STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

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Report of Investigations 87-17

WATER-WELL DATA FROM THE HOUSTON AREA, MATANUSKA-SUSITNA BOROUGH, ALASKA

In cooperation with the City of Houston, Alaska

by

Danita L. Maynard

STATE OF ALASKA
Department of Natural Resources
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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INTRODUCTION

This report is the second in a series of ground-water data compilation reports prepared by the Alaska Division of Geological and Geophysical Surveys (DGGS). The work was funded jointly by DGGS and the City of Houston, Alaska. The compilation summarizes local ground-water conditions and is intended to facilitate land-use planning by providing reconnaissance hydrogeological information. Data for the report were obtained from the files of DGGS, the United States Geological Survey (USGS), and the Alaska Department of Environmental Conservation (DEC). Additional information was obtained from responses to a questionnaire mailed to property owners in the area.

The locations of 38 wells throughout the area were verified and water levels measured. Water from 32 wells was sampled and tested on-site for temperature, pH, conductivity, hardness, and iron. Water samples from eight wells were also analyzed for major ions and selected trace metals at DGGS laboratory facilities in Fairbanks, Alaska.

GEOLOGY

The Houston area lies within the lower Susitna basin and is bounded to the south by the Little Meadow Creek area, to the north by the Zero Lake area, to the east by Cheri Lake, and to the west by Pear Lake. The Little Susitna River provides the major drainage in the area (pl. 1).

The major structural feature of the area is the Castle Mountain Fault, which Turner and Wescott (1982) described as a high angle reverse fault (north-side upthrown) with a vertical offset in excess of 10,000 ft. They also suggested that additional subsurface faults may be present but obscured by glacial drift. The following discussion is summarized from Turner and Wescott (1982).

Exploration wells drilled in the lower Susitna basin have encountered granitic rocks at depth which are believed to be continuous with the Tertiary-to-Cretaceous-age granitic batholith of the Talkeetna Mountains northeast of Houston. The granitic rocks are overlain by thousands of feet of coal-bearing Tertiary-age sedimentary rocks. A gravity survey of the area indicates the sedimentary section north of the Castle Mountain fault is about 2,000 ft thick. South of the fault the sedimentary section is estimated to be at least 12,000 ft thick. These sedimentary rocks are composed of sandstone, siltstone, claystone, and coal, similar to the coal-bearing rocks of the Chickaloon Formation.

Reger (1981) and Trainer (1960) have discussed the Quaternary-age glacial drift and alluvial deposits which overlie the sedimentary rocks. These deposits vary in thickness from 0 ft to over 180 ft. The glacial drift is composed principally of till, an undifferentiated mixture ranging from clay-size particles to boulders, and glaciofluvial deposits, consisting mostly of gravel and sand. The glaciofluvial deposits may be well-sorted gravel or gravelly sand deposits, typical of former glacial meltwater streams, or well- to poorly-sorted gravel, sand, and silt mixtures deposited by meltwater in and beneath glacial ice. Relatively permeable alluvial deposits of gravel

and sand are present along the Little Susitna River and Little Meadow Creek. The land surface over most of the Houston area is overlain by a thin (4-12 in.) blanket of loess, or wind-blown silt (Reger, 1981).

Local water supplies are generally obtained from the gravel and sand layers of the near-surface glaciofluvial or alluvial deposits. Ground-water supplies in a few instances are also obtained from the sandstone and coal layers within the buried sedimentary rock sequence.

WELL CHARACTERISTICS

The 220 wells in the Houston area for which DGGS has information range from 12 to nearly 300 ft in depth (fig. 1). Approximately half of these (125) are 30-90 ft deep. Depths of wells can vary substantially even when wells are in proximity. The percentage of wells drilled deeper than 100 ft is higher north of Loon Lake (T. 18 **N.).** Estimated well yields (as recorded on well logs or reported by homeowners) range from 2-3 gallons per minute (gpm) in domestic bedrock wells to 150-250 gpm from institutional wells at the Houston Junior-Senior High School and the Big Lake Fish Hatchery operated by Alaska Department of Fish and Game (fig. 2). Private supply wells in the area typically have reported yields up to 30 gpm. These figures generally agree with Feulner (1971) who estimated the potential yields of aquifers within the glacial deposits at 10-50 gpm. In areas immediately adjacent to the Little Susitna River, however, Feulner estimated the potential yield to be 50-1,000 gpm. Yields of this magnitude are not usually achieved in private, domestic wells, which are commonly unscreened and unperforated, but greater yields may be produced using more expensive well designs associated with commercial or public water supplies.

Twenty-six static water-level measurements were taken during the course of the study (table 1) using a steel tape or electric sounder. Water levels were considered static when readings taken one to two minutes apart did not differ by more than 0.01 ft. Sixteen of the measurements were taken in wells for which previous measurements were available from drillers' logs (table 3). In 10 instances, water levels measured by DGGS personnel were 1-21 ft higher than measurements recorded on drillers' logs. The discrepancies are most likely attributable to differences in technique, an initial measurement taken before the water in the well bore had risen to its final, static level, or a higher water level. The level of water in a given well can fluctuate seasonally (for example, levels are typically lowest in late winter/early spring) or annually (higher in wetter years).

In six wells, water levels obtained by DGGS personnel were 2-13 ft lower than those reported by drillers. Discrepancies in this case may be due to an actual lowered water table, may reflect cyclical changes or differences in measurement technique as discussed previously, or may be due to a measurement recorded as static when the water level was rising very slowly.

WATER SAMPLING AND ANALYSIS

Ground-water samples were obtained from ordinary household plumbing taps. The taps were allowed to run until the water temperature stabilized,

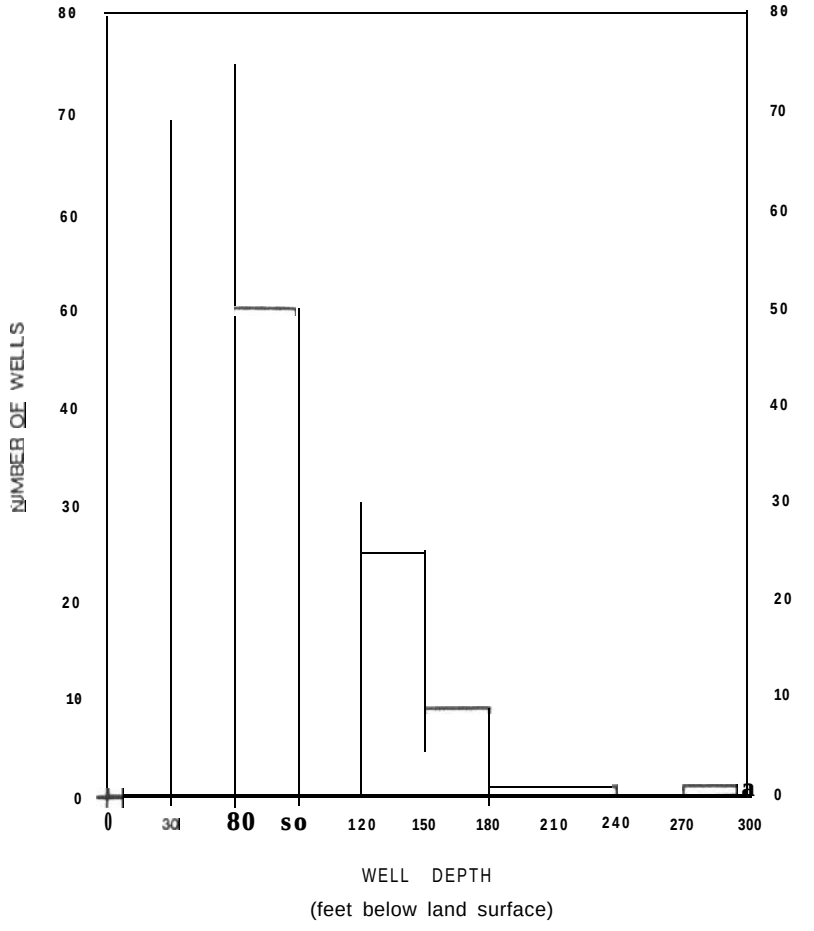

Figure 1. Reported water well depths in the study area.

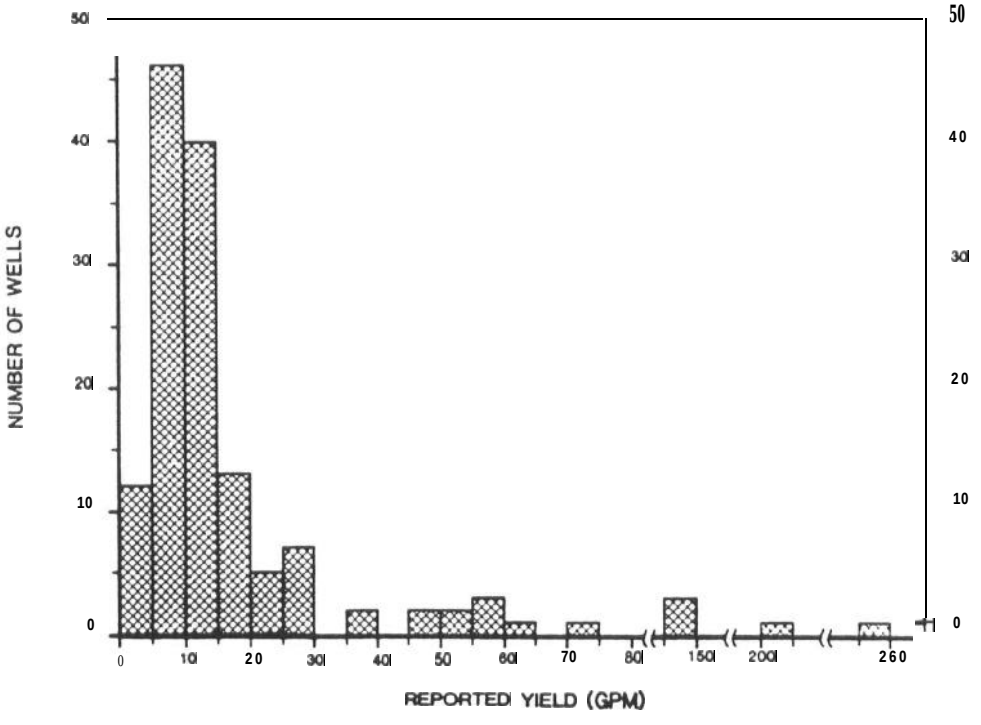

Figure 2. Reported well yields in the study area.

and the wellbore and pressure tank were assumed to have been flushed. Field tests were performed using a Hach Total Hardness Test Kit, a Hach Iron Test Kit, Electrolytic Conductivity Measuring Set, an Orion Research digital pH meter, and a Model 4041 Hydrolab. The results of the field tests are summarized in table 1. Eight samples were filtered and preserved in the field and refrigerated prior to shipment to the DGGS laboratory in Fairbanks, Alaska, where analyses were performed according to U.S. EPA or American Public Health Association (APHA) methods. Results of the laboratory testing are summarized in table 2.

GROUND-WATER QUALITY

Water can exhibit varied chemical characteristics, depending on the amount and nature of dissolved material present in the form of inorganic salts, small amounts of organic matter, and small amounts of dissolved gases. The results of sampling done for this study show that ground water in the Houston area is typified by total dissolved solids (TDS) less than 1,000 mg/L, pH values slightly above 7.0, and hardness values above 60 mg/L. Calcium, magnesium, and bicarbonate ions dominate. This is typical of water contained in glacial deposits derived from granitic rock types, but which has also had contact with carbonate minerals (Freeze and Cherry, 1979).

The water is generally of good quality, lacking objectionable taste or odor. Some homeowners in T.17 N., R. 3 W., secs. 2 and 13 feel the ground water in their area contains undesirable amounts of dissolved iron.

Exceptions to the good water quality occur in T. 18 N., R. 3 W., sec. 21. In that section, three neighboring wells (sec. 21, map numbers 2 and 15) produce water of lower quality, evidenced by occasional 'rotten egg' odor typical of the presence of hydrogen sulfide, conductivity values in excess of 650 us, and pH values greater than 9. Water samples from one well were selected for laboratory analysis, and the results show high levels of sodium and orthophosphate, and low levels of calcium and sulfate (table 2, sample 21-2).

The analyses are consistent with results of other studies of sandstone aquifers containing local clay horizons (Freeze and Cherry, 1979). The results could be attributed to geochemical processes involving exchange of calcium for sodium in clay minerals and the oxidation of organic matter by sulfate.

In the study area, sodium levels greater than 50 mg/L appear to be characteristic of ground water in the bedrock aquifer only. Among samples taken from wells finished in sand and gravel aquifers, sodium levels range from 2.07 mg/L to 34.4 mg/L (table 2). The ratio of sodium to calcium and magnesium appears to be higher in the area north of the Castle Mountain fault and the Little Susitna River. The total number of samples analyzed, however, was too low to provide statistically definitive trends.

Trace and nuisance elements for which tests were made are present in small amounts, often below instrument detection limits. Two exceptions are samples 13-18 and 21-2, which contain anomalously high amounts of

orthophosphate (4.8 mg/L and 8.23 mg/L, respectively). Phosphorus is generally present in natural waters at concentrations of less than 1 mg/L (Hem, 1985). Orthophosphate concentrations of approximately 6 mg/L have been associated with weak domestic sewage (Canter, 1985). However, ground water contaminated with septic system effluent typically exhibits elevated levels of chloride and nitrate (Sawyer and McCarty, 1978; Freeze and Cherry, 1979), which is not the case in these samples. Additional data would be necessary to determine if these values are a result of local ground-water contamination from septic systems.

Field measurements were made for pH, specific conductivity, iron, hardness, and temperature (table 1); 8 of 9 pH measurements were within the normal range for ground water (~6.0-8.5). The value of 9.4 for section 21, map number 2, is high.

Specific conductivity values, used to estimate the dissolved-solids content of a water supply, were generally low (less than 350 µs). However, 4 samples (from the three bedrock wells in section 21) had conductivities which ranged from 660 to 1,190 µs, indicating an anomalously high total dissolved-solids content.

Iron values determined in the field for 20 samples ranged from 0.1 to 1.0 mg/L. Two samples, in T. 17 N., R. 3 W., sec. 13 and T. 18 N., R. 3 W., sec. 23, showed values of 5.0 mg/L iron. The maximum concentration of iron acceptable in public drinking water systems is 0.3 mg/L (DEC, 1982). Higher levels may result in objectionable taste or staining of plumbing fixtures and laundry. Homeowners in T. 17 N., R. 3 W., sec. 2 complained of objectionable levels of iron. To correct this problem, they deepened their wells, or installed iron filters. High levels of iron or other metals sometimes occur in a sand and gravel aquifer overlying a silty or clayey layer. In such instances, ground water with a lower iron content may be contained in aquifers lying below the fine-grained layer.

Twenty-eight samples were tested in the field for hardness, a measure of the combined effects of calcium and magnesium (and, to a lesser extent, strontium, iron, and manganese). Water with a high degree of hardness may form scale and may react with soap to prevent foaming. Hem (1985) uses the following classification to describe water hardness:

Hardness range (in mg/L of $CaCO_3$)	Description
0 - 60	soft
61 - 120	moderately hard
121 - 180	hard
more than 180	very hard

Using Hem's classification, 22 samples were moderately hard and four samples were hard. Samples from the three bedrock wells (section 21, map number 2; and section 21, map number 15, sequence numbers 1 and 2) yielded hardness values of 2-16 mg/L and would be classified as soft.

Turner and Wescott (1982) suggested that the lower Susitna basin has a high potential for geothermal ground water--ground water with a temperature higher than normally expected. In our investigation, 33 temperature measurements ranged from 3.5°C (38°F) to 10.0°C (50°F). This is slightly higher than average values for ground water in southcentral Alaska.

WELL INFORMATION

Table 3 contains information from well logs on file at DGGS offices as of May 1986. For further hydrogeologic information, please contact either DGGS (phone: 907-696-0070; P.O. Box 772116, Eagle River, AK 99577) or the U.S. Geological Survey (phone: 907-271-4138; 4230 University Drive, Suite 101, Anchorage, AK 99508-4664).

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Table 1. Water quality field data for the Houston, Alaska area.

Well location						Depth to water	Temp.	Specific conductivity	Iron	Hardness	
T.	R.	Sec.	Sequence no.	Map no.	Date	(ft)	(°C)	(µmhos)	(mg/L)	(mg/L)	pH
17N	3W	1	1	1	08-23-85	44	--	--	--	--	--
17N	3w	2	1	3	09-20-85	31	3.5	90	0.3	75	7.9
17N	3w	2	1	6	07-25-85	84	--	--	--	--	--
17N	3w	4	1	3	07-25-85	--	4.5	160	0.3	85	--
17N	3w	8	1	1	08-05-85	15	4.0	175	0.4	110	--
17N	3W	8	1	2	08-30-85	14	4.0	200	0.4	99	6.9
17N	3w	8	1	2	09-20-85	--	4.0	125	--	--	7.6
17N	3w	11	1	7	06-13-85	42	4.0	145	0.5	86	--
17N	3w	12	1	2	08-05-85	28	6.0	200	0.6	116	--
17N	3w	12	1	6	07-25-85	10	5.0	140	--	61	--
17N	3w	13	1	11	08-06-85	11	4.5	--	5.0	168	--
17N	3w	13	1	15	08-06-85	32	4.0	--	0.4	87	--
17N	3w	13	2	18	09-26-85	28	5.0	100	0.6	68	7.2
17N	3w	14	1	4	06-13-85	29	5.2	150	1.0	98	--
17N	3w	15	1	4	08-06-85	19	4.0	--	0.1	97	--
18N	3w	17	2	3	09-11-85	72	4.7	250	--	--	7.2
18N	3W	21	1	2	08-06-85	18	3.0	660	0.4	16	--
18N	3w	21	1	2	09-11-85	--	--	985	--	--	9.4
18N	3w	21	1	15	08-05-85	--	5.0	1190	0.3	2	--
18N	3w	21	2	15	08-05-85	--	7.0	1130	0.1	5	--
18N	3w	22	1	8	08-02-85	24	5.0	192	4.3	145	--
18N	3w	22	1	9	08-23-85	--	3.0	330	1.0	93	--
18N	3w	22	1	9	09-20-85	--	4.0	190	--	--	8.2
18N	3w	23	1	4	07-24-85	--	4.0	200	5.0	60	--
18N	3W	23	2	5	07-24-85	5	--	--	--	--	--
18N	3w	23	1	6	08-30-85	18	4.5	190	1.5	130	--
18N	3w	25	1	5	07-24-85	104	5.0	150	--	88	--
18N	3w	25	1	7	09-26-85	--	5.0	210	0.4	94	7.2
18N	3w	26	1	1	07-24-85	13	4.0	200	--	135	--
18N	3w	26	1	2	09-26-85	--	4.0	170	0.2	70	--
18N	3w	26	1	2	10-03-85	125	5.0	100	--	--	7.2
18N	3w	26	1	3	08-30-85	6	10.0	230	--	100	--
18N	3w	26	1	3	02-26-86	7	9.5	--	1.0	99	--
18N	3w	34	1	2	07-24-85	63	4.0	180	--	92	--
18N	3w	35	1	1	07-18-85	63	6.0	230	--	73	--
18N	3w	35	1	2	08-23-85	--	6.0	--	1.2	80	--
18N	3w	35	1	3	07-18-85	22	--	--	--	--	--
18N	3w	36	1	1	08-23-85	117	6.0	--	0.8	83	--

-- = not determined.

Table 2. Laboratory analyses of ground water in the Houston, Alaska area. Measurements other than gross alpha are in mg/L. Gross alpha is measured in picocuries perliter. Samples are identified by section number followed by map number.

Constituent	Sample locations and date													
	2-3 09-20-85	2-3[a] 03-19-84	8-2 09-20-85	13-18 09-26-85	17-3 09-11-85	21-2 09-11-85	21-2[a] 06-11-85	21-12[a] 10-06-83	22-1[b] 08-22-69	22-8[a] 05-21-84	22-9 09-20-85	25-7 09-26-85	26-2 09-26-85	EPA/[c] DEC
Sodium	2.07	--	4.69	5.22	8.54	232	260	27	4.6	6.3	34.4	3.58	3.16	250
Potassium	0.53	--	1.12	0.68	0.87	1.28	0.59	3.1	0.6	--	1.61	0.86	0.70	--
Magnesium	1.10	--	1.47	1.68	1.47	0.69	0.30	25	3.1	—	2.51	2.01	1.36	--
Calcium	4.01	--	6.67	5.00	5.30	tr	0.57	--	13	--	5.61	7.89	6.87	—
Strontium	0.05	--	0.10	0.14	0.10	0.01	--	--	0.1	--	0.31	0.12	0.08	--
Barium	< 0.001	< 0.05	0.01	< 0.001	0.036	< 0.001	0.010	--	0.1	0.029	0.042	< 0.001	< 0.001	1
Sulfate	1.28	--	2.80	3.87	0.05	0.16	--	14.0	0.0	--	tr	1.69	2.01	250
Nitrate	< 0.01	< 0.10	< 0.01	< 0.01	< 0.01	< 0.01	< 0.5	0.20	1.7	< 0.5	< 0.01	< 0.01	< 0.01	10
Phosphate	< 0.01	--	< 0.01	4.80	< 0.01	8.23	--	--	--	--	< 0.01	< 0.01	< 0.01	--
Fluoride	< 0.01	< 0.10	< 0.01	0.05	< 0.01	0.69	0.5	--	0.0	--	0.83	0.04	< 0.01	2.4
Chloride	1.24	--	1.20	1.00	1.05	0.46	--	< 1.0	5.3	--	2.63	1.20	1.78	250
Bromide	< 0.01	--	< 0.01	< 0.01	< 0.01	< 0.01	--	--	--	—	< 0.01	< 0.01	< 0.01	--
Silica	4.33	--	3.47	3.89	5.63	2.00	--	--	20	--	2.71	4.90	4.16	--
Boron	0.039	--	0.044	0.055	0.040	0.377	--	--	--	--	0.075	0.041	0.040	--
Arsenic	< 0.002	0.002	0.012	0.021	< 0.002	< 0.002	0.015	--	--	< 0.005	< 0.002	< 0.002	< 0.002	0.05
Al uni num	0.034	--	0.037	0.066	0.008	0.036	< 0.040	--	--	--	0.039	0.037	0.048	—
Copper	0.021	--	< 0.01	< 0.01	< 0.01	< 0.01	0.044	--	0.24	--	< 0.01	0.016	0.050	1
Iron	0.158	--	0.195	0.443	--	0.066	0.037	--	0.02	0.045	0.660	0.056	0.061	0.3
Manganese	0.010	--	0.051	0.096	--	< 0.005	< 0.005	< 0.05	0.00	< 0.005	0.013	0.005	0.007	0.05
Lead	< 0.03	< 0.01	< 0.03	< 0.03	< 0.03	< 0.03	< 0.005	--	0.03	< 0.005	< 0.03	< 0.03	< 0.03	0.05
Zinc	0.048	--	0.008	0.005	0.120	0.028	0.020	--	0.24	--	0.272	0.943	1.304	5
Chromium	< 0.002	< 0.01	< 0.002	< 0.002	< 0.002	< 0.002	< 0.005	--	0.02	0.008	< 0.002	< 0.002	< 0.002	0.05
Selenium	< 0.02	< 0.001	< 0.02	< 0.02	< 0.02	< 0.02	< 0.002	--	0.01	< 0.002	< 0.02	< 0.02	< 0.02	0.01
Cross Alpha	< 1	--	< 1	< 1	< 1	< 1	< 1	--	--	< 1	< 1	< 1	< 1	--

[a] DEC records.
[b] USGS records.
[c] DEC/EPA Public Drinking Water recommended limits.
-- = not determined.

Explanation of table headings for Table 3

Well locations: Wells are located using the township, range, and section of the official rectangular subdivision of public lands (T. = township, R. = range, Sec. = section). Sections are divided into 2.5 aliquot parcels, and wells within each parcel are represented on Plate 1 by a single open circle. The circles, located on the center of the 2.5 acre parcels, are correlated to the text with map numbers. Note that all wells within a particular 2.5 acre parcel are assigned the same map number; therefore, a single map number may refer to two or more wells. Wells with the same map number are numbered sequentially. Thus, every well is uniquely described by township, range, section, sequence number, and map number.

Contractor: The name of the drilling company is given in preference to the individual operating the rig, when applicable.

Date completed: Date well installation completed as reported by owner or contractor.

Depth drilled: Maximum depth drilled in feet below land surface, as reported by owner or contractor.

Depth to water: Depth in feet to water as reported by owner or contractor (or government personnel involved in survey). Depths are assumed to represent a static water surface; that is, a natural level not influenced by recent withdrawal of water from the well. A non-static depth to water may be inadvertently reported as static in some instances.

Well yield: The rate, in gpm, that water has been extracted from the well during a short test period. Usually, this testing is accomplished by pumping or bailing for ½-2 hrs. Caution: this entry often does not reflect the long-term capacity of the well to supply water, and commonly either overstates or understates the full potential of the aquifer at that locality.

Use: Refers to the intended use of the well water at the time well data was acquired, normally when the well was drilled. C = commercial, H = domestic, P = public supply, T = institution, U = unused, Q = aquaculture.

Property description: Where available, legal descriptions (subdivision, lot, block) are used. In the absence of subdivisions, section number and appropriate tax lot number are used.

Table 3. Well data for the Houston, Alaska area. Includes water-supply wells, ground-water monitoring wells, and exploration wells.

T.	R.	Sec.	Sequence no.	Map no.	Contractor	Date completed	Depth drilled (ft)	Depth to water (ft)	Well yield (gpm)	Use	Property description
17N	3W	1	1	1	Moon Drl	05-04-84	60	--	15	H	Meadowview Sub L6A B1
17N	3W	2	1	5	L&M Drl	10-28-77	85	56	10	H	Sec 2 Lot A18
17N	3W	2	1	4	Cees Wtr Wls	08-30-85	78	68	10	H	Rainey Sub L6 B1
17N	3W	2	1	1	Valley Drl	08-31-82	78	56	10	H	Section 2
17N	3W	2	2	1	McKay Drl	09-03-83	98	75	12	H	Rainey Sub L4 B1
17N	3W	2	1	2	Unknown	--	129	--	--	H	Section 2 Lot All
17N	3W	2	1	6	Wheaton Wtr	11-08-83	121	70	15	H	Rainey Sub L2 B1
17N	3W	2	2	6	Penn Jersey Drl	05-l l-84	115	--	15	H	Rainey Sub L3 B1
17N	3W	2	1	3	Magnuson Drl	03-19-84	110	32	150	T	Section 2 Lot B4
17N	3W	4	1	1	Owner	00-00-66	17	6	--	H	--
17N	3W	4	2	1	M-W Drl	08-22-84	79	23	10	H	Lake Mount Est L2 B1
17N	3W	4	1	4	Wheaton Wtr	11-27-81	80	20	6	H	Lakefront Sub L4
17N	3W	4	1	6	McKay Drl	00-00-83	42	--	--	H	Lake Mount Est L5 B3
17N	3W	4	1	3	Hartner Drl	09-l 7-76	88	25	10	H	Lake Mount Est L5 B6
17N	3W	4	1	5	Hartner Drl	06-21-80	35	0	20	H	Lake Mount Est L8 B9
17N	3W	4	1	2	Moffitt Drl	05-26-70	39	36	10	H	Beaver Lake
17N	3W	8	1	1	D&E Drl	1 o-30-76	54	24	10	H	Freeman Sub 1 L3 B6
17N	3W	8	1	2	Blue Bear Drl	02-08-77	71	11	25	H	Freeman Sub 1 L15 B3
17N	3W	8	1	3	Triple M Cab	12-02-81	50	19	12	H	Freeman Sub 1 L1 B8
17N	3W	8	1	4	Unknown	09-l 2-75	50	30	20	H	Freeman Sub 1 L1 B3
17N	3W	8	1	5	Moon Drl	06-04-79	50	22	15	H	Freeman Sub 1 L12 B9
17N	3W	8	1	6	Triple M Cab	05-01-81	60	5	20	H	Freeman Sub 1 L1 B9
17N	3W	9	1	2	Patrick	00-00-74	42	17	15	H	Section 9
17N	3W	9	1	3	Larson L	00-00-64	56	26	--	H	--
17N	3W	9	1	5	L&M Drl	06-27-73	56	6	--	H	Beaver Lake Sub L8 B4
17N	3W	9	1	1	M-W Drl	06-l l-75	56	10	5	H	Beaver Lake Sub L9 B6
17N	3W	9	1	7	Patrick Bi 11	00-00-75	100	--	--	H	Beaver Lake Sub L3 B7
17N	3W	9	1	4	C&C Drl	00-00-66	58	41	20	T	Wasilla Assembly Church Camp
17N	3W	9	1	6	Cielarowski Drl	08-l 6-85	41	19	15	H	Texas Sub L15-16 B5
17N	3W	10	1	1	Blue Bear Drl	08-28-82	51	22	5	H	01 d Toby Town Sub L10 B1
17N	3W	11	1	6	Cielarowski Drl	00-00-85	81	41	10	H	Section 11 Lot A3
17N	3W	11	1	7	Wheaton Wtr	06-08-81	61	40	10	H	Section 11 Lot A15
17N	3W	11	1	2	Valley Drl	07-l 9-82	54	6	12	H	Long Lake Sub L7 B1
17N	3W	11	1	1	McKay Drl	07-09-77	42	9	30	H	Lona Lake Sub L5 B2
17N	3W	11	1	4	Unknown	00-00-75	43	--	--	H	Long Lake Sub Ad1 L7
17N	3W	11	2	4	Pioneer Drl	07-l 5-85	40	10	30	H	Long Lake Sub Ad1 L1
17N	3W	11	1	3	Frontier Drl	05-07-84	50	20	20	H	Long Lake Sub Ad1 L5
17N	3W	12	1	2	C&C Drl	00-00-66	91	21	10	H	Section 12 Lot A8
17N	3W	12	1	7	Wheaton Wtr	06-08-81	61	40	10	H	Section 12 Lot A15
17N	3W	12	1	6	Unknown	--	46	--	--	H	Section 12 Lot B6
17N	3W	12	1	8	Wheaton Wtr	07-08-82	161	55	15	H	Capitol Corridors Sub L1 B1
17N	3W	12	1	1	Owner	00-00-58	12	8	--	H	Section 12

T.	R.	Sec.	Sequence no.	Map no.	Contractor	Date completed	Depth drilled (ft)	Depth to water (ft)	Well yield (gpm)	Use	Property description
17N	3W	12	1	3	Unknown	--	42	--	--	H	Section 12
17N	3W	12	1	5	ADH	12-00-62	14	--	--	U	Houston area
17N	3W	12	1	4	C&C Drl	--	25	7	15	T	Big Lake Baptist Church
17N	3W	12	2	4	McKay Drl	10-21-83	65	17	15	T	Section 12 Lot D6
17N	3W	12	1	10	Meshew Tommy	06-06-78	61	--	50	H	Section 12 Lot D10
17N	3W	13	1	7	Big Dipper	00-00-84	37	--	10	H	Woody Lake Est L2 B3
17N	3W	13	1	2	C&C Drl	07-14-72	43	32	15	H	Lakeway Woods Sub L6 B2
17N	3W	13	1	8	Wheaton Wtr	11-09-84	60	30	25	H	Woody Lake Est L2 B1
17N	3W	13	1	9	Wheaton Wtr	11-09-84	60	30	20	H	Woody Lake Est L1 B1
17N	3W	13	1	11	Hood & Sons	10-20-85	105	13	15	H	Woody Lake Est L9 B1
17N	3W	13	1	12	Williams Jay	08-16-84	81	41	15	H	Woody Lake Est L12 B4
17N	3W	13	1	3	Unknown	--	50	24	--	H	Woody Lake Est Adl L17 B4
17N	3W	13	1	21	Wheaton Wtr	11-09-83	60	30	10	H	Woody Lake Est L10 B3
17N	3W	13	1	1	M-W Drl	08-l l-78	57	--	10	H	Woody Lake South Sub L20 B1
17N	3W	13	1	13	Penn-Jersey	08-01-83	79	--	15	H	Wood; Lake South Sub L11 B1
17N	3W	13	1	4	Unknown	--	69	--	--	H	Woody Lake South Sub L13 B1
17N	3W	13	1	10	Penn-Jersey	08-l 6-83	85	--	12	H	Woody Lake South Sub L16 B3
17N	3W	13	1	14	Hartner Drl	09-01-77	53	33	10	H	Woody Lake South Sub L6 B1
17N	3W	13	2	14	Blue Bear Drl	00-00-76	120	--	--	H	Woody Lake South Sub L7 B1
17N	3W	13	1	20	Penn-Jersey	00-00-78	78	--	--	H	Woody Lake South Sub L9 B1
17N	3W	13	1	5	Penn-Jersey	05-14-85	110	26	30	H	Wood; Lake South Sub L1 B1
17N	3W	13	1	15	Penn-Jersey	04-27-79	84	37	10	H	Woody Lake South Sub L4 B3
17N	3W	13	1	16	Swanson Drl	05-22-83	79	--	15	H	Woody Lake South Sub L9 B3
17N	3W	13	1	18	Blue Bear Drl	06-04-78	92	26	15	H	Wood; Lake South Sub L25 B1
17N	3W	13	2	18	Wheaton Wtr	01-20-83	140	25	25	H	Woody Lake South Sub L26 B1
17N	3W	13	1	19	Blue Bear Drl	07-26-81	86	20	15	H	Woody Lake South Sub L2 B5
17N	3W	13	1	22	Meshew Tommy	05-00-78	86	--	20	H	Woody Lake South Sub L3 B5
17N	3W	13	2	22	Blue Bear Drl	06-l 2-83	84	29	15	H	Woody Lake South Sub L4 B5
17N	3W	13	1	6	T&T Drl	07-22-84	96	50	3	H	Woody Lake South Sub L6 B5
17N	3W	13	1	17	Blue Bear Drl	06-l 3-78	89	27	20	H	Woody Lake South Sub L22 B3
17N	3W	14	1	3	Owner	--	22	--	--	H	
17N	3W	14	1	2	C&G Drl	00-00-70	84	0.7	10	H	Pailard Homestead
17N	3W	14	1	1	C&G Drl	00-00-65	41	13	10	H	Big Lake Rd
17N	3W	14	1	4	Davis Drl	09-03-84	76	50	15	H	Section 14 Lot D9
17N	3W	15	1	13	Meshew Tomny	1 O-01 -77	55	50	10	H	Birch Park Sub L3 B4
17N	3W	15	1	4	H & H Drl	08-06-80	80	40	30	H	Bia Lake Heiahts 1 L11 B3
17N	3W	15	1	14	Houston Drl	00-00-77	50	30	52	H	Big Lake Heights L11 B4
17N	3W	15	1	3	Blue Bear Drl	05-30-81	82	--	15	H	Big Lake Heights L14 B3
17N	3W	15	1	5	Friesen Drl	08-l 9-83	100	15	60	H	Bio Lake Heiohts L3 B7
17N	3W	15	1	18	Friesen Drl	04-06-84	41	23	5	H	Big Lake Heights L4 B2
17N	3W	15	1	6	Williams Jay	07-14-80	40	20	15	H	Bia Lake Heiahts L20 B1
17N	3W	15	1	7	Custom Wtr	07-07-79	52	30	8	H	Big Lake Heights L17 B1
17N	3W	15	1	8	Unknown		100	--	--	H	Big Lake Heights L1 B3
17N	3W	15	1	9	Moon Drl	07-26-83	80	--	40	H	Big Lake Heights L5 B6
17N	3W	15	1	10	McKay Drl	11-15-84	70	--	30	H	Big Lake Heights L18 B4
17N	3W	15	1	11	Wheaton Wtr	09-l 6-82	80	20	12	H	Ma Barker Sub L3

T.	R.	Sec.	Sequence no.	Map no.	Contractor	Date completed	Depth drilled (ft)	Depth to water (ft)	Well yield (gpm)	Use	Property description
17N	3W	15	2	11	Hartner Drl	08-20-76	80	20	8	H	Ma Barker Sub L4
17N	3W	15	1	1	McKay Drl	09-l 9-76	33	12	15	H	Ma Barker Sub L5
17N	3W	15	2	1	Custom Drl	07-26-76	50	30	8	H	Ma Barker Sub L9
17N	3W	15	1	12	Hartner Drl	06-l 8-78	30	15	10	H	Ma Barker Sub L6
17N	3W	15	1	15	Hartner Drl	07-1 3-76	40	19	10	H	Birch Park Sub L14 & 15 B3
17N	3W	15	1	2	Hartner Drl	11-26-76	120	--	20	H	Birch Park Sub Ad1 L11 B2
17N	3W	15	1	19	Cielarowski Drl	06-05-85	81	46	10	H	Birch Park Sub L4 B1
17N	3W	15	1	16	Moon Drl	1 O-l 8-84	164	--	150	H	Birch Park Sub Ad1 L5 B2
17N	3W	15	2	16	WWD Wtr Well	1 O-01 -82	141	28	20	H	Birch Park Sub Ad1 L6 B2
17N	3W	15	1	17	Hartner Drl	06-21-75	80	27	10	H	Birch Park Sub Ad1 L7 B2
17N	3W	16	1	4	Rebi schke J	00-00-83	50	--	--	H	Stephan Lake Sub L7
17N	3W	16	1	2	G&G Drl	--	53	6	10	H	Rocky Lake Sub L12 B1
17N	3W	16	1	3	Western States	10-13-76	54	14	25	H	Big Lake Fish Hatchery Duplex
17N	3W	16	2	3	Western States	11-18-76	46	9	--	T	Big Lake Fish Hatchery Well 2
17N	3W	16	3	3	Western States	--	31	8	--		Big Lake Fish Hatchery Well 3
17N	3W	16	4	3	M-W Drl	02-16-78	31	7	54	Q	Big Lake Fish Hatchery Well A
17N	3W	16	5	3	M-W Drl	02-l 6-78	27	8	150	Q	Big Lake Fish Hatchery Well B
17N	3W	16	6	3	M-W Drl	09-07-78	182	7	250	Q	Big Lake Fish Hatchery
17N	3W	16	7	3	M-W Drl	03-08-78	36	5	205	Q	Big Lake Fish Hatchery Well D
17N	3W	16	1	1	Hatch Drl	05-14-71	62	5	10	P	Rocky Lake
18N	3W	17	1	1	Owner	00-00-62	50	17	--	H	Section 17
18N	3W	17	1	4	Cielarowski	05-09-85	58	36	15	H	Section 17 Lot C4
18N	3w	17	1	2	Unknown	00-00-65	135	82	--	U	Section 17 Lot C6
18N	3W	17	1	3	Moon Drl	00-00-68	130	--	--	H	Section 17 Lot C6
18N	3w	17	2	3	Moon Drl	07-26-76	82	--	15	H	Section 17 Lot Cl
18N	3W	18	1	4	Unknown	00-00-50	140	--	--	H	Section 18
18N	3W	18	1	2	Unknown	00-00-64	150	--	--	C	Section 18 Lot D3
18N	3W	18	1	3	C&C Drl	--	118	96	10	C	Section 18
18N	3W	18	1	1	USBM	08-18-52	386	--	--	--	Section 18
18N	3W	20	1	3	Denali Drl	08-02-84	35	12	--		Section 20 Lot A4
18N	3W	20	2	3	Denali Drl	08-03-84	30	--	--	T	Secti on 20 Lot A4
18N	3W	20	1	1	USBM	11-10-51	481	471	--	--	Matanuska coal field
18N	3W	20	1	2	USBM	08-05-52	1142	555	--	--	Matanuska coalfield
18N	3w	21	1	12	Denali Drl	08-07-84	28	7	--	T	Section 21 Lot Al
18N	3w	21	1	11	Anch G&O Dev	1 o-09-61	1627	--	--	U	Rosetta #4
18N	3w	21	2	11	Hackathorn D	09-24-62	2407	--	--	U	Rosetta #4A
18N	3W	21	1	3	Acme Drl	11-20-69	85	12	--	H	Section 21
18N	3W	21	1	15	McKay Drl	03-19-81	137	--	6	H	Heath Hts Sub Tr A
18N	3W	21	2	15	McKay Drl	00-00-85	160	32	--	H	Heath Hts Sub Tr A
18N	3w	21	1	2	C&C Drl	00-00-65	100	18	3	T	Heath Hts Sub Tr D
18N	3W	21	1	1	G&G Drl	--	27	11	8	H	Section 21
18N	3w	21	1	9	Frontier Drl	12-08-69	141	18	3	H	Bryant Sub No 1 L13
18N	3W	21	2	8	Meshew Tommy	--	43	--	50	C	Bryant Sub No 2 L8
18N	3W	21	1	8	Moffitt Drl	00-00-70	30	11	--	H	Bryant Sub No 1 L8

T.	R.	Sec.	Sequence no.	Map no.	Contractor	Date completed	Depth drilled (ft)	Depth to water (ft)	Well yield (gpm)	Use	Property description
18N	3W	21	1	6	Cratiot Dick	00-00-76	32	--	--	H	Bryant Sub No 1 L1 & 2
18N	3w	21	2	6	Cl ements RE	00-00-72	26	10		H	Bryant Sub No 1 L 3
18N	3W	21	3	6	Blue Bear Drl	11-16-78	280	48	2	H	Bryant Sub No 1 L3
18N	3w	21	1	7	Clements	00-00-74	33	12	--	H	Bryant Sub No 1 L6
18N	3w	21	2	7	Cl ements	07-00-72	23	12	--	H	Bryant Sub No 1 L7
18N	3W	21	3	7	--	00-00-69	50	20	--	H	Bryant Sub No 1 L4
18N	3w	21	1	10	Unknown	--	30	7	--	H	Bryant Sub No 2 L7
18N	3w	21	1	4	Clements	00-00-73	27	--	--	C	Bryant Sub No 2 L9
18N	3w	21	1	5	Cl ements	00-00-73	25	4	--	U	Bryant Sub No 2 L8
18N	3w	21	1	13	Meshew Tommy	06-l 5-78	55	--	--	H	Bryant Sub No 2 L8
18N	3W	22	1	2	ADH	11-00-63	22	--	--	U	Section 22
18N	3w	22	1	3	Unknown	00-00-76	50	14	--	H	Section 22
18N	3W	22	1	6	Unknown	--	25	7	--	U	Bryant Sub No 2
18N	3w	22	1	7	Owner	00-00-76	175	--	--	U	Bryant Sub No 2
18N	3W	22	1	1	Owner	00-00-58	35	7	--	P	Houston Lodge
18N	3W	22	1	5	Moon Drl		51	48	--		Section 22
18N	3w	22	1	8	Blue Bear Drl	06-23 -82	75	26	65	--	Houston Fire Department
18N	3W	22	1	9	Blue Bear Drl	05-29-81	100	--	25		Houston Wayside Park
18N	3W	22	1	4	Owner	00-00-59	28	20	--	H	Section 22
18N	3W	23	1	5	Meshew Tommy	04-00-77	130	8	--	H	Susitna Heights Sub L5 B5
18N	3W	23	2	5	Owner	--	30	20	--	H	Susitna Heights Sub L4 B5
18N	3W	23	3	5	Davis Wel 1	03-04-83	38	9	4	H	Susitna Heights Sub L5 B5
18N	3W	23	4	5	Friesen Drl	1 O-24-83	100	5	16	H	Susitna Heights Sub L4 B5
18N	3W	23	1	2	Meshew Tommy	06-28-77	125	--	--	H	Susitna Heights Sub L5 B6
18N	3W	23	1	1	Trovero Di no		33	21	--	H	Susitna Heights Sub L5 B8
18N	3W	23	2	1	Trovero Di no	01-00-76	33	21	--	H	Susitna Heights Sub L4 B8
18N	3W	23	1	4	Unknown	--	32	27	--	H	Susitna Heights Sub L6 B8
18N	3W	23	2	4	Ciel arowski	08-21-85	48	13	20	H	Susitna Heights Sub L6 B8
18N	3W	23	1	6	Meshew Tommy	09-28-77	50	--	10	H	Susitna Heights Sub L2 B7
18N	3W	23	1	3	Meshew Tommy	10-l 2-77	50	40	10	H	Susitna Heights Sub L1 B8
18N	3W	24	1	1	Blue Bear Drl	10-01-82	69	17	15	H	Section 24 Lot D11
18N	3W	25	1	1	M-W Drl	07-25-83	39	6	30	H	Enchanted Forest Sub L30 B4
18N	3W	25	1	2	Unknown	--	50	8	--	H	Loch Haven Est L8 B1
18N	3W	25	1	3	Penn-Jersey	03-03-83	127	101	10	H	Enchanted Forest Sub L26 B15
18N	3W	25	1	8	McKay Drl	--	108	--	--	H	Enchanted Forest Sub L9 B15
18N	3W	25	1	12	Moon Drl	05-23-84	81	73	60	H	Enchanted Forest Sub L2 B24
18N	3W	25	1	9	Delta Drl	--	217	142	10	H	Enchanted Forest Sub L6A B31
18N	3W	25	1	4	Holohan Dr 1	07-1 8-85	120	110	20	H	Enchanted Forest Sub L5 B29
18N	3W	25	1	5	Unknown	00-00-78	117	--	--	H	Enchanted Forest Sub L6 B26
18N	3W	25	1	11	Moon Drl	10-25-84	141	--	40	H	Enchanted Forest Sub L9 B26
18N	3W	25	1	6	Friesen Drl	06-28-85	122	116	8	H	Enchanted Forest Sub L8 B28
18N	3W	25	1	7	Penn-Jersey	04-30-79	134	126	5	H	Enchanted Forest Sub L11 B28
18N	3W	25	1	10	McKay Drl	08-1 6-83	135	118	12	H	Enchanted Forest Sub L15 B32
18N	3W	25	2	10	Unknown	07-00-82	109	--	--	H	Enchanted Forest Sub L1 B33

T.	R.	Sec.	Sequence no.	Map no.	Contractor	Date completed	Depth drilled (ft)	Depth to water (ft)	Well yield (gpm)	Use	Property description
18N	3W	26	1	3	Unknown	00-00-78	36	--	60	H	Enchanted Forest Sub L1 B7
18N	3W	26	1	6	Blue Bear Drl	00-00-82	103	--	--	H	Enchanted Forest Sub L6 B7
18N	3W	26	1	1	Meshew Tomny	06-l O-77	41	--	0.8	H	Enchanted Forest Sub L2 B3
18N	3W	26	1	7	Owner	00-00-75	12	--	--	H	Enchanted Forest Sub L6 B9
18N	3W	26	1	13	Pioneer Drl	08-30-84	40	7	75	H	Enchanted Forest Sub L8 B9
18N	3W	26	1	8	Denali Drl	09-01-84	30	12	12	H	Enchanted Forest Sub L2 B13
18N	3W	26	1	9	Durbin Drl	05-07-84	38	16	30	H	Enchanted Forest Sub L2 B10
18N	3W	26	1	4	Moon Drl	08-l 6-84	161	--	11	H	Enchanted Forest Sub LO9 B13
18N	3W	26	2	4	Moon Drl	08-l 6-85	161	--	11	H	Enchanted Forest Sub L19 B13
18N	3W	26	3	4	Moon Drl	06-25-84	151	--	--	H	Enchanted Forest Sub L18 B13
18N	3W	26	1	10	Val ley Drl	07-11-79	140	124	8	H	Enchanted Forest Sub L21 B16
18N	3W	26	2	10	Moon Drl	11-27-78	146	--	5	H	Enchanted Forest Sub L20 B16
18N	3W	26	1	11	McKay Drl	03-03-83	128	114	15	H	Enchanted Forest Sub L2 B15
18N	3W	26	1	12	Moon Drl	05-22-80	162	146	12	H	Enchanted Forest Sub L2 B16
18N	3W	26	1	5	Unknown	00-00-85	160	--	13	H	Enchanted Forest Sub L1 B16
18N	3W	26	1	2	Valley Drl	08-27-82	150	135	10	H	Enchanted Forest Sub L4 B16
18N	3W	27	1	1	Owner	00-00-55	15	--	--	H	Section 27
18N	3W	27	1	2	Unknown	00-00-60	105	--	--	H	Section 27 Lot D7
18N	3W	32	1	1	Lovely Lum	02-09-70	8454	--	--	U	Section 32
18N	3W	34	1	1	Unknown	--	100	--	--	H	Horizon West Sub 1 L1 B3
18N	3w	34	2	1	Friesen Drl	07-00-84	65	--	--	H	Horizon West Sub 1 L4 B1
18N	3w	34	1	4	Unknown	00-00-54	80	--	--	H	Section 34 Lot A6
18N	3w	34	1	5	Wheaton Wtr	00-00-82	147	--	--	H	Section 34 Lot A5
18N	3w	34	1	2	Williams Jay	08-08-84	100	60	10	H	Horizon West Sub 1 L8 B1
18N	3w	34	1	6	Wheaton Wtr	--	97	--	--	H	Section 34 Lot B4
18N	3w	34	2	6	Wheaton Wtr	--	97	--	--	H	Section 34 Lot B4
18N	3w	34	1	7	Moon Drl	00-00-74	--	--	--	H	Section 34 Lot B4
18N	3w	34	1	3	Owner	00-00-53	16	--	--	U	Section 34 Lot D1
18N	3w	35	1	12	Unknown	--	86	--	--	H	Bearpaw Lake Sub L4 B2
18N	3w	35	1	13	Unknown	--	125	--	--	H	Bearpaw Lake Sub L11 B6
18N	3w	35	1	4	Moon Drl	04-07-82	86	--	10	H	Dehart Acres Sub L1
18N	3w	35	1	1	M-W Drl	05-07-76	86	68	10	H	Dehart Acres Sub L2 B1
18N	3w	35	1	2	Hartner Drl	06-24-76	88	60	10	H	Section 35 Lot B1
18N	3w	35	1	3	Wheaton Wtr	11-09-83	60	25	15	H	Horizon West Sub 1 L2 B5
18N	3w	35	1	5	Penn-Jersey	01-03-85	44	--	8	H	Gaunt Sub L4 B1
18N	3w	35	1	6	Penn-Jersey	04-18-85	49	--	15	H	Gaunt Sub L10 B1
18N	3w	35	1	7	McKay Drl	1 o-09-84	78	54	15	H	Gaunt Sub L12 B2
18N	3w	35	1	8	Unknown	00-00-75	57	--	--	H	Tall Birch Sub 1 2nd Rplt L3 B3
18N	3w	35	2	8	McKay Drl	08-09-82	102	88	12	H	Tall Birch Sub L4 B3
18N	3w	35	1	9	Wilson Well Drl	12-00-75	115	--	--	H	Tall Birch Sub 1 2nd Rpl t L1 B3
18N	3w	35	1	10	Valley Drl	00-00-79	89	--	--	H	Tall Birch Sub 1 2nd Rpl t L8 B1
18N	3w	35	1	11	CB Drl	06-l 2-78	80	40	6	H	Tall Birch Sub 1 2nd Rpl t L1 B1
18N	3W	36	1	1	McKay Drl	03-21-80	124	110	6	H	Cheri Lake Sub L11 B3
18N	3W	36	1	2	McKay Drl	06-05-80	80	66	5	H	Cheri Lake Sub L2 B2