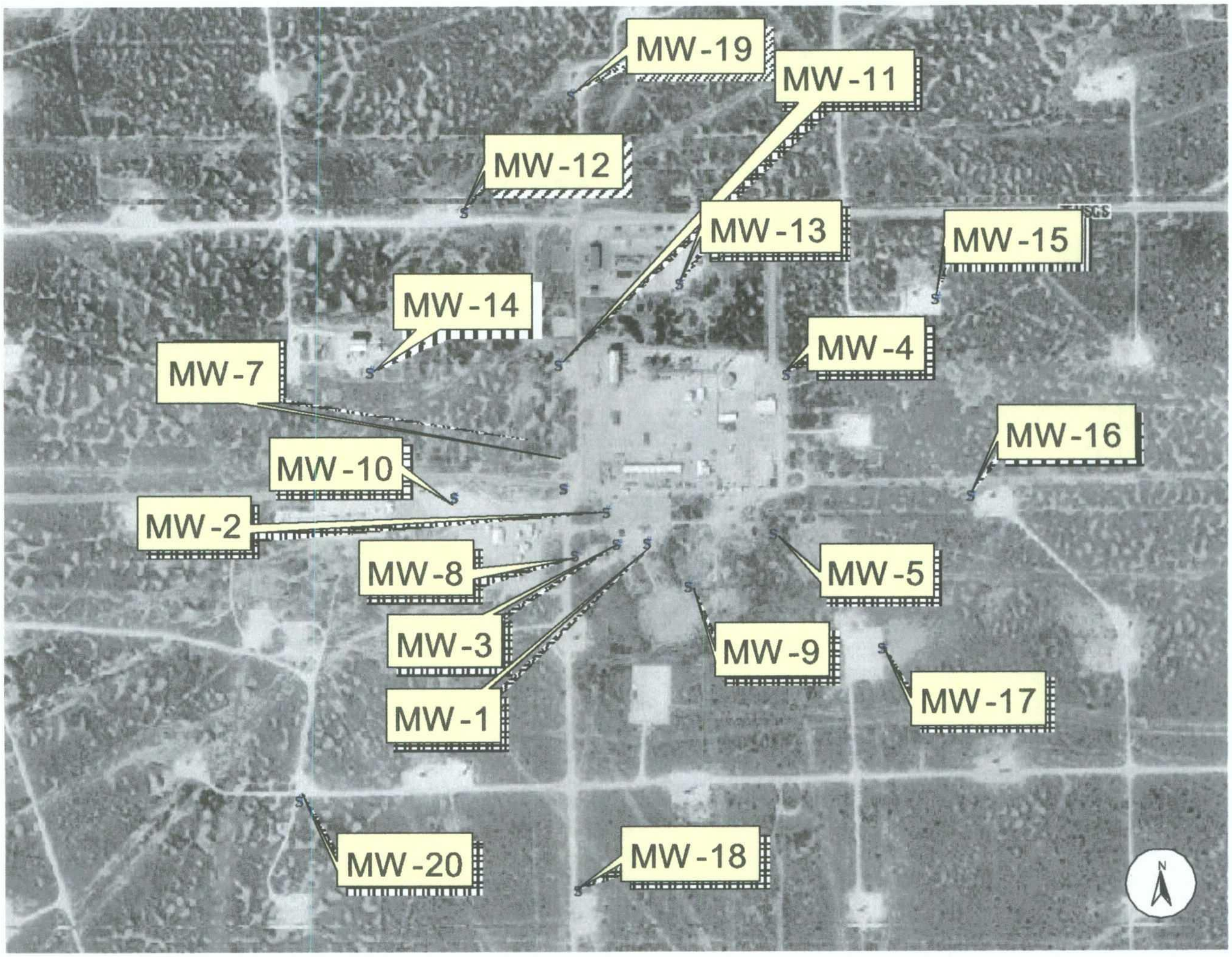
mg/L – Milligrams per liter

ND - not detected

NS - not sampled because of presence of free product

[1] NM Water Quality Control Commission

[2] Secondary Drinking Water Regulation



F:\share\Anne\Arcview32_projects\maljamar_groundwater\10_02_mgp_wle.apr\View - MONITOR WELL LOCATIONS\ Layout - Figure 1

WELL NAME	NORTHING	EASTING	ELEVATION
MW-1	32.81208	-103.77181	4002.24
MW-2	32.81250	-103.77244	4005.12
MW-3	32.81206	-103.77228	4001.94
MW-4	32.81425	-103.76967	4016.20
MW-5	32.81217	-103.76989	4009.42
MW-7	32.81281	-103.77308	4002.94
MW-8	32.81192	-103.77294	4000.72
MW-9	32.81150	-103.77119	4003.11
MW-10	32.81269	-103.77478	4000.47
MW-11	32.81442	-103.77314	4015.54
MW-12	32.81644	-103.77456	4022.71
MW-13	32.81547	-103.77128	4031.96
MW-14	32.81436	-103.77603	4006.98
MW-15	32.81523	-103.76737	4026.75
MW-16	32.81264	-103.76686	4017.74
MW-17	32.81066	-103.76825	3998.58
MW-18	32.80754	-103.77293	3980.46
MW-19	32.81796	-103.77289	4037.34
MW-20	32.80878	-103.77718	3976.92

SOURCES:

DOQs (dated 1/1996) downloaded from Microsoft / USGS TerraServer by Maxim Technologies, Inc., 2002. Well locations surveyed by Basin Surveys, 2001 and 2002.

0 400 800 1200 1600 2000 Feet

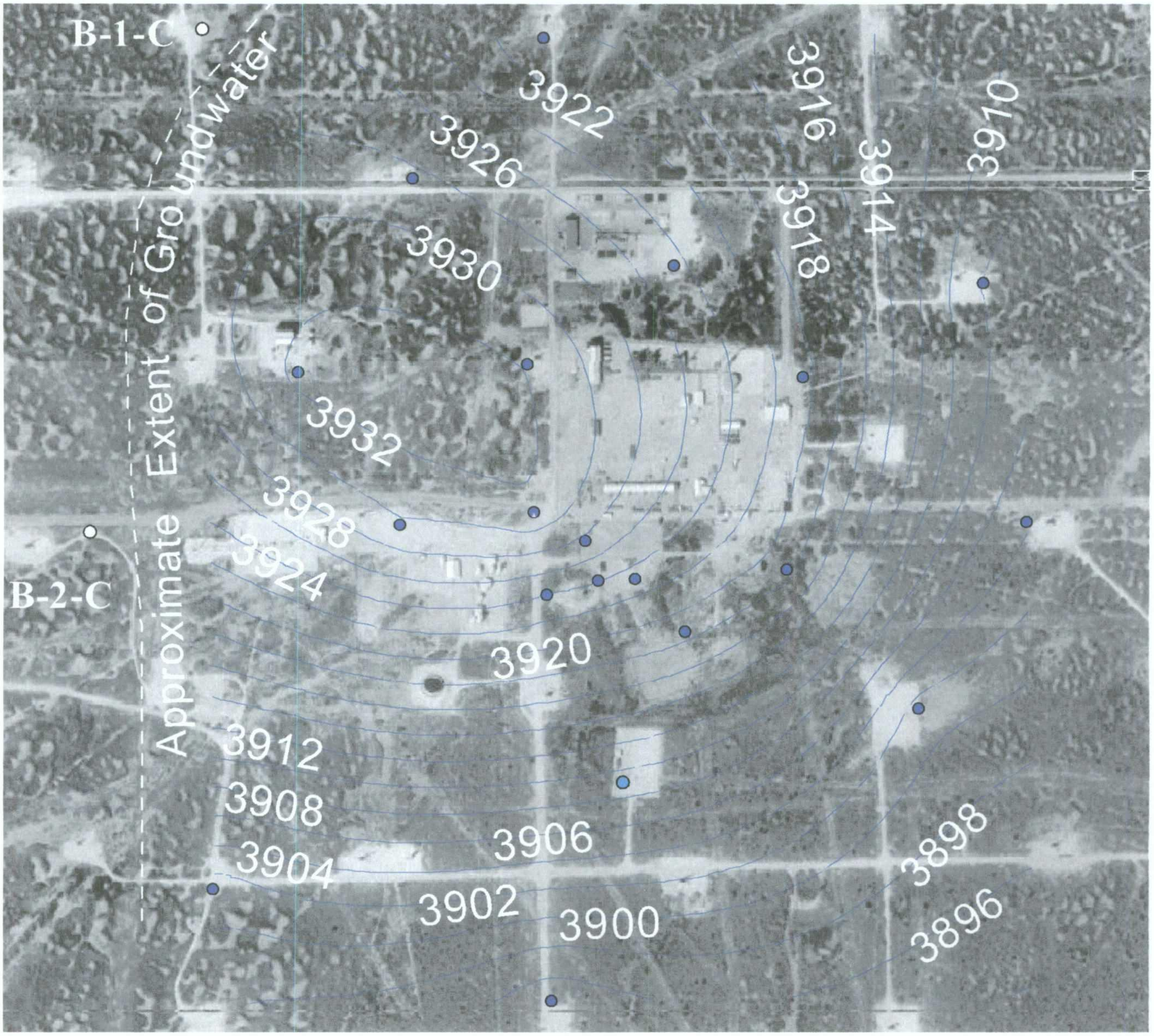
MAXIM
TECHNOLOGIES INC

Project Numbers: 269032/269033.100

CONOCO MALJAMAR GAS PLANT
MALJAMAR, LEA COUNTY, NEW MEXICO

MONITOR WELL LOCATIONS

FIGURE 1



SOURCES and NOTES:
DOQs photographed 1/1996, downloaded from USGS / Microsoft TerraServer 2002. Groundwater measurements collected by Maxim Technologies, Inc; corrected for product thickness. Contoured with Surfer 7.

0 300 600 900 1200 1500 Feet

MAXIM TECHNOLOGIES INC

Project Numbers: 2690032 & 2690032

CONOCO MALJAMAR GAS PLANT
MALJAMAR, LEA COUNTY, NEW MEXICO

WATER LEVEL ELEVATION CONTOURS
SEPTEMBER 20, 2002

FIGURE 2

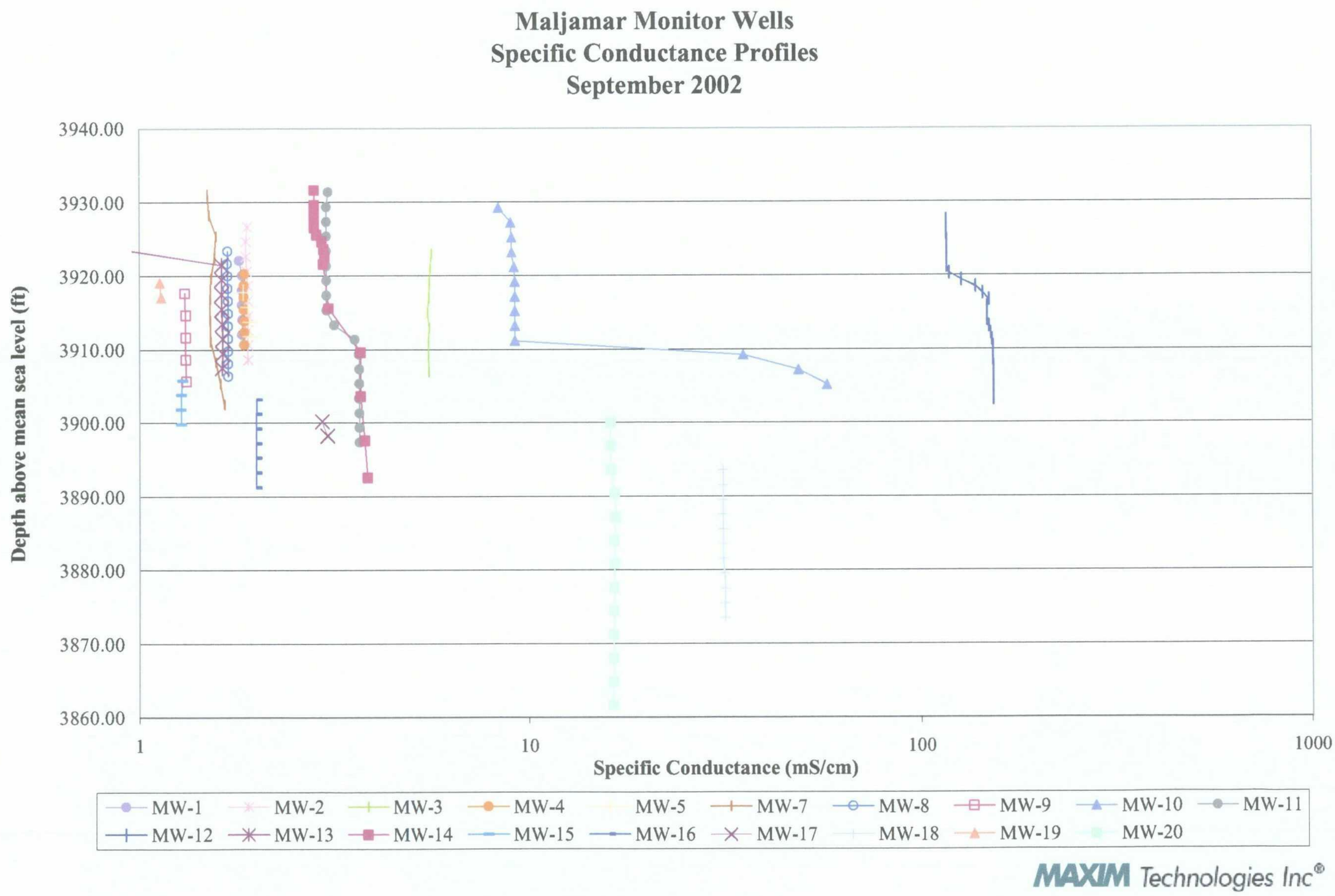


Figure 3. Specific Conductance Profiles