# REGIONAL WATER PLAN,
# ESTANCIA UNDERGROUND WATER BASIN,
# NEW MEXICO

prepared by

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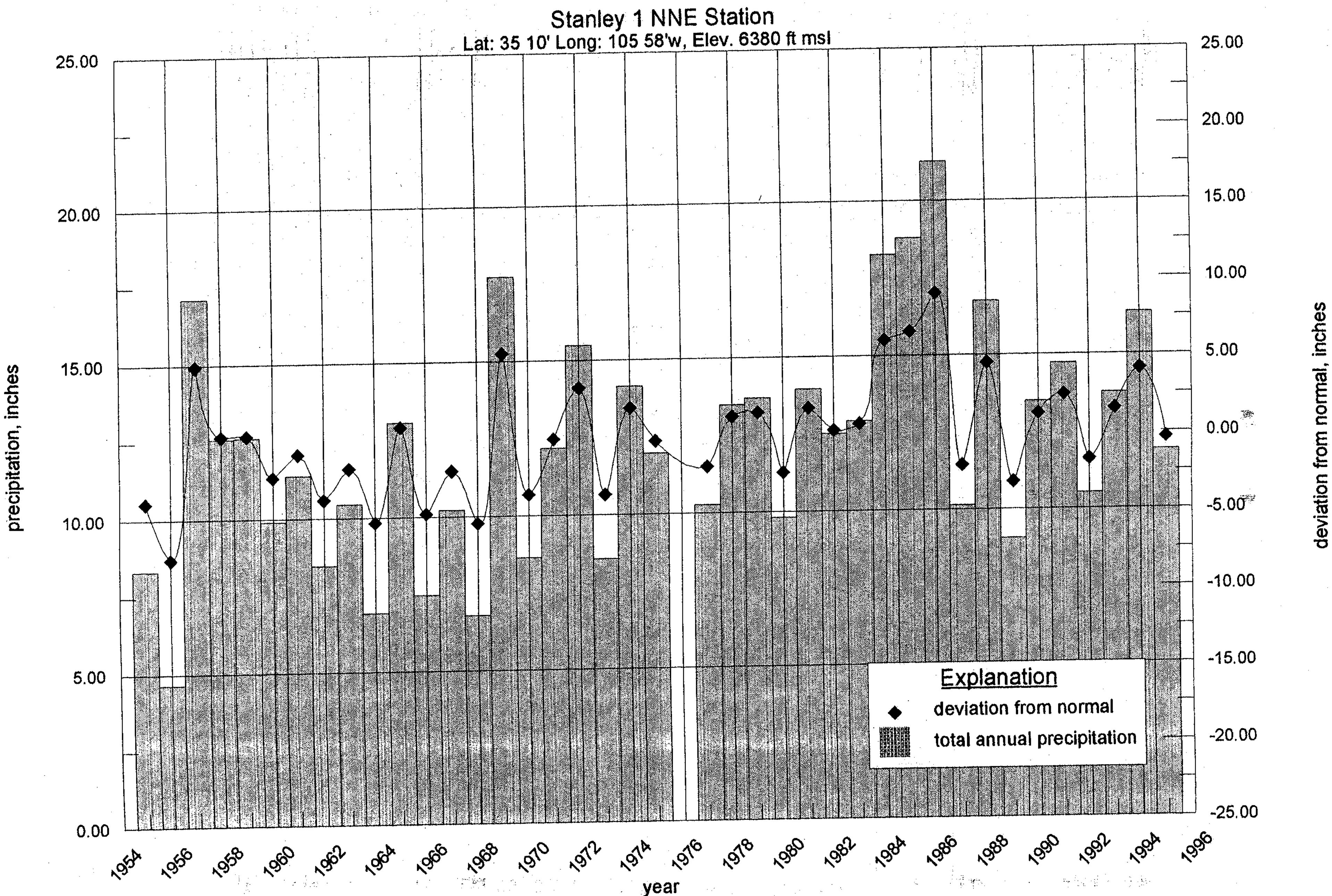
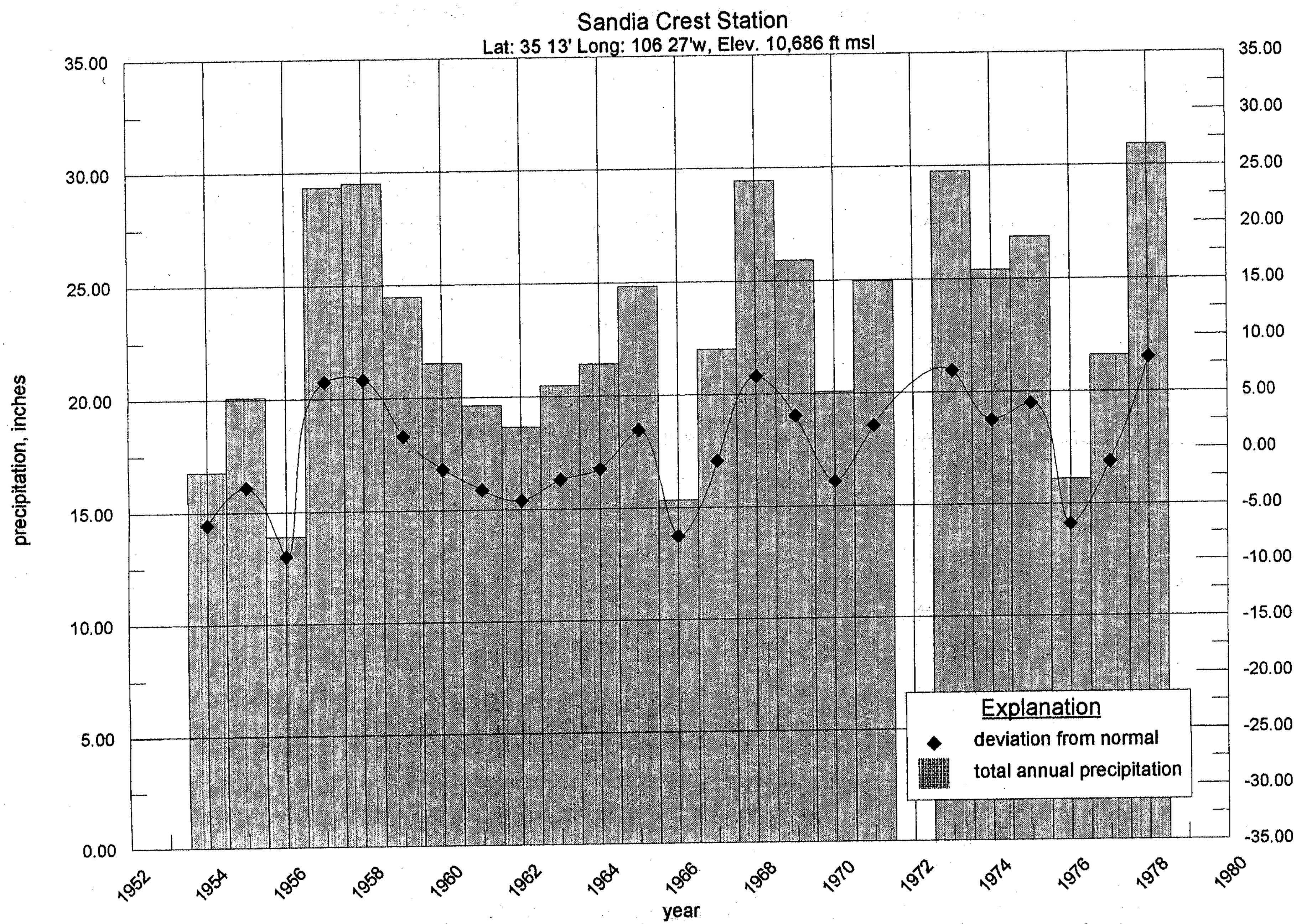
TORRANCE COUNTY
New Mexico

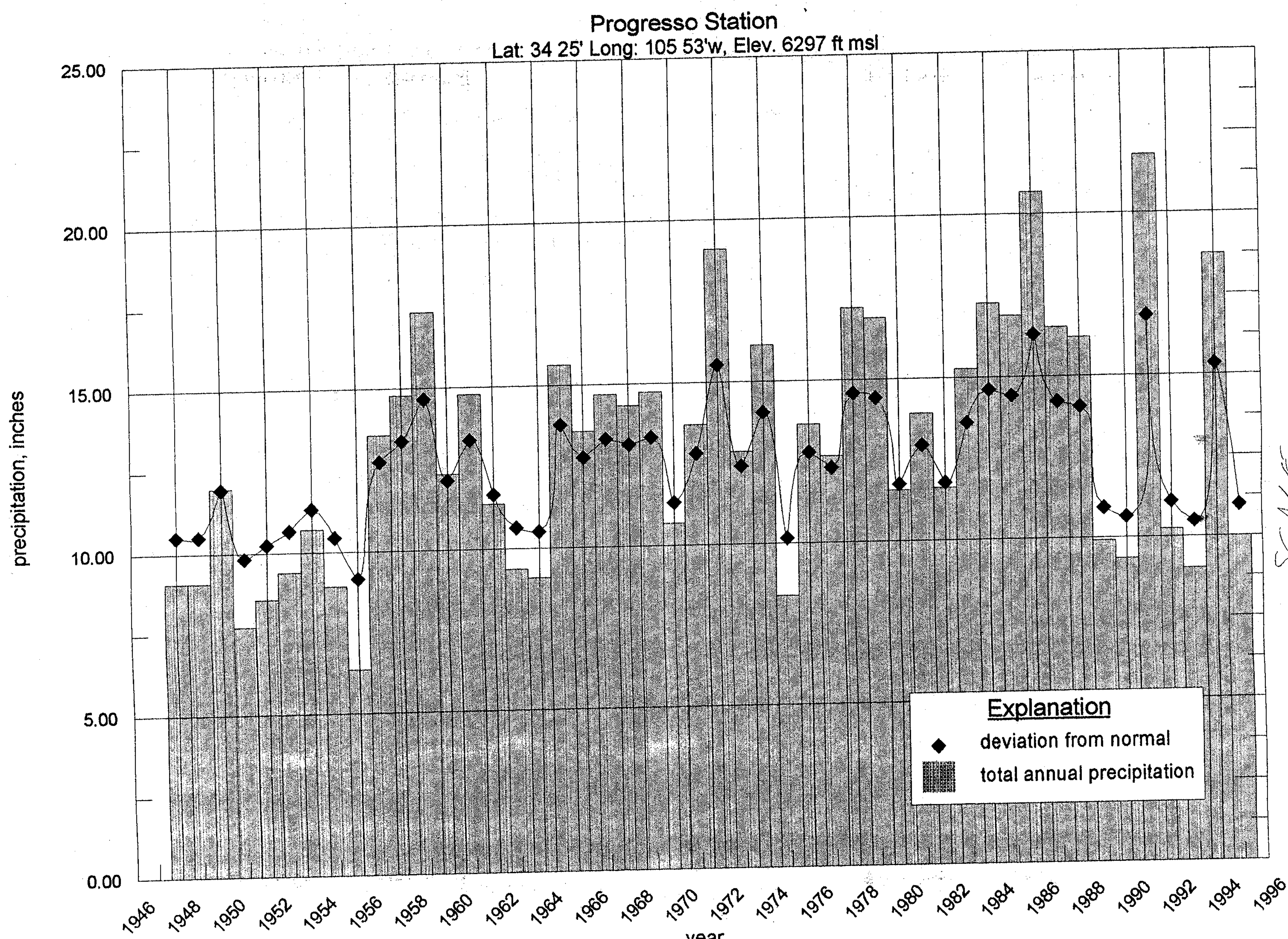
January 1997



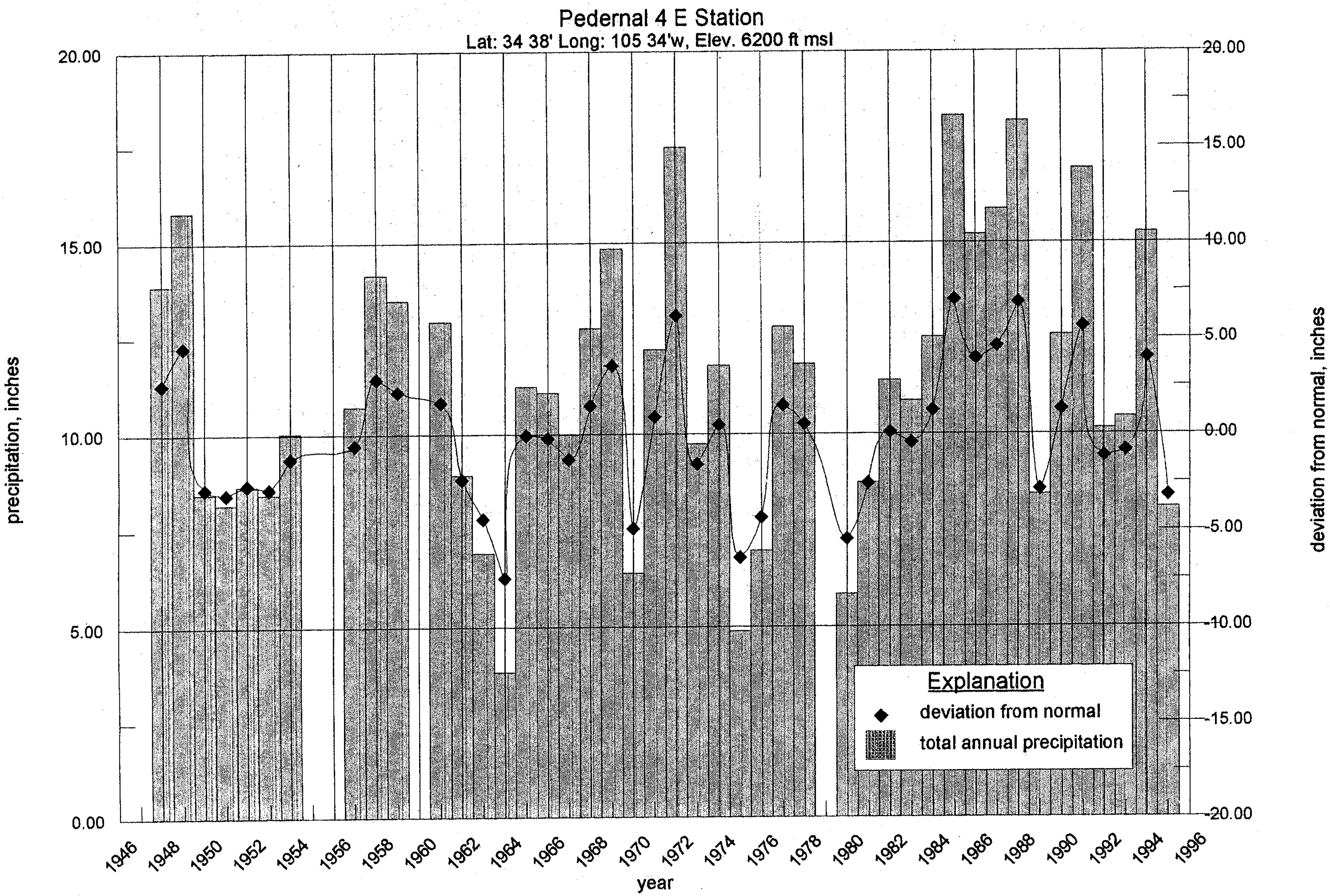

Total annual precipitation and deviation from normal recorded at the Stanley 1 NNE Station



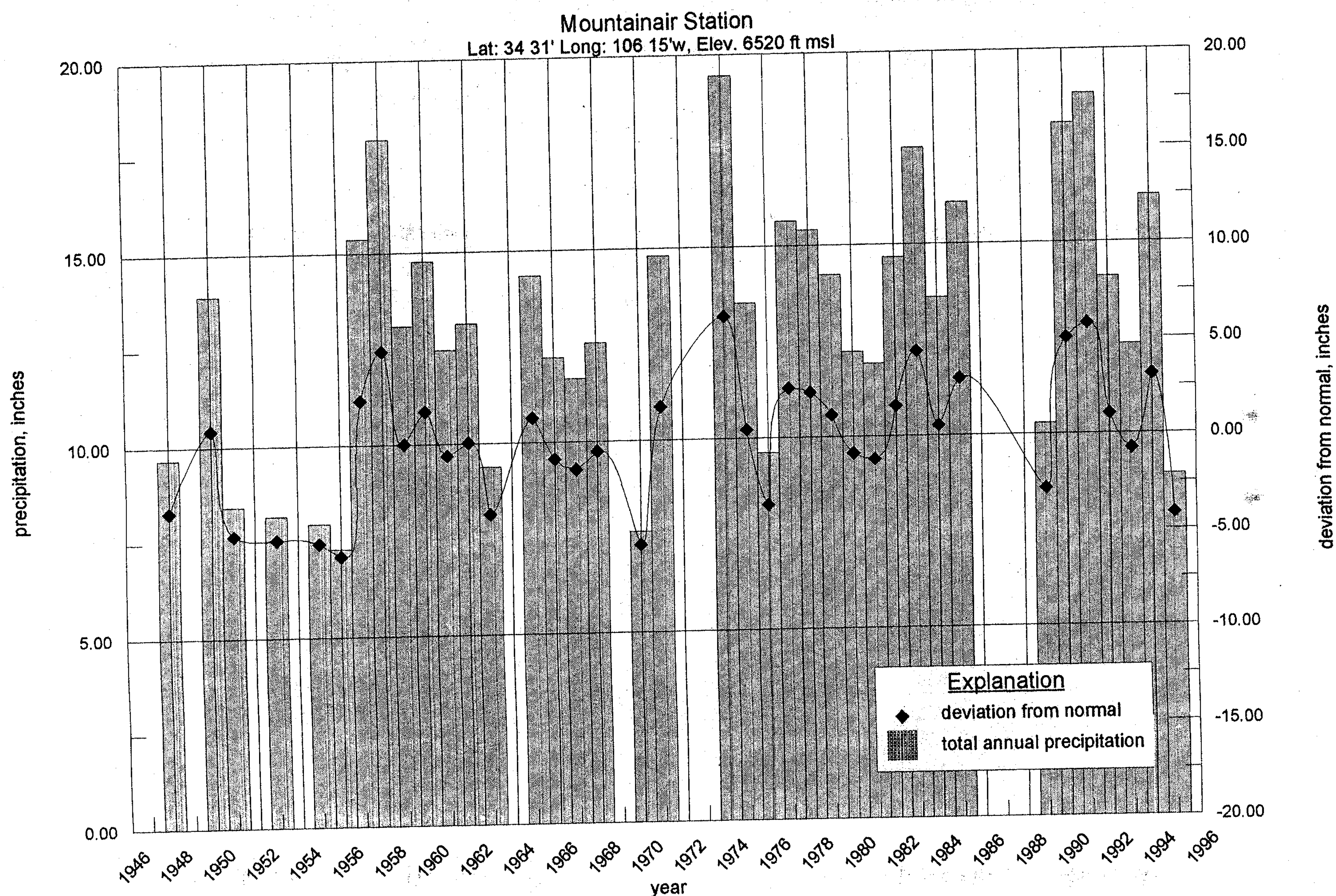

Total annual precipitation and deviation from normal recorded at the Sandia Crest Station



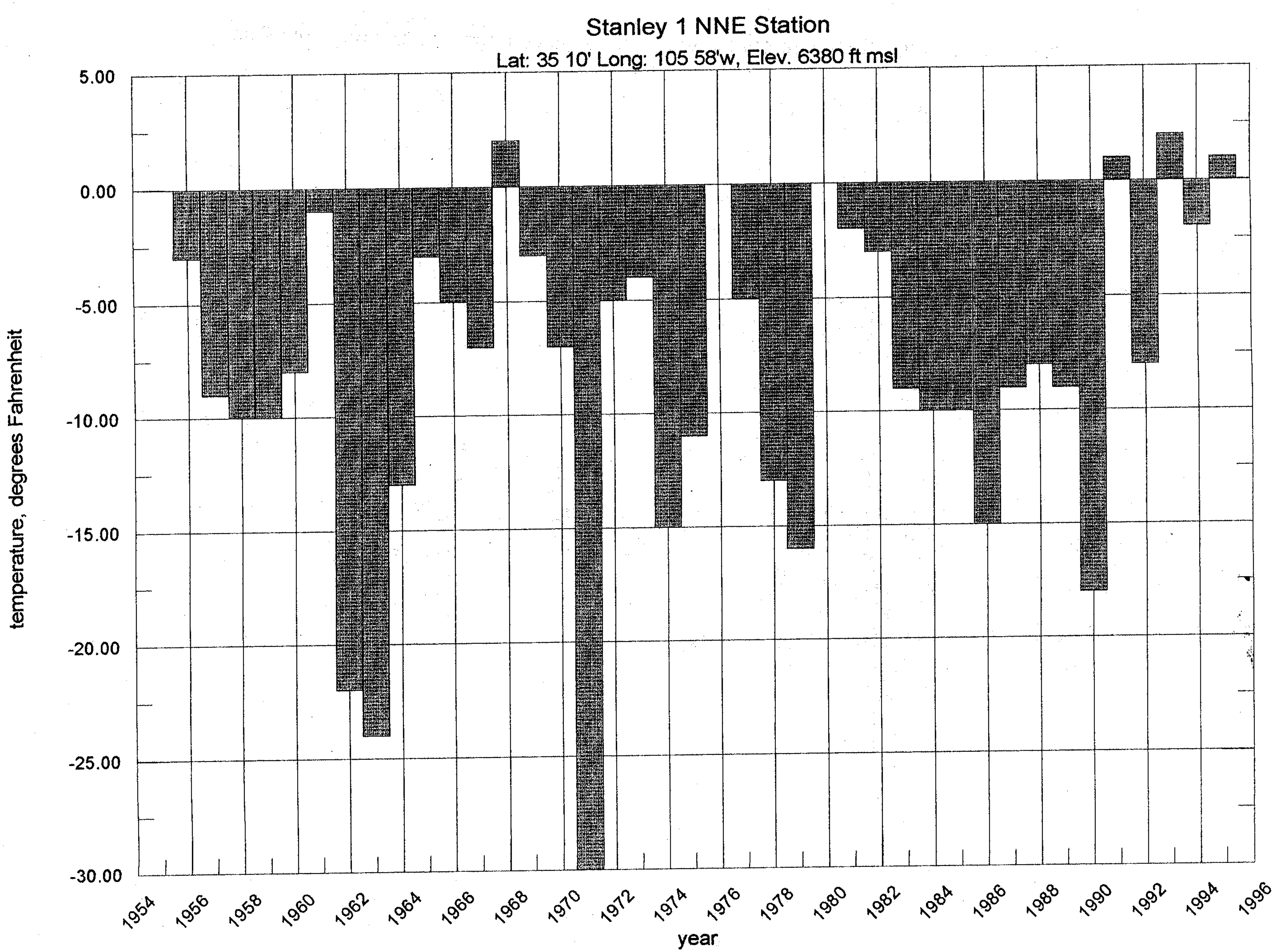

Total annual precipitation and deviation from normal recorded at the Progresso Station



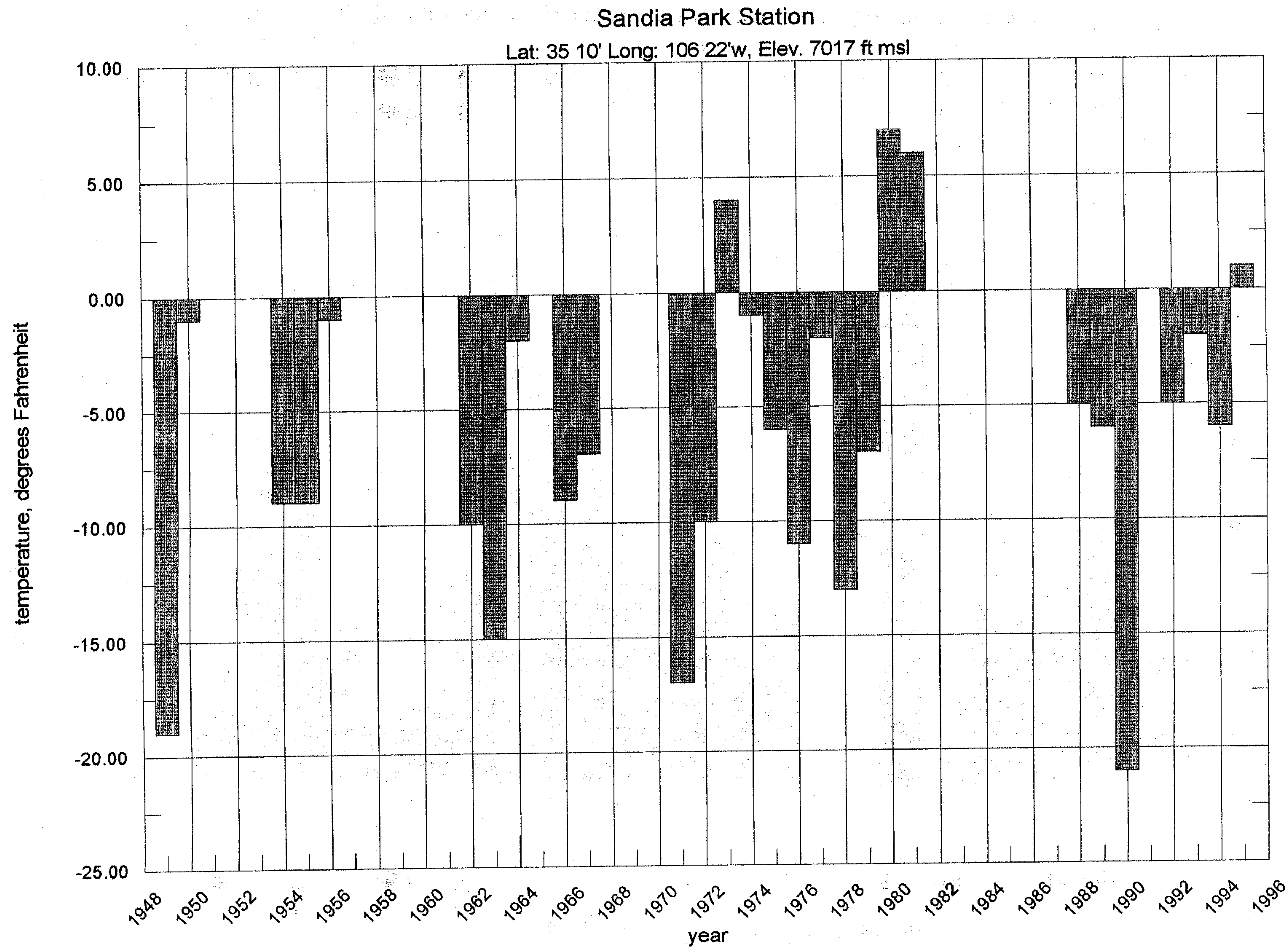

Total annual precipitation and deviation from normal recorded at the Pedernal 4 E Station



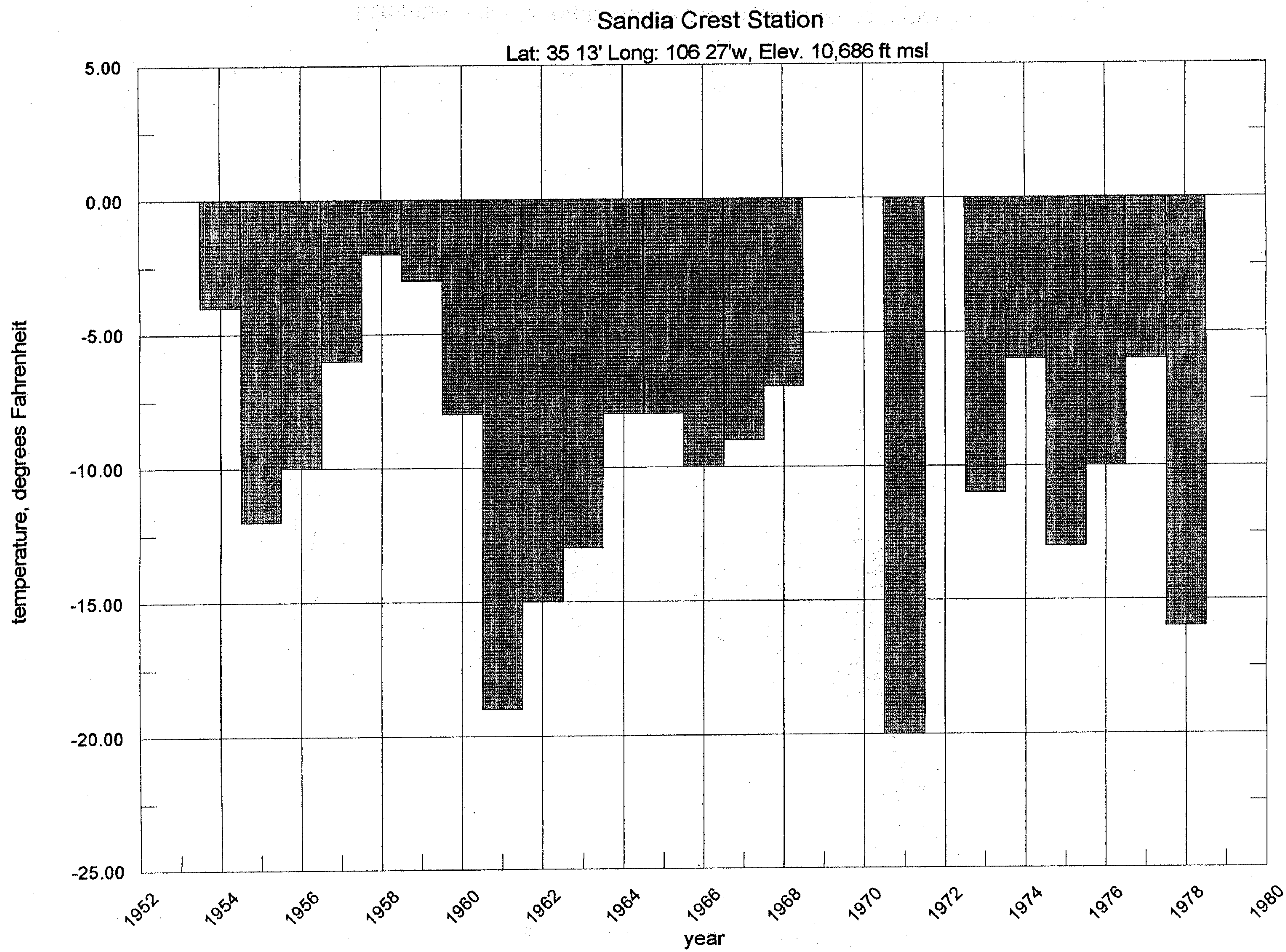

Total annual precipitation and deviation from normal recorded at the Mountainair Station



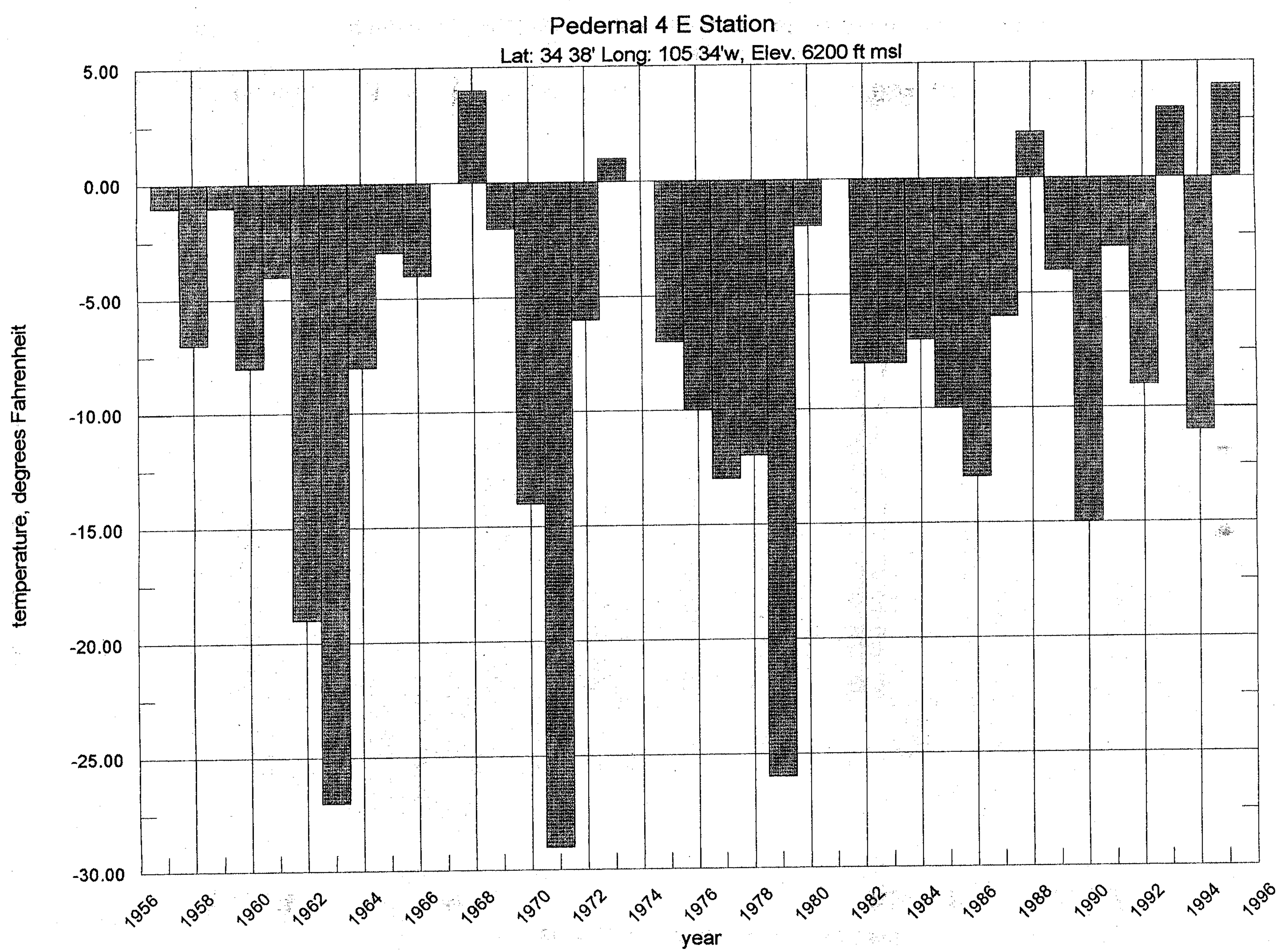
Minimum annual temperature recorded at the Stanley Station



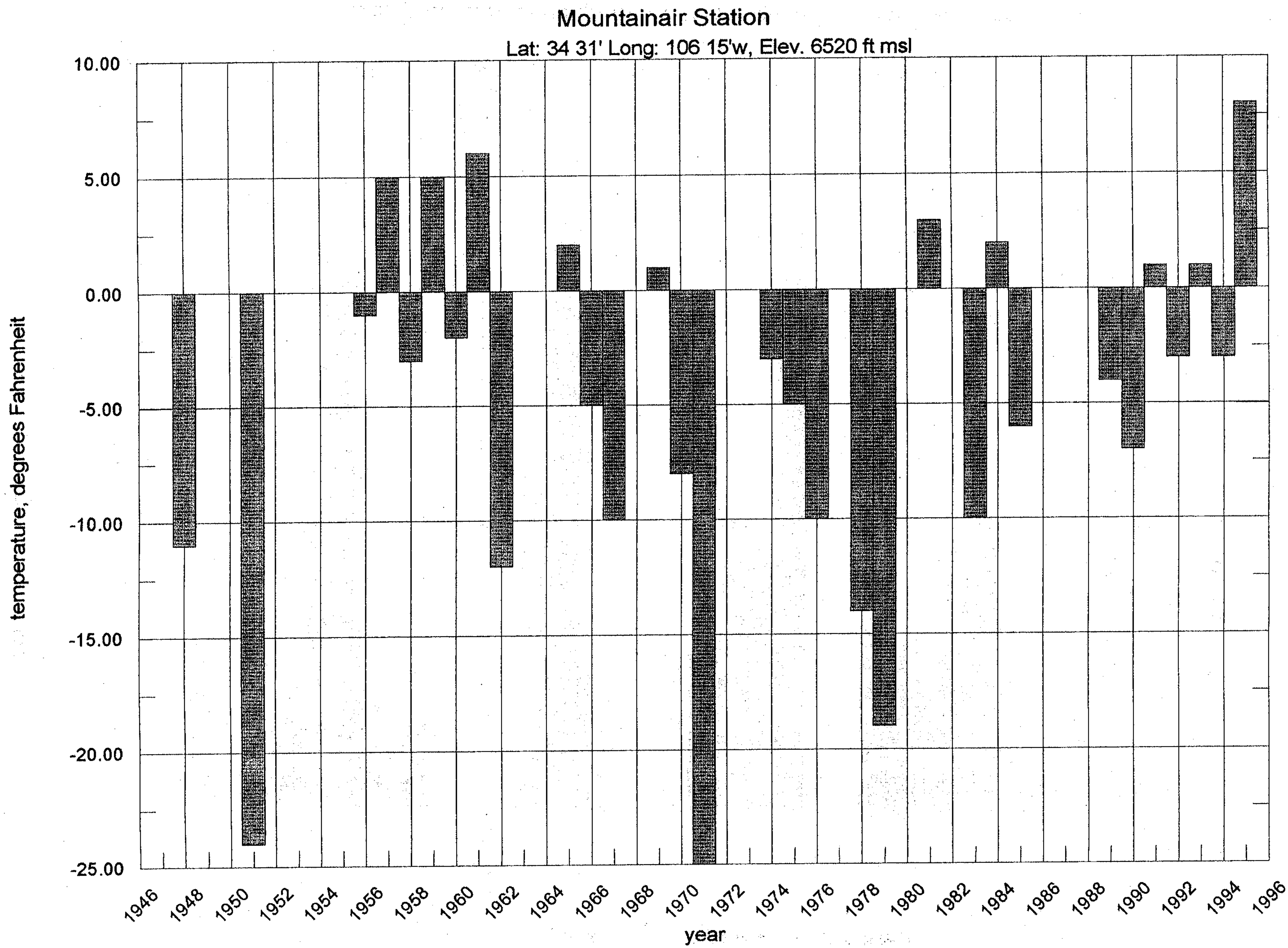
Minimum annual temperature recorded at the Sandia Park Station



Minimum annual temperature recorded at the Sandia Crest Station



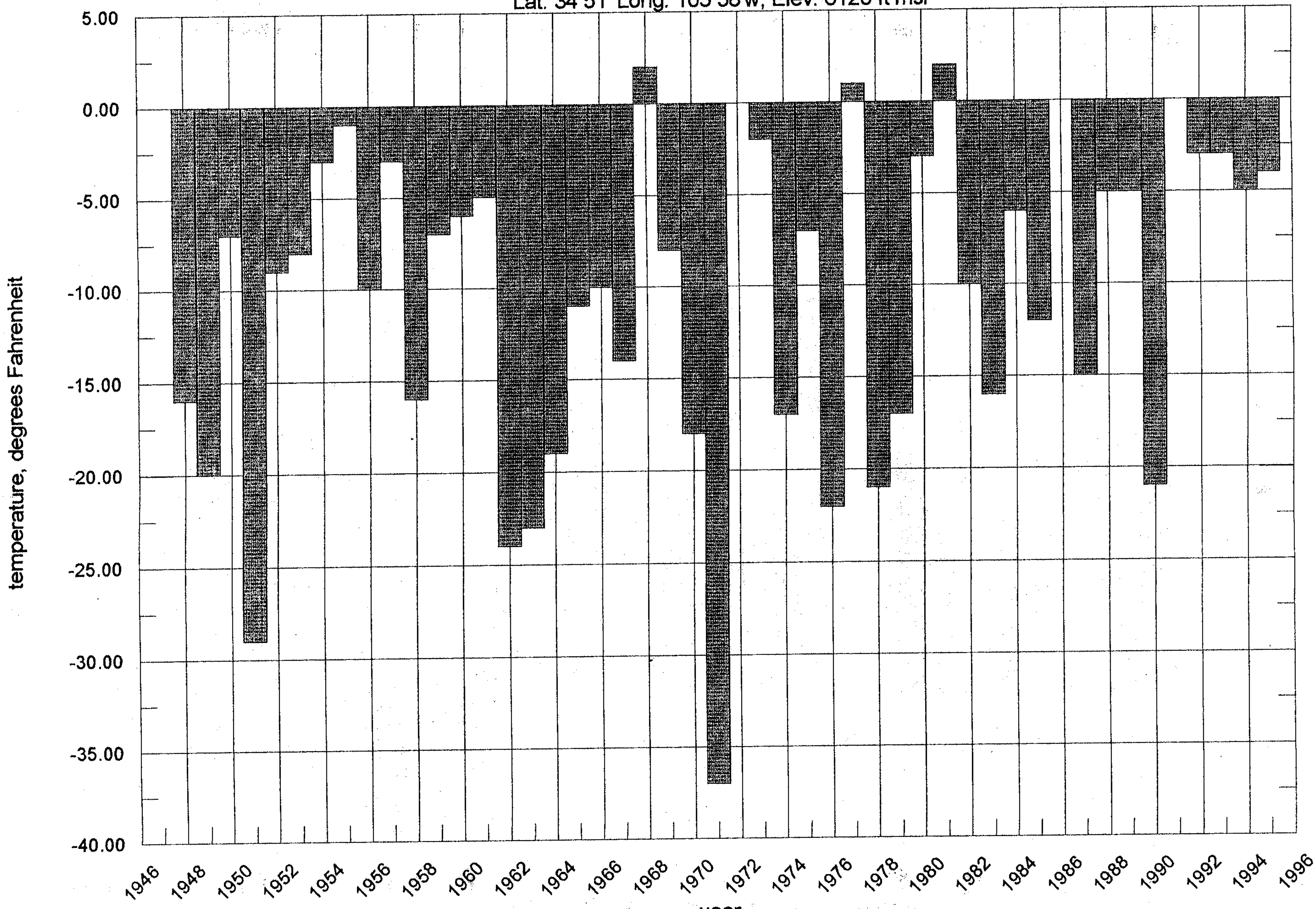
Minimum annual temperature recorded at the Pedernal 4 NE Station



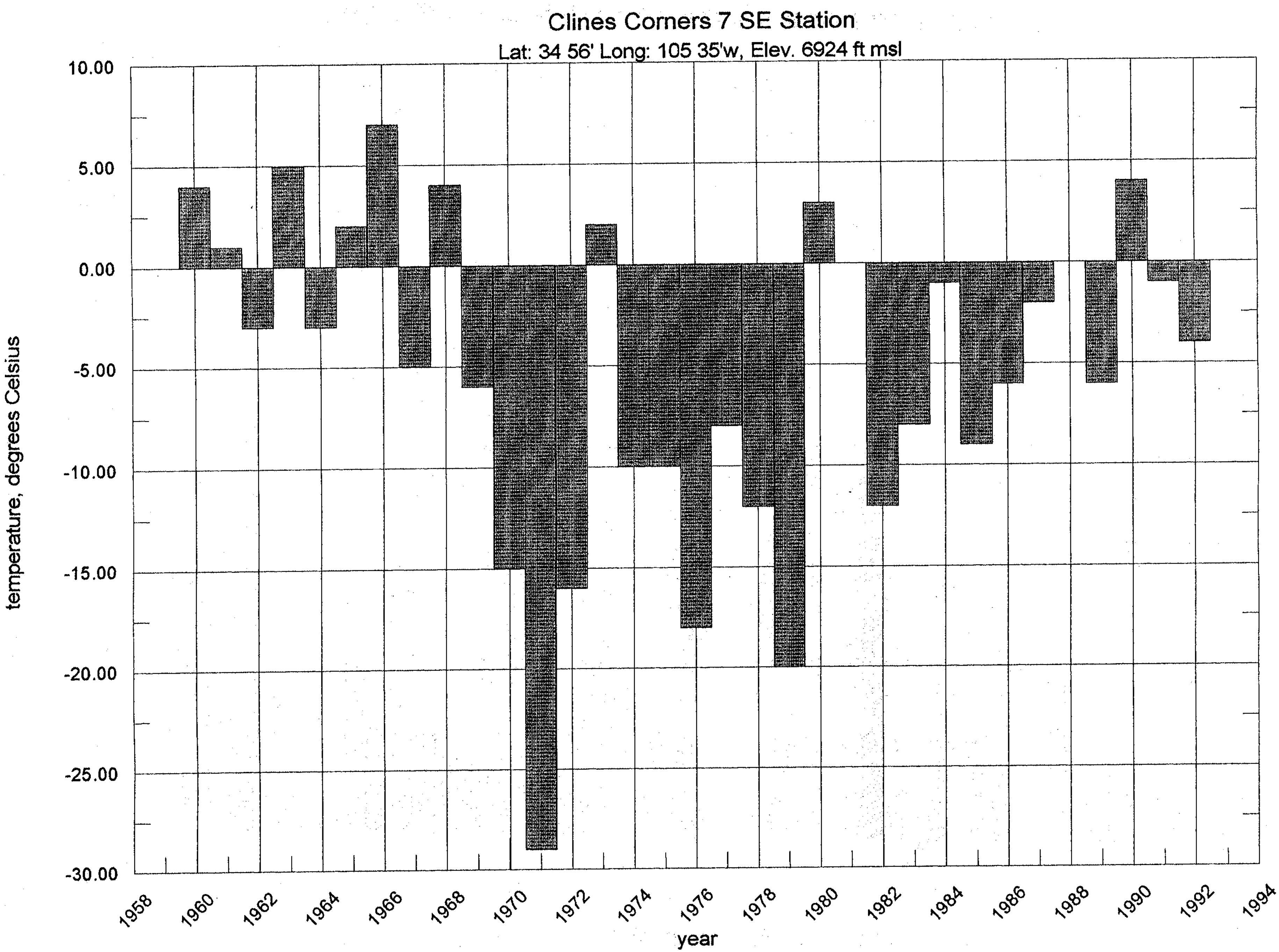

Minimum annual temperature recorded at the Mountainair Station

Estancia 7 NE Station

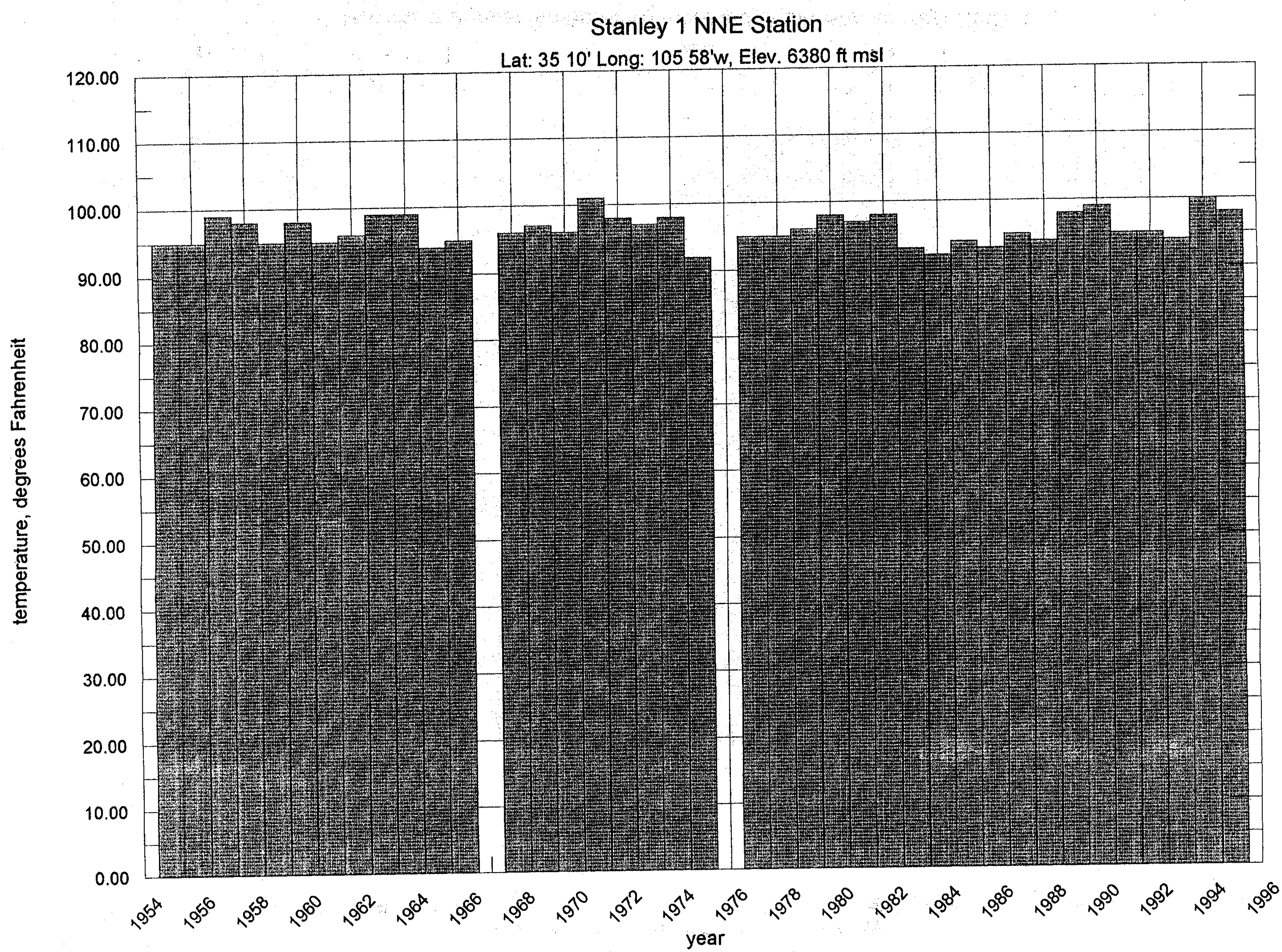
Lat: 34 51' Long: 105 58'w, Elev. 6120 ft msl



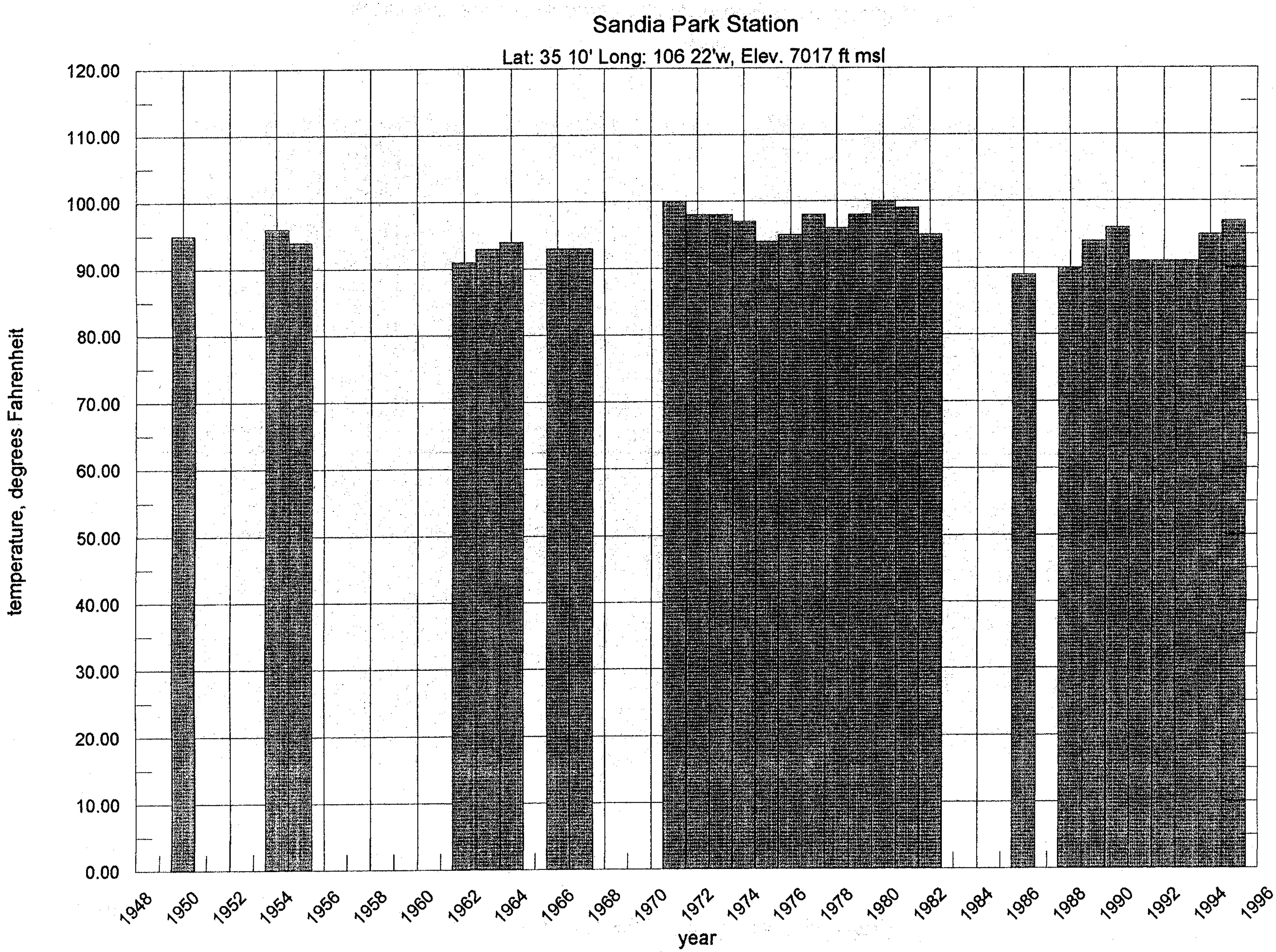

Minimum annual temperature recorded at the Estancia 7 NE Station



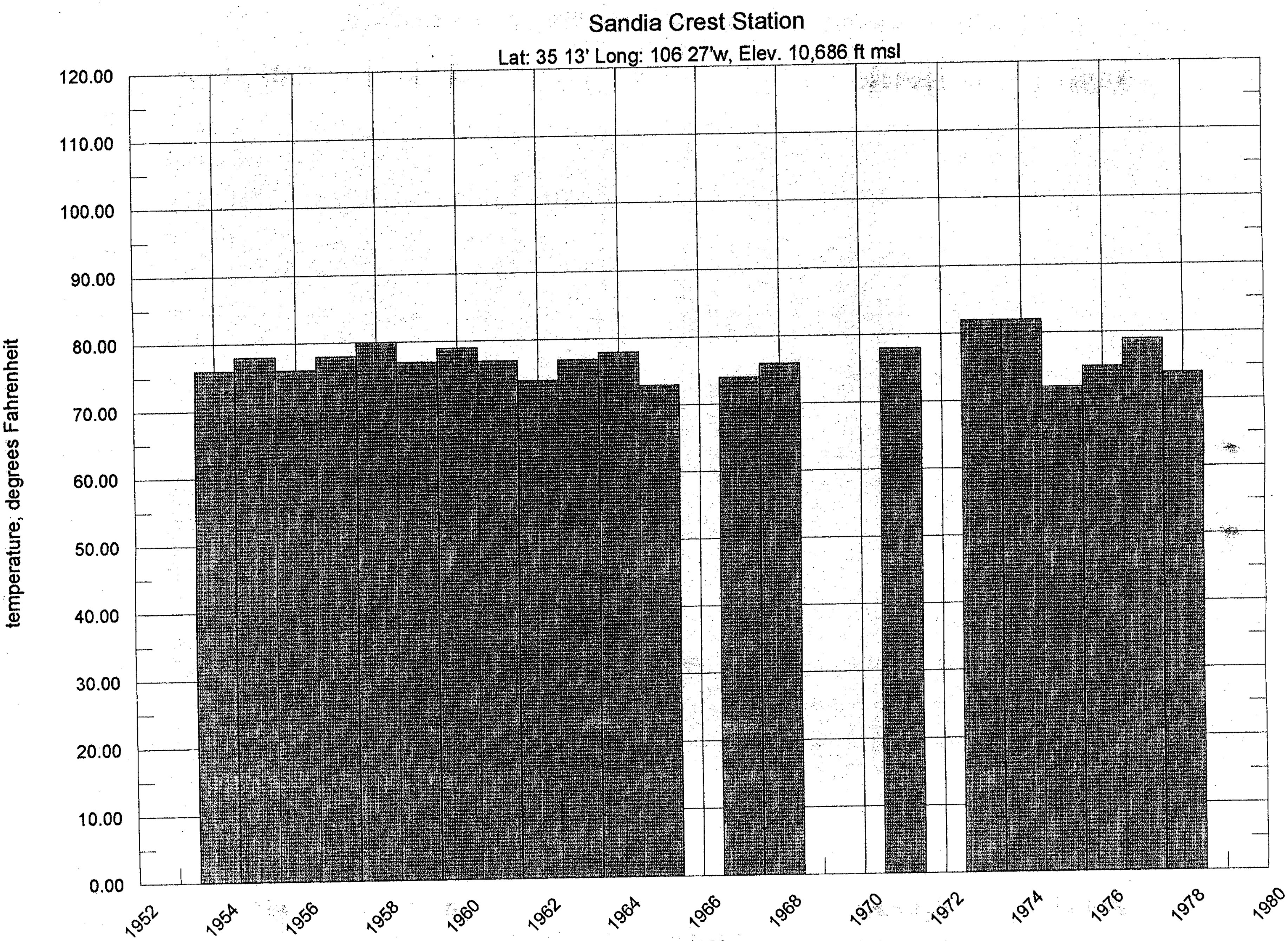
Minimum annual temperature recorded at the Clines Corner Station



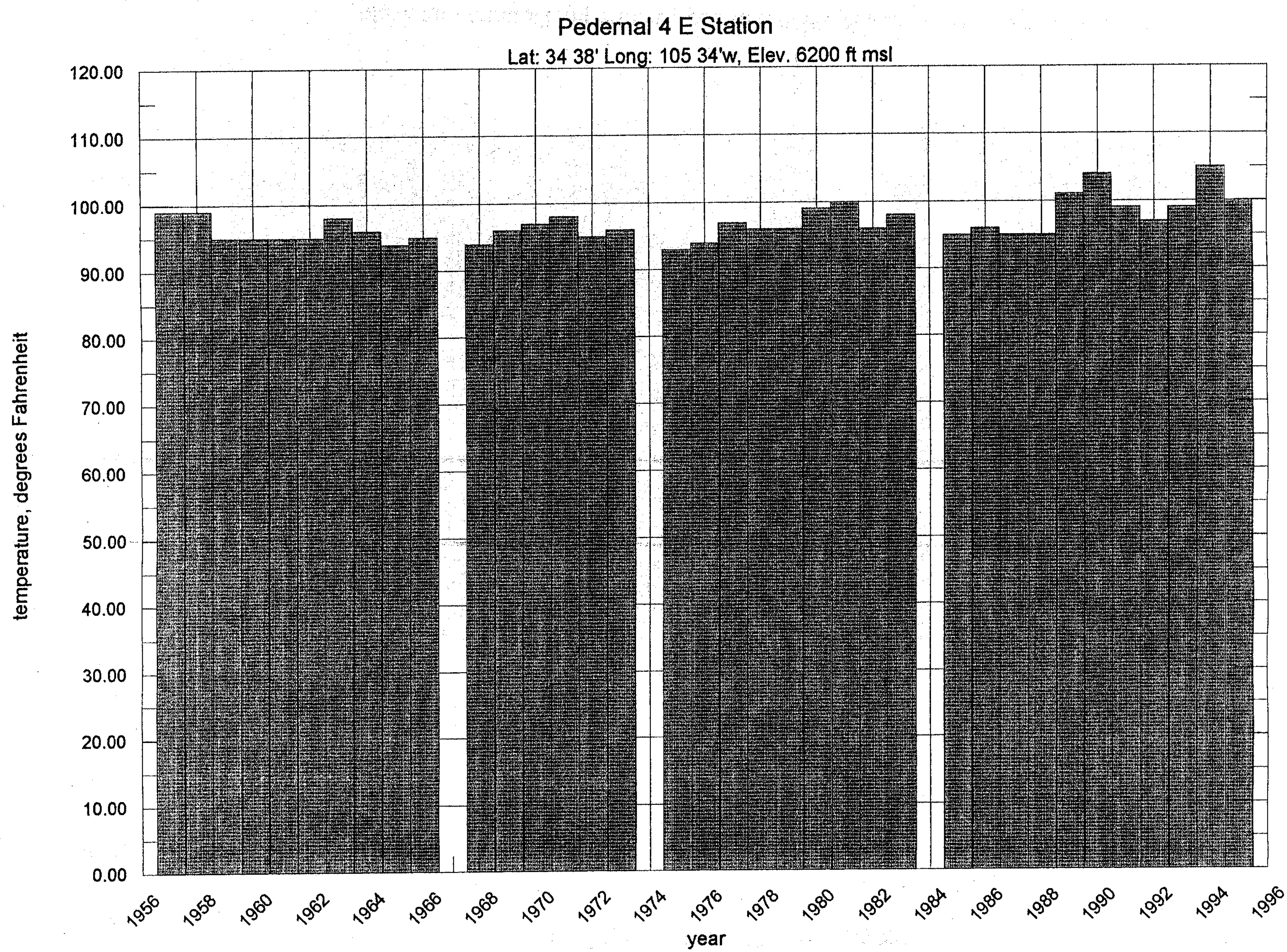
Maximum annual temperature recorded at the Stanley Station




Maximum annual temperature recorded at the Sandia Park Station



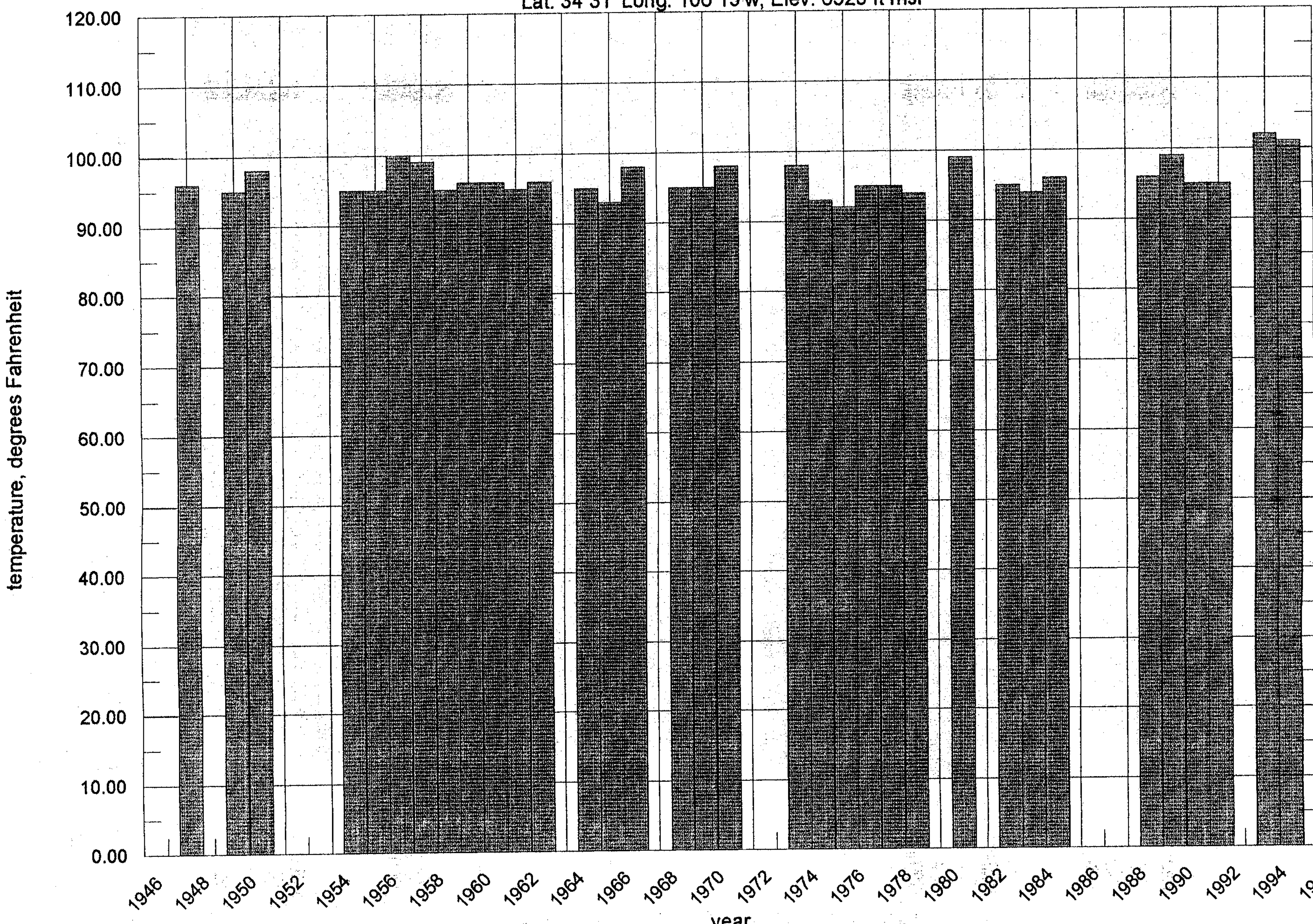
Maximum annual temperature recorded at the Sandia Crest Station



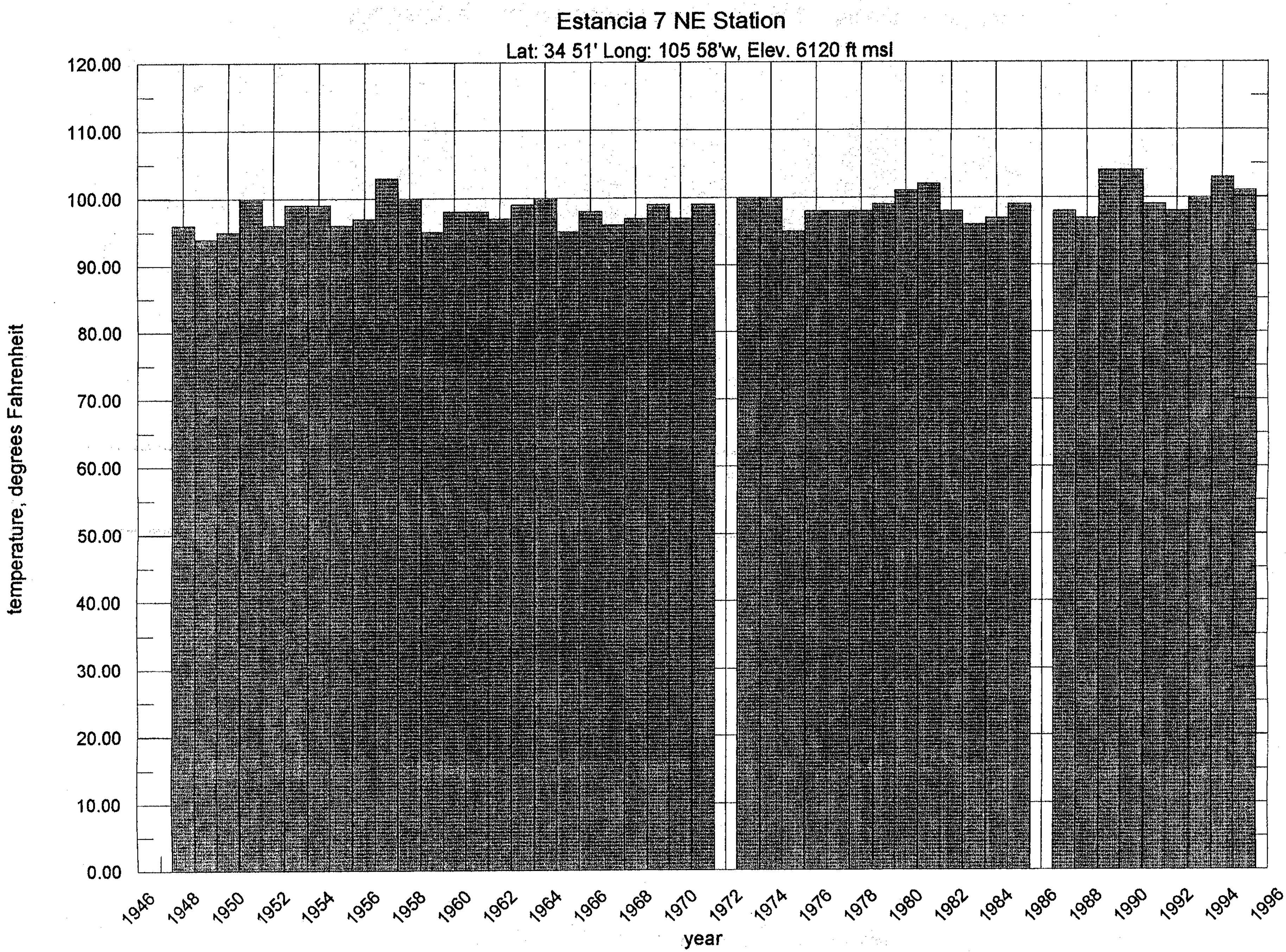

Maximum annual temperature recorded at the Pedernal 4 NE Station

Mountainair Station

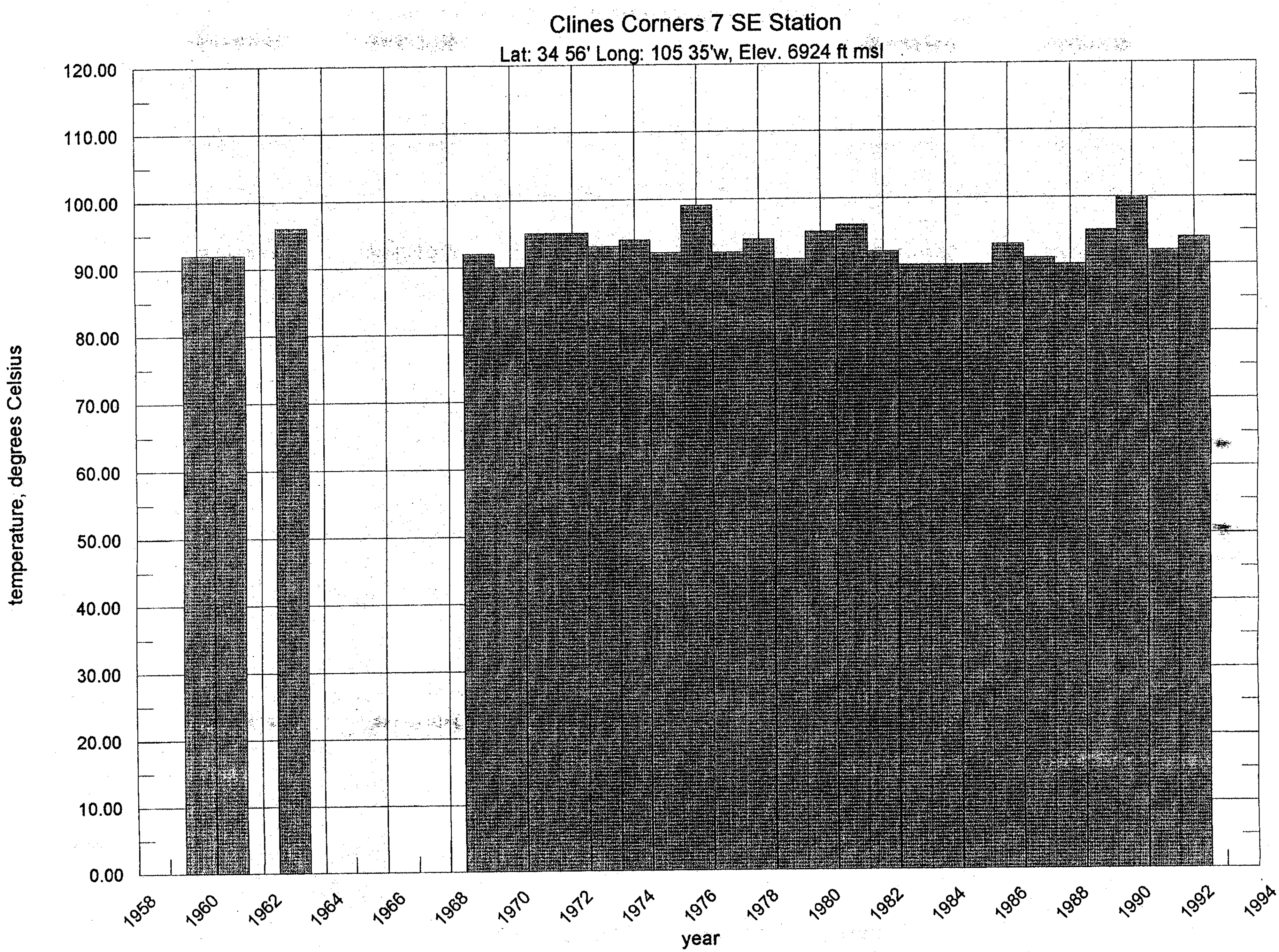
Lat: 34 31' Long: 106 15'w, Elev. 6520 ft msl



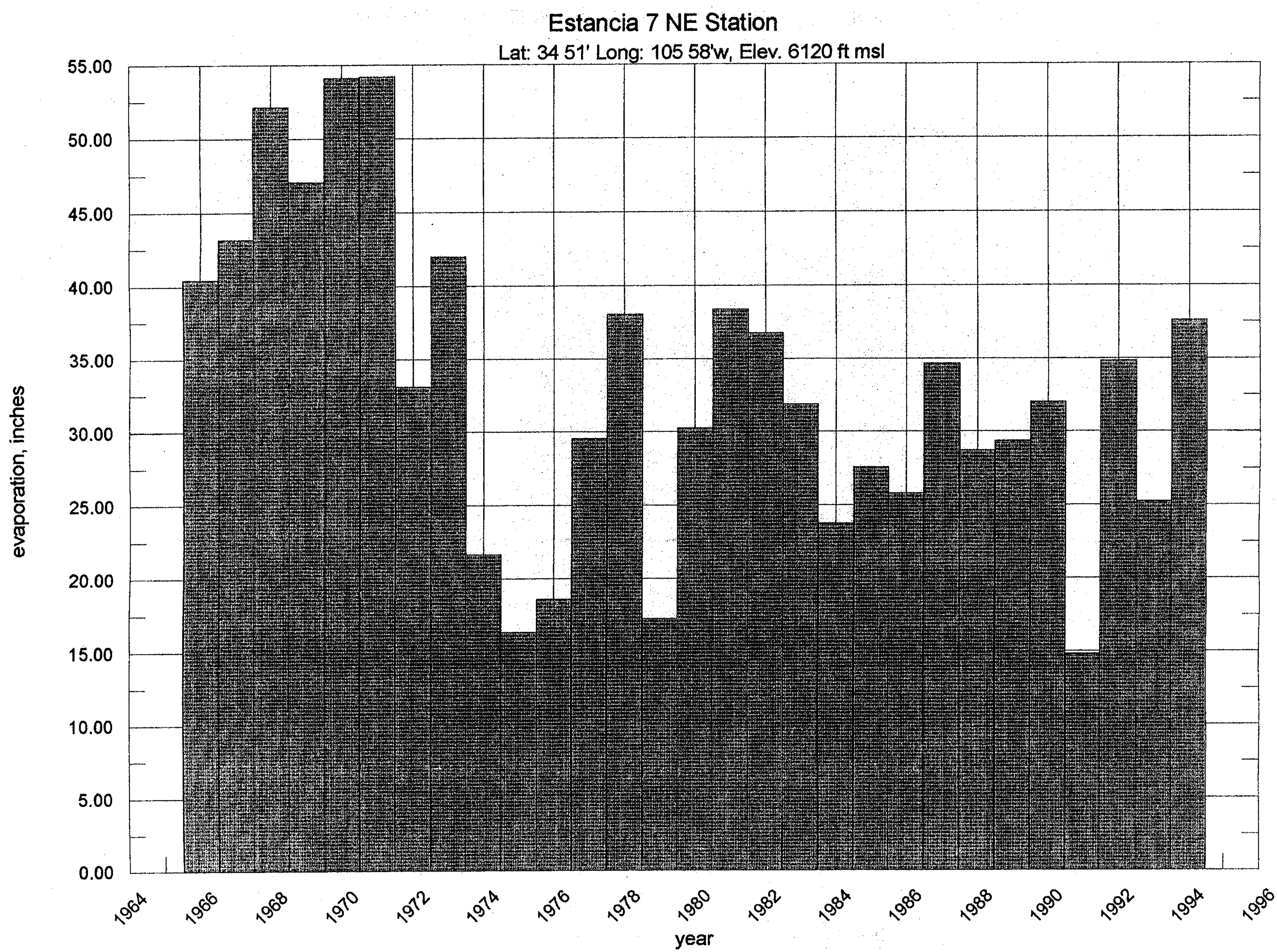

Maximum annual temperature recorded at the Mountainair Station




Maximum annual temperature recorded at the Estancia 7 NE Station



Maximum annual temperature recorded at the Clines Corner Station




Total annual evaporation recorded at the Estancia 7 NE Station

## Appendix 5.

## Spring Data for Bernalillo, Santa Fe, and Torrance Counties, New Mexico.

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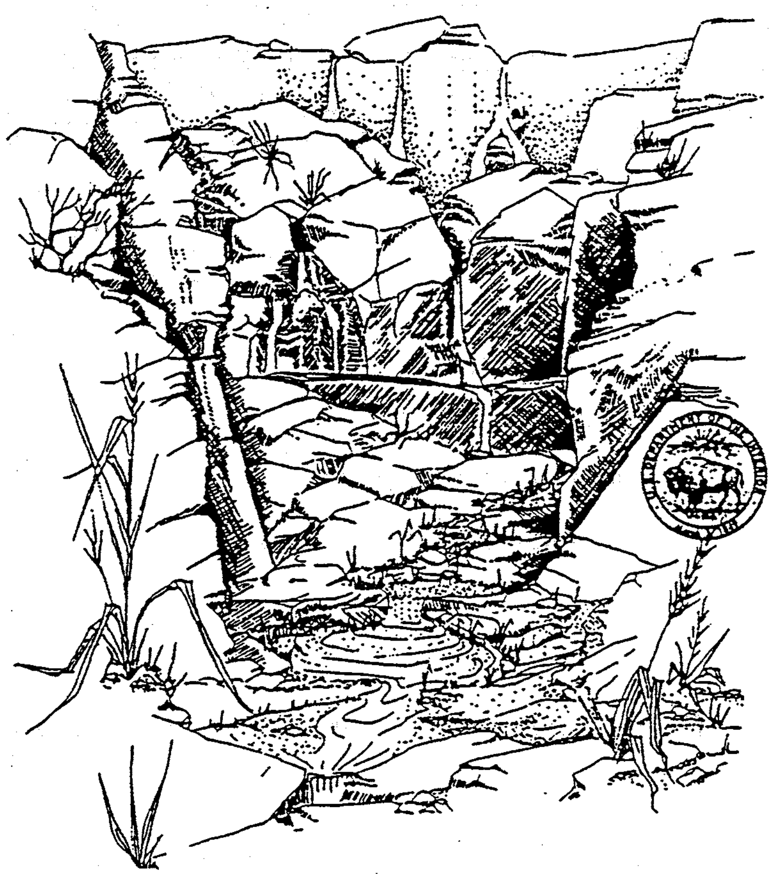
# INVENTORY OF SPRINGS IN THE STATE OF NEW MEXICO

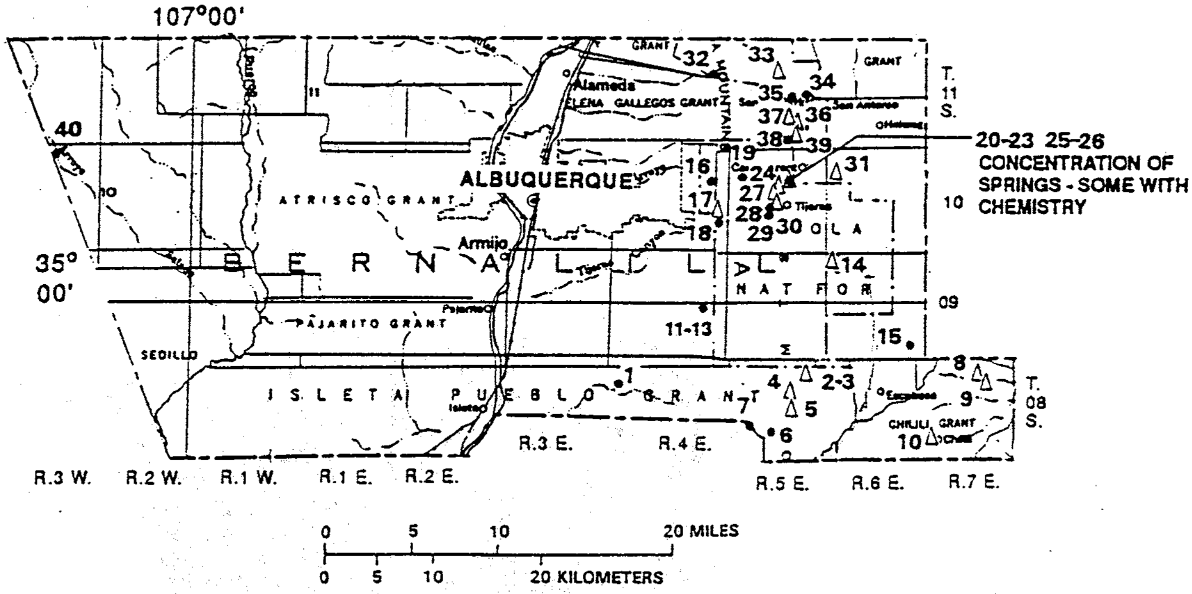
By W.E. White and G.E. Kues

U.S. GEOLOGICAL SURVEY
Open-File Report 92-118



Prepared in cooperation with the
NEW MEXICO STATE ENGINEER OFFICE

Albuquerque, New Mexico
1992




EXPLANATION

• SPRING WITH CHEMISTRY

Δ SPRING WITHOUT CHEMISTRY

**10** SPRING NUMBER REFERS TO TABLE 2

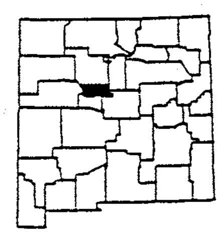


Figure 4.--Location of inventoried springs in Bernalillo County.

Table 2.--Physical characteristics of springs in Bernalillo County

| Number in figure 4 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8N.4E.9.314 | 345555-1063147 | Hubbell Spring | Pueblo of Isleta | East mesa, Rio Grande valley | QTs ? | 5,341 | 3 | 02-27-56 | 13.5 | 56 | 836 | S | Bjorklund and Maxwell, 1961 | CA. |
| 2 | 8N.5E.12.422 | 345559-1062135 | -- | do. | Canyon floor | IPm or Qal | 6,947 | 20-30 | 09-19-62 | -- | -- | -- | S? | * | Pueblo of Isleta; underflow from limestone possibly adds to spring discharge. |
| 3 | 8N.5E.12.432 | 345546-1062157 | -- | do. | do. | Qal | 6,890 | <1 | 09-19-62 | -- | -- | -- | S? | * | Pueblo of Isleta. |
| 4 | 8N.5E.14.434 | 345448-1062251 | -- | do. | Canyon wall | IPm | 6,620 | 10 | 09-19-62 | -- | -- | -- | S? | * | Pueblo of Isleta; fault-controlled seep; travertine festooning 15 feet above arroyo marks old seep. |
| 5 | 8N.5E.23.343 | 345358-1062313 | -- | do. | Canyon floor | Qal, IPm | 6,440 | 1-5 | 09-19-62 | -- | -- | -- | S? | * | Pueblo of Isleta; underflow from alluvium wedge-out. |
| 6 | 8N.5E.27.224 | 345343-1062337 | -- | -- | -- | IPm | 6,320 | 9 | 09-19-62 | 15.0 | 59 | 360 | S | * | CA; spring located in fault gouge. |
| 7 | 8N.5E.28.124 | 345316-1062513 | -- | Pueblo of Isleta | Canyon floor | Qal | 6,670 | <1 | 09-19-62 | 23.0 | 73 | 745 | S | * | CA; Pueblo of Isleta; underflow where channel narrows and alluvium thins. |
| 8 | 8N.7E.3.443 | 345636-1061106 | -- | -- | Head of box canyon | IPm | 6,620 | <1 | 10-03-63 | -- | -- | -- | S | * | Chilili Grant; flow issues from joint in rock. |

Table 2.--Physical characteristics of springs in Bernalillo County--Continued

| Number in figure 4 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 8N.7E.11.113 | 355617-1061101 | -- | -- | Head of box canyon | IPm | 6,575 | 1-5 | 10-03-63 | -- | -- | -- | S | * | Chilili Grant; flow issues from joint in rock. |
| 10 | 8N.7E.30.444 | 355305-1061414 | -- | -- | Valley floor | IPm | 6,830 | 20-30 | 09-27-63 | 17.0 | 63 | -- | S | * | Chilili Grant; discharge flows through Chilili; reported never dry; flow issues from joint in rock. |
| 11 | 9N.4E.24.112 | 345958-1062813 | Coyote Springs | Sandia Military Reservation | Channel | p€, IPm | 5,850 | -- | 07-25-45 | 18.5 | 65 | -- | N | * | CA; one of a group of three springs; TA. |
| 12 | 9N.4E.24.113 | 345955-1062815 | do. | do. | do. | do. | 5,850 | -- | 07-25-45 | 17.0 | 63 | 2,540 | N | * | CA; one of a group of three springs. |
| 13 | 9N.4E.24.211 | 345957-1062812 | do. | do. | do. | do. | 5,850 | 30 | 1942 | -- | -- | -- | -- | Murray, 1959 | Contact spring forming sump-like pools. |
| | | | | | | | | -- | 07-25-45 | 16.0 | 61 | 3,400 | N | * | CA; TA. |
| 14 | 9N.6E.6.132 | 350214-1062042 | -- | -- | Confluence of two canyons | IPm | -- | <1 | 11-08-62 | -- | -- | -- | N | * | -- |
| 15 | 9N.6E.36.312 | 345738-1061533 | -- | -- | -- | do. | 7,085 | >1 | 12-21-60 | 4.5 | 40 | 984 | S | * | CA; fault controlled (?); reported as 9N.6E.36.311. |

Table 2.--Physical characteristics of springs in Bernalillo County-Continued

| Number in figure 4 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 10N.4E.13.242 | 350548-1062749 | Embuda Spring | L. Petrino | Canyon floor | p€ | 6,520 | 50R | 05-07-56 | 13.5 | 56 | 963 | S | Bjorklund and Maxwell, 1961 | CA. |
| | | | | | | | | 2-5 | 12-06-61 | -- | -- | 669 | S | * | CA; reported location 10N.4½E.13.213. |
| 17 | 10N.4E.24.342 | 350420-1062736 | -- | -- | do. | do. | 6,160 | <1 | 10-21-60 | -- | -- | -- | -- | * | Fault controlled. |
| 18 | 10N.4E.25.111 | 350406-1062738 | Fach Spring | Fred C. Fach | Canyon side | do. | 5,990 | <1 | 10-21-60 | -- | -- | 704 | D | * | CA; reported location 10N.4½E.25.121; flow reported constant. |
| | | | | | | | | | | | | | N | Hudson, 1978 | Has concrete and rock crib, 3/4-inch outlet. |
| 19 | 10N.5E.7.432 | 350557-1062618 | Three Gun Spring | Cibola National Forest | Confluence of two canyons | do. | 7,370 | 2-3 | 12-07-61 | -- | -- | 391 | -- | * | CA. |
| 20 | 10N.5E.10.423 | 350617-1062309 | -- | -- | Anticline breached by canyon | Pg | 6,790 | 50-75 | 08-10-62 | 13.0 | 55 | 478 | P, S | * | CA; travertine deposit below spring; used by residents of San Antonio. |
| 21 | 10N.5E.10.432 | 350610-1062316 | -- | -- | Canyon | Psg, Py | 6,800 | 3 | 08-10-62 | -- | -- | -- | N | * | -- |
| 22 | 10N.5E.10.434 | 350600-1062315 | -- | Charles Hobbie | Fault in canyon | Pys | 6,750 | 2 | 08-10-62 | -- | -- | 426 | P | * | CA; water used by trailer park residents. |
| 23 | 10N.5E.11.333 | 350603-1062253 | -- | -- | Canyon | Kd | -- | 1 | 08-10-62 | -- | -- | -- | D | * | Steeply dipping sandstone beds. |

Table 2.--Physical characteristics of springs in Bernalillo County-Continued

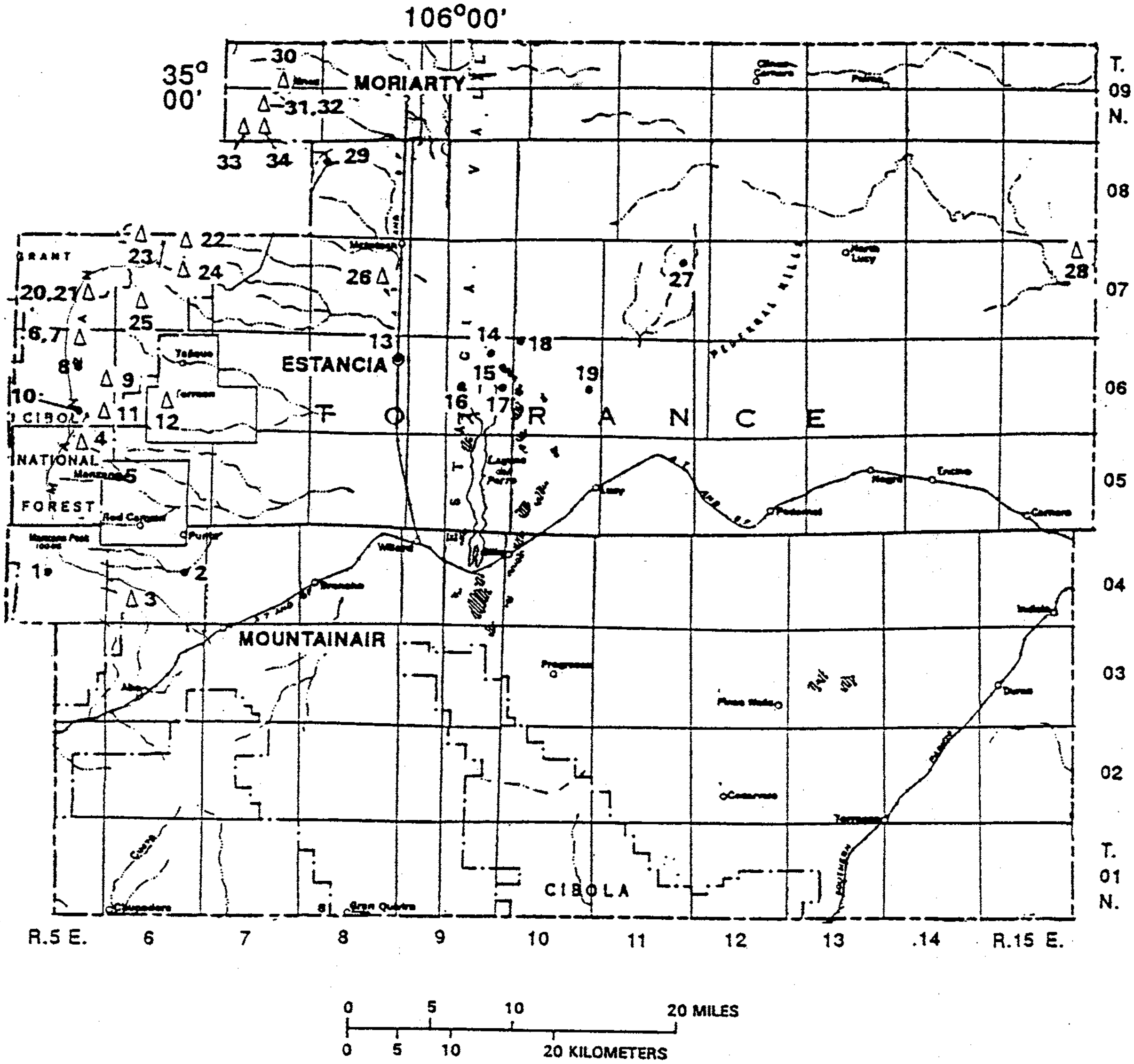
| Number in figure 4 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 10N.5E.15.142 | 350543-1062339 | -- | Cibola National Forest | Canyon | IPm | 6,840 | 5 | 06-12-62 | -- | -- | -- | N | * | Travertine coats face of 30-foot drop-off in stream channel; reported as 10N.5E.15.141. |
| | | | | | | | | -- | 09-10-74 | 13.5 | 56 | 562 | -- | -- | CA. |
| 25 | 10N.5E.15.212 | 350555-1062315 | -- | Charles Hobbie | Fault | -- | 6,740 | 5-10 | 08-09-62 | -- | -- | -- | P | * | Discharge fluctuates seasonally; used by trailer park residents. |
| 26 | 10N.5E.15.223 | 350555-1062314 | -- | do. | -- | Trc | -- | -- | 08-10-62 | 14.0 | 57 | 822 | N | * | CA; Chinle Formation faulted against Morrison Formation; iron stain in channel. |
| 27 | 10N.5E.15.331 | 350518-1062357 | Carlito Spring | -- | Fractures in cliff face | IPm | -- | 400 | 1942 | -- | -- | -- | -- | Murray, 1942 | -- |
| | | | | J.D. Guenko | -- | do. | -- | 500 | 11-08-62 | -- | -- | -- | D | * | Water may be from upper part IPs; travertine deposits present. |
| | | | | Tony Guenko | -- | do. | 6,790 | 20 | 06-22-72 | -- | -- | -- | D, I | Hudson, 1978 | -- |
| 28 | 10N.5E.21.223 | 350447-1062403 | -- | R.A. Curtis | Canyon wall | do. | -- | -- | 02-13-58 | 14.0 | 57 | 567 | -- | * | CA. |
| | | | | | | | | 5-10 | 08-10-62 | 14.0 | 57 | -- | D | * | Travertine deposits present. |

Table 2.--Physical characteristics of springs in Bernalillo County-Continued

| Number in figure 4 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 10N.5E.21.412 | 350447-1062414 | Seven Springs | -- | Canyon bottom | Qal | 6,150 | 100 | 1942 | -- | -- | -- | -- | Murray, 1942 | Seep. |
| | | | | John Giannini | | do. | -- | 20 | 06-15-62 | 11 | 52 | 692 | C | * | CA; trout ponds. |
| | | | | -- | | do. | -- | 6M | 07-08-75 | -- | -- | -- | N | Hudson, 1978 | Flowing from 1½-inch-diameter plastic pipe. |
| 30 | 10N.5E.22.143 | 350446-1062342 | -- | -- | Canyon floor | do. | -- | 30 | 06-21-62 | -- | -- | -- | -- | * | Qal wedges out. |
| 31 | 10N.6E.7.342 | 350606-1062024 | -- | -- | do. | do. | -- | <1 | 05-15-62 | -- | -- | -- | -- | * | Qal wedges out. |
| 32 | 11N.4E.1.314 | 351228-1062833 | -- | -- | -- | -- | -- | -- | 05-08-56 | 17 | 63 | 297 | -- | * | CA; Cibola National Forest. |
| 33 | 11N.5E.10.133 | 351137-1062407 | Tree Spring | -- | Canyon | IPm | 8,120 | <1M | 07-27-62 | 8 | 46 | -- | P | * | Cibola National Forest; canyon follows fault. |
| 34 | 11N.5E.14.342 | 351023-1062235 | Sulphur Spring | Cibola National Forest | Valley | Pa | 7,310 | <1 | 07-19-62 | 17 | 63 | -- | P | * | Picnic ground; reported as 11.5.14.242. |
| | | | | | | | | | 06-05-75 | -- | -- | 485 | | | CA. |
| 35 | 11N.5E.23.111 | 351012-1062304 | Cienega Spring | do. | do. | IPm | 7,514 | 10-15 | 06-20-62 | 10 | 50 | 503 | P | * | CA; picnic ground; travertine in channel below spring. |
| | | | | | | | | -- | 09-10-74 | 13 | 55 | 228 | -- | * | CA. |
| 36 | 11N.5E.26.333 | 350835-1062300 | -- | do. | do. | Qal, Pys | 7,200 | 25 | 07-26-62 | 11 | 52 | -- | D | * | -- |

Table 2.--Physical characteristics of springs in Bernalillo County-Concluded

| Number in figure 4 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 11N.5E.27.423 | 350851-1062319 | -- | -- | Canyon | IPm | 7,550 | 25 | 07-25-62 | 11 | 52 | -- | D | * | Cibola National Forest; travertine in past and present channel below spring; spring supplies water to Cañoncito through acequia. |
| 38 | 11N.5E.34.243 | 350807-1062317 | Cole Spring | -- | -- | Ql | 7,414 | 6M | 06-21-62 | 9 | 48 | 564 | P | * | CA; Cibola National Forest; picnic ground. |
| | | | | | | | | -- | 06-05-75 | 10 | 50 | 580 | -- | * | CA. |
| 39 | 11N.5E.35.131 | 350835-1062259 | -- | Dr. Jenkins | Canyon confluence | Pym | 7,250 | <1 | 08-02-62 | -- | -- | -- | D | * | Cibola National Forest. |
| 40 | 10N.3W.3.212 | 350750-1070817 | Jose Manuel Spring | Cañoncito Navajo Reservation | Channel wall | Jm | -- | -- | 01-28-52 | -- | -- | 372 | -- | Trauger, 1953 | CA; concrete-boxed seep. |
| | | | | | | | -- | -- | 09-03-53 | -- | -- | 389 | -- | do. | -- |
| | | | | | | | -- | -- | 06-06-67 | -- | -- | -- | -- | Doty, 1967. | Not flowing on June 6, 1967. |




EXPLANATION

• SPRING WITH CHEMISTRY

Δ SPRING WITHOUT CHEMISTRY

2 SPRING NUMBER REFERS TO TABLE 31

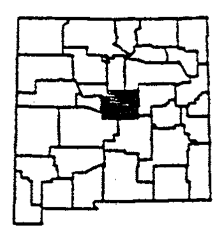


Figure 33.--Location of inventoried springs in Torrance County.

Table 31.--Physical characteristics of springs in Torrance County

| Number in figure 33 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4N.5E.16.331 | 343403-1062558 | Pine Shadow Spring | Cibola National Forest | Hillside | IPm | 7,240 | 3 | 03-28-50 | -- | -- | -- | -- | Spiegel, 1955 | CA. Reported as 4N.5E.16.332. |
| 2 | 4N.6E.14.300 | 343405-1061725 | -- | Mrs. Pine | -- | Trc | -- | 1-2 | 03-26-54 | -- | -- | 1,700 | -- | * | CA. |
| 3 | 4N.6E.29.444 | 343215-1061945 | -- | -- | Arroyo floor | Pa | 6,720 | 1 | 01-24-50 | -- | -- | -- | A | Smith, 1957 | Rock enclosed; water piped to tank. |
| 4 | 5N.5E.10.313 | 344017-1062435 | New Canyon Spring | Cibola National Forest | Base of mountain | Qal | 7,780 | 6 | 11-08-49 | -- | -- | -- | -- | do. | Rock enclosed at campground. |
| 5 | Manzano Grant | 345845-1062046 | -- | -- | -- | IPm | 6,910 | -- | 06-12-73 | 11.5 | 53 | 590 | -- | * | CA. TA. |
| 6 | 6N.5E.2.124 | 344650-1062316 | Big Spring | Cibola National Forest | Valley floor | do. | 7,740 | 1 | 11-18-49 | -- | -- | -- | -- | Smith, 1957 | Campground. |
| 7 | 6N.5E.2.134 | 344639-1062331 | -- | do. | do. | do. | 7,820 | 1 | 11-18-49 | -- | -- | -- | A | do. | -- |
| 8 | 6N.5E.11.114 | 344650-1062333 | -- | do. | -- | do. | 7,960 | 0.66M | 10-25-64 | 9.0 | 48 | 460 | -- | * | CA. |
| 9 | 6N.5E.24.224 | 344427-1062140 | -- | do. | Arroyo bank | do. | 7,190 | 2 | 12-07-49 | -- | -- | -- | D,S | Smith, 1957 | -- |
| 10 | Cibola National Forest | 344159-1062404 | -- | do. | -- | do. | 9,200 | -- | 06-05-75 | 6.5 | 44 | 151 | -- | * | CA. TA. Capilla Campground. |
| 11 | 6N.5E.36.221 | 344244-1062142 | -- | do. | Arroyo floor | do. | 7,200 | 1 | 12-07-49 | -- | -- | -- | D,S | Smith, 1957 | Rock enclosed. |
| 12 | 6N.6E.27.100 | 344325-1061804 | Torreon Spring | -- | do. | do. | -- | -- | -- | -- | -- | -- | D | do. | Town of Torreon Grant. Water pumped to reservoirs. |

Table 31.--Physical characteristics of springs in Torrance County--Continued

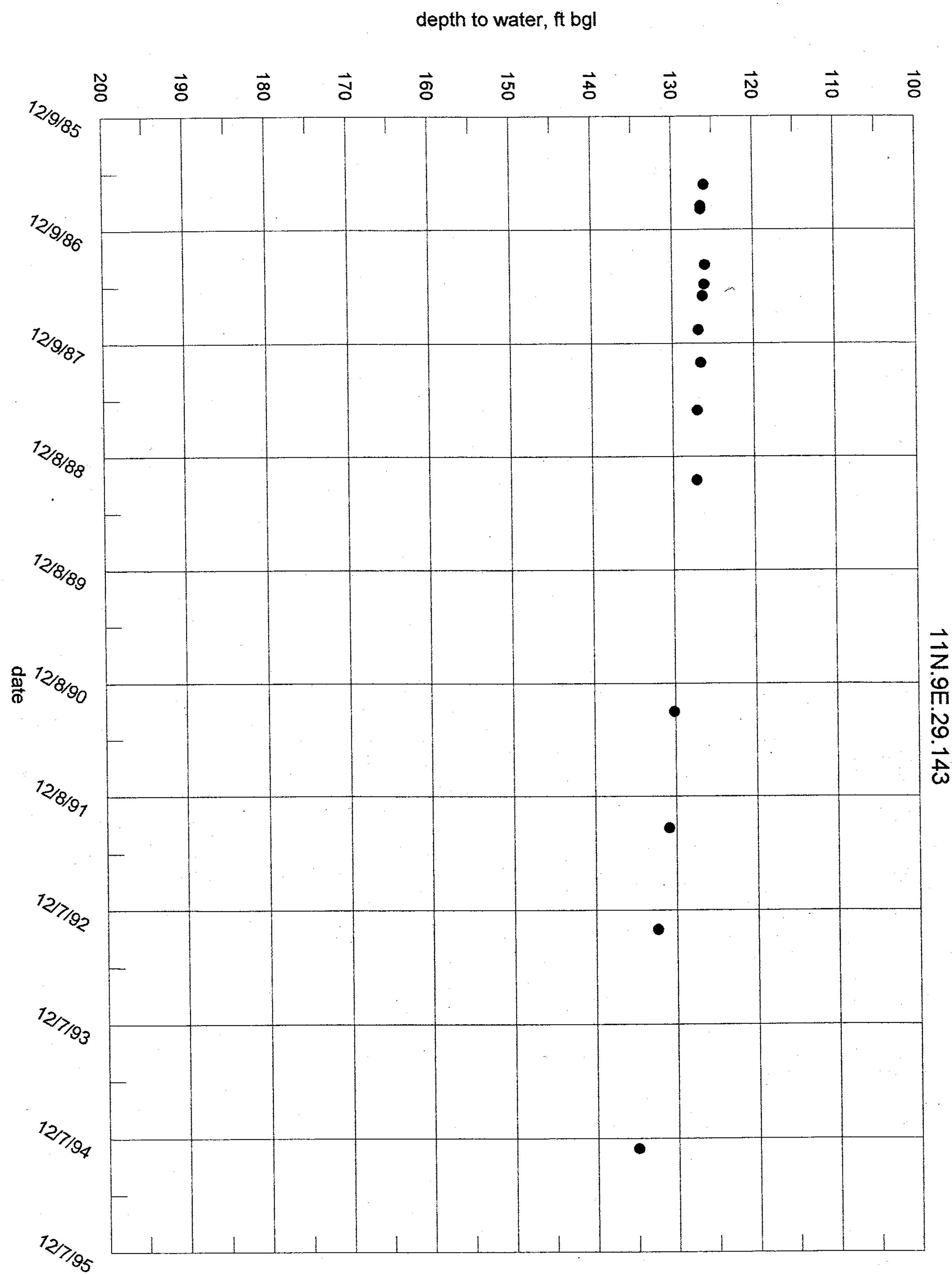
| Number in figure 33 | Location | | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield | | Temperature | | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Latitude-longitude | | | | | | Gallons per minute | Date | °C | °F | | | | |
| 13 | 6N.8E.11.442 | 344523-1060345 | Estancia Spring | Town of Estancia | Valley flat | Qal | 6,118 | -- | 08-17-50 | -- | -- | 484 | -- | Smith, 1957 | CA. Reported as 6N.8E.11.442. Rock and concrete enclosed. |
| 14 | 6N.9E.11.411 | 344538-1055745 | -- | -- | Playa | Qab | 6,081 | -- | 06-22-67 | 20.0 | 68 | 33,300 | -- | * | CA. |
| 15 | 6N.9E.13.134 | 344450-1055707 | -- | -- | do. | do. | 6,095 | -- | 06-22-67 | 21.5 | 71 | 7,840 | -- | * | CA. |
| 16 | 6N.9E.21.124 | 344410-1060002 | -- | -- | do. | do. | 6,075 | -- | 06-22-67 | 23.0 | 73 | 112,000 | -- | * | CA. |
| 17 | 6N.9E.24.333 | 344304-1055715 | -- | -- | Laguna del Perro | do. | 6,040 | -- | 06-22-67 | 21.5 | 71 | 137,000 | -- | * | CA. |
| 18 | 6N.10E.6.331 | 344608-1055606 | -- | -- | Playa | do. | 6,080 | -- | 06-22-67 | 30.0 | 86 | 187,000 | -- | * | CA. |
| 19 | 6N.10E.24.332 | 344354-1055032 | -- | -- | Valley flat | do. | 6,110 | -- | 06-22-67 | 26.0 | 79 | 20,500 | -- | * | CA. |
| 20 | 7N.5E.35.232 | 344734-1062258 | Fourth of July Spring | Cibola National Forest | Fault in canyon floor | IPm, Qal | 7,630 | -- | 10-25-63 | -- | -- | -- | P | * | Picnic ground. |
| 21 | 7N.5E.35.422 | 344722-1062243 | Fourth of July Spring (Lower) | do. | do. | do. | 7,540 | 1 | 11-18-49 | -- | -- | -- | P | Smith, 1957 | -- |
| 22 | 7N.6E.2.410 | 345141-1061646 | -- | -- | Valley | do. | 7,200 | -- | 10-02-63 | -- | -- | -- | S | * | Chilili Grant. Feeds perennial streamflow. |
| 23 | 7N.6E.5.322 | 345147-1062009 | Ojo los Casa | -- | Valley side | IPm | 7,605 | NV | 10-02-63 | -- | -- | -- | S | * | Chilili Grant. |

Table 31.--Physical characteristics of springs in Torrance County--Concluded

| Number in figure 33 | Location: Number | Location: Latitude-longitude | Name | Owner | Topographic situation | Source | Altitude (feet) | Yield: Gallons per minute | Yield: Date | Temperature °C | Temperature °F | Specific conductance (microsiemens) | Use | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 7N.6E.11.133 | 345100-1061724 | Deer Spring | -- | Head of canyon | IPm | 7,210 | <0.5 | 11-13-63 | -- | -- | -- | -- | * | Chilili Grant. |
| 25 | 7N.6E.29.120 | 344843-1062010 | Riley Ranch Spring | Riley Ranch | Valley floor, perched | do. | -- | NV | 11-14-63 | -- | -- | -- | -- | * | Reported location 7N.6E.29.213. Smith, 1957, reported spring dry in 1948. |
| 26 | 7N.8E.14.410 | 344955-1060408 | Antelope Springs | Antelope Spring Co. | Hillside | Qal | 6,150 | 20 | 09-01-50 | -- | -- | -- | C,S | Smith, 1957 | Reported as 7N.8E.23.410; spring house. |
| 27 | 7N.12E.11.411 | 345054-1053758 | -- | Marvin Henser | Mountain base | p€ | 6,955 | -- | 07-12-50 | -- | -- | 250 | D,S | do. | CA. Reported as 7N.12E.11.322. Deepened and concrete lined; hand-lift pump. |
| 28 | 7N.15E.2.100 | -- | -- | Bigbee Ranch | -- | Tr | -- | 0.5R | 07-12-50 | -- | -- | -- | S | do. | -- |
| 29 | 8N.8E.6.442 | 345636-1060802 | Buffalo Springs | Russ Thompson | Fault in valley floor | IPm | 6,360 | 2-7<br>-- | 10-03-63<br>01-05-66 | --<br>13.5 | --<br>56 | --<br>500 | D,S | * | CA. Reported never dry. |
| 30 | 9N.7E.21.341 | 345905-1061210 | -- | Ballinger | Valley | do. | 6,740 | 1-5 | 10-16-63 | -- | -- | -- | S | * | Numerous springs and seeps upstream for more than 3 miles. |
| 31 | 9N.7E.29.214 | 345846-1061248 | -- | -- | -- | do. | 6,800 | 10 | 10-16-63 | -- | -- | -- | S | * | -- |
| 32 | 9N.7E.29.441 | 345814-1061238 | -- | -- | Valley floor | IPm | 6,820 | -- | -- | -- | -- | -- | S | * | -- |
| 33 | 9N.7E.31.334 | 345714-1061429 | -- | -- | do. | do. | 6,880 | 3 | 10-16-63 | -- | -- | -- | D,S | * | -- |
| 34 | 9N.7E.32.111 | 345801-1061329 | -- | Paul Dannevie | do. | do. | 6,885 | 1-5 | 10-16-63 | -- | -- | -- | S | * | -- |

# Appendix 6.

## Hydrographs from Wells Monitored by the NMSEO and the USGS in the Estancia Underground Water Basin.



depth to water, ft bgl
200
190
180
170
160
150
140
130
120
110
100
date
12/9/85
12/9/86
12/9/87
12/8/88
12/8/89
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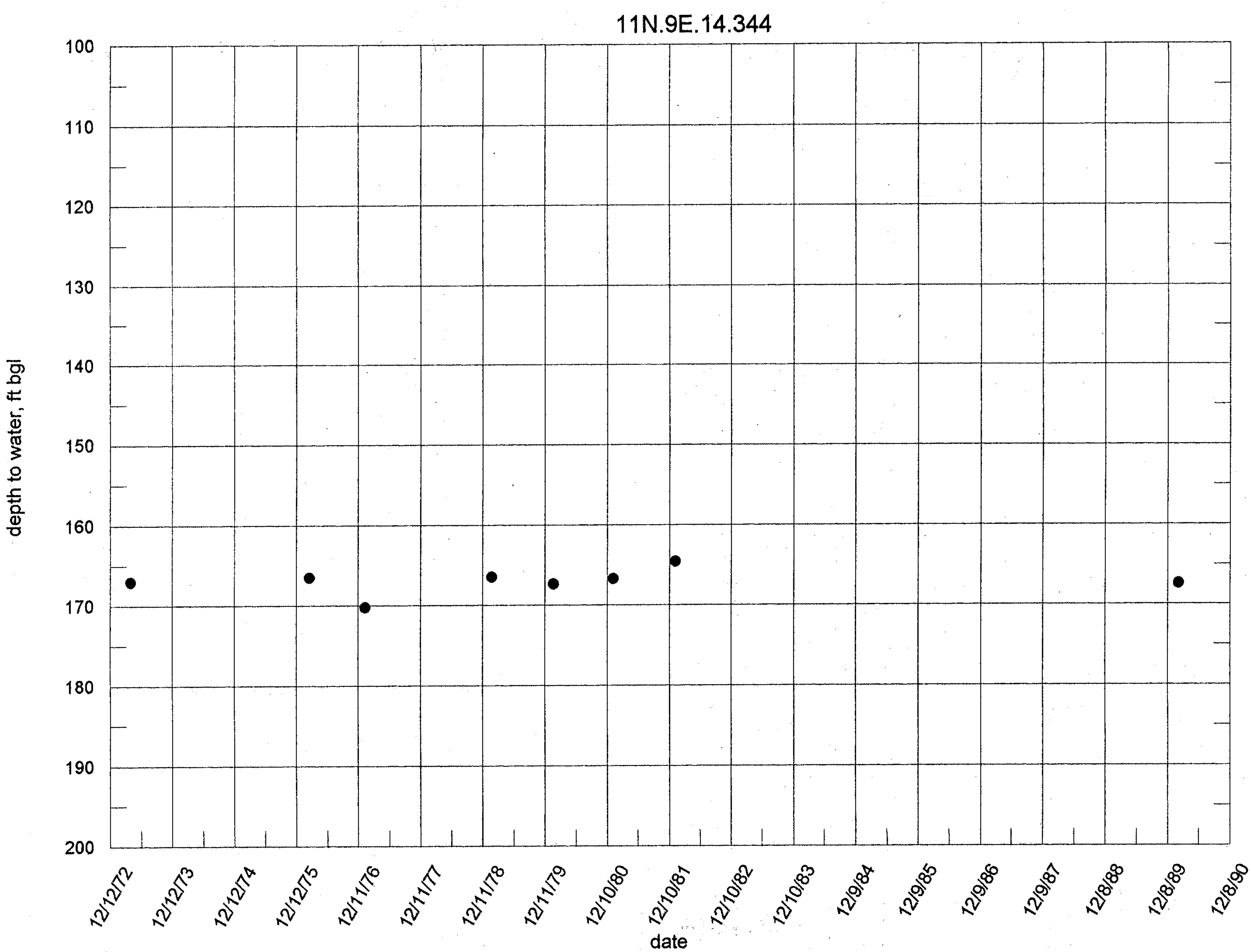
12/8/91
12/7/92
12/7/93
12/7/94
12/7/95
11N.9E.29.143



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110
120
130
140
150
160
170
180
190
200
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12/11/76
12/11/77
12/11/78
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12/10/80
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12/10/82
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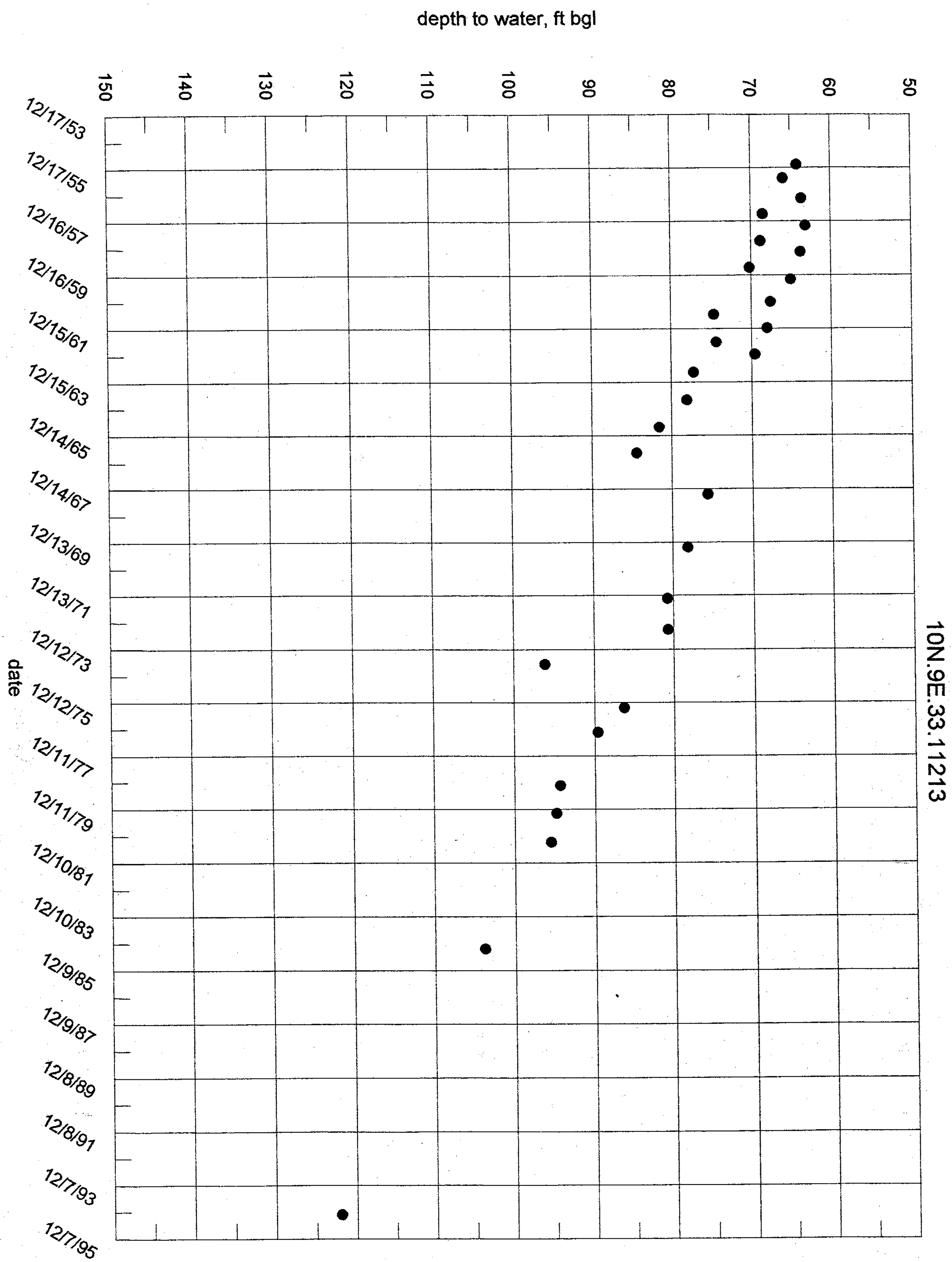
12/8/89
12/8/90
date



depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
date
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12/17/55
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12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
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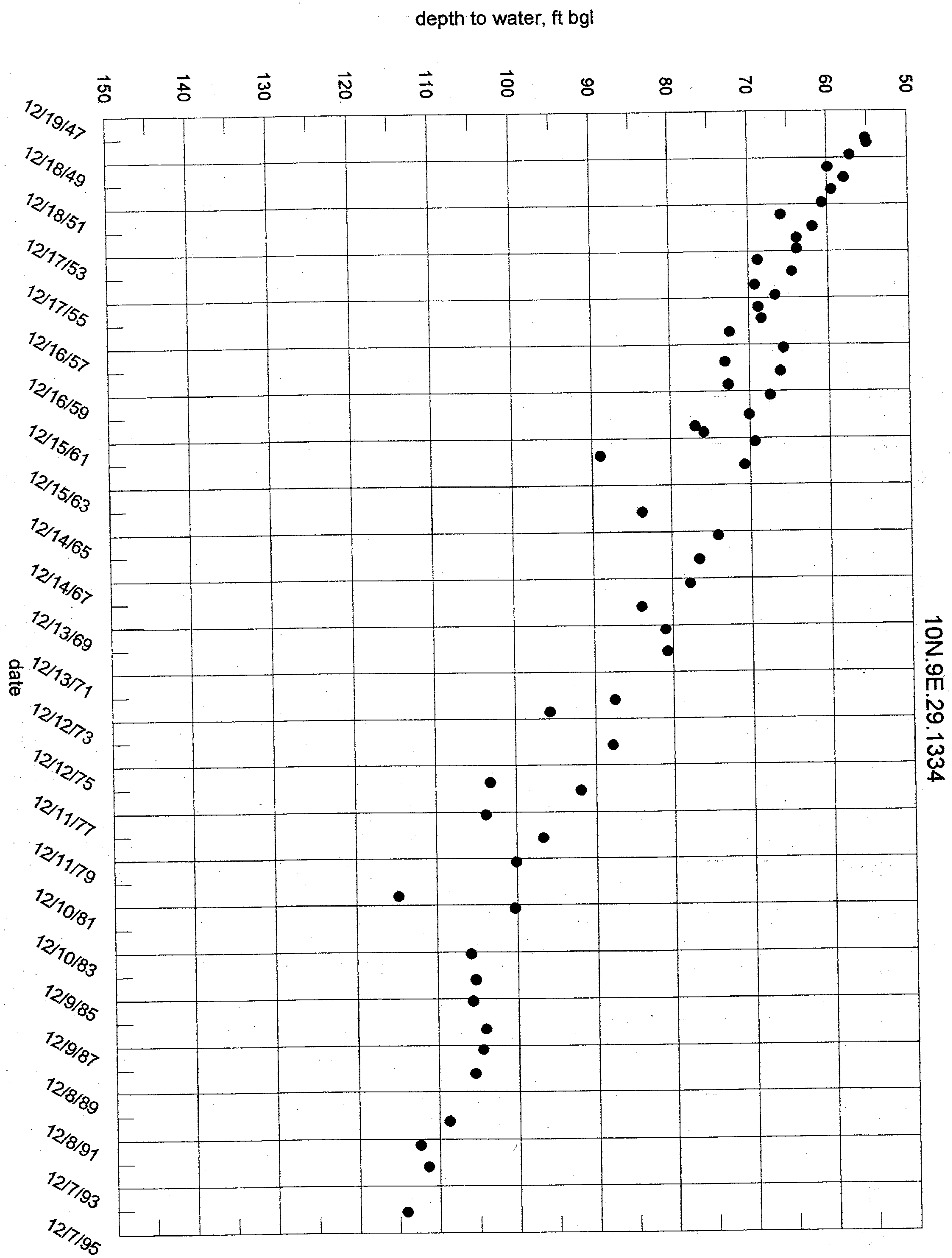

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depth to water, ft bgl
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140
130
120
110
100
90
80
70
60
50
date
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12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
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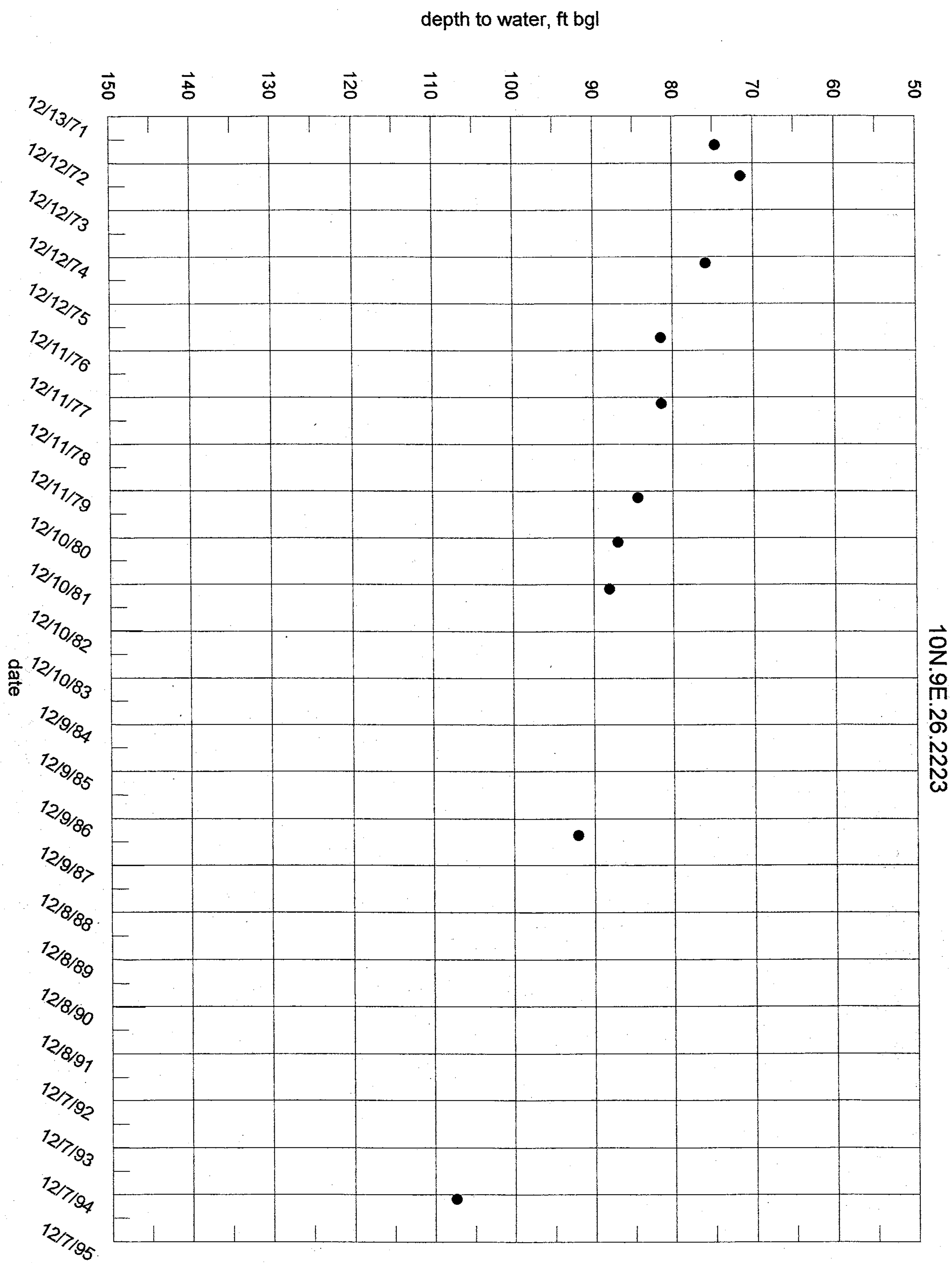
12/7/93
12/7/95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140
130
120
110
100
90
80
70
60
50
date
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
12/9/84
12/9/85
12/9/86
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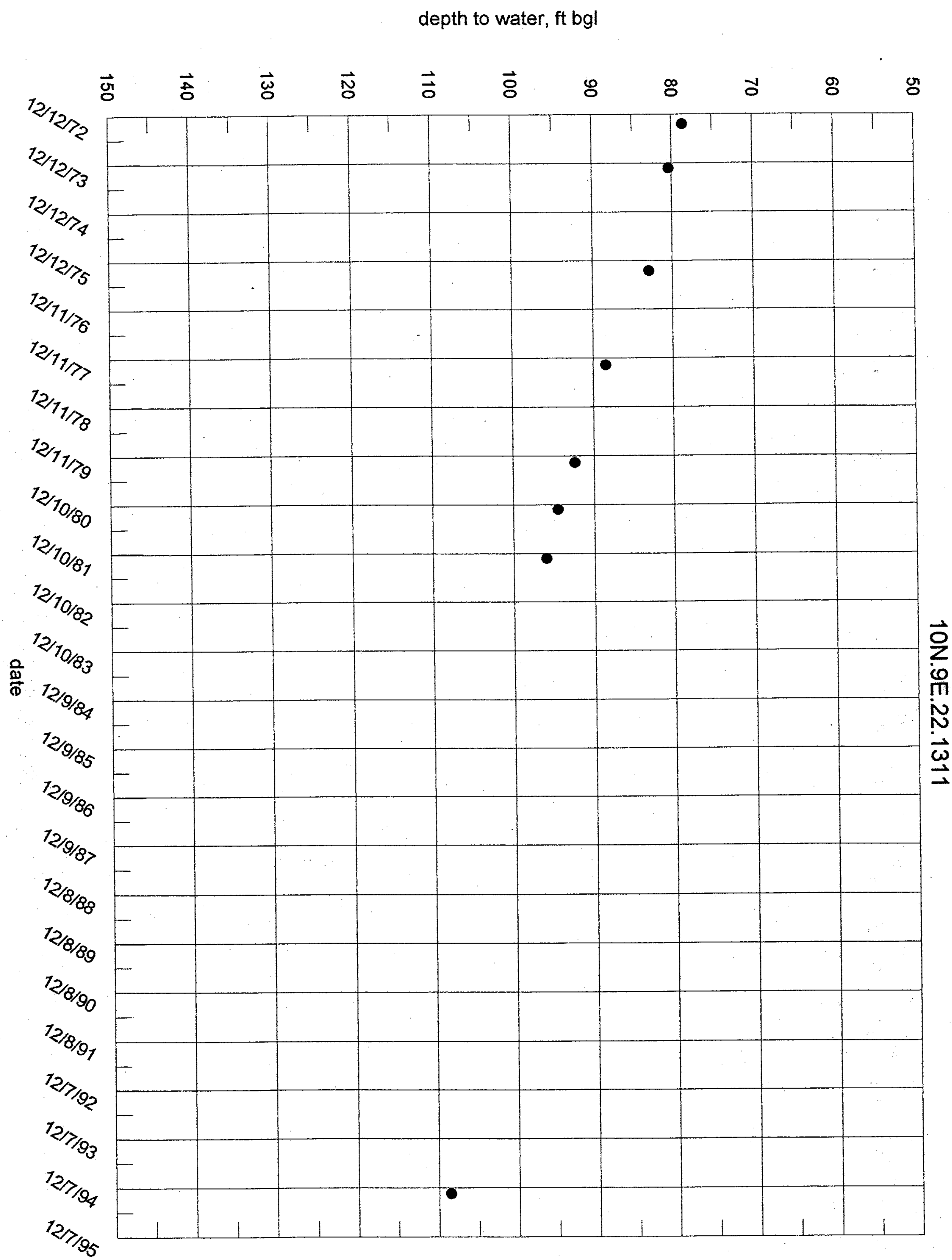
10N.9E.26.2223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130
120
110
100
90
80
70
60
50
12/12/72
12/12/73
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date
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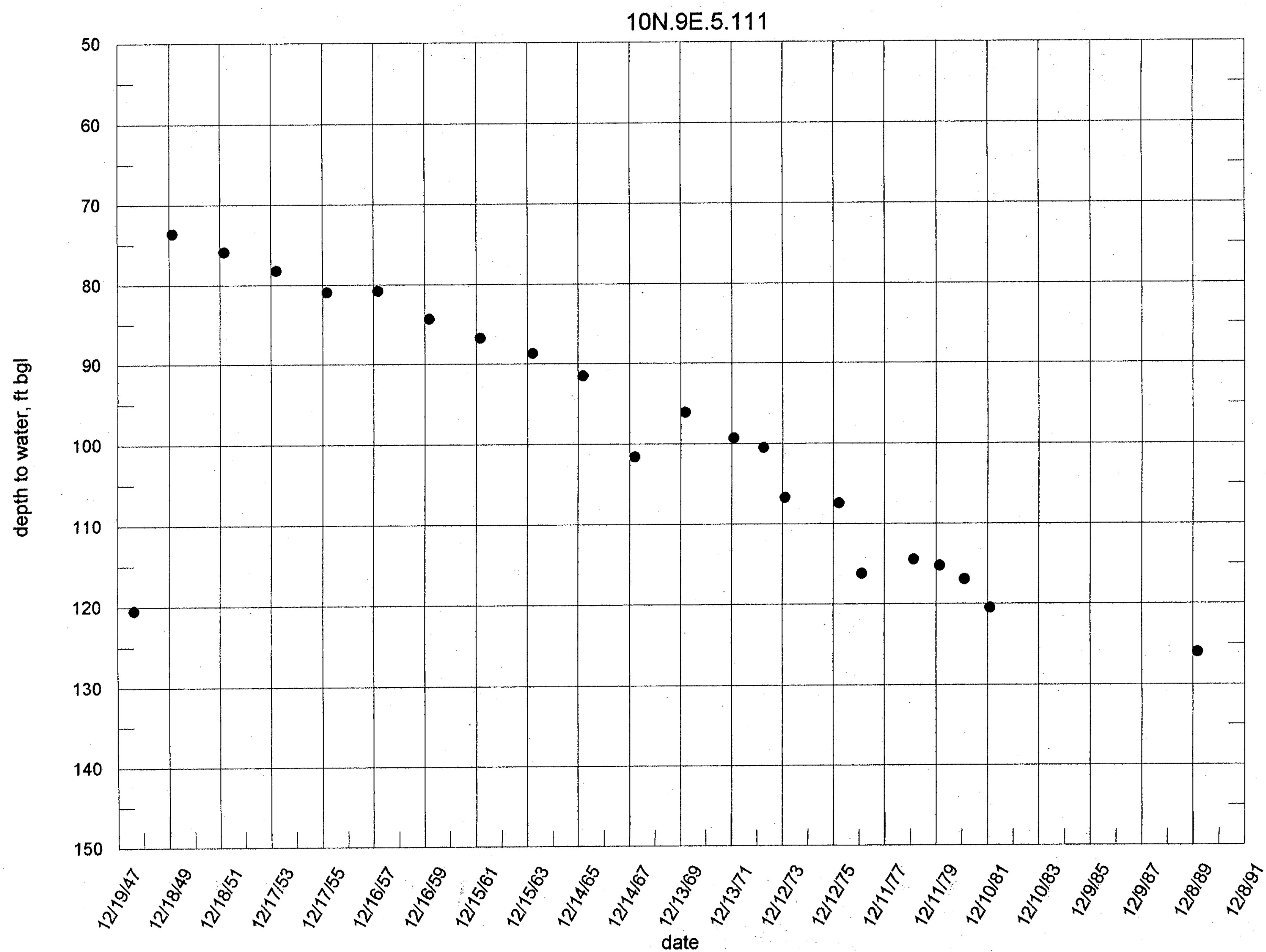
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100
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130
140
150
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12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
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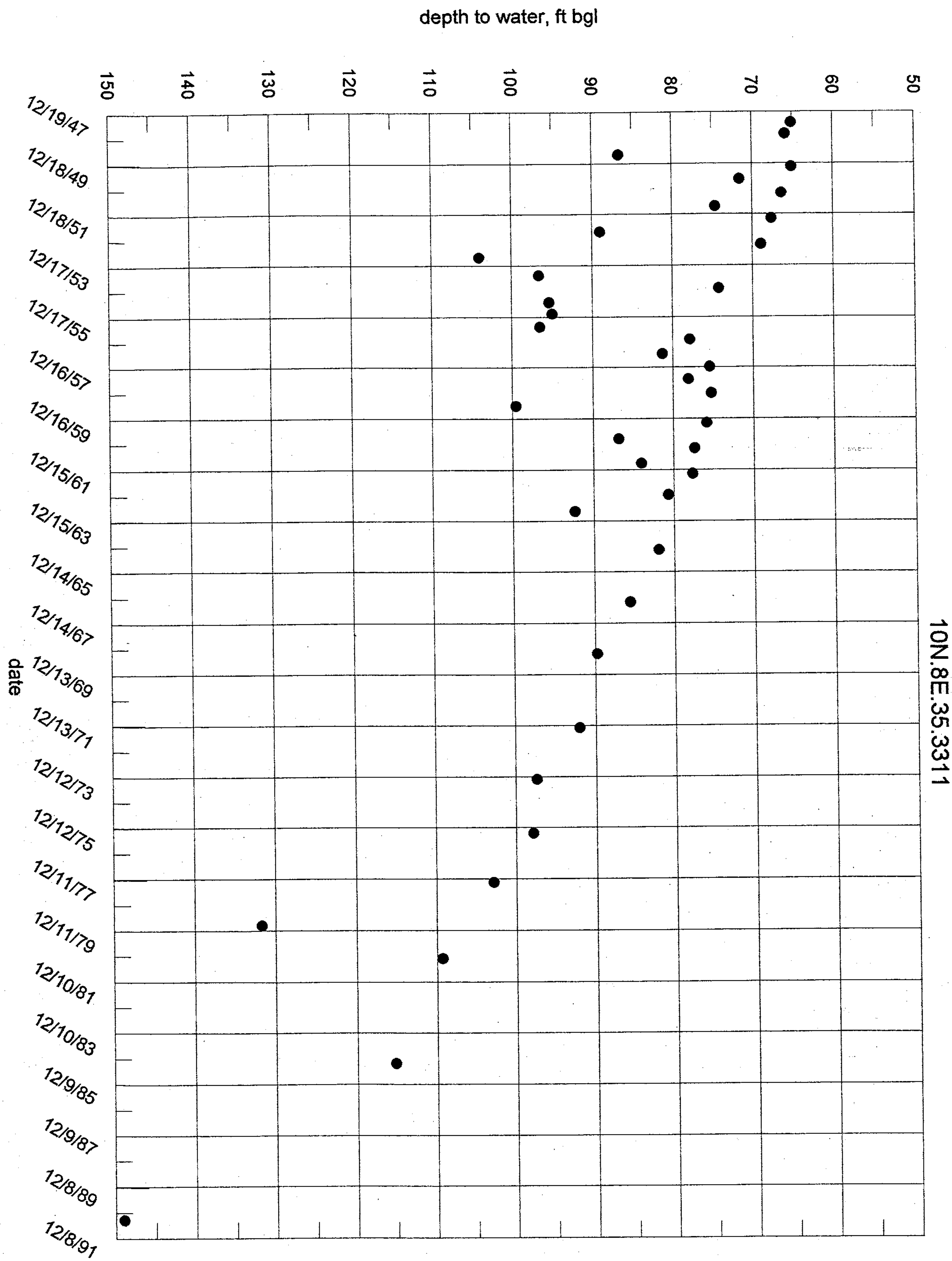
12/9/87
12/8/89
12/8/91
date



depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
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12/13/71
12/12/73
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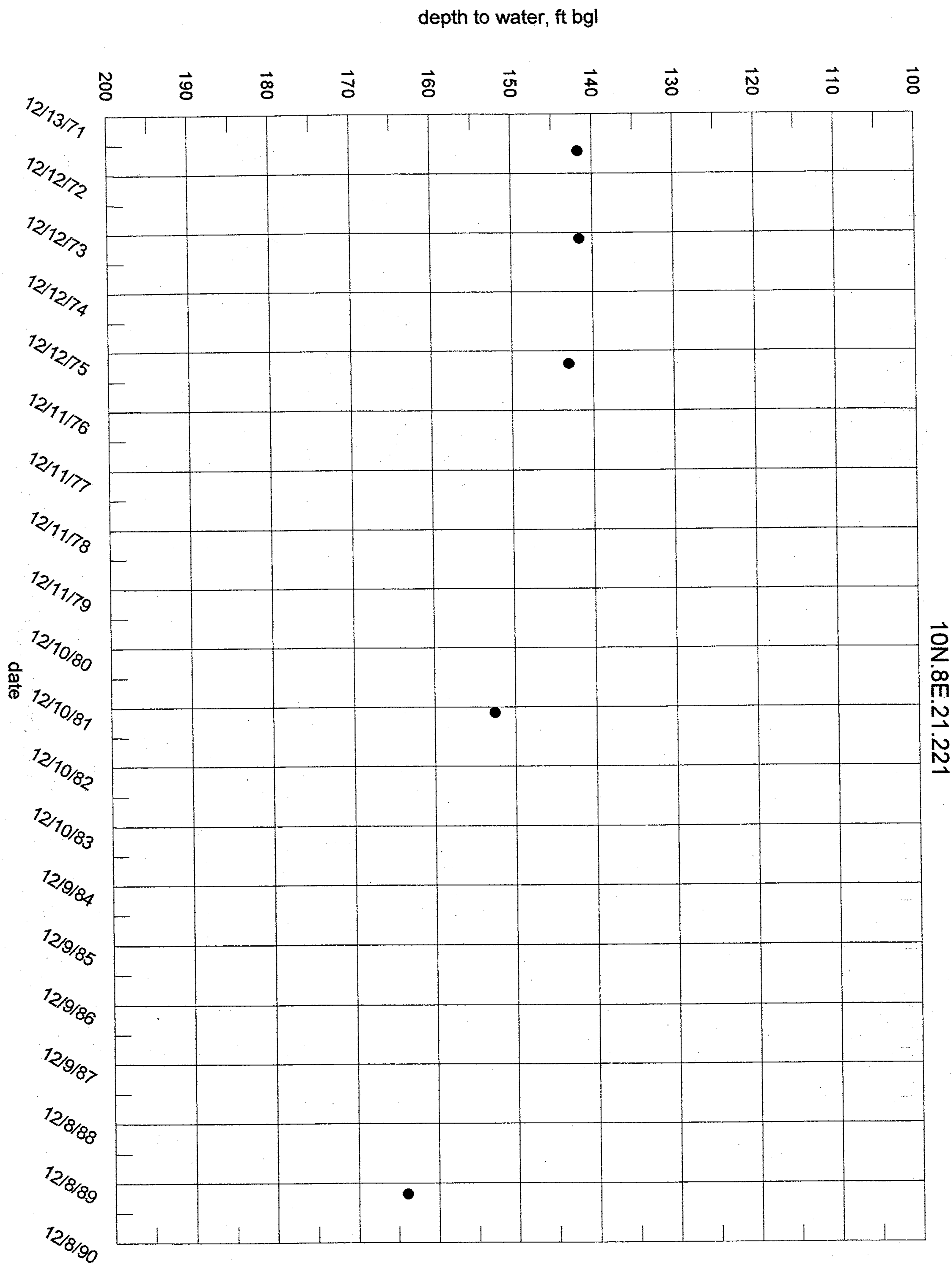

depth to water, ft bgl
200
190
180
170
160
150
140
130
120
110
100
date
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12/12/75
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12/11/78
12/11/79
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12/10/82
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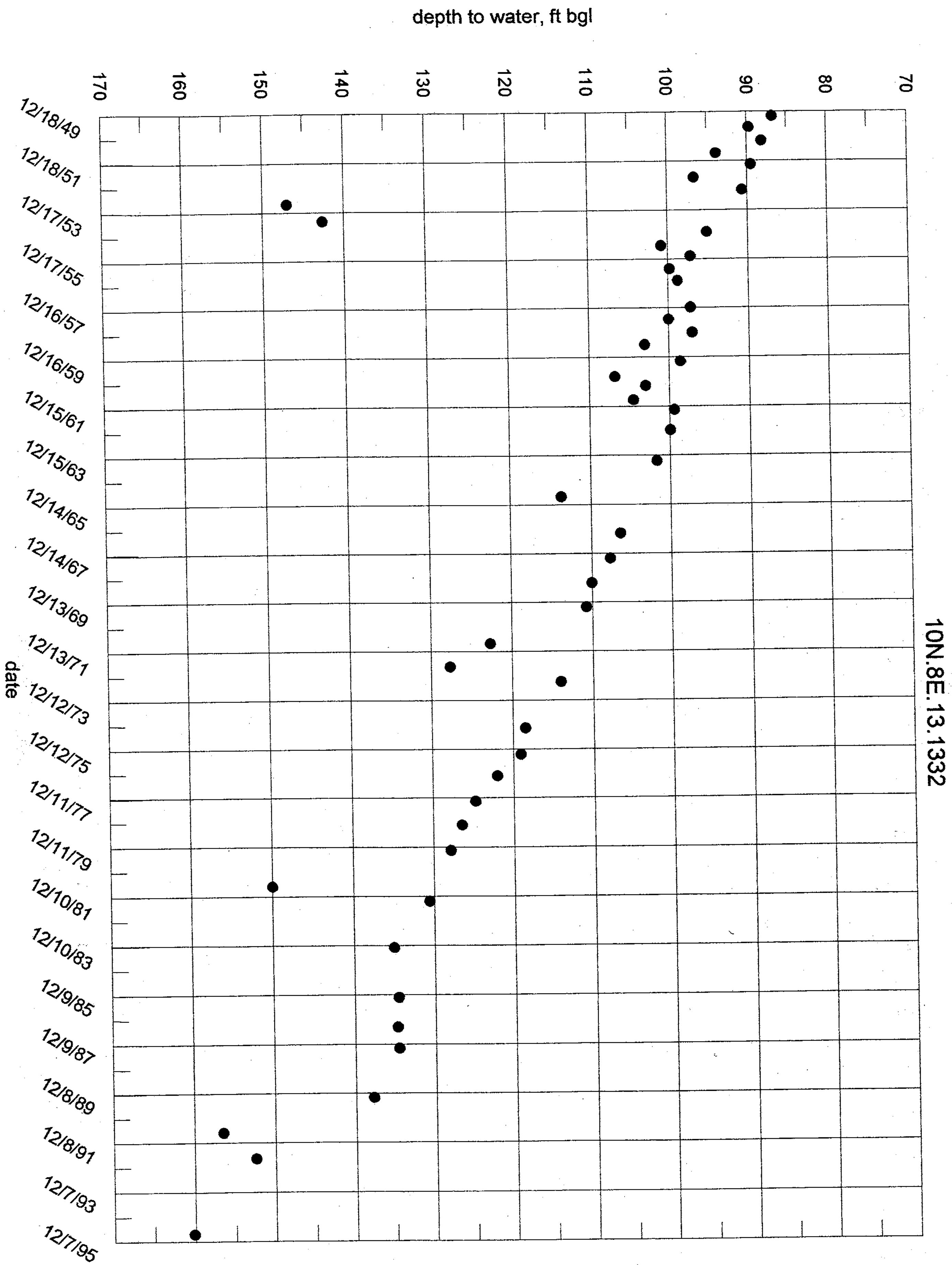
10N.8E.21.221



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150
140
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110
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90
80
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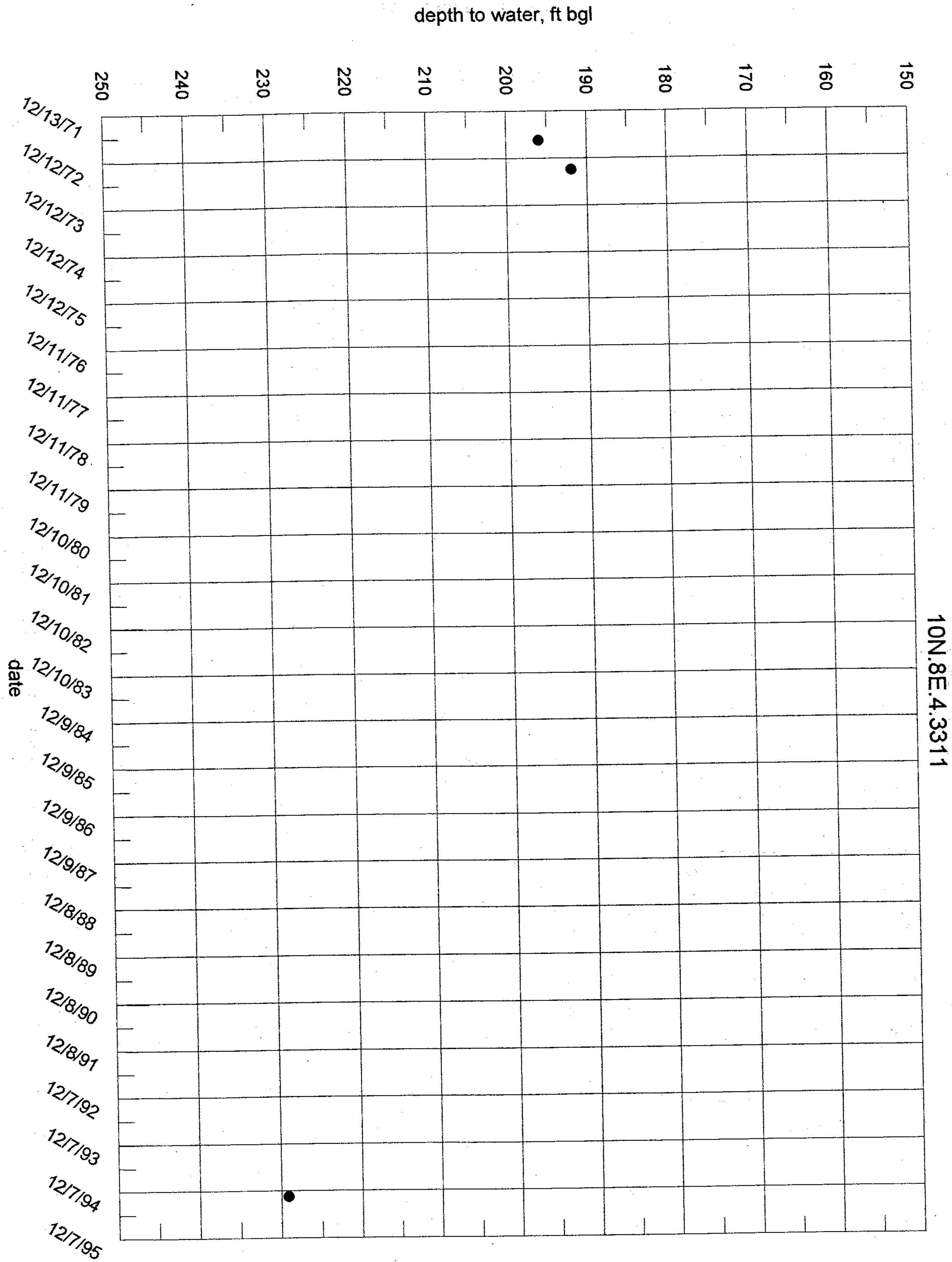
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date
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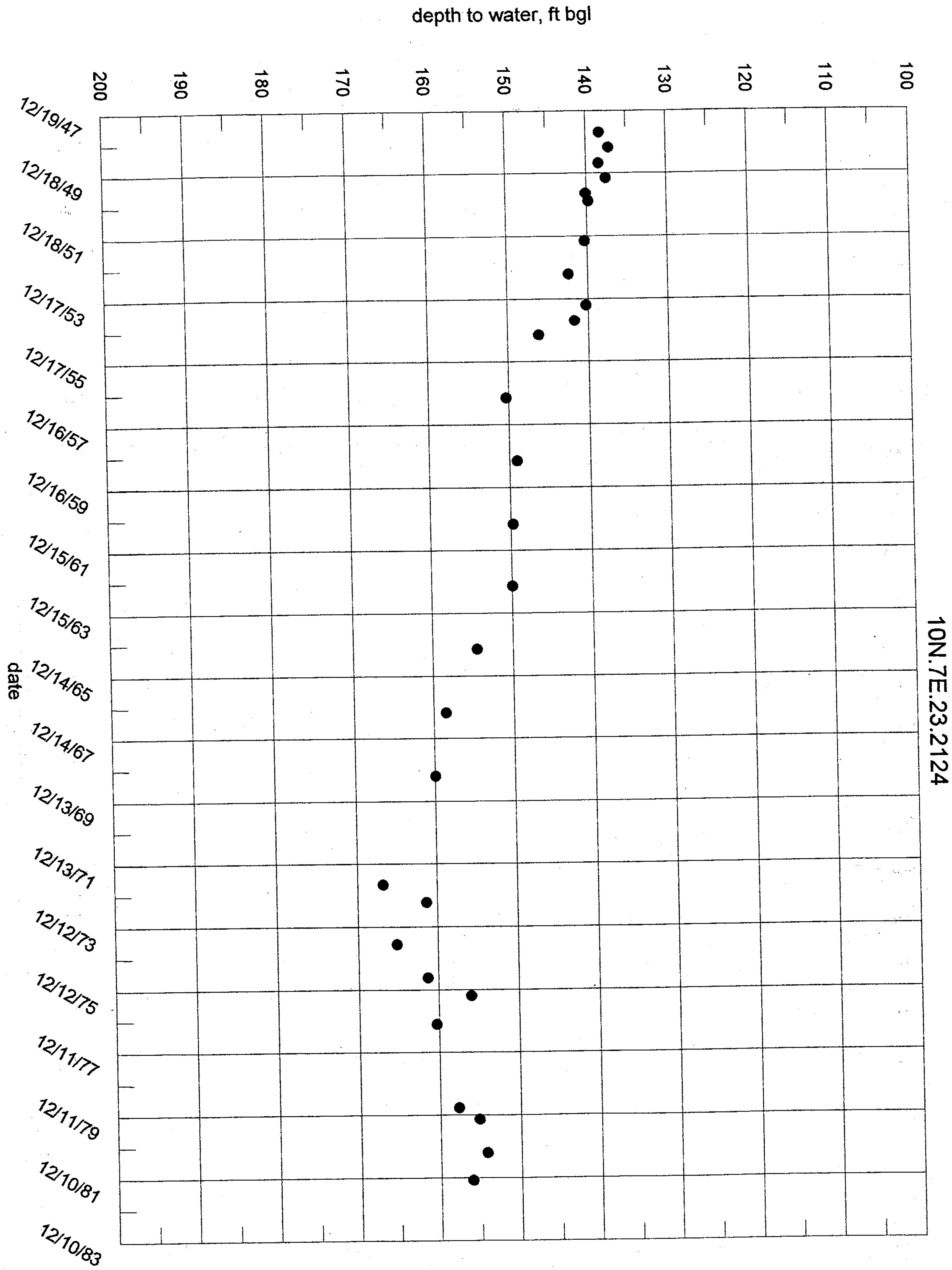

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12/14/65
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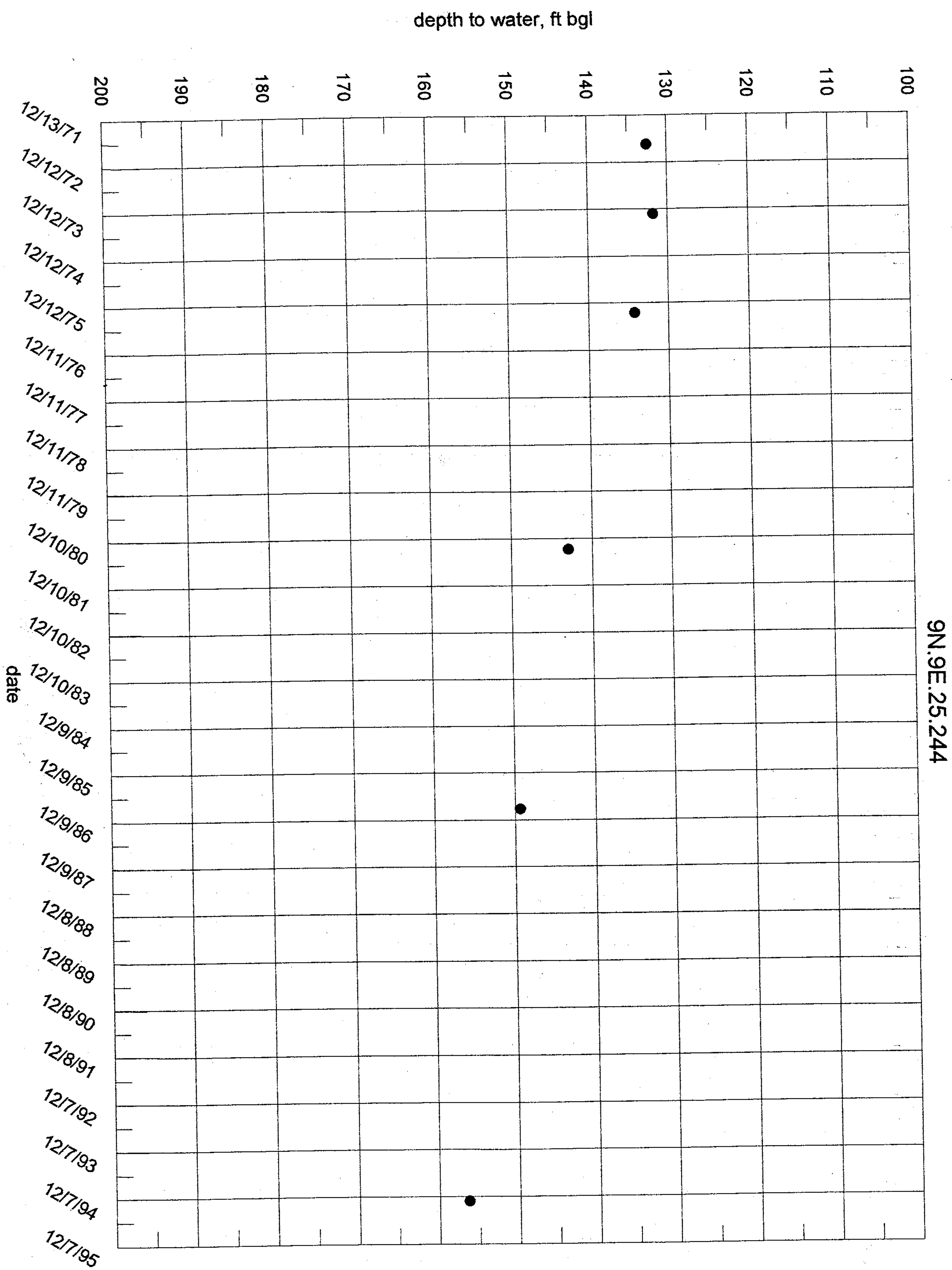
12/10/83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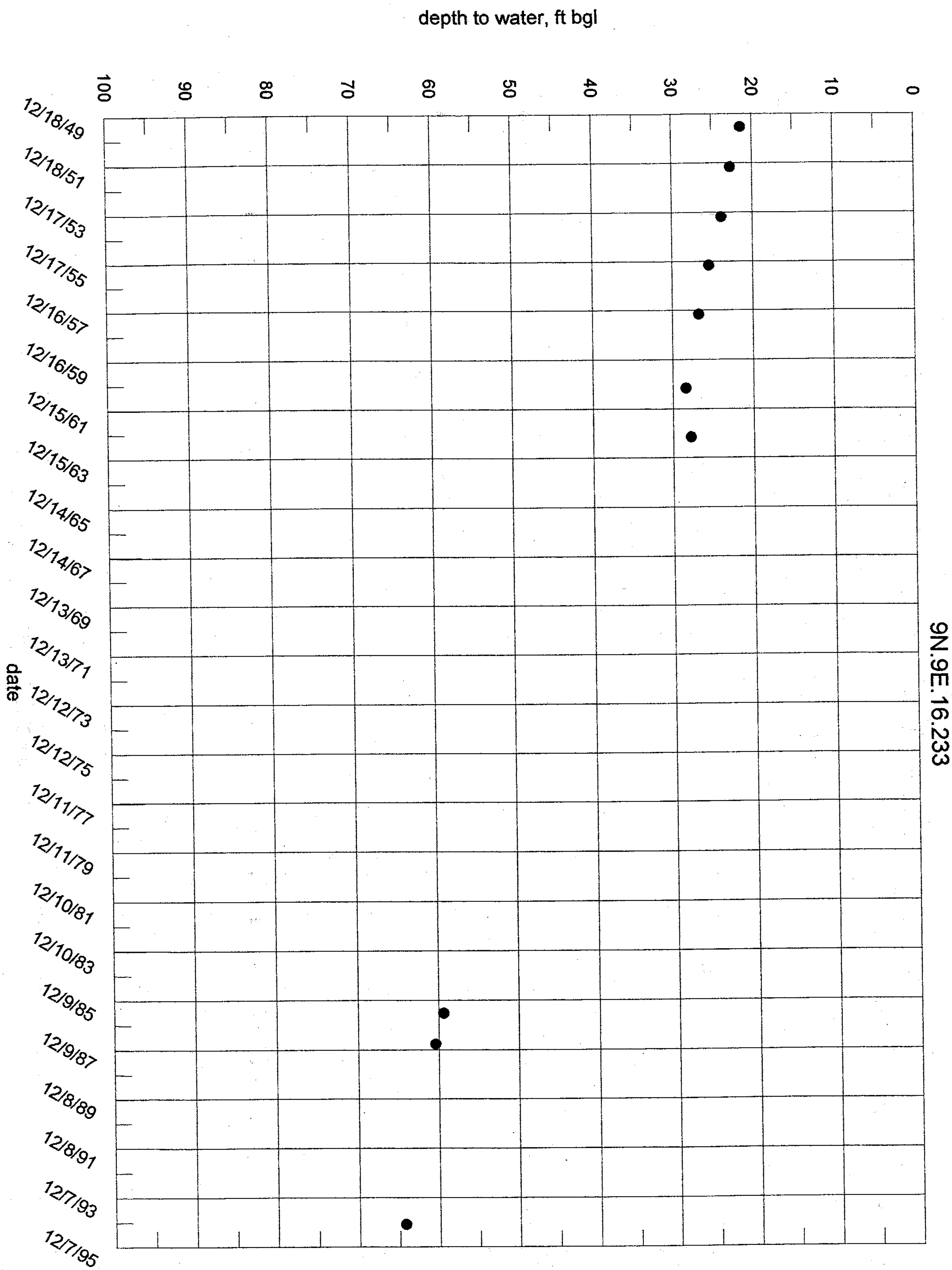
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12/16/57
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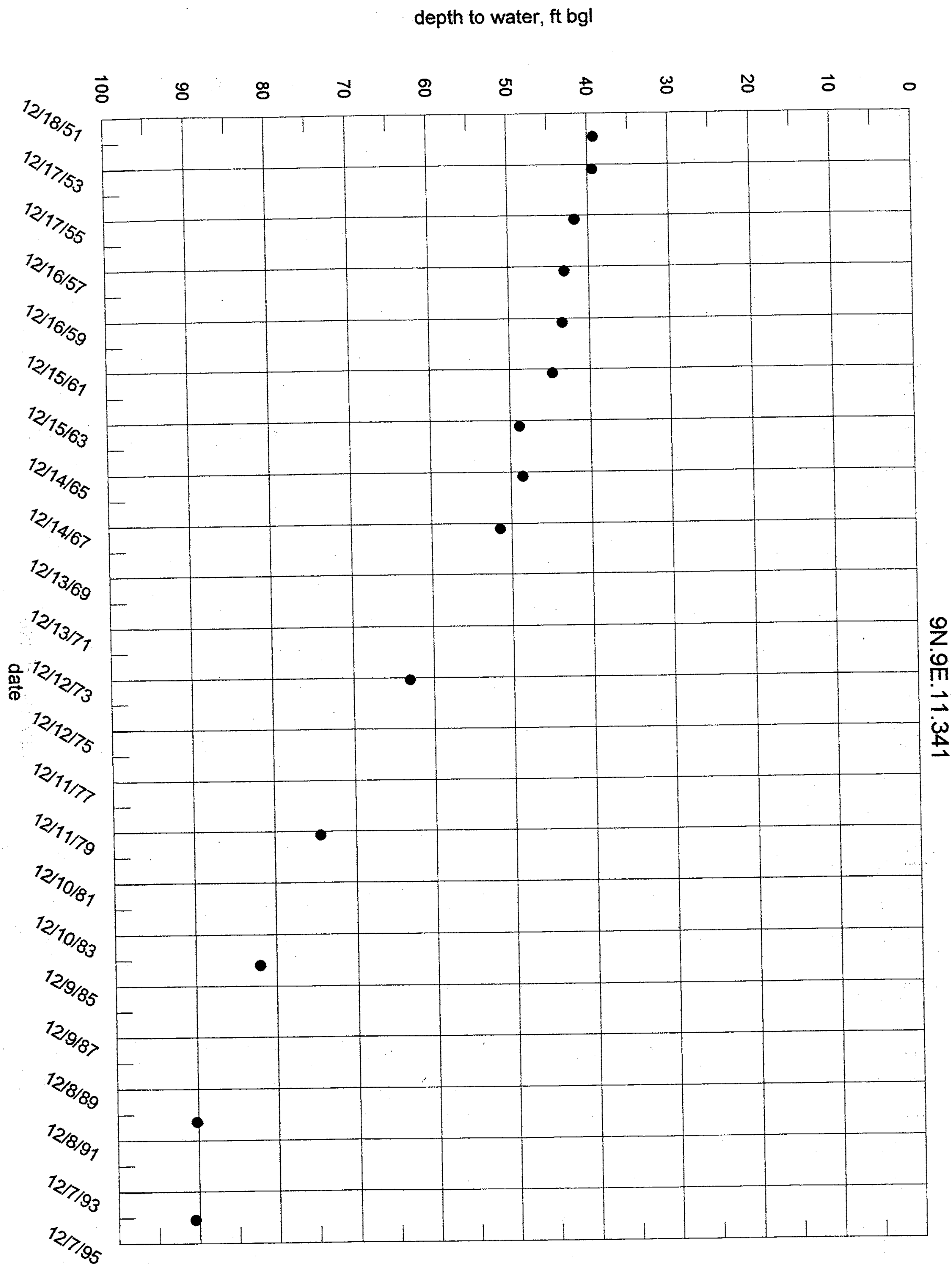
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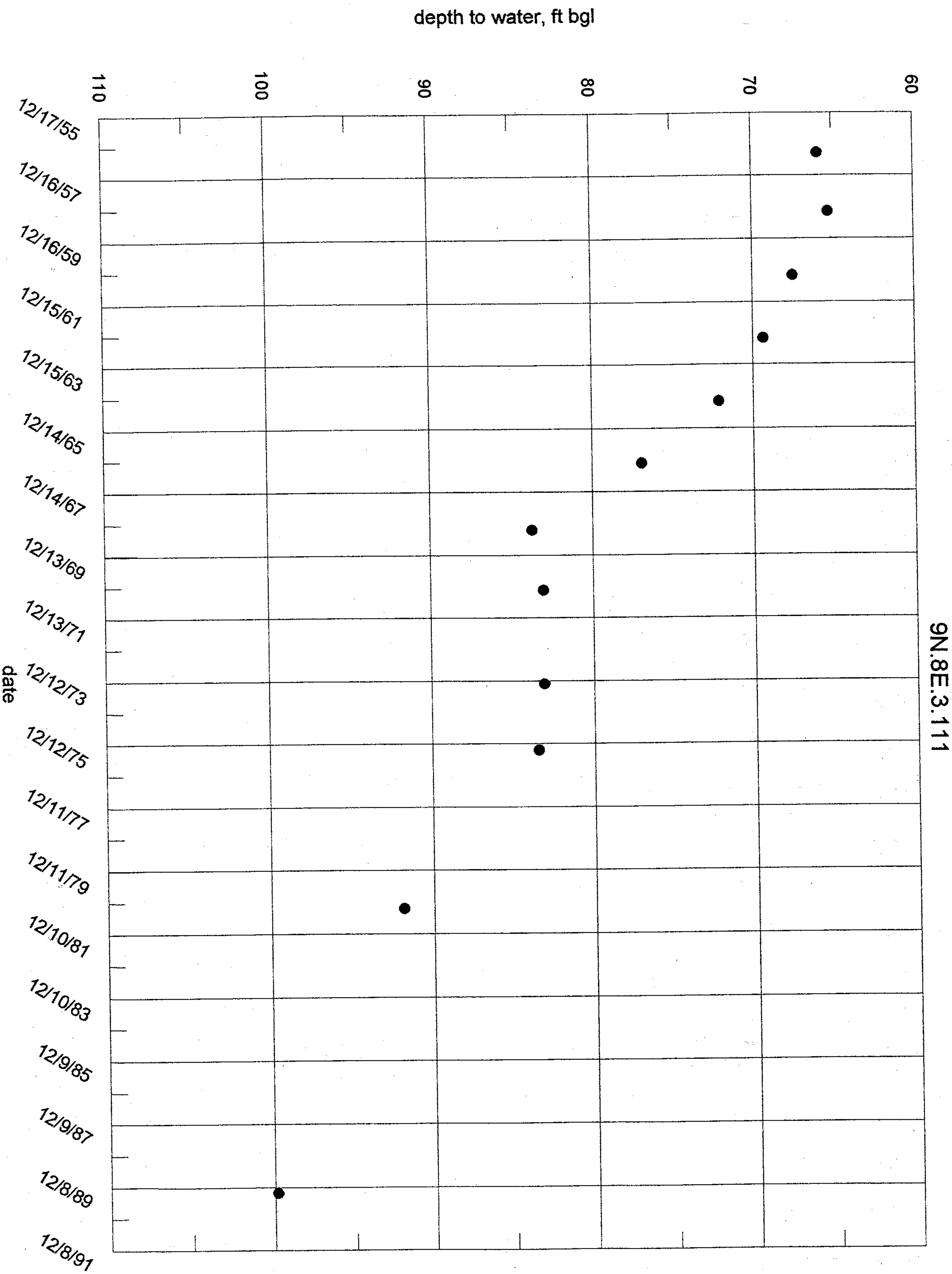
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80
70
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date
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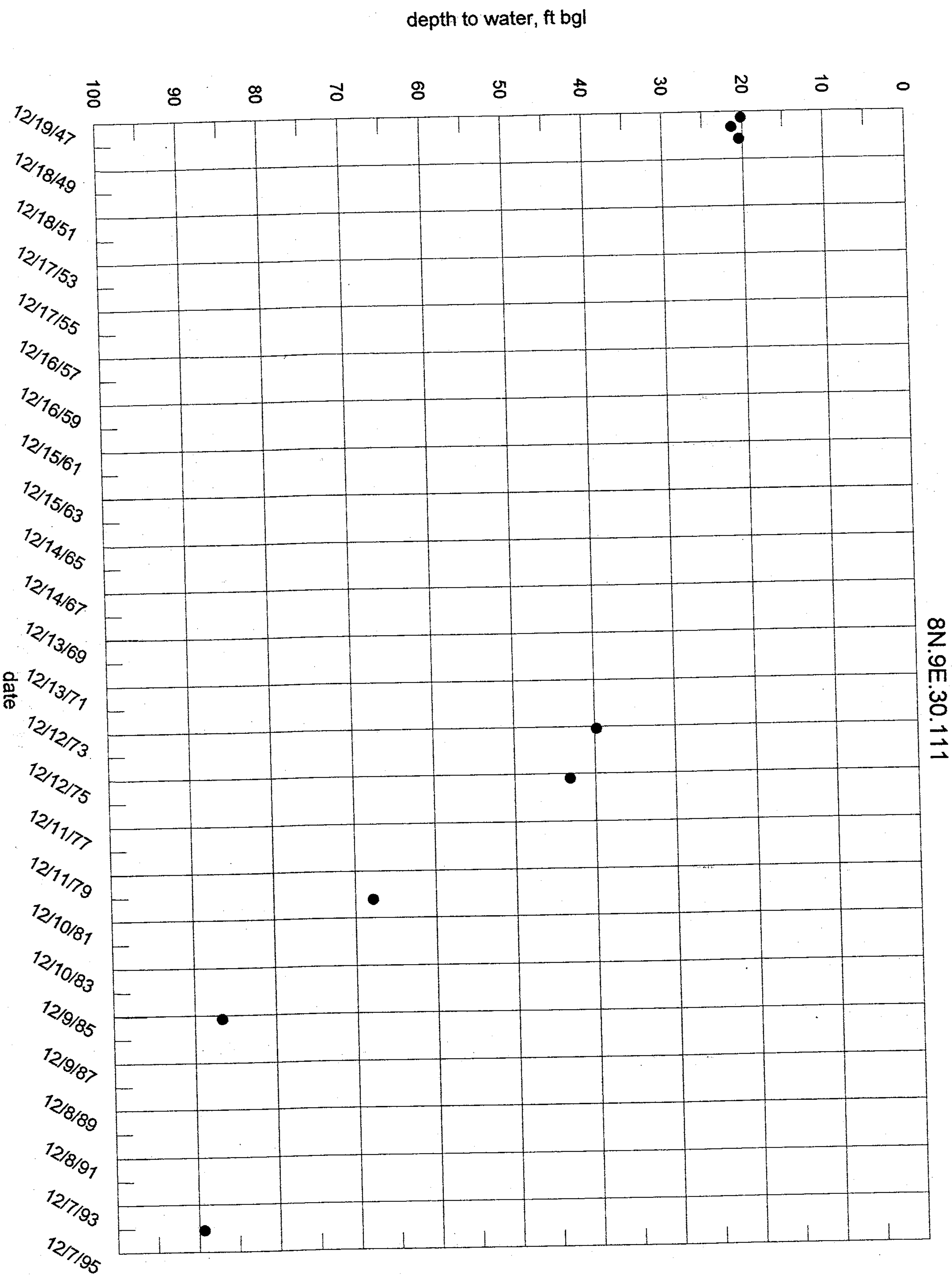
9N.8E.3.111



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depth to water, ft bgl
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30
40
50
60
70
80
90
100
date
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12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
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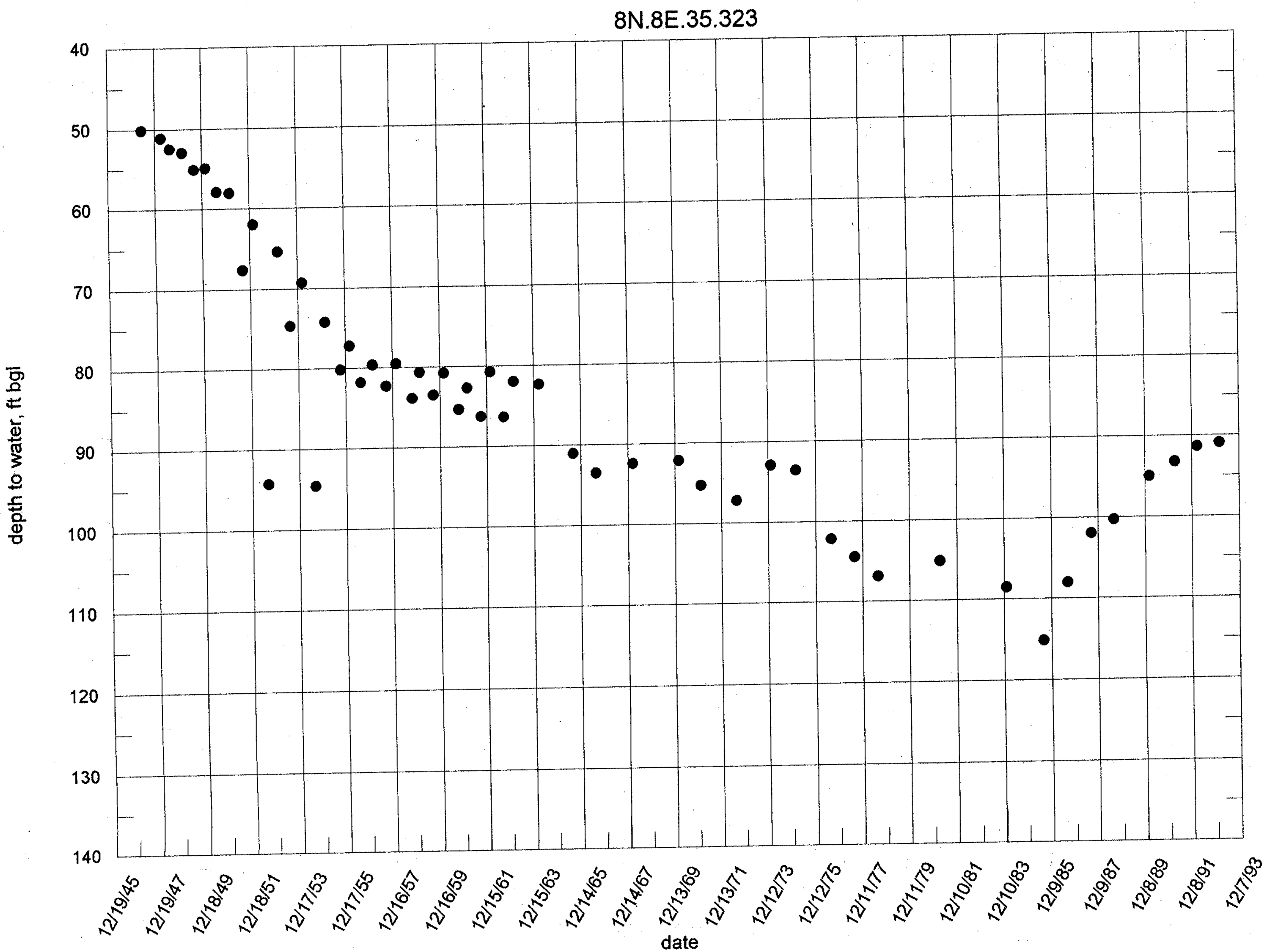
12/7/95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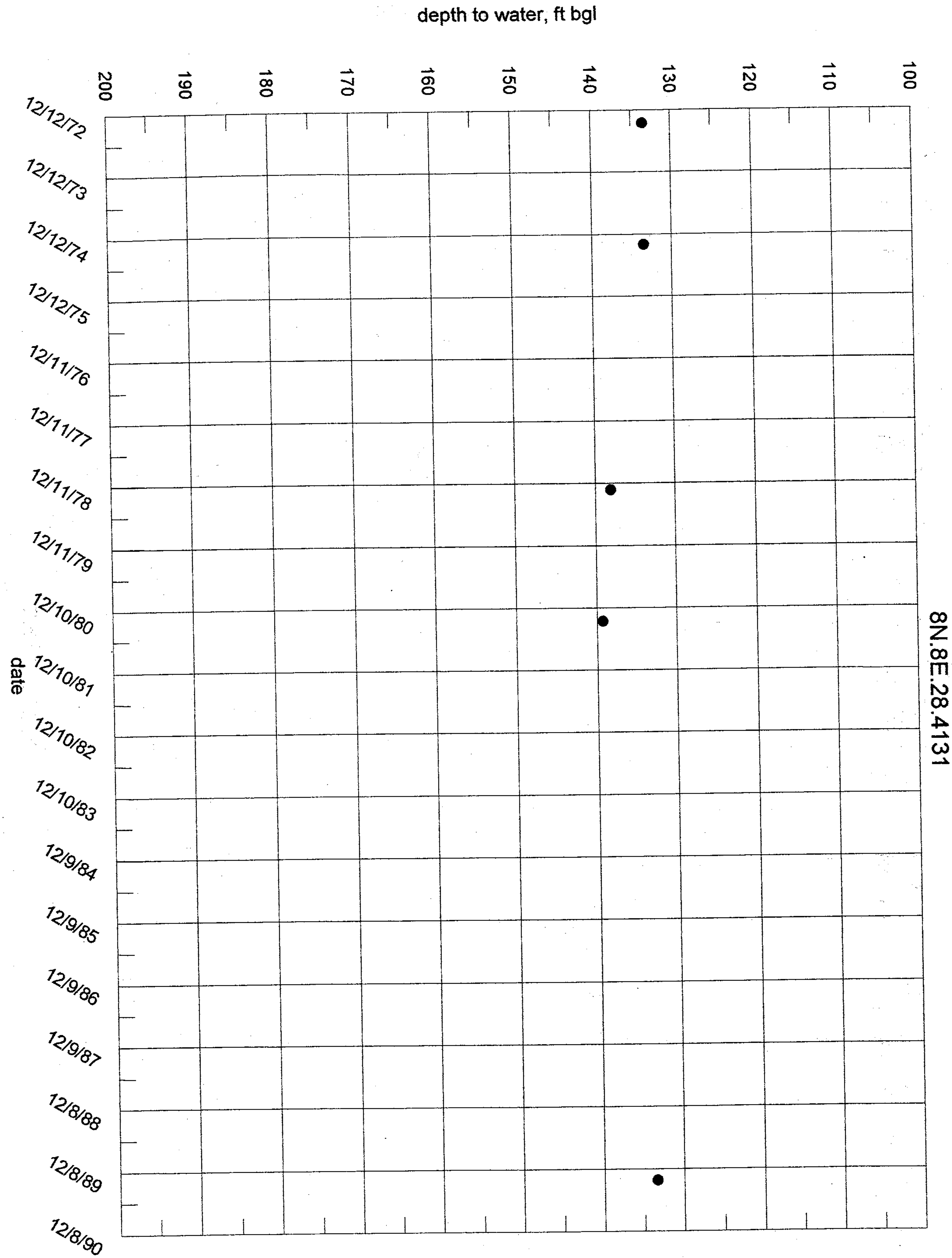
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150
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120
110
100
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12/12/74
12/12/75
12/11/76
12/11/77
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12/10/80
12/10/81
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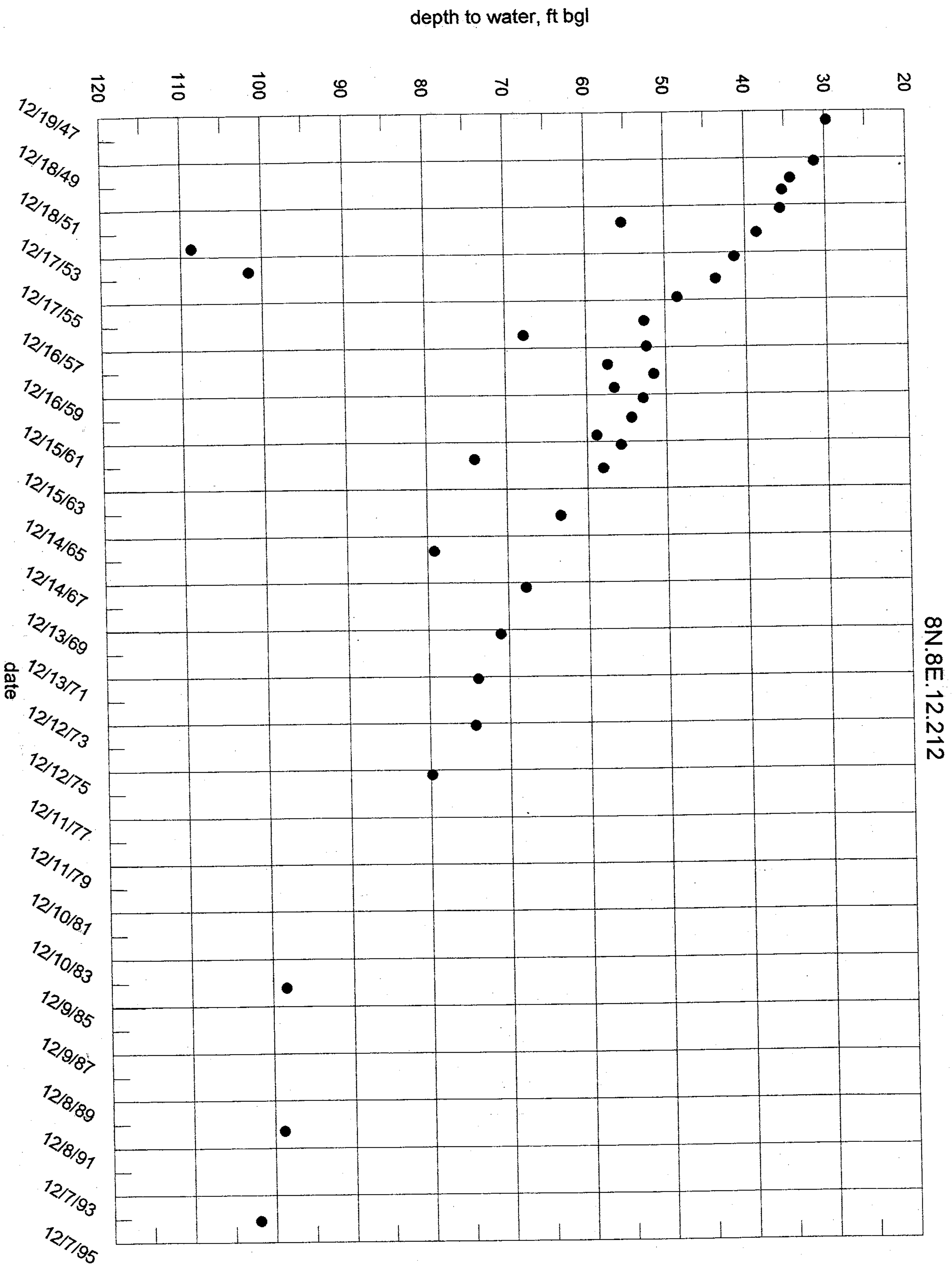
12/8/90



depth to water, ft bgl
120
110
100
90
80
70
60
50
40
30
20
date
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12/18/49
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12/10/83
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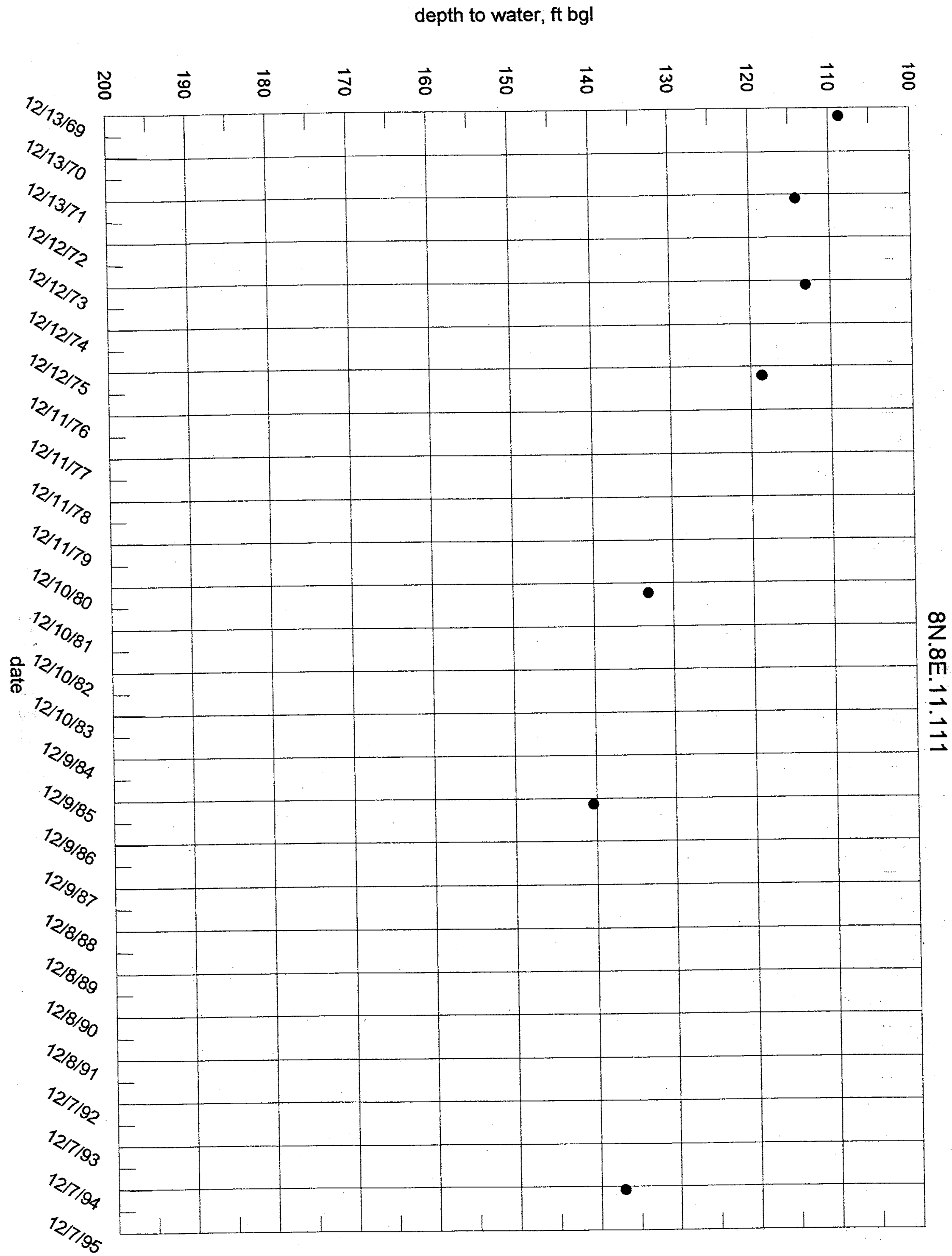
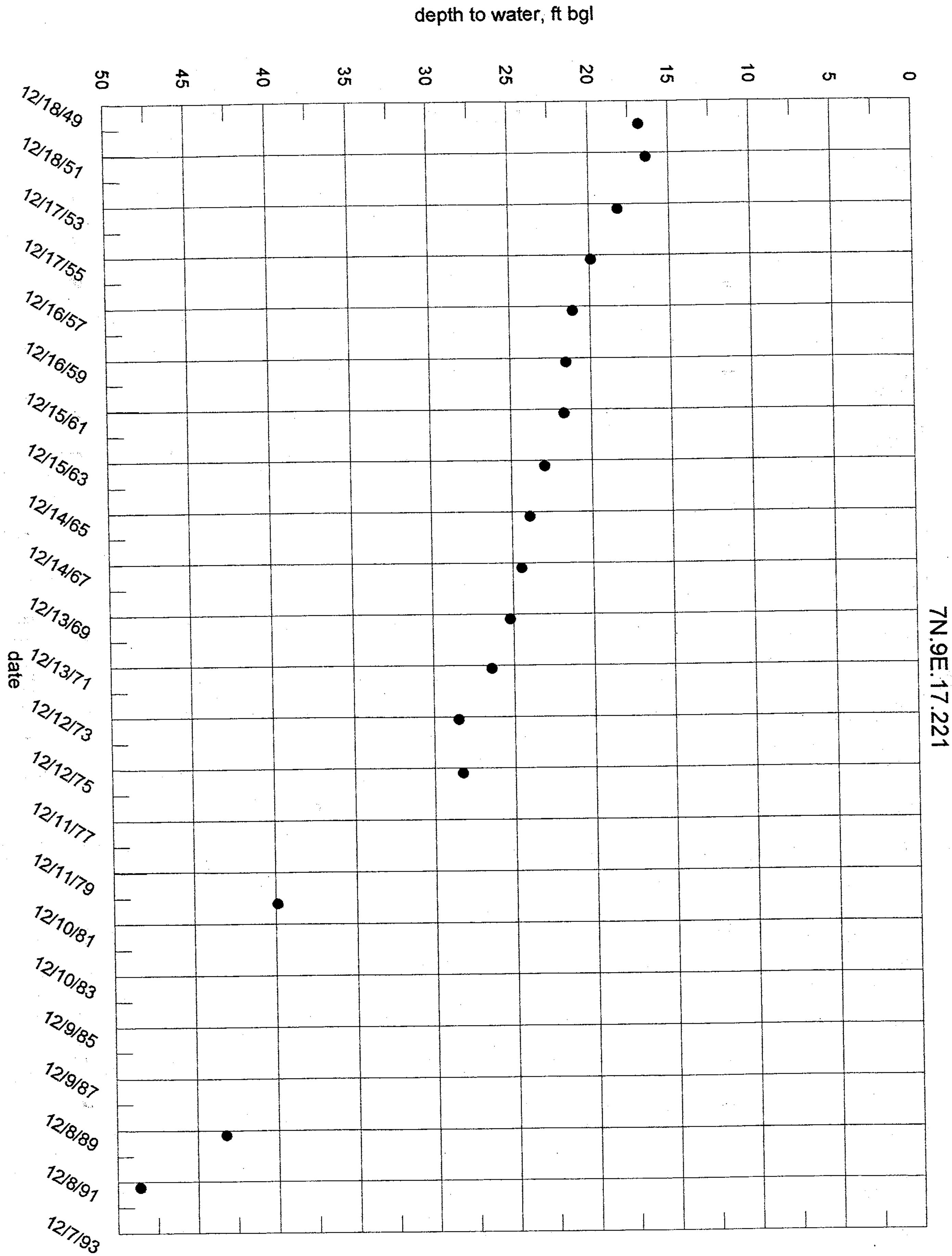
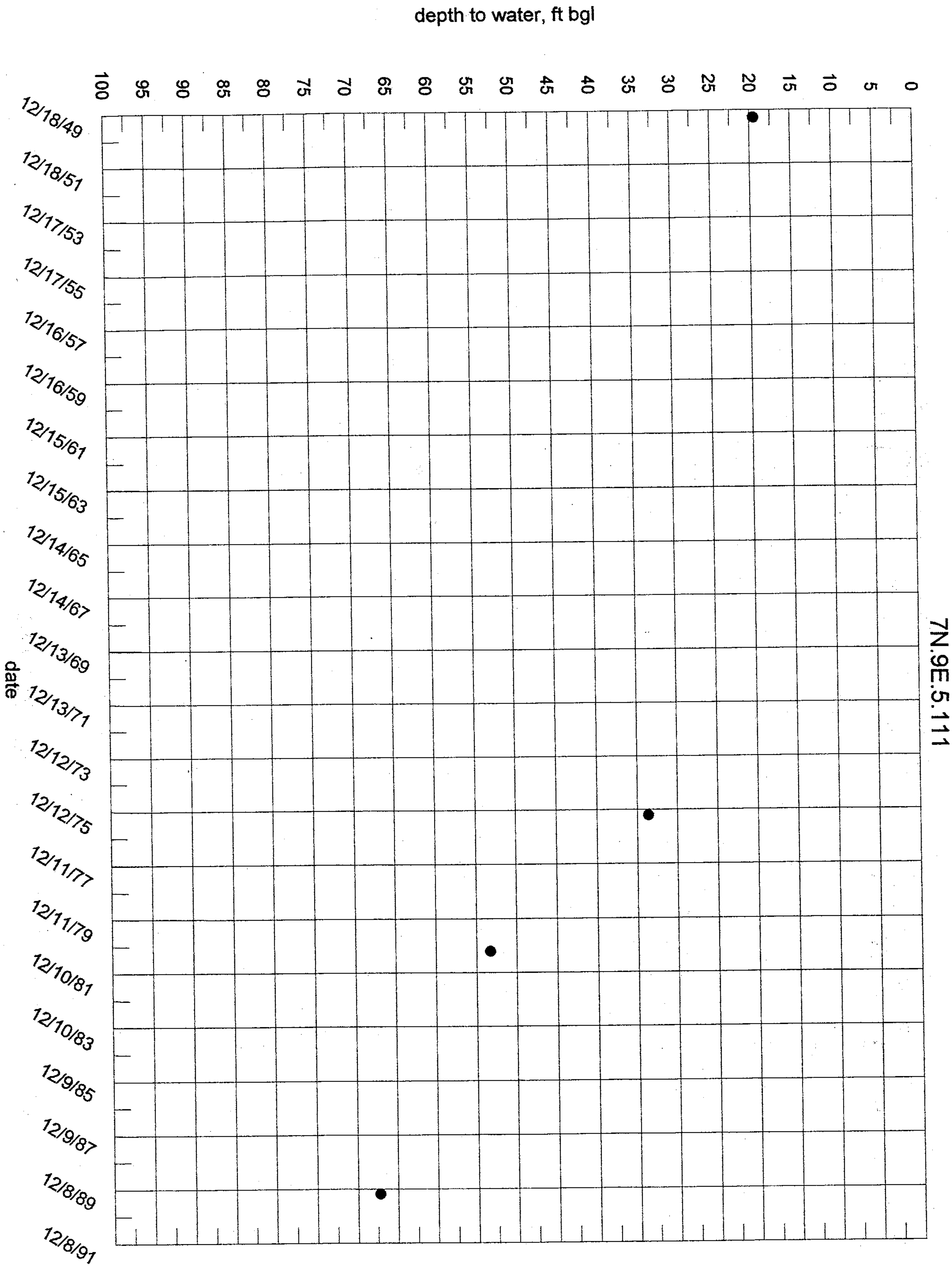
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
8N.8E.12.212

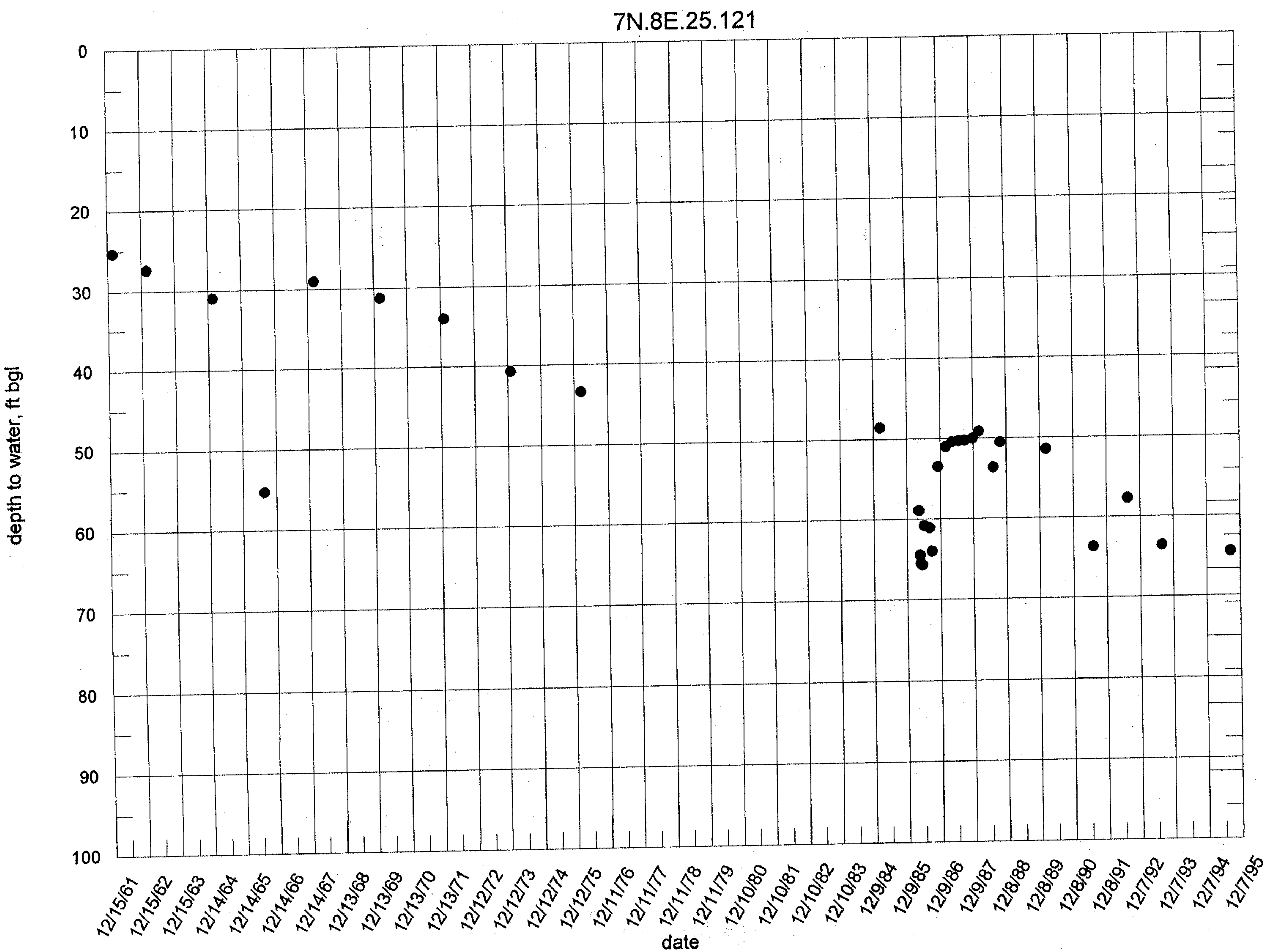


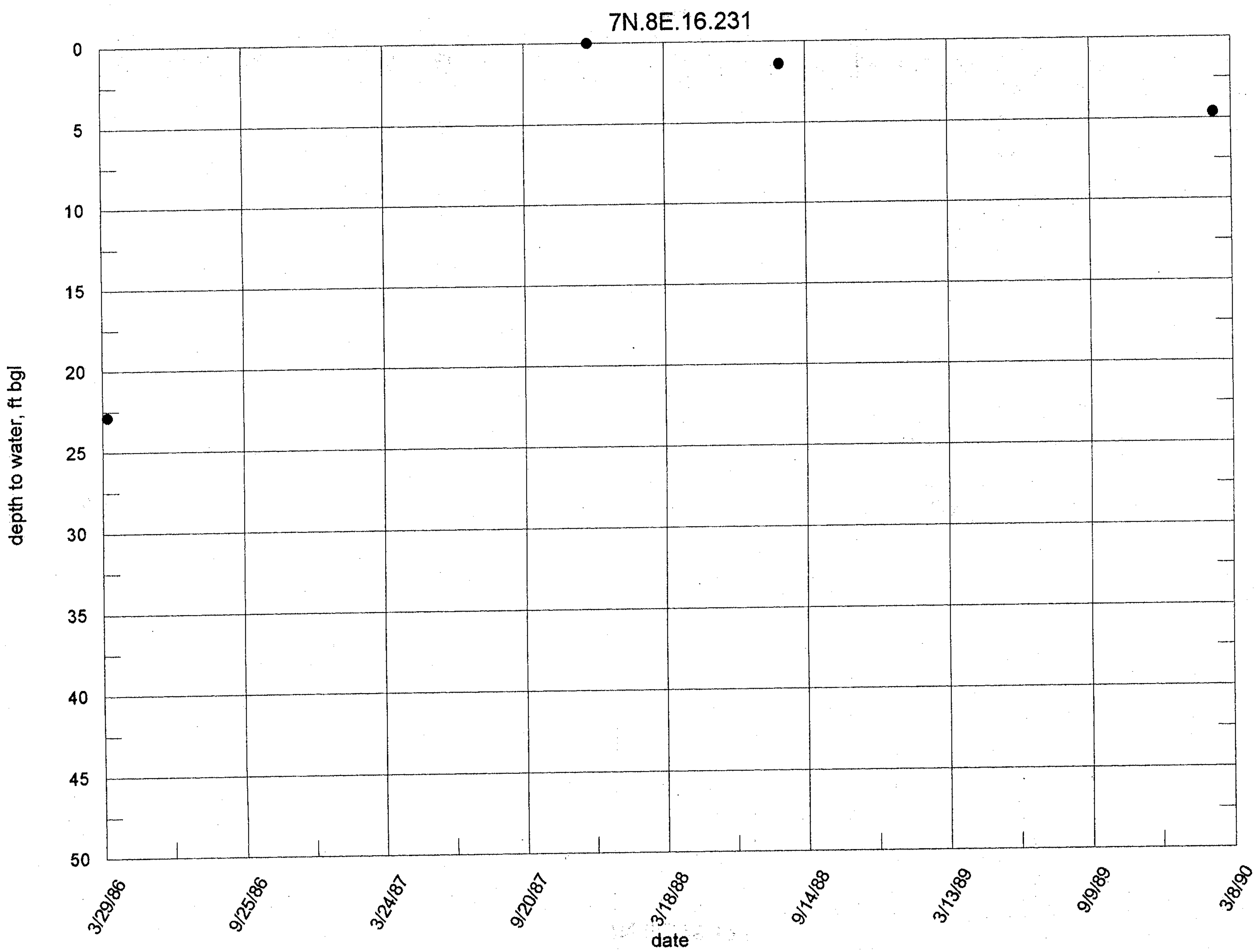
depth to water, ft bgl
200
190
180
170
160
150
140
130
120
110
100
date
12/13/69
12/13/70
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
12/9/84
12/9/85
12/9/86
12/9/87
12/8/88
12/8/89
12/8/90
12/8/91
12/7/92
12/7/93
12/7/94
12/7/95
8N.8E.11.111

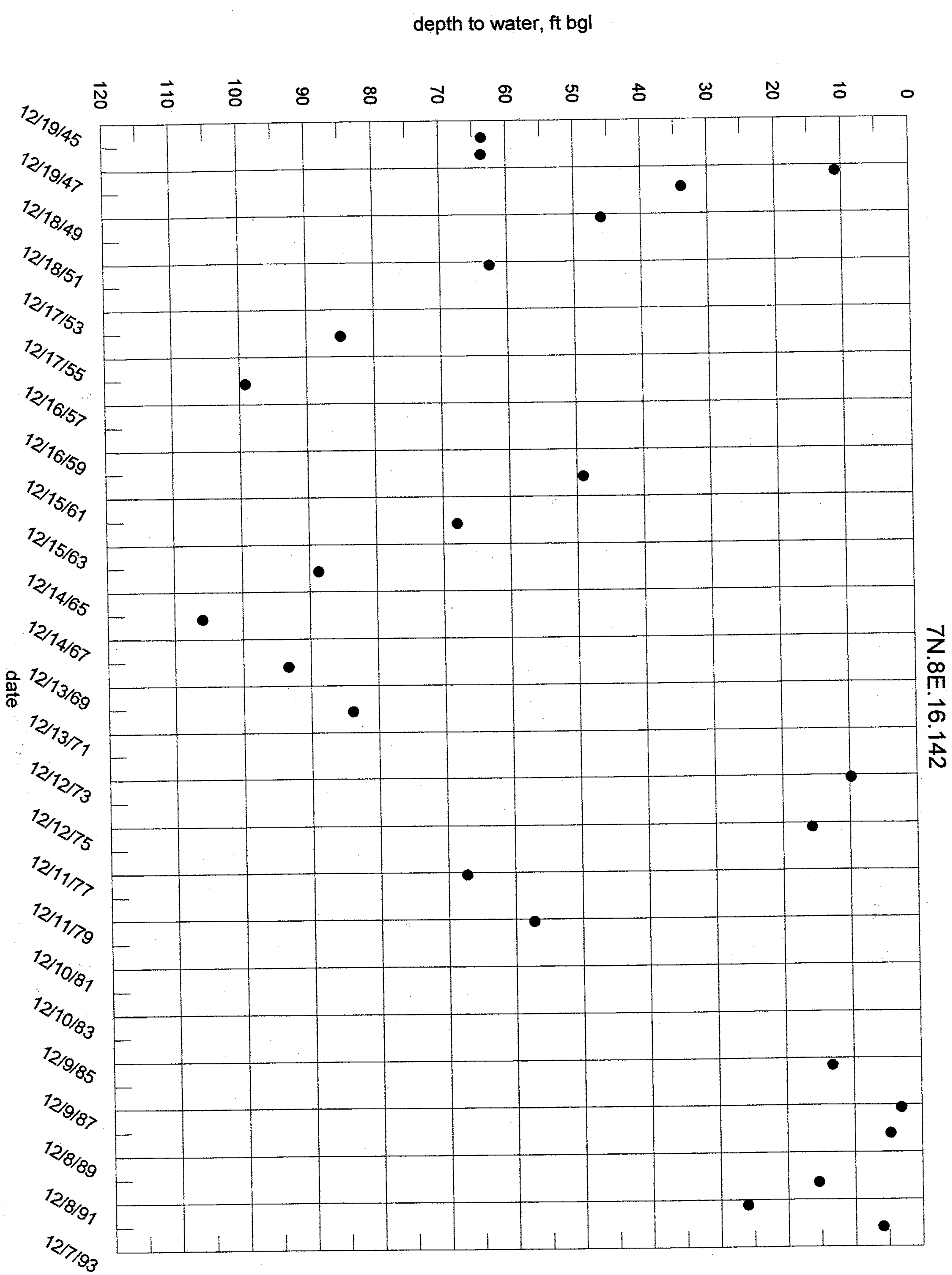


depth to water, ft bgl
50
45
40
35
30
25
20
15
10
5
0
date
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
7N.9E.17.221

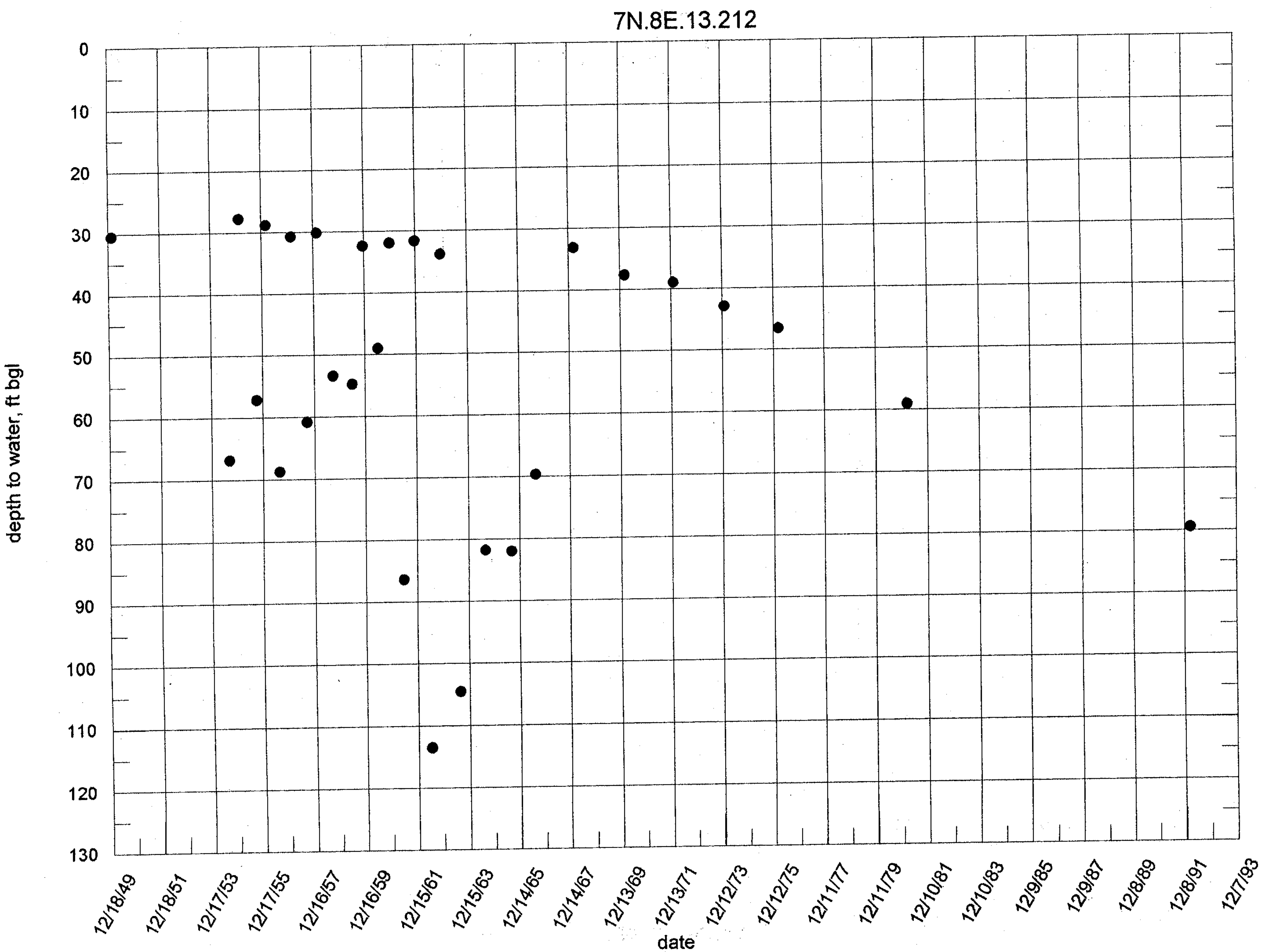

depth to water, ft bgl
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
date
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
7N.9E.5.111

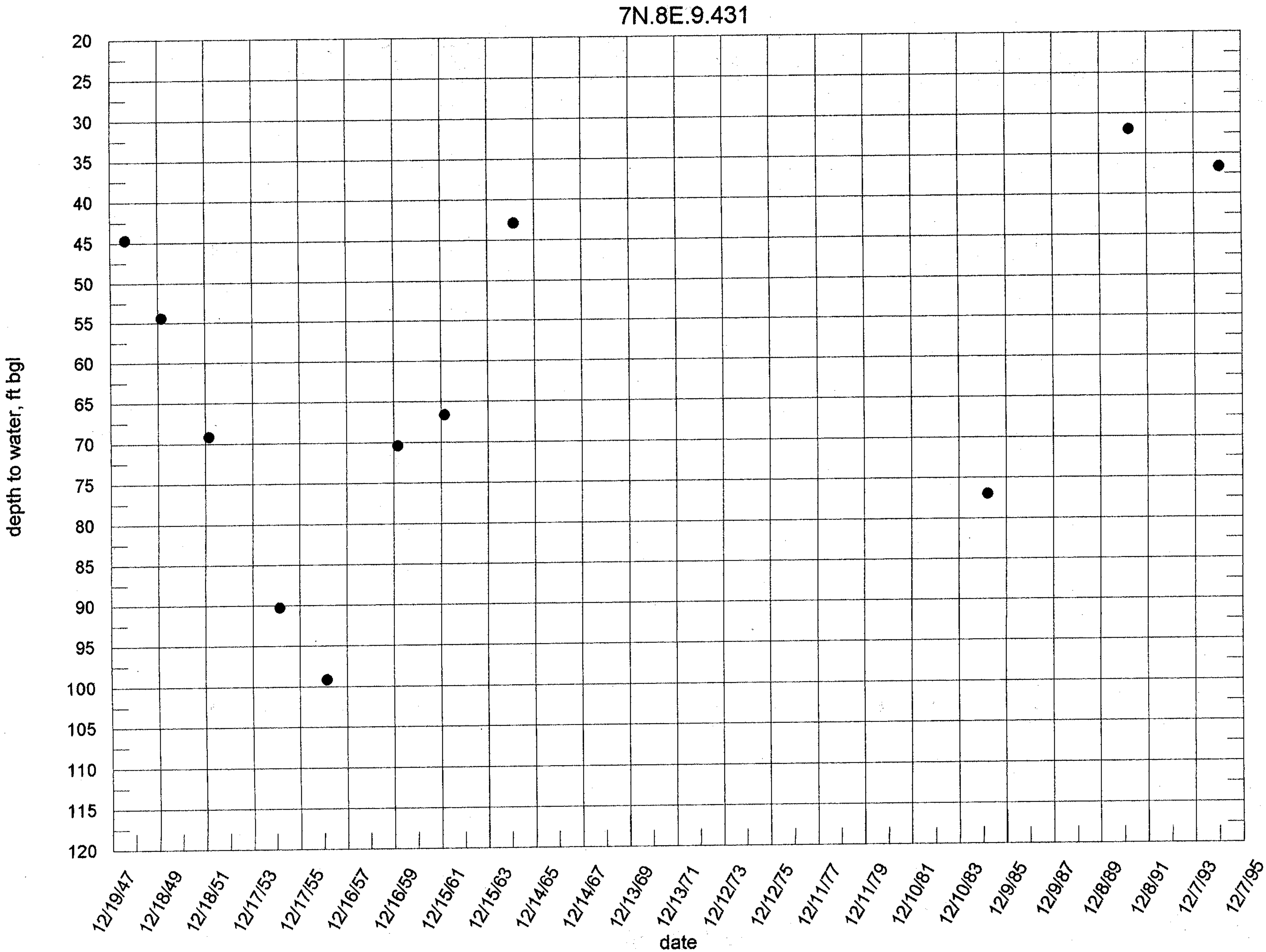

7N.8E.25.121
depth to water, ft bgl
0
10
20
30
40
50
60
70
80
90
100
12/15/61
12/15/62
12/15/63
12/14/64
12/14/65
12/14/66
12/14/67
12/13/68
12/13/69
12/13/70
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
12/9/84
12/9/85
12/9/86
12/9/87
12/8/88
12/8/89
12/8/90
12/8/91
12/7/92
12/7/93
12/7/94
12/7/95
date


7N.8E.16.231
depth to water, ft bgl
0
5
10
15
20
25
30
35
40
45
50
3/29/86
9/25/86
3/24/87
9/20/87
3/18/88
9/14/88
3/13/89
9/9/89
3/8/90
date

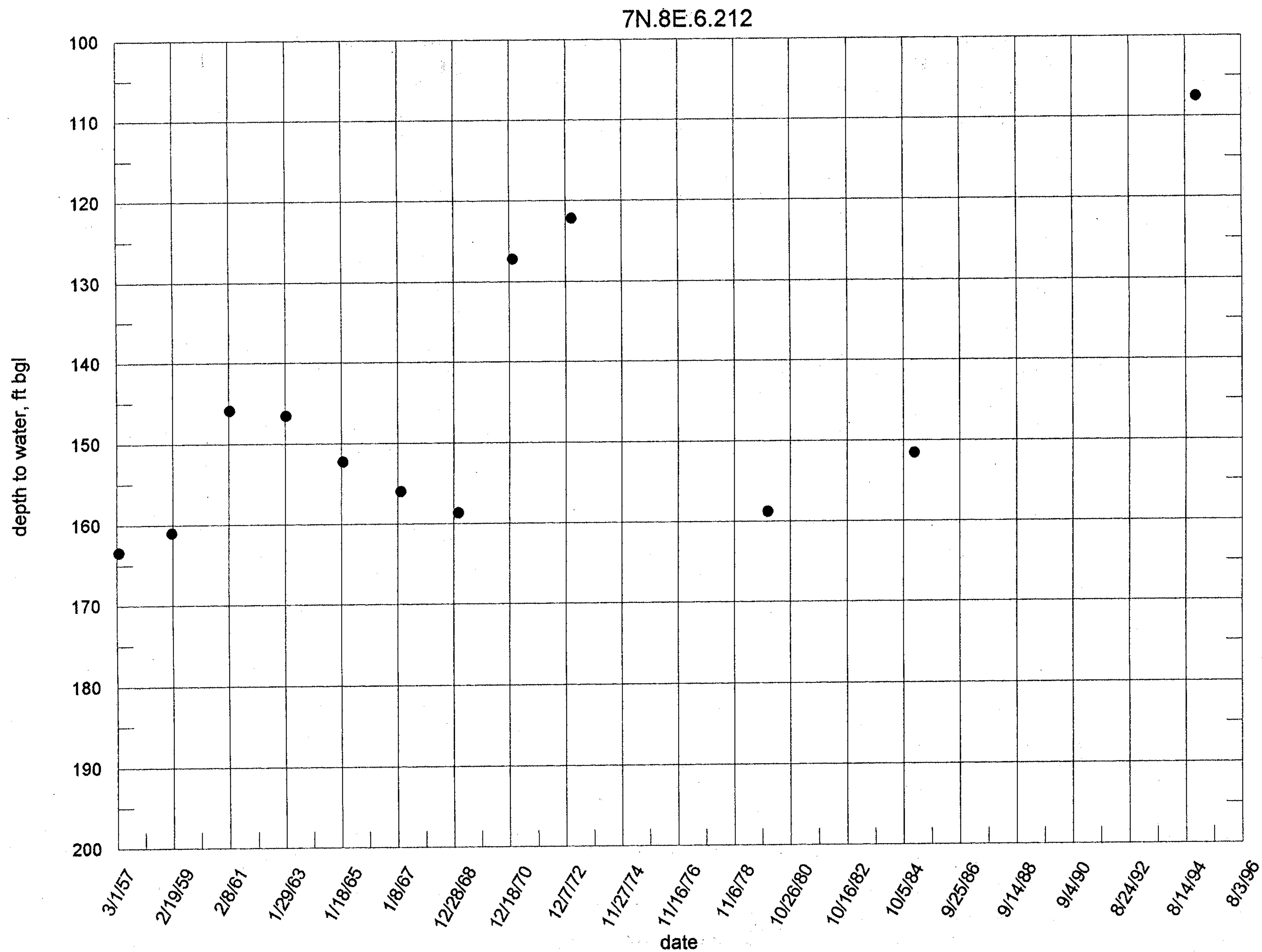


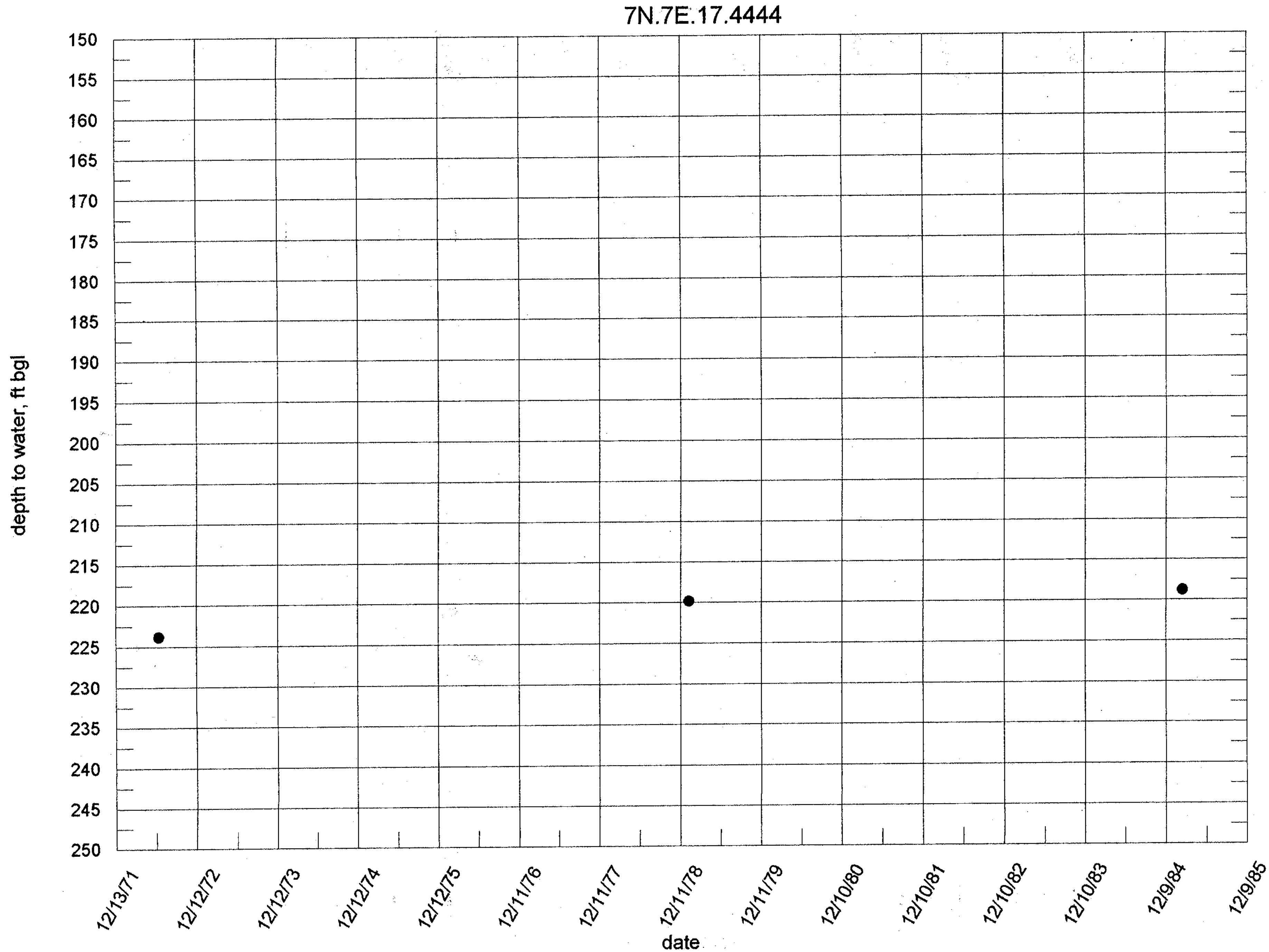
depth to water, ft bgl
120
110
100
90
80
70
60
50
40
30
20
10
0
7N.8E.16.142
date
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93

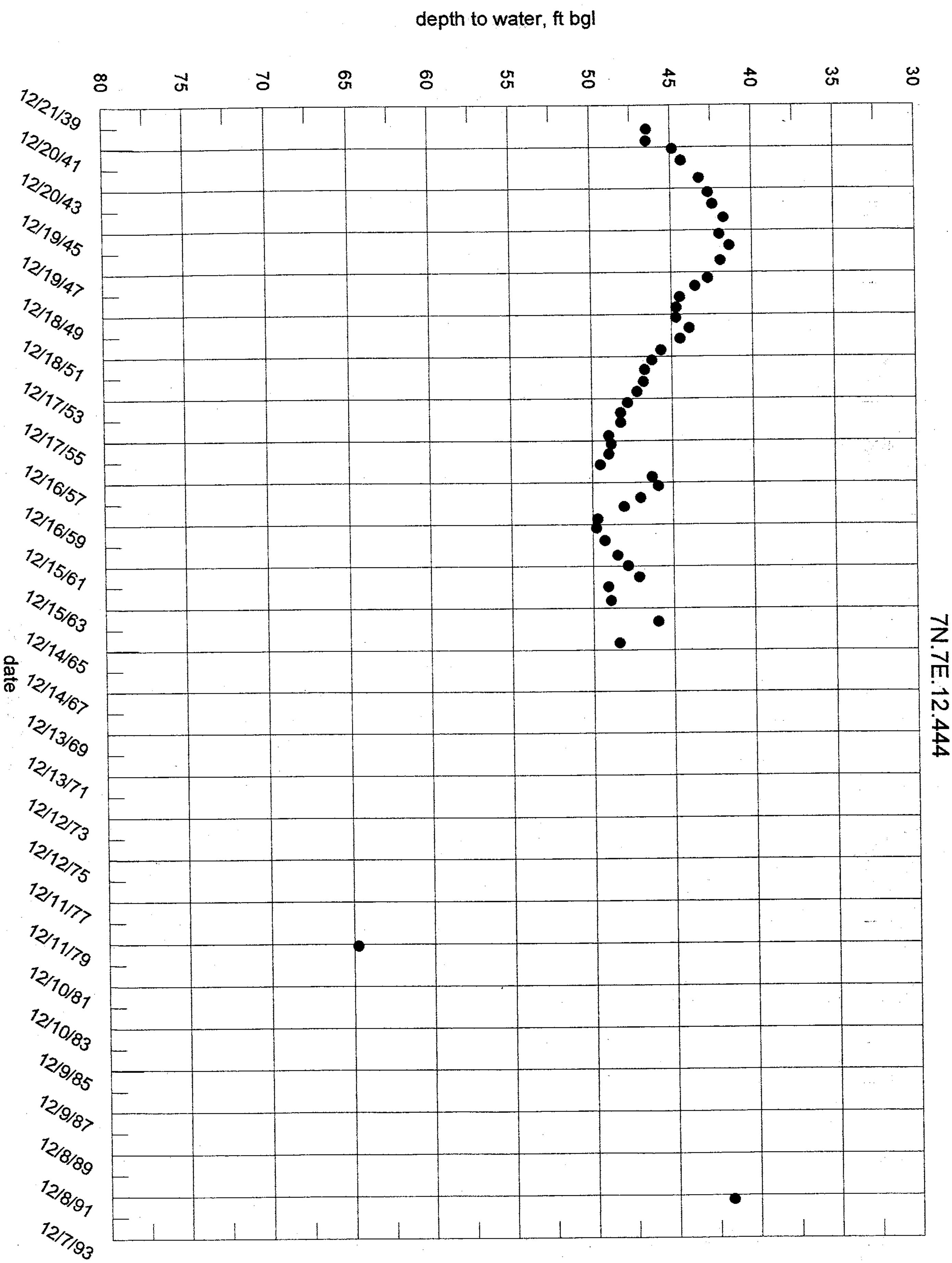

7N.8E.13.212
depth to water, ft bgl
0
10
20
30
40
50
60
70
80
90
100
110
120
130
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
date



7N.8E.9.431
depth to water, ft bgl
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date


7N.8E.6.212
depth to water, ft bgl
100
110
120
130
140
150
160
170
180
190
200
3/1/57
2/19/59
2/8/61
1/29/63
1/18/65
1/8/67
12/28/68
12/18/70
12/7/72
11/27/74
11/16/76
11/6/78
10/26/80
10/16/82
10/5/84
9/25/86
9/14/88
9/4/90
8/24/92
8/14/94
8/3/96
date


7N.7E.17.4444
depth to water, ft bgl
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
12/9/84
12/9/85
date



depth to water, ft bgl
80
75
70
65
60
55
50
45
40
35
30
date
12/21/39
12/20/41
12/20/43
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
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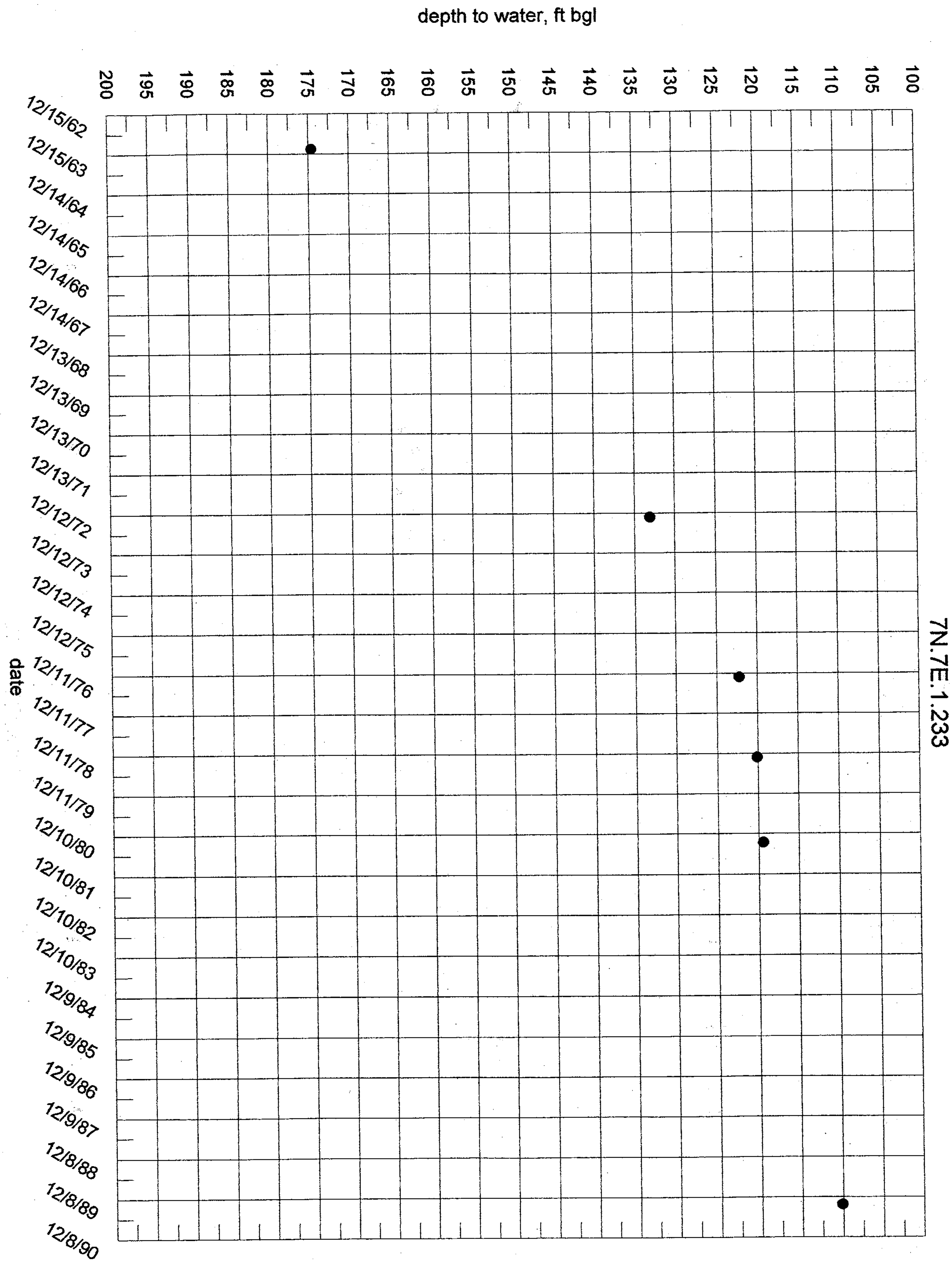
12/8/91
12/7/93
7N.7E.12.444


depth to water, ft bgl
200
195
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
date
12/15/62
12/15/63
12/14/64
12/14/65
12/14/66
12/14/67
12/13/68
12/13/69
12/13/70
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
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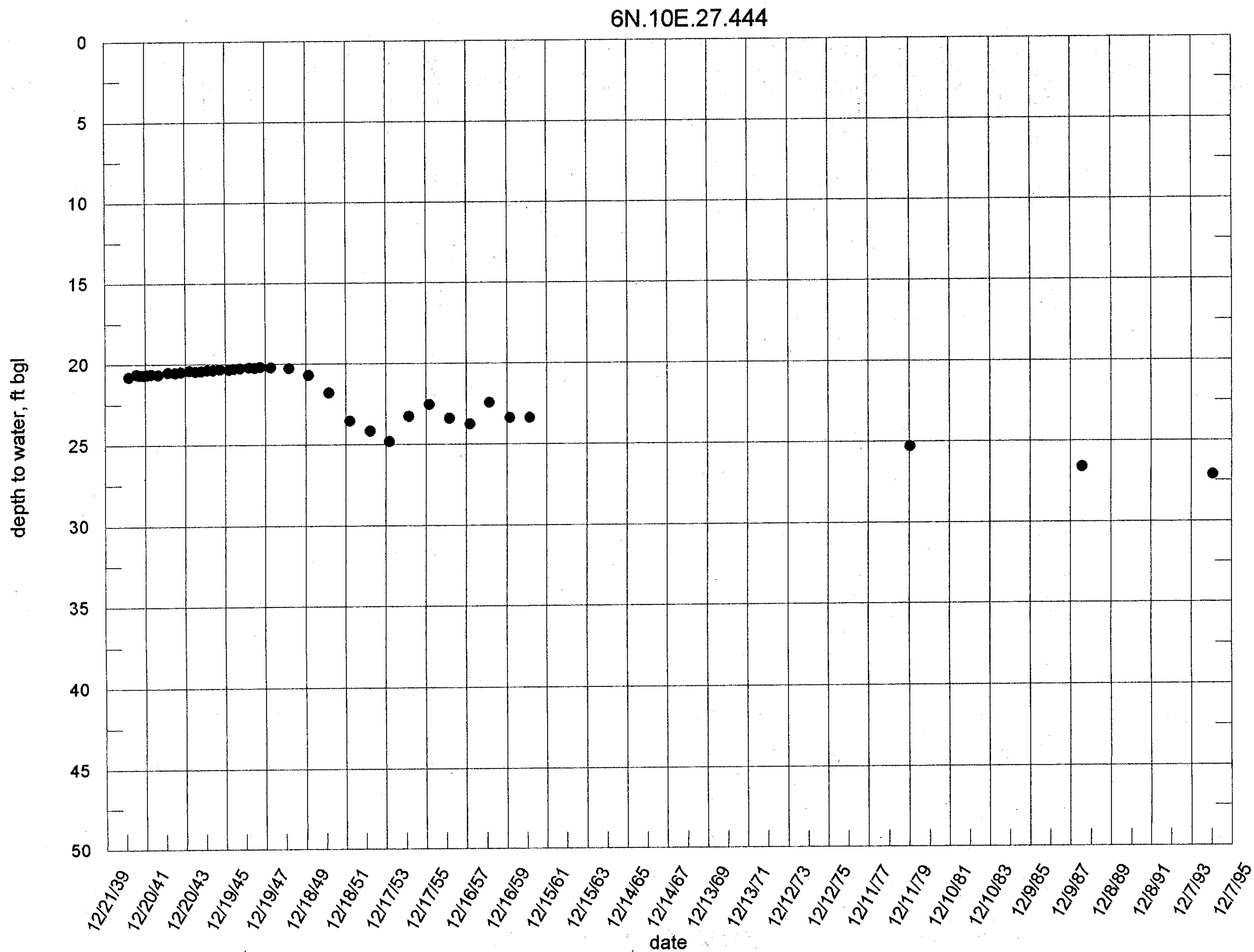
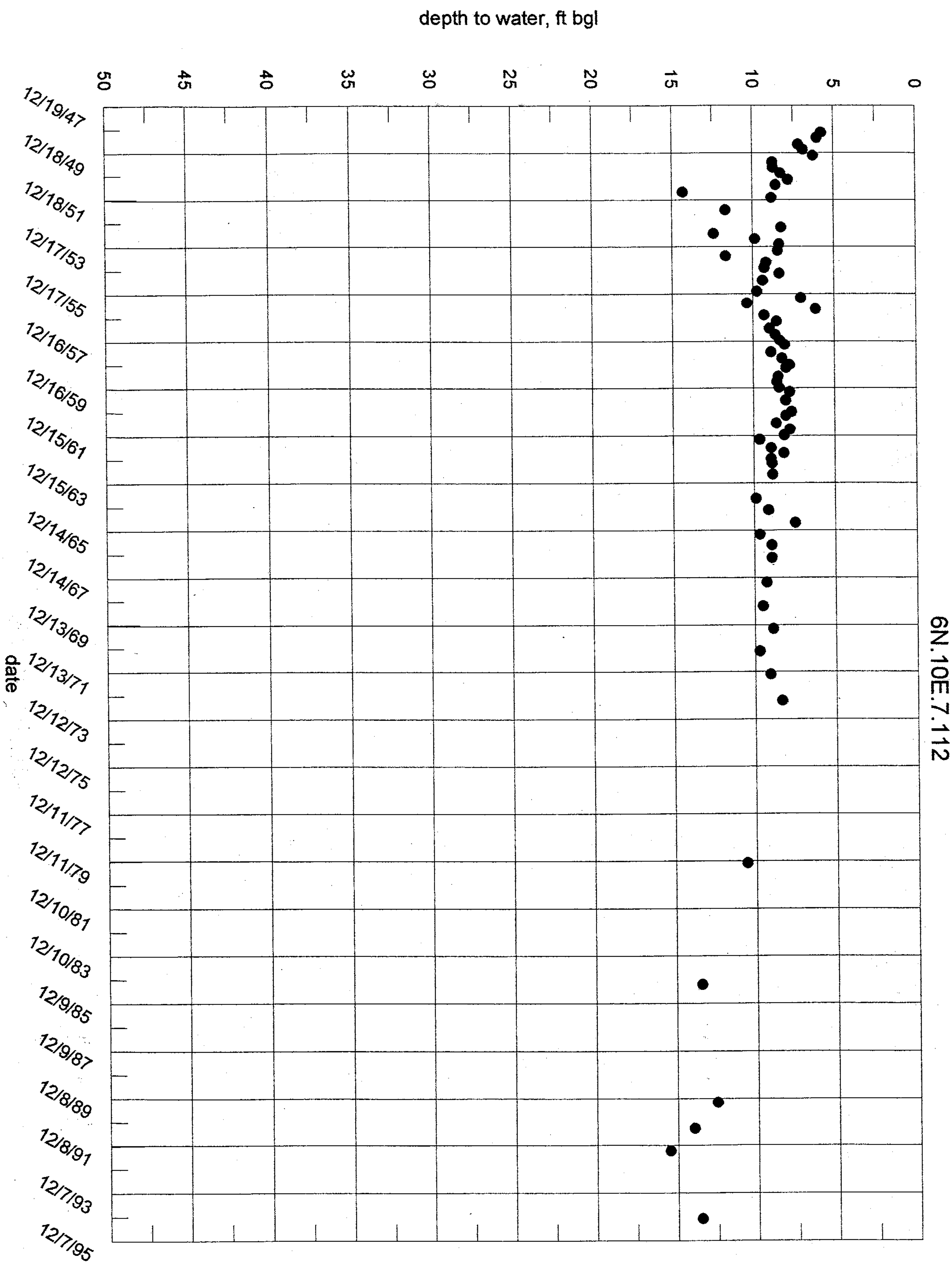
12/9/87
12/8/88
12/8/89
12/8/90
7N.7E.1.233



6N.10E.27.444
depth to water, ft bgl
0
5
10
15
20
25
30
35
40
45
50
12/21/39
12/20/41
12/20/43
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date



depth to water, ft bgl
50
45
40
35
30
25
20
15
10
5
0
date
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
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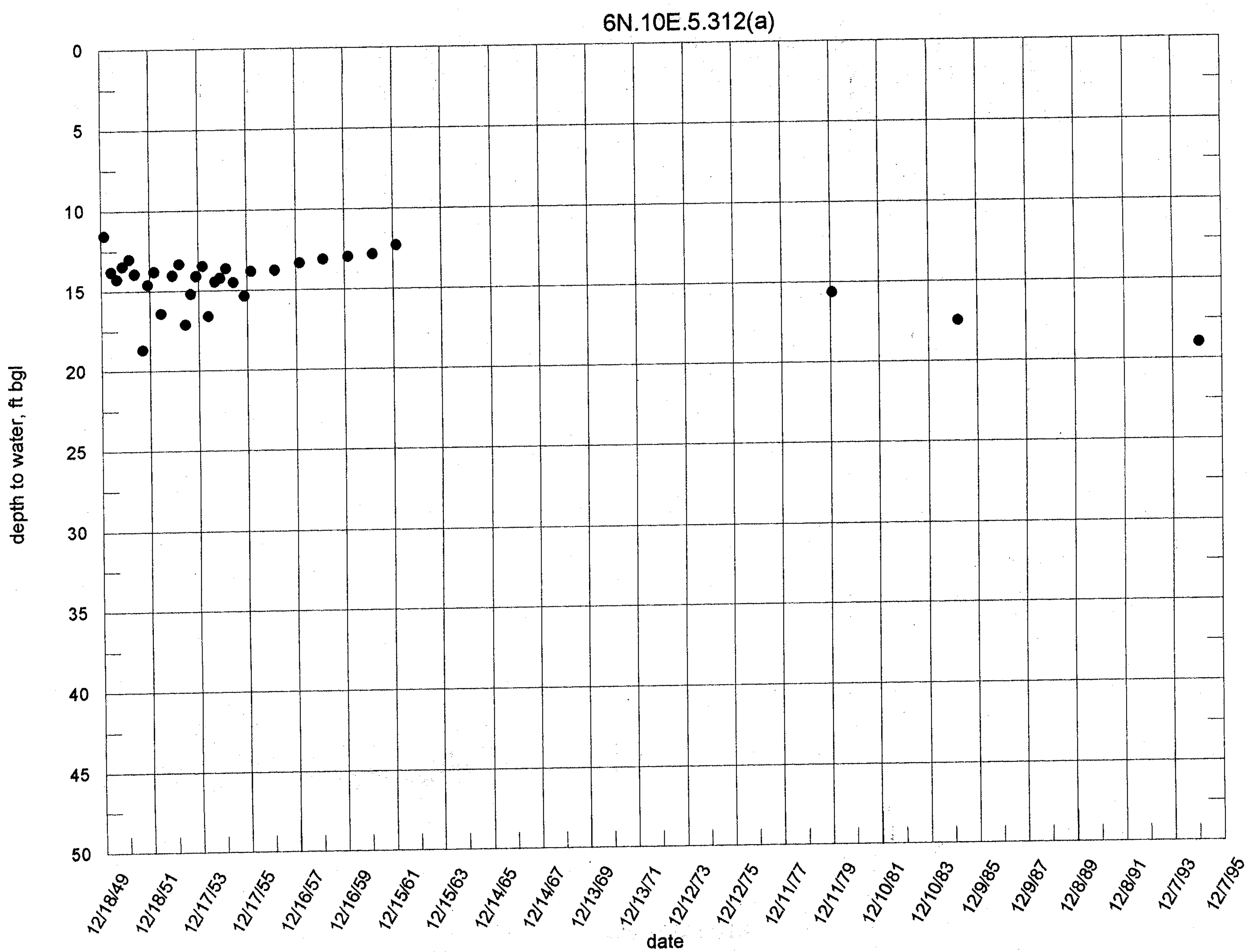
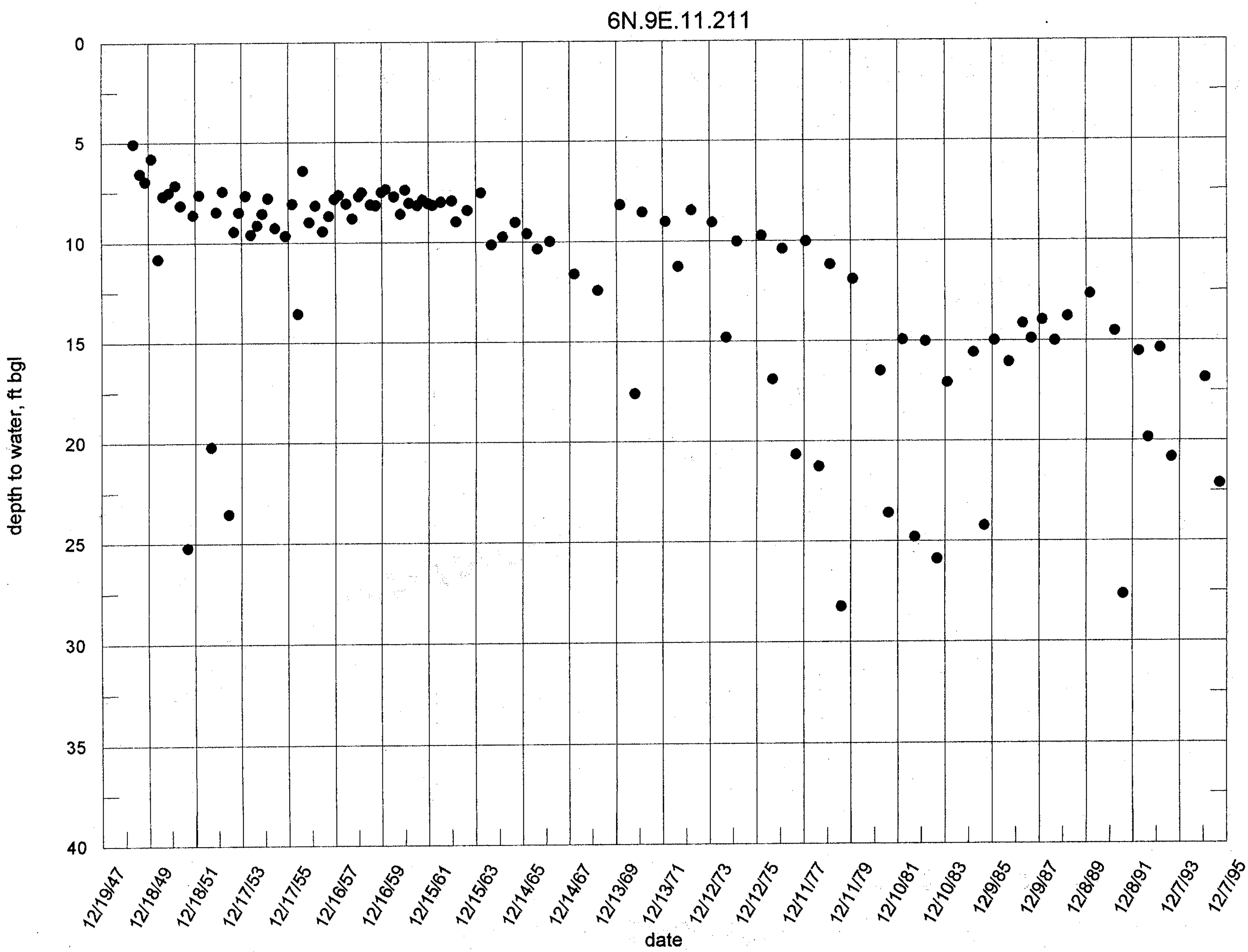
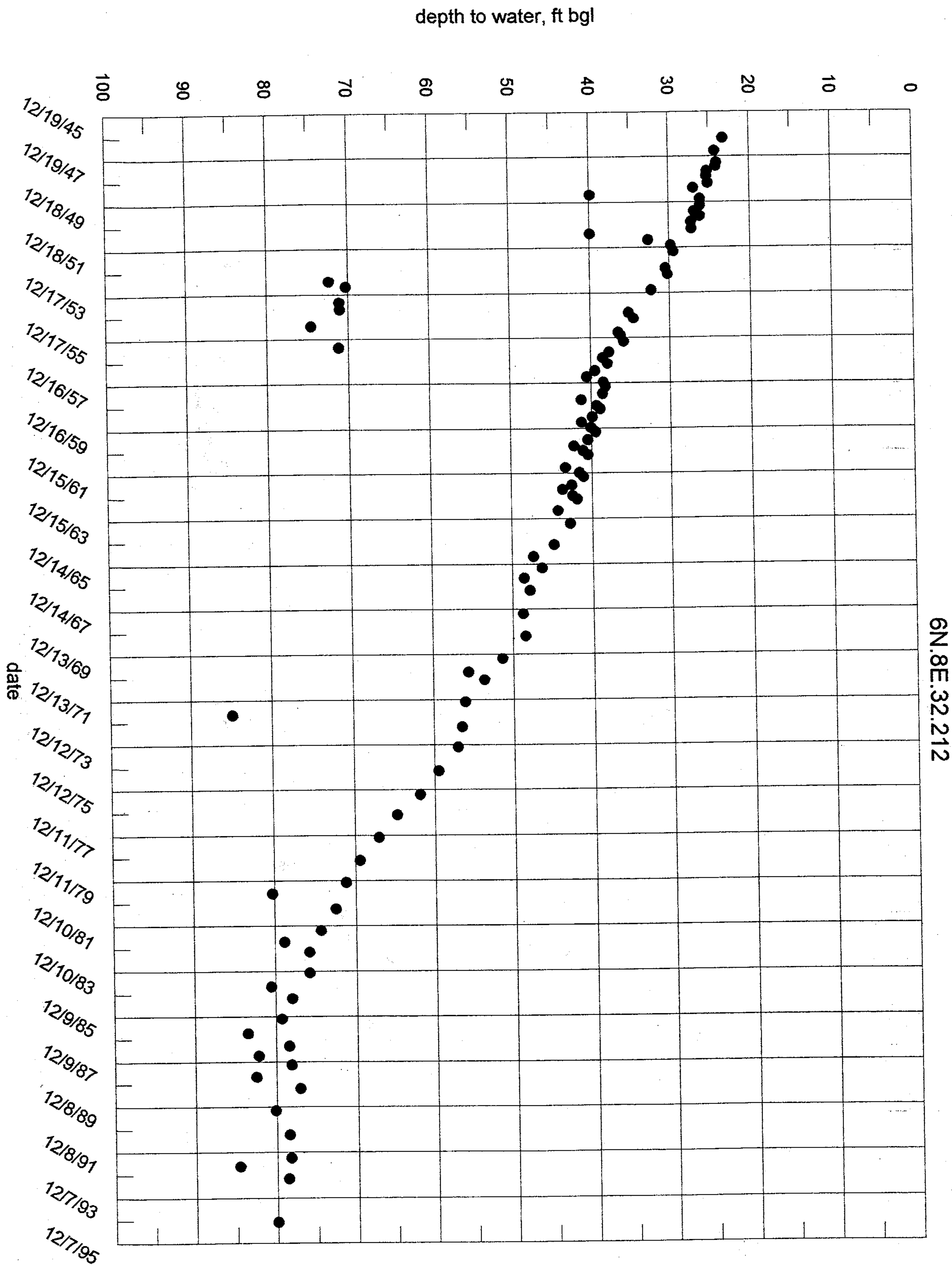
12/7/95
6N.10E.7.112


6N.10E.5.312(a)
depth to water, ft bgl
0
5
10
15
20
25
30
35
40
45
50
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date



6N.9E.11.211
depth to water, ft bgl
0
5
10
15
20
25
30
35
40
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date



6N.8E.32.212
depth to water, ft bgl
100
90
80
70
60
50
40
30
20
10
0
date
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
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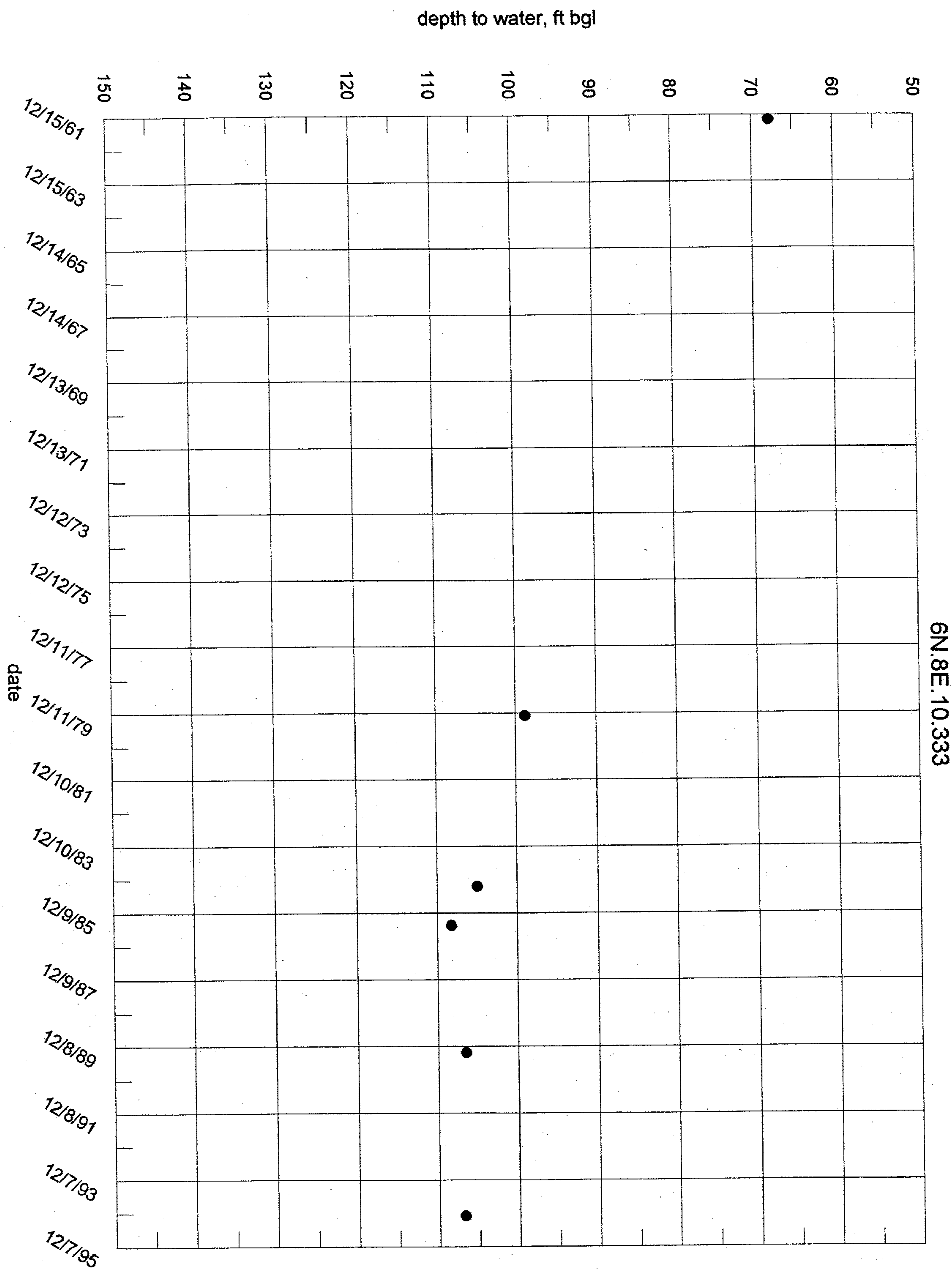
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95


depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
date
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
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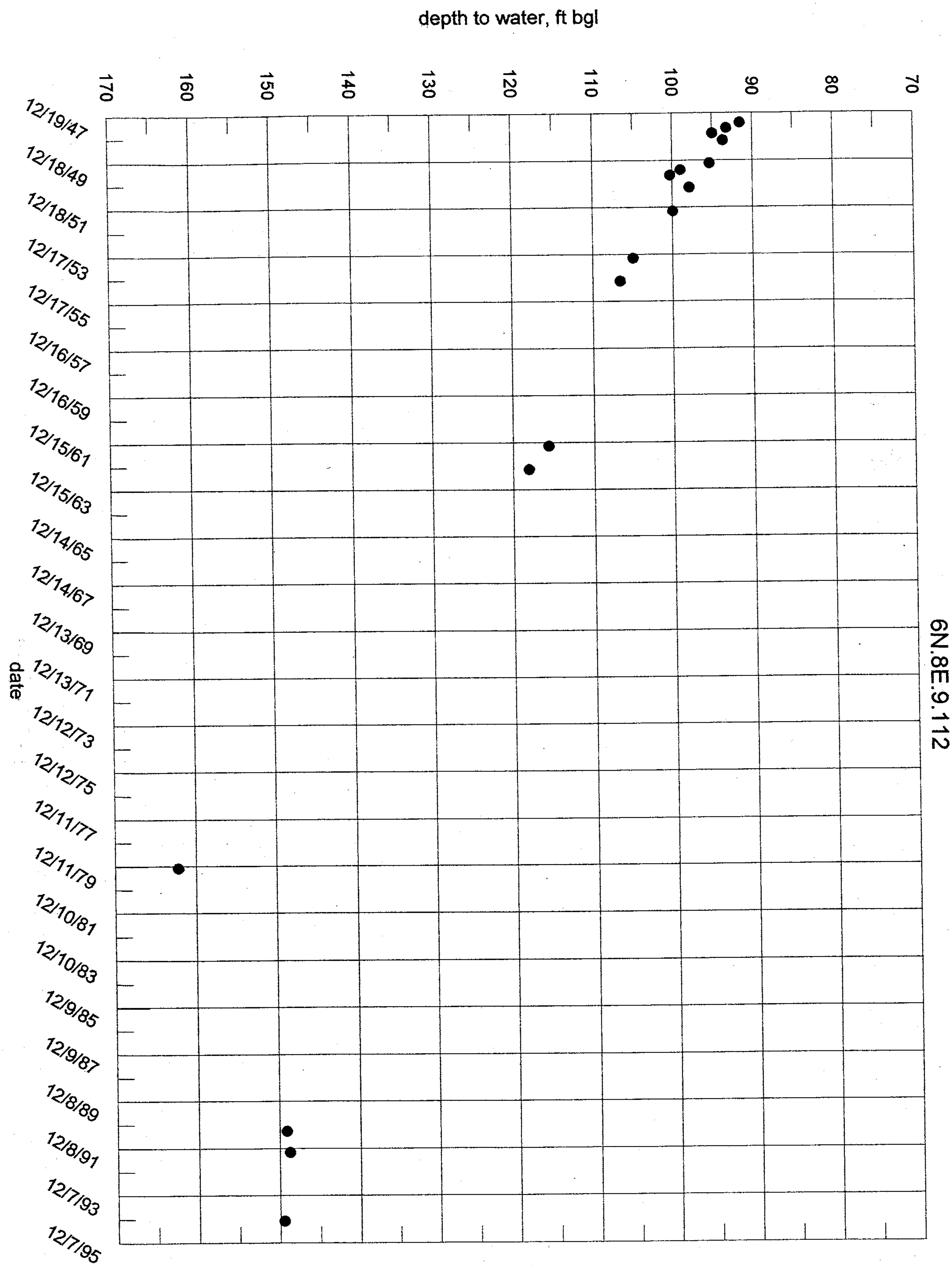
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
6N.8E.10.333


depth to water, ft bgl
170
160
150
140
130
120
110
100
90
80
70
date
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
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12/11/77
12/11/79
12/10/81
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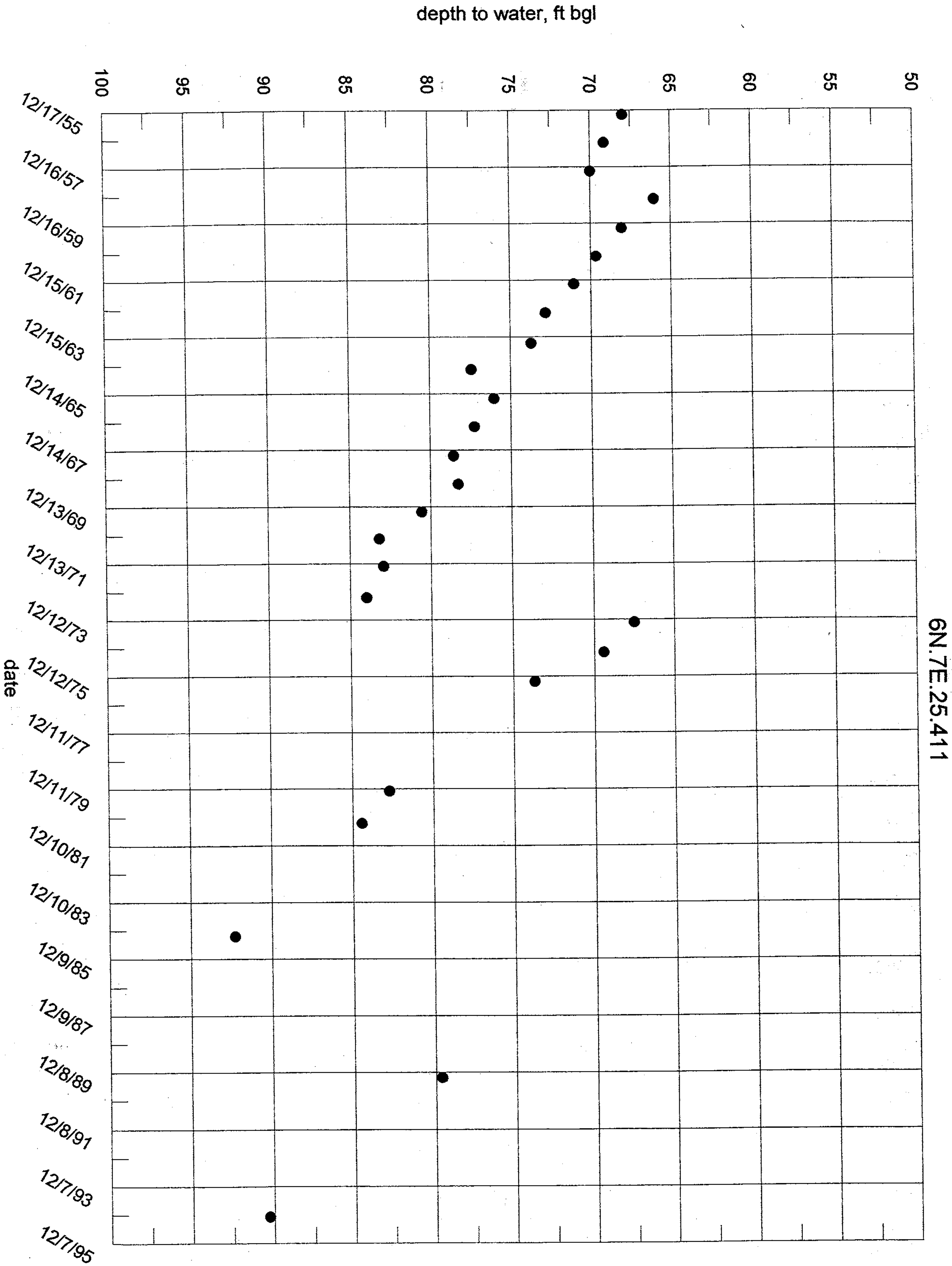
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
6N.8E.9.112



depth to water, ft bgl
100
95
90
85
80
75
70
65
60
55
50
date
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
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12/13/71
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12/12/75
12/11/77
12/11/79
12/10/81
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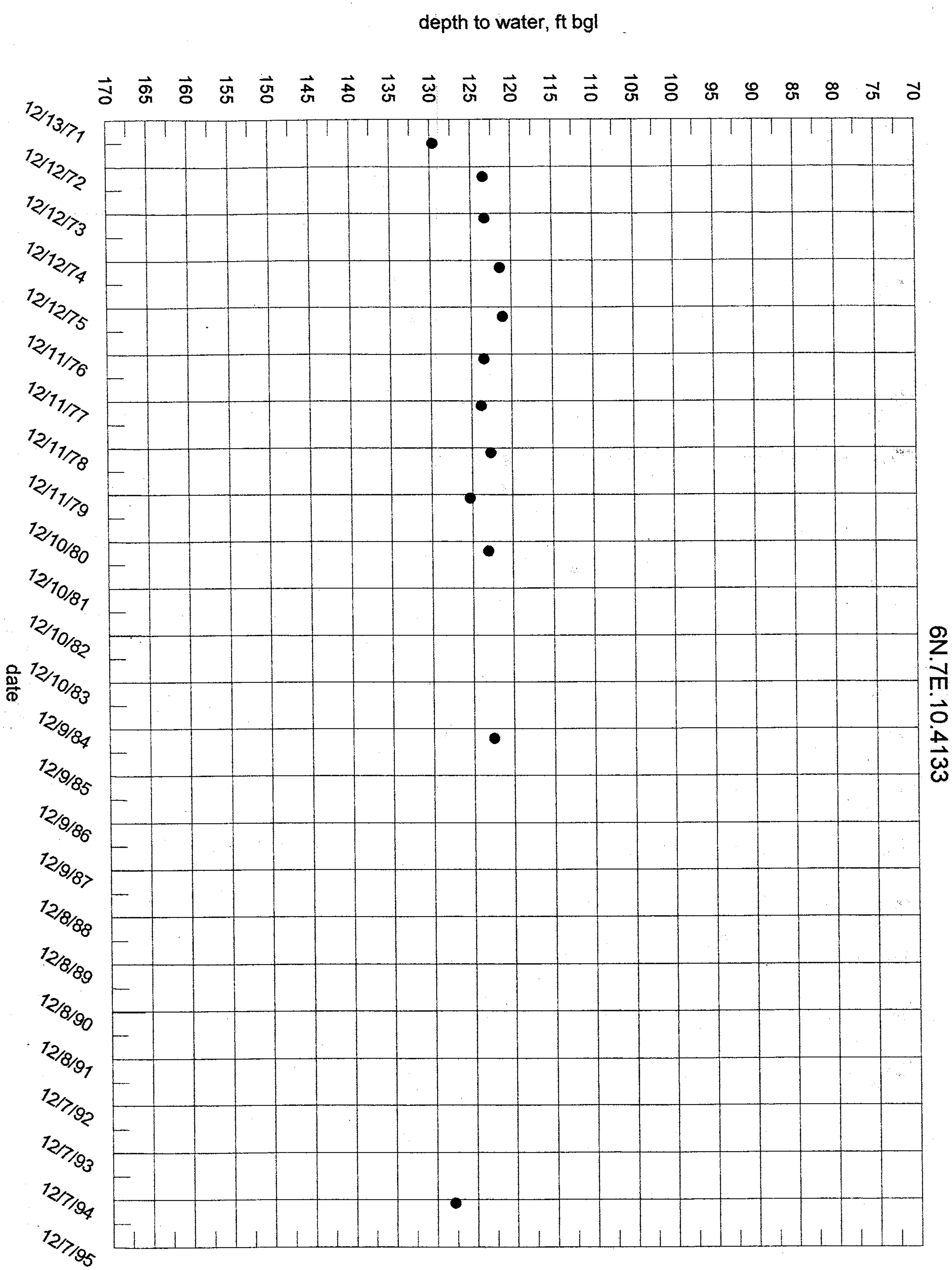
6N.7E.25.411



depth to water, ft bgl
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
date
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
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12/9/87
12/8/88
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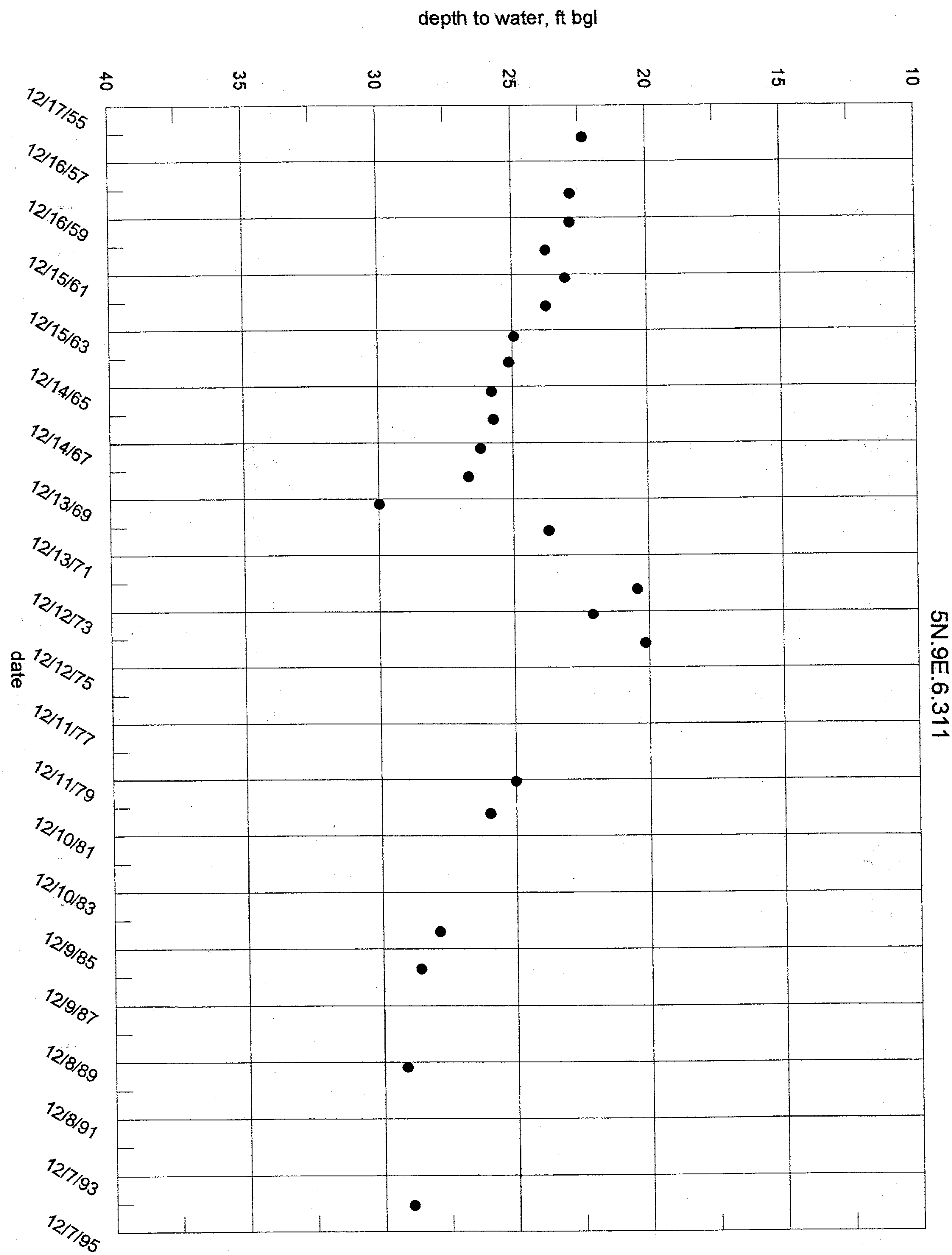
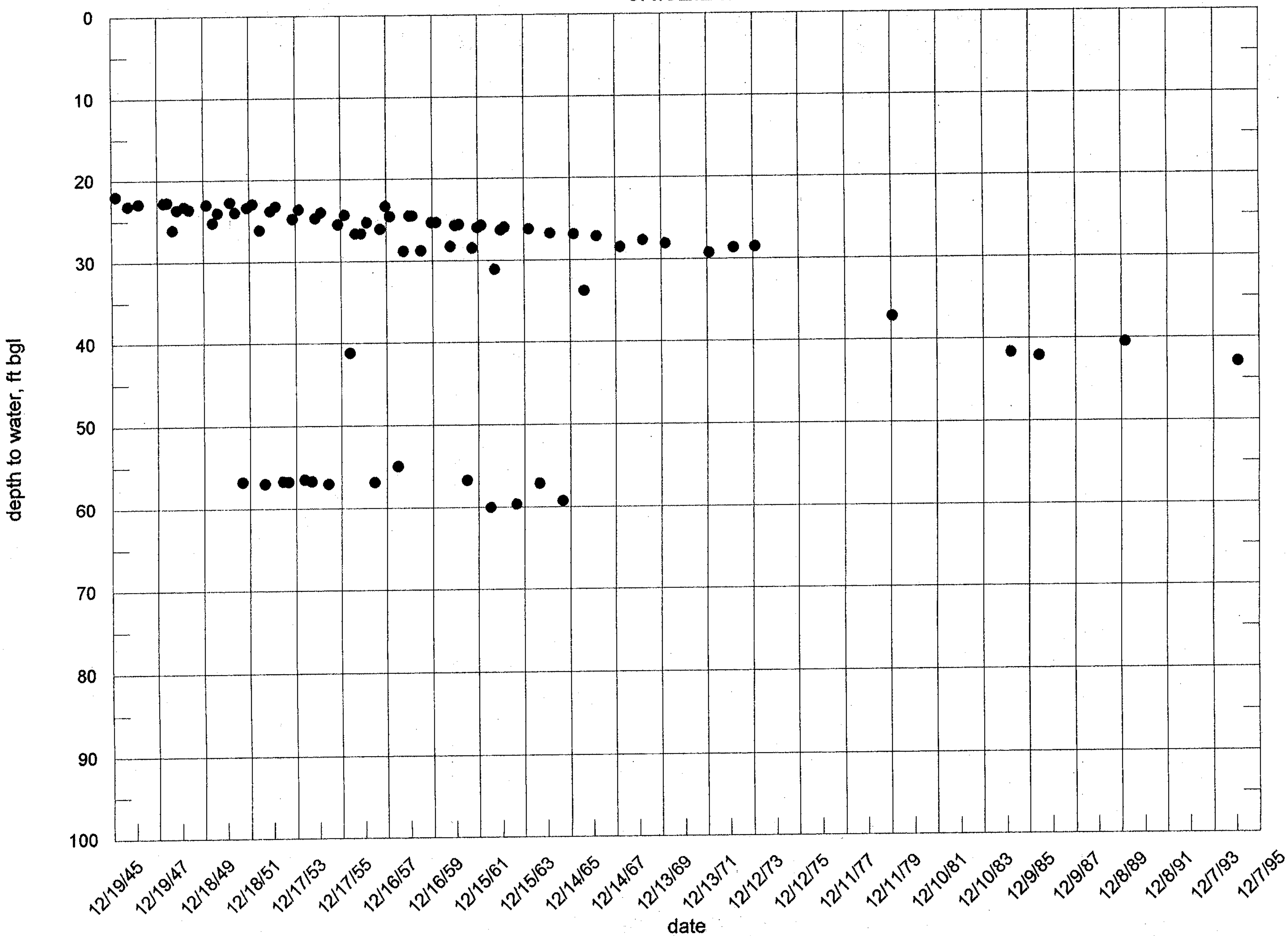
12/7/95
6N.7E.10.4133



depth to water, ft bgl
40
35
30
25
20
15
10
date
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
5N.9E.6.311

5N.8E.24.311



depth to water, ft bgl
0
10
20
30
40
50
60
70
80
90
100
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
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12/12/75
12/11/77
12/11/79
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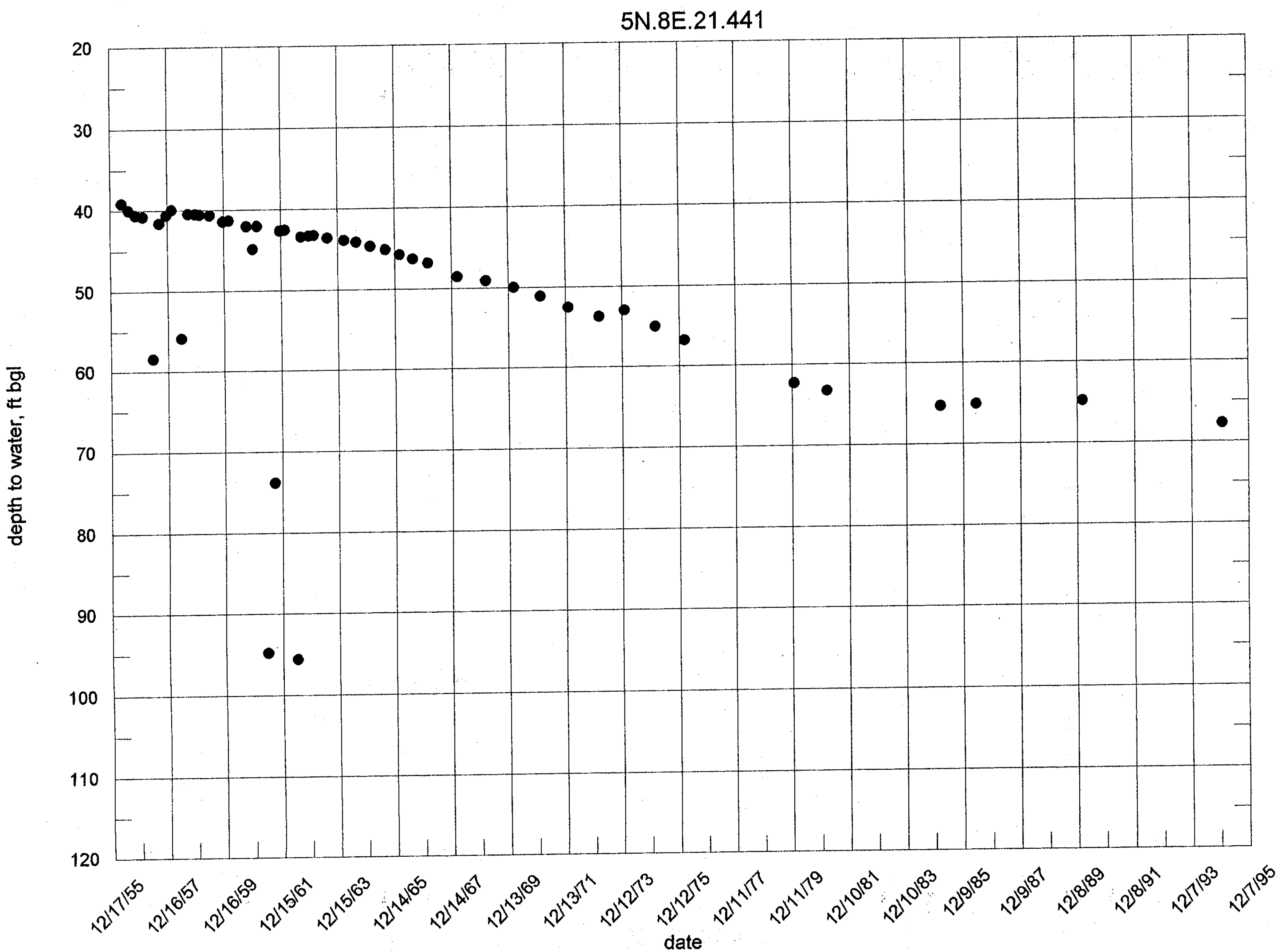
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date



5N.8E.21.441
depth to water, ft bgl
20
30
40
50
60
70
80
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100
110
120
12/17/55
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12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
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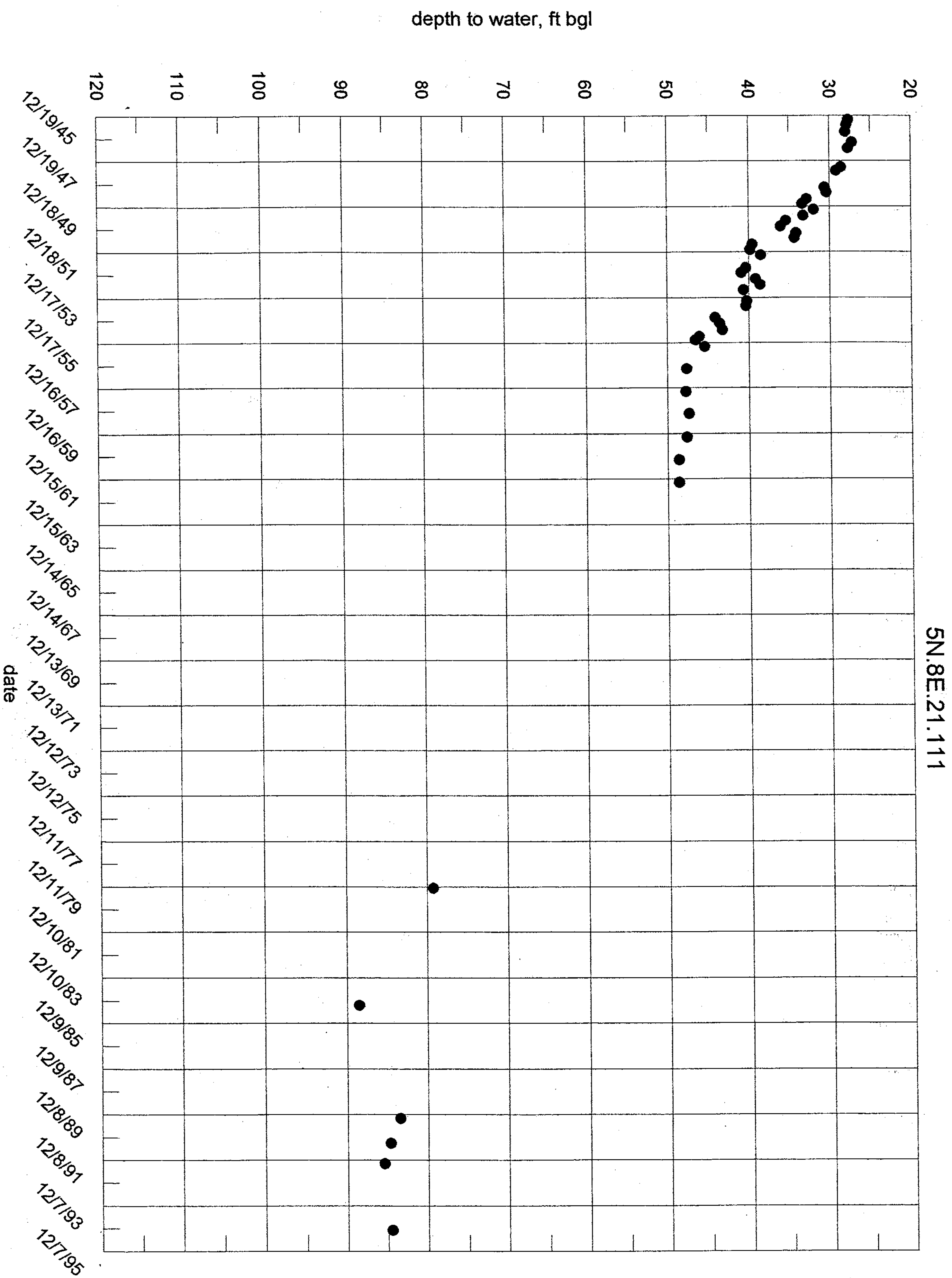
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date


depth to water, ft bgl
120
110
100
90
80
70
60
50
40
30
20
5N.8E.21.111
date
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
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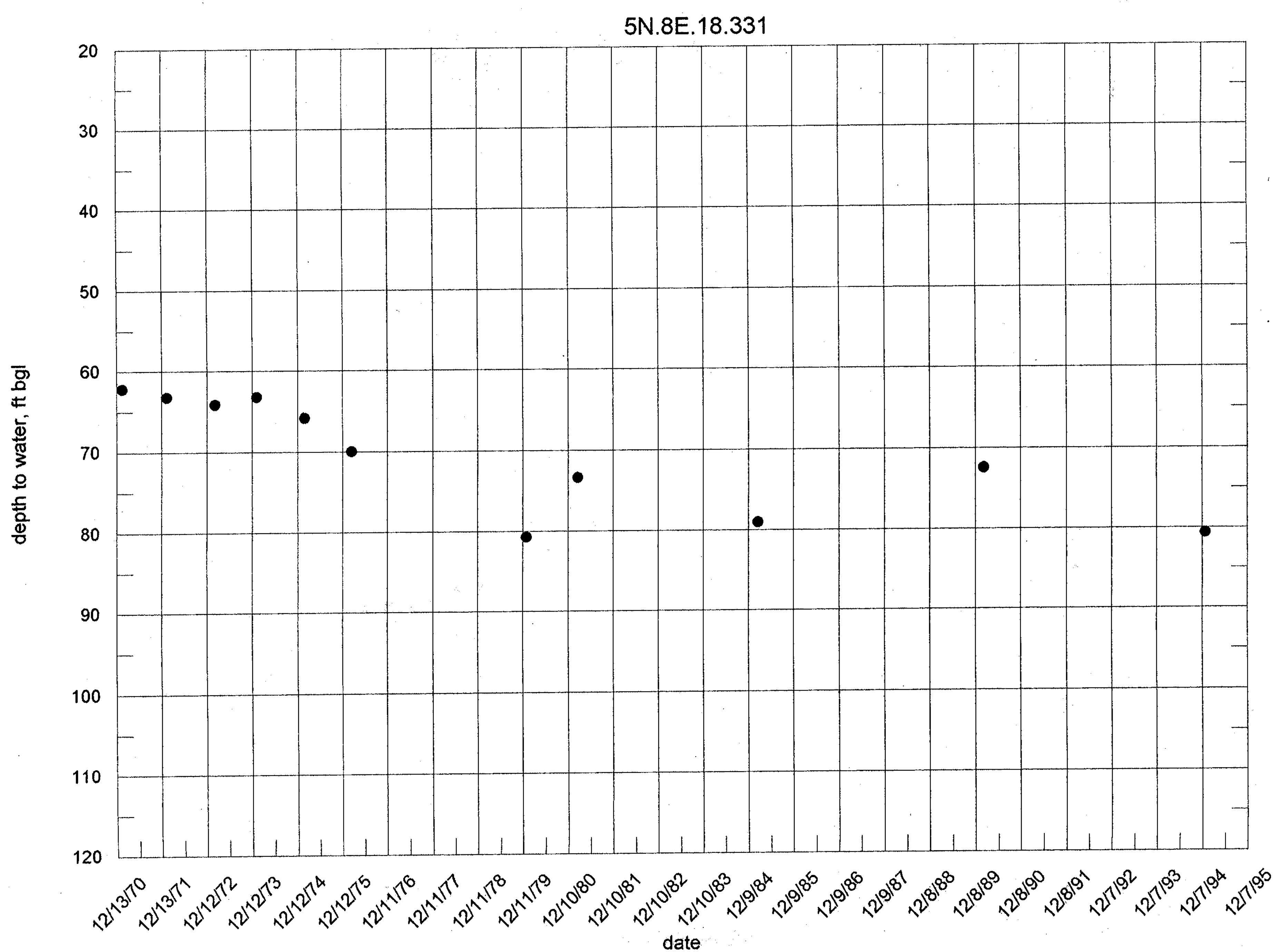
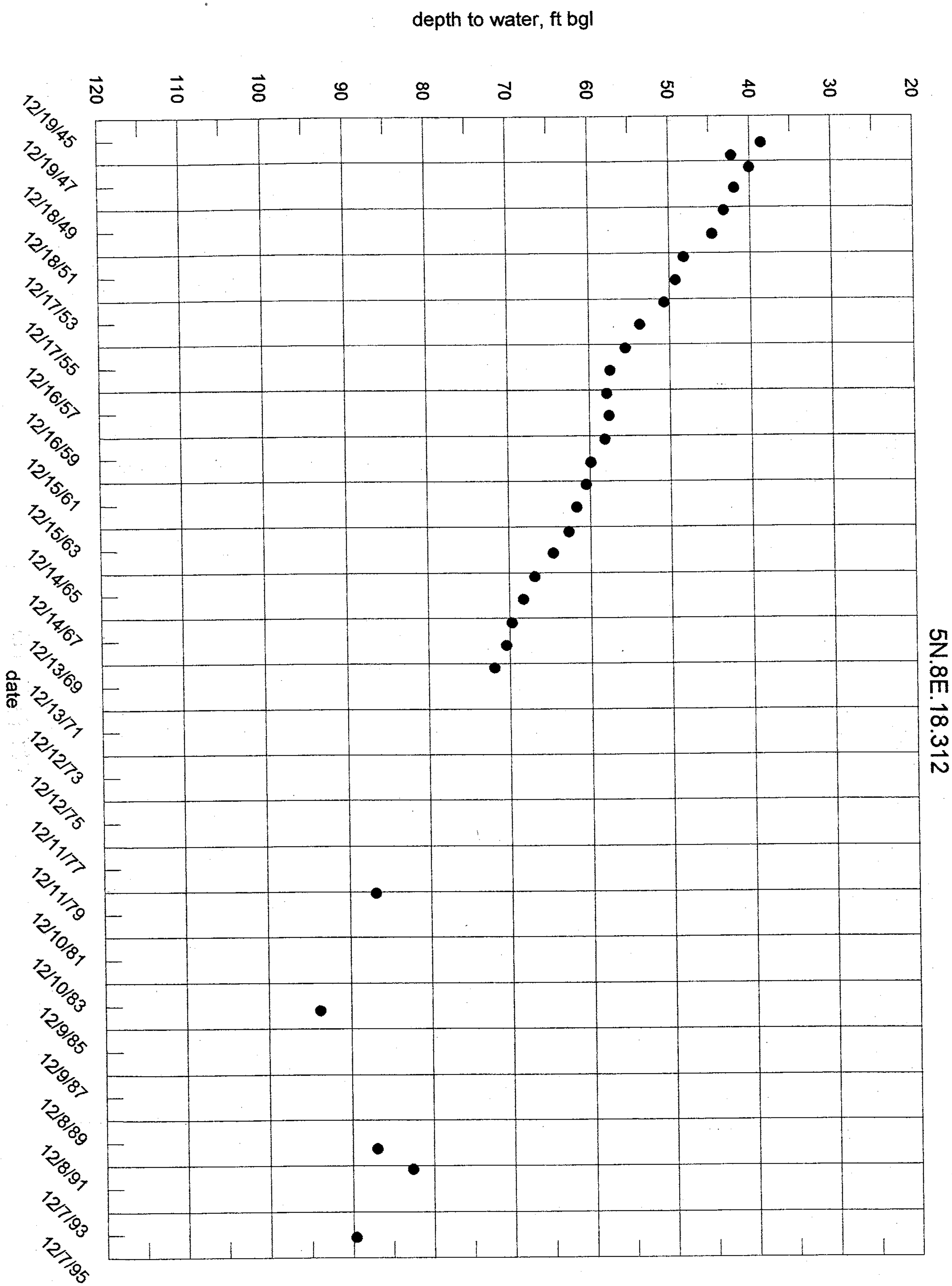
12/8/89
12/8/91
12/7/93
12/7/95



5N.8E.18.331
depth to water, ft bgl
20
30
40
50
60
70
80
90
100
110
120
12/13/70
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
12/9/84
12/9/85
12/9/86
12/9/87
12/8/88
12/8/89
12/8/90
12/8/91
12/7/92
12/7/93
12/7/94
12/7/95
date



depth to water, ft bgl
120
110
100
90
80
70
60
50
40
30
20
5N.8E.18.312
date
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
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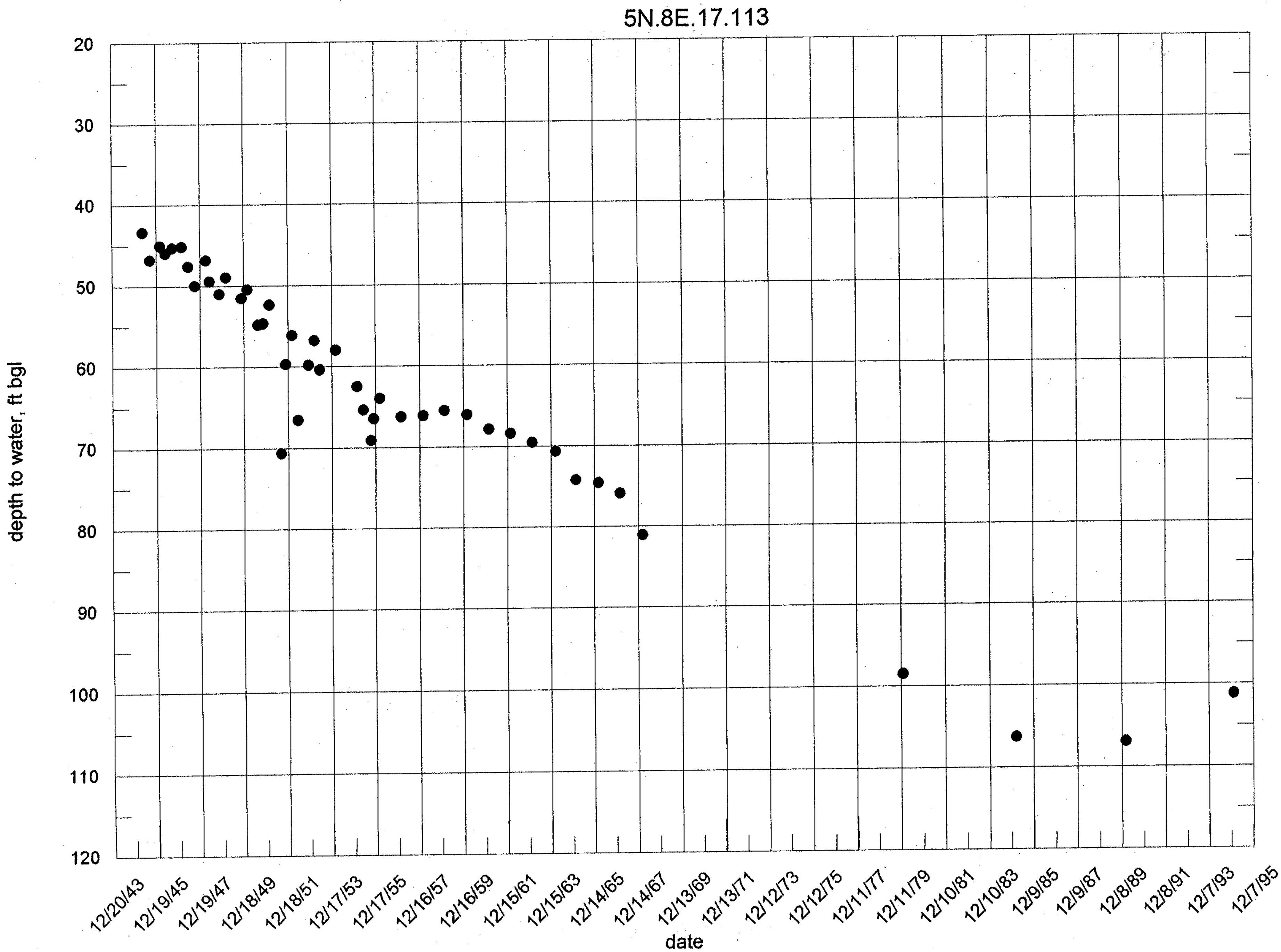
12/7/93
12/7/95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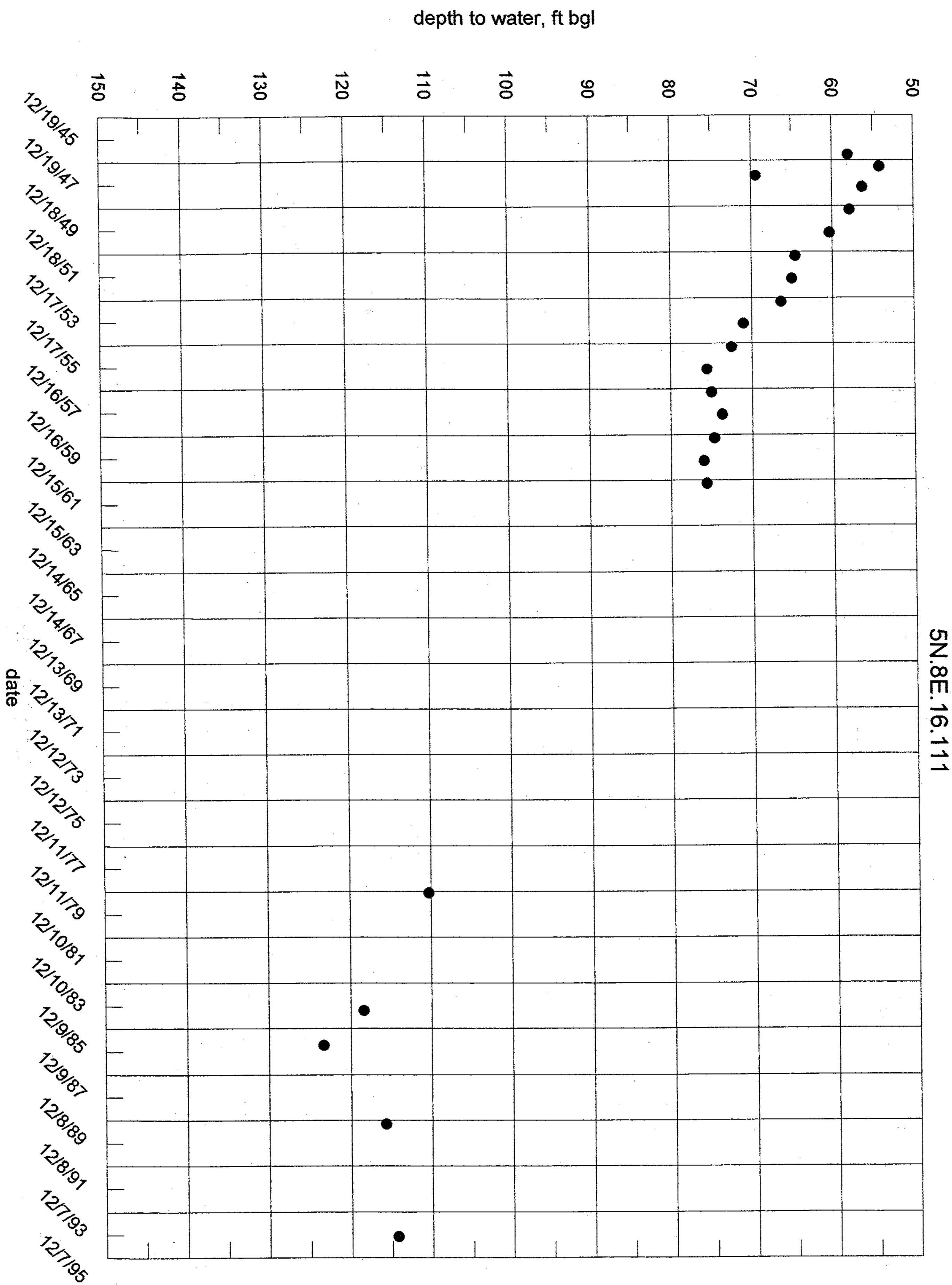
depth to water, ft bgl
20
30
40
50
60
70
80
90
100
110
120
12/20/43
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date


depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
date
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
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12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
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12/8/91
12/7/93
12/7/95
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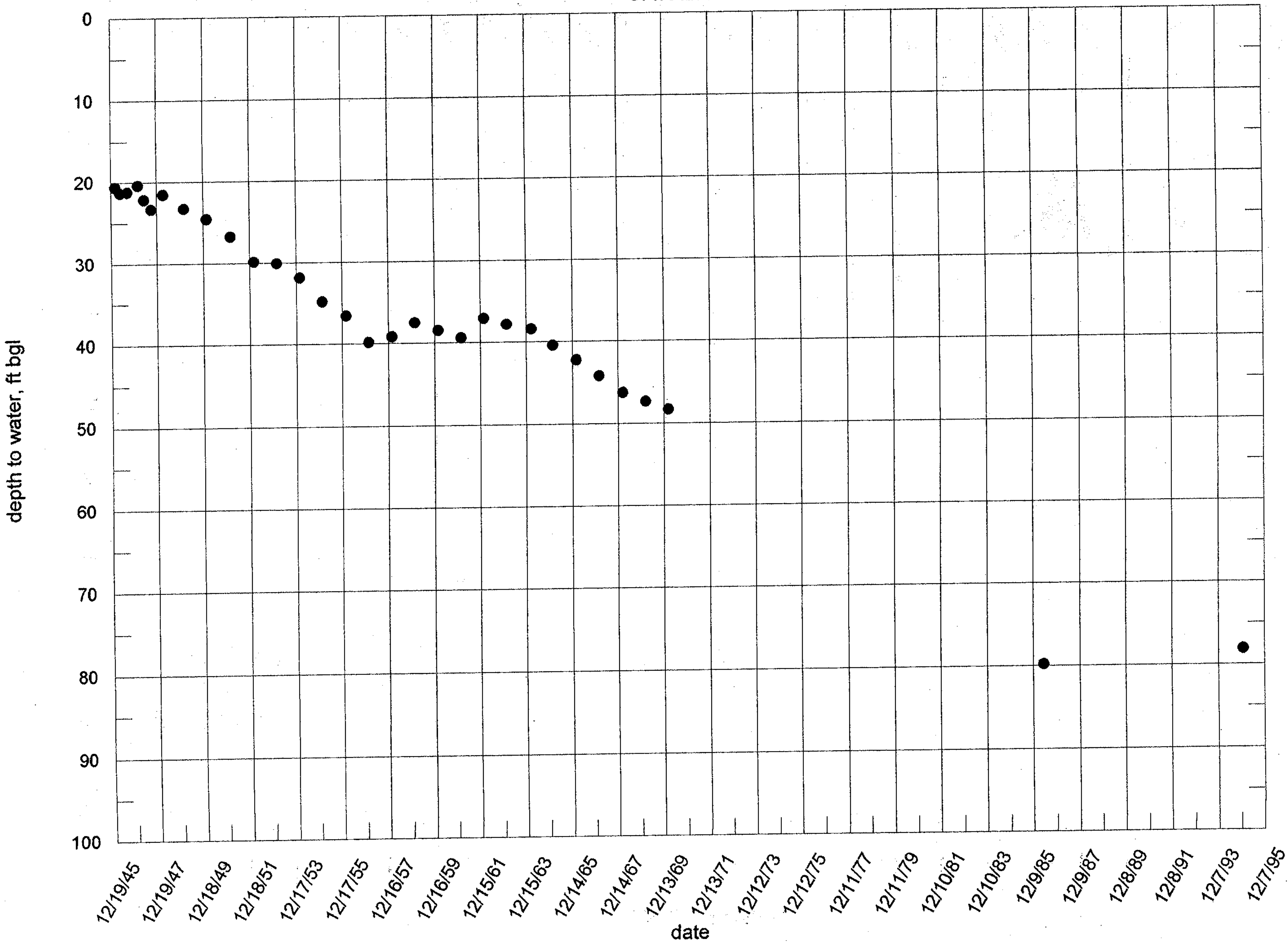
5N.8E.15.313



depth to water, ft bgl
0
10
20
30
40
50
60
70
80
90
100
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
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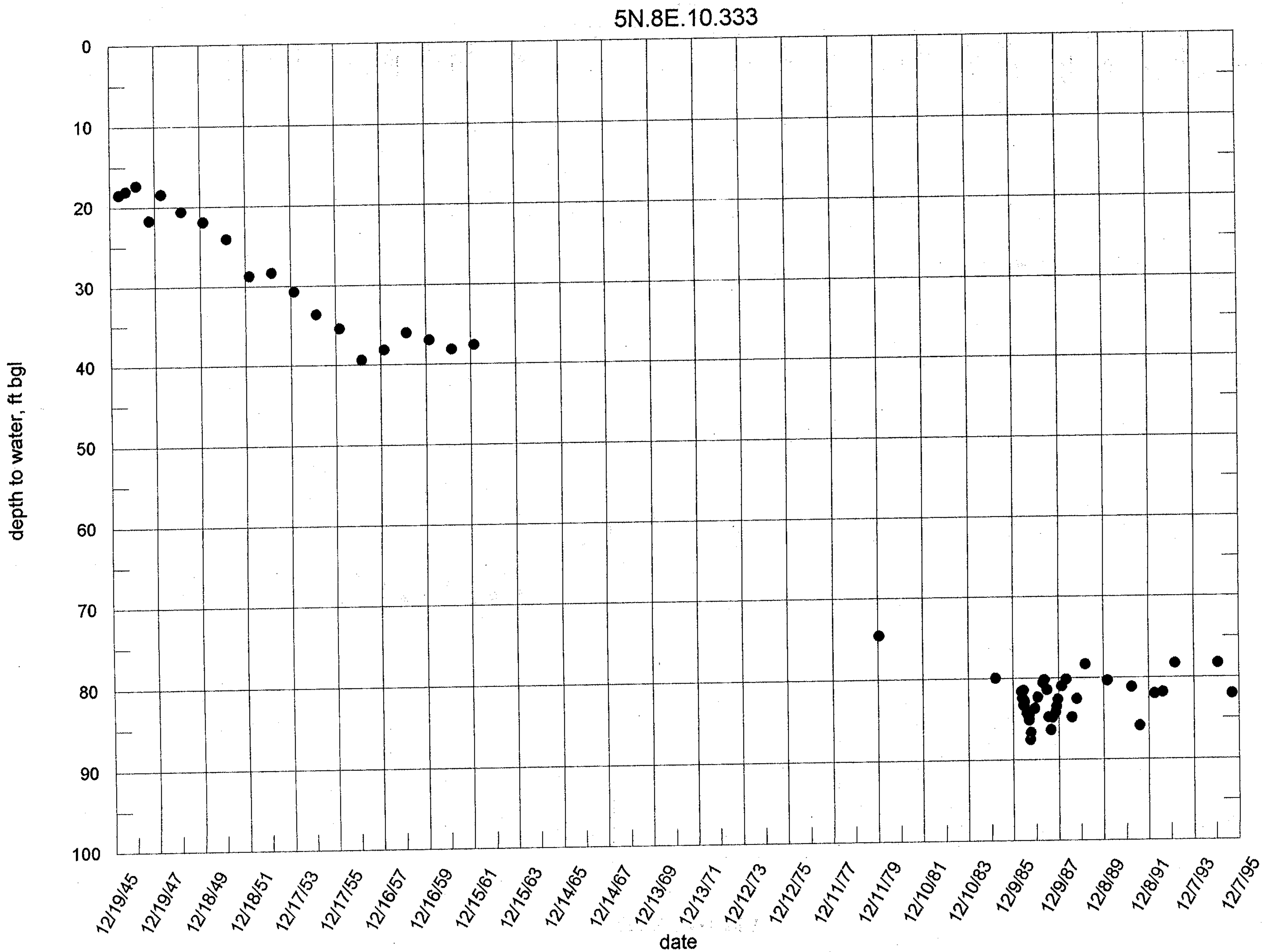
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date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depth to water, ft bgl
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10
20
30
40
50
60
70
80
90
100
12/19/45
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12/18/51
12/17/53
12/17/55
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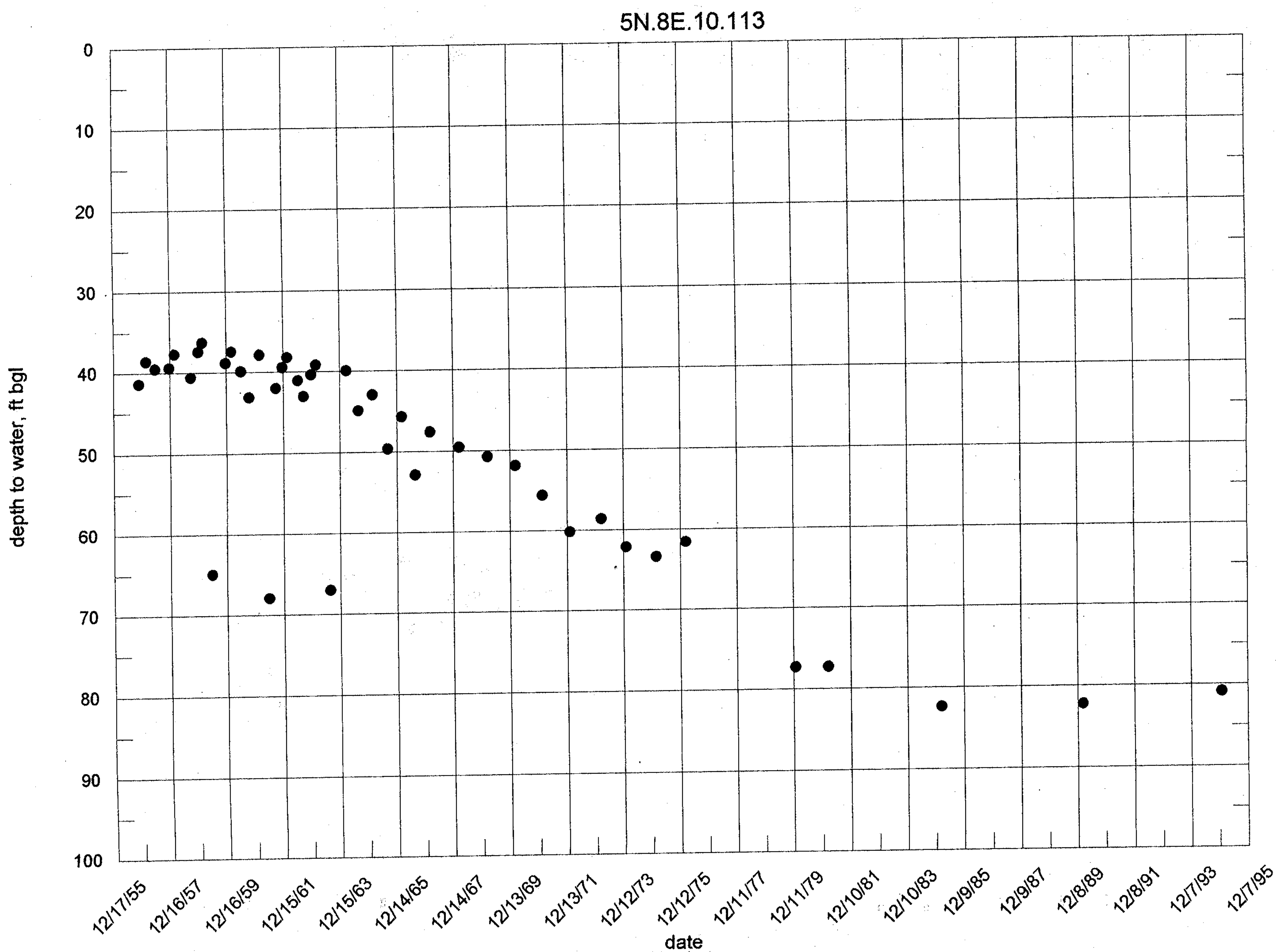
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date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depth to water, ft bgl
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10
20
30
40
50
60
70
80
90
100
12/17/55
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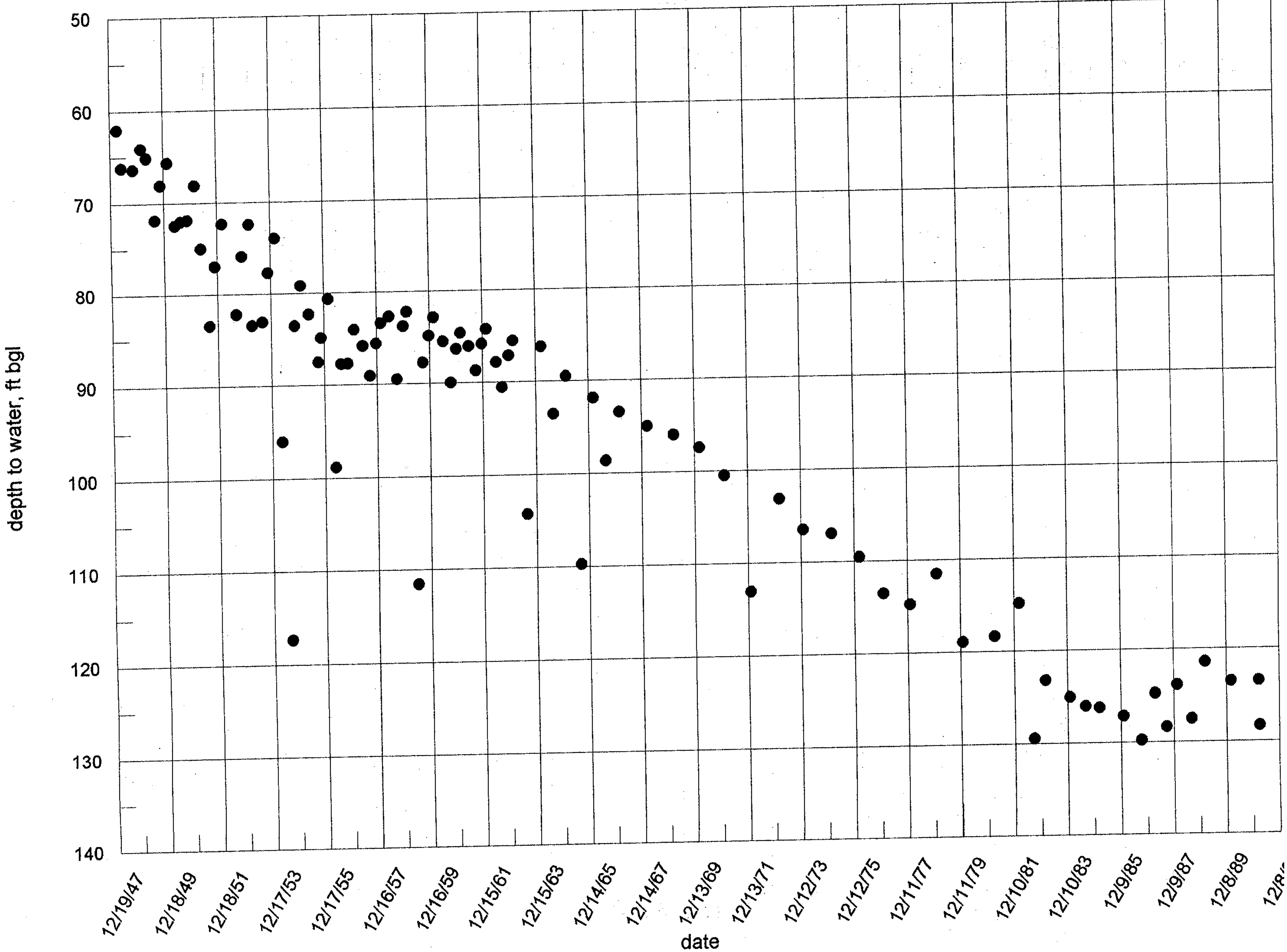
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date

5N.8E.8.424



50
60
70
80
90
100
110
120
130
140
depth to water, ft bgl
12/19/47
12/18/49
12/18/51
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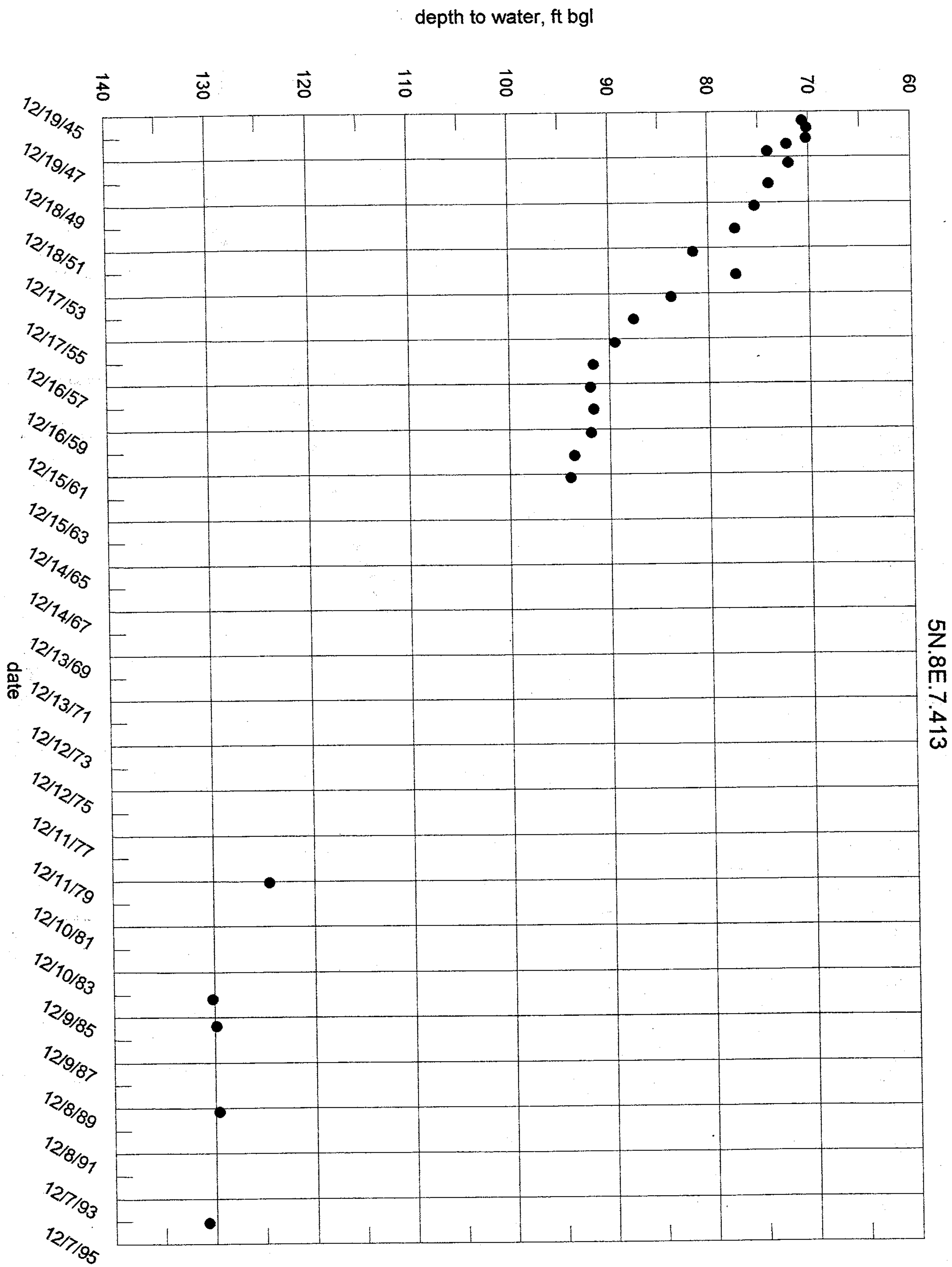
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
date



depth to water, ft bgl
140
130
120
110
100
90
80
70
60
date
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
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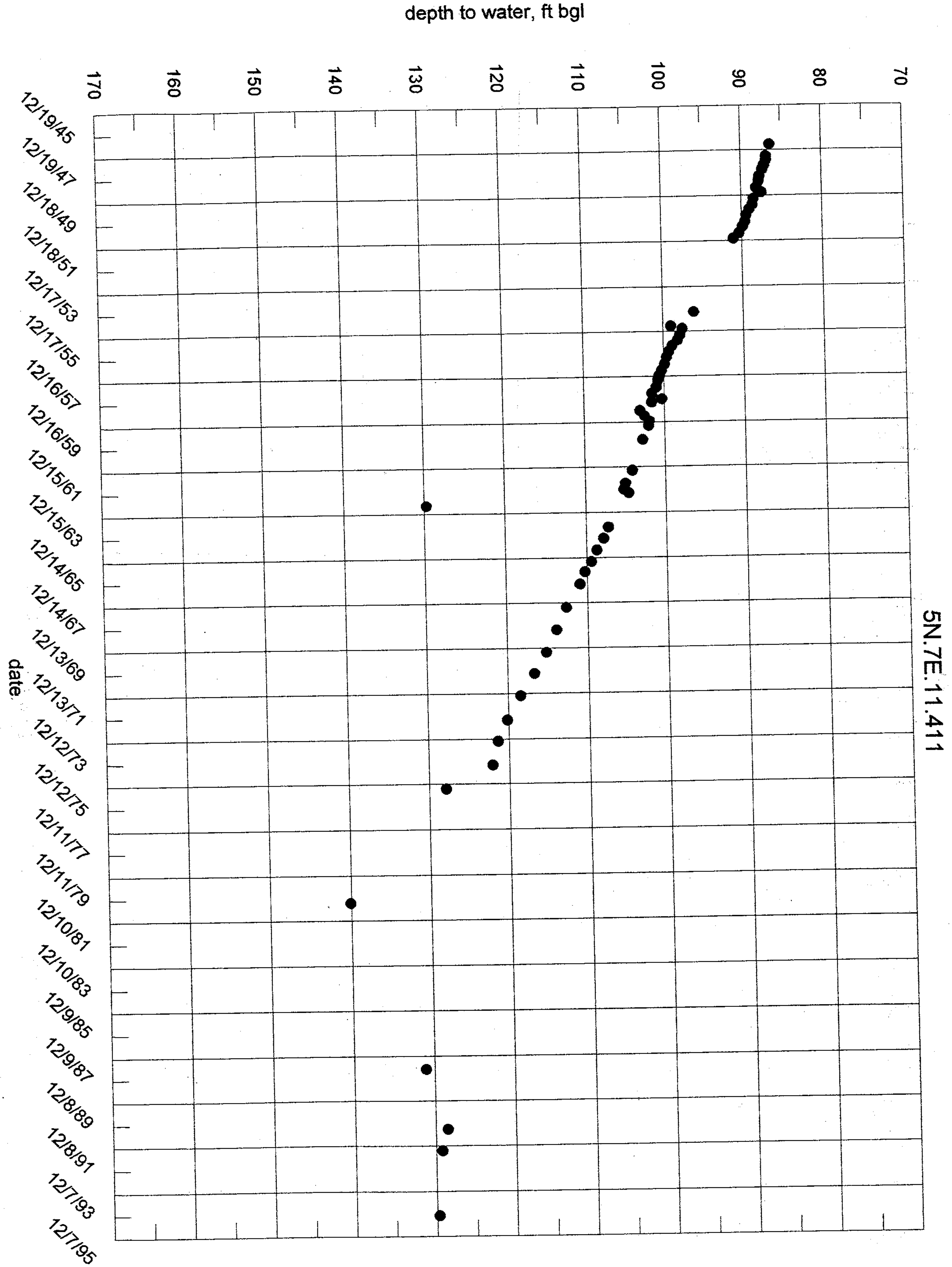
5N.8E.7.413



depth to water, ft bgl
170
160
150
140
130
120
110
100
90
80
70
12/19/45
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
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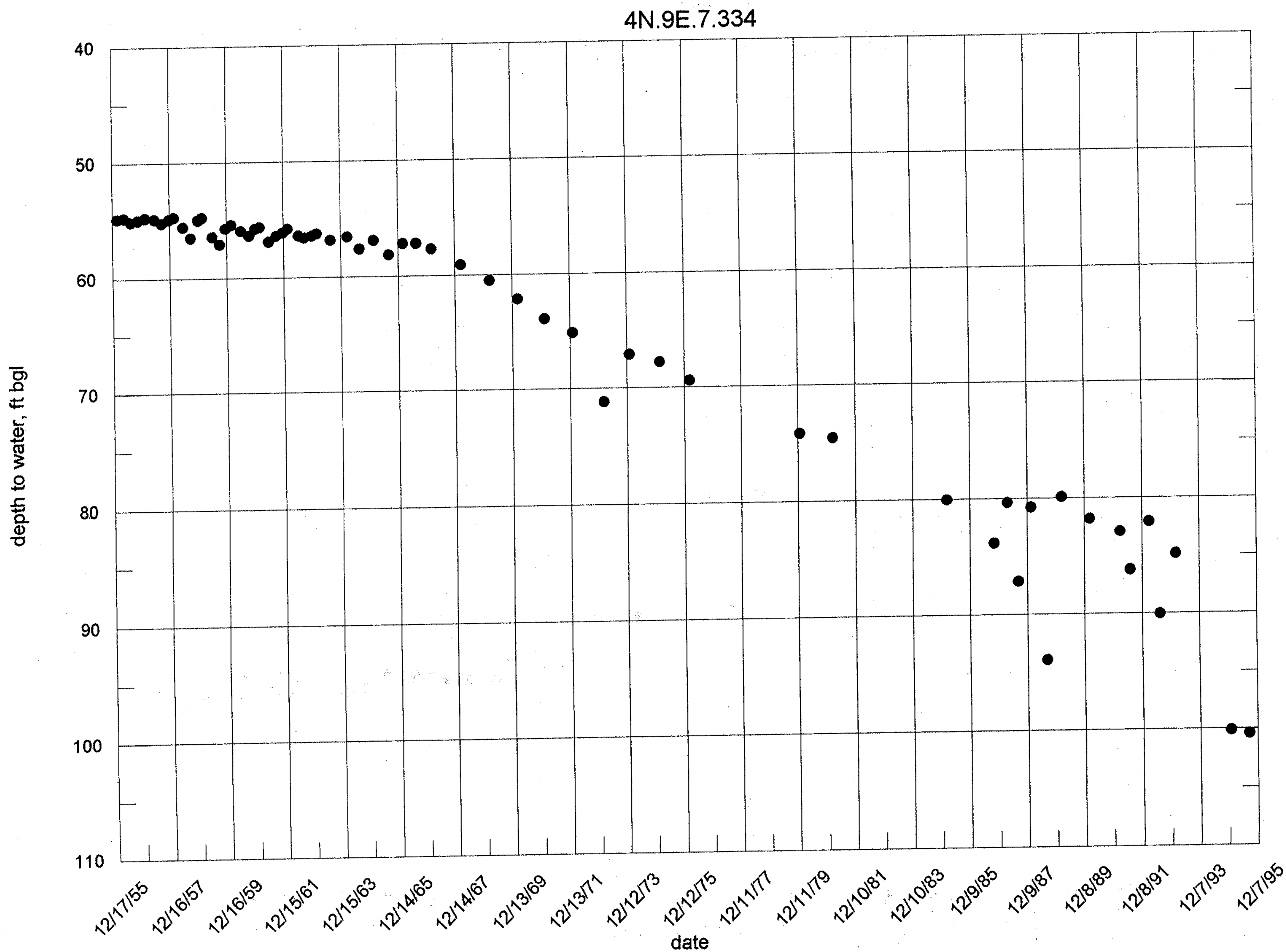
12/7/95
date
5N.7E.11.411


4N.9E.7.334
depth to water, ft bgl
40
50
60
70
80
90
100
110
12/17/55
12/16/57
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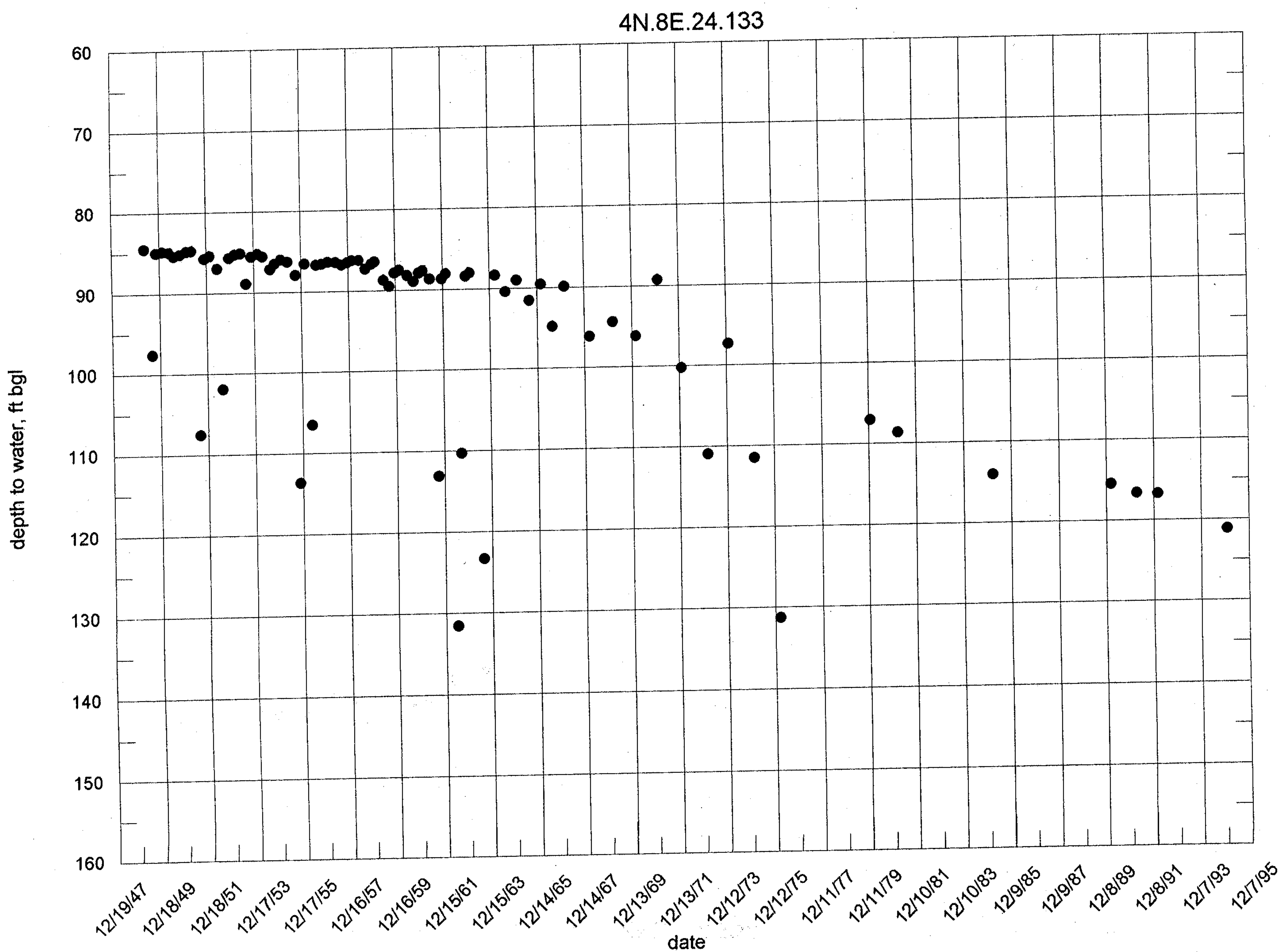
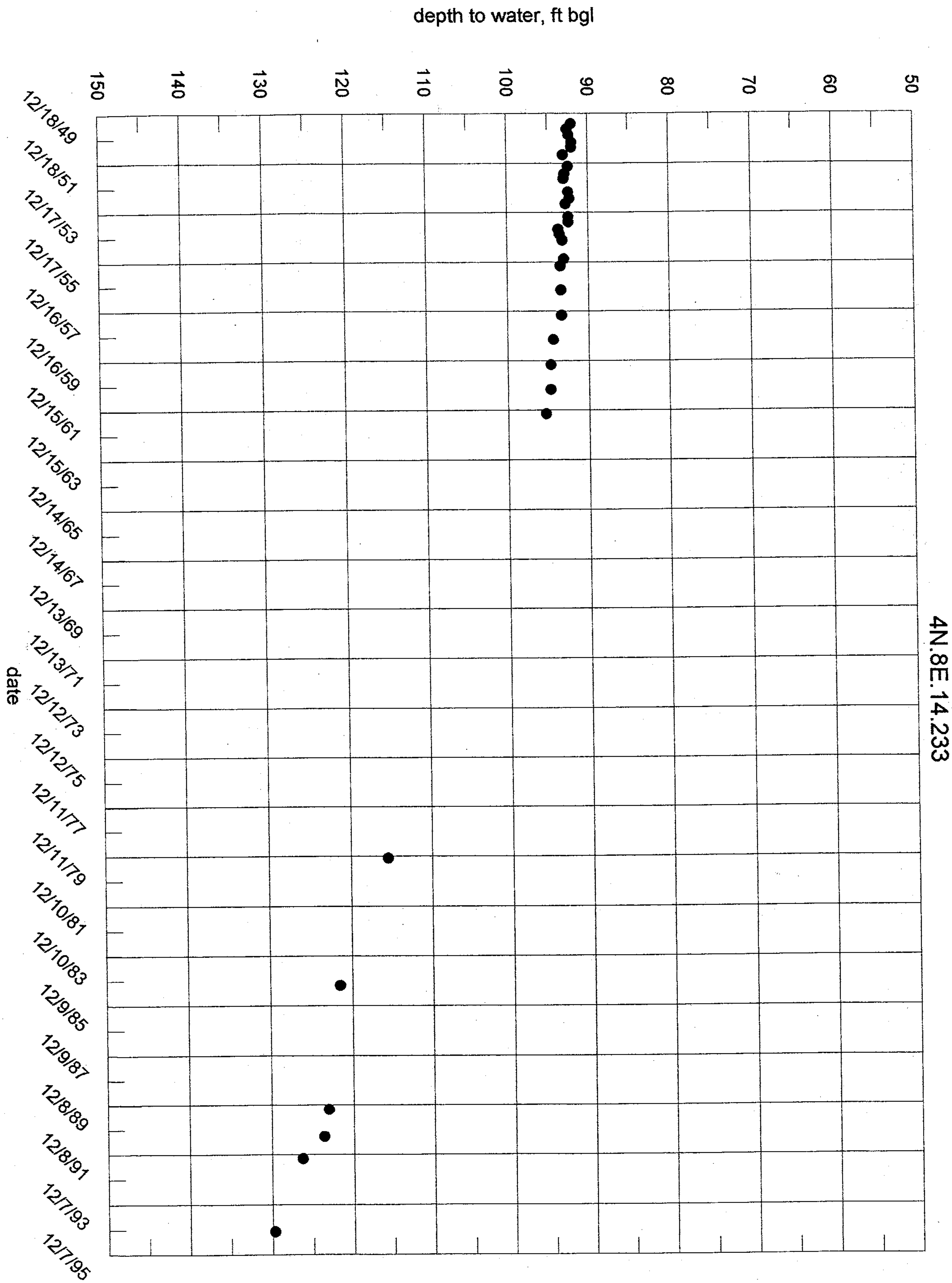
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date


4N.8E.24.133
depth to water, ft bgl
60
70
80
90
100
110
120
130
140
150
160
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date



depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
date
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
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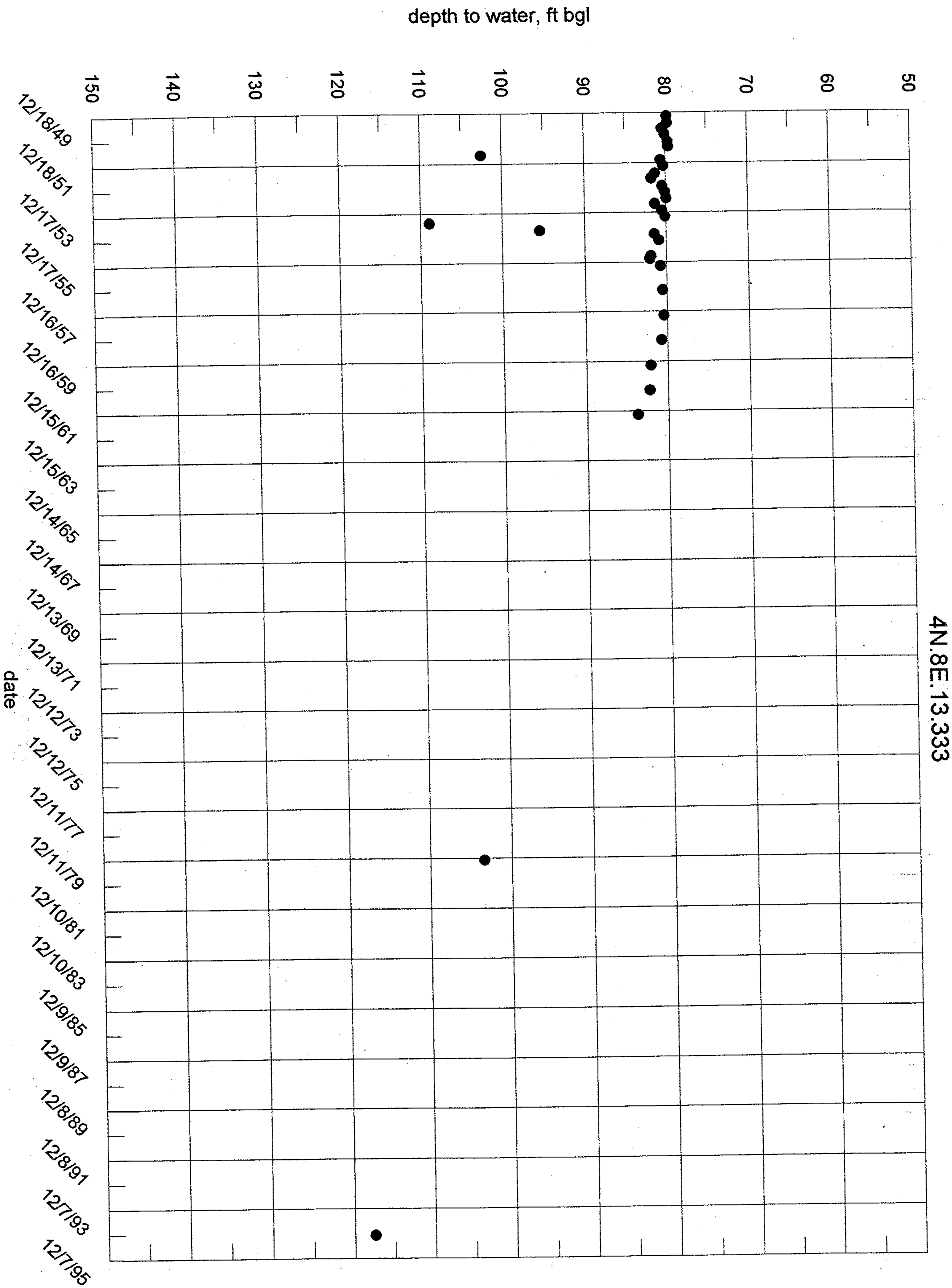
4N.8E.14.233



depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
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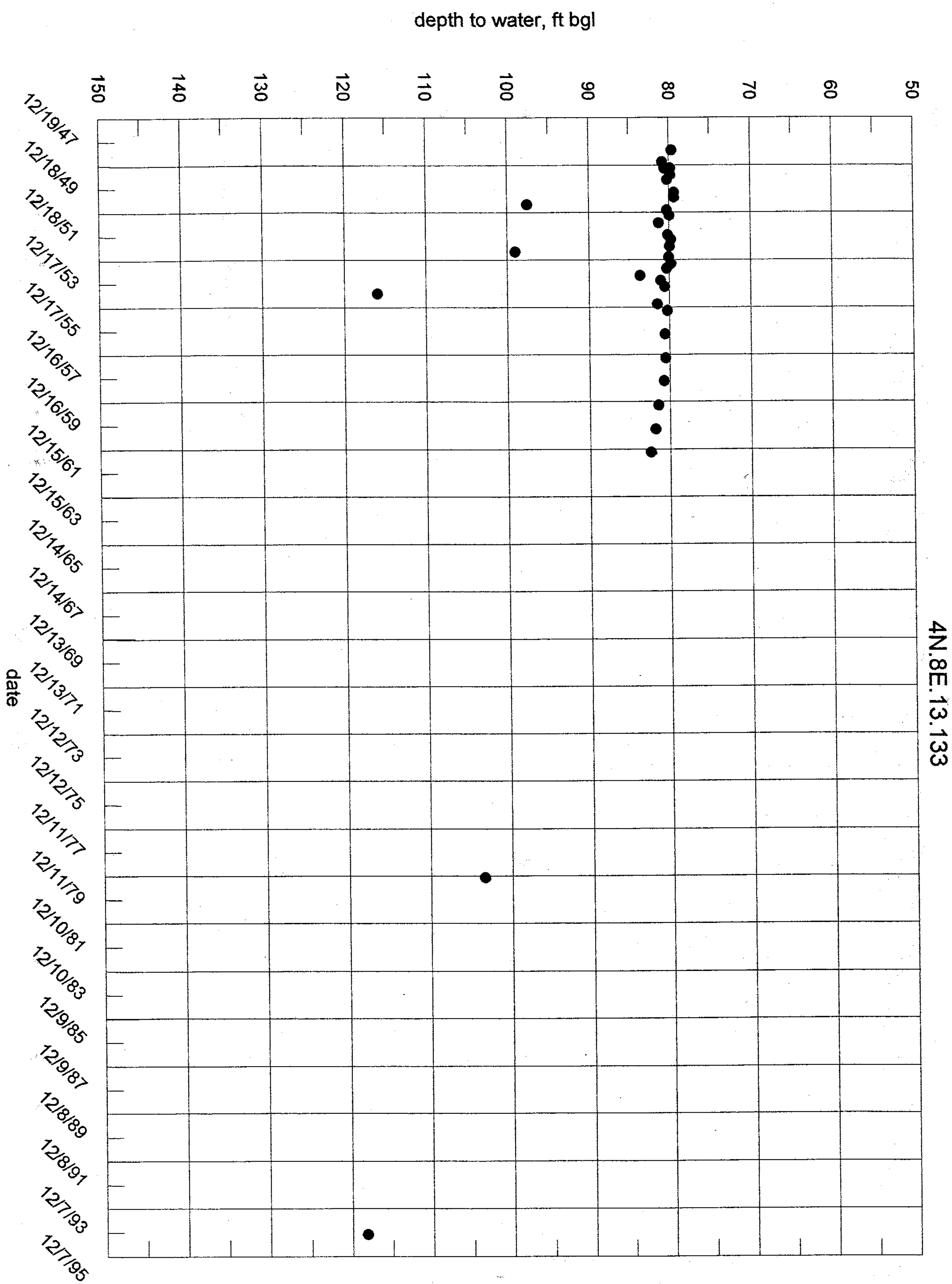
date
4N.8E.13.333



depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
date
12/19/47
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
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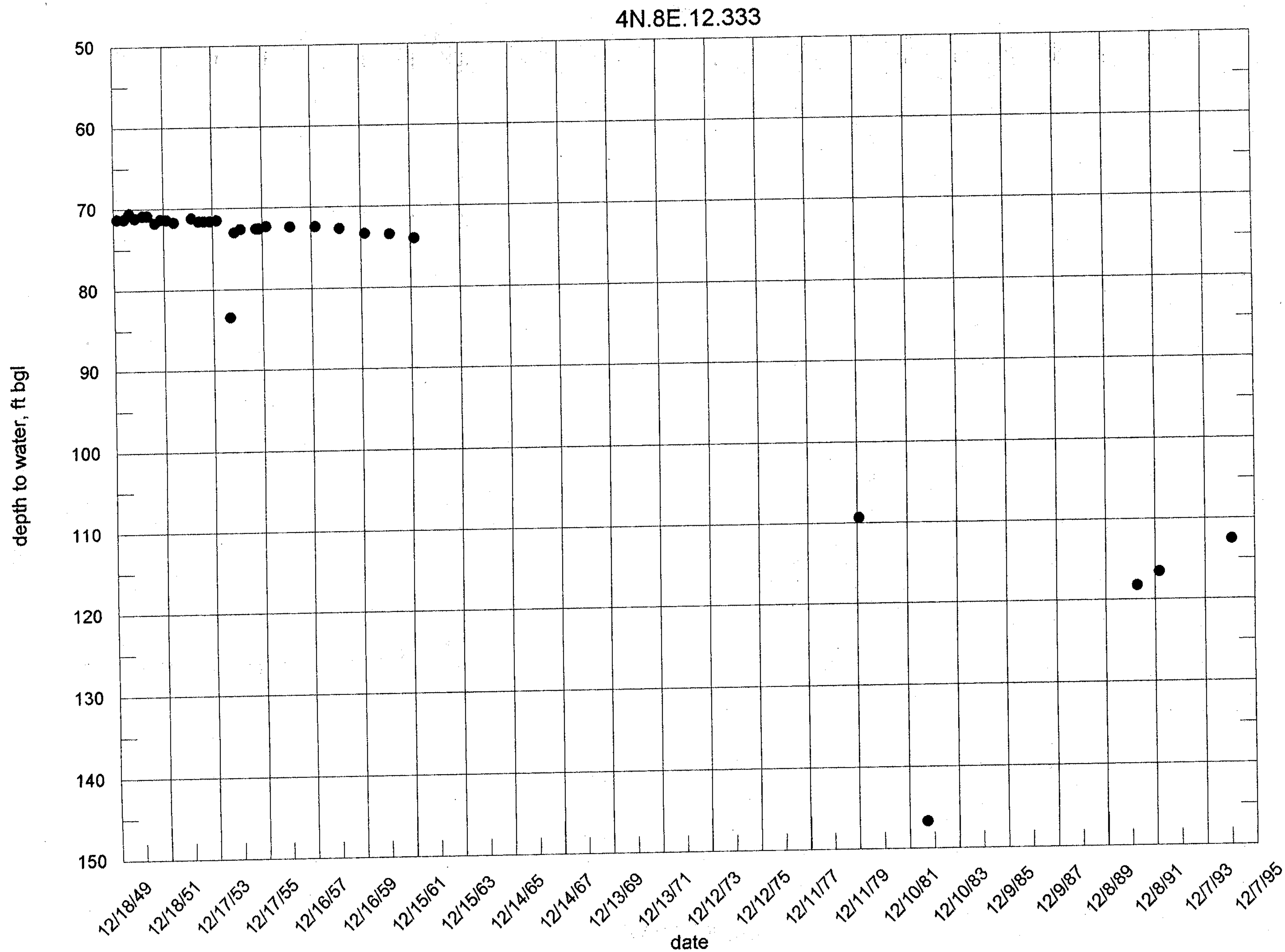
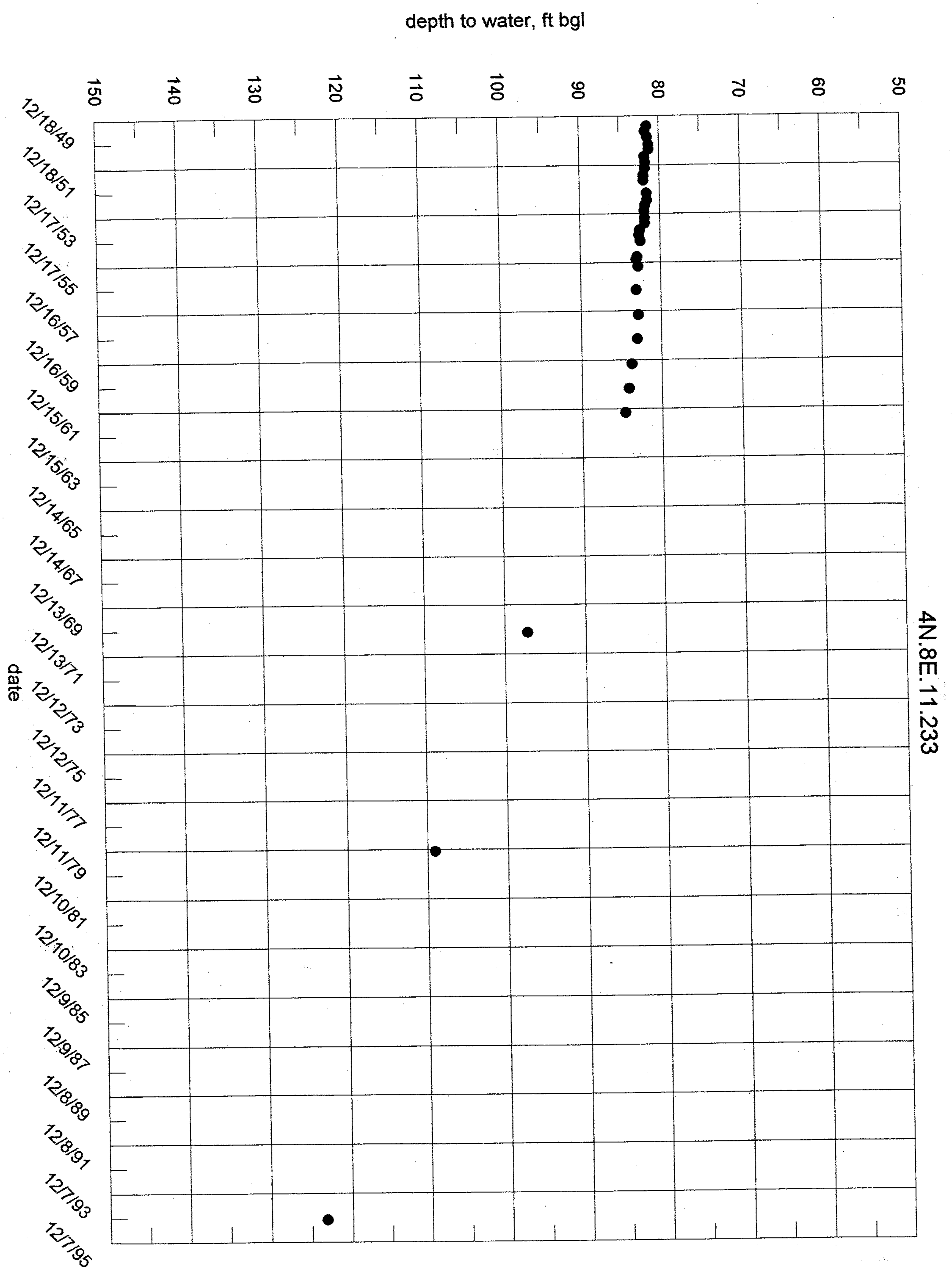
12/8/89
12/8/91
12/7/93
12/7/95
4N.8E.13.133


4N.8E.12.333
depth to water, ft bgl
50
60
70
80
90
100
110
120
130
140
150
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
12/11/79
12/10/81
12/10/83
12/9/85
12/9/87
12/8/89
12/8/91
12/7/93
12/7/95
date


4N.8E.11.233
depth to water, ft bgl
150
140
130
120
110
100
90
80
70
60
50
date
12/18/49
12/18/51
12/17/53
12/17/55
12/16/57
12/16/59
12/15/61
12/15/63
12/14/65
12/14/67
12/13/69
12/13/71
12/12/73
12/12/75
12/11/77
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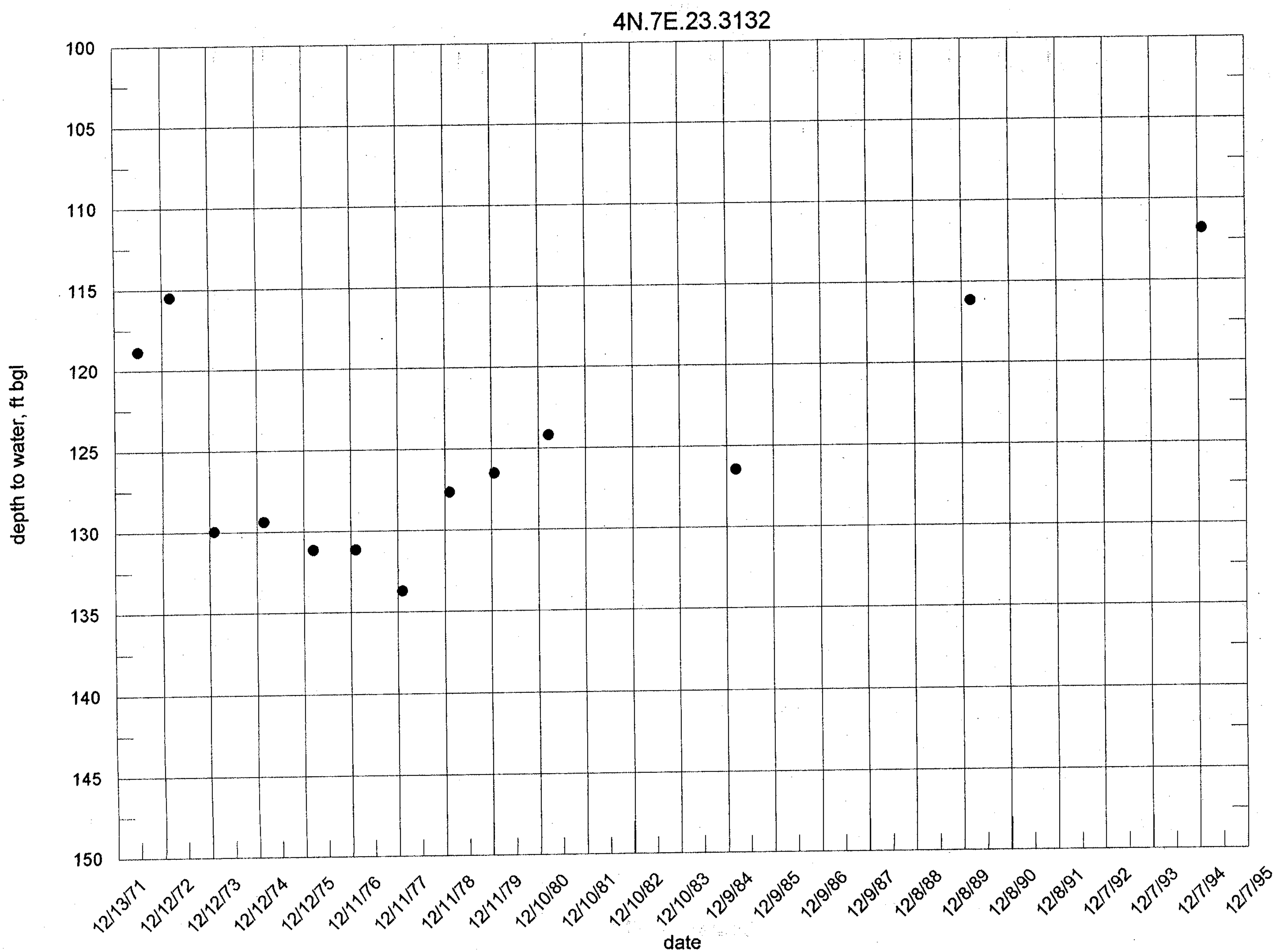
12/7/93
12/7/95



4N.7E.23.3132
depth to water, ft bgl
100
105
110
115
120
125
130
135
140
145
150
date
12/13/71
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
12/9/84
12/9/85
12/9/86
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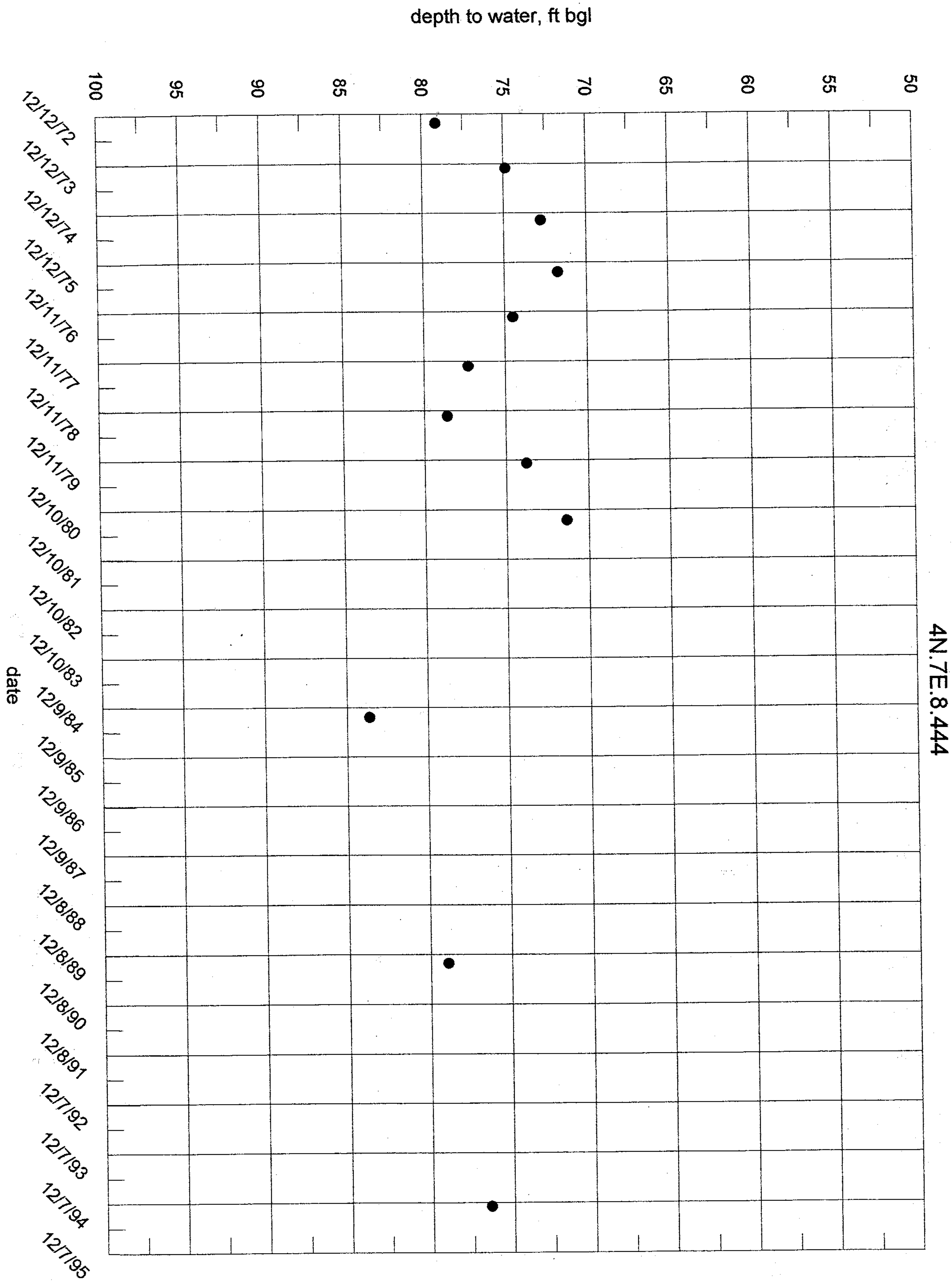
12/7/94
12/7/95


depth to water, ft bgl
100
95
90
85
80
75
70
65
60
55
50
date
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
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12/9/87
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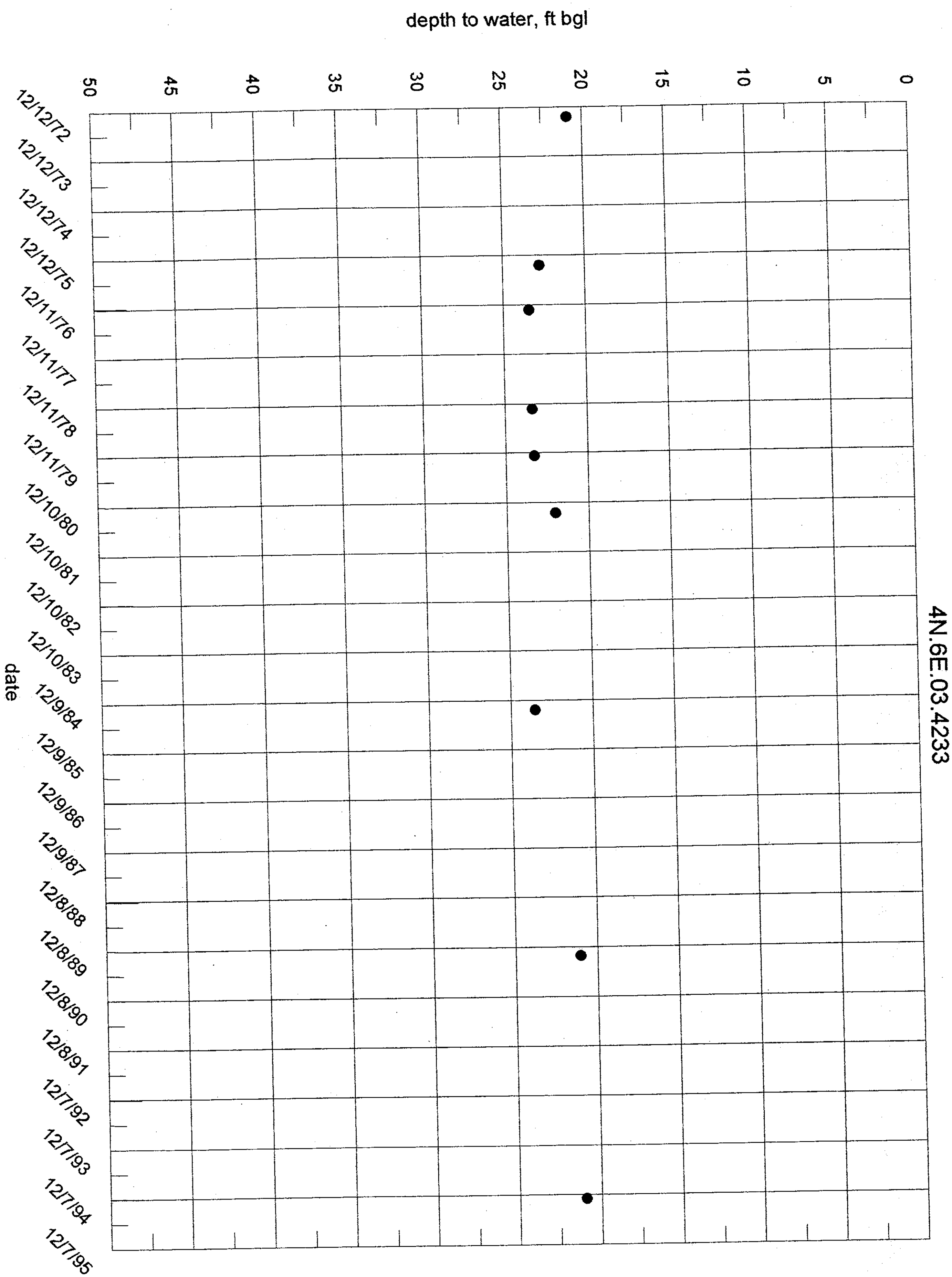
4N.7E.8.444



4N.6E.03.4233
depth to water, ft bgl
50
45
40
35
30
25
20
15
10
5
0
date
12/12/72
12/12/73
12/12/74
12/12/75
12/11/76
12/11/77
12/11/78
12/11/79
12/10/80
12/10/81
12/10/82
12/10/83
12/9/84
12/9/85
12/9/86
12/9/87
12/8/88
12/8/89
12/8/90
12/8/91
12/7/92
12/7/93
12/7/94
12/7/95

## Appendix 7.

## Selected NMSEO Well Records for Well Fields Within the Estancia Underground Water Basin.

Revised June 1972

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Armon T. Austin Owner's Well No. ____
Street or Post Office Address Route 1, Box 12-A
City and State Estancia, N.M. 87016

Well was drilled under Permit No. E-2134-Explor-2 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ S.W. ¼ of Section 30 Township 3N Range 11E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torrance County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor E.B. Hansford License No. WD430

Address Box 204 Mountainair N.M. 87036

Drilling Began 11-14-81 Completed 11-28-81 Type tools Cable Size of hole 18 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 223 ft.

Completed well is [x] shallow [ ] artesian. Depth to water upon completion of well 54 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 78 | 85 | 7 | gravel - Brown & gray | |
| 93 | 96 | 3 | Silt - Red - Believe to | |
| | | | Contain water | |
| | | | Well Pumped at | 600 GPM |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 16 | 42.05 | None | 0 | | 170 | None | 70 | 170 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

81 DEC 8 P 1:13
ALBUQUERQUE, N. MEX.

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ____ FWL ____ FSL ____

File No. E-2134-Explor-2 Use Explor Location No. SW¼ Sec. 30 T3NR11E Torrance

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 40 | 40 | Caliche - gray - Clay - Tan |
| 40 | 78 | 38 | Clay - Tan - with some gravel |
| 78 | 85 | 7 | gravel - gray & Brown - water |
| 85 | 93 | 8 | Clay - tan - Same gravel |
| 93 | 96 | 3 | Silt - Red - Believe to Contain water |
| 96 | 110 | 14 | Conglomerate - gray |
| 110 | 133 | 23 | Sandstone - tan - thin layers Clay - tan |
| 133 | 223 | 90 | Sandstone - Tan. |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

C. B. Hanford
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

Revised June 1972

# WELL RECORD

## Section 1. GENERAL INFORMATION

A) Owner of well Lowell Green Owner's Well No. ______

Street or Post Office Address 726 Jarles Road

City and State Belen, NM 87002

Well was drilled under Permit No. E-6439-X and is located in the:

a. NE ¼ NW ¼ SE ¼ ______ ¼ of Section 24 Township 03N Range 07E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Torrance County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

B) Drilling Contractor Garcia's & Sons Drilling Co. License No. WD-539

Address 28 Garcia Loop Tijeras, NM 87059

Drilling Began 04-04-96 Completed 04-09-96 Type tools Rotary Size of hole 6½ in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 155 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 80 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 80 | 155 | 75 | Creves | ½ a gallon |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 4½-160 | | pvc | 0 | 155 | 20 | cup | 80 | 100 |
| | | | | | | | 110 | 155 |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 4/24/96

Quad ______ FWL ______ FSL ______

File No. E-6439-X Use Dom. Location No. 03N.07E.24.412

## Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 20 | 20 | Brown sandstone |
| 20 | 60 | 40 | Tan sandstone |
| 60 | 70 | 10 | Brown sandstone |
| 70 | 72 | 2 | Creves |
| 72 | 80 | 8 | Gray sandstone and brown sandstone |
| 80 | 155 | 75 | Creves |

## Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Raymond Yarnis
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Mr. Bennie Maes
Street and Number
City Willard State N.M.
Well was drilled under Permit No. E-1709 and is located in the
¼ SE ¼ NE ¼ of Section 22 Twp. 3N Rge. 10E
(B) Drilling Contractor J. J. Turner License No. 399
Street and Number Box 524
City Fort Sumner State N.M.
Drilling was commenced Feb. 16, 19 70
Drilling was completed Feb. 17, 19 70

Elevation at top of casing in feet above sea level Total depth of well 60
State whether well is shallow or artesian shallow Depth to water upon completion 30

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 32 | 33 | 1 | red sand ( 2 gal. ) |
| 2 | 45 | 46 | 1 | sand & gravel ( 10 gal ) |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 65/8 | 14 | weld | surface | 60 | 60 | none | 45 | 60 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.
Street and Number City State
Tons of Clay used Tons of Roughage used Type of roughage
Plugging method used Date Plugged 19
Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1970 FEB 21

File No. E-1709 Use dom Location No. 22 3N 10E

240

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 5 | 5 | red | soil |
| 5 | 31 | 26 | red & gray | clay & sandy clay |
| 31 | 32 | 1 | red | sand |
| 32 | 45 | 13 | red & gray | clay |
| 45 | 46 | 1 | red | sand & gravel |
| 46 | 60 | 14 | yellow & red | clay |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

J. J. [illegible]
Well Driller

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Armon T. Austin

Street and Number

City Estancia State N. M.

Well was drilled under Permit No. E-1641 and is located in the

¼ ¼ NW ¼ of Section 25 Twp. 3N Rge. 10

(B) Drilling Contractor J. J. Turner License No. 3??

Street and Number Box 524

City Fort Sumner State N. M.

Drilling was commenced Jan 14 19 ??

Drilling was completed Jan 15 19 69

Elevation at top of casing in feet above sea level Total depth of well 240

State whether well is shallow or artesian shallow Depth to water upon completion 60

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 77 | 78 | 1 | red sandy lime rock ( 50 gal ) |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 65/8 | 14 | weld | 0 | 77 | 77 | no | none | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. Use Location No.

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 28 | 28 | red white | clay, caliche & gravel |
| 28 | 35 | 7 | red | clay |
| 35 | 50 | 15 | light | sand & gravel with streakes rock |
| 50 | 74 | 24 | white | sand & sandy clay |
| 74 | 82 | 8 | red | sandstone & sand |
| 82 | 240 | 158 | red | sandy shale with streaks clay |
| | | | | |
| | | | | lost part cir, at 77' |
| | | | | not to good samples |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

# STATE ENGINEER OFFICE
## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Matthew or Polly Luna Owner's Well No. E-6315
Street or Post Office Address 4527 Peridot Way,N.E.
City and State Rio Rancho,N.M. 87124

Well was drilled under Permit No. E-6315 and is located in the:

a. ____ ¼ ____ ¼ NE ¼ NE ¼ of Section 9 Township 4N Range 10E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torrance County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Tom Massey Drilling License No. 1358

Address P.O.Box 401,Estancia,N.M. 87016

Drilling Began 11/11/95 Completed 11/11/95 Type tools rotary Size of hole 6½ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 230 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 78 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 196 | 220 | 24 | red sandstone | 15 GPM |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5"OD | | sch 40 pvc | | | | | 200 | 220 |
| | | | | | | | | |
| | | | | | | | | |

NOV 21 P 2: 15

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:
____ State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 11/21/95

Quad ____ FWL ____ FSL ____

File No. E-6315 Use Dom Location No. 04N.10E.09.22

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 27 | 27 | brown clay |
| 27 | 80 | 53 | sandy clay |
| 80 | 116 | 36 | limestone |
| 116 | 172 | 56 | red sandy clay |
| 172 | 196 | 24 | limestone |
| 196 | 220 | 24 | red sandstone,hit water, 15 GPM |
| 220 | 230 | 10 | red clay |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Packer 20'

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June ...

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Matthew or Polly Luna Owner's Well No. E-6318
Street or Post Office Address 4527 Peridot Way, NE
City and State Rio Rancho, N.M. 87124

Well was drilled under Permit No. E-6318 and is located in the:

a. ____ ¼ ____ ¼ NE ¼ NE ¼ of Section 9 Township 4N Range 10E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torrance County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Tom Massey Drilling License No. 1358

Address P.O.Box 401, Estancia, N.M. 87016

Drilling Began 11/13/95 Completed 11/13/95 Type tools rotary Size of hole 6¼ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 70 ft.

Completed well is [x] shallow [ ] artesian. Depth to water upon completion of well 26 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 52 | 70 | 18 | gravel | 40 GPM |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 5"OD | | sch 40 pvc | | | | | 50 | 70 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

NOV 2 ... 03

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 11/21/95

Quad ____ FWL ____ FSL ____

File No. E-6318 Use Dom Location No. 04N.10E.09.22

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 3 | 3 | yellow clay |
| 3 | 26 | 23 | yellow salty clay & gravel |
| 26 | 38 | 12 | brown sandy clay |
| 38 | 52 | 14 | yellow clay & gravel |
| 52 | 70 | 18 | gravel,hit water, 40 GPM |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Packer 30'

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well ARMON AUSTIN
Street and Number BOX B-4
City ESTANCIA State N. MEXICO
Well was drilled under Permit No. E-1854 and is located in the NE ¼ ¼ ¼ of Section 20 Twp 4N Rge 11E

(B) Drilling Contractor JEWELL ADKISON DRLG. CO License No. WD 305
Street and Number STAR RT. BOX 287
City TIJERAS State N. MEXICO
Drilling was commenced 11/18 1971
Drilling was completed 11/24 1971

Elevation at top of casing in feet above sea level ________ Total depth of well 354 ft.
State whether well is shallow or artesian SHALLOW Depth to water upon completion 244 ft.

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 266 | 300 | 44 | FRACTURED ROCK |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Bottom | Feet | Type Shoe | Perforations From | To |
|---|---|---|---|---|---|---|---|---|
| 8 5/8 | 24 | P.E. | plus 2ft. | 354 | | NONE | 266 | 300 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | NONE | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor ________ License No. ________
Street and Number ________ City ________ State ________
Tons of Clay used ________ Tons of Roughage used ________ Type of roughage ________
Plugging method used ________ Date Plugged ________ 19____
Plugging approved by:

________
Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received ________

File No. ________ Use ________ Location No. ________

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 15 | 15 | | CLEACHIA |
| 15 | 22 | 7 | GRAY | CLAY&GRAVEL |
| 22 | 40 | 18 | BROWN | ROCK |
| 40 | 44 | 4 | BROKEN ROCK | BROWN |
| 44 | 50 | 6 | BLACK | ROCK |
| 50 | 55 | 5 | BROWN | BROKEN ROCK |
| 55 | 83 | 28 | BLACK | ROCK |
| 83 | 88 | 5 | BROWN | ROCK |
| 88 | 132 | 44 | GRAY | ROCK |
| 132 | 150 | 18 | BROWN | ROCK |
| 150 | 172 | 22 | GRAY | ROCK |
| 172 | 180 | 8 | BROWN | ROCK |
| 180 | 200 | 20 | GRAY&BROWN | ROCK |
| 200 | 222 | 22 | BROWN | BROKEN ROCK WITH SAND STRINGERS |
| 222 | 266 | 44 | BROKEN ROCK WITH RED SHALE STRINGERS | |
| 266 | 288 | 22 | BROWN&BLACK | ROCK |
| 288 | 296 | 8 | BLACK | ROCK |
| 296 | 332 | 36 | BLACK&BROWN | ROCK |
| 332 | 341 | 9 | BLACK | HARD ROCK |
| 341 | 354 | 13 | BLACK&BROWN | ROCK |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

Revised June 1972

# STATE ENGINEER OFFICE

## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Armon T. Austin Owner's Well No. 1
Street or Post Office Address Star Route, Box 24
City and State Estancia, NM 87016

Well was drilled under Permit No. E-3112 and is located in the:

a. ___ ¼ ___ ¼ ___ ¼ SE ¼ of Section 24 Township 4N Range 11E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in Torrance County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor T. M. Yates License No. WD-599

Address 3951 Hwy 85, Los Lunas, NM

Drilling Began Nov.14,1979 Completed Nov.15,1979 Type tools Rotary Size of hole 5 in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 160 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 58 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 65 | 85 | 20 | Sandstone Cavity | 100 |
| 85 | 135 | 50 | Gravel | 100 + |
| 150 | 160 | 10 | Sand | 100 + |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by: ___
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received November 28, 1979

Quad ___ FWL ___ FSL ___

File No. E-3112 Use domestic Location No. 4N.11E.24 SE¼ (Torrance)

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 4 | 4 | Clay |
| 4 | 27 | 23 | Sand |
| 27 | 65 | 38 | Clay |
| 65 | 85 | 20 | Sandstone Cavity |
| 85 | 135 | 50 | Gravel |
| 135 | 150 | 15 | Red shell |
| 150 | 160 | 10 | Sand |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Robert L Saline
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well David W. Sehin Owner's Well No. ______
Street or Post Office Address 2817 Plaza Amarilla
City and State Santa Fe, New Mexico, 87505

Well was drilled under Permit No. E-5323 and is located in the:

a. ____ ¼ SE ¼ SE ¼ SE ¼ of Section 18 Township 11N Range 10E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Santa Fe County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD 49

Address P.O. Box 91, Stanley, New Mexico, 87056

Drilling Began 12-15-91 Completed 2-19-92 Type tools Cable Size of hole 8 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 493 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 270 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 300 | 306 | 6 | Yeso rock | 10 |
| 365 | 366 | 1 | Yeso crack | 10 |
| 390 | 460 | 70 | Yeso lime streaks | 150 |
| 460 | 468 | 8 | Yeso lime streak less mud | 300 - 400 |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 5/8 | - | - | 0 | 393 | 394 | Welded | 300 | 490 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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## Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 2-20-92

Quad ______ FWL ______ FSL ______

File No. E-5323 Use Dom Location No. 11N.10E.18.444

# STATE ENGINEER OFFICE
## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Robert H. Gibson Owner's Well No. ____
Street or Post Office Address 419 Prosperity SE
City and State Albuquerque, NM, 87105

Well was drilled under Permit No. E-6216 and is located in the:

a. ____ ¼ NW ¼ NW ¼ NW ¼ of Section 17 Township 11N Range 10E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Santa FE County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD 49

Address PO Box 91, Stanley, NM, 87056

Drilling Began 9-23-95 Completed 9-26-95 Type tools Rotary Size of hole 7 7/8 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 430 ft.

Completed well is [x] shallow [ ] artesian. Depth to water upon completion of well 330 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 340 | 380 | 40 | Red - blue shale | 25 |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 5 | | | 0 | 430 | 430 | none | 330 | 430 |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

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### Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1/8/96

Quad ____ FWL ____ FSL ____

File No. E-6216 Use Dom Location No. 11N.10E.17.111

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 5 | 5 | Tan topsoil |
| 5 | 105 | 100 | Caliche - boulders - sand |
| 105 | 300 | 195 | Red clay |
| 300 | 340 | 40 | Red clay - gravel |
| 340 | 380 | 40 | Red - gray shale |
| 380 | 400 | 20 | Gray shale |
| 400 | 430 | 30 | Red - gray shale - sandy |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

# STATE ENGINEER OFFICE

## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well HENRY & PAT HUMME Owner's Well No. ______
Street or Post Office Address 124 COUNTY ROAD A-104
City and State EDGEWOOD, NM. 87015

Well was drilled under Permit No. E-6459 and is located in the:
TRACT 38 - 60 ACRES
a. ____ ¼ E½ ¼ SE ¼ SW ¼ of Section 18 Township 11N Range 10E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in SANTA FE, County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor DENNISSON DRILLING License No. WD-49

Address P. O. BOX 86, STANLEY, NM. 87056

Drilling Began 03/21/96 Completed 03/25/96 Type tools ROTARY Size of hole 7 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 425 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 290 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 300 | 320 | 20 | BROWN SAND STONE | 5 GPM |
| 390 | 412 | 22 | WHITE SAND STONE | 20 GPM |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5" PVC | | | 0 | 425 | 425 | NONE | 380 (SCREEN) | 410 |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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STATE ENGINEER OFFICE
ALBUQUERQUE, NM

### Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______ State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 04-04-96 Quad ______ FWL ______ FSL ______

File No. E-6459 Use Dom Location No. 11N.10E.18.340

## Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 3 | 3 | TOP SOIL |
| 3 | 12 | 9 | CALIOHE |
| 12 | 60 | 48 | TAN CLAY |
| 60 | 300 | 240 | TRIASSIC RED |
| 300 | 320 | 20 | BROWN SAND STONE |
| 320 | 390 | 70 | RED CLAY SHALE |
| 390 | 412 | 22 | WHITE SAND STONE |
| 412 | 425 | 13 | RED SHALE |

## Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Leo Dennison
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 120 | 120 | Red Shale |
| 120 | 440 | 320 | Red Shale & SS Streaks |
| 440 | 480 | 40 | Grey SS |
| 480 | 500 | 20 | Red Shale |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Larry Williams Owner's Well No.

Street or Post Office Address P.O. Box 144

City and State Moriarty, NM 87035

Well was drilled under Permit No. E-6325 and is located in the:

a. SW ¼ SW ¼ SW ¼ ¼ of Section 16 Township 9N Range 10E N.M.P.M.

b. Tract No. of Map No. of the

Well address: 6 miles south of Martinez road, moriarty, NM

c. Lot No. 1 of Block No. of the Lobo Acres

Subdivision, recorded in Torrance County.

d. X= feet, Y= feet, N.M. Coordinate System Zone in the Grant.

(B) Drilling Contractor Garcia's & Sons Drilling Co. License No. WD-539

Address 28 Garcia Loop Tijeras, NM 87059

Drilling Began 11-15-95 Completed 11-18-95 Type tools Rotary Size of hole 6½ in.

Elevation of land surface or at well is ft. Total depth of well 225 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 140 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 140 | 225 | 85 | Yellow sandstone and rock | 20 gallons |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 4½ | | pvc | 0 | 225 | 20 | cup | 180 | 225 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

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## Section 5. PLUGGING RECORD

Plugging Contractor

Address

Plugging Method

Date Well Plugged

Plugging approved by:

State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 11/22/95

Quad FWL FSL

File No. E-6325 Use Dom Location No. 09N.10E.16.333

Lobo Acres, Lot 1

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 25 | 25 | Brown clay |
| 25 | 85 | 60 | Red hard shell |
| 85 | 90 | 5 | Sandstone |
| 90 | 100 | 10 | Gray rock |
| 100 | 145 | 45 | Brown rock |
| 145 | 150 | 5 | Yellow and gray rock |
| 150 | 165 | 15 | Red shell and rock |
| 165 | 185 | 20 | White clay and hard rock |
| 185 | 200 | 15 | Sandstone - yellow |
| 200 | 203 | 3 | Green rock |
| 203 | 225 | 22 | Yellow sandstone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Raymund Garcia
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

# STATE ENGINEER OFFICE

## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Jack Love Owner's Well No. ______

Street or Post Office Address 3511 Carlisle NE

City and State Albuquerque, NM

Well was drilled under Permit No. E-4972 X and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section 19 Township 9N Range 10E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. 31 of Block No. 12 Unit 12N of the Estancia Valley Ranchettes Subdivision, recorded in Torrance County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennison Drilling License No. WD 49

Address P.O. Box 91, Stanley, New Mexico, 87056

Drilling Began 1-24-94 Completed 1-29-94 Type tools Rotary Size of hole 7 7/8 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 340 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 320 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 325 | 333 | 8 | Red - gray small gravel | 30 |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 5 | | | 0 | 340 | 340 | 0 | 240 | 340 |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | |

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### Section 5. PLUGGING RECORD

Plugging Contractor ______

Address ______

Plugging Method ______

Date Well Plugged ______

Plugging approved by:

______

State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 2-10-94

Quad ______ FWL ______ FSL ______

File No. E-4972-X Use Dom Location No. 09N.10E.19.224

| | | in Feet | Type of Material Encountered |
|---|---|---|---|
| 0 | 3 | 3 | Topsoil |
| 3 | 20 | 17 | Caliche boulders |
| 20 | 35 | 15 | Hard rock - black obsidian |
| 35 | 50 | 15 | Red clay |
| 50 | 120 | 70 | Yellow sandstone |
| 120 | 240 | 120 | Red sandstone |
| 240 | 310 | 70 | Red medium soft shale |
| 310 | 325 | 15 | Red sandstone |
| 325 | 333 | 8 | Red and grey small gravel |
| 333 | 340 | 7 | Red sandstone |
| | | | |
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Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

Revised June 1972

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Larry Stevens Owner's Well No. E-6105

Street or Post Office Address P O Box 561

City and State McIntosh N M 87032

Well was drilled under Permit No. ________ and is located in the:

a. SE ¼ NW ¼ ____ ¼ ____ ¼ of Section 6 Township 7N Range 10E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____ Subdivision, recorded in Torrance County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Morris Drilling License No. #1340

Address ________

Drilling Began 5/9/95 Completed 5/11/95 Type tools Rotary Size of hole 6 ½ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 135 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 80' ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 80 | 85 | 5 | Sandstone | 5 |
| 125 | 130 | 5 | Lime Stone & Glorieta | 15 |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5" ID | Plastic | | | 135 | | | 95 | 135 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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STATE ENGINEER OFFICE ALBUQUERQUE, N.M.

## Section 5. PLUGGING RECORD

Plugging Contractor ________

Address ________

Plugging Method ________

Date Well Plugged ________

Plugging approved by:

________
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

### FOR USE OF STATE ENGINEER ONLY

Date Received 5/15/95

Quad ____ FWL ____ FSL ____

File No. E-6105 Use Dom Location No. 07N.10E.06.14

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 2 | 2 | Top Soil Red |
| 2 | 80 | 78 | Sand Stone Red |
| 80 | 85 | 5 | Sand Stone Red |
| 85 | 125 | 40 | Sand Stone Red |
| 125 | 130 | 5 | Lime Stone & Glorieta Gray & Yellow |
| 130 | 135 | 5 | Lime Stone Gray |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Ray Morris
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

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Revised June 1972

STATE ENGINEER OFFICE

# WELL RECORD

STATE ENGINEER OFFICE
ALBUQUERQUE, N.M.

## Section 1. GENERAL INFORMATION

(A) Owner of well ROWENA BERKSHIRE GREENE Owner's Well No. ____
Street or Post Office Address 10024 BRIDGEPOINT NE 95 MAY 11 P 2:06
City and State ALBUQUERQUE, NM. 87111

Well was drilled under Permit No. E-169 and is located in the:

a. ____ ¼ ____ ¼ NW ¼ NW ¼ of Section 19 Township 7N Range 10E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in TORRANCE County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor DENNISSON DRILLING License No. WD-49

Address P. O. Box 86, STANLEY, NM. 87056

Drilling Began 01/15/95 Completed 01/30/95 Type tools ROTARY Size of hole 15 3/4 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 280 ft.

Completed well is [x] shallow [ ] artesian. Depth to water upon completion of well 60 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 255 | 280 | 25 | BOULDERS GRAVEL | 1000 GPM |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 12" PVC | | | 0 | 173 | 173 | NONE | | |
| 8" PVC | | | 163 | 280 | 117 | NONE | 240 | 280 |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 5/11/95

Quad ____ FWL ____ FSL ____

File No. E-169 Use Irrig Location No. 07N.10E.19.11

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 3 | 3 | TOP SOIL |
| 3 | 60 | 57 | YELLOW CLAY |
| 60 | 255 | 195 | RED YESO |
| 255 | 280 | 25 | BOULDERS GRAVEL |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Larry F. Dennison
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Pete E. Montano Owner's Well No. ____
Street or Post Office Address PO Box 522
City and State Moriarty, NM 87035

Well was drilled under Permit No. E-5168 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section 12 Township 8N Range 7E N.M.P.M.

b. Tract No. 5 of Map No. 17 of the Chilili Grant

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torrance County.

d. X= 508,700 feet, Y= 1,408,200 feet, N.M. Coordinate System Central Zone in the Chilili Land Grant.

(B) Drilling Contractor Sandia Well Drilling License No. WD 641

Address PO Box 940 Tijeras, NM 87059

Drilling Began 10-29-90 Completed 10-30-90 Type tools Rotary Size of hole 6 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 500 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 210 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 482 | 483 | 1 | gray/brown limestone | 3 |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5 | | | 18" | 500 | 501½ | | 480 | 500 |
| | | | | | | | | |
| | | | | | | | | |

JAN 4 '91

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1-4-91

Quad ____ FWL ____ FSL ____

File No. E-5168 Use Dom Location No. 08N.07E.12
Chilili Grant - Tr. 5, Map 17

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encounter |
|---|---|---|---|
| 0 | 8 | | brown soil |
| 8 | 35 | | yellow shale |
| 35 | 500 | | gray/brown limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

Sandia Well Drilling, Inc.

IN: TIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled red epened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well: Herman Chavez — Owner's Well No. ______

Street or Post Office Address: 7000 Cisco Road NW

City and State: Albuquerque, NM 87120

Well was drilled under Permit No. E-6163 and is located in the: Repair and deepen well

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ____ Township ____ Range ____ N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torrance County.

d. X= 493,300 feet, Y= 1,349,600 feet, N.M. Coordinate System ____ Zone in the Town of Toreon Land Grant Grant.

(B) Drilling Contractor: Garcia's & Sons Drilling Company — License No. WD-539

Address: 28 Garcia Loop Tijeras, NM 87059

Drilling Began 05-21-96 Completed 05-25-96 Type tools Rotary Size of hole 6½ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 205 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 100 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 100 | 205 | 105 | Red clay and green rock | 10 gallons |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 4½-160 | | pvc | 0 | 205 | 20 | cup | 100 | 160 |
| | | | | | | | 180 | 205 |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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## Section 5. PLUGGING RECORD

Plugging Contractor ____

Address ____

Plugging Method ____

Date Well Plugged ____

Plugging approved by:

____ State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 6/4/96 Quad X=493,300 y=1,349,600 FWL ____ FSL ____

File No. E-6163 Use Dom. Location No. ____

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 100 | 100 | Repair and deepen well from 100 feet |
| 100 | 120 | 20 | Pink clay |
| 120 | 130 | 10 | Gravel |
| 130 | 140 | 10 | Red clay |
| 140 | 160 | 20 | Green rock |
| 160 | 170 | 10 | Red clay and rock |
| 170 | 185 | 15 | Hard Limestone |
| 185 | 205 | 20 | Red clay and green rock |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Raymond Garcia
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Margaret V. & John G. Fehr Owner's Well No. HC-1-6556
Street or Post Office Address 9109 Sonya SW
City and State Albuquerque, NM 87121

Well was drilled under Permit No. E-6148 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ____ Township ____ Range ____ N.M.P.M.

b. Tract No. B of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torrance County.

d. X= 479,000 feet, Y= 1,355,000 feet, N.M. Coordinate System Central Zone in the Town of Torreon Grant Grant.

(B) Drilling Contractor W.H. Adkison Drilling, Inc. License No. WD-497

Address P.O. Box 478, Edgewood, NM 87015

Drilling Began 12-6-95 Completed 12-8-95 Type tools rotary Size of hole 6½ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 460 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 250 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| | | | Seeper | 40 gals per day |
| | | | | |
| | | | | |
| | | | | |

Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5 od pvc | | | +1.5 | 450 | 20 | | 240 | 260 |
| | | | | | | | 300 | 320 |
| | | | | | | | 340 | 380 |
| | | | | | | | 420 | 440 |

Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____ State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 12/21/95 Quad X=479,000 y=1,355,000 FWL ____ FSL ____

File No. E-6148 Use Dom. Location No. ____

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 24 | 24 | brown clay |
| 24 | 76 | 52 | brown clay W/limestone streaks |
| 76 | 108 | 32 | grey limestone |
| 108 | 112 | 4 | tan sandy clay |
| 112 | 134 | 22 | grey limestone |
| 134 | 141 | 7 | black shale |
| 141 | 244 | 103 | grey limestone |
| 244 | 257 | 13 | black shale |
| 257 | 364 | 107 | grey limestone |
| 364 | 372 | 8 | black shale |
| 372 | 460 | 88 | grey limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is [illegible] only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Harold Staley or Yvonne Staras Owner's Well No. E-6415
Street or Post Office Address General Delivery
City and State Tijique, N.M. 87057

Well was drilled under Permit No. E-6415 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ____ Township ____ Range ____ N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torrance County.

d. X= 498,000 feet, Y= 1,369,000 feet, N.M. Coordinate System Central Zone in the Town of Tijique Grant.

(B) Drilling Contractor ~~Tom Massey Drilling~~ License No. 1358

Address P.O.Box 401, Estancia, N.M. 87016

Drilling Began 3/23/96 Completed 3/25/96 Type tools rotary Size of hole 6½ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 500 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 268 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 268 | 332 | 64 | limestone | ½ GPM |
| 478 | 481 | 11 | black shale | 2GPM |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 5"OD | | sch 40 pvc | | | | | 300 | 320 |
| 5"OD | | sch 40 pvc | | | | | 460 | 480 |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

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STATE ENGINEER OFFICE

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 4/2/96

Quad x=498,000 y=1,369,000 FWL ____ FSL ____

File No. E-6415 Use Dom. Location No. ____

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 3 | 3 | red shale |
| 3 | 12 | 9 | red sandstone |
| 12 | 42 | 30 | red shale |
| 42 | ~~52~~ 57 | 15 | yellow shale |
| 57 | 116 | 59 | limestone |
| 116 | 122 | 6 | black shale |
| 122 | 227 | 105 | limestone |
| 227 | 268 | 41 | red shale |
| 268 | 332 | 64 | limestone,water, ½ GPM |
| 332 | 341 | 9 | black shale |
| 341 | 367 | 26 | red shale |
| 367 | 418 | 51 | limestone |
| 418 | 427 | 9 | black shale |
| 427 | 478 | 51 | limestone |
| 478 | 481 | 11 | black shale,water, 2GPM |
| 481 | 492 | 11 | green sandstone |
| 492 | 500 | 8 | limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Packer 20 '

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

## STATE ENGINEER OFFICE

# WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Frank E. Dow    Owner's Well No. HC-1-2427

Street or Post Office Address 11308 Academy Ridge Rd. NE

City and State Albuquerque, NM 87111

Well was drilled under Permit No. E-5781 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ____ Township ____ Range ____ N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= 483,600 feet, Y= 1,366,800 feet, N.M. Coordinate System Central Zone in the Town of Tajique Grant.

(B) Drilling Contractor W.H. Adkison Drilling, Inc.    License No. WD-497

Address P.O. Box 478, Edgewood, NM 87015

Drilling Began 6-7-94    Completed 6-7-94    Type tools rotary    Size of hole 6½ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 95 ft.

Completed well is ☒ shallow ☐ artesian.    Depth to water upon completion of well 50 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 71 | 77 | 6 | tan fractured limestone | 6 |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 5" od | | | +2 | 90 | 20 | | 50 | 90 |
| PVC | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

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### Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY    C Zone

Date Received 6/23/94

Quad ____ FWL ____ FSL ____

File No. E-5781    Use Dom    Location No. Town of Tajique Grant

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 5 | 5 | brown topsoil & bolders |
| 5 | 35 | 30 | grey fractured limestone |
| 35 | 42 | 7 | caverns (lost Circulation) no returns |
| 42 | 71 | 29 | tan limestone |
| 71 | 77 | 6 | tan fractured limestone W/fractured streaks |
| 77 | 95 | 18 | grey limestone W/fractured streaks |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Filomeno Gutierrez Owner's Well No. HC-1-2460
Street or Post Office Address 128 Placitas NE
City and State Albuquerque, NM 87107

Well was drilled under Permit No. E-5784 and is located in the:

a. ___ ¼ ___ ¼ ___ ¼ ___ ¼ of Section ___ Township ___ Range ___ N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in ___ County.

d. X= 524,600 feet, Y= 1,427,400 feet, N.M. Coordinate System Central Zone in the Chilili Land Grant.

(B) Drilling Contractor W.H. Adkison Drilling, Inc. License No. WD 497

Address P.O. Box 478, Edgewood, NM 87015

Drilling Began 5-24-94 Completed 5-24-94 Type tools rotary Size of hole 6½ in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 132 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 60 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 70 | 76 | 6 | tan fractured limestone | 1 |
| 85 | 90 | 5 | tan fractured limestone | 5 |
| 100 | 106 | 6 | grey fractured limestone | 20 |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5 od pvc | | | +2 | 132 | 20 | | 90 | 130 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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STATE ENGINEER OFFICE
ALBUQUERQUE, N. MEX.

## Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by:

___
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

C Zone
Chilili Land Grant

Date Received 6/3/94

Quad X=524,600 Y=1,427,400 FWL ___ FSL ___

File No. E-5784 Use Dom Location No. ___

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 7 | 7 | brown sandy clay |
| 7 | 23 | 16 | white calichi |
| 23 | 70 | 47 | tan calichi |
| 70 | 76 | 6 | tan fractured limestone |
| 76 | 85 | 9 | brown clay |
| 85 | 90 | 5 | tan fractured limestone |
| 90 | 100 | 10 | grey limestone |
| 100 | 106 | 6 | grey fractured limestone |
| 106 | 120 | 14 | grey limestone |
| 120 | 132 | 12 | tan limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 15 | 15 | Topsoil |
| 15 | 40 | 25 | Clay, shale |
| 40 | 100 | 60 | Clay |
| 100 | 120 | 20 | Clay, sand |
| 120 | 140 | 20 | Shale |
| 140 | 180 | 40 | Clay and sandstone |
| 180 | 240 | 60 | Shale and sandstone |
| 240 | 260 | 20 | Shale and gravel |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

EARL & SONS, INC.

By: [signature] Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Carlene Mitchell Owner's Well No. HC 137830
Street or Post Office Address P.O. Box 293
City and State Morarity, NM 87035

Well was drilled under Permit No. E 5177 and is located in the:

a. Government Lots (1)and(2) ____ ¼ NE ¼ NW ¼ ____ ¼ of Section 7 Township 10N Range 10E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Santa Fe County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Earl R. Taute dba Earl & Sons, Inc. License No. 583

Address P.O. Box 410, Cedar Crest, NM 87008

Drilling Began 11-1-90 Completed 11-2-90 Type tools Hammer Size of hole 7 in.

Elevation of land surface or 6500 at well is 6500 ft. Total depth of well 260 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 160 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 200 | 260 | 60 | Shale and gravel | 10+ |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5"ID | 200PSI | | 0 | 260 | 260 | | 200 | 260 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| 0 | 260 | 7 | | | Air, foam and water |
| | | | | | |
| | | | | | |

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STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEX.

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 11-14-90

Quad ____ FWL ____ FSL ____

File No. E-5177 Use Dom Location No. 10N.10E.07.12
Longhorn Reserved Grnd

Revised June 1972

# STATE ENGINEER OFFICE
## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well J.B. Wyche Owner's Well No. ______
Street or Post Office Address 8904 Volcano Rd., NW
City and State Albuquerque, NM, 87121

Well was drilled under Permit No. E-6114 and is located in the:

a. ______ ¼ SW ¼ NE ¼ NE ¼ of Section 17 Township 10N Range 10E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Santa Fe County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD 49

Address PO Box 91, Stanley, NM, 87056

Drilling Began 5-15-95 Completed 5-29-95 Type tools Rotary Size of hole 8 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 420 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 300 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| NA | NA | | Possibly fractured | pumping |
| | | | Sandstone | 17 |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 5 | | | 0 | 420 | 420 | None | 320 | 420 |
| | | | | | | | | |
| | | | | | | | | |

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STATE ENGINEER OFFICE

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 7/5/95

Quad ______ FWL ______ FSL ______

File No. E-6114 Use Dom Location No. 10N.10E.17.223
Longhorn Reservoir Quad.

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 2 | 2 | Tan topsoil |
| 2 | 35 | 33 | Sand - caliche boulders |
| 39 | 110 | 6[illegible] | Large gravel |
| 110 | 162 | 52 | Yellow sandstone |
| 162 | 420 | 258 | Lost circulation 162' - norreturns at all |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Wayne [illegible]
Driller [illegible]

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

# STATE ENGINEER OFFICE
## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Joe M. Anaya Owner's Well No. E-5459
Street or Post Office Address Star Route Box 13
City and State Stanley, NM 87056

Well was drilled under Permit No. ______ and is located in the:

a. SW¼ ¼ NE¼ ¼ NW¼ ¼ ____ ¼ of Section 10 Township 10N Range 10E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Santa Fe County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Garcia's Drilling Company License No. WD-539

Address 28 Garcia Loop Tijeras, NM 87059

Drilling Began 09-16-92 Completed 09-19-92 Type tools Rotary Size of hole 6 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 440 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 240 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 240 | 440 | 200 | Red shell and yellow sandstone | 10 |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 4½ | | pvc | 0 | 440 | 20 | cup | 240<br>280 | 260<br>300 |
| | | | | | | | 320<br>360 | 340<br>380 |
| | | | | | | | 400 | 440 |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

92 NOV 3 A 8:08
ALBUQUERQUE, N. MEX.

### Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

### FOR USE OF STATE ENGINEER ONLY

Date Received 11-13-92

Quad ______ FWL ______ FSL ______

File No. E-5459 Use Dom Location No. 10N.10E.10.123
El Cuervo Butte Quad.

| From | To | in Feet | |
|---|---|---|---|
| 0 | 30 | 30 | White clay |
| 30 | 110 | 80 | Brown clay |
| 110 | 140 | 30 | Red clay |
| 140 | 180 | 40 | Gray clay |
| 180 | 200 | 20 | Red clay |
| 200 | 260 | 60 | Blue shell |
| 260 | 300 | 40 | Red shell and yellow rock |
| 300 | 330 | 30 | Yellow rock and sandstone |
| 330 | 340 | 10 | Red shell |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Ray Garcia
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

## EXECUTIVE SUMMARY

The Estancia Underground Water Basin was declared by order of the New Mexico State Engineer Office on January 31, 1950, and was extended on March 28, 1975 and March 14, 1994 and includes about 2,005 square miles. The watershed boundary is topographically closed and includes southern portions of Santa Fe County, eastern portions of Bernalillo County, a small portion in the southwest corner of San Miguel County, a few square miles in the northern portion of Lincoln County, and much of the western portion of Torrance County. The watershed area for the Basin is 2,260 square miles.

Large scale ground-water development began in the Basin in about 1947. The majority of ground-water mining that has occurred in the valley fill aquifer was used for irrigation. A total of 1,410,000 acre-feet of ground water was mined from the valley fill sediments from 1910 to 1995, and there is about 6,580,000 acre-feet of ground water remaining in the aquifer, assuming a specific yield of 12.5 percent for the valley fill aquifer. The average quantity of ground water mined from the valley fill aquifer from 1956 to 1995 was 32,000 acre-feet per annum, assuming pumping from the aquifer was essentially constant each year.

The Glorieta Sandstone, Yeso Formation, Abo Formation, and Madera Group aquifers have relatively large quantities of ground water in storage, but most of these aquifers do not readily yield large quantities of water to wells throughout the Basin and generally cannot be used for irrigation, municipal, or other large capacity supplies. The Glorieta Sandstone and Yeso Formation aquifers are known to locally yield relatively large quantities to wells; however, the quality of water in the Yeso is often poor. The Madera Group aquifer is capable of yielding relatively large quantities of water to wells, particularly in the northwest portion of the Basin.

The total ground-water diversion in the Basin for 1995 was 57,174 acre-feet. Irrigation uses accounted for 95 percent of the diversions in the Estancia Basin in 1995, most of which were from the valley fill sediments. It may be necessary to drill and complete irrigation supply wells in aquifers beneath the valley fill sediments in order to reduce potential subsidence of the valley fill aquifer that may result from excessive dewatering.

Ground-water quality in the valley fill aquifer, based on specific conductance data, decreased north of Estancia, near the northeast quadrant of Township 7 North, Range 8 East from 1956 to 1995. Ground-water quality also decreased near Cedar Grove, Township 11 North, Range 7 East, Sections 20 through 22, from 1956 to 1995. In general, specific conductance increases from the Basin margins toward the center of the Basin.

The economy of the Basin is largely based on government, trade, and agriculture. Agriculture employs 18 percent of the local workforce (including agricultural wage and salary jobs and farm employment) and generates \$18 to \$20 million in receipts. Moriarty Public Schools accounts for almost one-fifth of all nonagricultural jobs. Retail trade is concentrated along Interstate 40.

Nearly 46 percent of the total land area in the Basin is rangeland. Irrigated cropland, which increased dramatically from 1940 to 1955 and has fluctuated since that time, occupies approximately 25,000 acres. Irrigated agriculture is concentrated in the central portion of the Basin along New Mexico State Highway 41 from Stanley to Willard.

In contrast, urban lands occupy an estimated 8,000 acres, with an additional 15,000 acres in "transitional" or urbanizing status. At current densities, projected population and employment growth could more than triple the amount of land in urban development, converting all land in transitional use to land in urban use.

In 1990, an estimated 68 percent of the Basin's population obtained water from a community or municipal water system, and 32 percent obtained water from domestic wells. Most businesses obtain water from community water systems, although about 20 commercial and industrial users have private wells. Total diversions for public and private water systems for residential, commercial, and industrial users were 2,294 acre-feet per annum in 1990.

The population of the Basin was an estimated 23,354 in 1995 and is projected to grow to 25,623 by 2000 and 42,630 by 2020. By 2040, the population could be as much as 70,300 if current trends continue. The majority of current population growth is concentrated along Interstate 40 in the northwest portion of the Basin. Residents in the Basin are primarily commuters; however, job growth is projected in the Basin, particularly in the communities along Interstate 40. These population increases within the Basin will require an additional ground-water diversion of 2,669 acre-feet per annum by 2000, 4,436 acre-feet per annum by 2020, and 7,316 acre-feet per annum by 2040.

Rapid growth in the East Mountain Area of Bernalillo County is also relevant to water resource planning for the Estancia Basin. Ground water is currently being exported out of the Basin to supply the Paa-Ko subdivision and other subdivisions in the Sandia Underground Basin. The East Mountain Area outside of the Basin is projected to grow to nearly 30,000 by 2040, adding a population of 19,000 new residents. It is probable that the population growth in the East Mountain Area will create a demand for Estancia Basin ground water.

Irrigated agricultural lands are expected to remain essentially the same and fluctuate between about 44,000 to 77,000 acres. Current estimates of ground-water diversions for irrigated agricultural land indicate the annual average diversion is 2.56 acre-feet per annum for flood irrigated land, 2.1 acre-feet per annum for sprinkler irrigated land, and 1.26 for drip irrigated land. Changes in irrigation methods, when possible, may reduce ground-water diversions.

Future commercial and industrial ground-water diversions were assumed to be proportional to projected employment. Projected commercial diversions are 58 acre-feet per annum by 2000, 98 acre-feet per annum by 2020, and 168 acre-feet per annum by 2040. Projected industrial diversions are 20 acre-feet per annum by 2000, 35 acre-feet per annum by 2020, and 59 acre-feet by 2040.

# CONTENTS

## TABLES

## ABBREVIATIONS

| | |
|---|---|
| ac-ft | acre-feet |
| ac-ft/an | acre-feet per annum |
| afy/p | acre-feet per year per person |
| avg | average |
| BBER | Bureau of Business Economic Research |
| BLM | Bureau of Land Management |
| cfs | cubic feet per second |
| CID | Carlsbad Irrigation District |
| CIR | consumptive irrigation requirement |
| DASZs | Data Analysis Subzones |
| EBID | Elephant Butte Irrigation District |
| EIB | Environmental Improvement Board |
| EPA | Environmental Protection Agency |
| ESA | Endangered Species Act |
| evap. | evaporation |
| ft/ft | feet per foot |
| $ft^2/d$ | feet squared per day |
| gpcd | gallons per capita per day |
| gpm | gallons per minute |
| gpm/ft | gallons per minute per foot |
| HW | highway |
| ID | incidental completions |
| MDWCA | Mutual Domestic Water Consumer Association |
| mi | mile(s) |
| MRGCOG | Middle Rio Grande Council of Governments |
| msl | mean sea level |
| NCDC | National Climatic Data Center |
| NEPA | National Environment Policy Act |
| NMED | New Mexico Environment Department |
| NMERI | New Mexico Engineering Research Institute |
| NMSEO | New Mexico State Engineer Office |
| NMSHTD | New Mexico State Highway and Transportation Department |
| NMWQCC | New Mexico Water Quality Control Commission |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollution Elimination System |
| OCD | Oil Conservation Division |
| OTA | Congressional Office of Technology Assessment |
| RCRA | Resource Conservation and Recovery Act |
| SC | specific conductance |
| TCU | Transportation, Communications, and Utilities |
| UNM | University of New Mexico |
| µmhos/cm | micromhos per centimeter |
| USGS | United States Geological Survey |
| Va | volume of water available for appropriation |

## DISCLAIMER

This report was prepared for the exclusive use of the Estancia Basin Water Planning Committee. Any other use of this report may be inappropriate. All work has been performed in accordance with generally accepted practices. No warranty is expressed or implied.

The results are based on reviews of selected published and unpublished information, and personal communication with individuals familiar with the study area. Unless contradicted by conflicting data obtained independently during the conduct of the work, all information was accepted at face value. No new data were collected for this report. The information obtained during interviews, and from files, publications, and databases is sometimes inaccurate or incomplete. The information and conclusions in this report are subject to the accuracy, completeness, and availability of such data.

## ILLUSTRATIONS

**(follow text)**

## APPENDICES

**(follow text)**

# ILLUSTRATIONS

**(follow text)**

# REGIONAL WATER PLAN, ESTANCIA UNDERGROUND WATER BASIN, NEW MEXICO

## I. INTRODUCTION

This project was initiated and supervised by the Estancia Basin Water Planning Committee, and made possible by the joint efforts of representatives from Torrance, Santa Fe, and Bernalillo Counties, the New Mexico Interstate Stream Commission, and the Edgewood, East Torrance Claunch/Pinto Soil and Water Conservation Districts. This report is intended to fulfill the requirements of the New Mexico Interstate Stream Commission, Regional Water Planning Template and deals with the watershed boundary for the Estancia Underground Water Basin. The Regional Water Planning Template format was used for this report. The watershed boundary for the Basin encompasses an area greater than the area defined by the New Mexico State Engineer Office (NMSEO) for the Basin. The report is a summary of 1) data as to the factors that govern water availability, 2) data as to water use and water quality, 3) the legal framework relating to water allocation, and 4) projected water demands, that provides the basic information needed for decision-making.

The geologic, hydrogeologic, and historic water use portions of the report were prepared by John Shomaker & Associates, Inc., Albuquerque, New Mexico. The legal framework portions were prepared by Sheehan, Sheehan, & Stelzner, P.A., Albuquerque, New Mexico. The demographic, economic, cultural, historic, and population and water use projection portions were prepared by Southwest Land Research, Albuquerque, New Mexico. The current water demand portions were prepared by Livingston Associates, P.C., Alamogordo, New Mexico.

At the request of the Estancia Basin Water Planning Committee, this report was prepared by representing as much of the information as possible in the form of tables, figures, maps and map-overlays. The intent of this report style was to provide an easily accessible and understandable representation of the data for decision makers in the Estancia Underground Water Basin and Torrance County, and at the same time to follow the format of the Regional Water Planning Template.

Specific locations in this report are referred to using a standard system of numbering public lands in New Mexico. Locations are referred to by Township, Range, and Section, with the section being further divided into tracts of 160-, 40-, and 10-acre tracts. Figure 1 is an example showing the well numbering system in New Mexico.

Most of the water used in the Estancia Basin is drawn from wells. Numerous ground-water studies have been performed within the study area with the earliest studies having been completed in the early 1900's. However, only several studies focused on reporting ground-water conditions for the entire Estancia Underground Water Basin and Torrance County. The most notable of the early work in the area was that of Meinzer (1911), and Smith (1957). Subsequently, many other quality reports have been generated by authors detailing work at specific sites within the study area, and several which have focused specifically on the Estancia Underground Water Basin. Unpublished data were also provided by the New Mexico State Engineer Office and the U. S. Geological Survey. A complete list of references is included.

# II. BACKGROUND INFORMATION

## A. Description of Water Planning Region

The Estancia Underground Water Basin was declared by an order of the New Mexico State Engineer on January 31, 1950. The Basin area was extended on March 28, 1975 and March 14, 1994 (NMSEO, 1995). The Basin defined by the NMSEO includes about 2,005 square miles. The watershed boundary for the Basin is approximately 2,260 square miles and encompasses the majority of the NMSEO defined basin. The watershed boundary includes the southern portions of Santa Fe County, eastern portions of Bernalillo County, a small portion in the southwest corner of San Miguel County, a few square miles in the northern portion of Lincoln County, and much of the western part of Torrance County. The watershed boundary will be referred to as the Estancia Basin, or Basin, throughout this report, except when referenced with other declared underground water basins, in the legal section, and ground-water diversions and depletions. The Estancia Basin is topographically closed, and is bounded 1) on the north by the crest of the San Pedro Mountains and the northern extent of the White Lakes area, which is near the southern boundary of the San Cristoval Grant, 2) on the east by mesas and the Pedernal Hills, 3) on the south by the Gallinas Peak, Mesa de los Jumanos, and West Mesa, and 4) on the west by the crest of the Manzano Mountains and by slopes east of the Sandia Mountains.

Manzano Peak has an elevation of 10,097 feet and is the highest point in the vicinity. The lowest point in the Basin is about 6,050 ft in the Laguna del Perro area. Slopes from the eastern side of the Manzano Mountains to Laguna del Perro, and in areas from the western portion of the Basin to the central portion, range from 1 to 2 percent (Fig. 3).

The majority of the Basin is rural and is dominated by farming and ranching. The main densely populated areas include the towns of Moriarty, Edgewood, Mountainair, and Estancia. Other small communities include Cedar Grove, Cedarvale, Willard, Stanley, Chilili, Tajique, Torreon, Manzano, Punta de Aqua, and McIntosh.

### 1. Natural resources

The most important natural resources in the Basin currently being used are the ground water and soils. Other natural resources include uncultivated vegetation, sand and gravel, fuel wood, forest products, cultural resources, and minerals.

#### a. Water Resources

##### i. Major Hydrologic Basins

The Estancia Underground Water Basin is generally considered a closed basin and includes an entire watershed. Some hydrogeologist have argued that the Basin is hydrologically connected to nearby underground water basins (Turner, 1992).

##### ii. Significant Streams

There are no significant streams in the study area. The Estancia Underground Water Basin is a closed basin and no surface water drains out of the Basin. The majority of surface water flow occurs as ephemeral flows in drainages and arroyos. Some springs in the Basin are reported to flow continuously, and there are two small fresh water lakes, Manzano and

Sherwood Forest Lakes. Laguna del Perro is a salt water lake and there are numerous small salt water lakes nearby. The U.S. Geological Survey does not have permanent gauges to monitor surface water flows, nor does it monitor surface water quality, in the study area.

**iii. Underground Water Basins**

The declared underground water basins in the region adjacent to the Estancia Underground Water Basin are the 1) Upper Pecos Basin, 2) Roswell Basin, 3) Rio Grande Basin, and 4) Sandia Basin. The Upper Pecos Basin is 3,842 square miles and borders the northeastern to the south-east central portion of the Estancia Basin. The Roswell Basin is 10,779 square miles and borders the southeastern portions of the Estancia Basin. The Rio Grande Basin is 26,209 square miles and borders the majority of the western to the southwestern corner of the Estancia Basin. The Sandia Basin is 73 square miles and borders a small part of the northwest portion of the Estancia Basin.

**iv. Assumptions to Determine Availability**

The assumptions used to estimate the availability of water-resources in the Basin are discussed in detail in **Section IV** of this document.

**b. Soils**

Soil associations in Torrance County include the Salas-Rock outcrops and slides, Wilcoxson-Supervisor-Pino, Witt-Wilcoxson-Turkeysprings, Witt-Harvey-Manzano, Willard-Ildefonso-Karde, Clovis-Otero-Rock land, Tapia-Dean-Pastura, Penistaja-Steep rock land, La Fonda-Alicia-Rock outcrop, and Otero-Palma-Trail (Bourlier et al., 1970). Soil associations in Santa Fe County within the study area include the Witt-Harvey-Clovis, Harvey-Dean-Tapia, Travessilla-Rock outcrop-Bernal, La Brier-Willard, Laporte-Witt, Rednun-Pena-Stony rock land, and Chimayo-Mirabal-Supervisor. Soil associations in Bernalillo County within the study area include the Silver-Witt-Laporte, Seis-Orthids, and the Kolob-Rock. Soil associations in San Miguel County within the study area include the Tuloso-Sombordo-Rock outcrop, Laporte-Rock outcrop, and the Vibo-Tapia. Soils in Lincoln County are described with the soils in Torrance County.

Some of the soil associations have slightly different names across county boundaries. For example, the Witt-Harvey-Clovis association in South Santa Fe County corresponds to the Witt-Harvey-Manzano association in Torrance County. The soil associations are very similar, and the difference in the names most likely reflects the source area of the soils. Where there associations are similar across county lines, the soil association in the county adjoining Torrance County were given the same designation as the association in Torrance County.

A soil association is a "landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils" (Bourlier et al., 1970). The first name in the soil association is the most extensive. Soil association maps are useful for regional planning, but may not present detailed enough data for planning purposes at relatively small scales. Figure 4 is a general map showing the soil associations in the

Basin and the relative permeability of each soils association. The permeability of the majority of the most extensive soil(s) in the association was assumed to represent the permeability of the entire association. Figure 5 shows the textural guide for soil classifications.

**i. Torrance County Soil Associations**

The Salas-Rock outcrops and slides association is present on the western slopes of the Manzano and Gallinas Mountains on steep to very steep slopes. This association consists of stony soils, rock outcrops, and rock slides, and includes about 2 percent of Torrance County. The Erramouspe soils are in this association and are on steep to very steep slopes in the Gallinas Mountains. This association is generally not amenable for conservation engineering structures because it is in areas which are steep and rocky. Vegetation on this association is primarily pinon and juniper, short and mid-grasses, mountain-mahogany, and cactus (Bourlier et al., 1970).

The Wilcoxson-Supervisor-Pino association is present on gently sloping to very steep mountain slopes at the highest elevations in the western and southern portions of the county. This association consists of moderately deep to deep stony and non-stony acidic soils, and includes about 1 percent of Torrance County. The Pinata soils are in this association on moderately steep to very steep slopes and ridges in the southern part of the county. Other soils include the Capillo, Fortwingate, Fuera, Stroupe, Tampico, and Tecolote. This association is not amenable to conservation engineering structures because it is in areas which are steep and rocky. The Tampico soils are present in drainage ways and are suitable for constructing ponds. Vegetation on this association is primarily ponderosa pine, limber pine, Douglas-fir, white fir, alligator juniper, deciduous oaks and shrubs, and short and mid-grasses (Bourlier et al., 1970). This association corresponds to the Kolob-Rock outcrop association in Bernalillo County.

The Witt-Wilcoxson-Turkeysprings association is present on gently sloping to very steep mountain slopes on the eastern slopes of the Manzano Mountains. This association consists of shallow to moderately deep wooded soils and includes about 12 percent of Torrance County. The Pinon, Laporte, Alicia, Encierro, and Washoe soils are in this association on the side slopes of ridges. This association is generally amenable to conservation engineering structures such as terraces and diversions, but not ponds because of the relatively shallow depth to gravel or bedrock. However, the Witt soils are relatively deep and can be used for ponds. Crops grown on these soils include wheat, corn, and pinto beans. Native Vegetation on this association is primarily pinon and juniper, short and mid-grasses, and cactus (Bourlier et al., 1970). This soil association corresponds to the Silver-Witt-Laporte association in Bernalillo County and the Laporte-Witt association in Santa Fe County.

The Witt-Harvey-Manzano association is present on nearly level to very steep slopes, pediment fans, and alluvium in the western and southern portions of the county. This association consists of moderate to deep soils and includes about 14 percent of Torrance County. The Tapia, Pinon, Dean, Wilcoxson, Carnero, and Clovis soils are in this association. This association is generally amenable to conservation engineering structures such as terraces, diversions, and ponds because of the relatively low permeability, and they are relatively deep soils. However, the Tapia and Pinon soils are relatively shallow and can not be used for ponds. The main crops grown on these soils include alfalfa, wheat, corn, and pinto beans. Native vegetation on this association is primarily pinon and juniper, short and mid-grasses, and cactus (Bourlier et al., 1970). This soil association corresponds to the Witt-Harvey-Clovis association in Santa Fe County.

The Willard-Ildefonso-Karde association is present on level to very steep slopes formed in lake sediments on terraces and wind-deposited hills in the Estancia, Encino, and Pinos Wells Lake Basins. This association consists of moderately deep saline and non-saline soils and includes about 15 percent of Torrance County. The Pedrick and Manzano soils are in this association. The Willard, Karde, and Harvey soils can be used for ponds, diversions, and terraces. Ildefonso and Pedrick soils have a relatively high permeability and are not amenable for use as diversions and ponds. Underground plumbing in these soils should be coated or cathodically protected, or plastic pipes should be used, to avoid corrosion problems. The main crops grown on these soils include alfalfa, barley, and corn. Native vegetation on this association is primarily short and mid-grasses, and chamiza (Bourlier et al., 1970). This soil association corresponds to the La Brier-Willard association in Santa Fe County.

The Clovis-Otero-Rock land association is present on gently sloping to very steep slopes formed over igneous rocks and in valley fill primarily in the Pedernal Hills. This association consists of shallow to deep soils and includes about 6 percent of Torrance County. The Kech, Scholle, and Chilton soils are in this association and are present on the sides and upper portion of pediment fans. The Clovis and Scholle soils can be used for ponds. Otero and Chilton soils have a relatively high permeability and Kech soils are too shallow to be used as diversions and ponds. Native vegetation on this association is primarily short and mid-grasses, cactus, yucca, and pinon and juniper at higher elevations (Bourlier et al., 1970).

The Tapia-Dean-Pastura association is present on nearly level to very steep slopes formed over igneous rocks and in valley fill throughout most of eastern Torrance County. This association consists of shallow to moderately deep soils and includes about 18 percent of Torrance County. The Harvey, Rance, Prewitt, and Manzano soils are in this association and are present on the sides of slopes and narrow drainages. Soils in the association are not generally used for ponds because they are underlain by caliche at depths ranging from about 12 to 20 inches. Native vegetation on this association is primarily short and mid-grasses, cactus, and some juniper (Bourlier et al., 1970). This soil association corresponds to the Harvey-Dean-Tapia association in Santa Fe County.

The Penistaja-Steep rock land association is present on nearly level to very steep upland slopes and rocky hillsides in the southern and eastern portions of the county. This association consists of shallow to deep soils, and steep rock land, and includes about 15 percent of Torrance County. The Hagerman, Bernal, Travessilla, and Laporte soils are in this association. The Penistaja soils can be used for terraces, diversions, and ponds. Other soils in the association are not generally used for ponds because they are relatively shallow and underlain by bedrock. Native vegetation on this association is primarily pinon, juniper, short and mid-grasses, cactus, and yucca (Bourlier et al., 1970). This association corresponds to the Laporte-Rock outcrop association in San Miguel County.

The La Fonda-Alicia-Rock outcrop association is present on gently sloping to very steep rock outcrops in the eastern and southwestern portions of the county. This association consists of deep loamy soils on upland pediment fans and includes about 9 percent of Torrance County. The Encierro, Chilton, Scholle, and Pinon soils are also in this association and are present on sides of slopes, pediment fans, and ridge crests. Soils in the association are highly susceptible to water erosion and may slough off when saturated; however, they are still used for ponds. Native vegetation on this association is primarily short and mid-grasses, cactus, and yucca (Bourlier et al., 1970). This soil association corresponds to the Travessilla-Rock outcrop-Bernal association in Santa Fe County.

The Otero-Palma-Trail association is present on rolling hills primarily in the southern portion of the county. This association consists of deep, sandy soils on alluvial fans and includes about 4 percent of Torrance County. The Penistaja and Chupadera soils are also in this association and are present on sides of slopes, pediment fans, and ridge crests. Soils in the association are highly susceptible to wind and water erosion and do not make good ponds because they are relatively permeable. Native vegetation on this association is primarily pinon, juniper, short to tall grasses, and yucca (Bourlier et al., 1970).

### ii. Santa Fe County Soil Associations

The Witt-Harvey-Clovis association is present on level to moderate slopes in the central and western portions of Santa Fe County. This association consists of deep, loamy soils formed on alluvial fans and includes about 11 percent of Santa Fe County. The La Brier, Penistaja, and Dean soils are also in this association and comprise about 5 percent. Soils in the association are primarily used for grazing cattle and are moderately susceptible to wind erosion in dry-farmed areas. Native vegetation on this association is primarily mid-grasses (Folks et al., 1975).

The Harvey-Dean-Tapia association is present on level to moderate slopes in the southeastern portions of Santa Fe County. This association consists of loamy soils formed on upland alluvial fans and includes about 9 percent of Santa Fe County. The Penistaja, Pastura, Otero, Palma, and Hagerman soils are also in this association and comprise about 30 percent.

Soils in the association are primarily used for grazing cattle and moderately susceptible to wind erosion. Native Vegetation on this association is primarily mid-grasses, and minor amounts of pinon and juniper (Folks et al., 1975).

The Travessilla-Rock outcrop-Bernal association is present on nearly level to moderate slopes in the southeast to south central portion of Santa Fe County. This association consists of shallow loamy soils and rock outcrop, and includes about 13 percent of Santa Fe County. The Prewitt, Rednun, Wilcoxson variant, Chimayo, Ortiz, Las Lucas, Cueva, and Encierro soils are also in this association and comprise about 40 percent. Soils in the association are primarily used for grazing cattle and are moderately susceptible to water erosion in areas where the range is in poor condition. Native vegetation on this association is primarily mid-grasses, shrubs, forbs, pinon and juniper (Folks et al., 1975).

The La Brier-Willard association is present on level to nearly level slopes in the south central portion of Santa Fe County. This association consists of loamy to clayey soils on alluvial fans and lake benches, and includes about 1 percent of Santa Fe County. The Moriarty, Penistaja, Harvey, and Witt soils are also in this association and comprise about 15 percent. Soils in the association are primarily used for grazing cattle and are moderately susceptible to wind erosion in areas where the range is in poor condition. Native vegetation on this association is primarily mid-grasses, forbs, and shrubs (Folks et al., 1975).

The Laporte-Witt association is present on level to moderately steep slopes in the southwestern portion of Santa Fe County. This association consists of loamy soils on low foothills and alluvial fans, and includes about 1 percent of Santa Fe County. The Harvey soils and limestone outcrop are also in this association and comprise about 10 percent. Soils in the association are primarily used for range and stock ponds. Native vegetation on this association is primarily mid-grasses, forbs, shrubs, pinon, and juniper (Folks et al., 1975). This soil association corresponds primarily to the Silver-Witt-Laporte and to minor extent the Seis-Orthids association in Bernalillo County.

**iii. Bernalillo County Soil Associations**

The Silver-Witt-Laporte association is present on level to moderately steep slopes in the eastern and southeastern portions of Bernalillo County. This association consists of loamy soils which formed in alluvial sediments, and includes about 10 percent of Bernalillo County. Rock outcrop, Manzano soils are also in this association and comprise about 26 percent. Soils in the association are primarily used for range and watershed development. Native vegetation on this association is primarily short and mid-grasses, pinon, and juniper (Hacker et al., 1977).

The Seis-Orthids association is present on level to very steep slopes in the northeastern portion of Bernalillo County. This association consists of very stony loamy soils which formed on the sides of canyons and mountains, and includes about 12 percent of Bernalillo County. Salas, Silver, La Fonda, Carlito, Millett, Tesajo, Bond, Scholle, Burnac, and Ildefonso soils, and rock outcrop are also in this association and comprise about 60 percent of the association. Soils in the association are primarily used for range and stock ponds. Native vegetation on this association is primarily short and mid-grasses, pinon, juniper, mountain mahogany, and oak (Hacker et al., 1977).

The Kolob-Rock outcrop association is present on steep to very steep slopes in the southeastern portion of Bernalillo County. This association consists of loamy and stony soils which formed on mesa breaks, canyon walls, and sides of ridges, and includes about 8 percent of Bernalillo County. Pino, Laporte, and Sandia soils are also in this association and comprise about 48 percent of the association. Soils in the association are primarily used for range and stock ponds. Native vegetation on this association is primarily ponderosa pine, Douglas-fir, mountain mahogany, and grass (Hacker et al., 1977).

**iv. San Miguel County Soil Associations**

The Tuloso-Sombordo-Rock outcrop association is present on moderately rolling to steep slopes. This association consists of shallow stony sandy loam, very stony loam, very stony fine sandy loam, and extremely stony clay, and includes about 15 percent of San Miguel County. Bernal and Carnero soils are also in this association and comprise about 25 percent of the association. Soils in the association are primarily used for grazing stock and wildlife habitat. Native vegetation includes pinon, juniper, oak, and grasses (Hilley et al., 1981).

The Laporte-Rock outcrop association is present on moderately rolling hills to ridges. This association consists of shallow stony loams, and limestone rock, and includes about 2 percent of San Miguel County. Dean, Escabosa, Manzano, Sombordoro, Tapia, and Tuloso soils are also in this association and comprise about 35 percent of the association. Soils in the association are primarily used for grazing stock and wildlife habitat. Native vegetation includes pinon, juniper, oak, and grasses (Hilley et al., 1981).

The Vibo-Tapia association is present on moderately slightly to moderately rolling hills. This association consists of sandy loam, sandy clay loam, loam, and gravely loam, and includes about 5 percent of San Miguel County. Dean, Laporte, Ribera, Sombordoro, Teco, and Tuloso soils are also in this association and comprise about 20 percent of the association. Soils in the association are primarily used for seasonal habitat for wildlife and for grazing stock. Native vegetation includes grass with scattered pinon and juniper (Hilley et al., 1981).

**v. Characteristics of Specific Soils**

The physical characteristics for the major soils within each association are listed in Table 1.

**Table 1. Summary of the characteristics of the primary soils in each soil association in the Estancia Underground Water Basin, New Mexico**

| soil series | description | total depth, inches | permeability, inches/hour | salinity | degree of limitation for sewage disposal field | shrink-swell potential |
|---|---|---|---|---|---|---|
| Alicia | loam, clay loam | 60 | 0.63 to 2.0 | none | slight | low to moderate |
| Bernal | fine sandy loam, sandy loam, sandy clay loam | 12 | 0.63 to 2.0 | none | severe: rock at shallow depth | low to moderate |
| Chimayo | very stony loam | 20 | 0.63 to 2.0 | - | severe: shallow depth to rock | low |
| Clovis | loam, clay loam | 60 | 0.20 to 0.63 | none | slight | moderate to high |
| Dean | loam, gravely loam | 36 | 0.63 to 2.0 | none | slight | low |
| Harvey | loam, clay loam | 60 | 0.63 to 2.0 | none to slight | slight | low to moderate |
| Ildefonso | fine sandy loam, gravely fine sandy loam | 36 | 0.63 to 6.3 | none | slight | low |
| Karde | loam, silt loam | 60 | 0.63 to 2.0 | moderate to severe | moderate: moderate permeable | low |
| Kolob | stony clay loam, and stony clay | 42 | 0.2 to 0.6 | none | severe: low permeability | moderate |
| La Brier | clay loam | 60 | 0.06 to 2.0 | - | severe: low permeability and subject to flooding | moderate |
| La Fonda | loam, heavy loam | 60 | 0.63 to 2.0 | none | moderate permeability | low to moderate |
| Laporte | stony loam | 11 | 0.63 to 6.3 | none | severe: shallow depth to rock | low |
| Manzano | loam, light clay loam | 41 | 0.63 to 2.0 | none | slight | low to moderate |
| Mirabal | stony sandy loam | 21 | 2.0 to 6.3 | none | severe: shallow depth to rock | |
| Orthids | variable lithology | variable | 0.2 to 0.6 | low to moderate | severe: steep slopes | low |
| Otero | fine sandy loam | 40 | 2.0 to 6.3 | none | slight | low |
| Palma | fine sandy loam, heavy fine sandy loam | 60 | 0.63 to 6.3 | none | slight | low |
| Pastura | loam | 24 | 0.63 to 2.0 | none | severe: caliche reduces permeability | low |
| Pena | stony clay loam, very gravely clay loam and loam | 60 | 0.63 to 2.0 | - | slight to severe: variable slopes | low to moderate |

**Table 1. Summary of the characteristics of the primary soils in each soil association in the Estancia Underground Water Basin, New Mexico (continued)**

| soil series | description | total depth, inches | permeability, inches/hour | salinity | degree of limitation for sewage disposal field | shrink-swell potential |
|---|---|---|---|---|---|---|
| Penistaja | fine sandy loam, sandy clay loam | 60 | 0.63 to 6.3 | none | slight | low to moderate |
| Pino | loam and very fine sandy loam, clay loam | 36 | 0.63 to 2.0 | none | moderate seepage | low to moderate |
| Rednun | clay loam, very fine sandy clay loam | 60 | 0.06 to 2.0 | - | severe: low permeability | moderate to high |
| Salas | stony loam, clay loam | 33 | 0.05 to 2.0 | none | severe: shallow depth to rock | low to moderate |
| Seis | very cobbly loam, very stony clay loam | 30 | 0.6 to 2.0 | none | severe: rocky | low |
| Silver | silty clay loam, silt loam | 60 | 0.06 to 0.6 | none | severe: low permeability in subsoil | low to moderate |
| Sombordo | very stony fine sandy loam, extremely stony clay | 16 | 0.06 to 6.0 | none | severe: shallow depth to rock | low to high |
| Supervisor | loam, stony loam | 30 | 0.63 to 2.0 | none | severe: shallow depth to rock | low to moderate |
| Tapia | loam, clay loam, gravely light clay loam | 21 | 0.05 to 2.0 | none | severe: caliche prevents drainage | low to moderate |
| Trail | loamy fine sand, fine sand | 60 | >6.3 | none | slight | low |
| Travessilla | fine sandy loam, loam | 6 | 0.63 to 2.0 | none | severe: shallow depth to rock | low |
| Tuloso | stony sandy loam, very stony loam, stony loam | 11 | 0.6 to 6.0 | none | severe: shallow depth to rock | low |
| Turkey-springs | stony loam, stony clay loam, stony clay, stony silty clay loam, stony silt loam | 42 | 0.05 to 2.0 | none | severe: shallow depth to rock | low to high |
| Vibo | fine sandy loam, clay loam, sandy loam | 24 | 0.6 to 6.0 | none | moderate: moderate permeability | low to moderate |

**Table 1. Summary of the characteristics of the primary soils in each soil association in the Estancia Underground Water Basin, New Mexico (concluded)**

| soil series | description | total depth, inches | permeability, inches/hour | salinity | degree of limitation for sewage disposal field | shrink-swell potential |
|---|---|---|---|---|---|---|
| Washoe | cobbly loam, very gravely clay loam | 60 | 0.20 to 6.3 | none | moderate: moderate permeability | low to moderate |
| Wilcoxson | clay loam, clay, silty clay loam, stony loam | 46 | 0.05 to 2.0 | none | severe: low permeability | low to high |
| Willard | fine sandy loam, clay loam, loam | 60 | 0.20 to 6.3 | none to severe | slight | low to moderate |
| Witt | loam, clay loam | 60 | 0.20 to 2.0 | none | moderate: moderate permeability | moderate to high |

### c. Uncultivated Vegetation

Uncultivated vegetation in the Basin includes pinon, juniper, cactus, short to tall grasses, mountain mahogany, ponderosa pine, limber pine, Douglas fir, white fir, deciduous oaks and shrubs, forbs, yucca, and chamiza (Bourlier et al., 1970, Folks et al., 1975, and Hacker et al., 1977).

Endangered species and non-native vegetation were not investigated as part of this study. Water consumption along streams was not assessed due to the lack of streams which flow year round and the limited data regarding spring flow.

### d. Minerals

Four precious-metal mines or prospects are reported to be within the study area: 1) the 3 in 1 Mine near Manzano, 2) the El Cuervo Butte Prospects west of Clines Corners, 3) the Pedernal Hills Mine west of Encino, and 4) the San Pedro Mine on the side of the San Pedro Mountains. Numerous gravel and rock quarries are within the study area. Naturally occurring radioactive mineral deposits have been found in the Permian-age Abo Formation and in Paleozoic-age syenites which have intruded Precambrian rocks in Torrance County (see potentiometric contamination map, Fig. 25). Only one deposit, the Abo Mining claims, reports uranium production (McLemore, 1983).

## 2. Demographics for the Region

The Estancia Basin study area consists of a large portion of Torrance County, a portion of the east mountain section of Bernalillo County, a large area of southern Santa Fe County, the northwest corner of San Miguel County, and a small area of National Forest Land in Lincoln County. The recent growth pattern for this area has been residential development in the rural areas, with a majority of residents commuting to jobs in Albuquerque.

In 1990, there were a total of 4,586 families in the Estancia Basin and the median family income for the area was $25,492. The average household size, which can be a family or a group of people who occupy a housing unit, was 2.3 persons per unit in 1990.

**a. Population**

The 1990 population information for the study area was obtained from the U.S. Census. Population totals were collected at the census block group level. When the study area did not conform to census block groups, individual blocks were used to calculate population totals. Table 2 shows the 1990 census totals for population and housing units for each county within the study area.

According to 1990 census data, the total population within the Estancia Basin study area was 16,631. The largest portion of the study area population--57 percent--is located within Torrance County. Santa Fe and Bernalillo Counties had the second and third largest portion of total populations at 23.5 and 19.3 percent, respectively. San Miguel County has less than 1 percent of the population in the study area.

**Table 2. 1990 and 1995 population and housing units in Estancia Basin study area by county and subcounty area**

| county (study area only) | population | | | housing units | | |
|---|---|---|---|---|---|---|
| | 1990 | 1995 | % growth 1990-95 | 1990 | 1995 | % growth 1990-95 |
| Bernalillo | 3,214 | 4,192 | 30.4% | 1,328 | 2,379 | 79.1% |
| Santa Fe | 3,911 | 5,180 | 32.4% | 1,443 | 2,154 | 49.3% |
| Edgewood area | 2,880 | 3,965 | 37.7% | 1,038 | 1,649 | 58.9% |
| Stanley area | 205 | 286 | 39.5% | 77 | 119 | 54.6% |
| Cedar Grove area | 826 | 928 | 12.3% | 328 | 386 | 17.7% |
| San Miguel | 40 | 42 | -- | 14 | 14 | -- |
| Torrance | 9,466 | 12,525 | 32.3% | 4,431 | 5,678 | 28.1% |
| Moriarty area | 2,355 | 2,979 | 26.5% | 980 | 1,274 | 30.0% |
| Estancia area | 1,004 | 1,205 | 20.0% | 470 | 575 | 22.3% |
| Mountainair area | 1,009 | 1,070 | 6.0% | 499 | 539 | 8.0% |
| West of Moriarty | 1,665 | 2,387 | 43.4% | 765 | 1,050 | 37.3% |
| South 14 | 1,002 | 1,093 | 9.1% | 576 | 640 | 11.1% |
| SW of Moriarty | 707 | 969 | 9.1% | 275 | 383 | 39.3% |
| SE of Moriarty | 670 | 902 | 37.1% | 307 | 420 | 36.8% |
| NW of Estancia | 511 | 668 | 30.7% | 232 | 308 | 32.8% |
| SW of Estancia | 238 | 259 | 8.8% | 125 | 139 | 11.2% |
| East of Estancia | 329 | 611 | 85.7% | 197 | 250 | 26.9% |
| South of US 60 | 291 | 382 | 31.3% | 143 | 191 | 33.6% |
| total | 16,631 | 21,908 | 31.7% | 7,216 | 10,225 | 41.7% |

Source: 1990 U.S. Census Data

The 1995 estimates were obtained from the Middle Rio Grande Council of Governments (Torrance and Bernalillo Counties) and from Santa Fe County. Both information sources estimated population growth based on new residential construction and installation of mobile homes. In some cases, housing and population was reported for areas that extend beyond the study area boundary. The proportion of the population in these areas within the Estancia Basin was assumed to remain the same as in 1990.

From 1990 to 1995, the study area population grew by over 30 percent. As a comparison, the state population and the population of the Bernalillo/Santa Fe/Torrance County region increased by about 10 percent during this period. The areas experiencing the most growth from 1990 to 1995 were Torrance County east of Estancia, Torrance County surrounding Moriarty; and southern Santa Fe County. Nearly one out of two residents in the Bernalillo County portion of the study area in 1995 did not live there in 1990. Over one in three residents in other growth areas in 1995 did not live there in 1990.

### i. Urban/Rural Populations

The Census Bureau defines "urban" for the 1990 census as places of 2,500 or more persons incorporated as cities, villages, boroughs, towns, or Census designated places of 2,500 or more persons. Territory, population, and housing units not classified as "urban," constitutes "rural" areas. All of the study area was "rural" in 1990 according to the Census definition.

As shown above, most of the population growth from 1990 to 1995 in the study area was in unincorporated areas, but population growth did occur in municipalities. Table 3 shows 1990 through 1994 population estimates for incorporated places within the study area. All of the municipalities in the study area are located in Torrance County. Moriarty has been the fastest growing municipality in the study area.

**Table 3. Growth trends for municipalities in the Estancia Basin**

| county/subcounty | 1990[1] | 1991[1] | 1992[1] | 1993[1] | 1994[1] | 1990 to 1994 growth rate |
|---|---|---|---|---|---|---|
| Town of Estancia | 799 | 778 | 776 | 817 | 866 | 8.4% |
| Moriarty City | 1,401 | 1,443 | 1,451 | 1,542 | 1,620 | 15.6% |
| Town of Mountainair | 926 | 911 | 914 | 923 | 958 | 3.5% |
| Village of Willard | 182 | 183 | 158 | 178 | 181 | 0.0% |

Source: U.S. Department of Commerce, Bureau of Census, October 1995
[1] July 1 estimates

Table 4 presents population data for the two unincorporated Santa Fe County communities--Edgewood and Stanley--that are located within the study area. According to a Santa Fe County official, the Edgewood traditional community is the fastest growing community in the county. During the twenty years from 1973 to 1993, the Edgewood area population increased by nearly 500 percent, and since 1993 the area has grown an additional 39 percent. Its annual rate of growth has exceeded 11 percent in recent years, making Edgewood the fastest growing part of the Estancia Basin.

**Table 4. Santa Fe traditional communities in study area**

| community | 1973 population | 1993 population | 1996 population | 1973-1993 growth rate | 1993-1996 growth rate |
|---|---|---|---|---|---|
| Edgewood | 506 | 2,991 | 4,156 | 491.1% | 39.0% |
| Stanley | 62 | 103 | 108 | 66.1% | 4.8% |

Source: Santa Fe County General Plan Update, 1996

## b. Employment

Employment data for counties are reported monthly by the New Mexico Department of Labor. Subcounty data are reported by the Middle Rio Grande Council of Governments for Torrance and Bernalillo Counties, by the City of Santa Fe for Santa Fe County, and by Dun & Bradstreet for zip codes in the Estancia Basin. Employment information was derived from these sources to arrive at current employment estimates for the Estancia Basin.

### i. Work Force

The most recent subcounty work force information is provided by the 1990 Census. 1990 Census employment information is available at the block group level. Block groups are bounded areas used by the Census, usually containing on average about 400 housing units. The areas of San Miguel and Lincoln Counties that are in the Estancia Basin are substantially smaller than block groups. Because the portions of these counties within the Basin are so small, employment data are not reported.

Employed residents in the Torrance County portion of the Estancia Basin account for approximately 90 percent of the civilian labor force in the County.

According to the Census, there were 6,836 employed residents within the Basin in 1990, as shown in Table 5. Major categories of employment are services, retail trade, and public administration. These were the top three categories of employment in all counties and in the overall Basin.

**Table 5. Workforce by type of employment, 1990**

| | county (study area only) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| type of employment | Torrance County | % | Bernalillo County | % | Santa Fe County | % | total | % |
| agriculture | 296 | 8 | 19 | 1.3 | 72 | 4.2 | 387 | 5.7 |
| mining | 96 | 3 | 0 | 0.0 | 6 | 0.3 | 102 | 1.5 |
| construction | 373 | 10 | 183 | 12.2 | 168 | 9.7 | 724 | 10.6 |
| manufacturing | 335 | 9 | 157 | 10.5 | 142 | 8.2 | 634 | 9.3 |
| TCU | 293 | 8 | 77 | 5.1 | 127 | 7.3 | 497 | 7.3 |
| wholesale trade | 79 | 2 | 111 | 7.4 | 56 | 3.2 | 246 | 3.6 |
| retail trade | 811 | 23 | 216 | 14.4 | 352 | 20.3 | 1,379 | 20.2 |
| finance, insurance, and real estate | 128 | 4 | 81 | 5.4 | 114 | 6.6 | 323 | 4.7 |
| services | 643 | 17.9 | 471 | 31.4 | 493 | 28.4 | 1,607 | 23.5 |
| public administration | 546 | 15.2 | 187 | 12.5 | 204 | 11.8 | 937 | 13.7 |
| total | 3,600 | 100.0 | 1,502 | 100.0 | 1,734 | 100.0 | 6,836 | 100.0 |

Source U.S. Census
TCU transportation, communications, and utilities

### ii. Unemployment Figures

Table 6 shows unemployment rates for the years 1993 through 1995 for the four counties within the study area. According to the New Mexico Department of Labor, in 1995 San Miguel County had the highest unemployment rate of the counties within the study area at 7.5 percent, which ranks 10th statewide. Bernalillo County had the lowest unemployment rate in the state at 3.9 percent.

The unemployment rate for the state of New Mexico in 1995 was 5.7 percent. Unemployment rates in the Estancia Basin counties reflect statewide trends over the past few years, decreasing from 1993 to 1994 and increasing somewhat from 1994 to 1995. The unemployment rate in Santa Fe and Bernalillo Counties is lower than the state unemployment rate, and the unemployment rate in Torrance County and San Miguel Counties is higher.

**Table 6. Unemployment by county***

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|
| Bernalillo County | 5.2% | 5.6% | 4.8% | 6.6% | 4.4% | 4.0% |
| Lincoln County | 5.5% | 6.8% | 6.7% | 6.7% | 5.7% | 8.4%** |
| San Miguel County | 8.9% | 10.1% | 10.0% | 9.1% | 7.5% | 8.3% |
| Santa Fe County | 3.3% | 3.7% | 4.0% | 3.9% | 3.7% | 4.3% |
| Torrance County | 7.6% | 8.0% | 9.9% | 9.3% | 6.4% | 6.7% |
| statewide | 6.3% | 6.9% | 6.8% | 7.5% | 6.3% | 6.3% |

Source: NM Labor Market Review, NM Department of Labor, January 1995 & February 1996
* Not Seasonally Adjusted
** Reflects closure of Fort Stanton Hospital

### c. Job Data by Sector of the Economy

#### i. Historic Employment Data

Since the 1970's, the northwestern portion of the Estancia Basin has been the fastest growing area. Many of the new residents have jobs in Albuquerque and use I-40 to commute to work. In 1990, 41 percent of the work force commuted to jobs in other counties.

Job growth by area from 1990 to 1995 is shown in Table 7. The number of jobs has increased throughout the Basin. The most rapid job growth has occurred in the rural portions of Torrance County and within the East Mountain Area of Bernalillo County.

**Table 7. Job growth, 1990 to 1995 by area**

| area | total jobs 1990 | total jobs 1995 | job growth | average annual growth rate |
|---|---|---|---|---|
| Moriarty Area | 1,096 | 1,335 | 239 | 4.0% |
| Estancia Area | 329 | 511 | 182 | 9.2% |
| Mountainair Area | 175 | 233 | 58 | 5.9% |
| remainder of Estancia Basin in Torrance County | 130 | 372 | 242 | 23.4% |
| Bernalillo County in Estancia Basin | 172 | 272 | 100 | 12.1% |
| Santa Fe County in Estancia Basin | n/a | 564 | n/a | n/a |
| total Estancia Basin | n/a | 3,267 | n/a | n/a |
| other East Mountain Area of Bernalillo County | 791 | 1,232 | 441 | 11.7% |

Source: Middle Rio Grande Council of Governments, City of Santa Fe
n/a not available

According to the New Mexico Department of Labor, there were a total of 2,206 wage and salary jobs in Torrance County in 1995. These are roughly 73 percent of the total wage and salary jobs in the Estancia Basin. The wage and salary jobs include all employees covered under the state's unemployment law. Military employment, self-employed individuals, railroad employment, and non-profit agencies (such as churches) are not included in this sample.

As shown in Table 8 public administration followed by retail trade industry, services, and construction are the largest industries, accounting for approximately 75 percent of the total wage and salary jobs in the Basin.

**Table 8. Jobs by industry in the Estancia Basin, 1995**

| industry | Torrance County | Bernalillo County | Santa Fe County | Basin total | percent |
|---|---|---|---|---|---|
| agriculture, forest, and fishing | 55 | 17 | 69 | 141 | 4.7% |
| mining | 0 | 0 | 0 | 0 | 0.0% |
| construction | 0 | 45 | 129 | 174 | 5.8% |
| manufacturing | 97 | 8 | 4 | 109 | 3.6% |
| TCU | 106 | 35 | 58 | 199 | 6.6% |
| wholesale trade | 33 | 1 | 33 | 67 | 2.2% |
| retail trade | 595 | 24 | 135 | 754 | 25.0% |
| finance, insurance, and real estate | 37 | 7 | 19 | 63 | 2.1% |
| service | 404 | 57 | 112 | 573 | 19.0% |
| public administration | 879 | 58 | 5 | 942 | 31.2% |
| total | 2,206 | 252 | 564 | 3,022 | 100.0% |

Source: NM Department of Labor
TCU transportation, communications, and utilities

According to the Torrance County Extension Office, in 1996 there are a total of 578 businesses accounting for 2,195 full and part time jobs in Torrance County and the Edgewood area of Santa Fe County. The source of this information is the Torrance County Business Retention and Expansion Data Base. The largest industry within this area is the service industry, followed by retail and construction. Out of the 578 businesses, 80 have five or more employees, 20 businesses have 10 or more employees, 11 have 20 or more employees and the largest employer in the area has over 120 employees.

The New Mexico Department of Labor employment numbers for the Torrance County and southern Santa Fe County portion of the Basin totaled 2,770 jobs while the Torrance County Extension Office total was 2,195 jobs. The New Mexico Department of Labor's figures include public administration jobs, the Torrance County figures do not.

Employment trends in Torrance County are shown in Table 9. These trends are assumed to be representative of trends in the entire Basin. Trend data are only available by county, and the number of jobs in all other counties is such a small proportion of the county totals, that county trend data are not a useful indicator of job trends in the Basin.

The information shown in Table 9 is taken from the Bureau of Economic Analysis report of jobs, including full-time and part-time employees, by major industry. These data include farm employment and sole proprietors, which represent over 40 percent of total jobs in Torrance County and are not reported to the Department of Labor.

Strong job growth, in terms of number of jobs, has occurred in services. Construction and transportation, communications and utilities (TCU) have experienced up and down cycles since 1990.

**Table 9. Employment by type and industry in Torrance County, 1990 to 1994**

| industry | 1990 | 1991 | 1992 | 1993 | 1994 | average annual percent change |
|---|---|---|---|---|---|---|
| wage and salary employment | 2,025 | 2,090 | 2,183 | 2,181 | 2,410 | 4.4% |
| proprietor's employment | 1,208 | 1,232 | 1,384 | 1,406 | 1,431 | 4.3% |
| total | 3,233 | 3,322 | 3,567 | 3,587 | 3,841 | |
| farm employment | 564 | 561 | 599 | 589 | 597 | 1.4% |
| non-farm employment | | | | | | |
| agriculture, forest, and fishing | 78 | 79 | 82 | 88 | 95 | 5.1% |
| mining | 4 | 4 | 4 | 6 | 7 | 15.0% |
| construction | 133 | 166 | 217 | 187 | 205 | 11.4% |
| manufacturing | 95 | 100 | 145 | 142 | 145 | 11.2% |
| TCU | 289 | 268 | 187 | 202 | 228 | -5.8% |
| wholesale trade | 29 | 57 | 59 | 56 | 60 | 19.9% |
| retail trade | 726 | 719 | 689 | 708 | 788 | 2.1% |
| finance, insurance, and real estate | 124 | 116 | 107 | 111 | 119 | -1.0% |
| service | 450 | 460 | 650 | 692 | 725 | 12.7% |
| government | 741 | 792 | 828 | 806 | 872 | 4.2% |
| total | 3,233 | 3,322 | 3,567 | 3,587 | 3,841 | |

Source: Bureau of Economic Analysis
TCU transportation, communications, and utilities

## d. Family Income

### i. Median Family Income for the Region

Median family income by county for 1992 through 1996 is shown in Table 10. These data are available by county. Santa Fe and Bernalillo Counties have the highest median family incomes, largely due to the incomes in the urban areas that lie outside the Estancia Basin. Median family income in Torrance County is estimated to be $30,000 in 1996.

**Table 10. Median family income by county**

| county | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| Bernalillo* | $35,900 | $37,600 | $38,300 | $38,300 | $42,000 |
| Santa Fe** | $39,900 | $44,000 | $46,000 | $46,000 | $60,644 |
| San Miguel | $18,300 | $22,800 | $23,400 | $23,400 | $25,300 |
| Torrance | $20,200 | $26,400 | $28,100 | $28,100 | $30,000 |

Source: HUD Office of Economic Affairs, Economic and Market Analysis Division
* Bernalillo County is part of Albuquerque metropolitan statistical area
** Santa Fe County is part of Santa Fe metropolitan statistical area

### ii. Numbers of Families

#### a) Total in Region

Table 11 shows total families in the Estancia Basin. Most families in the Basin live in Torrance County.

**Table 11. Family poverty status, 1989**

| county (Estancia Basin portion) | families for which poverty statistics are determined | families with incomes below the poverty level | percentage of families with incomes below poverty level |
|---|---|---|---|
| Torrance | 2,561 | 461 | 18.0% |
| Bernalillo | 958 | 112 | 11.7% |
| Santa Fe | 1,067 | 98 | 9.2% |
| total | 4,586 | 671 | 14.6% |

Source: U.S. Census

#### b) Families on Welfare

The total number of New Mexico Income Support Division cases in Torrance County for April 1996 was 2,290 cases. These include food stamp, Assistance to Families with Dependent Children, general assistance, and medical assistance cases. The breakdown of cases by type is shown in Table 12.

**Table 12. Income support division caseload for Torrance County, April 1996**

| | food stamp | AFDC | general assistance | medical assistance | total |
|---|---|---|---|---|---|
| Torrance County | 1,067 | 370 | 13 | 840 | 2,290 |

Source: New Mexico Human Services Department, Income Support Division
AFDC: Assistance to Families with Dependent Children

c) **Families Within Income Below the Poverty Level**

Nearly 15 percent of the families in the Estancia Basin were below the poverty level in 1989, as reported in the 1990 Census. This compares to a state poverty rate of 16.5 percent of all families.

## 3. Economy of the Region

### a. Main Urban Economies in the Region

According to the 1990 Census, the economy of the Estancia Basin is largely based on government, trade, and agriculture. Three school districts account for two-thirds of the government employment. The Moriarty School District is the largest employer in the Basin, providing almost one-fifth of all the nonagricultural jobs in 1990.

Trade in the Basin is primarily retail and is concentrated along I-40. The major retailers are oriented to users of I-40, both truckers and tourists. In 1990, 85 percent of the retail jobs were located near the interstate. Edgewood, Moriarty, and Clines Corners are the principle retail locations, with smaller concentrations in Estancia, Willard, Mountainair, and Stanley. In 1990, tourism directly or indirectly supported one-fourth of the jobs in the Basin. Service stations generate about a third of the Basin's retail receipts.

Agriculture employs 18 percent of the Torrance County workforce (including wage and salary jobs and farm employment) and generates $18 to $20 million a year in receipts. A majority of the receipts--60 percent--are the result of raising livestock, primarily cattle. Principle crops include alfalfa, sillage, grains, and vegetables. Farming is located in the area from Stanley south to Willard while ranching is spread throughout the rest of the county.

Table 13 shows all large employers in the Estancia Basin in the fourth quarter of 1994. Large employers are defined as having 25 or more employees. All large employers are located in Torrance County. No businesses with 25 or more employees are located in the Estancia Basin portions of Bernalillo, Santa Fe, San Miguel, or Lincoln Counties.

### b. Industrial Activity in the Region

None of the manufacturing activity in the Basin are water related, except for two greenhouses in Estancia and Edgewood and two sod farms in McIntosh and Moriarty.

#### i. Recent New Industries

There is currently a cabinet manufacturing business under construction in Torrance County north of Moriarty. This business will occupy 5,000 square feet.

#### ii. Manufacturing Firms

In addition to the cabinet manufacturer, there is a doorknob manufacturer in Moriarty located in the Moriarty Industrial Park.

#### iii. Industrial Parks

There is one industrial park in the Basin, located in Moriarty. This park is 40 acres with three buildings, one of which is occupied by the doorknob manufacturer.

### Table 13. Large Employers in Torrance County

| name | location | type of business |
|---|---|---|
| **Private Employers** | | |
| ARA Food Service | Moriarty | food service |
| Blackies Restaurant | Moriarty | restaurant |
| Central NM Electric | Mountainair | power company |
| Clines Corner Operating | Clines Corners | souvenirs/convenience |
| El Comedor De Anayas | Moriarty | restaurant |
| Jelly Bean Junction Day Care | Moriarty | child care |
| McDonalds Restaurant | Moriarty | restaurant |
| Moriarty Foods | Moriarty | grocery store |
| Rip Griffin Truck Service Center | Moriarty | truck stop |
| Tillery Chevrolet-GMC | Moriarty | car/truck dealership |
| Torrance County Detention Facility, Correction Corporation of America | Estancia | detention facility |
| White Mesa | Estancia | jewelry manufacturer |
| **Government Employers** | | |
| Estancia Municipal Schools | Estancia | public schools |
| Moriarty Municipal Schools | Moriarty | public schools |
| Mountainair Public Schools | Mountainair | public schools |
| New Mexico Highway Department | Mountainair | highway department |
| Torrance County | Estancia | county offices |

Source: Large Employers in New Mexico by County, NM Department of Labor, December 1995

### c. Government Employment

All government employment in the Basin is located in Torrance County. In Torrance County, the three school districts account for two-thirds of the government employment. Other major government employers include Torrance County, located in Estancia, and the State Highway Department maintenance yard, located in Mountainair. Government employment by level of government is shown in Table 14. All government agencies located in the Basin are based in Torrance County. This includes Moriarty Public Schools, which serves Edgewood in Santa Fe County.

**Table 14. Total government employment by county and type, 1995**

| type | Torrance | Bernalillo (Estancia Basin) | Santa Fe (Estancia Basin) | total |
|---|---|---|---|---|
| federal | 73 | 0 | 0 | 73 |
| state | 82 | 0 | 0 | 82 |
| local | 724 | 0 | 0 | 724 |
| total | 879 | 0 | 0 | 879 |

Source: New Mexico Department of Labor

Government employers are listed in Table 15.

**Table 15. Government employers in the Estancia Basin**

| employer | location | type of agency |
|---|---|---|
| Estancia Municipal Schools* | Estancia | public schools |
| Estancia Town Government | Estancia | municipal government |
| Moriarty City Government | Moriarty | municipal government |
| Moriarty Municipal Schools* | Moriarty | public schools |
| Mountainair Public Schools* | Mountainair | public schools |
| Mountainair Town Government | Mountainair | municipal government |
| New Mexico State Government | | |
| Children Youth and Families Dept. | Estancia | social services |
| Cooperative Extension Service | Estancia | agricultural services |
| Corrections Department | Moriarty | public safety services |
| Health Department | Estancia | social services |
| Human Services Department | Estancia | social services |
| Highway Department* | Moriarty, Mountainair | highway department |
| Magistrate Court | Estancia, Moriarty | judicial services |
| Motor Vehicle Department | Moriarty | general government |
| State Land Office | Moriarty | public land management |
| State Police | Moriarty | public safety services |
| Torrance County* | Estancia | county government |
| U.S. Government | | |
| Department of Agriculture | Estancia, Mountainair | agricultural services |
| National Park Service | Mountainair | recreational services |
| Post Office | Estancia, Moriarty | general government |

Source: New Mexico Department of Labor
* Employs 25 or more persons

## d. Agricultural Activity

### i. Location of Cropland

According to the New Mexico Agricultural Statistics Report, the total amount of acreage of dry and irrigated cropland for Bernalillo, Santa Fe, and Torrance Counties has remained the same since 1992. Table 16 shows the 1994 total acreage of dry cropland in these counties, including the entire county. Almost all dry cropland is located in Torrance County. The State Engineer's 1990 estimates of irrigated cropland show that approximately three-fourths of irrigated cropland in the Basin is located in Torrance County. The acreage shown in the last column in Table 16 are 1996 estimates of irrigated cropland provided by Farm Services Agency, Torrance County Office. The 1996 numbers show that almost 70 percent of the irrigated crop land in the Basin is located in Torrance County. Note: The acreage shown in Table 16 has been taken from three different sources and therefore all the information will not be consistent.

**Table 16. Acres of dry and irrigated cropland by county**

| county | acres of dry cropland, 1994[1] | acres of irrigated cropland in the Basin, 1990 | acres of irrigated cropland in the Basin, 1996 |
|---|---|---|---|
| Bernalillo | 1,000 | 50 | n/a |
| Santa Fe | 2,000 | 6,540 | 9,830 |
| Torrance | 51,000 | 18,000 | 22,160 |
| total | 54,000 | 24,590 | 31,990 |

Source: New Mexico State University, Agricultural Experimental Station; State Engineer Office; Farms Services Agency
[1] dry cropland estimates are county totals
n/a: not available

#### a) Irrigable Acreage

Most irrigated acreage is located in the central port of the Basin, extending north-south on either side of NM State Highway 41 from Stanley to Willard. According to the Farm Services Agency, in 1996 there were a total of 40,000 irrigable acres in the Torrance County and southern Santa Fe County portions of the Estancia Basin and 31,990 acres out of the 40,000 irrigable acres were used for farming. The acreage not used for farming has been set aside as part of the Conservation Reserve Program. The Farm Services Agency reported zero irrigable acres for Bernalillo County.

#### b) Dryland Acreage

Most of the Basin is dry rangeland, with ranches covering approximately 68.4 percent of the total Basin area. There is almost no dry cropland in Santa Fe and Bernalillo Counties, and approximately 95 percent of dry cropland is located in Torrance County.

**ii. Farm Data**

**a) Historic Number of Farms Trend**

According to New Mexico Agricultural Statistics, in 1982 there were a total of 426 farms in Torrance County and in 1994 there was a total of 485 farms. The U.S. Census definition of a farm is any entity that produces or sells more than $1,000 worth of agricultural products during the year. This represents a 13.8 percent increase in the number of farms from 1982.

**b) Historic Size of Farms Trend**

The U.S. Department of Census, Bureau of Census, and Census of Agriculture reported that in 1982, the average farm size for Torrance County was 3,908 acres. In 1992, the Census of Agriculture reported the average farm size was 3,706 acres, a decrease in the average farm size of 202 acres. According to an extension officer for Agricultural Community Development in Torrance County, farm sizes have remained about the same over the last 20 years. Generally, the size of the farm depends on the water production capacity of the farm's well and available water rights.

**iii. Historic Irrigated Acreage Trend**

Prior to 1940, there was almost no irrigated agriculture land in the Estancia Basin. Extensive irrigated farming began about 1950 and has continued to the present as shown in Table 17.

**Table 17. Historic irrigated acreage trend, 1940-1990 in the NMSEO defined Estancia Underground Water Basin**

| year | estimated irrigated acres |
|---|---|
| 1941 | 160 |
| 1945 | 250 |
| 1950 | 19,000 |
| 1955 | 25,000 |
| 1960 | 20,000 |
| 1965 | 20,000 |
| 1969 | 25,930 |
| 1975 | 28,440 |
| 1980 | 34,360 |
| 1985 | 32,055 |
| 1990 | 24,590 |

Sources: New Mexico State Engineer Office, 1977, 1982, and 1992, and Wilson, 1986

Table 18 shows total current acres of irrigated cropland in the Basin in the three counties.

**Table 18. Total acres irrigated by county, by type of irrigation, 1990**

| county | flood | drip | sprinkler | total |
|---|---|---|---|---|
| Bernalillo | 50 | 0 | 0 | 50 |
| Santa Fe | 1,265 | 110 | 5,165 | 6,540 |
| Torrance | 5,765 | 10 | 12,225 | 18,000 |
| total | 7,080 | 120 | 17,390 | 24,590 |

Source: State Engineer Office

### iv. Livestock Data

The number of cattle and calves on farms and ranches in the three counties fluctuates from year to year, with 77,000 head of cattle in this area in 1995.

**Table 19. Number of cattle and calves on farms and ranches by county**

| county | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|
| Bernalillo | 22,000 | 21,000 | 22,000 | 23,000 |
| Santa Fe | 29,000 | 26,000 | 27,000 | 29,000 |
| Torrance | 24,000 | 24,000 | 24,000 | 25,000 |
| total | 75,000 | 71,000 | 73,000 | 77,000 |

Source: New Mexico Agricultural Statistics

### v. Gross and Net Farm Receipts

Cash receipts for farm commodities, livestock, and crops are reported by county, as shown in Tables 20 and 21. These statistics include areas outside the Estancia Basin. In Bernalillo and Santa Fe Counties, most agricultural activity is outside the Basin. The trend has been a decline or very small increase in farm receipts for both livestock and crops in all counties.

**Table 20. Cash receipts, all farm commodities by county**

| county | 1994 county ranking | 1992* | 1993* | 1994* |
|---|---|---|---|---|
| Bernalillo | 11 | $30,328 | $32,689 | $30,806 |
| Santa Fe | 19 | $21,492 | $21,231 | $22,333 |
| Torrance | 25 | $18,228 | $18,866 | $16,437 |

Source: 1994 New Mexico Agricultural Statistics
* All amounts in thousands of dollars

**Table 21. Cash receipts, all livestock and all crops**

| county | all livestock 1992* | 1993* | 1994* | all crops 1992* | 1993* | 1994* |
|---|---|---|---|---|---|---|
| Bernalillo | $25,260 | $27,827 | $25,494 | $5,068 | $4,862 | $5,312 |
| Santa Fe | $15,410 | $16,164 | $16,546 | $6,082 | $5,067 | $5,787 |
| Torrance | $11,669 | $12,462 | $9,540 | $6,559 | $6,404 | $6,897 |

Source: 1994 New Mexico Agricultural Statistics
* All amounts in thousands of dollars

**e. Mining Activity**

Mining activity is discussed in Section IV.A.3.b.iv.

**f. Tourism Activity**

Tourist traffic helps support highway oriented businesses along I-40, including motels, restaurants, and gas stations.

Major tourist attractions that draw visitors to communities in the Basin include the Salinas Pueblo Missions National Monument and the Manzano Mountains. In 1995, there were 54,000 recreational visits to the Salinas Pueblo Missions, with 71 overnight stays.

## 4. Cultural Information

### a. History of People Inhabiting the Region

Human settlement in the Estancia Basin is of considerable antiquity. As much as 20,000 years ago, Sandia Man may have hunted there, and much later Pueblo Indians traveled through it to obtain salt, extracted from salt lakes in the center of the Basin.

The earliest traces of sedentary settlement in the Basin are 9th century pit houses found at Gran Quivira in the southwest portion of the Basin. Until the 10th century the Mogollon culture was dominant. Inhabitants lived in pit houses and later in adobe-plastered pole dwellings. By the late 1100's Anasazi cultural influence was apparent in the contiguous stone and adobe homes.

Between 1100 and 1500, the area became one of the most populous Pueblo trade centers, located along major trade routes. An estimated 10,000 people inhabited the area by the 1600's. In addition to the valuable salt from the Salinas Valley, they traded maiz, pinon nuts, beans, squash, and cotton goods from the Rio Grande villages for buffalo meat, hides, flints, and shells from the plains to the east.

In 1598, the Spanish colonizer Oñate visited the Basin and its largest settlement, Gran Quivira. Oñate found a community living in multi-storied buildings, practicing farming and water management by damming arroyos and constructing wells. He accepted formal submission to the Spanish King from the area's Indians. The area's salt was considered one of New Mexico's "four riches." However, there were insufficient natural riches for self sufficiency of the Spanish colonies, and the Spanish placed heavy demands on the Indians to support the missions.

Spanish colonization, epidemics of European diseases, strong influences from the Zuni, and deteriorating relations with the Apaches altered life in the pueblos. Drought and famine followed in the 1660's and 1670's, and the settlements were abandoned by 1670.

Colonization of the western mountain foothill areas by the Spanish began after the Spanish reconquest of New Mexico and continued throughout the 18th century. Manzano, Torreon, Tajique, Chilili, and Punta de Agua were established during this period.

By the turn of the century, the railroad arrived, and with it a flood of homesteaders. By 1910, there were over 10,000 people living in the region. The homesteader farming towns of Mountainair, Willard, McIntosh, Estancia, Moriarty and Stanley were founded during this period along the east/west "Belen Cut-off," which still exists today, and the rail route between Santa Fe and Willard that no longer exists. Moriarty was established in 1887; Estancia was laid out in 1902, and Mountainair was founded in 1903.

Original homesteaders were dryland farmers. In 1941, 32 million pounds of pinto beans were shipped from Mountainair, but the droughts of the 1950's devastated the bean farmers. The county population fell from 11,000 in 1940 to 5,800 in 1962. In the 1950's and 1960's much of the land toward the middle of the Basin, which had a high water table, yet was not close enough to the salt lakes to have immediate salinity problems, was given over to pump irrigation farming. Today pivot irrigation rigs supplying water to alfalfa, feed corn, wheat, pinto beans, pumpkins, and other crops are common sights in the central portion of the Basin. Ranching has replaced bean farming in other parts of the Basin.

The 1937 rerouting of Route 66 through Tijeras Canyon, and later the construction of I-40, caused the growth of towns along it, including Edgewood, Clines Corners, and Moriarty.

### b. Fish and Wildlife and Recreation Areas

Two districts of the Cibola National Forest are located within the Basin. Recreational activities in the National Forest include hiking, picnicking, camping, and cross country skiing. Manzano State Park and Manzano Lake provide opportunities for camping, picnicking, fishing, and hiking. Trails are accessible to horses. The Fourth of July Canyon, within the Cibola National Forest, provides a campground and trails.

### c. Land Ownership and Land Use in the Region

#### i. Land Uses in Acres

Estimated land use by acres and proportion of the basin are shown in Table 22 and in Figure 6; zoning and subdivisions are shown on Figure 7. Nearly 46 percent of the basin's land area is rangeland, about 20 percent is forest land, and less than 10 percent is irrigated crop or pasture land. Just under 20,000 acres, or around 1 percent of total land area is urban or urbanizing (transitional areas).

**Table 22. Land use in the Estancia Basin (1982)**

| land use type | total land area (acres) | percent of total land area |
|---|---|---|
| Urban Area | | |
| residential | 3,122 | <1% |
| commercial and services | 870 | <1% |
| industrial | 10 | <1% |
| mixed urban or built-up land | 182 | <1% |
| other urban or built-up land | 71 | <1% |
| transitional areas | 14,952 | 1% |
| total urban and urbanizing | **19,207** | **2%** |
| Inland Waters | | |
| reservoirs | 40 | <1% |
| lakes | 32 | <1% |
| total inland waters | **72** | **<1%** |
| Transportation, Communities, and Utilities | **2,282** | **<1%** |
| Cropland and Pasture | **130,959** | **9%** |
| Other Agricultural Land | | |
| confined feeding operations | 125 | <1% |
| other agricultural land | 529 | <1% |
| total other agricultural land | **654** | **<1%** |
| Range Lands for Grazing | | |
| herbaceous rangeland | 330,484 | 23% |
| shrub-brushland rangeland | 2,562 | 2% |
| mixed rangeland | 658,069 | 46% |
| total rangeland | **991,115** | **68%** |
| Strip mines, Quarries, and Gravel Pits | **654** | **<1%** |
| Department of Defense Facilities | **--** | **--** |
| Forest Land | | |
| evergreen forest land | 286,147 | 20% |
| deciduous forest land | 30 | <1% |
| total forest land | **286,177** | **20%** |
| Shrub and Brush Tundra | **60** | **<1%** |
| Nonforested Wetland | **586** | **<1%** |
| Dry Salt Flats | **14,634** | **1** |
| total land area | **1,446,400** | |

Source: JSAI; New Mexico Water Resources Research Institute; land use data are based on a 1982 survey conducted by EPA

### ii. Land Ownership and Administration in Acres

Land ownership and administration by type of owner is shown in Table 23 and in Figure 8. Approximately 80 percent of land is in private ownership. The Cibola National Forest accounts for 104,385 acres and the Bureau of Land Management (BLM) manages 13,298 acres. The State of New Mexico, the major government landowner, owns 179,658 acres.

**Table 23. Land ownership and administration**

| type of ownership | total land area (acres) | percent of total land area |
|---|---|---|
| Indian Lands | 80 | <1% |
| Forest Service (National Forest) | 104,385 | 7% |
| Bureau of Land Management | 13,298 | 1% |
| Department of Defense | -- | -- |
| state lands | 179,658 | 12% |
| private lands | 1,148,979 | 79% |
| total lands | 1,446,400 | |

Sources: JSAI; New Mexico Water Resources Research Institute

## B. Historic Overview of Water Use in Region

### 1. History of Water Uses and Development to Present

Ground-water development in the basin has been primarily for irrigated agriculture. Early records of ground-water diversions were not available for any use except for irrigation. Other ground-water diversions were limited to domestic and possibly some limited municipal uses. Irrigated acreage and ground-water diversions for irrigation from 1941 through 1990 are shown in Table 24. The source of the information for Table 24 was NMSEO (1967), and Wilson (1977, 1982, 1987, and 1992).

The NMSEO began cataloging diversions for surface and ground water in the basin at 5-year intervals beginning in 1975. Summaries of the diversions from 1975 through 1990 are shown in Table 25.

**Table 24. Irrigated acres and the corresponding ground-water diversion from 1941 through 1990 in the Estancia Underground Water Basin**

| year | irrigated acres | water diverted (acre-feet) |
|---|---|---|
| 1941 | 160 | 500 |
| 1942 | 100 | 75 |
| 1943 | 150 | 150 |
| 1944 | 200 | 150 |
| 1945 | 250 | 500 |
| 1946 | 725 | 1,000 |
| 1947 | 5,000 | 5,000 |
| 1948 | 6,000 | 5,400 |
| 1949 | 10,000 | 8,000 |
| 1950 | 19,000 | 19,000 |
| 1951 | 20,000 | 40,000 |
| 1952 | 21,000 | 30,000 |
| 1953 | 21,000 | 36,500 |
| 1954 | 23,000 | 33,000 |
| 1955 | 25,000 | 36,000 |
| 1956 | 25,000 | 36,000 |
| 1957 | 25,000 | 33,000 |
| 1958 | 20,000 | 26,000 |
| 1959 | 20,000 | 27,000 |
| 1960 | 20,000 | 29,000 |
| 1961 | 20,000 | 30,000 |
| 1962 | 20,000 | 30,000 |
| 1963 | 20,000 | 30,000 |
| 1964 | 20,000 | 30,000 |
| 1969 | 25,930 | 32,420 |
| 1975 | 28,440 | 35,860 |
| 1980 | 34,360 | 47,090 |
| 1985 | 32,055 | 77,562 |
| 1990 | 24,590 | 54,386 |

Sources: NMSEO (1967), and Wilson (1977, 1982, 1987, 1992)

**Table 25. Summary of annual surface and ground-water diversions in Torrance County at 5-year intervals from 1975 through 1990**

| year | public water systems | domestic | irrigated agriculture | livestock | com-mercial | industrial | stockpond evaporation | reservoir evaporation | total diversion |
|---|---|---|---|---|---|---|---|---|---|
| **surface water, (acre-feet)** | | | | | | | | | |
| 1975 | 0 | 0 | 0 | 233 | 0 | 0 | 1,284 | 0 | 1,517 |
| 1980 | 0 | 0 | 0 | 182 | 0 | 0 | 1,284 | 15 | 1,481 |
| 1985 | 0 | 0 | 0 | 142 | 0 | 0 | 1,284 | 15 | 1,441 |
| 1990 | 0 | 0 | 0 | 29 | 0 | 0 | 1,284 | 0 | 1,313 |
| **ground water, (acre-feet)** | | | | | | | | | |
| 1975 | 0 | 633 | 45,990 | 232 | 5 | 0 | 0 | 0 | 46,860 |
| 1980 | 0 | 348 | 31,980 | 191 | 0 | 0 | 1,780 | 0 | 32,519 |
| 1985 | 0 | 895 | 58,675 | 145 | 5 | 0 | | 0 | 59,720 |
| 1990 | 781 | 477 | 41,820 | 280 | 47 | 17 | | 0 | 43,422 |
| **total diversion, (acre-feet)** | | | | | | | | | |
| 1975 | 0 | 633 | 45,990 | 465 | 5 | 0 | 1,284 | 0 | 48,377 |
| 1980 | 0 | 348 | 31,980 | 373 | 0 | 0 | 1,284 | 15 | 33,985 |
| 1985 | 0 | 895 | 58,675 | 287 | 5 | 0 | 1,284 | 15 | 61,161 |
| 1990 | 781 | 477 | 41,820 | 309 | 47 | 17 | | 0 | 43,142 |

References: NMSEO Tech Reports 41, 44, 46, 47

# III. LEGAL ISSUES

## A. Water Laws Relevant to Region

### 1. New Mexico Water Law

The use of water in New Mexico is governed by the Doctrine of Prior Appropriation. The "prior appropriation" system of water law was adopted in the West as a result of the carryover of the Mexican civil law in the western territories ceded to the United States by Mexico in 1848,[1] the Mormon influence in the state of Utah,[2] and federal policy during the expansion of the western United States from the mid-nineteenth century on.[3] Although stated differently in the various western states, the prior appropriation system has always contained two essential principles:

(1) The first user (appropriator) in time has the right to take and use water; and

(2) That right continues as against subsequent users as long as the appropriator puts the water to beneficial use.[4]

At least ten western state constitutions acknowledge the appropriation system based upon beneficial use,[5] as do numerous western state laws[6] and the Federal Reclamation Act.[7]

Debate has taken place concerning what physical acts are sufficient to constitute an appropriation[8] and what is a beneficial use. Most prior appropriation jurisdictions recognize beneficial use as the basis, the measure, and the limit of the right to use water. The common theme in all these states is that beneficial use means application of water to a lawful purpose which is useful to the appropriator and at the same time is a use consistent with the general public interest in having water utilized to its maximum.

Beneficial use refers to the amount of water actually used, not to water appropriated to be used. The prior appropriation doctrine is tailored to fit the geography and climate of the western United States. Water is a precious commodity in scarce supply. The basic principle behind the prior appropriation doctrine is that if it is no longer economically or geographically feasible for an individual to use his or her water rights, persons who will use the water in a profitable manner should be allowed to do so.[9] If an appropriator ceases using water beneficially for long enough, the water becomes available to other appropriators, because of forfeiture or abandonment.

An example of how this system operates may be helpful. The day a person diverts water from a stream or from the ground becomes the "priority date" of the right. More priority dates are assigned as more people use the water source until it is fully "appropriated"--all of the water available is taken--or even until it is "over-appropriated"--a circumstance where people wish to use more water than is available for distribution. When there is insufficient water in a stream to meet the demand, the person with the oldest water right is entitled to his or her full amount irrespective of geographical location. Once the senior right is fully exercised, the next most senior right in time may be used to its full amount, and so on, until the entire supply is exhausted. Thus, persons with the newest rights on an over-appropriated stream get no water in times of scarcity. In terms of economic theory, those newest right holders, if they are willing to pay the price, will go to the long-time water users and buy senior water rights. In this manner, water will, at least theoretically, be continually transferred to the use that will generate the most revenue. As one can imagine, whether this system actually functions this way is the subject of unending debate, especially among economists.

The western states' prior appropriation treatment of ground water has not been as consistent as their treatment of surface water. For example, some courts and legislatures steadfastly deny the hydrological relationship between water in the ground and water flowing on the surface in stream beds.[10] New Mexico, on the other hand, is a state that acknowledges this relationship. Well before statehood, prior appropriation governed the use of both ground and surface waters,[11] and even hybrid forms of the riparian doctrine, of wetter climates, found no foothold in New Mexico.[12]

### a. New Mexico Water Code

New Mexico statutory law codified and refined the prior appropriation doctrine. New Mexico's water code governing the use of surface water was enacted in 1907.[13] The code's purpose was the conservation, protection, and development of public waters of the state and their application to beneficial use.[14] The 1907 water code expressly recognized existing or vested surface water rights, allowing for the filing of Declarations with the State Engineer stating the beneficial use of rights vested prior to 1907.[15] In 1931, the Legislature extended the state water code to underground waters, declaring water in underground streams, channels, artesian basins, lakes, and reservoirs having reasonably ascertainable boundaries to be public waters subject to appropriation for beneficial use.[16] Since all of the water in New Mexico running in natural streams and underground belongs in effect to the state as trustee for the people, no individual owns the water.[17] However, one may acquire a real property right[18] to divert water consistent with the procedures under state law,[19] up to the amount which can be put to a beneficial use.[20]

New Mexico has not statutorily limited what constitutes a "beneficial use." The term has been construed to include irrigation and recreational fishing,[21] as well as other traditional western uses such as stock watering,[22] if the water is actually diverted.

By statute, however, an owner forfeits his water right if he fails to apply water to beneficial use for a period of four years and he continues not to use the water for one year after notice of proposed forfeiture is given him by the State Engineer.[23] In addition to statutory forfeiture, water rights can also be abandoned in New Mexico if both the intent to abandon as well as nonuse occur. Intent to abandon is extremely difficult to prove.[24] The law is unclear concerning whether one can lose a water right due to adverse possession, but this result seems extremely unlikely.[25] The doctrine of estoppel may exist as against private litigants providing that one person cannot knowingly let another develop a system of utilizing a water source and then deny that person's water right.[26] An underlying principle that runs through the New Mexico cases is that the courts traditionally have not favored forfeiture of water rights; and, where a court can find a reason or legitimate excuse for the nonuse, the original holder's rights generally will be upheld.[27]

The jurisdictional effect of enactment of the water code in 1907 was that it converted New Mexico into a permit jurisdiction. The result was a shift of the burden of proof of impairment from the party alleging injury to the party seeking a permit to make a new appropriation or to change an existing appropriation. The surface water code in 1907 required that applicants seeking such a permit obtain approval from the Territorial Engineer.[28]

**b. Administration of Water Rights**

Today New Mexico law continues to charge the State Engineer with the duty of administering all matters relating to the appropriation, transfer, and distribution of water.[29] The State Engineer must approve all new appropriations of water for beneficial use as well as changes in the place or manner of existing uses.[30] The State Engineer has the power to appoint water masters, to apportion water consistent with priorities, and to install headgates and meters for measuring the quantity of water being used.[31]

A water right owner can sell a surface water right to another who may elect to change the point of diversion, storage, or use without losing the priority date. This can only be done, however, with approval of the State Engineer. The State Engineer must publish the proposed changes and, before allowing such a transfer, determine that no foreseeable detriment exists to other right holders.[32]

One aspect of New Mexico case law which serves to facilitate transfers is that one who has been party to a court proceeding where the water rights were adjudicated, and who later wants to transfer that right, can rely on the previous adjudication as the measure of the water right. The transferor need not prove that this amount of water was put to beneficial use. The existence of the previous adjudication will sustain a claim absent evidence to the contrary.[33] Subsection c, below, discusses water rights transfers in detail.

The State Engineer has very expansive jurisdiction over water if he chooses to exercise it. Certain nominal types of "captured" waters are, however, exempt from State Engineer jurisdiction, but are not worthy of discussion in this report.[34] In addition, water rights that were acquired prior to the creation of State Engineer jurisdiction, while governed by the law of prior appropriation, are free of the State Engineer's control. If they are transferred, they become subject to the State Engineer's jurisdiction.

As mentioned above, since 1931, state law has made all water in an underground water basin, declared to be such by the State Engineer, the property of the public subject to appropriation for beneficial use.[35] If one wishes to appropriate ground water in a declared underground water basin, that person must apply to the State Engineer,[36] who may grant a permit after determining that unappropriated water exists and that the proposed appropriation will not impair the existing water rights of others.[37] While the potential appropriator has the burden of proving the absence of impairment, the State Engineer must make an independent investigation.[38] Subsection d, below, illustrates this process. The difficulty of determining what constitutes "impairment" is discussed in Subsection d as well as in Section H.

Ground-water rights can be sold or transferred. The transfer can be of both location and purpose.[39] Also, the State Engineer has allowed transfers from surface appropriations to ground-water appropriations on a limited basis.[40] To make such a transfer, the transferor has the burden of showing that other users' water rights will not be impaired.[41] Again, the statute imposes an independent obligation on the State Engineer to make a similar determination before granting the application.[42]

The State Engineer has no jurisdiction, however, even in a declared underground water basin, to prohibit wells for nominal personal domestic use.[43] Most areas of the state have been declared to constitute underground water basins. In the remaining open areas, however, the State Engineer has no jurisdiction. The New Mexico Supreme Court in State v. Mendenhall[44] held that a person who commences drilling a well prior to declaration of an underground basin and diligently develops the water right subsequent to the basin being declared acquires a water right with a priority date relating back to the date of commencement of drilling.

### c. Transfer of Water Rights

The legal right to transfer a water right is generally the same whether the water is ground or surface, tributary or nontributary. One exception to this rule is the conjunctive management obligation to maintain an equilibrium between ground and surface water in stream-related aquifers.[45] Water can be transferred from basin to basin, subject to interstate compacts and federal law.[46] In such an instance, the transferor must be certain that within-basin consumptive use after the transfer would not be greater than before the transfer. Simply put, an out-of-basin transfer cannot make the basin worse off than it was before.[47]

Under State Engineer regulations governing the use of underground waters, a change of place and/or purpose of use of ground water will only be approved if the change would not have specified adverse effects. State Engineer Ground water Regulation 2-2 provides:

> **Change of Place and/or Purpose of Use.** The owner of a water right within a declared underground water basin cannot change the place or purpose of use of the right without the approval of the State Engineer. Such approval will be granted only after proper application is made and the State Engineer determines that the proposed move would not impair existing water rights and will not be contrary to the conservation of water within the state and will not be detrimental to the public welfare of the state.[48]

Section 72-12-7 of the New Mexico statutes likewise places the same three conditions on the change of use of ground water.[49] Because the conservation and public welfare conditions were only made requirements by amendment to state law in 1985, their application remains somewhat uncertain. As discussed below in Section G, the meaning of public welfare is particularly open-ended and undefined at this time.

The requirement of nonimpairment is the most specific condition. As long as a change in place of use, even outside of a declared underground basin, does not impair prior existing water rights within the basin, such a usage meets the nonimpairment condition. To assure such nonimpairment, it is the practice and policy of the State Engineer to approve only the consumptive portion, as opposed to return flow, of a ground-water right for transfer, including transbasin export.

This standard is consistent with state law governing the use of surface waters for transbasin export. Section 72-5-26, which provides for the diversion of surface waters from one water shed to another, states in part:

> Whenever the owner of a ditch, canal, pipeline, reservoir or other works shall turn or deliver water from one stream or drainage into another stream or drainage, such owner may take and use the same quantity of water, less a reasonable deduction for evaporation and seepage to be determined by the State Engineer ....[50]

Undoubtedly some limitations on transbasin export of water may be appropriate and would withstand legal challenge. However, under New Mexico law a water right is a property right.[51] Limitations on the use or alienation of such a right if excessive may run afoul of the takings clause of the U.S. Constitution.[52] Regulations that penalize transbasin uses may violate equal protection guarantees in federal and state law.[53] Restraint on use also could conceivably compromise the Commerce Clause, if interstate commerce were adversely implicated. The Commerce Clause empowers congress "to regulate Commerce ... among the several States."[54]

To date, judicial application of the Commerce Clause has focused on interstate export issues. The United States Supreme Court in Sporhase v. Nebraska ex rel. Douglas[55] and the U.S. District Court for the District of New Mexico in City of El Paso v. Reynolds[56] ("El Paso I") have held that ground water is an article of commerce and, therefore, the ability of states to regulate its interstate use is restricted. The court in El Paso I held:

> [A] state may discriminate in favor of its citizens only to the extent that water is essential to human survival. Outside of fulfilling human survival needs, water is an economic resource.[57]

In response to El Paso I's invalidation of New Mexico's ban on interstate export of waters, the state legislature amended the state law to allow for export of New Mexico water "under appropriate conditions."[58] Under the amended provision, the State Engineer may not approve an application to use New Mexico waters outside of the state that would cause impairment or would be contrary to principles of conservation and public welfare. The statute provides six additional considerations:

1. The supply of water available to the State of New Mexico;
2. Water demands of the State of New Mexico;
3. Whether there are water shortages in the State of New Mexico;
4. Whether the water that is the subject of the application could feasibly be transported to alleviate water shortages in the State of New Mexico;
5. The supply and sources of water available to the applicant in the state where the applicant intends to use the water; and
6. The demands placed on the applicant's supply in the state where the applicant intends to use the water.[59]

In a subsequent ruling in the El Paso case, the federal court held that these six factors were legitimate considerations for evaluating an application to export water out of state.[60] The court reasoned: "A state may favor its own citizens in the utilization of scarce water resources unless the burden imposed on [interstate] commerce is clearly excessive in relation to the putative local benefits."[61]

The standard for intra-state transbasin limitations is less clear. In contrast to New Mexico, Texas and Oklahoma have enacted statutes requiring the consideration of in-basin needs before granting permits for out-of-basin diversions.[62] Except for possible application of public welfare and conservation principles, New Mexico law does not favor one basin over another, as long as water sheds are kept whole.

A water right priority date remains the same even though it is transferred. Imported water, on the other hand, does not carry a priority date, but is subject to state rules of forfeiture and beneficial use. New Mexico's water rights leasing statute allows temporary transfers,[63] but those transfers and transfers on a permanent basis always go through the Office of the State Engineer.[64] Where a transfer is within irrigation or conservancy districts, and is on lands served by the district works, the State Engineer does not get involved[65] as long as downstream users are not affected.

Persons seeking to transfer a water right must file a formal application with the State Engineer. The application indicates the point of diversion, the place of use, the quantity of the right, and, where they exist, the file and license number of the right. After filing an application, the applicant publishes a notice of intent to change the right's use or place of use in a newspaper of general circulation where the right is located.[66]

Anyone objecting to a proposed transfer can file a formal protest with the State Engineer. Protests must be based on a claim that the transfer will impair existing rights, will be contrary to the conservation of water, or will be detrimental to the public welfare. Where no protest is filed and the State Engineer finds the transfer compatible with state law, the transfer application will be approved. Where there is a protest, the State Engineer holds a formal, due process hearing on the issues set out in the protest and decides the case.[67] If either party is dissatisfied with the State Engineer's decision, the party may appeal de novo[68] to the district court. Although such appeals are de novo, caselaw suggests that courts should defer to the State Engineer's expertise.[69]

In transfer hearings, the applicant bears the burden of proving nonimpairment, conservation of water, and consistency with the public welfare.[70] Technically, the applicant also must prove the use and amount of the transferred right.[71] Practically, however, where the right has been adjudicated, the protestant bears the burden of disproving the right's use and amount. This is the case because adjudication of rights in a transfer proceedings is not allowed, and an existing adjudication decree is accepted as prima facie evidence of the size and validity of the right. Generally, in water right cases the burden of proof is by preponderance of the evidence. If the action filed is a forfeiture or abandonment claim, however, the standard of clear and convincing evidence applies.[72]

### d. State Engineer's Role Illustrated

The role of the State Engineer as water manager and planner is illustrated best by two New Mexico cases: Mathers v. Texaco[73] and City of Albuquerque v. Reynolds.[74] Mathers reflects his role vis-a-vis a mined aquifer; i.e., one where recharge is less than the rate of withdrawal. City of Albuquerque v. Reynolds demonstrates this management function in a non-"mining" circumstance.

The case of Mathers v. Texaco[75] arose in connection with an essentially non-recharging aquifer in eastern New Mexico which was being mined by ground-water users and, therefore, is particularly pertinent to the Estancia Basin.

In 1952, the New Mexico State Engineer made a determination of the amount of water in each township in the Lea County Basin, the amount of water that had been appropriated in each township, and the amount of water that would be drawn from the stock or supply in each township into the surrounding townships after the waters in the surrounding townships would be fully appropriated. He then calculated the amount of water that could be withdrawn from each township and still leave one-third of the water in storage at the end of forty years. It was determined that at the end of the forty-year period, some of the remaining water could be economically withdrawn for domestic and perhaps other uses, but that it would no longer be economically feasible to withdraw water for agricultural and most other purposes.

Persons desiring to pump water from this declared basin had to receive a permit from the State Engineer. Texaco received a permit from the New Mexico State Engineer to appropriate 350 acre-feet of water per year for oil production from the Lea County Basin. Mathers, who had acquired prior rights to appropriate water from the basin, sued Texaco for impairing his water right and attacked the validity of the method of administering the basin adopted by the State Engineer. He argued that any appropriation from the aquifer subsequent to his necessarily impaired his right because the amount of water in the aquifer was finite.

The court of appeals upheld the State Engineer's method of managing the basin as valid. In addition, in discussing the issue of impairment of prior rights, the court said that the lowering of a water table does not necessarily constitute an impairment of water rights of adjoining appropriators, and went on to add: "This must, of necessity, be true in a nonrechargeable basin, such as the one here involved, if the water is to be put to beneficial use, and if the use is to be made available to more than the initial appropriator."[76]

In ruling in favor of Texaco, the court ratified the following principles followed by the State Engineer:

1. The New Mexico State Engineer can and does have the power to determine the useful life of an underground water basin and allow water to be mined from that basin until agricultural and industrial use of the water is no longer economically feasible, thus practically terminating all industrial and agricultural water rights stemming from the basin on that day.
2. He can and does allow mining of that basin for the specified number of years even though this results in higher pumping costs for earlier appropriators.

The case of City of Albuquerque v. Reynolds[77] described and defined the State Engineer's duties in a non-mining circumstance, involving possible impairment of an interstate compact.

There, the City of Albuquerque filed applications for permission to drill four wells within the declared Rio Grande Underground Water Basin. The facts at the hearing established that the wells would directly affect the base flow of the Rio Grande River, which was fully appropriated and had previously been apportioned by the Rio Grande Compact of 1938[78] and the Mexican Water Treaty of 1906.[79]

Before the State Engineer would allow these wells, he ruled that new well users would have to retire surface rights equal to the amount of the drawdown on the base flow of the river. This meant that a substantial amount of ground water could not be mined until all surface rights were retired. On appeal, the New Mexico Supreme Court upheld the State Engineer's three conditions on the withdrawal of ground water:

1. That the amount of water pumped be measured;
2. That the amount of return flow be measured; and
3. That existing rights to the consumptive use of surface water would be retired to the extent necessary to offset the effects of the appropriation on the Rio Grande.[80]

Thus, the State Engineer's managerial functions in New Mexico encompass two basic areas. The first is calculating a reasonable rate of ground-water mining for mined aquifers[81] and, second, in rechargeable aquifers, coordinating the interrelationships between the ground-water withdrawals and prior surface commitments in the form of prior appropriative rights, interstate compacts, and treaties.

#### e. Other State Agencies Administering Water Rights

The State Engineer is not alone in governing the allocation of water rights. Over the years, the legislature has spawned numerous other entities with overlapping and undefined jurisdiction. For example, the Interstate Stream Commission is given the authority to investigate, develop, and conserve the waters of New Mexico both intra-state and inter-state.[82] At the local level numerous entities such as conservancy districts share the State Engineer's jurisdiction.[83]

### 2. Federal Water Law Relevant to Basin

Over the course of this century, a doctrine of federal reserved water rights was developed that recognizes a federal water right outside of the requirements of state law under the prior appropriation doctrine. Simply stated, federal reserved rights are created when the United States sets aside land for specific purposes (thereby withdrawing the land from the general public domain), and there is implied, if not expressed, a concomitant intent to reserve that amount of water required to fulfill the purpose for which the land was set aside. The doctrine was first applied to recognize inchoate water rights on Indian reservations.

In <u>Winters v. United States,</u>[84] the United States Supreme Court decreed the applicability of the reserved rights doctrine to Indian waters. In that case, the United States sued to enjoin the construction of a dam on the Milk River in Montana which would have prevented the flow of water downstream to the Fort Belknap Indian Reservation. The reservation had been created by a treaty between the Indians and the United States with the consent of Congress. In affirming the issuance of an injunction prohibiting construction of the dam, the Court found that when the Fort Belknap Indians granted their vast domain to the United States, the Indians <u>did not</u> relinquish the waters appurtenant to the lands they retained.[85] Noting that without waters the lands retained by the Indians would be arid and practically useless, the Court found the Indian reservation of waters to continue in full force against the states, the United States, and their respective grantees.

Within a few months of that decision, the United States Court of Appeals for the Ninth Circuit held that the Indian reservation water rights extended to reasonable future uses as well as present uses.[86] Courts have consistently upheld and applied the Winters doctrine to cases where an Indian reservation is created by Executive Order as well as by Act of Congress.[87] Thus, the Winters doctrine provides that whenever a parcel of land is withdrawn from the public domain and reserved for Indian use, sufficient waters are also reserved to enable the Indians to fulfill the goal of the reservation.

For more than half of a century, the federal reserved rights doctrine was thought to apply only to Indian lands. In 1963, however, the Supreme Court stated that the reserved rights doctrine would apply to any enclave withdrawn from the public domain by the federal government.[88] Because the priority date of a federal reserved water right may be very early, based on the date of the land reservation, and because the quantity of the federal claim can be sizeable, many western states have viewed the reserved rights doctrine as a threat to the proper functioning of water rights determination under state law. Since 1963, many western states have sought to narrow the scope of the federal reserved rights doctrine. States have been successful in establishing state court jurisdiction over such federal claims under the McCarran Amendment[89] and by sharply narrowing the potential federal claim associated with national forests, the largest acreage of lands owned by the federal government in the west. In United States v. New Mexico,[90] the Court ruled that the federal reserved water rights doctrine was limited to the "primary purpose" for which the federal reservation was established and only in amounts without which the purposes of the reservation would be entirely defeated.[91]

Fitting the federal reserved rights doctrine into a state water scheme based on prior appropriation is difficult at best. Under prior appropriation, a water right is created by diversion and application to beneficial use, of a fixed amount of water, on a given date. The reserved rights doctrine is practically the antithesis of this system because it relies on federal rights which are not based on these elements for their existence. Consequently, the potential for federal claims to reserved water adds uncertainty to water rights planning and administration under state law.

## B. Federal Legal Issues

### 1. Federal Reservations and Water Projects

Relative to some of the other underground water basins or stream systems in New Mexico, the potential effects of federal and Indian water rights claims within the Estancia Basin do not represent a substantial threat. In other areas of the state, such as on the San Juan River and the Rio Grande, the presence of Indian reservations and pueblos and of federally designated lands makes the determination of water rights, and consequently the planning for future water supplies, a complex problem. By and large, the Estancia Basin is free of such federal and pueblo claims.

The federal land interests in or near the Basin do not pose a significant threat to existing water rights because of the unavailability or limitations of the federal reserved water rights doctrine, discussed above. Throughout the Basin, there are a number of Bureau of Land Management (BLM) holdings; however, BLM land status by itself is insufficient to make a federal water rights claim, as such land was never reserved for a specific federal purpose, which is a requirement for a reserved water rights claim.

The other large federal ownership interest can be found at the western and southern edges of the Basin, in the form of national forest and wilderness lands. At the southern end of the Basin, a portion of the Cibola National Forest just touches the edge of the Basin, but is principally outside of it. The western edge of the Basin extends into the Cibola National Forest, in the area of the Manzano mountains and includes a small portion of the Manzano wilderness. These forest and wilderness areas do constitute federal reserved lands, and it certainly is conceivable that at some point in the future, the United States will claim surface flows as federal reserved water rights. But, as discussed previously, the United States Supreme Court has taken a narrow view of such federal claims. In United States v. New Mexico,[92] the Court stated that such claims must be "carefully examined" for their "primary purposes" and that reserved water rights should not be implied unless "without the water the purposes of the reservation would be entirely defeated." In that case, involving federal claims in the Gila National Forest, the Court found that the primary purposes of the national forest did not include fish, wildlife, recreation, or aesthetic purposes, but only timber production and watershed protection.[93]

The far western portion of the Estancia Basin also abuts Isleta Pueblo lands within the Manzano mountain area and at one point contains a small tract of Pueblo lands. Because virtually all of the Pueblo lands are outside the Basin and because of the hydrology within this mountainous terrain, a potential Indian water rights claim should be considered insignificant. Indian water rights claims are determined using the "practicably irrigable acreage" standards first established in Arizona v. California.[94] Consequently, whether from an irrigation standpoint or some "needs-based" standard that a court might apply, the present Isleta Pueblo reservation represents a minimal or negligible threat to the underground waters of the Estancia Basin.

## 2. Federal Environmental Laws and Water Quality Standards

### a. The Endangered Species Act:

The Endangered Species Act (ESA) can play a prominent role in disputes pitting environmentalists against developers or other users of scarce natural resources such as water. Although the Endangered Species Act may play a more significant role in systems which are reliant on surface water, development of ground-water resources also may be affected by the Endangered Species Act. There are four endangered species, and three threatened species which could potentially affect development of water resources in the Estancia Basin; see Appendix 3. Both endangered and threatened species receive protection under the Act.[95] Additionally, there are numerous "species of concern" in the Estancia Basin which are monitored by the United States Fish and Wildlife Service and which could be listed as threatened or endangered sometime in the future; see Appendix 2. In addition, it is worthy to note that the Fish and Wildlife Service has recognized the Playa Lakes in Torrance County as significant wetland habitat for migratory waterfowl. This recognition is not pursuant to any federal statute or authority, but rather in accordance with a policy to protect, where possible, migratory bird flyways. This recognition currently has no effect on the development of water resources.

The current ESA was enacted in 1973 and, with limited exceptions, has remained in its current form since then. The ESA has been up for reauthorization through the last several Congresses, and substantial amendments have been proposed, including adding provisions which mollify the effect of the Act on state held property rights, including water rights.

The protections of the Endangered Species Act are triggered by the "listing" of a species as threatened or endangered. The goal of the Act is to "recover" threatened or endangered species through a statutorily mandated recovery plan and ultimately to delist the species.[96] The recovery plan identifies the needs of the species, the reasons for decline, and proposes a plan for "recovery." Of the threatened and endangered species found in the Estancia Basin, all but the Southwestern Willow Flycatcher, the most recently listed species, have recovery plans in place. Recent revisions to the American Peregrine Falcon and the Arctic Peregrine Falcon plans may result in downlisting or delisting of these species.

Once listed as threatened or endangered, no person may "take" any member of the species. "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, trap, capture, or collect or to attempt to engage in any such conduct."[97] In addition, federal agencies are prohibited from taking any action that may jeopardize the continued existence of any threatened or endangered species and are prohibited from taking any action which results in the "destruction or adverse modification" of the "critical habitat" of the species.[98] Federal agencies are required to consult with the Fish and Wildlife Service to determine whether federal actions or federally sponsored actions will affect or jeopardize threatened or endangered species or critical habitats.[99]

Although the existence of threatened and endangered species in the Estancia Basin may impose some constraints on development of water supplies in the Basin, the needs of currently listed species do not appear at present to affect development of ground-water resources.

**b. Clean Water Act**

The Clean Water Act applies to "navigable waters" which is broadly defined under the Act as "the waters of the United States."[100] The United States Environmental Protection Agency (EPA) has defined "waters of the United States" to encompass most surface waters, including navigable waters, their tributaries, interstate waters, and intrastate waters that can affect interstate or foreign commerce.[101] The Clean Water Act does not apply to ground-water pollution unless it affects surface waters.[102] The Act regulates water quality through effluent limitations based on water-quality standards. These effluent limitations are put into effect through a permitting system, the National Pollution Discharge Elimination System (NPDES). States can adopt stricter water-quality standards than the federal standards, but cannot approve more lenient standards. New Mexico has adopted its own water-quality standards for surface water within the state which are published in the "State of New Mexico - Standards for Interstate and Intrastate Streams" published by the New Mexico Water Quality Control Commission (NMWQCC). A state can also receive authorization to administer the NPDES program within the state, but New Mexico has not taken this step.[103]

While the Estancia Basin is not likely to be affected by the majority of Clean Water Act requirements, the Act also extends its regulatory reach to the use of "wetlands" through Section 404 of the Act. Wetlands come under the auspices of the Act through the definition of "waters of the United States" which includes "adjacent wetlands." Under Section 404, the Corps of Engineers is responsible for issuing permits for the discharge or dredging of wetlands. Permits for dredge and fill may be individually issued under 33 C.F.R. Part 323 or authorized under a Nationwide Permit issued under 33 Part 330. All discharges of dredge or fill material must be permitted unless exempted.[104]

Over the last two years, numerous amendments have been proposed to the Clean Water Act which has yet to be reauthorized despite efforts in the last several sessions of Congress. As with the Endangered Species Act, numerous proposed amendments focus on limiting the regulatory effect of the Clean Water Act on state held individual property rights, including water rights.

### c. Safe Drinking Water Act

Another federal statute related to water quality is the Safe Drinking Water Act.[105] The Act regulates the quality of a municipal water supply for public consumption and requires EPA to set maximum levels for contaminants in public water systems.[106] Of special concern are toxic contaminants in water from underground sources. A 1984 report by the Congressional Office of Technology Assessment (OTA) identified more than 200 contaminants in ground water used for drinking, many of them associated with cancer and damage to the central nervous system, liver, and kidneys. The report documented serious incidents of such contamination by toxic chemicals, including pesticides and wastes leaked from landfills or disposed of in underground injection wells, in at least 34 states.

The Safe Drinking Water Act directs EPA to set health-based standards for contaminants in drinking water and to require water supply system operators to come as close as possible to meeting the standards by using the best available technology that is economically and technologically "feasible."

EPA has developed a special regulatory program to deal specifically with pesticide contamination of ground water. The program rests on a combination of state pesticide management plans and federal ground-water quality standards. Most prominent among the federal statutes invoked are Federal Insecticide, Fungicide, and Rodenticide Acts[107] as well as the Safe Drinking Water Act.

Under the Underground Injection Control Program, the Safe Drinking Water Act also regulates the use of injection wells for disposal of hazardous wastewaters. The Act's Sole-Source Aquifer provisions allow EPA to intervene when federally funded projects pose a threat to a designated sole-source aquifer. The Act also calls for states to develop wellhead protection strategies.

Primary enforcement responsibility may be delegated to states which request it, if they adopt drinking water regulations no less stringent than the national standards and implement adequate monitoring and enforcement procedures.

New Mexico has obtained authorization to exercise primary enforcement responsibility under the Safe Drinking Water Act. Pursuant to the Environmental Improvement Act,[108] the Environmental Improvement Board (EIB) promulgates regulations and standards for water supplies, and NMED has the power to develop and enforce regulations for water supplies pursuant to the "Water Supply Regulations."

The Water Supply Regulations apply to all public water supply systems, defined under the regulations as a system for the provision to the public of piped water for human consumption if the system has at least 15 service connections or regularly services an average of at least 25 individuals at least 60 days out of the year.[109]

**d. National Environmental Policy Act**

The National Environmental Policy Act of 1969,[110] (NEPA) expresses Congress' intent to restore and maintain environmental quality. To achieve this goal, Congress directed federal agencies to preserve important historical, cultural, and natural aspects of the nation's heritage through the use of a systematic, interdisciplinary approach in planning and decision making. NEPA is purely a procedural act, but requires a "hard look" be given to environmental concerns by requiring federal agencies undertaking major federal actions to prepare Environmental Assessments and Environmental Impact Statements. Private and state agencies may also be required to participate in the preparation of Environmental Assessments and Environmental Impact Statements if there is a sufficient federal nexus.

**e. Resource Conservation and Recovery Act**

Enacted in 1976 and significantly amended in 1984, the Resource Conservation and Recovery Act[111] (RCRA) was a response to growing public awareness of serious problems related to disposal of hazardous wastes. For many contaminated sites the most serious risk is that toxic chemicals enter the ground water and contaminate public drinking supplies.

Three sets of standards are required, covering generators, transporters, and disposal sites. EPA has broad authority to prescribe such standards "as may be required to protect human health and the environment." As the last phase of this "cradle to grave" system for hazardous wastes, Section 3004 requires standards covering storage and disposal facilities. These standards cover compliance with the manifest system and other recordkeeping requirements. More importantly, they also cover treatment and disposal methods, as well as location, construction, and operation of disposal sites.

Under Section 3004 (as amended in 1984), new landfills and surface impoundments, as well as expansions of existing units, must have double liners, leachate collection systems, and ground-water monitoring facilities unless the EPA Administrator specifically finds for a particular site that an alternative design or operating practice will be equally effective in preventing migration of hazardous substances into ground or surface water.

A permit system established under Section 3005 is the key enforcement provision for disposal sites. EPA is given broad inspection powers (Section 3007) and the power to issue compliance orders (with violators subject to a civil penalty) or bring a civil action against violators of any requirement (Section 3008). Criminal penalties are also available for violation of the permit requirements or falsification of documents (Section 3008(d)). Finally, RCRA makes careful provision for state regulation. Under a provision modeled on the Clean Water Act, states may assume responsibility for hazardous waste control (Section 3006), but state laws less stringent than federal requirements are preempted (Section 3009).

New Mexico's corollary to RCRA is the Hazardous Waste Act.[112] New Mexico is authorized, through the EIB, to administer a hazardous waste program in lieu of the federal RCRA program, with the exception of EPA regulations promulgated pursuant to the 1984 amendments. EPA also maintains some oversight and influence over the state's implementation. For the most part, EIB has adopted the federal RCRA regulations by reference.

### 3. Treaties

The Estancia Basin contains a number of Spanish land grants. The New Mexico Constitution recognizes the "rights, privileges and immunities" guaranteed to the people of New Mexico by the Treaty of Guadalupe Hidalgo.[113] However, the U.S. Supreme Court has ruled, as to non-Indian grants, that the U.S. Patent was a deed de novo that would carry no special water rights. Such rights, if any, would have to be based on New Mexico law and, therefore, should not pose a threat to planning for future water supplies.

## C. State and Municipal Water-Quality Standards

### 1. State Water Quality

State authority for regulation of surface water quality stems from section 303 of the Clean Water Act and the New Mexico Water Quality Act.[114] The Water Quality Act charges the NMWQCC with adopting a water-quality management program and continuing planning process, adopting water-quality standards for surface and ground waters, and adopting regulations to prevent or abate water pollution and to govern the disposal of septage and sludge.[115] Implementation of the NMWQCC regulations falls to the New Mexico Environment Department.[116] The EIB and Oil Conservation Division (OCD) also play a role in water-quality regulation. The EIB assumes responsibility for promulgating standards and regulations for water supplies and liquid waste,[117] and pursuant to the Oil and Gas Act, the OCD has responsibility for regulating water pollution stemming from oil and gas activities.[118]

Regulation of ground-water quality remains primarily a state activity and New Mexico regulates ground water through the Water Quality Act and the Water Quality Control Commission. Regulation is premised on water quality standards and the requirement that no discharge may be made into ground water absent a discharge plan which incorporates such standards.[119]

### 2. Municipal Water Quality

The local jurisdictions supplying water in the Estancia Basin are subject to the various federal and state statutes described above, most notably the Safe Drinking Water Act and its state corollary.

Also worthy of note at the local level is the joint City of Albuquerque and County of Bernalillo "Groundwater Protection Policy and Action Plan." The plan, adopted by the County in November 1993, and the City in August 1994, establishes a Ground-Water Protection

Advisory Board and outlines various policies and strategies to protect the ground water within Bernalillo County.

The plan is innovative in many respects, most importantly recognizing that where, as in the Estancia Basin, the public water supply relies on the mining of ground water, protection of the quality of that water is of utmost importance.

## D. Lawsuits Relevant to Water Uses and Supplies

### 1. Water Rights Adjudication

#### a. Framework for an Adjudication:

The New Mexico Constitution, ratified in 1912, confirms all existing rights to the use of any waters in the state, makes beneficial use the basis, measure, and limit of the right to the use of water, and declares all unappropriated water in the state to be property of the public.[120] Unlike Wyoming, the New Mexico Constitution did not create an administrative body to regulate the appropriation of water in the state. Rather, the New Mexico Constitution merely authorized the legislature to provide for the organization and operation of drainage districts and systems, and, by amendment in 1967, provided for de novo appeals to the district court from decisions made by any state executive body in matters relating to water rights.[121]

In 1907 the territorial legislature wrote the New Mexico Water Code,[122] which included the creation of the Office of the State Engineer.[123] The State Engineer was charged with "the supervision of waters of the state and of the measurement, appropriation, distribution thereof...[a]ccording to the licenses issued by him and the adjudications of the courts."[124] He also was delegated the authority to "adopt regulations and codes to implement and enforce any provision of any law administered by him...to aid him in the accomplishment of his duties...."[125] State Engineer regulations may be for the purpose of "prescribing procedures and interpreting and exemplifying the statutes to which they relate...."[126]

Section 72-4-13 of the Water Code mandates the State Engineer to conduct hydrographic surveys, beginning on those stream systems most used for irrigation, in order for the waters of the state to be adjudicated. He also is directed "[to obtain and record] all available data for the determination, development and adjudication" of the state's water supply.[127] The Code further states that the State Engineer shall deliver his surveys to the Attorney General, who, at the request of the State Engineer, shall enter suit on behalf of the state for the determination of all rights to the use of such water.[128]

Despite the statutory mandate, the State Engineer has been slow to adjudicate the state's waters. Currently, the State Engineer Office is devoting its resources in other parts of the state to adjudication suits there, many of which have been pending for decades. At this time, the State Engineer has indicated no intention to commence an adjudication of the Estancia Basin.

#### b. Example of the Pecos River Adjudication:

In 1956, the State of New Mexico and the Pecos Valley Artesian Conservancy District initiated a general adjudication of ground-water rights in the Roswell

Artesian Basin in Chaves County. The ground-water adjudication was subsequently consolidated with a second suit filed in 1958 by the same parties to adjudicate the water rights of the Hagerman Irrigation Company and individual water users of the Company, State of New Mexico v. Lewis, Fifth Judicial District, Nos. 20294 & 22600 Consolidated. The adjudication was further expanded in 1974 to encompass both surface and ground water uses and to include the tributary Rio Hondo system.

The Pecos River adjudication is ongoing, but because of the suit's size, involving thousands of claimants, it proceeds slowly and in phases. Currently, the most significant portion of the adjudication is the quantification of rights within the Carlsbad Irrigation District (CID). The State of New Mexico ex rel. State Engineer, as plaintiff, has entered into a settlement agreement with defendants United States of America and Carlsbad Irrigation District, describing the water rights for the CID. An expedited proceeding is going forward in which other claimants may oppose the proposed judgment. Over 900 claimants objected to the proposed judgment, and the court has since issued a pretrial order governing the proceedings, including an extensive and time-consuming briefing schedule.

## E. Water Rights Administration Policies Specific To Basin

### 1. Regulations Governing Ground-Water Pumping*

The current administrative criteria used by the State Engineer Office are designed to achieve a reasonable consumption of water assuming a limited and declining water supply. As with other closed basins, such as the Mimbres, Lea County, Capitan, and Tularosa, the State Engineer has developed criteria to allow a regulated level of mining of the Estancia Basin aquifer.

In 1965, the State Engineer developed an inventory system to describe the amount of water physically present in the valley fill aquifer. This initial inventory of water was based on the estimated thickness of the aquifer as it varies throughout the saturated alluvium. Once the initial inventory was established, the State Engineer instituted an inventory block system to administer the basin assuming a productive life of 40 years, to the year 2005. The inventory block system is essentially a division of the basin into a grid where each block in the grid consists of a 1/4 township of nine square miles.

Once the initial inventory was established, accounting for prior existing uses, the State Engineer issued permits based on a projected 40-year use for each existing water right. In addition to existing rights, a 40-foot aquifer reserve was also deducted from the total inventory to allow for adequate capacities for pump depth and for domestic uses and stock watering. The volume of water remaining after these deductions was designated as water available for appropriation. The State Engineer then established administrative criteria to evaluate applications to appropriate the available water.

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* The following discussion is based upon conversations with staff of State Engineer Office District 1 and upon administrative memoranda provided by that office, including excerpts contained in Appendix III-A. Particular appreciation is expressed to Bob Thompson for his review of and comment on this sub-section, sub-section G.1 and Appendix III-A.

Since establishment of the basin criteria, applications to appropriate new water in the valley fill have been considered based on water availability within the subject block and the surrounding eight blocks, together creating a 9-block "template." Applying the 9-block template, the State Engineer will determine whether sufficient unappropriated water is available in the 9-block area to allow a new diversion from the center block. Because the State Engineer estimates that only about 20 percent of pumped water will come from the center block, the greatest effects of pumping will be felt in the surrounding eight blocks. The following diagram shows the calculations the State Engineer applies to apportion effects among nine blocks covering the valley fill.

The 9-block template: Apportionment of effects within saturated valley

| | | |
|---|---|---|
| 8.3% | 11.7% | 8.3% |
| 11.7% | 20%<br>Pumping Block | 11.7% |
| 8.3% | 11.7% | 8.3% |

The State Engineer will not approve an application to appropriate ground water from the valley fill unless each of the nine blocks has sufficient available water to sustain the designated effects. If any of the nine blocks within the valley fill shows an inventory that has no available water for appropriation, the current administrative criteria require that the application be denied. The rationale is that the "zero" block cannot afford any more water withdrawals because all the water in that block has been previously allocated. Using the inventory block system, the State Engineer has developed fairly sophisticated and technical regulations for determining whether appropriable water is available depending on whether the applicable 9-block template is completely within the valley fill, partially within the valley fill, or completely out of the valley fill. Generally, the system is designed to predict the effects of pumping where they are most likely to occur, that is in the valley fill, the place of greatest stored water. For instance, State Engineer information indicates that water pumped from the Madera Limestone is derived principally from storage in the saturated valley alluvium over time. Consequently, an application to appropriate new ground water from a Madera Limestone block adjoining the valley fill would be denied if any of the surrounding valley blocks contains insufficient or no water available in inventory for appropriation.

Whether proposed diversions from blocks located away from the valley fill will be allowed depends on their effects on the saturated alluvium. To determine such effects, the State Engineer Office will use when necessary 25-, 49-, or even 81-block templates to register the effects of a proposed appropriation on water in storage in the valley fill. See attached Appendix 1 outlining State Engineer criteria for the Estancia Basin.

The following is a hypothetical illustration of the use of inventory values within a 9-block template of saturated valley fill to evaluate an application to appropriate water.

Hypothetical inventory values in storage (Va = X)
(Va = volume of water available for appropriation)

| | | |
|---|---|---|
| 1<br>10,000 | 2<br>25,000 | 3<br>600 |
| 4<br>10,000 | 5<br>16,000 | 6<br>200 |
| 7<br>10,000 | 8<br>15,000 | 9<br>25,000 |

In this instance, we will assume an application to appropriate 100 consumptive use acre-feet of water per annum by drilling a well in block number 5. Looking first at block number 5, the pumping block would itself have sufficient water available to satisfy the application. Over a 40-year period, 16,000 acre-feet of water in storage would allow an appropriation of 400 acre-feet per annum, which would easily provide 20 percent of the requested appropriation.

In determining whether to grant the application for 100 acre-feet, the State Engineer would then look to the effects on the surrounding 8 blocks. Seven of those blocks have sufficient available water in storage to satisfy the requested appropriation. Even block number 3 with 600 acre-feet available has sufficient supply. Over 40 years, 600 acre-feet would yield 15 acre-feet per year available for appropriation. Because of the apportionment of effects, only 8.3 acre-feet (8.3 percent of 100 acre-feet) per year would be required to meet the demands of the application.

However, the application would not be fully granted because of the low amount of water available in storage in block number 6. Two hundred acre-feet in storage would yield only 5 acre-feet for appropriation per year over 40 years. Because block number 6 must sustain 11.7 percent of the effects of an appropriation, no more than 42.7 acre-feet per year would be approved under State Engineer criteria.

As discussed below in Section G.1., the current administrative criteria contain conservative assumptions that function to make the model a barrier to the full use of water within the basin.

### 2. Duty of Water and Return Flow Credits

The State Engineer Office has established the amount of water that may be diverted and consumed per irrigated acre of land within the Estancia Basin. A water right allows the annual diversion of 2.5 acre-feet per acre of irrigated land. The State Engineer has determined that the average depletion or consumptive use is 1.23 acre-feet per acre. This average is based on a depletion within the basin of 1.29 acre-feet per irrigated acre per annum and assumes that no more than 95 percent of irrigated land will be in use at any one time. Consequently, return flow from irrigation is 1.27 acre-feet per irrigated acre per annum. Return flow by deep percolation is assumed to be 30 percent of pumpage.

### 3. Water Rights for New Subdivisions

In response to the proliferation of communities that lack basic amenities and infrastructure resulting from misuse of the "four-lot split" exemption to the Subdivision Act, the New Mexico Legislature in 1995 amended the Act to narrow its exceptions. Effective July 1, 1996, the amended Subdivision Act defines "subdivision" to mean the division of surface lands into two or more parcels for the purpose of sale, lease, or other conveyance or for building development.[129]

The new Subdivision Act requires counties to scrutinize subdivision water demands and corresponding availability closely before approving a subdivision plat. Whereas under the former act, county regulations had to establish a requirement for "enough water for subdivision use,"[130] the new act states that each county shall adopt regulations setting forth the county requirements for "quantifying the maximum annual water requirements of subdivisions including water for indoor and outdoor domestic uses" and "assessing water availability to meet the maximum annual water requirements of subdivisions[.]"[131] Bernalillo, Doña Ana, and Santa Fe Counties are required to adopt such regulations on or before July 1, 1996.[132] All remaining counties, including Torrance County, are required by the Act to adopt implementing regulations on or before July 1, 1997.[133] Even though the Act does not require Torrance County to adopt implementing regulations until July 1, 1997, the Act itself is effective July 1, 1996.

Under the new Act, county regulations shall require, as part of preliminary plat approval, a showing of adequate water supply to meet subdivision needs. Prior to the amendment, subdividers only had to satisfy proposals as to water supply made in disclosure statements.[134] County regulations under the new Act cannot rely on satisfaction of the subdivider's disclosure statement. As part of preliminary plat review and approval, a subdivider must furnish documentation of "water sufficient in quantity to fulfill the maximum annual water requirements of this subdivision, including water for indoor and outdoor domestic uses[.]"[135] And further, the subdivider must provide documentation of "water of an acceptable quality for human consumption and measures to protect the water supply from contamination[.]"[136] In order to evaluate such documentation, the county shall request opinions from the State Engineer and the Environment Department.[137]

Finally, the new Act contains a provision adding a requirement of a water permit for any subdivisions of 20 or more parcels where any parcel is smaller than 2 acres in size.[138] During the Act's first effective year, until July 1, 1997, the provision mandates that county regulations require the subdivider to provide a copy of a water-rights permit obtained from the State Engineer[.]"[139] Absent issuance or existence of a permit for use by the subdivision, the Board of County Commissioners may not approve the final plat. Significantly, after July 1, 1997, the permit condition is no longer mandatory under the Act; instead the "Board of County Commissioners may require that the subdivider provide a copy of a permit that will be used to supply the subdivision[.]"[140] Accordingly, the Board of County Commissioners may elect to deny a final plat if there is not a State Engineer permit to meet the subdivision needs. Finally, the Act requires disclosure statements for all subdivisions, not just for Types 1, 2, and 4, and specific statements are required for subdivisions of more than four lots providing a detailed description, including information regarding water requirements and availability.[141]

Because the Estancia Basin extends into four separate counties, the implementation of the Act will likely vary within the Basin. The major portion of the Basin is in Torrance County, including the municipalities of Moriarty, Estancia, Willard, and the northern portion of

Mountainair. The next largest portion of the Basin falls in Santa Fe County, at the northern end of the Basin. Stanley falls in the approximate middle of the declared Basin within Santa Fe County. Bernalillo County includes a relatively small portion of the Basin on its west side including Chilili. An even smaller portion falls within San Miguel County on the northeast corner of the Basin, near White Lakes.

As required by the Subdivision Act, counties in New Mexico have implemented or are in the process of developing regulations implementing the new Act. As stated above, Santa Fe and Bernalillo Counties are required to implement regulations by July 1, 1996, and Torrance and San Miguel Counties have until July 1, 1997. For purposes of water planning for new subdivisions, regulations implemented by the counties will be of great importance. Under the Act, a county may implement the Act's requirements per se, however, the Act specifically provides that a county may adopt more stringent regulations as long as the county has adopted a comprehensive plan and the more stringent regulations are consistent with such a plan.[142]

On July 9, 1996, Santa Fe County adopted Ordinance 1996-8 implementing regulations in accordance with the Act. Article VII, Section 6, governs water supply requirements for subdivision approval. Notably for all subdivisions containing six or more lots, the Santa Fe County regulations go beyond the requirements of the Act, requiring a water availability assessment demonstrating a 100-year water supply for any development using a new community ground-water diversion, or an existing community or municipal water utility, or individual or shared domestic wells.[143] For new surface water diversions, a subdivider must submit a hydrologic report demonstrating that the supply is sufficient to meet the maximum annual water requirements of the subdivision and is physically available.[144] Furthermore, a community water system (as opposed to domestic well diversions under Section 72-12-1 NMSA 1978) must be available for specified subdivisions and must be supplied under a valid existing State Engineer permit for all subdivisions containing 20 or more parcels, any one of which is 2 or less acres in size.[145] The regulations also contain extensive provisions governing water quality[146] and water conservation.[147]

On December 11, 1996, the Torrance County Commission adopted ordinance number 96-7 implementing the County's new subdivision regulations. The new ordinance requires a water availability assessment demonstrating a 70-year water supply for all subdivisions of six or more parcels where the source of water is from a new community well and water system, or from an existing community system served by a utility company or where the water supply is individual or shared domestic wells.[148] The ordinance requires a community water system for all proposed subdivisions containing twenty or more parcels, any of which is 2 acres or less.[149] More stringent than the Act, the county ordinance also requires a subdivider to demonstrate that the proposed water supply would be under a valid water rights permit issued by the State Engineer for any subdivision containing twenty or more parcels any one of which is 2 or less acres in size.[150] Furthermore, unless a subdivider submits a water demand analysis or water conservation plan, the subdivision ordinance quantifies the water requirements per parcel at an amount of 0.55 acre-feet per annum.[151] The ordinance also contains design requirements for conservation[152] as well as regulations governing water quality.[153]

Bernalillo County adopted Ordinance No. 96-23 implementing its subdivision regulations on October 1, 1996. As with the Torrance County ordinance, the Bernalillo County subdivision ordinance requires subdividers to demonstrate a 70-year supply of water provided by new community ground-water diversions, or by existing community water supply companies or from individual or shared domestic wells.[154] If supplied by a new surface water diversion, the subdivider must submit a hydrological report demonstrating that surface water is sufficient to meet the maximum annual water requirements of the subdivision and is physically available.[155] Again, the regulations require a community water system for subdivisions of twenty or more lots, if any, are 2 acres or smaller.[156] Furthermore, absent a detailed water demand analysis, the county ordinance sets 0.6 acre-feet per year as the maximum annual water requirement for each parcel in a residential subdivision.[157] More stringent than the Act, the county ordinance requires a valid water right permit issued by the State Engineer for all subdivisions containing twenty or more parcels any one of which is 2 or less acres in size.[158] The ordinance contains design standards[159] and water quality requirements.[160]

The San Miguel County Commission adopted Ordinance No. SMC-06-25-96-ORD on July 16, 1996. This ordinance requires a 40-year supply of water for all subdivisions containing 6 or more parcels with a source of water from a new community ground-water diversion, or from an existing community water utility or from individual or shared domestic wells.[161] For new surface water diversions, a subdivider must submit a hydrological report demonstrating that the supply is sufficient to meet the maximum annual water requirements of the subdivision and is physically available.[162] Furthermore, a community water system must be available and supplied under a valid existing State Engineer permit for all subdivisions containing 20 or more parcels any one of which is 2 or less acres in size.[163] The ordinance provides for water conservation[164] and water quality standards.[165]

### 4. Incorporation of Regional 40-Year Water Plans

As discussed above, water rights that are not exercised for a period of 4 years are subject, after notice, to forfeiture by New Mexico statute, and water rights that go unused for an unreasonably long period (perhaps 10 to 15 years) are subject to common law abandonment. In order to allow municipalities, counties, and the public utilities supplying water to them a longer planning horizon within which to use water rights, the New Mexico legislature in 1985 enacted the 40-Year Planning Statute.[166] The statute allows municipalities, counties, and public utilities to acquire and hold unused water rights in an amount to meet reasonable needs within 40 years, based on the development and implementation of water plans.

In addition to planning at the municipal or county levels, the state has recognized the importance of regional water planning.[167] Because water users within the boundaries of a common underground basin or along a water course compete for a finite and shared resource, integrated and comprehensive water planning reduces conflict and allows for reasonable and efficient management and use of water resources. Statutory requirements for regional planning by the Interstate Stream Commission state that such a planning region should contain "sufficient hydrological and political interest in common to make water planning feasible."[168]

The Estancia Basin is an ideal candidate for joint water resources planning. As a mined basin extending into four counties and containing a number of municipalities as well as rural water users, a regional plan is essential. Such a plan will assist in the beneficial use of water in the short-term and for protection of water resources for future needs.

**b. County Improvement Districts:**

Any county, except H class counties (i.e., Los Alamos County), may create a county improvement district to acquire, construct, or maintain a water utility when the board of county commissioners determines that the creation of an improvement district is necessary for the public safety, health, or welfare.[178]

### 4. Intercommunity Water Associations

Any combination of two or more municipalities and the board of county commissioners of the county in which the municipalities are located may organize, by joint or concurring resolution of the governing bodies, an association for the purpose of acquiring a water supply system.[179]

### 5. Cooperative Associations

Cooperative associations may be formed to acquire and distribute any type of goods or services,[180] including water. Cooperatives are alternatively known as mutual domestic water associations and are non-profit organizations.

### 6. Water and Sanitation Districts

Water and sanitation districts may be formed pursuant to the Water and Sanitation Act,[181] to establish or acquire waterworks for domestic and industrial consumers. Class A and Class B counties which have over 90,000 residents may create water and sanitation districts.[182]

### 7. Sanitary Projects

Sanitary projects are formed to install and operate sanitary domestic water facilities in rural unincorporated communities, using some funds from the state. Two or more communities may combine for this purpose. Communities, however, must have been in existence for at least twenty-five years to qualify for the program, and communities which abut incorporated subdivisions may not participate in the program.[183]

## G. Legal Issues Needing Resolution

### 1. Accurate Administrative Criteria

The current administrative criteria used by the State Engineer to administer the Estancia Basin contain conservative assumptions that may serve as a barrier to full use of water within the Basin. Although a conservative approach to regulating appropriations from a mined basin may be in order, the criteria adopted by the State Engineer appear to be overly cautious in several respects, leading to an unrealistic and inflexible basin administration.

One of the principal reasons for the apparent inaccuracy of the current criteria are two assumptions regarding basin hydrology. The first assumption, regarding water supply, is that there is no recharge to the Basin. As indicated in Section IV of this Water Plan, the aquifer experiences significant recharge. Although there may be some hydrologic debate as to the level of recharge, it is clear that recharge in substantial amounts is occurring. Second, and on the demand side of the equation, the model assumes full development of existing permits at the time the criteria were instituted. Although the State Engineer's practice is to add back into inventory waters associated with permits that are terminated or diminished, the assumption of full use still operates in a conservative fashion to "lock up" water that could reasonably be calculated to be available.

Additionally, use of the 9-block template itself appears to operate as a barrier to the appropriation of water which otherwise would be available for use without impairment to others. The first aspect of the 9-block template which limits appropriation is the confinement of effects for approval purposes to the 9 blocks. The State Engineer recognizes that the effects of an appropriation within the valley fill will extend beyond a 9-block template and may require a larger template to register the expected effects. Nonetheless, the 9-block criteria is used for approval purposes.[184] In other words, because of high hydrologic transmissivity levels, apportionment of effects exclusively within the 9-block criteria may be overly restrictive, thereby leading to an administrative finding of greater impact on neighboring blocks than actual hydrology would demonstrate .

The second aspect of the 9-block system that may serve as a barrier to appropriation of available water is the general prohibition of additional appropriations where any of the 9 blocks is a "zero" block, containing no water in inventory available for appropriation, as illustrated in Diagram number 3.

Hypothetical inventory values in storage, including "zero" block (Va = X)

| | | |
|---|---|---|
| 1<br>10,000 | 2<br>25,000 | 3<br>0 |
| 4<br>10,000 | 5<br>16,000 | 6<br>1,000 |
| 7<br>10,000 | 8<br>15,000 | 9<br>25,000 |

Unless there are no permitted water rights in a "zero" block, any application to appropriate water within a 9-block template that included the "zero" block would automatically be denied. The result of such a denial functions to preclude the appropriation of water that appears to be available in the aquifer. Despite the general availability of water within a 9-block template, as shown in Diagram number 3, an application to divert water from a block adjoining a "zero" block, such as block number 3, will be denied. This veto effect leaves some water unappropriated despite an application that in every other respect meets state water law requirements. In short, under the 9-block template system, the sum of the parts may not equal the whole.

It should be noted that application of the administrative criteria need not be the final outcome. After denial, an applicant may seek a hearing during which a demonstration of actual hydrology could be undertaken. However, putting an evidentiary burden on denied applicants to this extent may be costly and time consuming and may have the practical effect of frustrating meritorious applications to appropriate ground water, if, as in many cases, the applicant lacks the financial resources to develop hydrologic data to rebut the denial of an application under the administrative criteria.

In addition to their practical shortcomings, the basin criteria may not fully meet violate state law requirements. In considering an application for use of underground waters, New Mexico law imposes a duty on the State Engineer to determine whether waters are available for appropriation.[185] In administering the Estancia Basin using the present criteria, it may be that the State Engineer has not met the statutorily imposed duty. Because the administrative system is not a realistic reflection of the hydrologic facts of the basin, the criteria may function to deny a justifiable application, which otherwise would be approved, if the State Engineer were to apply criteria reflecting physical realities. However, because the current administrative criteria may operate mechanically to deny an application, the duty or burden is thereby shifted to the applicant to investigate and demonstrate the availability of appropriable water.

The State Engineer Office has recognized deficiencies in current administrative criteria and is attempting to develop a replacement model. The Hydrology Division of the State Engineer Office is currently working to develop a "finite difference model" that would provide a more realistic and dynamic picture of the aquifer. Development of a sophisticated and accurate model would be helpful in achieving reliable water planning and reasonable use of aquifer resources within the Basin. Once the model is completed, the State Engineer could propose new criteria that should both protect the Basin through appropriate conservation criteria and, at the same time, allow for a more realistic evaluation of applications. In that way, the best use of the Basin may be achieved. Particularly in light of new subdivision regulations requiring a demonstration of 40- to 100-year supply of water, accurate administrative criteria based on a realistic timeline are essential.

### 2. Quantification of Water Rights

Under the New Mexico Water Code, and consistent with the Prior Appropriation Doctrine, a water rights claim will not be recognized where prior existing rights constitute full appropriation of a river's waters. As previously mentioned, before authorizing a permit to appropriate water, the State Engineer must determine that there is "unappropriated water available for the benefit of the applicant."[186] With respect to the Estancia Basin, the principal obstacle to determining the existence of unappropriated water is the lack of a reliable hydrologic model and appropriate corresponding administrative criteria. An additional barrier, however, should be noted, and that barrier is the uncertain legal status of water rights within the Estancia Basin.

New Mexico Water Code requires the State Engineer to undertake a hydrographic survey of each stream and source of water supply within the state, and, upon completion thereof, to request the Attorney General to enter suit on behalf of the state to adjudicate all of the water rights within the subject area.[187] The State Engineer has not commenced an adjudication and has indicated no intention to adjudicate water rights in the Estancia Basin. If conflict over legal title to water rights occurs or the use of underground waters is denied because of the uncertainty of prior existing legal title or because of the existence of unperfected water rights that should be considered for judicial termination, it may be necessary to commence adjudication of the Estancia Basin in order to quantify its water rights.

### 3. Conservation of Water Resources Within the Basin

More and more, the conservation of water will be necessary to assure a future supply. It will also be necessary to prove good conservation practice to assure the transferability of water rights before the State Engineer.

The criteria used by the State Engineer to administer the Estancia Basin are not designed to extend the useful life of the basin as long as possible. Instead, the aim of the criteria is to define legal access to the aquifer for use within a specified period. An assumption underlying the criteria is that after 40 years of pumping, at most 40 feet of saturated alluvium will be available in the valley fill for domestic uses and stock watering. To prolong the life of the aquifer, two steps may be taken. First, local governmental entities may take what reasonable measures are within their authority to require conservation of water. Second, the State Engineer Office may consider redesigning its administrative criteria to place a greater emphasis on conservation.

Either regionally or on an individual basis, the local governmental entities having jurisdiction within the Estancia Basin must develop conservation plans. Such plans must take into account economic forces affecting demand for water. An effective means of promoting conservation is by raising the cost of its use, either directly or indirectly. Where municipal water systems are already in place, pricing structures and use restrictions can be implemented to encourage the efficient use of water.

The pertinent counties may also wish to consider valuation adjustments within their jurisdictions to promote conservation of water. Counties could consider accomplishing this by adjusting property tax assessments to reflect the value of perfected water rights appurtenant to private lands. Water rights are a valuable asset that give their owners the right to deplete the basin's limited natural water resources. Assessments should reflect that value and thereby help to assure that water rights are exercised in a beneficial manner. Finally, counties could consider placing an excise or a severance tax on all water that is pumped from the Basin. Of course, with respect to all of these suggestions, accommodations could be made to reflect the cultural and historical values of the region, including the prevalence of agriculture.

Conservation measures are not only vital from a practical standpoint, but also as a matter of compliance with state law. In considering an application for use of underground waters, the State Engineer is required to deny the application if the proposed use would be "contrary to conservation of water within the state[.]"[188] Likewise, in reviewing an application to change the location of a well or change the place or purpose of use of water, the State Engineer will again require that the proposal not be contrary to the conservation of water.[189] Indeed, the State Engineer should be encouraged to adopt reasonable conservation requirements in administering the Estancia Basin.

### 4. State Recognition of Conservation Credits

Another issue requiring resolution is the legal right of water users under state law to use conserved water for other purposes. Among the issues that must be addressed is the legal right to engage in water spreading, water banking or conveyance of conserved waters.

The State Engineer has demonstrated a long-standing policy and practice of approving water spreading. Under this policy and practice, an irrigator may apply to extend the exercise of a water right on additional farm lands. Through conservation practices, the duty of water required per acre is reduced, allowing the same water right to irrigate a larger acreage. The New Mexico Supreme

Court in Sun Vineyards v. Luna County Wine Development Corp.[190] recognized the desirability of spreading as a water savings device.

If an irrigator implements water saving measures, the irrigator's only alternative, however, should not be limited to water spreading. If through efficient irrigation practices conserved waters become available, the water user may wish to keep excess waters in reserve for future use without threat of forfeiture or abandonment. Or, the irrigator may wish to sell excess water to another user for use in a different place and perhaps for a different purpose.

The State Engineer is in the process of considering these issues. In order to protect the viability of agriculture in New Mexico in the future, and in the face of substantial population growth projections, both in the state overall and in the Estancia Basin in particular, it will be necessary to formulate and create procedures that recognize and encourage conservation.

### 5. Scope of 40-Year Planning Statute

New Mexico has a statute that provides that municipalities and counties may appropriate sufficient water to meet their needs for a 40-year planning horizon, as discussed above. The statute allows for the acquisition of rights for future use so that rights do not have to be purchased piecemeal and put to beneficial use. Rather, anticipated new demand may be included in an application to appropriate. But, some problems are raised by this planning process resulting in practical constraints on municipalities and counties.

First, the ability to appropriate water is determined by demographers who will provide their expert opinion as to future populations of an area; this in turn will be tied to water demand. Population projections vary widely between experts. The municipality is often placed in a bind. To be safe, it wishes to appropriate the greatest amount of surface water possible, but at the same time wishes to encourage water conservation. However, if a city anticipates water savings through conservation, it will be decreasing its ability to appropriate water for future needs.

Furthermore, the law is unclear as to the kinds of demands that can go into a municipal water plan in terms of future needs. To address this problem, any reasonable municipality will include the following potential uses in its plan. These uses should include at a minimum the following: domestic use, commercial use, lease for commercial purposes, investment, recreation, wildlife, fire protection, health and safety, evaporation, carriage and delivery losses. The application should, of course, make it possible to use any or all of the water for any of the varied purposes, rather than having a specific quantity earmarked for a particular use.

From a financing standpoint, a number of considerations also arise. Water rights acquisitions are expensive, and if a public entity plans to finance water rights acquisitions through pledging real property, approval by popular vote is constitutionally required. It is not always easy to convince the voters that they should encumber their property today to support the water needs of future generations. In addition, some argue that if one is to finance a "water system," the only method for doing so is through the issuance of water revenue bonds.

Unfortunately, acquisition of water rights for future use is not an activity which can provide current revenues to retire a bond obligation, so this mechanism does not work for this purpose. More creative financing mechanisms need to be found. These could include rebates by the state government of locally earned severance taxes on oil and gas or mineral reserves or tax breaks to those conveying rights to municipalities. The municipalities and counties having jurisdiction within the Estancia Basin should begin to evaluate what regional revenue sources currently going to the state are available to help offset the costs of acquiring rights for future generations. In addition, any rights purchased today, but not needed until the future, should be leased back to the seller to lower the acquisition costs. Also, state income tax rebates for selling rights to municipalities could ease the costs of acquiring rights.

### 6. Meaning of Public Welfare

In reviewing an application to appropriate water or to transfer water rights, the State Engineer will consider whether approval of the application would be detrimental to public welfare. Neither the New Mexico legislature, the courts, nor the State Engineer have provided a definition of "public welfare" as used in the Water Code. The following section discusses the dispute over a proposed non-traditional water use that first raised "public welfare" considerations.

**A Case in Point**

The requirement that appropriation and transfer applications be consistent with the public welfare became state law in 1985.[191] Because few such applications have been challenged on that ground, the full ramifications of the requirement are not known. The likelihood that the ramifications will be prolix is perhaps best illustrated by the case of Sleeper v. Ensenada Land and Water Ass'n.[192] This case directly pitted the economic values associated with a new ski development against the cultural values of a northern New Mexico community.

Events leading up to the Sleeper suit date to the late 1970s, when Tierra Grande Corporation began developing a subdivision in conjunction with a large ski resort development[193] near Ensenada, New Mexico, a small farming community in the north central part of the state. While building roads for the new subdivision, Tierra Grande dug a gravel pit, then later transformed the pit into a recreational lake by damming the Nutrias Creek.[194] The Nutrias, a tributary of the Rio Brazos,[195] empties into the Ensenada irrigation ditch before it joins the Rio Brazos. Fed mainly from snowmelt, the Nutrias runs heavily during the spring and is dry by late May or early June.[196] The Ensenada Land and Water Association uses the creek's waters, drawn off the Ensenada ditch, to fill irrigation reservoirs and "fertilize" the soil with its rich silt.[197] Association members use the Rio Brazos water when the Nutrias runs dry.

Tierra Grande's actions in damming the creek violated laws regarding the building of dams and the diversion of water.[198] Then the State Engineer discovered the lake, and ordered Tierra Grande to breach the dam.[199] After complying with the order, Tierra Grande contracted with two local property owners to purchase their lands and appurtenant water rights.[200] The parties conditioned the purchase upon the State Engineer's approval of the property owners' application for change of use, place of use, and point of diversion of their surface water rights.[201]

The Applicants requested a one-time diversion of 61.32 acre-feet of water from Nutrias Creek to create the lake, and, thereafter, annual diversions of 13.32 acre-feet to compensate for evaporative loss.[202] These diversions necessarily would result in the retirement of agricultural land,[203] because when water rights used to irrigate land are transferred to a nonagricultural use, the previously irrigated land must be retired from agriculture. To offset loss of water from the creek, the Applications proposed to temporarily retire 64.55 acres of irrigated land during the year the lake was filled, then, in the next year, permanently retire 14.02 acres of irrigated land.[204]

In 1982, the Applicants applied for transfer of the surface water rights. The Ensenada Association protested, alleging that the transfer would impair existing rights and would be contrary to the public interest. Relying upon hydrologic studies and a finding that the transfer would not impair existing rights, the hearing officer recommended that the State Engineer approve the transfer application. When the State Engineer acted on this recommendation, the Ensenada Association appealed his decision, and the state district court reversed in a de novo hearing.

At the district court hearing, Ensenada Association argued that the transfer would be contrary to the public interest because it would result in the permanent loss of agricultural land and, inasmuch as ditch maintenance expenses after the transfer would be born by fewer people than before, would increase the financial obligations of individual association members.

Applicants contended that economic development resulting from the proposed resort project would be in the public interest because it would stimulate the local economy. The resort would generate construction jobs, such as the building of second homes, in the Ensenada area. Eventually, the Applicants claimed, the tourist industry associated with the project would provide more local jobs, shifting the populace from an agricultural subsistence economy to an economy based on tourism.[205]

An expert for Ensenada Association countered that the development of tourism/recreational facilities would not improve the financial outlook of people currently residing in the area. The resort project would provide only menial jobs, such as those for waiters and maids. Overall, he said, most local residents would never realize any benefits from the resort economy.[206]

Presiding at the hearing, Judge Art Encinias addressed the conflict between economic and cultural values inherent in the dispute. Although Encinias used the term "public interest" rather than "public welfare," it is clear he considered the terms synonymous. "Northern New Mexicans possess a fierce pride over their history, traditions, and culture," he said, noting that the deeply rooted traditional ties of northern New Mexicans to the land and water are central to maintaining that culture.[207] He observed, further, that the living culture of the northern New Mexico region is recognized at the state and federal levels as possessing significant value that cannot be expressed in monetary terms. "[H]ere," he said, "it is simply assumed by the Applicants that greater economic benefits are more desirable than the preservation of a cultural identity."[208] In opposition to this view, Encinias mentioned that developments such as the resort community in question contribute step-by-step to the destruction of the local culture.[209] Reversing the State Engineer, Encinias stated that "to transfer water rights, devoted for more than a century to agricultural purposes, in order to construct a playground for those who can pay is a poor trade, indeed."[210]

On appeal, the New Mexico Court of Appeals held that the statute in effect at the time of the application precluded the State Engineer from considering broad public interest factors in the transfer of surface water. Because, in a strict hydrological sense, the transfer did not harm existing rights, the court reversed.[211] In response to this dispute, the Legislature in 1985 amended the Water Code to include consideration of public welfare by the State Engineer when reviewing applications to appropriate water or to transfer water rights. Although 11 years have passed, the definition and impact of the term remains unknown.

### 7. Right of Counties to Regulate Domestic Wells

Section 72-12-1 of the water code provides that the State Engineer shall issue permits "for watering livestock, for irrigation of not to exceed one acre of non-commercial trees, lawn, or garden; or for household or other domestic use...."[212] State Engineer regulations set the maximum quantity of water under a section 72-12-1 permit at three acre-feet per annum.[213]

In light of the statutory and regulatory allowance of up to three acre-feet per annum of diversion's from a domestic well, the question arises to what extent counties may seek to implement conservation measures that would operate to reduce pumping from domestic wells to a level below the allowance. New Mexico statutory law recognizes the rights of counties to exercise police powers in order to promote the health, safety and welfare of county residents.[214] Counties, along with municipalities also have a statutory right to regulate water courses and to regulate the flow and use of water in public acequias for irrigating purposes.[215] At present, neither court decisions nor state statutes adequately delineate the extent of which a county may regulate water pumping and usage from domestic wells. The State Engineer's policy is that Section 72-12-1 permits may be conditioned on more stringent county regulations.

### 8. Declaration of Unregulated Basins

The Estancia Basin was first declared within the jurisdiction of the State Engineer on January 31, 1950. Since then, the basin has been extended in 1975 and again in 1994. Today, the basin abuts other regulated basins with the exception of a portion of the southern boundary of the Basin that is contiguous with an undeclared area, essentially south of Mountainair. Given hydrologic flows within the Estancia Basin, the absence of State Engineer regulation over underground water use to the south probably does not pose a threat to Basin water supply. Nonetheless, in conjunction with the State Engineer's development of a new hydrologic model for the Basin, the physical connection between the Basin and the unregulated area should be determined and, if necessary, State Engineer jurisdiction should be extended to the unregulated lands or pertinent portion thereof.

## H. Local Conflicts

### 1. Well Interference

As urbanization continues, it will lead to more and more ground-water withdrawals. As a result, not only will wells affect an underground basin, they will also affect each other. New Mexico statutes prohibit a junior well user from "impairing" the rights of others who have existing wells.[216] The question is thus raised: when does the pumping of one well impair another enough that the new well should be prohibited? The calculus is not easy.

A hypothetical example may illustrate this point. If well owner A decides to put down a well, and pumping from A's well affects well owner B who owns an existing well, the following questions seem appropriate for the State Engineer in deciding whether the effects on well owner B constitute impairment. First, has well owner A designed her well to minimize the effects on B, and has she selected a site which will minimize the effects on B? If the answer to both of these questions is "yes," then the State Engineer should ask the following questions of B. What is the depth of B's well, and what is the depth to water in the aquifer where B's well is located? Finally, what is the water column in B's well? If B has a water column of 75 feet and the pumping by A would lower that water column only 10 feet over the next 50 years, this would definitely affect B's well. This would not, however, constitute impairment. B's well would function as efficiently at the end of 50 years with a water column of 65 feet as it did with 75 feet of water column.

Suppose, however, that B's well has only 20 feet of water column in it, and that after 25 years it will be lowered to a water column of 12 feet. If we assume that the well ceases to function with only 12 feet of water column, this would seem to be an open and shut case of impairment. Unfortunately, additional factors can make the State Engineer's job more difficult.[217]

Suppose the aquifer is 300 feet thick and begins at 20 feet below the ground surface. Suppose further that B chose to drill his well only 40 feet deep to save expenses and that if he had drilled it 80 feet deep, there would have been no impairment problem. Can B choose to tap just the top of the aquifer and foreclose A's junior, but more efficiently constructed, well?

In arguing impairment in this case, B would argue that his well is impaired because 25 years from now, he will have to replace his well with a deeper one as a result of A's pumping. The question that must be asked by the State Engineer is whether the pumping of A has actually caused B to have to replace his well. There may be no easy answer. In virtually all urban aquifers there will be other pumpers who are also having an effect on the aquifer by lowering the water table. If the water table is already declining before A puts in her well, at some point B would have to replace his well even if A did not pump.

In this hypothetical example, suppose that as a result of pumping by other permitted well users, B's well would have to be replaced after 30 years even if A never pumped a drop. Therefore, if A's pumping caused B to replace his well after 25 years, and it would have to be replaced after 30 years even if A didn't pump, then the actual impairment to B is the impact of having to replace his well at the end of 25 years rather than at the end of 30 years. This would mean he would have to expend the capital he would otherwise have to spend in the future, but 5 years earlier. Thus, it is not the capital expenditure that is the damage, as this would have to be spent anyway because of others' pumping. Rather, the damage is the loss of the use of the money for drilling a well for 5 years. However, the loss of the use of that money for 5 years will not occur for 25 years. The actual cost today is the present value of not being able to use the money 25 years from now. At historical interest rates, this cost would not be high. The State Engineer must balance this cost against the benefit to A of drilling a well and supporting her business operation.

If the issue were not complicated enough, another factor may be relevant. Suppose that at the time of drilling A's well, B's well is 30 years old. If the useful life of a well is 50 years, then B's well will have to be replaced anyway before A's well would have any impact. Therefore, A would argue that B's well is not impaired because simple depreciation of the well is requiring the replacement, not A's well. B would counter that because of A's pumping he will have to drill the well deeper in the future, at greater cost, when he does replace his well. Therefore, the additional cost of drilling a deeper well is impairment. A will respond that the actual damage to B today is the present value of B's having to drill his well somewhat deeper 20 years in the future. In this argument, the State Engineer will have to decide whether the depth of a well is part of B's water right or whether the water right is the right to obtain water at reasonable depths with an efficiently designed well appropriate to the aquifer.

Both logic and caselaw support the proposition that one's water right in a well does not include the right to a well of a particular depth. The rational solution for the State Engineer in these cases is to place burdens on the new well driller as well as on the holder of a vested right. First, the new well owner must have selected a site that is designed to minimize the impacts on surrounding wells and have drilled and equipped her well to minimize impacts on other well owners. As to the vested right holder, the State Engineer must (1) not allow an inefficient shallow well to foreclose all future access to the aquifer; (2) distinguish between impacts that are actually caused by the new well owners as opposed to existing and projected impacts caused by pumping by others; (3) determine the practical present effects on the water column within the well of the lowering of the water table; and (4) determine whether the well would have to be replaced anyway because of depreciation of the well itself. Finally, if there are actual effects caused by the new well, the State Engineer should determine whether to condition a well permit on the new well owner's willingness to either compensate the existing well owner for the damage or in severe cases, drill a new well for the existing owner. If a new well would inflict actual costs on persons of modest incomes in the area who are unable to pay the costs, this factor is relevant to the State Engineer's inquiry under the issue of "public welfare" and would certainly present a good case for requiring compensation. However, the State Engineer should not rule that any lowering of the water column in a well is impairment.

The "tradeoffs" between protecting vested rights on the one hand and allowing full development of the aquifer on the other were perhaps best framed by the Colorado Supreme Court in A-B Cattle Co. v. United States.[218] Commenting upon past decisions that protected senior water rights but foreclosed other development, the court stated:

> These decisions are concerned primarily with the respective priorities of vested rights which have been established. It is implicit in these constitutional provisions that, along with vested rights, there shall be maximum utilization of the water of this state. As administration of water approaches its second century, the curtain is opening upon the new drama of maximum utilization and how constitutionally that doctrine can be integrated into the law of vested rights. We have known for a long time that the doctrine was lurking in the backstage shadows as a result of the accepted, though oft violated, principle that the right to water does not give the right to waste it.[219]

The "waste" in A-B Cattle was the possibility that a storage reservoir could not be built if the supreme court upheld an alleged inefficient means of diversion by surface users.[220] The court did not allow that "waste." In the context of ground water, the "waste" caused by interpreting any decline in water levels as "impairment" would be the loss of valuable ground-water resources because senior well owners have drilled shallow wells.

The New Mexico Supreme Court has held that a decline in water level in a well is not per se "impairment." In Application of Brown, the Supreme Court refused to hold that a decline in the water level of 3.9 feet was impairment as a matter of law.[221] Rather, the court held that it was merely a factor to be considered among others, including the particular characteristics of the aquifer.[222]

The issue of reasonable water table declines was addressed most directly in Mathers v. Texaco.[223] As previously discussed, in Mathers an application was filed to appropriate water in the Lea County Underground Water Basin.[224] Prior to any litigation, the State Engineer had recognized that the Lea County Basin would necessarily decline if it was to be utilized at all.[225] As a result, he applied a time dimension to the rights and decided to allow water to be taken by future appropriators at a rate such that, at the end of 40 years, there would be sufficient water left for domestic and nominal uses, but not for commercial agriculture.[226]

The protestants whose wells were being substantially affected by the declines in the water table as a result of new permits argued that under the doctrine of prior appropriation, no new appropriator could lower water levels and deny them their right to the water level they had when they put down their well.[227] In rejecting this argument, the Supreme Court pointed out:

> [If] the position of the protestants be correct, then each and all of the many permits to withdraw waters from this basin issued by the State Engineer, subsequent to the initial permit, have been issued wrongfully and unlawfully, because each withdrawal, to some degree, has caused a lowering of the water level, and thus an impairment of the rights of the initial appropriator.[228]

Judge Bratton also described the issue thoroughly and clearly in a United States District Court decision involving an attempt to drill wells in the then-unregulated lower Rio Grande. In Maestas v. Elephant Butte Irrigation District,[229] Elephant Butte Irrigation District (EBID) had drilled wells in an undeclared basin. Individuals claiming that the pumping of EBID's wells adversely affected the performance of their wells filed suit to enjoin EBID from pumping.[230] Judge Bratton distinguished the integrity of an appropriator's "water right" from the functioning of the means of diversion.[231]

In Maestas, high volume pumping from deeper wells, to supplement the entire water supply of the District, reduced the amount of water discharged by the shallow private wells.[232] This caused surging and caused some wells to pump sand.[233] Judge Bratton refused to grant an injunction, pointing out that the effects the farmers observed "relate only to the functioning of their wells and not to the integrity of their water rights."[234] He found that "at this point in time there is ample water of an acceptable quality available and it is economically feasible to pump it."[235]

The Albuquerque Task Force Subcommittee on impairment commissioned by former State Engineer Eluid Martinez reached a conclusion similar to the Supreme Court and to Judge Bratton.[236] The Subcommittee concluded that if water were available through deepening of wells, it would be appropriate to allow water level declines so long as they were not excessive:

> Drawdown calculations shall be performed in the manner as described . . . to provide the most realistic estimates of drawdown at wells in the area of hydrologic influence. Excessive water level decline is deemed as the drawdown which will result in a certain number or percentage (e.g., 30 percent) of the wells in the area of hydrologic influence to require deepening within a 40-year period.[237]

The Task Force Subcommittee pointed out that a key consideration is whether it would be possible for the senior user to deepen a well. If the saturated thickness was not adequate to allow the well to be deepened, then a replacement supply would have to be developed by the junior appropriator. The report states that "[t]he definition of excessive water level decline will be made on a case-by-case basis. Factors to be considered include the . . . available saturated thickness to enable wells to be deepened."[238]

In New Mexico, even in the area of water quality, a decline in the water level is reasonable if it does not significantly increase effects caused by past pumping. In Stokes v. Morgan,[239] a new well was causing saltwater intrusion in an old well.[240] The court rejected an argument that this was impairment because historical pumping had already begun to cause deterioration in the water quality in the well. The court stated, "[t]his Court has previously held that the lowering of a water table does not necessarily constitute impairment, even though there may be some negative economic impact. . . ."[241] It went on to hold that "protestants have not shown that the proposed move will cause a significant change in the rate of deterioration."[242]

Unlike New Mexico, which addressed reasonable water declines through case law, many western states have dealt with this issue by statute. This is true in Idaho,[243] Kansas,[244] Colorado,[245] Montana,[246] Nevada,[247] and Utah.[248]

### 2. Contradictory Hydrologic Studies

As discussed in Section IV of this report, consensus among hydrologists has not been achieved regarding the Basin hydrology, especially the amount of recharge. Most recently, a study by William Turner in 1992,[249] concluded that the amount of recharge to the aquifer is substantial. Given the contradictory opinions on this subject, it is essential that a thorough and accurate hydrologic study be performed so that the State Engineer may adopt a model and may implement administrative criteria that are realistic and appropriate.

# IV. WATER RESOURCES ASSESSMENT FOR THE PLANNING REGION

## A. Water Supply

### 1. Surface Water Supplies

Surface water supplies in the Basin are limited to relatively small quantities of runoff impounded in stock tanks, Manzano Lake and Sherwood Forest Lake reservoirs, and the salt lakes at Laguna del Perro. Spring flows may provided limited supplies to livestock and wildlife. Manzano Lake and Sherwood Forest Lake are used primarily for wildlife and recreation.

#### a. Precipitation Data and Statistics

Climatological data for the Basin were collected from nine National Oceanic and Atmospheric Administration (NOAA) weather stations in and around the study area. Data for all stations, from the beginning of the period of record to 1994, were retrieved from the National Climatic Data Center (NCDC) Summary of the Day digital database. Data from 1995 were collected from the NOAA Climatological Data Annual Summary for New Mexico. Station locations, elevations, and available parameters are shown in Table 26.

**Table 26. NOAA climatic data recording stations in the Estancia Basin area**

| station name | elevation (feet msl) | latitude | longitude | parameters recorded |
|---|---|---|---|---|
| Clines Corners 7 SE | 7,205 | 34.56 | 105.35 | prec., Tmax, Tmin, snow |
| Estancia 7 NE | 6,106 | 34.51 | 105.58 | prec., Tmax, Tmin, snow |
| Golden | 6,699 | 35.16 | 106.13 | prec. |
| Mountainair | 6,519 | 34.31 | 106.15 | prec., Tmax, Tmin, snow |
| Pedernal 4 E | 6,204 | 34.38 | 105.34 | prec., Tmax, Tmin, snow |
| Progresso | 6,296 | 34.25 | 105.53 | prec., Tmax, Tmin, snow |
| Sandia Crest | 10,686 | | | prec., Tmax, Tmin, snow |
| Sandia Park | 7,018 | 35.10 | 106.22 | prec., Tmax, Tmin, snow |
| Stanley | 6,318 | 35.10 | 105.58 | prec., Tmax, Tmin, snow |

NOAA: National Oceanic and Atmospheric Administration
prec.: precipitation
Tmax: maximum temperature
Tmin: minimum temperature
snow: inches of snow
msl: mean sea level

Total annual precipitation data were collected for each station. Total annual precipitation was compared to the departure from normal for each station. While departure from normal is published in the NOAA Climatological Data Annual Summary for New Mexico, it was not available in the NCDC digital data. For the years prior to 1995, deviation from normal was derived by comparison of a given annual total to the mean for the period of record. Graphs of total annual precipitation with departure from normal are included in Appendix 4.

Average annual precipitation was compared with the respective station elevation to provide information for an estimate of average precipitation over the Basin (Fig. 9). Table 27 shows the average annual precipitation for the period of record for each station.

**Table 27. Average annual precipitation for NCDC recording stations for the period of record through 1995, in and near the Estancia Underground Water Basin**

| station name | average precipitation, inches |
|---|---|
| Clines Corners 7 SE | 18.81 |
| Estancia 7 NE | 12.18 |
| Golden | 13.79 |
| Mountainair | 13.11 |
| Pedernal 4 E | 11.33 |
| Progresso | 13.17 |
| Sandia Crest | 22.87 |
| Sandia Park | 18.68 |
| Stanley | 12.26 |

NCDC: National Climatic Data Center

### b. Drainage Basins and Watersheds

The Estancia Underground Water Basin is a closed basin and encompasses an entire watershed. The watershed area is 2,260 square miles and includes the majority of Torrance County, the southern portion of Santa Fe County, and small portions of eastern Bernalillo County, and western San Miguel County. Surface water flows are generally ephemeral and drain toward the center of the Basin.

### c. Streamflow Data and Statistics

There are no perennial streams in the Basin. Spring flow provides small discharges to the drainages in select portions of the Basin. However, these surface flows ultimately infiltrate into the underlying sediments or are lost through evapotranspiration. Many of the drainages have surface flows only during periods of rapid snowmelt or high precipitation events.

### d. Evaporation Data and Statistics

Evaporation from Laguna del Perro and the other nearby salt lakes was estimated by Smith (1957) and DeBrine (1971). Smith (1957) reported the pan evaporation in the Estancia Valley to range from 65 to 76 inches per year, and estimated that the evaporation from the salt lakes (playas) would be less than pan evaporation because evaporation is less for a larger body of water and saline water evaporates more slowly. He assumed that 50 inches of ground water was lost to evaporation per year at the playas and that the total evaporation from the playas was about 50,000 acre-feet per annum. The study performed by DeBrine (1971) indicated that between 27,000 and 36,000 acre-feet per annum of ground water is lost to evaporation from the playas.

Titus (1969) reviewed the evaporation estimate from the playas by Smith (1957). Titus (1969) suggested that the total evaporation from the playas may be two or more times lower than estimated due to the decreased evaporation rate from wet mud or water in a salt crystal mesh.

The NMSEO does not monitor evaporation from the salt lakes. The NMSEO does compile data for other surface water bodies in the Basin which include stock ponds, Manzano Lake, and Sherwood Forest Lake. The net evaporation from these sources was reported as 1,959 acre-feet per annum in 1980.

Evaporation data are available from the Estancia weather station, and indicate a range of total evaporation ranging from about 15 to 54 inches per annum. No other evaporation data were available from the eight other NOAA weather stations in and near the area.

**e. Surface Water Yields**

Surface water yields in the Basin occur predominantly as spring flow, and ephemeral flows associated with storm events and snow melt. Flows move from the Basin margins toward the central portion of the Basin.

The U.S. Geological Survey (USGS) does not have any gages which measure daily flows within the Basin. The USGS does have six stations at which it measures peak flows in select drainages, and these are 1) Estancia Valley tributary at Cedar Grove, 2) Juan Tomas Canyon near Edgewood, 3) Osita Draw near Clines Corners, 4) Canon de Torreon at Torreon, 5) Arroyo del Cuervo near Torreon, and 6) Big Draw near Mountainair. Surface water flows within the Basin can vary from no flow during most of the year to peak flows exceeding several thousand cubic feet per second (cfs).

The USGS has inventoried numerous springs throughout New Mexico including many within the Estancia Underground Water Basin. The USGS (White and Kues, 1992) reports 34 springs in Torrance County, 30 of which are within the Basin, no springs in Santa Fe County within the Basin, and 4 springs in Bernalillo County within the Basin (see potentiometric elevation map, Fig. 13). At least two springs not inventoried by the USGS are known to be within the study area in Santa Fe County (personal communication, Bud Hagerman, 1996) and are also shown on Figure 13.

Discharge from springs in Bernalillo County within the study area ranged from less than 1 to 30 gpm in 1963 (White and Kues, 1992). Discharge from springs in the Chilili Grant are reportedly from joints in rock. Discharge from a spring about 3 miles northeast of Escabosa is reported to be fault controlled. Spring discharge in Torrance County within the Basin ranged from less than 1 to 20 gpm, unfortunately yields from many of the springs were not reported. The nature of the rock or sediments from which the springs flow was generally not reported in the Basin. Tables generated by White and Kues (1992) listing other data such as location, elevation, discharge rate, and water-quality data for each spring are included in Appendix 5.

Flows from selected eastward-flowing springs, drainages, and arroyos in the Manzano Mountains were measured intermittently from December 1985 to September 1987 (White, 1994). Flow rates ranged from 0.0 to 23.1 cubic feet per second (cfs). One cfs equals 448.8 gallons per minute. Flows were measured where drainages cross State Highway 337 (South Highway 14) and at a location between Manzano Spring and Manzano Lake. Table 28 shows the locations, measured flow, and the date of measurement for data collected by White (1994). Discharges measured in April 1987, and to a lesser degree, June 1987, were substantially greater than flows measured during other months. The increased flows were likely due to surface discharge resulting from snowmelt or rain.

**Table 28. Measured flow, date of measurement and location for selected springs, and drainages in the Estancia Underground Water Basin**

| drainage or spring | discharge, cubic feet per second | | | | | |
|---|---|---|---|---|---|---|
| | Dec. 4, 1985 | Mar. 26, 1986 | Oct. 23, 1986 | Apr. 2, 1987 | June 16-17, 1987 | Sept. 24, 1987 |
| Arroyo de Yrisarri at junction of Highways 337 and 222 | 0 | 0 | 0 | 0 | 0 | 0 |
| Canada de Escabosa at Highway 337 | 0 | 0 | 0 | 0.05 | 0.06 | 0.01 est. |
| Canon de Chilili at Highway 337 | 0.50 | 0.44 | 0.18 | 10.9 | 5.17 | 0.61 |
| Canada de la Perra at Highway 337 | 0 | 0 | 0 | 1.26 | 0.84 | 0 |
| Canon de Tajique at Highway 337 | 0.24 | 0.26 | 0.15 | 23.1 | 4.55 | 0.29 |
| Canon de Torreon at Highway 337 | 0 | 0.1 est. | 0.43 | 20.5 | 5.29 | 0.51 |
| Arroyo del Cuervo at Highway 337 | 0 | 0 | 0 | 0 | 0.13 | 0 |
| Arroyo de Manzano at Highway 337 | 0 | 0 | 0 | 6.53 | 0.20 | 0 |
| Manzano Spring, between spring and lake | 0.47 | 2.46 | 1.51 | 9.57 | 1.80 | 0.29 |
| Canon de los Pino Reales at Highway 337 | - | - | 0 | 3.0 est. | 0.01 est. | 0 |
| Canon del Chato at Highway337 | - | - | 0 | 2.0 est. | 0 | 0 |
| Canon Colorado at El Gato at Highway 337 | - | - | 0 | 6.0 est. | 0.73 | 0.2 est. |
| Canon Sapato near Punta de Agua at Highway 337 | - | - | 0 | 6.0 est. | 0.73 | 0.2 est. |
| total | 1.21 | 3.26 | 2.35 | 83.2 | 18.9 | 2.02 |

Table modified from White, 1994
est.: estimate

White (1994) measured surface water flow at selected locations in Canon de Tajique (Arroyo de Tajique) and Canon de Torreon (Torreon Draw) May 28 through 29, 1985, and July 8, 1987, respectively. Flow in Canon de Tajique began as spring flow in a tributary at an elevation of 7,800 feet above mean sea level, and reached a maximum of 6.61 cfs at the Village of Tajique on the east side of Highway 337. Surface water flow in Torreon Draw began at springs in the Manzano Mountains at an elevation of about 7,900 feet above mean sea level, and reached a maximum flow of 2.21 cfs east of Highway 337.

### f. Uses of Surface Water

Surface water uses are fairly limited due to the relatively small number of springs and their relatively small discharges. Surface water is generally used for stock watering, wildlife, and possibly for limited domestic supplies.

### g. Water Supply Facilities

There are no known surface water supply facilities for community, municipal, or industrial uses.

## 2. Ground-Water Supplies

### a. Geologic Data

#### i. Geologic Structure and Units

The Estancia Basin is structurally bounded on the west by the eastward dipping rocks of the Manzano Mountains. The eastern structural boundary is the uplift associated with the Pedernal Hills. The northeast boundary is formed by the Tertiary-age intrusive and Precambrian-age rocks at South Mountain and the San Pedro Mountains. The southeastern boundary is formed by the Precambrian-age rocks in the Gallinas Peak area.

The expression of faulting at the surface is not dominant in the study area. Several relatively extensive northeast-trending faults have been mapped by Titus (1980) south of Chilili. Other faults trending northeast and northwest are present from northeast of Chilili to South Mountain. Titus (1969) reports the east side of the Basin has probably been faulted down against the west side of the Pedernal uplift. Oil-test holes provided evidence for the faulting and suggested a minimum vertical displacement of 650 feet between test holes drilled in Township 6 North, Range 11 East, Section 31, and Township 6 North, Range 9 East, Section 19. Both holes passed through the Madera into the underlying Precambrian rock.

The geologic units which crop out in the Estancia Underground Water Basin are shown on Figure 10, and geologic cross-sections are shown on Figures 11 and 12. Precambrian, Pennsylvanian, Permian, Triassic, Tertiary, and Quaternary-age units are present in the study area. These units are described in ascending order below.

Precambrian-age rocks are present in outcrop primarily the eastern Manzano Mountains, eastern Pedernal Hills, and Cerrito del Lobo. Precambrian rocks in the area consist of igneous and metamorphic, and include granite, quartzite, and schist (Smith, 1957).

Pennsylvanian-age rocks consist of the Sandia Formation and the overlying Madera Formation in the northwestern portion of the study area. In the Manzano Mountains, the Madera Formation is referred to as the Madera Group of Pennsylvanian and early Permian age (Myers, 1982). The Sandia Formation was deposited on the erosional surface of the Precambrian. The Sandia Formation ranges in thickness from 10 to about

200 feet, and consists of interbedded sandstone, shale, limestone, conglomerate, and siltstone.

In the Manzano Mountains, the Madera Group includes three units, which are the Los Moyos Limestone, Wild Cow Formation, and Bursum Formation. The Los Moyos Limestone gradationally overlies the Sandia Formation. The Los Moyos Limestone is about 590 feet thick and consists of cliff-forming beds of limestone with minor interbeds of shale, sandstone, and conglomerate. The Wild Cow Formation overlies the Los Moyos Limestone and ranges in thickness from about 200 to 620 feet thick. The Wild Cow Formation consists of interbeds of arkosic sandstone, sandstone, conglomerate, siltstone, and shale. The early Permian-age Bursum Formation gradationally overlies the Wild Cow Formation. The Bursum Formation is present only in the southern portion of the Manzano Mountains. The Formation is up to about 95 feet thick and consists of limestone, sandstone, siltstone, and shale.

Permian-age units in the study include the Abo Formation, Yeso Formation, Glorieta Sandstone, and San Andres Limestone. The Abo Formation crops out primarily in the southern portion of the Manzano Mountains. The thickness of the Abo ranges from about 700 to 900 feet; it consists predominantly of shale, sandstone, and minor conglomerate (Smith, 1957).

The Yeso Formation conformably overlies the Abo Formation. The Yeso crops out primarily in the east-central and southwestern portions of Torrance County. The Yeso ranges in thickness from 600 to 1,000 feet thick and consists of sandstone, gypsum, siltstone, limestone, and shale (Smith, 1957). Titus (1969) reports the Yeso to be more than 1,000 feet in the east-central portion of the Basin at Township 6 North, Range 10 East, Section 21, and only about 150 feet thick 4 miles to the west in Township 6 North, Range 9 East, Section 19. This indicates the Yeso was thinned by erosion prior to the deposition of the valley fill.

The Glorieta Sandstone conformably overlies the Yeso Formation and crops out primarily in the eastern, and north- and south-central portions of Torrance County. The Glorieta Sandstone is yellow to white, well-sorted, and well-cemented. The Glorieta ranges in thickness from about 150 to 280 feet (Smith, 1957).

The San Andres Limestone crops out primarily in the south central and northwestern portions of Torrance County. The San Andres Limestone is up to 200 feet thick and consists of limestone containing numerous solution channels, gypsum, and sandstone (Smith, 1957).

Triassic-age units include the Santa Rosa Sandstone and the Chinle Formation and are shown on the geologic map as one unit. These units may exceed 350 feet in thickness. The Santa Rosa Sandstone consists of a gray and white sandstone containing limestone and quartz pebbles. The Chinle Formation consists of red shale with interbedded sandstone.

Tertiary-age intrusive rocks crop out in areas between Encino and Duran, and it is possible that these rocks are a sill or a series of sills, and may be related to the Gallinas Mountains intrusive center (Smith, 1957). Tertiary-age monzonitic rocks crop out at South Mountain and the San Pedro Mountains (Titus, 1980). Tertiary-age dikes and sills are present primarily in the southwestern portion of Torrance County.

Quaternary-age sediments include valley-fill material, lake and dune deposits, and alluvium along drainage channels and mountain valleys. Valley-fill sediments consist of up to 400 feet of silt, sand, and gravel (Titus, 1980, and NMSEO, 1996). Lake and dune deposits range in thickness from 30 to 80 feet and consist predominantly of clay, shale, gypsum, and minor interbeds of sand (Smith, 1957). Alluvial sediments are up to several feet thick, and consist of sand, silt, clay, and gravel.

**ii. Water Bearing Characteristics by Basin**

Precambrian-age rocks are generally not considered major aquifers because they provide only limited quantities of water to wells. Smith (1957) reported that there were several windmill wells completed in these rocks that were capable of supplying a quantity sufficient for domestic or stock uses, but that the quality was poor. Smith reports the highest-yielding well completed in Precambrian-age rocks produced 100 gallons per minute (gpm) with a drawdown of 60 feet. The well was owned by the Atchison, Topeka & Santa Fe Railway and was about 3 miles north of Negra. White (1994) studied the hydrology of the Estancia Basin and indicated that no wells inventoried for his study produced water from the Precambrian-age rocks. Generally, wells completed in these rocks are capable of producing only a few gallons per minute.

Few wells are completed in the Sandia Formation because it crops out near the summits of steep slopes in the Manzano Mountains where few wells are drilled. Where it is present in other portions of the study area, it is at relatively great depths and few wells are completed in the formation because there are other water-bearing units at shallower depth.

For the purposes of the hydrogeologic interpretation, the Madera Formation and Group will be referred to as the Madera Group. The Madera Group is the principal aquifer in the west central and northwestern portions of the study area. The Madera supplies water to wells through fractures along bedding planes, fracturing resulting from faulting, solution channels, and cavernous areas. Wells completed in the Madera are capable of producing quantities from less than 1 to more than 1,000 gpm. Most wells completed in the Madera produce from about 1 to 15 gpm. Unusually high well yields have been reported in Townships 6 to 8 North, Ranges 7 and 8 East. A well at Township 7 North, Range 7 East, Section 1.233 was reportedly pump tested at 1,470 gpm, and other nearby wells have reported yields up to 450 gpm (Titus, 1980). Many "dry" holes have also been drilled into the formation where the rock was not fractured enough to yield water to wells; wells which yield less than 1 gpm are often considered dry holes. Well yields between the towns of Edgewood and Cedar Grove have well yields which range from about 24 to 72 gpm (Kues, 1990).

The specific yield of the Madera Formation is reported by Titus (1980) to be 1 percent or less. The specific yield refers to the ratio of water that will drain from a volume of saturated rock, under the influence of gravity, to the volume of rock. The specific yield does not give an indication of the time it takes for the water to drain from the saturated rock. Locally, in areas where the aquifer is highly fractured, solution channels are prominent, or cavernous conditions exist, the specific yield of the aquifer may be as high as 2 to 3 percent.

Titus (1980) collected data from 300 holes drilled into the Madera Group in the Sandia and Manzano Mountains. He reports that within the upper 600 feet, the permeability of the limestone decreases with depth. However, Titus (1980) reports that two wells drilled outside the Basin, at the Ideal Cement Company Plant at Tijeras, had significant increases in permeability at depths exceeding 1,000 feet. It is possible that the increased permeability is the result of nearby faulting and, therefore, significant increases in permeability at relatively great depths in the Madera Group may not be present in other areas.

The Abo Formation does not appear to be a major aquifer in the study area. The Abo is known to produce yields of a few gallons per minute, which is sufficient for supplying water for domestic purposes. Near Punta de Agua, Smith (1957) reports a well drilled 400 feet into the Abo which yielded 3 gpm. The specific yield of the Abo northwest of the study area was reported to be 0.10 (Shomaker, 1984).

The Yeso Formation is the principal aquifer north and east of Chupadera Mesa. Wells completed in the Yeso yield from several to more than 3,000 gpm (Smith, 1957). Water-supply wells for the Town of Mountainair are completed in the Yeso about 4 miles northeast of the town, and produce from 100 to 300 gpm. Smith (1957) reported two wells completed in fractured Yeso, Township 7 North, Range 10 East, Section 18.431 and Township 7 North, Range 10 East, Section 19.112, which were pump tested at 3,000 and 2,250 gpm, respectively. The fracturing increased the transmissivity of the aquifer. Transmissivity refers to the capacity of an aquifer to transmit water. Yields from wells completed in the Formation are substantially less than those mentioned above and would generally be less than 15 gpm.

The Glorieta Sandstone is the principal aquifer near the north, south, and eastern sides of Lobo Hill. Wells completed in the Glorieta Sandstone may yield from several to more than 1,000 gpm depending on the amount of fracturing (Smith, 1957). Some irrigation wells north of Moriarty were reported to have been completed in the Glorieta and the overlying valley fill.

The San Andres Limestone is above the water table throughout the study area. Precipitation can easily enter the limestone where it crops out at the surface (Smith, 1957). This allows recharge to underlying rocks.

Triassic-age rocks provide water to wells in the northeastern portion of the study area. Wells completed in these rocks provide adequate water quantity for domestic and stock uses.

Tertiary-age intrusive rocks generally do not provide large quantities of water to wells. Locally, it is possible that these rocks are sufficiently fractured or weathered to provide limited quantities of water for domestic and stock uses. Water quality will likely be highly variable, and depend on the type of igneous rock and the overlying rocks, or sediments, through which the water flowed. Yields will generally be on the order of a few gallons per minute.

Quaternary-age valley fill is the principal aquifer in the central portion of the Estancia Underground Water Basin. The valley fill extends from the south central portion of Santa Fe County to the southern portion of Torrance County. The saturated portion of the valley fill sediments encompass an area of approximately 625 square miles. Wells completed in the valley fill provide yields ranging from several to hundreds of gallons per minute. Most irrigation wells in the Basin are completed in the fill. The greatest irrigation withdrawals occur from several miles north of Moriarty to several miles south of Willard.

Quaternary-age lake and dune deposits have relatively low permeability and provide only enough water to wells for domestic and stock purposes. Water quality is not expected to be high because gypsum was deposited with these sediments.

Quaternary-age alluvial sediments in drainages can provide limited quantities of water to wells for domestic and stock purposes. Yields are generally low because the alluvium is relatively thin. If the alluvium overlies relatively permeable rock, such as fractured limestone or sandstone, it is not likely to provide water to wells because the water will infiltrate through the alluvium and recharge the underlying rocks.

### iii. Geologic Cross-Sections by Basin

Two geologic cross-sections were made for the Basin and are provided as Figures 11 and 12. The geology shown on the cross-sections was discussed in detail in the previous sections.

### iv. Geologic Control of Water Resources

Geologic control of ground-water resources is determined by the physical characteristics of the sediments and rocks in the Basin and can be highly variable. The hydraulic conductivity of an aquifer is generally one or more orders of magnitude greater in the horizontal direction than in the vertical direction. This is because the physical properties of rocks and sediments are more homogeneous horizontally. Greater hydraulic conductivity values indicate that ground water can move more readily through the rocks or sediments.

Physical properties of the aquifers such as 1) size and extent of fractures, 2) presence of solution channels and caverns, 3) dominant grain size, 4) degree of cementation of the rock matrix, 5) orientation of the beds, and 6) horizontal and vertical continuity of the beds will control ground-water movement, the quantity that can be stored, and the yield of wells. For example, in areas where the limestone or sandstone aquifers are highly fractured, or solution channels are extensive in the limestone, yields from wells will be significantly greater than in areas where fractures and solution channels are sparse. The water-supply wells for the Town of Mountainair are completed in limestone in the Yeso Formation which apparently is fractured cavernous, and well yields range up to 500 gallons per minute (Smith, 1957). The Yeso Formation in other areas is capable of providing yields which are adequate only for domestic or livestock uses, yet in fractured areas between Cerrito del Lobo and Laguna del Perro, yields of up to 3,000 gpm have been reported (Smith, 1957).

Fracturing of bedrock aquifers in the Basin was the result of movement of rocks along and adjacent to faults. While faulting can increase the permeability of rocks it can also create clay gouge along the fault which can reduce the permeability of the rocks and limit ground-water flow along or across the fault. The effects of faulting should be assessed at specific sites to determine the local control of ground water.

## b. Hydrogeology Data by Aquifer

### i. Location and Extent of Aquifers

#### a) Areal Extent

The areal extent of each aquifer was estimated by comparing the published geologic data (Fig. 10) with the 1995 potentiometric surface elevation map (Fig. 13). The area of each rock unit beneath the potentiometric surface was measured per township using a planimeter and is shown in Table 29.

**Table 29. Area extent of aquifers in the Estancia Underground Water Basin**

| aquifer | horizontal extent, square miles |
|---|---|
| valley fill | 625 |
| San Andres Limestone | 89 |
| Glorieta Sandstone | 486 |
| Yeso Formation | 1,023 |
| Abo Formation | 11,513 |
| Madera Group (includes Sandia Formation) | 1,913 |

#### b) Aquifer Thickness

The saturated thickness of the valley fill was estimated by comparing the thickness of the valley fill (Fig. 14, modified from unpublished NMSEO data) and the 1995 potentiometric surface elevation contours shown on Figure 13. The saturated thickness of each bedrock aquifer within the Estancia Basin was determined first by examining each township within the Basin. Characteristics, such as surface geology, elevation of Precambrian basement, alluvial thickness, valley fill thickness, potentiometric surface elevation, and projected locations of geologic contacts in the subsurface were examined for each township. In townships where the geologic relations appeared to be complex, the township was divided into smaller areas, so that the saturated thickness of the Paleozoic aquifers could be estimated.

The elevation of the Precambrian basement in each township was determined from the map of the basement by Foster and Stipp (1961) (see Fig. 15). The elevation of the potentiometric surface was then compared with the basement elevation in order to determine the total saturated thickness of alluvium and bedrock in each township. The saturated thickness of the valley fill was then subtracted from this total in order to determine the total saturated bedrock thickness.

The average stratigraphic thickness of each Paleozoic-age unit was used in determining the individual saturated thickness of each unit in each of the townships. Oil-test-well logs were used where available in order to provide control on the thickness of the units in each of the townships. It was assumed in most areas that where the total calculated saturated thickness was less than the sum of the estimated maximum stratigraphic thickness of each of the Paleozoic units, that the uppermost units must have been removed by erosion prior to the deposition of the valley-fill. Variations in the thicknesses of the lowermost units, such as the Madera, Abo, and Yeso Formations, were also taken into account along the margins of the Basin, and in the area proximal to Lobo Hill. In areas where the calculated saturated thickness of the Paleozoic aquifers exceeded the sum of the maximum average stratigraphic thicknesses of the units, it was assumed that the Precambrian basement was actually higher than shown on the map by Foster and Stipp (1961), rather than assuming over-thickened Paleozoic units in that location. Table 30 lists the range of average saturated thickness for each stratigraphic unit used to estimate the ground water in storage.

**Table 30. Range of average saturated thickness for stratigraphic units used to estimate ground water in storage in the Estancia Underground Water Basin for 1995**

| stratigraphic unit | range of average saturated thickness used to estimate ground water in storage, feet |
|---|---|
| valley fill | 50 to 325 |
| San Andres Limestone | 50 to 150 |
| Glorieta Sandstone | 50 to 215 |
| Yeso Formation | 35 to 800 |
| Abo Formation | 100 to 800 |
| Madera Group (includes Sandia Formation) | 100 to 1,165 |

### c) Aquifer Storage Amounts

The quantity of water in storage in the valley fill was estimated by the NMSEO based on the estimated quantity of water pumped from January 1948 to January 1965 and the corresponding water-level declines. The NMSEO assumed a specific yield of 0.125, and the corresponding ground water in storage in the valley fill sediments was estimated to be 8,013,151 acre-feet in 1965.

JSAI estimated the quantity of water in storage in the valley fill material by multiplying the average saturated thickness of the valley fill material by the specific yield for the sediments which was previously estimated by the NMSEO. The estimated ground water in storage for 1995 was 6,580,000 acre-feet. JSAI estimated that 1,410,000 acre-feet of ground water has been mined from the Basin since 1910. This indicates a volume of about 8,000,000 acre-feet of ground water in storage in the valley fill in 1910, which is a slightly lower quantity than estimated by the NMSEO.

The area where the individual Paleozoic aquifers are present in the subsurface were measured using a planimeter. Each area was then multiplied by the estimated saturated thickness of each of the units per township. This calculation yielded a volume estimate for each aquifer. This saturated volume was then multiplied by the assumed average specific yield for each aquifer to estimate the volume of ground water in storage in each of the units. This procedure takes into account variations in saturated thickness of units in the various parts of the Basin, and is a much more exacting method than assuming an average saturated thickness for each of the aquifers over the entire Basin. Table 31 is a summary of estimates of ground water in storage for the extensive aquifers in the Basin. Estimates of ground water in storage were not made for Precambrian-age rocks because of the large variability in the capability of these rocks to yield ground water to wells.

**Table 31. Summary of estimates of 1995 ground water in storage in the Estancia Underground Water Basin**

| aquifer | specific yield | ground water in storage, acre-feet |
|---|---|---|
| valley fill | 0.125 | 6,580,000 |
| San Andres Limestone | 0.01 | 67,155 |
| Glorieta Sandstone | 0.15 | 5,854,925 |
| Yeso Formation | 0.10 | 23,787,357 |
| Abo Formation | 0.10 | 44,877,728 |
| Madera Group (includes Sandia Formation) | 0.01 | 11,065,988 |

Although there is a relatively large quantity of ground water in storage in several of the aquifers in the Basin, the aquifers may not readily yield water to wells unless fracturing has enhanced permeability. This is particularly true for the Abo and Yeso Formations. Well yields of up to 20 gpm were reported from the Abo Formation northwest of the study area with specific capacities up to 0.29 gpm per foot of drawdown (Pearson et al., 1995). Well yields for the Abo and Yeso Formations in the Basin should generally be expected to be less than 20 gpm.

The specific yield is the volume of water that will drain under the influence of gravity from a volume of aquifer. The specific yield does not indicate how long it takes for water to drain from the aquifer material. In general, fine-grained sediments are capable of storing more water than coarse grained sediments because fine-grained sediments have more pore space. However, fine-grained sediments will release water from storage more slowly than coarse-grained sediments.

Water quality may also limit the usefulness of ground water in select areas. For example, ground water in the valley fill sediments in the southeastern portion of the study area has high total dissolved solids concentrations which can limit its use for irrigation, domestic, and industrial supply. Gypsum beds are present in the Yeso Formation and when present in the saturated portion of the formation, the gypsum increases the total dissolved solids concentration of the water.

### ii. Aquifer Storage Characteristics

#### a) Specific Yield and Transmissivity

Storage coefficients used by JSAI to estimate ground water in storage are shown in Table 32. The aquifer characteristics for the principal hydrogeologic units in the Basin are listed in Table 32. The values given in the table are those reported by the person or firm that tested the well. JSAI has only presented the reported data and did not attempt to evaluate the pumping-test data to assess the results.

The specific capacity of a well is the rate at which a well will yield water per unit of drawdown, and in this report is expressed as gallons per minute per foot of drawdown (gpm/ft). Transmissivity is the capacity of an aquifer to transmit water and in this report is expressed in units of feet squared per day ($ft^2/d$). The specific yield is the ratio of water that will drain from a volume of saturated rock, under the influence of gravity, to the volume of saturated rock, and is expressed as a percent or a decimal fraction.

**Table 32. Reported aquifer characteristics for the Madera Group and valley fill in the Basin**

| reference | well location | specific capacity, gpm/ft | transmissivity, feet$^2$/day | specific yield | geologic unit |
|---|---|---|---|---|---|
| DeBrine, 1971 | T6N.R9E.16.333 | - | 1,340 | 0.00029 | valley fill |
| DeBrine, 1971 | T6N.R9E.20.244 | - | 1,680 | 0.0019 | valley fill |
| Geoscience Consultants, 1974 | T8N.R7E.29.341 | - | 1,340 | 0.00002 | Madera Group |
| Summers, 1975 | T9N.R6E.36.322 | - | 4,630 to 4,840 | 0.00011 (assumed) | Madera Group |
| Turner, 1984 | T9N.R8E.10.324 | 6.4 | 227 to 245 | Sy = 12.5 (assumed) | valley fill |
| Jenkins, 1980 | T10N.R7E.4.242 | - | 10,000 to 40,000 | 0.01 (assumed) | Madera Group |
| Earth Environmental Consultants, 1974 | T10N.R7E.23.111 | 178 | 82,000 | 0.038 to 0.05 | Madera Group |
| Jenkins, 1980 | T11N.R7E.28.442 | - | 400 | | Madera Group |

gpm/ft: gallons per minute per foot

The NMSEO (1965) suggested a specific yield of 12.5 percent as an average value for the valley fill. The value was selected after the NMSEO estimated the quantity of ground water pumped in the Basin from January 1948 to January 1965, and compared the volume of valley fill that had been dewatered over the same time period. The NMSEO selected an average transmissivity value of 4,010 ft$^2$/d for the valley fill material.

Additional data regarding the transmissivity and storage coefficient were compiled by the NMSEO for the Basin, and has not been published by the NMSEO to date. Much of the data came from unpublished NMSEO, USGS and Bureau of Land Management sources. Transmissivity ranges for the Madera Group, Glorieta Sandstone, and the valley fill based on these data are shown in Table 33. Transmissivity ranges for the San Andres Limestone, Glorieta Sandstone, Abo Formation, and Yeso Formation in the study area were not available.

**Table 33. Transmissivity ranges for the Madera Group, Glorieta Sandstone, and valley fill aquifers in the Estancia Underground Water Basin**

| aquifer | transmissivity range, feet$^2$/day | average transmissivity, feet$^2$/day |
|---|---|---|
| valley fill | 226 to 21,277 | 5,382 |
| Glorieta Sandstone | 4,010 to 51,778 | 20,082 |
| Madera Group | 401 to 1,300,000 | 150,040 |

### iii. Ground-Water Recharge

#### a) Sources

Ground-water recharge occurs as rain and snowmelt infiltrate into rock outcrops and the valley fill. The majority of recharge is likely to the Madera Group, the Glorieta Sandstone, and to the valley fill. Recharge to the Madera Group would be through fractures, and solution channels. Recharge to the Glorieta Sandstone would be through fractures in the rock and along bedding planes. Recharge to the limestone or the sandstone occurs where the fractured or solution-channeled rocks crop out or are overlain by relatively permeable soils, shallow alluvium, and shallow valley fill. Recharge to the valley fill is from precipitation and spring flow infiltrating along arroyos and drainages, and from water moving vertically upward from underlying aquifers. The rates of vertical upward ground-water flow into the valley fill from underlying aquifers has not been quantified and will likely be highly variable throughout the Basin.

It appears the Madera Group, at least locally, provides recharge to the valley fill. Evidence for this is in the northwest portion of T.7N., R.8E. where there have been increases in the potentiometric surface elevation (ground-water mounding) in the valley fill aquifer. The mounding is probably not related to recharge to the valley fill from nearby drainages, but rather from water rising up from the underlying Madera Group aquifer. At least three wells completed in the area of ground-water mounding were reported to have been drilled deep enough to penetrate into the Madera Group aquifer. If the wells were not completed such that the Madera Group was sealed off from the overlying valley fill, the ground water would be able to flow upward, assuming there is an upward vertical gradient in the Madera aquifer at this location, and increase the ground-water elevation in the valley fill.

The majority of recharge to the Basin probably occurs where the Madera Group is present in outcrop and has sufficient permeability to allow water to enter the rock readily. The Madera Group is known to be fractured and cavernous in northwestern portions of the Basin near the Cedar Grove area, and it is fractured in outcrop in many other places. It is likely that the Madera Group provides recharge to valley fill where the head (ground-water elevation) is higher in the Madera Group than it is in the valley fill and the valley fill lies directly over the Madera Group. This recharge from the Madera Group to the valley fill is probably substantially greater than the quantity of recharge to the valley fill from springs and runoff in drainages, because recharge can readily enter permeable portions of the Madera Group and the Madera immediately underlies the valley fill throughout much of the west central portion of the Basin. The hydraulic connection between the Madera Group aquifer and the overlying valley fill is poorly understood. No wells have been completed in the Madera Group and the valley fill solely for the purpose of assessing the hydraulic interaction between these aquifers.

**b) Rates**

The rate of recharge to the Basin may be assumed to equal natural discharge from the Basin via evaporation from the salt lakes, which has been estimated to range from 27,000 to 50,000 acre-feet per annum (DeBrine, 1971 and Smith, 1957, respectively). Smith (1957) assumed that the system was in equilibrium prior to large-scale ground-water development in the area, and that discharge from the Basin was still about equal to recharge as recently as 1957.

The majority of recharge is to the Madera Group which crops out over about 244 square miles on the western portion of the Basin. Recharge may range from 0 to more than 10 percent of the total precipitation on the outcrop depending on the permeability of the rocks where they crop out. Small quantities of recharge also occur to other rock outcrops in the Basin. Evidence for this is that the ground-water flows from the Basin margins (recharge areas) towards discharge areas in the central portion of the Basin. The quantity of recharge to the different aquifers and the hydraulic relation between these aquifers is unknown because no data are currently available.

Recharge estimates for the Basin, excluding arroyos and drainages, were made by assuming recharge occurs at, or near, the Basin margins, and that the recharge is distributed equally along a given segment of the Basin perimeter. Ground-water recharge estimates for the Estancia Basin are based on rates developed for the Albuquerque Basin (Kernodle et al., 1995) and applied to basin lithologic boundaries as follows.

1) Manzano Mountains: 0.75 cfs per mile, along the Madera Group--Quaternary alluvium boundary, from Manzano Peak to the west side of South Mountain.
2) north basin: 0.15 cfs per mile, along the basin boundary, from east side of South Mountain eastward to the Triassic-age outcrops.
3) northeast basin: 0.05 cfs per mile, along the eastern boundary of the Triassic-age outcrops, from approximately White Lakes to Clines Corners.

4) east basin: 0.1 cfs per mile, along the Pre-Cambrian-age outcrop and the valley fill boundary, from approximately Clines Corners to Willard.
5) south basin: 0.15 cfs per mile, along the Glorieta Sandstone and the valley fill boundary, from approximately Willard to Manzano Peak.

**Table 34. Recharge estimates along the Estancia Underground Water Basin perimeter**

| area | average recharge per mile, cfs | length of recharge perimeter, miles | annual recharge, ac-ft/an |
|---|---|---|---|
| Manzano Mountain | 0.75 | 51 | 27,710 |
| north basin | 0.15 | 22 | 2,391 |
| northeast basin | 0.05 | 18 | 652 |
| east basin | 0.10 | 29 | 2,101 |
| south basin | 0.15 | 45 | 4,890 |
| total | | | 37,744 |

cfs: cubic feet per second
ac-ft/an: acre-feet per year

**c) Variability**

Recharge is variable in the Basin and depends on fluctuations in the annual precipitation and evaporation rates. In areas where rocks and sediments have greater permeability at and near the surface the potential for recharge is greater. Site specific studies have not been performed to assess the variability of recharge to specific rocks or sediments, or in particular locations in the Basin.

The quantity of recharge will vary due to fluctuation in annual precipitation. Precipitation deviations from normal, either above average or below the annual average, for the stations monitored in and near the Basin, range from 0 to about 10 inches. Kues (1990) noted that fluctuations in a well in the Sandia Park area, northwest of the Basin, were likely to be related to changes in precipitation. The lag time between a change in precipitation and fluctuation in ground-water level was thought to range from 7 months to 2.5 years.

**d) Recharge-Precipitation Relation**

The relation between recharge and precipitation is likely to be highly variable throughout the Basin. For example, ground water in the Madera Group in the northwestern portion of the study basin is known to occur in solution channels and caverns. Recharge to Madera outcrop exhibiting these features can occur readily during relatively moderate to high precipitation events, and the effects may be noticed quite quickly. Conversely, there may be a longer lag time between precipitation events and changes in ground-water elevations, and a more subtle change, with recharge to the Madera Group in areas where fracturing may be limited.

### iv. Annual Withdrawals by Aquifer

Meter records were not available for all water-supply wells in the Basin. Irrigation wells in the Basin generally withdraw water from the valley fill aquifer. Some irrigation wells withdraw water from the Madera Group, or Glorieta Sandstone, often in conjunction with the valley fill aquifer. Therefore, all irrigation withdrawals are assumed to be from the valley fill aquifer. Some of the municipal wells for Moriarty are completed in saturated valley fill and the underlying Yeso Formation, and because the quantity of water provided from the Yeso is unknown, all of the water was assumed to be withdrawn from the valley fill. Domestic ground-water withdrawals were assumed to be equally from the valley fill and the Madera Group based on the location of the majority of subdivisions in the Basin. All withdrawals for livestock, commercial, and industrial uses were assumed to be from the valley fill. 1995 withdrawals from selected aquifers in the Basin are estimated in Table 35.

**Table 35. Estimated 1995 withdrawals from aquifers in the Estancia Underground Water Basin**

| aquifer | ground-water withdrawal in 1995, acre-feet |
|---|---|
| valley fill | 55,781 |
| Yeso Formation | 180 |
| Madera Group (includes Sandia Formation) | 1,213 |
| total from above aquifers | 57,174 |

1995 data are unofficial NMSEO

A portion of the ground water pumped does represent a withdrawal from ground-water storage, and the proportion is larger at greater distance from the areas of natural discharge near the axis of the Basin, but a significant part of the pumping is "salvaged" water that would otherwise be lost to evaporation in the areas of natural discharge. This water is not accounted for in the administrative scheme used by the NMSEO to administer water rights in the Basin.

### v. Water-Level Data and Statistics

Hydrographs showing historic water-level data (unpublished NMSEO and USGS data) for the Basin were plotted to assess the changes in the depth to ground water. Data from the majority of the hydrographs were used to construct the maps showing ground-water declines in the valley-fill sediments, potentiometric surface elevations for 1995, and depth to ground water (Figs. 13, 15, and 22). The potentiometric surface represents the elevation of the ground-water surface above mean sea level. In general, the water level data indicate declines in the potentiometric surface elevations throughout most of the valley fill aquifer. The data did indicate an increase in the potentiometric surface elevations, or a decrease in the depth to ground water, throughout the central and northwest portion of T.7N., R.8E. Hydrograph plots are included in Appendix 6. Figure 17 shows depth to water contours for Torrance County.

### vi. Ground-Water Flow Direction And Gradient

The ground-water flow direction in the Basin is from the Basin boundaries toward the central portion of the Basin. The gradient in 1910 ranged from 0.001 feet per foot (ft/ft) in the northern portion of the Basin to 0.004 ft/ft on the western side of the Basin. Flow directions and gradients for the year 1910 were based on data collected by Meinzer (1911). No data were available for the eastern and northeastern portion of the Basin for 1910. Figure 18 shows the 1910 potentiometric surface elevation contours in the Basin.

The ground-water gradient ranged from 0.02 ft/ft in the west central portion of the Basin to 0.01 ft/ft in the south western portion of the Basin in 1957. Figure 19 shows the 1956 potentiometric surface elevation contours in the Basin. The ground-water gradient ranged from 0.02 ft/ft in the west central portion of the Basin to 0.007 ft/ft in the south western portion of the Basin in 1995. Figure 20 shows the potentiometric surface elevation contours for Torrance County.

## c. Uses of Ground Water

### i. Categories of Water Use by Source

Most of the wells capable of producing relatively large yields are completed in the Madera Group, Yeso Formation, Glorieta Sandstone, and valley fill aquifers. All irrigation water is assumed to be withdrawn from the valley fill aquifer even though some of the wells are completed in the Madera Group and Glorieta Sandstone, because it is likely that the wells are completed in both the valley fill and underlying aquifer. The estimated sources for different water uses in the Basin are shown in Table 36.

**Table 36. Categories of water use, estimated aquifer from which the water is withdrawn, and the annual withdrawal (1990 and 1995 data) in the Estancia Underground Water Basin**

| water use category | primary aquifer(s) and estimated withdrawal (acre-feet) |
|---|---|
| public water systems | Madera Group 977 acre-feet, valley fill 600 acre-feet, and Yeso 180 acre-feet |
| domestic | Madera Group 236.5 acre-feet, and valley fill 236.5 acre-feet |
| irrigated agriculture | valley fill 54,440 acre-feet |
| livestock | Madera Group 100 acre-feet, and valley fill 340 acre-feet |
| commercial | Madera Group 5 acre-feet, and valley fill 42 acre-feet |
| industrial | valley fill 17 acre-feet |

### ii. Storage Depletion Summary by Aquifer

The majority of wells monitored used to monitor potentiometric surface elevations in the Basin are completed in the valley fill, Madera Group, or both aquifers. Well completion data are generally not available for the wells and it is likely that the majority of wells completed in the Madera Group, or other aquifers beneath the valley fill, are in hydraulic connection with the valley fill because annular seals are not commonly used to prevent hydraulic communication between the aquifers via the borehole annulus. Most of the early ground-water supply wells were completed in the valley fill and, therefore, most of the data regarding changes in ground-water conditions are for this aquifer. The ground-water depletion estimates in the Basin for this report will be limited to the valley fill sediments.

It should be noted that as an aquifer is depleted, the costs associated with using water from that aquifer increase. The increased costs are a result of 1) increases in energy costs from having to pump water from greater depths, 2) increases in capital costs from having to drill more wells to provide the same amount of water, and 3) increases in energy costs from pumping more wells.

#### a) Depletion of Ground Water in Storage From the Valley Fill From 1910 to 1956

Ground-water declines in the valley fill between 1910 and 1956 occurred in six areas (Fig. 21) based on data by Meinzer (1911) and Smith (1957). The approximate central portions of the areas with ground-water declines are 1) 4 miles north of Moriarty in T. 10 N., R. 8 E., Section 26, 2) 1.5 miles southwest of Moriarty in T. 9 N., R. 8 E., Section 28, 3) 3 miles northwest of McIntosh in T. 8 N., R. 8 E., Section 34, 4) 9 miles east of McIntosh in T. 7 N., R. 10 E., Section 9, 5) 1.5 miles southwest of Estancia in T. 6 N., R. 8 E., Section 10, and 6) 3 miles southwest of Willard in T. 4 N., R. 8 E., Section 13. Maximum ground-water declines in the valley fill ranged from 10 to 40 feet

#### b) Depletion of Ground Water in Storage From the Valley Fill From 1956 to 1995

Ground-water declines in the valley fill between approximately 1956 and 1995 are shown by contours on Figure 22. Some data slightly prior to 1956 and post-1995 were also used to generate this map because 1956 or 1995 data were not available for many areas. Ground-water declines over this period extend over the majority of the valley fill. Declines of at least 20 feet extend from about Stanley southward along State Highway 41 to about 5 miles south of Willard, and from several miles to about 10 miles east and west of State Highway 41.

The largest ground-water declines from 1956 to 1995 occurred in five main areas. The approximate central portions of the areas with ground-water declines are 1) 6 miles northeast of Moriarty in T. 10 N.,

R. 9 E., Section 18, 2) 2.5 miles northwest of Moriarty in T. 10 N., R. 8 E., Section 35, 3) 4 miles northeast of McIntosh in T. 8 N., R. 9 E., Section 18, 4) 2 miles northwest of Estancia in T. 6 N., R. 8 E., Section 3, and 5) 6.5 miles southwest of Estancia in T. 5 N., R. 8 E., Section 9.

**c) Total Volume of Valley Fill Sediments Dewatered From 1910 to 1995**

There were not enough data to reliably define the area where only a few feet of ground-water declines occurred, nor the northern or southern extent of ground-water declines from 1956 to 1995. However, an estimate of the total volume of sediments that have been dewatered was made by assuming that the zero contour of ground-water decline is correct and that the northern and southern extent of ground-water declines is represented by the maximum extent of the inferred contours shown on Figure 22.

The NMSEO assigned a specific yield of 12.5 percent to the valley fill sediments (NMSEO, 1965). Table 37 lists the estimated volumes of valley fill that have been dewatered from 1910 to 1995 and the corresponding amount of ground water that has been withdrawn from the sediments, assuming a specific yield of 12.5 percent.

**Table 37. Estimated volume of valley fill dewatered and quantity of ground water mined from the valley fill from 1910 to 1995**

| time interval | volume of valley fill dewatered (feet$^3$) | specific yield | quantity of ground water mined (acre-feet) |
|---|---|---|---|
| 1910 to 1956 | $5.72 \times 10^{10}$ | 0.125 | 160,000 |
| 1956 to 1995 | $4.36 \times 10^{11}$ | 0.125 | 1,250,000 |
| 1910 to 1995 | $4.93 \times 10^{11}$ | 0.125 | 1,410,000 |

The estimate of the average quantity of ground water mined from the valley fill aquifer from 1956 to 1995 is 32,000 acre-feet per annum, assuming ground water pumping has remained essentially unchanged.

## d. Water Supply Facilities

### i. Well Fields

Well fields which provide ground water for municipal use in the Basin are listed in Table 38. The locations shown in the table are intended only to describe the general area of the well fields. NMSEO well records for specific wells within the well fields are included in Appendix 7. Selected domestic and municipal well locations are also shown on Figure 20.

**Table 38. General locations of well fields in the Estancia Underground Water Basin**

| well owner | well locations |
|---|---|
| Horton Family | T.11N., R.7E., Sections 3, 19, 20, 27, 28, 29, 30, 32, and 33, and T.10N., R.7E., Section 4 |
| Entranosa Water Cooperative | T.11N., R.7E., Section 33, and T.10N., R.7E., Section 4 |
| Calkins, Bassett (Edgewood) | T.10N., R.7E., Sections 23 and 27 |
| Moriarty | T.9N., R.8E., Sections 14 and 23 |
| Town of Estancia | T.6N., R.8E., Section 11 |
| Town of Mountainair | T.5N., R.9E., Section 31 |
| Village of Willard | T.4N., R.9E., Sections 5 through 7 |

#### ii. Conveyance Canals and Pipelines

Water is pumped from well fields to storage tanks which supply water to domestic, commercial, and industrial users via gravity flow, or through the use of lift stations and gravity flow. The locations of the various water-supply pipelines were not mapped during this study. Irrigation wells generally pump water from the wells directly to the crop, using flow, sprinkler, or drip irrigation.

## 3. Water Quality

### a. Surface Water

#### i. Water-Quality Description

Surface water quality in Laguna del Perro and the other nearby small surface water bodies is poor; the water is saline, with specific conductance ranging from 20,500 to 187,000 micromhos per centimeter (µmhos/cm) (White and Kues, 1992). Manzano Lake and Sherwood Forest Lake are also within the Basin. Water quality data for these two lakes were not available, but they probably have relatively good water quality as they are in areas in which the ground-water quality is relatively high. The quality of surface water from spring flow is generally good, with specific conductance ranging from 151 to 1,700 µmhos/cm (White and Kues, 1992).

#### ii. Sediment Yield by Station

These data were not available because surface water flows are not regularly monitored in the Basin.

#### iii. Limitations on Supply Due to Quality

Laguna del Perro and the other small saline surface water bodies cannot be used as water supplies for domestic, livestock, or irrigation purposes without treatment to reduce the salinity. Therefore, the potential uses for the water would be few without treatment.

Use of spring flow is not limited by the quality of the water based on data collected by White and Kues (1992). The use of springs is limited by the small yield of the springs.

## b. Ground Water

### i. Water-Quality Description by Aquifer

#### a) Ground Water in Storage

Comprehensive ground-water quality data were not available for each aquifer. However, specific conductance data for the majority of the aquifers in the Basin were available and are listed in Table 39. Specific conductance is related to total dissolved solids content, which in turn provides a general indicator of water quality. Specific conductance multiplied by a value ranging from 0.55 to 0.75, depending on the relative concentration of ions, will give an approximation of total dissolved solids concentration, and the higher of the values is generally associated with water high in sulfate (Hem, 1970). In the Basin, White (1994) multiplied specific conductance measurements by a factor of 0.65 to 0.70 to estimate the total dissolved solids concentration. The specific conductance data presented in Table 39 were taken from Smith (1957), Titus (1980), White (1994), and USGS files (unpublished data), and the corresponding range of total dissolved solids concentration was estimated by multiplying the specific conductance by 0.65 to 0.70.

**Table 39. Specific conductance and estimated total dissolved solids concentration ranges for ground water in select aquifers in the Estancia Underground Water Basin**

| aquifer | specific conductance (µmhos/cm) | estimated total dissolved solids (mg/l) | comments |
|---|---|---|---|
| valley fill | 350 to 6,000 | 227 to 4,200 | highest values east side of Laguna del Perro and east of Moriarty |
| Triassic-age rocks | 1,300 | 845 to 910 | data from outside study area |
| Glorieta Sandstone | 900 to 6,000 | 585 to 4,200 | |
| Yeso | 1,700 to 5,100 | 1,105 to 3,570 | higher specific conductance due to gypsum |
| Abo | 400 to 800 | 260 to 560 | |
| Madera Group | 400 to 1,300 | 260 to 910 | calcium bicarbonate water |

µmhos/cm: micromhos per centimeter
mg/l milligrams per liter

Two specific conductance (SC) contour maps of the Estancia Underground Water Basin were generated in order to assess historical changes in the specific conductance of ground water. The majority of water quality data are specific conductance data from ground water in the valley fill sediments. Figure 23 is primarily based on information published by Smith in 1957, and data gathered during 1973 and published in 1980 by Mourant (figure annotated where Mourant data was used). The Mourant (1980) data were used primarily in the northern portion of the Basin where Smith (1957) did not have data. Figure 24 was generated principally from late 1980's USGS and NMSEO data published by White (1994); SC contours in the western portion of the Basin were based on information gathered during 1990 to 1995 and stored in a USGS water quality database. In general, the specific conductance of ground water is greater in the east central portion of the Basin, several miles east of Highway 41. Specific conductance increases from the Basin margins toward the center of the Basin.

The two SC contour maps (Figures 23 and 24) were compared to assess changes in SC between the two periods. In general, the SC values have not changed significantly basin-wide. Local changes occurred primarily in areas that have experienced a significant lowering (i.e., greater than 40 feet) of the ground-water level due to pumping. An improvement, or reduction in SC values, has been observed northeast of Moriarty in T. 10 N., R. 9 E. and T. 10 N., R. 10 E.

The northeast quadrant of T. 7 N., R. 8 E., north of Estancia, has shown an increase in SC values from less than 750 μmhos/cm to approximately 1,000 μmhos/cm. A similar trend is noted south of Estancia along the eastern boundaries of T. 5 N., R. 8 E. and T. 6 N., R. 8 E., and north of Moriarty in T. 9 N. , R. 8 E. and T. 10 N., R. 8 E. Each of these areas experienced a decline in ground-water level greater than 40 feet since 1956.

The area of Cedar Grove (T. 11 N., R. 7 E., Sections 20, 21, and 22) also experienced an increase in SC values from approximately 400 μmhos/cm to 900 μmhos/cm. This SC change does not appear to correspond to a change in ground-water level.

As previously mentioned, an approximate 50 percent decrease in SC values has been observed in portions of T. 10 N., R. 9 E. and T. 10 N., R. 10 E. This improvement in water quality also does not appear to correspond to any significant change in ground-water elevation.

Carbon dioxide gas has been found in two areas in the Basin: 1) T. 6 N., R. 7 E., Sections 11 and 12, and 2) T. 7 N. , R. 7 E., Sections 12, 13, 32, and 36. The gas is thought to occur in the lower portion of the Sandia Formation (Foster and Jensen, 1972). Elevated concentrations of carbon dioxide in water is corrosive to plumbing. Carbon dioxide gas can build up in well houses and create an oxygen-deficient environment which can be hazardous or fatal to people and animals.

**b) Return Flow Quality**

Ground water returning to the system would primarily be return flow from irrigated areas. This is because most of the irrigation in the Basin occurs in the valley fill areas where the sediments are relatively permeable and the depth to ground water is relatively shallow. The quality of ground water that returns to the system from irrigation practices is unknown. However, due to long history of irrigation in the area, and the fact that the water quality degraded in areas from about 1956 to 1995, it can be assumed that the return flow from irrigation is degrading water quality.

Ground-water return flow from septic systems also occurs. Return flows from septic systems can degrade ground-water quality by increasing nitrate concentrations. Elevated nitrate concentrations can be particularly harmful to young children, and animals, causing serious health problems or death (Peavy, Rowe, and Tchobanoglous, 1985). The Environmental Protection Agency standard for nitrate in drinking water is 10 milligrams per liter (as nitrogen).

**ii. Limitations on Supply Due to Quality**

As of 1995, the availability of ground water to supply existing wells in the Basin was not limited due to water quality. Ground water with higher specific conductance (lower quality) is present in the east central portion of the Basin. As the valley fill sediments continue to be dewatered, ground water with greater specific conductance will be drawn toward pumping wells completed in, or in hydraulic connection with, the saturated valley fill.

Generally, water-bearing rocks older than, and underlying, the valley fill should have water quality suitable for most uses. Unfortunately, production from these rocks can be substantially lower than that from the valley fill. The Yeso Formation does not generally yield large quantities of water to wells, and it may yield water which has high total dissolved solids in areas where gypsum is present. This could limit the usefulness of the Yeso as an aquifer, without treatment of the water for domestic uses.

**iii. Assess Quality of Different Water Sources**

**a) Existing Water Quality**

Ground-water quality is the best toward the Basin margins, and decreases towards the east central portion of the Basin, based on specific conductance data. No data were available to adequately assess major ion or metal concentrations in the regional ground water, or historic changes in water quality.

**b) Potential for Contamination**

In order to assess the potential for ground-water contamination at selected areas, soil permeability (Fig. 4), geology (Fig. 10), and depth-to-water (Fig. 16) should be considered. The potential for ground-water contamination is dependent on the depth to ground water, soil permeability and thickness, and the presence of fractures or solution channels in rocks near the ground surface and in the underlying aquifer. In general, where the depth to ground water is less than 100 feet the potential for ground-water contamination is greater. This is particularly true if there are no low-permeability beds, such as clay or unfractured rock, between the source of contamination and the ground water. In areas where the depth to ground water exceeds 100 feet and there is only a thin soil horizon overlying fractured rock, the potential for ground-water contamination is high. This is because fluids can move readily through the fractures down into the ground water.

**c) Water-Quality Standards**

Federal and New Mexico water-quality standards are included in Appendix 8.

**iv. Identify Sources of Water Contamination**

The potential sources of ground-water contamination in the Estancia Basin which were examined in this study are leaking underground storage tanks, septic tanks, mines and quarries, naturally occurring radioactive mineralization, and hazardous waste dumps. Individual sites are plotted on Figure 25. Overall, the study area appears to be minimally affected by introduced contaminants.

**a) Point Sources**

**1) Underground Storage Tanks**

The District 1 Office of the New Mexico Environment Department, Underground Storage Tank Bureau provided information on all reported underground storage tank leaks within Torrance County. Additional information was provided in the *East Mountain Area Plan* report (1992). Ten sites exist within Torrance County which are either in investigation, active remediation, or monitoring. These sites are in Encino, Estancia, Moriarty, Mountainair, and Willard. Data regarding the underground storage tanks and sites listed as being in active status are provided in Table 40. Sites listed as active are not necessarily in active remediation, but may be under investigation or may be undergoing monitoring.

**2) Contamination from Mines and Quarries**

Five precious-metal mines or prospects are reported to occur within the study area: the 3 in 1 Mine near Manzano, the El Cuervo Butte Prospects west of Clines Corners, the Pedernal Hills Mine west of Encino, the Carnahan Mine, and the San Pedro Mine (Fig. 25). The potential for acid mine drainage can exist at sites host to sulfide mineralization. Sulfide-bearing tailings associated with the Carnahan Mine in the San Pedro Mine Grant have traveled down a drainage away from the source. The effects of the sulfide-bearing mine on ground water in the area is not known. No reported ground-water contamination has been associated with the other sites. Information relating to these sites is included in Appendix 9.

Numerous gravel and rock quarries were identified within the study area. The impacts of these operations on the quality of the ground water has not been assessed, but is expected to be minimal.

**Table 40. Reported leaking underground storage tanks**

| location | | owner/responsible party | date file opened | date file closed | case manager | status |
|---|---|---|---|---|---|---|
| Abo | | | | | | none |
| Cedarvale | | | | | | none |
| Chilili | | | | | | none |
| Chupadera | | | | | | none |
| Clines Corners | | | 06-25-91 | 06-28-91 | | closed |
| Corona | State Rd. 42 | NMSHTD | 09-25-90 | 10-05-90 | | closed |
| Derramadero | | | | | | none |
| Duran | | | | | | none |
| Encino | | NMSHTD | | active | Ray Montes | investigating |
| | | Milagro Chevron | 03-20-95 | active | | investigating |
| Escabosa | | | | | | none |
| Estancia | 10th & Allen | County Yard | | active | Chris Holmes | active |
| | 5th & Arthur | vacant lot | 11-15-92 | 03-23-93 | | closed |
| | 5th & Allen | H&M Service Sta. | 09-23-93 | active | Pat DeGruyter | active |
| Gran Quivira | | | | | | none |
| Manzano | | | | | | none |
| Martinez | | | | | | none |
| McIntosh | | | | | | none |
| Moriarty | | NMSHTD | 11-90 | 03-91 | | closed |
| | 904 Irene | El Bar, Inc. | 08-01-90 | 12-09-93 | | closed |
| | HW 366 | Circle K Corp. # 1430 | 01-05-90 | 06-28-91 | | closed |
| | | Estancia Concrete | 05-09-91 | 06-12-91 | | closed |
| | | Griffin's Truck Stop | 05-13-88 | 12-04-90 | | closed |
| | 1001 Rt. 66 | Sierra Cable Vision | 04-01-92 | active | Jane Cramer | active |
| | old HW 41 | Moriarty Bulk Plant | | active | Jane Cramer | monitoring |
| | | Chaparral Truck | 04-01-92 | active | | active |
| | I-40 | Longhorn Ranch | 07-14-92 | 07-30-92 | | closed |
| | 601 HW 66 E | JRS Tire | 07-10-92 | active | | active |
| Mountainair | HW 55 | NMSHTD | 10-03-90 | 10-09-90 | | closed |
| | | USFS Ranger Sta. | 10-05-91 | 12-19-91 | | closed |
| | HW 60 | Padilla's Service Sta. | 07-17-92 | 10-30-92 | | closed |
| | HW 60 | Padilla's Service Sta. | 01-94 | 02-94 | | closed |
| | HW 60 and 55 | Transwestern Station #7 | 10-22-93 | 05-31-94 | | closed |
| | | Tom's Minimart | 09-27-94 | active | | active |
| Negra | | AT&SF, Negra Siding | 11-15-91 | 12-07-92 | | closed |
| North Lucy | | | | | | none |
| Progresso | | | | | | none |
| Punta de Agua | | | | | | |
| Torrance | | | | | | |
| Torreon | | | | | | |
| Willard | 6 mi N. of Willard | AT&SF, Silo Cygno | 10-29-91 | 12-07-92 | | closed |
| | | AT&SF, Culebra | 11-15-91 | 12-07-92 | | closed |
| | | AT&SF, Lucy Siding | 11-15-91 | 12-07-92 | | closed |
| | | Dean's Gas & Grocery | | active | | investigating |

Source: obtained from New Mexico Envir. Dept., Underground Storage Tank Bureau, Kalvin Martin, 4-18-96

**3) Landfill**

The Torrance County Landfill is in Township 10 East, Range 9 North, Section 22.3. The landfill was constructed within the last few years. Potential contamination from the site would be leachate from the waste placed in the landfill.

**b) Non-Point Sources**

**1) Contamination from Septic Systems**

Data on ground-water contamination related to septic systems was derived from two previous studies on the East Mountain Area. The *East Mountain Area Plan* (1992) provided information for the communities of Cedar Crest and Chilili within the present study area. The *East Mountains Wastewater Feasibility Study* (NMERI, 1995) provided data on the northwest quarter of Torrance County, and include the communities of Willard, Estancia, McIntosh, Moriarty, Bella Vista Subdivision, Tajique, Torreon, Punta de Agua, Manzano, and Chilili.

Though only Chilili was found to have concentrations of nitrate in drinking water exceeding the New Mexico Water Quality Control Commission standard of 10 milligrams per liter (as nitrogen), it was discussed within the texts of the referenced reports that the potential for future ground-water contamination exists in areas where numerous septic systems exist in close proximity to each other. Concern was also expressed as to the ability of septic tank effluent to easily migrate to the ground water through solution cavities in the Madera Group limestone beds.

Subdivisions in the Edgewood area which use septic systems also present a potential source of nitrate contamination because of the increasing housing density. No data were available from Santa Fe County regarding current or historic nitrate concentrations in the ground water in this or other areas in south Santa Fe County.

**2) Contamination from Naturally Occurring Radioactive Mineralization**

Naturally occurring radioactive mineral deposits have been found in the Permian-age Abo Formation and in Paleozoic syenites which have intruded Precambrian-age rocks in Torrance County (Fig. 25). Only one deposit, the Abo Mining claims, reports uranium production (McLemore, 1983). These deposits appear to be very small and are not reported to have affected the quality of ground water in the Estancia Basin.

**c) Water Bodies Affected by Contamination**

Ground-water contamination associated with the leaking underground storage tanks has the potential to contaminate relatively extensive areas, but this is dependent on the quantity of fuel (or other hydrocarbon) lost, depth to water, distance to nearby pumping wells, and the transmissivity of the aquifer. The volume of ground water presently affected by contamination appears to be minimal.

Nitrate contamination will probably pose the greatest threat to ground-water quality of the non-point sources in the Basin. As housing density increases in the Basin, the potential for nitrate contamination will increase. This is particularly true in areas where the ground water is shallow, and where there are thin soils overlying fractured bedrock beneath septic systems.

### v. Water-Quality Management Plans

Water quality management plans for point sources should address the potential for point and non-point source contamination to reach the ground water and the proximity of point sources to water supply wells. Such plans should include well-head protection requirements which delineate buffer zones around community and municipal water supply wells. Within the buffer zones, activities that have the potential to contaminate the ground water, and ultimately the water produced from supply wells, should not be allowed.

Water quality management plans for housing subdivisions should address the potential for nitrate contamination of ground water from septic systems. This may include investigating alternative treatment systems which can reduce the quantity of fluid discharged to septic systems, individual liquid waste treatment systems, or community treatment systems.

## B. Water Demand

### 1. Present Water Uses, Rights, and Ownership

### a. Bases for Water Use Data

Water use data for this portion of the study were obtained primarily from records and reports available from the NMSEO. The report entitled, *Water Use by Categories in New Mexico Counties and River Basins, and Irrigates Acreage in 1990,* by Brian C. Wilson, P.E., NMSEO, was used extensively as the primary source of information. Other reports are used as discussed in their respective categories.

Interviews with individual public water suppliers were also used as an additional source of information when other data were not available (n/a).

### b. Water Diversions by Category of Use

### i. Public Water Supply

Water diversions used for public water supply " ...include all water utilities, publicly or privately owned, which have at least 15 service connections or regularly serve an average of at least 25 individuals daily at least 60 days out of the year. Water used for the irrigation of self-supplied playing fields, golf courses, and parks, or to maintain the water level in ponds and lakes owned and operated by a municipality which is a public water supplier, is also included in this category" (Wilson, 1992).

A total of seven (7) water-supply systems reported to the 1995 inventory survey conducted by the NMSEO, with service populations ranging from 200 to over 4,500 persons. Records from the Environmental Protection Agency list approximately 15 water systems in Torrance County serving residential population of about 5,080, and approximately 24 transient, non-transient and other (school) water systems serving more than a total of 2,960 persons. These are generally recreational, rest areas, camp grounds, etc., and are not classified as commercial water uses. Table 41 summarizes the water withdrawals used for public water supply in the Estancia Basin.

**Table 41. Public water-supply diversions for 1995 in the Estancia Underground Water Basin**

| water supplier | population served | usage (gpcd) | total diversion (ac-ft) |
|---|---|---|---|
| Entranosa Water Co-Op | 4,400[a] | 91[a] | 442.74[a] |
| Edgewood Water Co-Op | 4,500[a] | 79[a] | 398.66[a] |
| Thunder Mountain Water Co. | 1,200[a] | 76[a] | 102.00[a] |
| Estancia Water System | 792[a] | 285[a] | 253.35[a] |
| Moriarty Water System | 1,399 | 207 | 325.16 |
| Tajique Water System | 452[a] | 13.5[a] | 6.8[a] |
| Echo Ridge Subdivision | 225[a] | 106[a] | 26.72[a] |
| Mountainair | 926 | 173 | 179.86 |
| Willard Water System | 200[a] | 99[a] | 22.20[a] |
| total | 14,094 | 125.5 (avg.) | 1,757.49 |

a based on unofficial 1995 data, NMSEO questionnaire (Brian Wilson, P.E.)
gpcd: gallons per capita per day
ac-ft: acre-feet
avg.: average

### ii. Domestic

Domestic uses include self-supplied residences which may be single family homes or multiple housing units with less than 25 occupants, where water is used for normal household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. This use also includes water used by that segment of the population which is served by small community water systems for which reliable population and water use data are unavailable.

Approximately 6,600 persons are served by self-supplied domestic systems. There are approximately 5,800 domestic well permits in the Estancia Basin. Each domestic well is entitled to 3 acre-feet per year diversion. The per capita consumption for a domestic well (typically located in a rural setting) is likely about 125.5 gallons per capita per day (gpcd). An average daily use of 64 gpcd would include little or no outdoor irrigation.

An average daily use of 125.5 gpcd would include moderate outside irrigation. Because meters are not required on domestic wells, the per capita consumption is estimated based on previous studies (Wilson, 1990) Typically the per capita consumption is substantially lower than urban usage, because the landscaping component is minimal to non-existent. Santa Fe County 1996 regulations have restricted domestic water use for housing at new subdivisions to 0.25 acre-feet per annum.

The following Table 42 summarizes the water withdrawals used for domestic water supply in the Estancia Basin.

**Table 42. Domestic water-supply diversions for 1990 in the Estancia Underground Water Basin**

| water supplier | population served | gallons per capita per day use | total diversion (ac-ft) |
|---|---|---|---|
| rural self supplied homes | 6,594 | 64 to 125 | 473 to 924 |
| total | 6,594 | 64 to 125 | 473 to 924 |

### iii. Industrial

Industrial uses within the Estancia Basin are limited, and of those uses that are self supplied (i.e., not already supplied via a public water-supply system), only one industrial user is reported on record. This industrial water user is Transwestern PL, and the water is used for a natural gas compressor station.

The following Table 43 summarizes the industrial water withdrawals in the Estancia Basin.

**Table 43. Industrial use diversions for 1990 in the Estancia Underground Water Basin**

| water use | user | classification | total diversion (ac-ft) |
|---|---|---|---|
| industrial | Transwestern PL | ground water | 16.57 |
| total | | | 16.57 |

ac-ft: acre-feet

### iv. Commercial

Commercial uses (self supplied) within the Estancia Basin include businesses, campgrounds, picnic areas, and visitor centers. These facilities are self supplied in that they derive their water supply from dedicated wells, and not the public water system.

The following Table 44 summarizes the water withdrawals used for commercial use in the Estancia Basin.

**Table 45. Irrigated agricultural diversions for 1990 in the Estancia Underground Water Basin**

| type of irrigation | county | irrigated acreage | total diversion (ac-ft) |
|---|---|---|---|
| flood | Bernalillo | 50 | 137 |
| flood | Santa Fe | 1,265 | 2,172 |
| flood | Torrance | 5,765 | 15,854 |
| sub-total | | 7,080 | 18,163 |
| drip | Santa Fe | 110 | 140 |
| drip | Torrance | 10 | 11 |
| sub-total | | 120 | 151 |
| sprinkler | Santa Fe | 5,165 | 10,171 |
| sprinkler | Torrance | 12,225 | 25,955 |
| sub-total | | 17,390 | 36,126 |
| total all classes | | 24,590 | 54,440 |

ac-ft: acre-feet

### vi. Livestock

The livestock water withdrawals rely primarily upon the number of livestock reported by various state and federal agencies and per capita water requirements determined by research. This category includes both surface and ground waters.

The following Table 46 summarizes the water withdrawals used for livestock use in the Estancia Basin.

**Table 46. Livestock use diversions for 1990 in the Estancia Underground Water Basin**

| water use | surface water | ground water | total diversion (ac-ft) |
|---|---|---|---|
| livestock | 164 | 440 | 604 |
| total | 164 | 440 | 604 |

ac-ft: acre-feet

Values for stockpond evaporation were obtained from 1980 data compiled by the NMSEO and used in previous reports. These data are not available for current NMSEO inventories. The number of stock ponds were counted from aerial mapping, and an assumed surface area of one acre was used in the evaporation computations (personal communication with, and files from, Brian Wilson, P.E., NMSEO).

The following Table 47 summarizes the water withdrawals associated with stockpond evaporation in the Estancia Basin:

**Table 47. Stockpond evaporation withdrawals for 1980 in the Estancia Underground Water Basin**

| county | number of stockponds | net evaporation (feet) | total evaporation (acre-feet) |
|---|---|---|---|
| Santa Fe | 464 | 3.35 | 496 |
| Torrance | 1,163 | 3.25 | 1,284 |
| total | 1,627 | | 1,780 |

Values for reservoir evaporation were obtained from 1980 data compiled by the NMSEO and used in previous reports. These data are not available for current NMSEO inventories. There are only two surface water bodies inventoried for reservoir evaporation. Typically, playa lakes (such as the Laguna del Perro in southern Estancia Basin) are not categorized as reservoirs and evaporation not considered. The reservoir surface area is obtained from mapping, and an assumed surface area of three acres was used in the evaporation computations (personal communication with, and files from, Brian Wilson, P.E., NMSEO).

The following Table 48 summarizes the water withdrawals associated with reservoir evaporation in the Estancia Basin.

**Table 48. Reservoir evaporation withdrawals for 1980 in the Estancia Underground Water Basin**

| reservoir | surface area (acre) | net evaporation (feet) | total evaporation (acre-feet) |
|---|---|---|---|
| Manzano Lake | 3 | 2.67 | 8 |
| Sherwood Forest Lake | 3 | 2.33 | 7 |
| total | 6 | | 15 |

ac-ft: acre-feet

### vii. Fish, Wildlife, and Recreation

There are no fish, wildlife, or recreational water uses in the Estancia Basin.

### ix. Summary Total All Uses

The following Table 49 summarizes the water withdrawals associated with all uses in the Estancia Basin.

**Table 49. Summary of diversions for 1995 in the Estancia Underground Water Basin**

| use | surface water (acre-feet) | ground water (acre-feet) | total diversion (acre-feet) |
|---|---|---|---|
| public water systems | 0 | 1,757[a] | 1,757[a] |
| domestic (self supplied) | 0 | 473 | 473 |
| irrigated agriculture | 0 | 54,440 | 54,440 |
| livestock (self supplied) | 164 | 440 | 604 |
| commercial (self supplied) | 0 | 47 | 47 |
| industrial (self supplied) | 0 | 17 | 17 |
| stockpond evaporation | 1,780 | 0 | 1,780 |
| reservoir evaporation | 15 | 0 | 15 |
| total | 1,959 | 57,174 | 59,133 |

a includes unofficial 1995 data

### c. Water Depletions by Category of Use

#### i. Public Water Supply

Depletions in a water system indicate the amount of water totally lost out of the system; in other words, that quantity is not returned to either surface or ground water. This water is taken up in consumption, cooking uses, evapotranspiration, etc., and is not returned to the system via sewage treatment, landscape irrigation, etc. Data available indicate that approximately 45 percent of all public water supply ground-water withdrawals are assumed as depletions to the Estancia Basin.

The following Table 50 summarizes the water depletions by the public water supply in the Estancia Basin.

**Table 50. Public water-supply depletions for 1995 in the Estancia Underground Water Basin**

| water supplier | population served | depletion (gpcd) | total depletions(ac-ft) |
|---|---|---|---|
| Entranosa Water Co-Op | 4,400[a] | 41[a] | 199[a] |
| Edgewood Water Co-Op | 4,500[a] | 36[a] | 179[a] |
| Edgewood | 1,200[a] | 34[a] | 46[a] |
| Estancia Water System | 792[a] | 128[a] | 114[a] |
| Moriarty Water System | 1,399 | 93 | 146 |
| Tajique Water System | 452[a] | 6[a] | 3[a] |
| Echo Ridge Subdivision | 225[a] | 48[a] | 12[a] |
| Mountainair | 926 | 78 | 81 |
| Willard Water System | 200[a] | 45[a] | 10[a] |
| total | 14,094 | 57 (avg.) | 790 |

a estimated, based on unofficial 1995 data and 1990 NMSEO report percentages (Brian Wilson, P.E.)
gpcd gallons per capita per day
ac-ft acre-feet

### ii. Domestic

Because water use associated with depletions is the same for self-supplied domestic homes as with those on a public water system, the depletion factor remains the same for domestic uses. Data available indicate that approximately 45 percent of self-supplied domestic ground-water withdrawals are assumed as depletions to the Estancia Basin.

The following Table 51 summarizes the water depletions by the domestic water supply in the Estancia Basin assuming diversion ranges from 64 to 125.5 gpcd.

**Table 51. Domestic water-supply depletions for 1990 in the Estancia Underground Water Basin**

| water supplier | population served | depletion (gpcd) | total depletion (ac-ft) |
|---|---|---|---|
| rural self supplied homes | 6,594 | 29 to 57 | 213 to 421 |
| total | 6,594 | 29 to 57 | 213 to 421 |

gpcd gallons per capita per day
ac-ft acre-feet

### iii. Industrial

The following Table 52 summarizes the water depletions by industrial use in the Estancia Basin:

**Table 52. Industrial Use Depletions for 1990 in the Estancia Underground Water Basin**

| water use | type of use | per capita use | total depletion (ac-ft) |
|---|---|---|---|
| industrial | Transwestern (nat'l gas) | 100% | 16.57 |
| total | | | 16.57 |

ac-ft acre-feet

### iv. Commercial

Because most commercial users do not directly meter their discharges, computation of depletions are difficult. Where meter data are not available, depletions are usually determined as a percentage of withdrawal, depending on use. For the commercial uses in the Estancia Basin, a depletion factor of 49.8 percent was used.

The following Table 53 summarizes the water depletions by commercial use in the Estancia Basin.

**Table 53. Commercial use depletions for 1990 in the Estancia Underground Water Basin**

| water use | user | depletion factor | total depletion (acre-feet) |
|---|---|---|---|
| commercial | Assoc. Devel. Co. | 45% | 0.77 |
| commercial | Bethany United Church | 45% | 0.58 |
| commercial | Carl Colletti Realty | 45% | 0.23 |
| commercial | Cibola National Forest | 45% | 0.41 |
| commercial | Moriarty Cemetery | 80% | 2.66 |
| commercial | Estancia Mun School | 45% | 1.35 |
| commercial | Forest Meadows Baptist | 45% | 0.01 |
| commercial | Hanson Enterprises, Inc. | 45% | 0.23 |
| commercial | Indian Hills VFD | 45% | 0.23 |
| commercial | McIntosh Bible Church | 45% | 0.45 |
| commercial | McIntosh Fire Dept. | 45% | 0.07 |
| commercial | Moriarty School-Mtnv | 45% | 1.05 |
| commercial | Moriarty Mun. School | 45% | 0.51 |
| commercial | NM Laborers Training | 45% | 9.05 |
| commercial | NM State Parks & Rec. | 45% | 0.23 |
| commercial | NMSHTD rest area | 45% | 2.87 |
| commercial | R. Crotwell Salon | 45% | 0.23 |
| commercial | Estancia Cemetery | 80% | 2.40 |
| total | | | 23.33 |

### v. Irrigated Agriculture

The total depletion of water used by irrigated agriculture includes both the consumptive irrigation requirement (CIR) of the crop and incidental depletions (ID). The CIR of a crop is that quantity of irrigation water that is consumptively used by crops or evaporated from the soil in a specific period of time. This volume of water is exclusive of rainfall. The ID include such factors as evaporation from canals and laterals, transpiration by phreatophytes, water-supply pipe leakage, sprinkler spray evaporation and drift, and evaporation and runoff from irrigated fields and wetted crop canopies.

The ID depend on the method of irrigation used, and the relative "on-farm" efficiency. For the data reviewed, the on-farm efficiencies for the three irrigation methods are as follows:

- flood irrigation, 60 percent
- drip irrigation, 85 percent
- sprinkler irrigation, 65 percent

The following Table 54 summarizes the water depletions by Irrigated Agriculture use in the Estancia Basin.

**a) Private Use by District and Area**

### 1) Crop Consumption

For the Estancia Basin, the CIR for each irrigation method depends on the location, and are as follows in Table 54.

**Table 54. Consumptive irrigation requirement for 1990 in the Estancia Underground Water Basin**

| type of irrigation | county | irrigated acreage | consumptive irrigation requirement (ft) |
|---|---|---|---|
| flood | Bernalillo | 50 | 1.640 |
| flood | Santa Fe | 1,265 | 1.030 |
| flood | Torrance | 5,765 | 1.650 |
| | | | |
| drip | Santa Fe | 110 | 1.080 |
| drip | Torrance | 10 | 0.900 |
| | | | |
| sprinkler | Santa Fe | 5,165 | 1.280 |
| sprinkler | Torrance | 12,225 | 1.380 |

### 2) Incidental On-Farm Depletions

The incidental on-farm depletions for flood, drip, and sprinkler irrigation in the Estancia Basin for 1990 are listed in Table 55.

**Table 55. Irrigated agriculture depletions for 1990 in the Estancia Underground Water Basin**

| type of irrigation | county | irrigated acreage | total depletion (acre-feet) |
|---|---|---|---|
| flood | Bernalillo | 50 | 86 |
| flood | Santa Fe | 1,265 | 1,368 |
| flood | Torrance | 5,765 | 9,988 |
| sub-total | | 7,080 | 11,442 |
| | | | |
| drip | Santa Fe | 110 | 119 |
| drip | Torrance | 10 | 9 |
| sub-total | | 120 | 128 |
| | | | |
| sprinkler | Santa Fe | 5,165 | 8,343 |
| sprinkler | Torrance | 12,225 | 21,291 |
| sub-total | | 17,390 | 29,634 |
| | | | |
| total all classes | | 24,590 | 41,204 |

[a] - based on 1990 NMSEO data

### vi. Livestock

#### a) Summary Total Livestock Depletion

All of the livestock water withdrawals are considered depletions because there is no return flow to the Basin. These depletions may be conservatively high because the ponds may not be full every year, and a portion of the water depleted from the ponds would have been lost to evapotranspiration if the water was not stored in the ponds.

The following Table 56 summarizes the water used by Livestock in the Estancia Basin.

**Table 56. Livestock Use Depletions for 1990 in the Estancia Underground Water Basin**

| water use | surface water | ground water | total depletion (acre-feet) |
|---|---|---|---|
| livestock | 164 | 440 | 604 |
| total | 164 | 440 | 604 |

#### b) Stockpond Evaporation

All of the stockpond evaporations are considered depletions to the Basin.

The following Table 57 summarizes the water depletion associated with stockpond evaporation in the Estancia Basin.

**Table 57. Stockpond evaporation depletions for 1980 in the Estancia Underground Water Basin**

| county | no. of stockponds | net evaporation (feet) | total evaporation (acre-feet) |
|---|---|---|---|
| Santa Fe | 464 | 3.35 | 496 |
| Torrance | 1,163 | 3.25 | 1,284 |
| total | 1,627 | | 1,780 |

All reservoir evaporations are also considered depletions to the Estancia Basin.

The following Table 58 summarizes the water depletions associated with reservoir evaporation in the Estancia Basin.

**Table 58. Reservoir Evaporation Depletions for 1980 in the Estancia Underground Water Basin**

| reservoir | surface area (ac) | net evaporation (ft) | total evaporation (ac-ft) |
|---|---|---|---|
| Manzano Lake | 3 | 2.67 | 8 |
| Sherwood Forest Lake | 3 | 2.33 | 7 |
| total | 6 | | 15 |

ac-ft acre-feet

### viii. Fish, Wildlife, and Recreation

There are no fish, wildlife, or recreational water uses in the Estancia Basin.

### ix. Mining

There are no mining water uses listed with the NMSEO in the Estancia Basin.

### x. Summary All Depletions

**Table 59. Summary of depletions for the Estancia Underground Water Basin**

| use | surface water (ac-ft) | ground water (ac-ft) | total depletions (ac-ft) |
|---|---|---|---|
| public water systems | 0 | 790[a] | 790[a] |
| domestic (self supplied) | 0 | 213[b] | 213[b] |
| irrigated agriculture | 0 | 41,204[b] | 41,204[b] |
| livestock (self supplied) | 164[b] | 440[b] | 604[b] |
| commercial (self supplied) | 0 | 23[b] | 23[b] |
| industrial (self supplied) | 0 | 17[b] | 17[b] |
| stockpond evaporation | 1,780[c] | 0 | 1,780[c] |
| reservoir evaporation | 15[c] | 0 | 15[c] |
| total | 1,959 | 0 | 44,646 |

[a] - includes unofficial 1995 data
[b]- 1990 data
[c]-1980 data
ac-ft: acre-feet

## c. Water Rights by Category of Use

Water rights information is catalogued at the State Engineer District Office in Albuquerque. Besides the individual water rights paper documentation contained in individual files, the information is summarized on mapping of the Estancia Basin, by section, township, and range. These maps were researched and part information on water rights in this report was obtained from that mapping, and should not be construed as exhaustive. The maps, however, do not include self supplied domestic wells. The declared or licensed water rights are recognized by the NMSEO pre-basin rights. Current permitted water rights are rights that were issued by the NMSEO based on the current administrative criteria using the 9-block template. Pending license for water rights include applications for water rights which have been submitted to the NMSEO.

**Table 60. Location of water rights as reported by the State Engineer Office in 1995 for the Estancia Underground Water Basin**

| location | | declared or licensed water right | | current permitted water right | | pending license for water right | | non-irrigation water right (municipal, etc.) | |
|---|---|---|---|---|---|---|---|---|---|
| township | range | acreage | wells | acreage | wells | acreage | wells | right (ac-ft) | wells |
| 2N | 11E | 50.2 | 1 | | | | | 15 | 1 |
| 3N | 10E | | | 160 | 1 | | | | |
| 3N | 11E | 160 | 2 | 328 | 1 | | | | |
| 4N | 5E | | | | | | | | |
| 4N | 6E | 6.2 | 1 | | | | | 4.5 | 1 |
| 4N | 7E | 59.7 | 2 | 26.66 | 2 | | | 564.6 | 2 |
| 4N | 8E | 412.5 | 4 | | | 1,601 | 12 | | |
| 4N | 9E | 83.4 | 3 | 160 | 1 | 1,225.1 | 11 | 17.98 | 3 |
| 5N | 6E | | | 50 | 2 | 40.8 | 3 | 8.06 | 1 |
| 5N | 7E | 942.9 | 12 | 284.4 | 5 | | | | |
| 5N | 8E | 4,978.3 | 53 | 97.3 | 2 | 1,106.8 | 16 | | |
| 5N | 9E | 1,290.6 | 7 | | | 79.8 | 1 | 1,000 | 1 |
| 5N | 10E | 269.9 | 1 | | | | | | |
| 6N | 5E | | | | | 1 | 1 | | |
| 6N | 6E | | | | | | | 36.7 | 1 |
| 6N | 7E | 483.2 | 9 | 220 | 3 | | | | |
| 6N | 8E | 3,457.86 | 46 | 938.29 | 15 | 336.9 | 6 | 529.45 | 3 |
| 6N | 9E | 536.57 | 4 | 667.01 | 2 | 773.78 | 4 | | |
| 6N | 10E | 397.31 | 3 | 128.12 | 1 | | | | |
| 6N | 11E | | | 160 | 1 | | | | |
| 7N | 7E | 341 | 3 | 503 | 3 | | | 14.5 | 3 |
| 7N | 8E | 5,048.51 | 67 | 515.19 | 13 | 265.2 | 7 | | |
| 7N | 9E | 2,560.60 | 25 | 2,019.80 | 14 | 1,105.27 | 8 | | |
| 7N | 10E | 355.4 | 2 | | | | | | |
| 8N | 6E | | | | | | | 25.8 | 2 |
| 8N | 7E | 50 | 1 | | | | | 13.44 | 1 |
| 8N | 8E | 3,710.5 | 42 | 834.65 | 10 | 135.2 | 2 | 48 | 2 |
| 8N | 9E | 3,424.29 | 40 | 1,356 | 12 | 485.7 | 7 | 180 | 1 |
| 9N | 7E | | | 30 | 1 | | | | |
| 9N | 8E | 1,574.95 | 30 | 1,259.45 | 17 | 901 | 4 | 999.75 | 21 |
| 9N | 9E | 151.41 | 7 | | | 184.5 | 2 | 168.94 | 6 |
| 9N | 10E | | | | | | | 15.4 | 2 |
| 10N | 5E | 10 | 2 | | | 0.7 | 1 | 658.35 | 31 |
| 10N | 6E | | | 20 | 1 | | | 36.25 | 6 |
| 10N | 7E | 339.26 | 4 | 139.51 | 5 | | | 2,055.72 | 12 |
| 10N | 8E | 1,172.17 | 14 | 396.4 | 9 | 3,843.14 | 33 | 20 | 2 |
| 10N | 9E | 1,498.3 | 14 | 55.97 | 1 | 1,952.1 | 18 | | |
| 11N | 5E | | | 160 | 1 | | | 76.5 | 9 |
| 11N | 6E | | | 8 | 1 | | | 29.2 | 2 |
| 11N | 7E | 80 | 1 | 185 | 4 | | | 3,236.73 | 4 |
| 11N | 8E | | | | | 688.04 | 6 | 1,570 | 1 |
| 11N | 9E | | | 106.66 | 3 | 821.34 | 9 | | |
| 11N | 10E | | | 75 | 2 | | | | |
| 12N | 7E | 17.6 | 2 | | | | | 15.4 | 2 |
| total | | 33,463 | 402 | 10,884 | 133 | 15,547 | 151 | 11,340 | 120 |
| total (acre-feet) | | 83,658[a] | | 27,210[a] | | 38,868[a] | | 11,340 | |
| grand total | | 149,736 acre-feet | | | | | | 11,340 acre-feet | |

[a] - based on 2.50 acre-feet per acre

### i. Public Water Supply

Public water-supply water rights consist of municipal, mutual domestic water associations, water cooperatives, and wells for subdivisions. According to the water rights mapping, only two municipalities are listed with water rights, the towns of Mountainair and Estancia. One Mutual Domestic Water Consumers Association (MDWCA) was also indicated. Substantial research into the documents on file with the NMSEO is required to identify the rights associated with all public water supplies in the Estancia Basin.

The following Table 61 summarizes the current water rights information contained in the mapping on file with the State Engineer for public water supply.

**Table 61. Public water-supply water rights per the 1995 State Engineer Office mapping file**

| public water supplier | water rights (ac-ft/an) |
|---|---|
| Entranosa Water Co-Op | n/a |
| Edgewood Water Co-Op | n/a |
| Estancia Water System | 489.95 |
| Moriarty Water System | n/a |
| Mountainair Water System | 1564.60 |
| Willard Water System | n/a |
| Melody Ranch Subdivision | n/a |
| Pajarito Estates Subdivision | n/a |
| Manzano MDWCA | n/a |
| Punta de Agua MDWCA | 13.44 |
| Torreon MDWCA | n/a |
| Tajique MDWCA | n/a |
| Edgewood Meadows Water Co-Op | n/a |
| Indian Hills Water Company Subdivision | n/a |
| Echo Ridge Water Company | n/a |
| Homestead Water Company | n/a |
| Squaw Valley Water Supply | n/a |
| total | |

MDWCA: Mutual Domestic Water Consumers Association
ac-ft/an: acre-feet per annum
n/a: not available

### ii. Domestic

Domestic well permits are not recorded on the NMSEO Estancia Basin water right mapping. To obtain a fairly accurate count of domestic-use-only well permits, the latest well permit number was used as the total number of permits issued, and the number of non-domestic wells obtained from the water right mapping was subtracted (Bob Thompson, NMSEO Albuquerque District, personal communication). A total of 5,889 domestic well permits in the Estancia Basin are estimated. Domestic wells are permitted to use up to 3 acre-feet per year for non-commercial uses. Based on the estimated 5,889 domestic well permits, there are approximately 17,667 acre-feet per annum domestic water rights in the Estancia Basin.

### iii. Industrial

There is only 1 well permit recorded for Industrial uses in the Estancia Basin. The water rights for this well total 6.0 acre-feet per annum.

### iv. Commercial

There are 69 well permits recorded for Commercial uses in the Estancia Basin. The water rights for these wells total 4,954.12 acre-feet per annum.

### v. Irrigated Agriculture

There are approximately 686 well permits recorded for Irrigation uses in the Estancia Basin. The water rights for these wells total 59,834.41 acres, which converts to 149,586.025 acre-feet per annum based on 2.50 acre-feet per acre.

### vi. Summary Total All Uses

The following Table 62 summarizes the approximate current water rights information contained in the mapping on file with the State Engineer.

**Table 62. Summary of water rights per the 1995 State Engineer Office mapping file**

| type of water right | irrigation right (acres) | irrigation right (acre-feet)[a] | number of wells |
|---|---|---|---|
| declared or licensed water right | 33,402.63 | 83,506.58 | 402 |
| current permitted water right | 10,884.41 | 27,211.03 | 133 |
| pending license for water right | 15,547.37 | 38,868.43 | 151 |
| non-irrigation water right (municipal, etc.) | n/a | 11,340.27[b] | 115 |
| self supplied domestic users | n/a | 17,667[c] | 5,889[d] |
| total water rights, all categories | 59,834.41 | 149,586.03 | 6,690 |

[a] - based on 2.50 acre-feet per annum per acre
[b] - non-irrigation uses
[c] - based on 3 acre-feet per annum per permit
[d] - permits

## e. Public Water-Supply Systems by Community

### i. Present Water Use Data

The following Table 63 summarizes the water withdrawals used for public water supply in the Estancia Basin.

**Table 63. Public water-supply withdrawals for 1995 in the Estancia Underground Water Basin**

| water supplier | population served | usage (gpcd) | total withdrawal (ac-ft) |
|---|---|---|---|
| Entranosa Water Co-Op | 4,400[a] | 91[a] | 442.74[a] |
| Edgewood Water Co-Op | 4,500[a] | 79[a] | 398.66[a] |
| Edgewood | 1,200[a] | 76[a] | 102.00[a] |
| Estancia Water System | 792[a] | 285[a] | 253.35[a] |
| Moriarty Water System | 1,399 | 207 | 325.16 |
| Tajique Water System | 452[a] | 13.5[a] | 6.8[a] |
| Echo Ridge Subdivision | 225[a] | 106[a] | 26.72[a] |
| Mountainair | 926 | 173 | 179.86 |
| Willard Water System | 200[a] | 99[a] | 22.20[a] |
| total | 14,094 | 125.5 (avg.) | 1,757.49 |

[a] - based on unofficial 1995 data, NMSEO questionnaire (Brian Wilson, P.E.)
gpcd: gallons per capita per day
ac-ft: acre-feet

**a) Average Daily Water Consumption (see below)**

The following Table 64 summarizes the public water-supply data for the Estancia Basin.

**Table 64. Public water-supply data for 1995 in the Estancia Underground Water Basin**

| water supplier | population served | usage (gpcd) | daily use (gallons) |
|---|---|---|---|
| Entranosa Water Co-Op | 4,400[a] | 91[a] | 400,400[a] |
| Edgewood Water Co-Op | 4,500[a] | 79[a] | 355,500[a] |
| Edgewood | 1,200[a] | 76[a] | 91,200[a] |
| Estancia Water System | 792[a] | 285[a] | 225,720[a] |
| Moriarty Water System | 1,399 | 207 | 289,950 |
| Tajique Water System | 452[a] | 13.5[a] | 6,100[a] |
| Echo Ridge Subdivision | 225[a] | 106[a] | 23,850[a] |
| Mountainair | 926 | 173 | 160,200 |
| Willard Water System | 200[a] | 99[a] | 19,800[a] |
| total | 14,094 | 112 | 1,572,720[b] |

[a] - based on unofficial 1995 data, NMSEO questionnaire (Brian Wilson, P.E.)
[b] - rounded
gpcd: gallons per capita per day

**b) Per Capita Water Withdrawal Rates**

As shown in Table 64 above, the per capita water use varies substantially with the public water system. These withdrawal rates vary from just under 14 gallons per person per day (gpcd) in Tajique to around 285 gpcd in the Estancia water system. Typically, any type of landscape irrigation will increase the per capita consumption by as much as 100 percent of the typical domestic uses (drinking/cooking, bathing, washing, etc.). Additionally, in larger systems where there are commercial/industrial or irrigation (parks, etc.) uses, the per capita consumptive values are higher than their rural counterparts because the non-domestic use is averaged into the figures.

**f. Irrigation Practices**

**i. Irrigated Lands**

**a) Present**

In 1990, 24,590 acres of irrigated farmland were reported (Wilson, 1990). The quantity of ground water that must be diverted for crops depends on the type of crop and the irrigation method. Flood, sprinkler, and drip irrigation are used throughout the Basin. Consumptive irrigation requirements for the three types of irrigation for Bernalillo, Santa Fe, and Torrance Counties within the Basin are shown on Table 54. Wilson (1990) points out that when considering a change from one type of irrigation to another, factors such as land slope, soil conservation, water conservation, and crop type should be taken into account.

**g. Return Flows**

**i. Agriculture**

**a) Amounts**

Agriculture return flows are based on the irrigation method and the number of acres irrigated with each type of irrigation. The return flow is the difference between the total quantity of ground water diverted less the quantity of water depleted. Ground-water diversions for irrigation are shown in Table 45, and ground-water depletions for irrigation are shown on Table 55. The following Table 65 summarizes the return flows from irrigated agriculture use in the Estancia Basin.

**Table 65. Irrigated agriculture return flows for 1990 in the Estancia Underground Water Basin**

| type of irrigation | county | irrigated acreage | total return (acre-feet) |
|---|---|---|---|
| flood | Bernalillo | 50 | 51 |
| flood | Santa Fe | 1,265 | 804 |
| flood | Torrance | 5,765 | 5,866 |
| sub-total | | 7,080 | 6,721 |
| drip | Santa Fe | 110 | 21 |
| drip | Torrance | 10 | 2 |
| sub-total | | 120 | 23 |
| sprinkler | Santa Fe | 5,165 | 1,828 |
| sprinkler | Torrance | 12,225 | 4,664 |
| sub-total | | 17,390 | 6,492 |
| total all classes | | 24,590 | 13,236 |

[a] - based on 1990 data

## ii. Municipal and Industrial

### a) Amounts

Municipal and industrial return flow values indicate the estimated amount of water which may be theoretically returned to the Estancia Basin via wastewater treatment discharge, septic tank drain fields, landscape watering, etc., and are obtained by subtracting the total depletions from the total diversions.

The following Table 66 summarizes the water return flows from the municipal, domestic, industrial, and commercial water supply in the Estancia Basin:

**Table 66. Municipal, domestic, industrial, and commercial water-supply return flows in the Estancia Underground Water Basin**

| water supplier | population served | return (gpcd) | total returns (ac-ft)[c] |
|---|---|---|---|
| Entranosa Water Co-Op | 4,400[a] | 50[a] | 244[a] |
| Edgewood Water Co-Op | 4,500[a] | 43[a] | 220[a] |
| Edgewood | 1,200[a] | 42[a] | 56[a] |
| Estancia Water System | 792[a] | 157[a] | 139[a] |
| Moriarty Water System | 1,399 | 114 | 179 |
| Tajique Water System | 452[a] | 8[a] | 4[a] |
| Echo Ridge Subdivision | 225[a] | 58[a] | 15[a] |
| Mountainair | 926 | 95 | 99 |
| Willard Water System | 200[a] | 54[a] | 12[a] |
| self supplied domestic | 6,954 | 35 | 260 |
| commercial | n/a | n/a | 24 |
| industrial uses | n/a | 0.00[b] | 0.00[b] |
| total | 21,048 | 53 | 1,252[c] |

[a] - estimated, based on unofficial 1995 data and 1990 NMSEO report percentages (Brian Wilson, P.E.)
[b] - 100 percent depletion, based on 1990 NMSEO report (Brian Wilson, P.E.)
[c] - rounded
gpcd: gallons per capita per day
ac-ft: acre-feet
n/a: not available

### h. Natural Lake Evaporation

#### i. Mountain Lakes

The following Table 67 summarizes the reservoir evaporation in the Estancia Basin.

**Table 67. Reservoir evaporation for 1980 in the Estancia Underground Water Basin**

| reservoir | surface area (acres) | net evaporation (feet) | total evaporation (acre-feet) |
|---|---|---|---|
| Manzano Lake | 3 | 2.67 | 8 |
| Sherwood Forest Lake | 3 | 2.33 | 7 |
| total | 6 | | 15 |

The NMSEO does not recognize playa lake evaporation in its water use inventory.

The following Table 68 summarizes the return flows in the Estancia Basin.

**Table 68. Summary of annual return flows for the Estancia Underground Water Basin based on 1990 and 1995 data**

| use | surface water (ac-ft) | ground water (ac-ft) | total return (ac-ft) |
|---|---|---|---|
| public water systems | 0 | 967[a] | 967[a] |
| domestic (self supplied) | 0 | 260 | 260 |
| irrigated agriculture | 0 | 13,236 | 13,236 |
| livestock (self supplied) | 0 | 0 | 0 |
| commercial (self supplied) | 0 | 24 | 24 |
| industrial (self supplied) | 0 | 0 | 0 |
| total | 0 | 14,487 | 14,487 |

[a] - includes unofficial 1995 data
ac-ft: acre-feet

## 2. Future Water Uses in the 40-Year Planning Horizon

### a. Projected Future Demographics

Continued population growth is projected for the Estancia Basin, as shown in Table 69. The Moriarty area is projected to be the fastest growing part of the Basin.

Population projections for Bernalillo County and Torrance County were developed from population projections prepared by the Middle Rio Grande Council of Governments (MRGCOG). MRGCOG compiled 1990 Census data, prepared 1995 estimates, and developed 2020 projections for small areas called Data Analysis Subzones (DASZs). The Moriarty, Estancia, and Mountainair areas are individual DASZs, and Willard falls within three DASZs. Therefore, population estimates and projections are reported for the Moriarty, Estancia, and Mountainair areas, and the county remainder, including Willard. Southwest Land Research prepared interim year projections and projections to 2040 based on MRGCOG average annual growth rates.

Population projections for the Santa Fe County portion of the Estancia Basin were developed from population and housing projections prepared for the Santa Fe County Land Use Department in August 1994. These projections were developed for 1990 through 2020, and have been extended to 2040.

**Table 69. Population projections for the Estancia Underground Water Basin**

| county (within Basin) | 1990 | 1995 | 2000 | 2010 | 2020 | 2040 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | long term trend | short term trend | MRCOG water study rates | BBER rate |
| Moriarty (0111) | 2,355 | 2,979 | 3,607 | 4,749 | 6,172 | 11,054 | 10,425 | 9,681 | 8,500 |
| Estancia (0321) | 1,004 | 1,205 | 1,340 | 1,609 | 1,970 | 2,919 | 2,953 | 2,557 | 2,245 |
| Mountainair (0401) | 1,009 | 1,070 | 1,167 | 1,313 | 1,458 | 1,867 | 1,798 | 1,636 | 1,436 |
| Unincorporated Area | | | | | | | | | |
| West of Moriarty | 1,665 | 2,387 | 2,908 | 3,754 | 5,365 | 10,255 | 10,958 | 8,982 | 7,886 |
| SW of Moriarty | 707 | 969 | 1,166 | 1,566 | 2,111 | 3,936 | 3,936 | 3,447 | 3,026 |
| SE of Moriarty | 670 | 902 | 1,080 | 1,445 | 1,944 | 3,593 | 3,518 | 3,147 | 2,763 |
| South 14 | 1,002 | 1,093 | 1,242 | 1,497 | 1,793 | 2,664 | 2,572 | 2,333 | 2,049 |
| NW of Estancia | 511 | 668 | 811 | 1,086 | 1,448 | 2,689 | 2,574 | 2,355 | 2,068 |
| East of Estancia | 329 | 611 | 804 | 1,045 | 1,215 | 2,106 | 1,642 | 1,844 | 1,619 |
| SW of Estancia | 238 | 259 | 289 | 350 | 430 | 645 | 649 | 565 | 496 |
| South of US 60 | 291 | 382 | 494 | 633 | 731 | 1,229 | 975 | 1,076 | 945 |
| total Unincorporated | 5,413 | 7,271 | 80,794 | 11,376 | 14,306 | 27,116 | 26,725 | 22,673 | 19,907 |
| Torrance County total | 9,781 | 12,525 | 14,908 | 19,047 | 24,637 | 42,957 | 41,901 | 37,622 | 33,033 |
| Santa Fe County | | | | | | | | | |
| Cedar Grove Area | 826 | 928 | 1,011 | 1,188 | 1,302 | 2,328 | 2,184 | 1,188 | 1,402 |
| Edgewood Area | 2,880 | 3,965 | 5,025 | 6,915 | 8,296 | 20,425 | 13,917 | 10,422 | 12,306 |
| Stanley Area | 205 | 286 | 395 | 585 | 725 | 2,081 | 1,216 | 1,062 | 1,254 |
| Santa Fe County Total | 3,911 | 5,180 | 6,430 | 8,688 | 10,323 | 24,447 | 17,318 | 12,474 | 14,729 |
| Bernalillo County | 3,214 | 4,162 | 4,755 | 6,285 | 8,347 | 12,840 | 14,723 | 9,242 | 9,941 |
| San Miguel County | 40 | 42 | 44 | 49 | 54 | 66 | 66 | 66 | 66 |
| basin total | 16,946 | 21,908 | 26,137 | 34,069 | 43,361 | 80,309 | 74,008 | 59,404 | 57,769 |
| EMA outside basin | 8,190 | 10,100 | 11,668 | 15,383 | 20,170 | 29,694 | 28,643 | 22,332 | 24,020 |
| population of area potentially using basin water | 25,136 | 32,009 | 37,806 | 49,451 | 62,800 | 110,003 | 119,969 | 94,406 | 96,751 |

Source: Middle Rio Grande Council of Governments (MRCOG), Santa Fe County, and Southwest Land Research

The highest projection assumes continuation of the projected 1995 to 2020 trend to 2040. Under that scenario, the Basin population would reach 70,796 by 2040, and when combined with the remaining East Mountain Area, nearly 100,000 people could be creating demand for Estancia Basin water.

The MRGCOG Water Planning study and BBER growth rates produce nearly identical results for the entire East Mountain Area, but the population of the Basin is higher using COG assumptions.

**a) Source of Population Growth**

Population growth in the Estancia Basin is largely attributable to migration into the area. The growth of urban Albuquerque has resulted in increasing population growth in rural communities outside the urban area, and this growth extends as far as Moriarty and Estancia. Accessibility to jobs in Albuquerque via I-40, lower housing costs, the availability of large rural lots, and an excellent small school district make the East Mountain area and the communities in the Estancia Basin attractive to families seeking a more rural lifestyle.

Natural increase and net migration are typically projected at the county level, so information regarding the Bernalillo County and Santa Fe County portions of the Basin is not very useful for analyzing the source of population growth. Components of growth for Torrance County are similar to characteristics for the Basin.

From 1980 to 1990, migration accounted for 75 percent of the growth in Torrance County. Projections for Torrance County prepared by the Bureau of Business and Economic Research at UNM show that net migration is projected to continue to account for about 75 percent of the County's population growth over the next 25 years.

**b) Methodology to Project Population**

The methodology used in projecting population starts with a "top-down" approach which considers growth at the state and county levels and then allocates projected growth to the subcounty level. Existing projections to 2020 were used as the basis for projections to the year 2040. Existing projections were prepared by three different sources, the BBER and MRGCOG and Santa Fe County, but similar methodologies were used in both sets of projections.

Population was projected first at the county level for all counties using a cohort-component methodology which takes into account natural increase (births minus deaths) and net migration (people moving into the county less people moving out). The data required for making assumptions about birth and death rates and historic migration trends are available only at the state and county levels. In general, county growth is projected by considering natural increase at the county level and migration in the context of projected state growth and historic migration trends.

At the subcounty level, the share of county growth allocated to small areas is based on historical subcounty growth rates and the availability of land for future development. County projections are considered to be control totals, with subcounty growth summing to the county control total.

Projections for 2020 for Bernalillo and Torrance Counties were developed by the MRGCOG using BBER county forecasts. These projections were done for the four-county area surrounding Albuquerque and reflect a trend of increasing rural and suburban development surrounding the Albuquerque urban area.

Projections for 2000, 2010, and 2020 for Santa Fe County were developed by Santa Fe County as part of the County's General Plan Update. The Santa Fe County projections assume that the southern part of Santa Fe County will account for a slightly higher share of county growth through 2020 because of the expansion of the Albuquerque metropolitan area east of the Sandia Mountains and because of higher housing costs in the central region of the county closer to Santa Fe.

Four sets of projections were prepared for 2020 to 2040, using different assumptions about the future rate of growth. Long term trend projections assume a growth rate from 2020 to 2040 equal to the 1995 to 2020 trend. Short term trend projections assume that growth from 2020 to 2040 will be at a rate similar to the trend from 2010 to 2020. In general, this series assumes a slowing of growth at the end of the projection period. The COG Water Study rate projection assumes that growth from 2020 to 2040 will be at the rate projected by the MRGCOG in its Regional Development Forecast for Regional Water Planning, completed in 1991. The projections are updated by starting with the current 2020 projections and assuming the 2020 to 2030 average annual growth rate to 2040. The BBER Rate series assumes that the rate of future growth is similar to the rate projected by the BBER in its most recent published county level forecasts for the state. Growth rates for subcounty areas for each series are shown in Table 70.

**Table 70. 2020 to 2040 average annual growth rate by area**

| | 2040 growth rate | | | |
|---|---|---|---|---|
| | long term trend | short term trend | COG water study rates | BBER rates |
| Moriarty | 2.96% | 2.66% | 2.28% | 1.61% |
| Estancia | 1.99% | 2.04% | 1.31% | 0.65% |
| Mountainair | 1.25% | 1.05% | 0.58% | -0.08% |
| | | | | |
| Unincorporated Area | | | | |
| West of Moriarty | 3.29% | 3.64% | 2.61% | 1.94% |
| SW of Moriarty | 3.16% | 3.03% | 2.48% | 1.82% |
| SE of Moriarty | 3.12% | 3.01% | 2.44% | 1.77% |
| South 14 | 2.00% | 1.82% | 1.33% | 0.67% |
| NW of Estancia | 3.14% | 2.92% | 2.46% | 1.80% |
| East of Estancia | 2.79% | 1.52% | 2.11% | 1.45% |
| SW of Estancia | 2.05% | 2.08% | 1.37% | 0.72% |
| South of US 60 | 2.63% | 1.45% | 1.95% | 1.29% |
| total Unincorporated | 3.25% | 3.17% | 2.33% | 1.67% |
| | | | | |
| Torrance County total | 2.97% | 2.45% | 2.29% | 1.63% |
| | | | | |
| Santa Fe County | | | | |
| Cedar Grove Area | 2.62% | 2.62% | -0.46% | 0.37% |
| Edgewood Area | 2.62% | 2.62% | 1.15% | 1.99% |
| Stanley Area | 2.62% | 2.62% | 1.92% | 2.78% |
| Santa Fe County total | 2.62% | 2.62% | 0.95% | 1.79% |
| | | | | |
| Bernalillo County | 2.18% | 2.88% | 0.51% | 0.88% |
| San Miguel County | 1.00% | 1.02% | 1.02% | 1.02% |
| Basin Total | 3.22% | 3.88% | 2.66% | 2.71% |
| EMA outside basin | 1.95% | 1.77% | 0.51% | 0.88% |
| Population of area potentially using basin water | 2.84% | 3.29% | 2.06% | 2.18% |

Source: Southwest Land Research

### ii. Future Land Use Requirements

The estimates of future land use requirements are based on the current ratio of land to population and employment. Projections of land for urban development are shown in Table 71.

Table 71. Land required for urban development

| land use type | 1980 baseline (population and employment density) | land required in 1995 (acres) | land required in 2020 (acres) | land required in 2040 (acres) | | | |
|---|---|---|---|---|---|---|---|
| | | | | long term trend | short term trend | COG water study rate | BBER rate |
| residential | 3,122 acres<br>11,830 people<br>3.7 persons/acre | 5,681 | 11,250 | 18,264 | | 15,677 | 15,245 |
| other urban development | 1,133 acres<br>1,411 jobs | 2,427 | 5,135 | | | | |

Source: Southwest Land Research

### iii. Economic Growth and Jobs

Projected employment growth is shown in Table 72.

Table 72. Projected employment growth

| county (w/in Basin) | 1990 | 1995 | 2020 | 2040 | | | |
|---|---|---|---|---|---|---|---|
| | | | | long term trend | growth rate* | short term trend | growth rate* |
| Torrance | 1,730 | 2,451 | 4,362 | 7,657 | 2.85% | 5,864 | 1.96% |
| Santa Fe | NA | 564 | 833 | 1,137 | 1.57% | 1,128 | 1.53% |
| Bernalillo | 172 | 252 | 1,065 | 3,374 | 5.93% | 2,135 | 4.86% |
| basin total | 1,902 | 2,975 | 6,260 | 12,168 | 3.18% | 9,127 | 2.52% |
| East Mountain Area outside basin | 794 | 1,165 | 2,892 | 5,792 | 3.63% | 5,502 | 3.51% |
| employment in area potentially using Estancia Basin water | 2,696 | 4,140 | 9,152 | 17,960 | 3.31% | 14,629 | 2.84% |

Source: Middle Rio Grande Council of Governments, Santa Fe County, Southwest Land Research
*Average annual rate of growth from 1995 to 2040

Strong job growth is projected for the Basin, with the most rapid job growth projected for the East Mountain Area of Bernalillo County. Within the Basin, over 12,000 jobs are projected by 2040 under the long term scenario, and over 9,000 jobs are projected under the short term trend scenario.

Job growth is projected to outpace population growth, increasing local job opportunities for Basin residents. However, commuting to jobs outside the Basin will still be the dominant trend.

### b. Assumptions in Developing Projections of Water Use

Public water systems provide water to serve population growth within their service areas as well as most businesses in the Basin. Historical use rates include use by both population and businesses. Projected water demand is based primarily on population growth, and because employment growth is projected to parallel population growth, demand includes most projected demand for businesses as well. In 1995, about 68 percent of the Basin population obtained water from a public system. This proportion is projected to continue into the future.

By 2020, the Paa-Ko Subdivision will be built out. This subdivision has been approved for 1,440 units, which will support a population of approximately 3,900. The State Engineer has approved diversion of 500 acre-feet per annum from the Estancia Underground Water Basin to serve this development, and it is assumed that the entire 500 acre-feet per annum diversion will be in use by 2020. An application has been filed for the export of an additional 300 acre-feet per annum from the Basin. The projections do not assume diversions out of the Basin other than what has been approved for Paa-Ko Subdivision. The East Mountain Area of Bernalillo County outside the Estancia Basin is growing rapidly, and it is likely that additional exports out the Basin will be requested by 2040.

**Table 73. Projected water demand, public water supply diversion in the Estancia Underground Water Basin**

| | projected population on public water systems | | | projected diversion, afy assuming 0.12 afy/p | | |
|---|---|---|---|---|---|---|
| location | 2000 | 2020 | 2040 | 2000 | 2020 | 2040 |
| in basin | 17,463 | 29,031 | 47,900 | 2,096 | 3,484 | 5,748 |
| out of basin | 1,200 | 3,900 | 3,900 | 144 | 500 | 500 |

afy/p: acre-feet per year per person

An estimated 32 percent of the Basin population is served by domestic wells. A portion of new residential development will continue to be on private wells. The projections assume that 32 percent of the total basin population continues to obtain water from domestic wells, as shown in Table 74.

**Table 74. Projected water demand, domestic water diversions for the Estancia Underground Water Basin**

| projected population on domestic wells | | | projected diversion, afy assuming 0.12 afy/p | | |
|---|---|---|---|---|---|
| **2000** | **2020** | **2040** | **2000** | **2020** | **2040** |
| 8,180 | 13,599 | 22,400 | 573 | 952 | 1,568 |

afy/p: acre-feet per year per person

The amount of irrigated agricultural land in the Basin has fluctuated from 20,000 to 35,000 acres over the past 40 years. If local conditions continue, these values can be expected to represent the upper and lower bounds of irrigated agricultural lands in the future. As shown in Table 75, projected diversions could vary widely, from 44,000 to 77,000 acre-feet per annum, depending upon the total lands in production in a given year.

**Table 75. Projected water demand, based on historic range of irrigated agriculture in the Estancia Underground Water Basin**

| diversion | projected irrigated agriculture (acres) | projected diversion (ac-ft/an) |
|---|---|---|
| 2.2 ac-ft/ac/y | 20,000 to 35,000 | 44,000 to 77,000 |

ac-ft/ac/y: acre-feet per acre per year
ac-ft/an: acre-feet per annum

Per acre water use also varies by type of irrigation. Current estimates of water demand show that the average annual diversion per acre for flood irrigated land is 2.56 acre-feet. The average annual diversion for sprinkler irrigated land is 2.1 acre-feet, and the average annual diversion for drip irrigated land is 1.26 acre-feet. Prudent management of irrigation through installation of lower water use irrigation systems, whenever possible, should reduce water demand without reducing the amount of land in production.

Most businesses in the Basin are served by public water systems. One industrial user and 18 commercial users (including local governments, churches and other institutions) currently have private wells, and account for a very small portion of total water demand in the Basin. It is assumed that a portion of industrial and commercial users will remain on private wells and that new demand for industrial and commercial wells will be proportional to projected employment growth. Table 76. shows projected commercial and industrial water use from private wells.

**Table 76. Projected water demand, commercial, and industrial use diversions from private wells in the Estancia Underground Water Basin**

| projected industrial water use, ac-ft/an | | | projected commercial use, ac-ft/an | | |
|---|---|---|---|---|---|
| 2000 | 2020 | 2040 | 2000 | 2020 | 2040 |
| 20 | 35 | 59 | 58 | 98 | 168 |

ac-ft/an: acre-feet per annum

It is assumed that livestock use, and stockpond and reservoir evaporation will remain about the same as current.

**Table 77. Projected livestock diversions, and stockpond and reservoir evaporation depletions**

| livestock diversions, ac-ft/an | stockpond evaporation depletion, ac-ft/an | reservoir evaporation depletion, ac-ft/an |
|---|---|---|
| 604 | 1,780 | 15 |

ac-ft/an: acre-feet per annum

## V. GROUND WATER SUMMARY

A summary of selected ground water data provided in the report are shown in Table 78. Projected ground-water diversions for 2020 and 2040 assume that irrigated agricultural will be within the historic range of 20,000 to 35,000 acres of land. The corresponding ground-water diversions would range from 44,000 to 77,000 acre-feet.

**Table 78. Basin ground-water diversions, depletions, projected ground-water diversions for 2020, estimated ground-water depleted from the valley-fill from 1956 to 1995, and estimated ground water in storage in the valley fill 1995**

| category | acre-feet |
|---|---|
| ground-water diversions, 1995[a] | 57,174 |
| ground-water depletions, 1990[b] | 42,687 |
| ground-water return flows[c] | 14,487 |
| projected ground-water diversion for 2020 | 50,314 to 83,314 |
| projected ground-water diversion for 2040 | 51,316 to 84,316 |
| ground-water depleted from the valley-fill from 1910 to 1995 | 1,410,000 |
| ground-water storage in the valley fill, 1995 | 6,580,000 |
| evaporation from salt lakes | 27,000 to 50,000 |

[a] - includes unofficial 1995 data
[b] - includes 1980 data, 1990, and unofficial 1995 data
[c] - includes 1990 and unofficial 1995 data

# VI. RECOMMENDATIONS FOR FUTURE STUDIES

## A. Hydraulic Connection Between the Madera Group and the Valley Fill

The hydraulic connection between the Madera Group and valley fill aquifers is poorly understood. No wells are known to have been completed solely in the Madera Group aquifer beneath saturated areas of the valley fill. Monitor wells, or nested piezometers, completed in select areas in the Madera Group and the valley fill could provide useful data regarding the hydraulic connection between these aquifers. Water levels in the wells should be monitored at least quarterly to assess changes in the potentiometric surface elevations. The use of transducers and data loggers could provide daily water level measurements. Daily water level data could be used to assess flow between the aquifers. Ideally, the wells would be completed as far from large pumping wells as practicable to reduce the effects from pumping on water levels.

Water-quality analyses from the wells should also be performed. Water-quality data can also help assess the interaction between the aquifers.

## B. Subsidence of Valley Fill

Dewatering of the valley fill sediments will lead to compaction of the aquifer, and consequent subsidence of the land surface. This may also be accompanied by the formation of fissures at land surface and by damage to structures. The magnitude of drawdown in the valley fill sediments that will result in subsidence depends on many factors and has not been estimated. Compaction of the aquifer will limit the ability of the aquifer to store water. This could limit future opportunities for performing artificial recharge (injection of water into the aquifer) in the aquifer.

## C. Septic and Nitrate Problems

An increase in the density of septic tanks may lead to elevated nitrate concentrations in the ground water in portions of the Basin. Ground-water quality should be monitored in areas where developments using septic systems are becoming relatively dense. Community waste-water treatment plants, or alternative waste-water treatment methods for individual homes, should be investigated in areas where the potential to contaminate the ground water is relatively high.

## D. Monitor Spring Flows

A monitoring plan should be developed and implemented to document spring flow quantity and quality. Springs which flow year round should be monitored since it is likely to be cost prohibitive to monitor all springs in the Basin. Continuous flow-measurement recording devices would provide the best data. The data can be used to refine recharge estimates in the drainages. Two or three appropriately placed gages within a given drainage will help estimate surface water gains and losses in various portions of the drainage. Spring water quality could be monitored at intervals of 1 to 5 years to assess changes in water quality.

## E. Evapotranspiration Data

Evapotranspiration data for the Basin were not available. A study estimating evapotranspiration from the native plants could lead to more accurate estimates of the percentage of precipitation available annually for recharge. Evaporation data from additional weather stations and the salt lakes would also help in estimating recharge for various areas in the Basin.

## F. Isotope Studies

Stable isotope studies are often used to assess the location of recharge and the interaction between aquifers. These studies are often costly because of the relatively large number of samples that must be collected and analyzed, but they may provide valuable data for assessing the ground-water flow system.

## G. Ground-Water Quality Monitoring

Intrusion of ground water having high total dissolved solids concentrations into areas which have relatively low total dissolved solids concentrations should be monitored in the valley fill aquifer. As the ground water in the valley fill sediments continues to be mined, the opportunity for ground water having relatively high total dissolved solids concentrations, from areas generally on the eastern side of the Basin, becomes greater. This is because the ground water with high total dissolved solids concentrations is drawn towards pumping centers as the higher-quality ground water is mined. Several wells should be completed in selected areas where decreases in the ground-water elevation in the valley fill aquifer are relatively high and poorer quality water is relatively near. The water-quality monitoring program should include at least annual sampling and water-level measurements.

## H. Recommendations

1. In order to promote the beneficial use of water and to reduce conflict caused by uncertainty, it would be helpful for the State Engineer Office to develop more accurate administrative criteria for administration of the Basin and to promulgate regulations that outline procedures for and encourage the conservation of water within the Basin. Furthermore, the State Engineer may want to consider extending the Basin to include those lands adjoining the Basin that are currently unregulated. Finally, the State Engineer may wish, either administratively or by commencing judicial proceedings, to quantify more fully water rights within the Basin. State Engineer regulations defining the standard for non-interference between wells may also be of help in clarifying the rules by which ground water is withdrawn, thereby reducing conflict caused by well interference or impairment.

2. In order to promote conservation of water resources within the Basin, local governmental entities may wish to consider implementing measures to require or to create incentives for conservation of water. Land use regulations, including subdivision water quantity requirements and regulation of domestic wells, should also be considered. In addition to conservation plans, local governments could consider adopting taxation/rebate policies to advance conservation objectives.

3. Adoption of new regulations or statutory provisions designed to promote the beneficial use of water in the Basin may also be appropriate. A change in the law may be necessary in order to define more clearly requirements for the use of water, including under the 40-year planning statute and with regard to conserved water. Furthermore, the statutory or regulatory refinement of the meaning of public welfare may be important in determining adequate standards for the appropriation and use of water.

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2 Id. at 75.

3 Id. at 78.

4 Id. at 79.

5 Id. at 86.

6 Id. at 86 n. 97.

7 43 U.S.C. § 372 (1976). See California v. United States, 438 U.S. 645 (1978).

8 R. Clark, supra, note 1, § 19.3, at 88.

9 Id. at 87.

10 Clark, Ground Water Law: Problem Areas, 8 Nat. Res. Law. 377 (1975).

11 Trambley v. Lutterman, 6 N.M. 15, 27 P. 312 (1891).

12 N.M. Const. Art. 16. This general principle predated the New Mexico Constitution, having been recognized under Mexican law and the Kearney Code as well as territorial legislation.

13 § 72-1-1 NMSA 1978 (1985 Repl. Pamp.)

14 See State ex rel. Red River Valley Co. v. District Court, 39 N.M. 523, 51 P.2d 239 (1935).

15 § 72-1-3 NMSA 1978 (1985 Repl. Pamp.)

16 Id. at § 72-12-1.

17 Id. at § 72-1-1.

18 New Mexico Prods. Co. v. New Mexico Power Co., N.M. 311, 77 P.2d 634 (1937).

19 Snow v. Abalos, 18 N.M. 681, 140 P. 1044 (1914).

20 See N.M. Const. Art. 16, § 2; Keeney v. Carillo, 2 N.M. 480, 493 (1883), which recognizes that even though beneficial use is the measure of one's water rights, if one uses reasonable diligence in developing his water right, he is entitled to the expanded flow resulting from his efforts when his works are completed.

21 State ex rel. State Game Comm'n v. Red River Valley Co., 51 N.M. 207, 182 P.2d 421 (1945).

22 First State Bank v. McNew, 33 N.M. 414, 269 P. 56 (1928). See also Albuquerque Land & Irrigation Co. v. Gutierrez, 10 N.M. 177, 61 P. 357 (1900) (holding that a corporation could appropriate water for a third party).

23 Id. §§ 72-5-28, 72-118. These statutes do not allow forfeiture when a reasonable cause has brought about the nonuse. Prior to 1965, there was no requirement of notice from the State Engineer and the additional one-year waiting period.

24 State ex rel. Reynolds v. South Springs Co., 80 N.M. 144, 452 P.2d 478 (1969).

25 Martinez v. Mundy, 61 N.M. 87, 295 P.2d 209 (1956).

26 La Luz Community Ditch Co. v. Town of Alamogordo, 34 N.M. 127, 279 P. 72 (1929). Estoppel will not run against the State Engineer, however.

27 See, e.g., Chavez v. Gutierrez, 54 N.M. 76, 213 P.2d 597 (1950); New Mexico Prods. Co. v. New Mexico Power Co., 42 N.M. 311, 77 P.2d 634 (1937).

28 See § 72-5-1 (Repl. Pamp. 1996).

29 Id. § 72-2-1.

30 Id. §§ 72-2-9, 72-5-1 to 39.

31 Id. §§ 72-3-2, 72-5-20.

32 Id. §§ 72-5-22, 75-5-23 and 72-5-25. A few community ditches that were actually operating prior to 1907 are not governed by State Engineer jurisdiction when changing uses. Id. § 75-14-60.

33 W.S. Rancho Co. v. Kaiser Steel Corp., 79 N.M. 65, 439 P.2d 714 (1968).

34 A silt retention dam or a stock pond created on a stream by erecting a dam less than ten feet in height and a pond holding less than ten acre-feet of water is exempt. § 72-5-32 NMSA 1978. Springs which do not have a well-defined channel and which sink back into the ground are likewise exempt. Burgett v. Calentine, 56 N.M. 194, 242 P.2d 276 (1956). Finally, diffused surface waters as well as other "artificial surface waters" such as seepage, drainage, and wastewater may be captured by the landowner. §§ 72-12-18, 72-12-20 NMSA 1978.

35 § 72-12-18, 72-12-20 NMSA 1978.

36 Id. at 72-12-3.

37 Id. § 72-12-3(E).

38 City of Roswell v. Berry, 80 N.M. 110, 452 P.2d 179 (1969).

39 § 72-12-7 NMSA 1978.

40 Comment, Water Law--The Rise and Fall of New Mexico's Templeton Doctrine, 6 Nat. Res. J. 325 (1966).

41 § 72-12-7 NMSA 1978.

42 Heine v. Reynolds, 69 N.M. 398, 367 P.2d 708 (1962).

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47 Id.

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50 Section 72-5-26 NMSA 1978 (1985 Repl. Pamp.).

51 See New Mexico Prds. Co. v. Mexico Power Co., 42 N.M. 311, 321 77 P2d 634 (1937); Elephant Butte Irr. Dist. v. Regents of New Mexico State University, 115 N.M. 229, 233, 849 P.2d 372 (Ct. App.), cert. denied, Martinez v. Elephant Butte Irr. Dist., 115 N.M. 359, 851 P.2d 481 (1993).

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59 Id. at subsection (D).

60 City of El Paso v. Reynolds, 597 F. Supp. 694, 703 (1984) (El Paso II).

61 Id. (quoting Pike v. Bruce Church, 397 U.S. 137, 142 (1970)).

62 82 Okl.Stat.Ann. § 105.12, par. 4; San Antonio v. Texas Water Commission, 407 S.W.2d 752 (Tex. 1966).

63 Id. at § 72-6-3 (1985 Repl. Pamp.).

64 Id.

[65] See Ellis & DuMars, Two-Tiered Market in Western Water, 57 Neb. L. Rev. 333 (1978).

[66] § 72-12-7(a) NMSA 1978 (1985 Repl. Pamp.).

[67] Id. § 72-12-3 (1985 Repl. Pamp.).

[68] N.M. Const., art. XVI, § 5, see also N.M. Stat. Ann. §§ 72-7-1 to -7-3 (1985 Repl. Pamp.).

[69] Stokes v. Morgan, 101 N.M. 195, 680 P.2d 335, 342 (1978).

[70] § 72-12-7(a) NMSA 1978 (1985 Repl. Pamp.).

[71] W.S. Ranch v. Kaiser Steel Corp., 79 N.M. 65, 439 P.2d 714 (1968).

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[73] 77 N.M. 239, 421 P.2d 771 (1966).

[74] 71 N.M. 428, 379 P.2d 73 (1962).

[75] Id. n. 43.

[76] 77 N.M. at 23, 245, 421 P.2d at 776.

[77] 71 N.M. 428, 379 P.2d 73 (1962).

[78] See 46 Stat. 767 Ch. 506 (June 17, 1930), 53 Stat. 785 Ch. 155 (May 31, 1939). For background, see 1929 N.M. Laws Ch. 42, at 61. See also Hill, The Development of the Rio Grande Compact, 14 Nat. Res. J. 163 (1974).

[79] Convention--Mexico, May 21, 1906. 34 Stat. 2453 (1906).

[80] 71 N.M. at 435, 379 P.2d at 78.

81 The problem of determining what is an acceptable "safe yield" of an aquifer has been much discussed in the literature. For a good discussion of the position of the experts in the field, such as Professors Clark and Corker, see International Groundwater Management: The Case of the Mexico-United States Frontier, 61-97 (1978) (Natural Resources Center/Water Resources Research Institute, UNM).

82 N.M. Stat. Ann. § 72-14-3 (1985 Repl. Pamph.).

83 See, e.g., Id. §§ 73-2-1 to -20, 72-2-22 to -64 (providing for community ditches and acequias), §§ 73-1-1 to -26 (artesian conservancy ditches), and § 73-13-1 to 88 (providing for conservancy districts) to list just a few.

84 207 U.S. 564 (1908).

85 Id. at 575.

86 Conrad Investment Company v. United States, 161 Fed. 839 (9th Cir. 1908).

87 Arizona v. California, 373, U.S. 546, 598; United States v. Powers, 305 U.S. 527 (1939).

88 Arizona v. California, 373 U.S. at 601.

89 43 U.S.C. § 666 (1988).

90 438 U.S. 696 (1978).

91 Id. at 700.

92 438 U.S. at 700.

93 Id. at 707.

94 373 U.S. 546, 600 (1963).

95 Endangered species is defined by the Act as "any species which is in danger of extinction throughout all or a significant part of its range . . . ." 16 U.S.C. § 1532(6). Threatened species is defined as "any species which is likely to become an endangered

species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(20).

96 16 U.S.C. § 1533(f).

97 16 U.S.C. § 1532(19). The take prohibition does not apply to threatened species.

98 Critical habitat is defined as "the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act [15 USCS §1533], on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act [15 USCS § 1533], upon a determination by the Secretary that such areas are essential for the conservation of the species.

99 16 U.S.C. § 1536(a).

100 33 U.S.C. §§ 1251(a)(1), 1252(a), 1313(c)(4); 1342(b); 1362(12); 1362(7).

101 40 C.F.R. § 122.2.

102 See, e.g. Exxon Corp. v. Train, 554 F.2d 1310, 1312, 1331 N.1 (5th Cir. 1977.)

103 33 U.S.C. § 1342(b).

104 33 C.F.R. § 323.3.

105 42 U.S.C.A. §§ 300f to 300j-26.

106 A reauthorized Safe Drinking Water Act recently passed both the House and Senate and was signed by the President on August 7, 1996 after several years of debate.

107 7 USC § 136 et seq.

108 § 74-1-1 et seq. NMSA 1978 (1993 Repl. Pamp.)

109 New Mexico Water Supply Regulations (EIB/WSR) § 103 (as amended through 4/16/91); see also NMSA § 74-1-13(G)(2) NMSA 1978 (1993 Repl. Pamp.).

110 42 U.S.C. §§ 42 U.S.C. 4321 to 4379a.

111 42 USC § 6901 et seq.

112 § 74-4-1 to -13 NMSA 1978 (1993 Repl. Pamp.).

113 N.M. Const. Art. II, § 5.

114 § 74-6-1 to -17 NMSA 1978 (1993 Repl. Pamph.).

115 § 74-6-4 NMSA 1978 (1993 Repl. Pamp.).

116 § 74-6-4(E) NMSA 1978 (1993 Repl. Pamp.).

117 § 74-1-8(A)(2)(3) NMSA 1978 (1993 Repl. Pamp.).

118 § 70-2-12(B)(15).

119 New Mexico Water Quality Standards § 3-104; 3-109; NMSA § 74-6-5(A) (1993 Repl. Pamp.).

120 N.M. Const. Art. XVI.

121 N.M. Const. amend. Art. XVI, § 5.

122 Codified at § 72-1-1 et seq. NMSA 1978 (1985 Repl. Pamp. & 1990 Supp.).

123 § 72-2-1 NMSA 1978.

124 § 72-2-1 and § 72-2-9 NMSA 1978.

125 § 72-2-8 NMSA 1978.

126 Id.

127 § 72-4-13 NMSA 1978 provides in part: "The state engineer shall make hydrographic surveys and investigations of each stream system and source of water supply in the state, beginning with those most used for irrigation, and obtaining and recording all available date for the determination, development and adjudication of water supply of the state...."

128 § 72-4-15 NMSA 1978.

129 Section 47-6-2 NMSA 1978 (1995 Repl. Pamp.).

130 Id. at § 47-6-9 (effective until July 1, 1996).

131 Id. § 47-6-9 (effective July 1, 1996).

132 Id. at 47-6-9C.

133 Id. at 47-6-9D.

134 Id. at 47-6-11A(1) and E(1).

135 Id. at 47-6-11B(1) (effective July 1, 1996).

136 Id. at 47-6-11 at B(2).

137 Id. at 47-6-11 at F(1) and (2).

138 Id. at 47-6-11.2.

139 Id. at 47-6-11.2(a).

140 Id. at 47-6-11.3(b).

141 Id. at 47-6-17B(11) (effective July 1, 1996).

142 NMSA § 47-6-9E (effective July 1, 1996) (1995 Repl. Pamp.).

143 Art. VII, Sec. 6.4, Santa Fe County Ordinance 1996-8, July 9, 1996.

144 Id

145 Id. at Sections 6.2 and 6.3.

146 Id. at Section 6.5.

147 Id. at Section 6.6.

148 Section 5, Supplemental Guidelines, Torrance County Subdivision Regulations, Ordinance No. 96-7, December 11, 1996.

149 Id. Supp. Guidelines at § 4.

150 Id. § 5.7 and Supp. Guidelines at § 3 .

151 Id. Supp. Guidelines at § 2.

152 Id. Supp. Guidelines at § 1

153 Id. Supp. Guidelines at § 14 and 15.

154 Art. 10, Sec. 5, Subdivision Ordinance, No. 96-23, Bernalillo County, October 1, 1996.

155 Id. at Art. 10, Sec. 5.5.

156 Id. at Art. 10, Sec. 4.

157 Id. at Art. 10, Sec. 2.

158 Id. at Art. 5, Sec. 3.11 and Art. 10, Sec. 3.

159 Id. at Art. 10, Sec. 1.

160 Id. at Art. 10, Secs. 14 and 15.

161 Appendix E, Part 5, San Miguel County Ordinance No. SMC-06-25-96-ORD, July 16, 1996.

162 Id. Appendix E, Part 5.

163 Id. § 5.5 and Appendix E, Part 4.

164 Id. Appendix E, Part 1.

165 Id. Appendix D, § 2 and § 3.

166 Section 72-1-9 NMSA 1978 (1996 supp.).

167 Section 72-14-44 NMSA 1978 (1996 supp.).

168 Id. at 72-14-44D.

169 For a thorough discussion of formation, finances and authority of such entities, see Water Entities in New Mexico: Comparisons and Contrasts, Suedeen Kelly, 1995 CLE International.

170 §§ 62-2-1 to 62-2-22 NMSA 1978.

171 §§ 53-11-1 to 53-18-12 NMSA 1978.

172 § 3-18-35 NMSA 1978. See also § 3-27-2 NMSA 1978.

173 § 3-33-3 NMSA 1978.

174 § 3-33-2 NMSA 1978.

175 § 4-37-1 NMSA 1978.

176 § 4-36-8 NMSA 1978.

177 Id. at 4-36-10 (1996 Supp.)

178 § 4-55A-1, -3(A) NMSA 1978.

179 § 3-28-1 NMSA 1978.

180 § 53-4-3 NMSA 1978.

181 §§ 73-21-1 to 73-21-55 NMSA 1978.

182 § 73-21-4(F) NMSA 1978.

183 § 3-29-2 to 3-29-5 NMSA 1978.

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184 See Appendix III-A, Illustration III.

185 Section 72-12-3E NMSA 1978 (1985 repl. pamp.).

186 § 72-5-6 NMSA 1978 (1985 Repl. Pamp.).

187 § 72-4-14 and -15 NMSA 1978 (1985 Repl. Pamp.).

188 § 72-12-3E NMSA 1978 (1985 Repl. Pamp.).

189 Id. at 72-12-7 (1996 supp.).

190 107 NM 524, 760 P.2d 1290 (1988)

191 § 72-12-3 and -7 NMSA 1978 (1985 Repl. Pamp.).

192 No. RA 84-53(C), slip. op. (N.M. Dist. Ct., Apr. 16, 1985) [hereinafter Sleeper I], rev'd, 107 N.M. 494, 760 P.2d 787 (Ct. App. 1988) [hereinafter Sleeper II], cert. quashed, 107 N.M. 413, 759 P.2d 200 (1988).

193 Sleeper I, slip. op. at 2. This case is complex. This description of the facts is taken from an excellent student comment by Ms. Shannon A. Parden, in "The Milagro Beanfield Revisited in Ensenada Land and Water Association v. Sleeper: Public Welfare Defies Transfer of Water Rights," 29 Nat. Res. J. 861 (1989) [hereinafter "Comment"].

194 Comment, supra note 75.

195 Id.

196 Id.

197 Id.

198 Id.

199 Id.

200 Id.

201. Id. at 2-3.

202 Sleeper II, 107 N.M. at 496, 760 P.2d at 789.

203 Sleeper I, slip. op. at 3.

204 Sleeper II, 107 N.M. at 496, 760 P.2d at 789.

205 Sleeper I, slip. op. at 5-6.

206 Id.

207 Id.

208 Id.

209 Id.

210 Id.

211 Sleeper II, 107 N.M. 496, 500, 760 P.2d at 791-93.

212 Section 72-12-1 NMSA 1978 (1985 Repl. Pamp.)

213. Rule 1-15.2 State Engineer Rules and Regulations Governing Groundwater, 1995.

214. Section 4-37-1 NMSA 1978 (1992 Repl. Pamp.)

215. Sections 3-53-1 (E) and 3-53-3 NMSA 1978 (1995 Repl. Pamp.)

216 City of Roswell v. Berry, 80 N.M. 110, 452 P.2d 179 (1979); N.M. Stat. Ann. §§ 72-12-3 to 72-12-7 (Repl. Pamp. 1985 & Cum. Supp. 1995).

217 See In re Brown, 65 N.M. 74, 80, 332 P.2d 475, 479 (1958) (a decline in water level in a well is merely a factor to be considered among others in determining impairment, including the particular characteristics of the aquifer).

218 589 P.2d 57 (Colo. 1978) (en banc), reh'g denied (1979).

219 Id. at 60 (emphasis in original).

220 See id.

221 65 N.M. 76, 80, 332 P.2d 474, 479 (1955).

222 Id.

223 77 N.M. 239, 421 P.2d 771 (1967).

224 Id. at 241, 421 P.2d at 773.

225 See id. at 242, 421 P.2d at 774.

226 Id. at 244, 421 P.2d at 776.

227 See Id. at 243, 421 P.2d at 775.

228 Id.

229 No. 78-138-B, slip. op. at 1 (D.N.M. May 11, 1979).

230 Id. at 1-2.

231 See id. at 15.

232 Id. at 7-10.

233 Id. at 8.

234 Id. at 15.

235 Id. at 16.

236 A Report of the Rio Grande Task Force--Impairment Subcommittee, March 8, 1994, Appendix C to the Memorandum from the Task Force on the Albuquerque Region to Eluid Martinez, State Engineer, Executive Summary of the Task Force's Discussions on Policy of the State Engineer in the Albuquerque Region.

237 Id. at 13-14 (emphasis added).

238 Id. at 13.

239 101 N.M. 195, 680 P.2d 335 (1984).

240 Id. at 197, 680 P.2d at 337.

241 Id. at 201, 680 P.2d at 341.

242 Id. at 202, 680 P.2d at 342 (emphasis added).

243 Idaho Code § 42-222 (Cum. Supp. 1995).

244 Kan. Stat. Ann. § 82a-711a (1989).

245 Colo. Rev. Stat. Ann. §§ 37-92-101 to -602 (West. 1990).

246 Mont. Code Ann. §§ 85-2-402 to -403 (1995).

247 Nev. Rev. Stat. § 534.110 (Michie 1995).

248 Utah Code Ann. § 73-3-23 (1989).

249 William M. Turner, The Geology and Hydrology of Eastern Bernalillo and Southern Santa Fe Counties, New Mexico, May 1992.

## Appendix 1.

## State Engineer Office Administration of Estancia Basin (Excerpted Memorandum).

## APPENDIX III-A

## STATE ENGINEER OFFICE
## ADMINISTRATION OF ESTANCIA BASIN
## (Excerpted Memoranda)

### Definition of Terms

1. Inventory Block: a square block with dimensions of three sections by three sections and is 1/4 of a township.

2. Vo: initial volume of water in storage in the valley fill formation under one inventory block at the time the inventory was initially computed (1965 or 1967).

3. V40: calculated volume of water which would be depleted in 40 years, to supply the rights which existed in 1965.

4. Vr: Vo-V40 (volume remaining).

5. Vna: volume of water represented by 40 feet of saturated thickness and not appropriable.

6. Va = Vo - (V40 + Vna): volume of water available for new appropriations.

**Overview**

Administration of the Estancia Basin is based on the amount of water in the saturated alluvium, and the factors that are included are Vo, which was the estimated volume of water in acre-feet in saturated alluvium. V40 was the calculated volume of saturated water which would be depleted after 40 years to supply all existing rights at the time the study was made. Vr was the water which remained after the V40 was subtrated from the Vo. Vna was a volume of water reserved to provide pump depth, stock and domestic water and this was 40 feet of the bottom of the saturated valley fill. If the Vr exceeds the Vna, this leaves a Va, which is the calculated volume of water that is available for new appropriations. The administration is based on a block system. Each block is a quarter township or nine sections. For appropriations within the valley fill area, a nine block template is centered over the block containing the well from which the water will be appropriated. If water is available in each of the nine blocks then the appropriation can be approved. If any one of the nine blocks does not have a Va the appropriation is denied. There are other factors which enter into the administration. The first is the Madera block. The Madera block is a block which at one time contained the zero saturated valley fill line and it is determined that wells can be deepened into the Madera to provide the supply. It is felt that the Madera contains no storage but derives its storage from valley fill water.

If a template for a valley fill appropriation covers a Madera block, the water which would ordinarily come from the Madera block is folded back and by reasonable calculation taken out of the adjacent valley fill blocks. If a well is applied for in a Madera block (if the Madera block is the center block), the application is considered on a basis that water is available in any of the blocks of the nine block template, in which are covered due to the location of the center block. Since the nine block template may not reach a sufficient number of blocks to provide water, the water for this application may be taken out on the basis of a 25 block template or a 49 block template or even a 81 block template. If templates larger than the nine blocks overlie valley fill blocks which have no water available, this is not considered reason for denial. The same type of administration is used for wells in hard rock aquifers which are outside of the immediately adjacent Madera blocks. Another modification to the valley fill criteria is the area known as the Playa Lakes, in the southeastern part of the basin. The blocks which contain the Playa Lakes are designated as recharge blocks. If the template overlies a recharge block the water which would have ordinarily come from the recharge block is added to the inventory in its neighboring blocks by some reasonable method similar to that which is used when you fold water out of the Madera blocks.

Another modification of the valley fill criteria are the so called permian blocks. Permian blocks are template blocks underlaying by older formations other than the Madera Limestone which act in a similar manner hydrologically to the Madera Limestone.

In other words it is deemed these formations would be, for example, the Yaso. In these blocks, if there is no water, it is not considered reason for denial but the water which would ordinarily be taken out of these blocks is folded back from adjacent valley fill blocks.

Another modification of the valley fill criteria are the Glorieta blocks. Glorieta blocks are blocks which are deemed to be underlaying by the Glorieta Sandstone formation. It is felt that the Glorieta Sandstone in many areas in the Estancia Basin is highly fractured and forms very good medium to high capacity irrigation wells, but it is felt that there is no storage in the Glorieta. So the present criteria is the reservation will be removed from the Glorieta. In other words, it was not necessary to reserve 40 feet of water above the pump but that at the time the Glorieta block went to zero. It was at the time that the Vna went to zero that it would be considered a valley fill block at zero and therefore would be a block which would stop further development if the proposed applications infringed on that block.

Another modification of the valley fill criteria primarily occurs on the edges of the valley fill when there are blocks which have a Vna but which have no Va. If there are no rights in these blocks having a Vna, water is used out of these blocks to supply applications in <u>adjacent</u> blocks. If the Vna goes to zero, this block is considered to be as if it never had water and would be an unsaturated valley fill block.

One appropriation is allowed in a block designated with a Vna. After this one appropriation, no further appropriations or drafts are allowed to affect this block. If a valley fill block exists in which the calculated amount of water is a Vna and this block contains rights, it is considered to be a valley fill block with rights with no further water for appropriation. And under this consideration, no new rights are allowed in this block or permitted from blocks which would cause a draft on the Vna block.

## Administrative Areas

### I. <u>Valley Fill - General Administration</u>

Administration of water in the valley fill is based on the amount of water in inventory within a square nine block template which is centered on the block which contains the proposed well. This template is used to calculated the theoretical draft on each of the nine valley fill blocks which will result from pumping the proposed well based on a 40 year life. If the inventory in each of the nine blocks shows that water is available for the appropriation (Va is greater than the draft of 40 years), the application can be approved. If the inventory in any block is not adequate to supply the 40 year draft (Va less than 40 year draft) then the application cannot be approved because its approval would impair existing rights. If Va=0, application cannot be approved. If Va is greater than 0, application approved in part until Va=0.

### II. <u>Valley Fill - Special Cases</u>

A. No rights, no Va or Va small. If one or more blocks in a template area contains no Va or Va which is insufficient to supply the proposed application, but no rights exist in the block(s) (no wells with appurtenant rights are situated in the subject block) the Vna can be used to satisfy the application. No further effects (drafts) are considered on this block and effects which would normally be subtracted from its inventory are redistributed or "folded" to adjacent blocks.

If the block containing no Va (preceding paragraph) happens to be the center block of the template area (contains proposed well) on application (first application) can be approved for its full acreage even though it may require more water than is inventoried as Vna. No further drafts are allowed in this block.

B. Playa Lakes Blocks: The southeastern part of the inventoried valley fill contains playa lakes which are assumed to be discharge points for the valley fill aquifer. Blocks which contain playas are designated as recharge blocks. If one or more blocks of the nine block template for a proposed application are recharge blocks; the water which would normally be reserved in the valley fill inventory of a recharge block is added to the inventory of its adjacent blocks. A reasonable method of apportioning the water similar to the methods used to "fold out" of blocks containing no water is used to "fold in" the recharge water.

C. Valley Fill Blocks Bordering Madera Blocks

1. Template centered on valley fill block corners a Madera block which contains water (Va greater than 0). The water in inventory is reserved in all blocks.
2. Template centered on valley fill blocks corners one or more Madera blocks in which the Va or the Vna=0. If water is available to satisfy the proposed appropriation in the valley fill blocks the application is considered for approval and the water which would normally be reserved in the Madera blocks is "folded out" by a reasonable method and reserved from the inventory in the valley fill blocks covered by the nine block template.

D. Valley Fill Blocks Bordering Permian Formations Other Than Madera or Glorieta: If a proposed application with template centered on valley fill block corners a Permian formation which is known to behave in a manner hydrologicsally similar to the Madera it is administered as if it were a Madera block. (See C above)

E. Valley Fill Block Bordering a Glorieta Block:

1. Glorieta block containing Va or Vna is administered as a valley fill block which has a Va inventory. Expressed differently, the Vna in a Glorieta block is considered as if it were Va. If the template for an application centered on a valley fill block corners one or more Glorieta blocks which contain Vna inventory, the application is considered for approval and the Vna water in the Glorieta blocks is reserved to satisfy the application.
2. If the Vna water in a Glorieta block is depleted to zero this block is considered to act as a valley fill block which has a Va of zero and therefore is a limiting block which is cause for recommendation of denial of an application whose template overlies it.

## III. Madera Blocks

1. Proposed application centered on a Madera block adjacent to valley fill blocks. If the Va in the Valley fill blocks covered by the nine block template centered on a Madera block contain sufficient Va water to support the draft which the application would impose on a particular valley fill block the application is considered for approval. The water to satisfy this application is reserved using a larger template i.e. 25 or 49 block template.
2. Proposed application centered on Madera block which is separated from the valley fill by one or more Madera blocks. Evaluate the application on the basis of local impairment which may consider: distance to other water right wells, geometry of aquifer in the local area, potential for recharge and any other factors dictated by particular case. If the proposed application covers no local impairment, use a large template (49 or 81 block) to reserve the water in the valley fill inventory. The fact that the large template overlies as valley fill block which has a Va=0 is not considered a reason to deny the application.

## IV. Glorieta

If an application for a new appropriation is made which will have an effect on the blocks designated as Glorieta blocks and Vna does not equal 0, the application can be approved. If the Glorieta block Vna equals 0, the application cannot be approved.

## V. Permian

If an application for a new application is made which will effect a designated Permian block, the inventory in the Permian block is reduced until Vna=0, at which time the effects are folded out of the block into the adjacent valley fill blocks in the same manner as in the Madera valley fill interface. However, if the proposed application is located within the Permian block and Vna=0 then this application cannot be approved as it impairs existing rights.

## Illustrations

I. An application is made in a valley fill block where water is available for appropriation. Also all of the surrounding blocks have water available for appropriation in the valley fill, except one which has some remaining "Vna." However, no rights exist in that block; therefore, the application could be considered for approval and a reduction would be made from the "Vna." This process would continue until all of the "Vna" reservation had been folded out of that block, and the block become "Vr" = 0. At that time the edges of the block would be considered an impermeable boundary, and no more water would be subtracted from that block.

II. Assume that an application for a new appropriation is made within a valley fill block where water is not available for a new appropriation, but no rights exist within that block. If water is available in the surrounding blocks from the valley fill, based on the 9 block template criteria, then one appropriation could be acted upon favorably within the block where no rights had existed before, even though water is not available for a new appropriation. To further clarify the last statement, in order to make that one new appropriation there must be "Vna" water available. Once the block goes to "Vr" = 0, then that theory would not longer apply, and a new appropriation could not be considered in that block.

Also, if there is not enough water available under the "Vna" criteria to fulfill the one proposed new appropriation, then the full appropriation would be allowed, even though the amount of water would go below that available under the amount shown as "Vna."

III. In 1965 and then again in 1967, reductions from the valley fill were made based on the 9 block template, as if the total appropriation would come out of the 9 blocks, when, in fact, it does not. Subsequently, that policy was changed. The 9 block template is used only as a criteria to determine if a new appropriation can be approved. Once it is decided that there is water available under the 9 block criteria, then the reduction of water from the blocks is taken out with various templates. The templates used are the 25 block template, or the 49 block template, or the 81 block template, depending upon judgment of the person making the reduction and whether or not the template fits the case. The reason for this change in policy, even thought it was in effect changing in mid-stream, was because it became obvious that too much water was being taken out of the valley fill in certain blocks and it would limit new appropriations far sooner that it should. What should be done is that all of the deductions that were made based strictly on the 9 block template should be re-done. If effect, this means that all of the calculations going back to 1967 should be recalculated, based on this philosophy. This modification and the inventory system was done after a discussion between Williams and Don Akin, Chief, Technical Division. At that time, it seemed like the most reasonable approach to both of the people involved in the discussion.

This discussion will involve the adding back of water into the inventory. These things come about when a permit is canceled, or an application for extension of time is denied, or which a license is written for less than the amount that was originally approved for appropriation. The way the water should be added back into the inventory is in the exact same manner as it was taken out, using the calculation sheet for that particular appropriation. One exception to this is that for those permits that were in effect at the time of the original inventory, the water was calculated as if the right was fully developed, and the amount of effect was taken out of the system, either on the 49 or 81 block template. For those permits that are either canceled, or where a license is written for a lesser amount, then the water could be added back in on a 9 block template or any one of the other templates. Water should be added back in in the same manner that it was taken out with one additional exception, and that is: if there is a block where "Vr" = 0, then no water will be added back into that block. Water will be added back into blocks where there is a "Va" or water available for appropriation or water in the "Vna." For re-clarification where a block has a "Vr" of zero (0), then the edges of that block act as an impermeable boundary. The "Vr" = 0 acts as a boundary, except when there is a consideration for a new appropriation where the 9 block template would over-lie a block that is "Vr" = 0, and rights exist. In that case, since rights exist in the block where "Vr" = 0, no new appropriation could be recommended, if the 9 block template over-lies such a block. On the other hand, if the "Vr" block has no rights, then there would be no consideration given that block, based on the 9 block criteria, and an application could be considered for approval.

## Appendix 2.

## New Mexico County List, Endangered, Threatened, and candidate species and species of concern.

## APPENDIX III-B
## NEW MEXICO COUNTY LIST
## ENDANGERED, THREATENED, AND CANDIDATE SPECIES
## AND SPECIES OF CONCERN

**Bernalillo**

Arizona black-tailed prarie dog, Cynomys ludovicianus arizonensis, SC
Big free-tailed bat, Nyctinomops macrotis (=Tadarida m., T. molossa), SC
Black-footed ferret, Mustela nigripes, E
Fringed myotis, Myotis Thysanodes, SC
Long-legged myotis, Myotis volans, SC
New Mexican meadow jumping mouse, Zapus hudsonius luteus, SC
Occult little brown bat, Myotis lucifugus occultus, SC
Pale Townsend's (=western) big-eared bat, Plecotus townsendii pallescens, SC
Pecos River Muskrat, Ondatra zibethicus ripensis, SC
Small-footed myotis, Myotis ciliolabrum, SC
Spotted bat, Euderma maculatum, SC
Yuma myotis, Myotis yumanensis, SC
American peregrine falcon, Falco peregrinus anatum, E
Arctic peregrine falcon, Falco peregrinus tundrius, T (S/A)
Baird's sparrow, Ammondramus bairdii, SC
Bald eagle, Haliaeetus leucocephalus, T
Black tern, Chlidonias niger, SC
Ferruginous hawk, Buteo regalis, SC
Loggerhead shrike, Lanius ludovicianus, SC
Mexican spotted owl, Strix occidentalis lucida, T w/CH
Mountain plover, Charadrius montanus, C
Northern goshawk, Accipiter gentilis, SC
Southwestern willow flycatcher, Empidonax traillii extimus, E w/PCH

Western burrowing owl, Athene cunicularia hypugea, SC

White-faced ibis, Plegadis chihi, SC

Whooping crane, Grus americana, E

Flathead chub, Platygobio, (Hybopsis) gracilis, SC

Rio Grande silvery minnow, Hybognathus amarus, E w/PCH

Texas horned lizard, Phrynosoma cornutum, SC

Millipede, Toltecus chihuanus, SC

**Santa Fe**

Black-footed ferret, Mustela nigripes, E

Fringed myotis, Myotis thysanodes, SC

Long-legged myotis, Myotis volans, SC

New Mexican meadow jumping mouse, Zapus hudsonius luteus, SC

Occult little brown bat, Myotis lucifugus occultus, SC

Pale Townsend's (=western) big-eared bat, Plecotus townsendii pallescens, SC

Small-footed myotis, Myotis ciliolabrum, SC

Spotted bat, Euderma maculatum, SC

Yuma myotis, Myotis yumanensis, SC

American peregrine falcon, Falco peregrinus anatum, E

Arctic peregrine falcon, Falco peregrinus tundrius, T (S/A)

Baird's sparrow, Ammondramus bairdii, SC

Bald eagle, Haliaeetus leucocephalus, T

Ferruginous hawk, Buteo regalis, SC

Loggerhead shrike, Lanius ludovicianus, SC

Mexican spotted owl, Strix occidentalis lucida, T w/CH

Mountain plover, Charadrius montanus, C

Northern goshawk, Accipiter gentilis, SC

Southwestern willow flycatcher, Empidonax traillii extimus, E w/PCH

Western burrowing owl, Athene cunicularia hypugea, SC

White-faced ibis, Plegadis chihi, SC

Whooping crane, Grus americana, E

Flathead chub, Platygobio, (Hybopsis) gracilis, SC

Texas horned lizard, Phrynosoma cornutum, SC

Santa Fe cholla, Opuntia viridiflora, SC

**Torrance**

Arizona black-tailed prarie dog, Cynomys ludovicianus arizonensis, SC

Black-footed ferret, Mustela nigripes, E

Fringed myotis, Myotis thysanodes, SC

Long-legged myotis, Myotis volans, SC

Occult little brown bat, Myotis lucifugus occultus, SC

Spotted bat, Euderma maculatum, SC

American peregrine falcon, Falco peregrinus anatum, E

Arctic peregrine falcon, Falco peregrinus tundrius, T (S/A)

Baird's sparrow, Ammondramus bairdii, SC

Bald eagle, Haliaeetus leucocephalus, T

Black tern, Chlidonias niger, SC

Ferruginous hawk, Buteo regalis, SC

Loggerhead shrike, Lanius ludovicianus, SC

Mexican spotted owl, Strix occidentalis lucida, T w/CH

Mountain plover, Charadrius montanus, C

Southwestern willow flycatcher, Empidonax traillii extimus, E w/PCH

Northern goshawk, Accipiter gentilis, SC

Texas horned lizard, Phrynosoma cornutum, SC

Index: E = Endangered; PE = Proposed Endangered;

PE w/CH = Proposed endangered with critical habitat; T = Threatened;

PT = Proposed Threatened; PT w/CH = Proposed threatened with critical habitat; PCH = Proposed Critical Habitat; C = Candidate Species;

SC = Species of Concern; S/A = Similarity of Appearance; * = Introduced population

## Appendix 3.

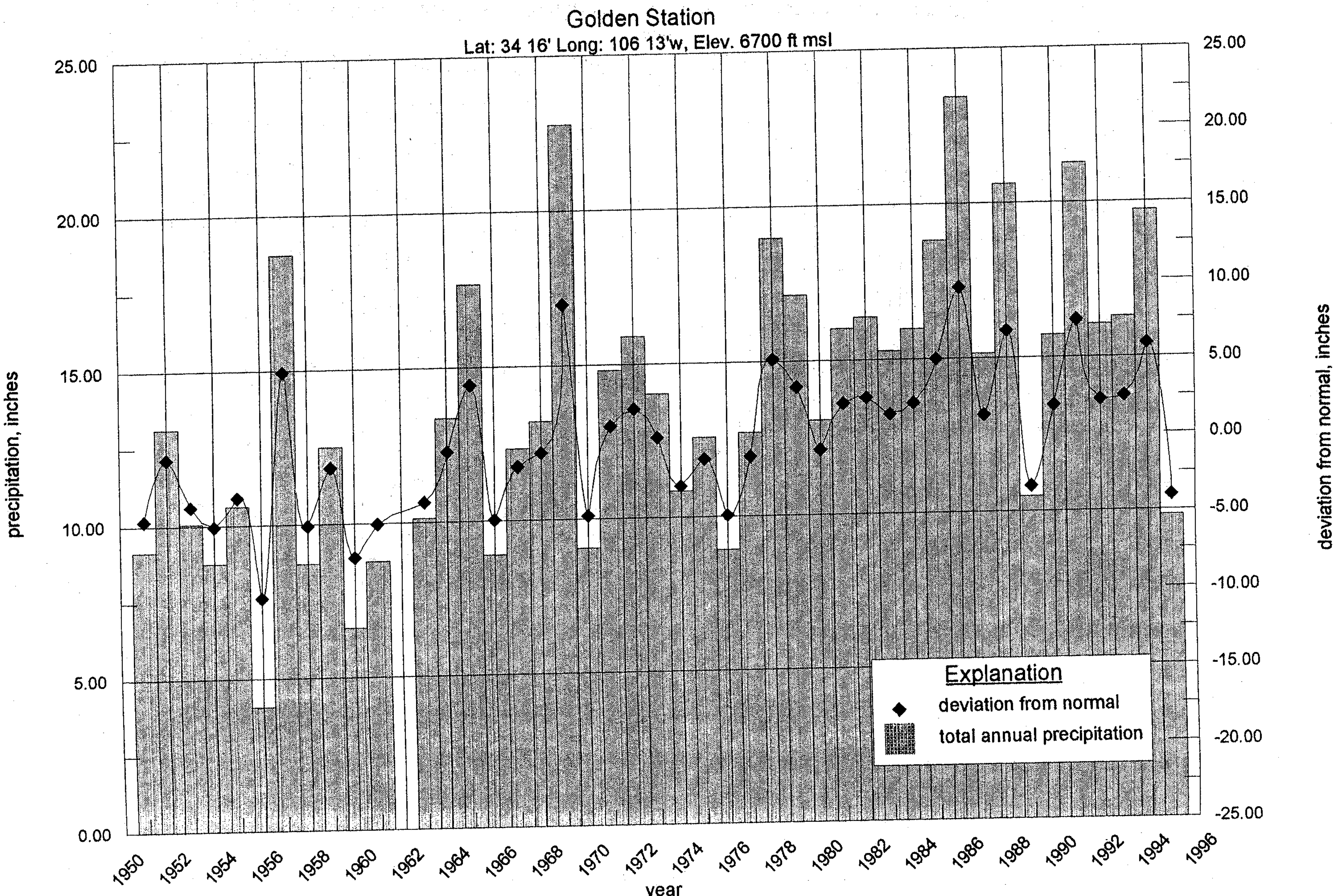
## Status of Recovery Plans for Endangered or Threatened Species Within Bernalillo, Santa Fe and Torrance Counties.

# APPENDIX III-C
## STATUS OF RECOVERY PLANS FOR ENDANGERED OR THREATENED SPECIES WITHIN BERNALILLO, SANTA FE AND TORRANCE COUNTIES

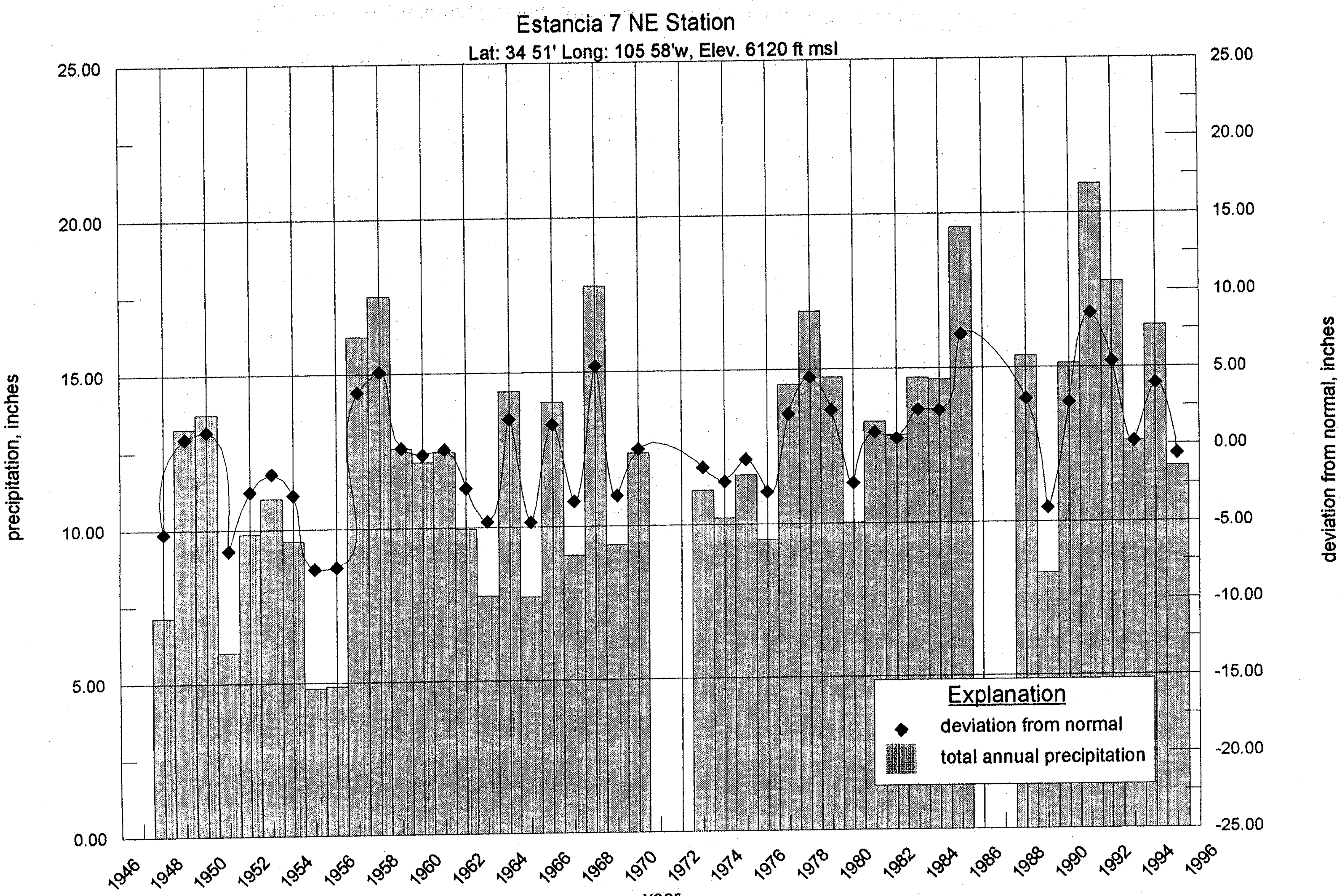
| | |
|---|---|
| Black Footed Ferret: | First Recovery plan on 6/14/78; latest revision on 8/8/88 |
| American Peregrine Falcon: | First Recovery plan on 8/3/77; in the process of being revised, possibly de-listed or downlisted (at least in some populations). |
| Arctic Peregrine Falcon: | Same as American Peregrine Falcon |
| Bald Eagle: | Recovery plan on 9/8/82 |
| Mexican Spotted Owl: | Recovery plan on 12/16/95 |
| Southwest Willow Flycatcher: | Recovery plan not yet completed. Likely will not be completed within the 2.5 years projected for completion. |
| Whooping Crane: | Recovery plan on 1/23/80; revised 2/11/94 |

## Appendix 4.

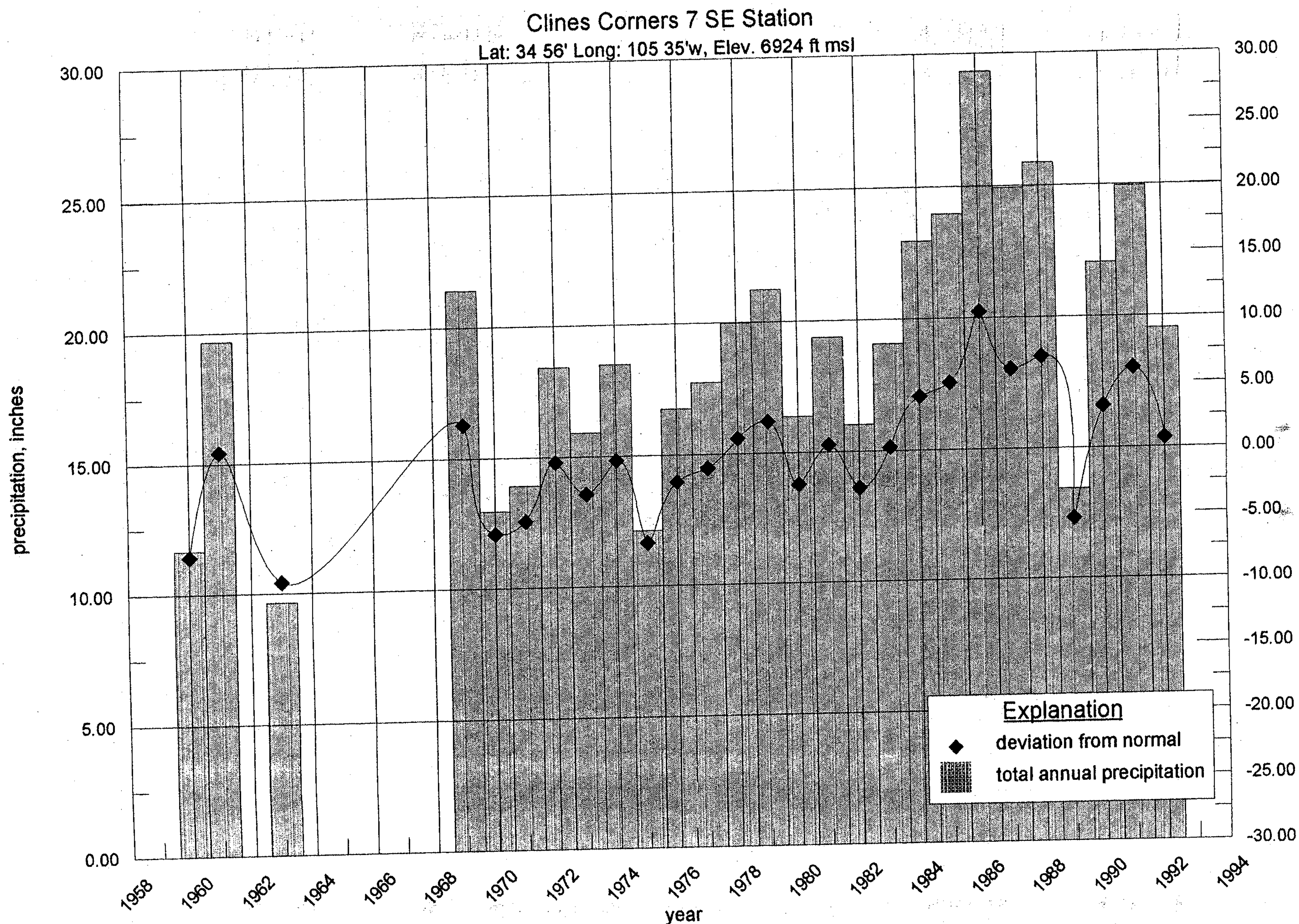
## Graphs of Annual Precipitation With Departure for Normal, Maximum Annual Temperature, Minimum Annual Temperature, and Evaporation from the Estancia Station.



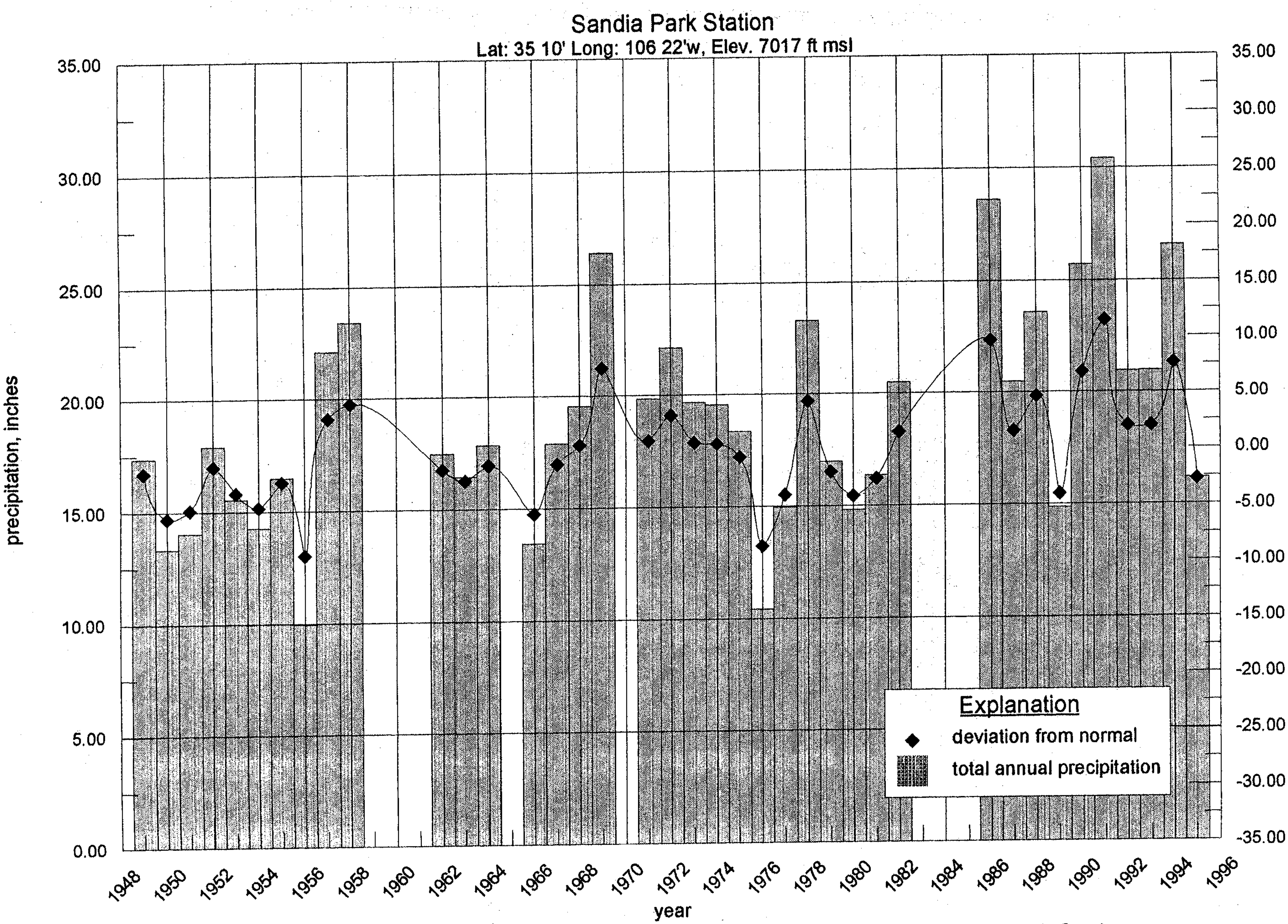

Total annual precipitation and deviation from normal recorded at the Golden Station




Total annual precipitation and deviation from normal recorded at the Estancia 7 NE Station



Total annual precipitation and deviation from normal recorded at the Clines Corner Station




Total annual precipitation and deviation from normal recorded at the Sandia Park Station

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Puck C. Chavez Owner's Well No. [illegible]
Street or Post Office Address Box 740 P12
City and State Moriarty, New Mexico, 87035 41

Well was drilled under Permit No. E-6396 and is located in the:

a. ____ ¼ SW ¼ NW ¼ NW ¼ of Section 18 Township 9N Range 11E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Torance County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD 49

Address PO Box 91, Stanley NM, 87056

Drilling Began 1-25-96 Completed 1-30-96 Type tools Rotary Size of hole 7 7/8 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 515 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 510 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 500 | 510 | 10 | Yeso | 10 |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 2/5/96

Quad ____ FWL ____ FSL ____

File No. E-6396 Use Dom Location No. C9N.11E.18.113
El Cuervo Btte Quad.

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 2 | 2 | Top soil - red |
| 2 | 595 | 543 | Yeso - red |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

# STATE ENGINEER OFFICE
## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Jane Lovato Owner's Well No. ______
Street or Post Office Address HCR 81 Box 200
City and State Moriarty, NM 87035

Well was drilled under Permit No. E-6496 and is located in the:

a. -- ¼ SE ¼ NE ¼ -- ¼ of Section 13 Township 09N Range 10E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Torrance County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Garcia's & Sons Drilling Co. License No. WD-539

Address 28 Garcia Loop Tijeras, NM 87059

Drilling Began 05-20-96 Completed 05-25-96 Type tools Rotary Size of hole 6½ in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 680 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 520 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 520 | 680 | 160 | Red shale and gravel | 10 gallons |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 4½-160 | | pvc | 0 | 680 | 20 | cup | 500 | 520 |
| | | | | | | | 650 | 680 |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

JUN 4 P12:11

### Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 6/4/96

Quad ______ FWL ______ FSL ______

File No. E-6496 Use Dom. Location No. 09N.10E.13.24
El Cuervo Butte Quad.

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 40 | 40 | Top soil |
| 40 | 180 | 140 | Red shale |
| 180 | 260 | 80 | Sandstone |
| 260 | 500 | 240 | Red shale |
| 500 | 540 | 40 | Green rock and red shale |
| 540 | 600 | 60 | Red shale |
| 600 | 605 | 5 | Gravel |
| 605 | 650 | 45 | Red shale |
| 650 | 655 | 5 | Gravel |
| 655 | 680 | 25 | Red shale |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Raymond Marcie
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

## Section 1

(Plat of 640 acres)

(A) Owner of well Roy Dunn

Street and Number Box 26

City Estancia State N. M.

Well was drilled under Permit No. E-1760 and is located in the NE ¼ ______ ¼ ______ ¼ of Section 26 Twp. 7N Rge. 11E

(B) Drilling Contractor C.B. Blanford License No. WD 437

Street and Number Box 204

City Mountainair State N. M.

Drilling was commenced 11-23 19 70

Drilling was completed 11-3 19 70

Elevation at top of casing in feet above sea level ______ Total depth of well 189'

State whether well is shallow or artesian shallow Depth to water upon completion 109'

## Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 170 | 175 | 5 | Sand and gravel |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | 6 G.P.M. |
| 5 | | | | |

## Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 5½ | 10 | none | | | 187 | none | 100 | 187 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5 PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19___

Plugging approved by:

______ Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received [illegible]

File No. E-1760 Use Stock Location No. 7N 11E 26

Pedernal Mountain 002 Quad

Section 6

## LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 10 | 10 | Tan | Sandy soil & clay |
| 10 | 60 | 50 | Tan | Boulders and clay |
| 60 | 189 | 129 | Tan + Blk | Sandstone and shale |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

C. B. H. Crawford
Well Driller

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Paul Butt — Owner's Well No. 1

Street or Post Office Address 4300 Prospect N.E.

City and State Albuquerque, NM 87110

Well was drilled under Permit No. E-3927 and is located in the:

a. NE ¼ SE ¼ NE ¼ ____ ¼ of Section 2 Township 7N Range 1LE N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Santa Fe County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor SANDIA WELL DRILLING INC License No. W. D. 461

Address P. O. Box 757, Cedar Crest, NM 87008

Drilling Began 10/10/83 Completed 10/17/83 Type tools rotary Size of hole 5 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 620 ft.

Completed well is [x] shallow [ ] artesian. Depth to water upon completion of well 300 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 360 | 361 | 1 | Black & White Granite | 1/5 |
| | | | | |
| | | | | |
| | | | | |

ALBUQUERQUE, N. MEX. — 83 NOV 9 AM 10:52

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 5 | | | 0 | 620 | 620 | | 340 | 620 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____

Address ____

Plugging Method ____

Date Well Plugged ____

Plugging approved by:

____ State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 11-9-83

Quad ____ FWL ____ FSL ____

File No. E-3927 Use Dom Location No. 7N.11E.2 242 (SF)

Pedernal Mountain Quad.

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 3 | | Red Top Soil |
| 3 | 15 | | Gray Shale |
| 15 | 20 | | Gray Shale |
| 20 | 75 | | Gray Limestone |
| 75 | 290 | | Red Shale |
| 290 | 300 | | Gray Shale |
| 300 | 355 | | Green Granite |
| 355 | 393 | | Black 7 White Granite |
| 393 | 620 | | Green Granite |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

SANDIA WELL DRILLING INC

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled [illegible]

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Howard Calkins

Street and Number

City Edgewood State New Mexico

Well was drilled under Permit No. E 1036 and is located in the N.W.¼ N.E.¼ N.W.¼ of Section 27 Twp. 10 N. Rge. 7 E.

(B) Drilling Contractor C.C.Dennisson License No. W.D. 49.

Street and Number

City Stanley State New Mexico.

Drilling was commenced July 20 19 61

Drilling was completed August 23 19 61.

Elevation at top of casing in feet above sea level Total depth of well 312

State whether well is shallow or artesian Shallow Depth to water upon completion ~~171~~ 265

Section 2

## PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 310 | 312 | 2 | Open stratum in conglomerate. |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3

## RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 7/8 in | | | 0 | ~~312~~ 325 | ~~312~~ 325 | None | 292 | 312. |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4

## RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5

## PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE 1961 SEP 18 AM 8:16

File No. E-1036 Use domestic Location NDON.7E.27 121

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 10 | 10 | | SURFace Soil. |
| 10 | 45 | 35 | BROWN | Clay. |
| 45 | 97 | 52 | Grey | Limestone. |
| 97 | 110 | 13 | | Shale and Lime Boulders. |
| 110 | 156 | 45 | Grey | Limestone. |
| 155 | 160 | 5 | Yella | Shale. |
| 160 | 175 | 15 | Grey | Limestone. |
| 175 | 180 | 5 | Yellow | Shale. |
| 180 | 215 | 35 | Red | Shale. |
| 215 | 283 | 68 | Brown | Lime (hard). |
| 283 | 312 | 29 | | Cemented Conglomerate |
| 312 | 325 | 13 | | Conglomerate. |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

C. C. Hennison
Well Driller

(Complete Form in Triplicate)

# PROOF OF COMPLETION OF WELL

Permit No. E 1036

1. Name of Water Right Owner Howard Calkins
Mailing address P.O. Box 388
City and State Edgewood, New Mexico 87015

2. Permit is for Commercial (supplemental well, change location of well) from shallow (artesian or shallow) ground water.

3. Description of well:
Located in the NW ¼ NE ¼ NW ¼, of Sec. 27 Twp. 10N Rge. 7E N.M.P.M., or Tract No. 1-2 of Map No. NA of the NA District; total depth, 325 feet; is well cased Yes; outside diameter of top casing (or hole, if uncased), 6 5/8 inches; if artesian, is well equipped with gate valve NA; date drilled September 1961; Name of driller C. C. Denisson.

4. Record of Pumping Test, if made (to be supplied by person or firm making test); Name and address of person making test, Unknown; date of test NA 19___; depth to water before test, NA feet ______ (above, below) land surface, and pumping level during test, ______ feet; length of test, ______ hours; average discharge, ______ G.P.M.; specific capacity of well, NA gals./min. per foot of drawdown.

5. Permanent Pump Equipment:
(a) Description of pump: Make Universal; Type Submersible; size of discharge 1 1/4 inches; if turbine type, give size of column, ______ inches; diameter of bowls ______ inches; number of bowls ______; length of suction pipe 320 feet; total length of column, bowls and suction pipe ______ feet; if centrifugal type, give size of pump ______ inches; if other type, describe Universal Submersible Pump; rated capacity of pump (if known), 25 G.P.M., at NA rev. per min., from a depth of 320 feet.

(b) Description of power plant: Make Electric; Type Central N.M. Electric Co-op, In rated horsepower (if available) 5; type of drive connection to pump direct (direct, gearhead, or belt).

(c) Actual discharge of pump, 20 G.P.M., at -- rev. per min., from a depth of 320 feet; Date of test 4/15 1976.

6. If reservoir is used, give approximate size: length NA feet; width ______; depth ______.

7. If above well replaced an old well to be plugged or abandoned, fill out the following: the well abandoned is located in the NA ¼ ______ ¼ ______ ¼ of Sec. ______, Twp. ______, Rge. ______.

Describe plugging method NA
Name of plugging contractor NA

8. Well Record filed with State Engineer's Office Yes (Yes or No)

---

I, Howard Calkins, affirm that the foregoing statements are true to the best of my knowledge and belief and that I am the sole (sole, partial, agent for, etc.,) owner and holder of said water right.

Howard Calkins, Permittee
Howard Calkins
By: ______

---

## STATEMENT OF STATE ENGINEER'S REPRESENTATIVE

I hereby certify that I have inspected the above well and find it constructed in accordance with the conditions of the permit. Note any exceptions This Proof of Completion of Well is accepted without benefit of field check by State Enginer personnel.

Well was producing ______ gpm against a ______ (measured) (estimated) head of ______ feet at ______ rpm.

Old well has been ______ (plugged) (capped) (retained for other rights).

By: C. R. Connaughton
Title: Asst.
Date: 6-14-76

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Howard Calkins Owner's Well No. —
Street or Post Office Address
City and State Edgewood, N.M.

Well was drilled under Permit No. E-1036-S and is located in the:

a. ___ ¼ NW ¼ NE ¼ NW ¼ of Section 27 Township 10N Range 7E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in Santa Fe County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor W. H. Adkison License No. WD-497

Address South Route, Edgewood, N.M. 87015

Drilling Began 5-3-76 Completed 5-7-76 Type tools rotary Size of hole 8" in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 340 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 290 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 305 | 340 | 35 | broken limestone | 150 |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 65/8 | 188 wall | | 0 | 340 | 20 | | 300 | 340 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by:

___
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ___ FWL ___ FSL ___

File No. E-1036-S Use Irrig-Supp. Location No. 10.7E.27.121

## Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 10 | 10 | top soil |
| 10 | 50 | 40 | yellow clay |
| 58 | 80 | 22 | grey limestone |
| 80 | 112 | 32 | yellow clay |
| 112 | 160 | 48 | limestone |
| 160 | 175 | 15 | yellow shale |
| 175 | 235 | 60 | limestone |
| 235 | 262 | 27 | yellow shale |
| 262 | 340 | 78 | broken limestone |

## Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Tom Massey
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, exc Section 5, shall be answered as completely accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Ray Bassett

Street and Number

City Edgewood State New Mexico

Well was drilled under Permit No. E-1107 and is located in the NW ¼ NW ¼ ¼ of Section 23 Twp. 10 N Rge. E 7 E

(B) Drilling Contractor Dennisson Cont. License No. 249

Street and Number Box 91

City Stanley State New Mexico

Drilling was commenced Oct. 23 19 65

Drilling was completed Nov. 2 19 65

Elevation at top of casing in feet above sea level Total depth of well 220

State whether well is shallow or artesian Shallow Depth to water upon completion 184

Section 2

## PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 196 | 210 | 14 | Broken Limestone |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3

## RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 12 1D | [illegible] | [illegible] | 0 | 220 | 221 | [illegible] | 194 | [illegible] |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4

## RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5

## PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE DISTRICT I ALBUQUERQUE, NEW MEXICO NOV 30 10 26 AM '65

File No. RG E-1107 Use Location No. 10N. 7E. 23

Section 6 LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 4 | 4 | Brown | Top Soil |
| 4 | 90 | 86 | Gray | Congomorate |
| 90 | 220 | 130 | Gray | Broken Limestone |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Dennison Contractors Inc.
Well Driller

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

## Section 1

(Plat of 640 acres)

(A) Owner of well Bassett, Ray

Street and Number

City Edgewood State New Mexi

Well was drilled under Permit No. E1107S and is located in the

¼ ¼ ¼ of Section Twp. Rge.

(B) Drilling Contractor DennissonCont. Inc. License No. 49

Street and Number Box 91

City Stanley State New Mex

Drilling was commenced April 10 19 71

Drilling was completed July 25 19 71

Elevation at top of casing in feet above sea level Total depth of well 309

State whether well is shallow or artesian shallow Depth to water upon completion 184

## Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 218 | 235 | 17 | Lime |
| 2 | 265 | 300 | 35 | lime |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

## Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 12 3/4OD | 3/8wall | PE | 0 | 309 | 309 | homemade | 220 | 305 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. E-1107-S Use Location No. 23

Section 6

# LOG OF WELL

| Depth in Feet From | To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 5 | 5 | brown | topsoil |
| 5 | 45 | 40 | grey | boulders |
| 45 | 90 | 45 | brown | shale |
| 90 | 260 | 170 | grey | lime |
| 170 | 175 | 5 | blue | shale |
| 175 | 304 | 129 | grey | lime |
| 304 | 309 | 5 | blue | shale |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Dennisson Contractors Inc.

Well Driller

0 0

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well New Mexico State Highway Department

Street and Number 1120 Cerrillos Road

City Santa Fe State New Mexico

Well was drilled under Permit No. ______ and is located in the

NE ¼ SE ¼ SW ¼ of Section 20 Twp. 10N Rge. 7E

(B) Drilling Contractor NMSHD License No. 319WD

Street and Number 1120 Cerrillos Road

City Santa Fe State New Mexico

Drilling was commenced January 19, 1974

Drilling was completed March 20, 1974

Elevation at top of casing in feet above sea level 6775.5 Total depth of well 385

State whether well is shallow or artesian D & A Depth to water upon completion None

Section 2 — PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | | | | NONE |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3 — RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 7" | 20.75 | none | +1 | 57.8 | 58.8 | none | none | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 — RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 — PLUGGING RECORD

Name of Plugging Contractor Not plugged, left for observation. License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19__

Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received ______

File No. ______ Use ______ Location No. ______

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0.0 | 7.0 | | | Medium Hard Brown Stiff Clay |
| 7.0 | 8.6 | | | Sandy Clay (Considerably sandy) traces of caliche - also broken rock |
| 8.6 | 23.8 | | | Soft to Medium Hard Limestone (grey) |
| 23.8 | 26.4 | | | Yellow limey shale (soft no hyd.press.) |
| 26.4 | 71.6 | | | Hard to Medium hard grey limestone (reduced hole at 57.8'-6 3/4") |
| 71.6 | 81.2 | | | Brownish shale and broken grey lime. |
| 81.2 | 113.8 | | | Hard grey limestone alternating layers of yellow and brown shale. |
| 113.8 | 116.8 | | | Soft to medium hard yellow-brown sandy clay |
| 116.8 | 144.0 | | | Hard grey limestone with alternating layers of yellow and brown shale - also occasional streaks of soft clay (red) |
| 144.0 | 159.0 | | | Medium hard red clay with intermittent layers of white or grey clay |
| 159.0 | 165.0 | | | Hard to medium hard grey limestone - also layers of a dark grey shale (med.hard) occas. traces of red grey clay. |
| 165.0 | 170.6 | | | Alternating layers of shale (medium hard) mostly re[illegible] |
| 170.6 | 204.0 | | | Hard broken grey limestone - also some shale soft to medium hard (dark grey) |
| 204.0 | 244.0 | | | Soft grey shale with layers of grey limestone - also some traces of red or brown shale. |
| 244.0 | 251.5 | | | Medium hard to hard black limestone - also layers of light grey limestone - some traces of brown shale. |
| 251.5 | 285.0 | | | Light brown limestone (hard) with layers of dark grey limestone - Lost circulation at 260' occas. layers of 6" sticky grey clay or shale. |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 251.5 | 285.0 | 33.5 | | Light Brown Lime Stone (Hard) with Layer |
| | | | → | of Dark Gray Lime Stone Lost Circulation |
| | | | | at 260' occ. Layers of 6" Sticky Gray |
| | | | | Clay or Shale |
| 285.0 | 313.0 | 28.0 | | Dark Gray Lime Stone (Hard) with Layers |
| | | | | of Light Brown Lime Stone Also, occ. |
| | | | | Layers of Red or Brown Shale |
| 313.0 | 319.5 | 6.5 | | Light Gray Lime Stone( Med. Hard) Also |
| | | | | Traces of Shale |
| 319.5 | 325.0 | 5.5 | | Med. Soft, Gray, Sticky Clay or Shale |
| | | | | with Alternate layers of brownish or |
| | | | | yellow Shale |
| 325.0 | 352.0 | 27.0 | | Hard to Med. Hard Gray Lime Sone with |
| | | | | Traces of Gray Clay or Shale. |
| 352.0 | 355.0 | 3.0 | | Med. Soft Gray Sand Stone with Occ. |
| | | | | Layers of Lime Stone |
| 355.0 | 385.0 | | | Med. Hard Dark Gray and Light Gray Lime |
| | | | → | Stone from 375.0 to 384.0 cavites tools |
| | | | | Drop 1' to 2' |
| | | | | Dry and Abandoned |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 1 | | Top soil |
| 1 | 27 | | Caliche and clay |
| 27 | 30 | | Gravel |
| 30 | 64 | | Caliche and clay |
| 64 | 73 | | Sand and gravel |
| 73 | 113 | | Clay |
| 113 | 118 | | Sand and gravel |
| 118 | 128 | | Clay |
| 128 | 134 | | Sand and gravel |
| 134 | 138 | | Clay |
| 138 | 153 | | Broken lime |
| 153 | 158 | | Sand, hard, tan (cemented) |
| 158 | 172 | | Sand and gravel, tan (cemented) |
| 172 | 190 | | Sand, tan (cemented) |
| 190 | 195 | | Sand and red shale, hard (consolidated) |
| 195 | 210 | | Red sand and thin red shale streaks (consolidated) |
| 210 | 231 | | Sand (cemented) |
| 231 | 233 | | Lime, hard, sandy |
| 233 | 234 | | Sticky red clay (red beds) |
| 234 | 237 | | Red conglomerate |
| 237 | 250 | | Red sandstone, hard |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

L. Ayres
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, e[illegible]pt Section 5, shall be answered as complete[illegible]d accurately as possible when any well is drilled, repaired or deepened. When thi[illegible]orm is used as a plugging record, only Section 1[illegible] and Section 5 need be completed.

(Complete Form in Triplicate) Revised December 1966

# PROOF OF COMPLETION OF WELL

Permit No. E-2057

1. Name of Water Right Owner City of Moriarty, New Mexico
Mailing address P. O. Drawer 130
City and State Moriarty, New Mexico 87035

2. Permit is for appropriation (supplemental well, change location of well) from shallow (artesian or shallow) ground water.

3. Description of well:
Located in the SE ¼ NW ¼ NE ¼, of Sec. 23 Twp. 9N Rge. 8E N.M.P.M., or Tract No. ____ of Map No. ____ of the ____ District; total depth, 250 feet; is well cased yes; outside diameter of top casing (or hole, if uncased), 16 inches; if artesian, is well equipped with gate valve ____; date drilled March 19 74; Name of driller Rodgers & Co., Inc.

4. Record of Pumping Test, if made (to be supplied by person or firm making test); Name and address of person making test, Clarence Rodgers, 2615 Isleta Blvd., SW, Albuquerque, NM; date of test April 19 74; depth to water before test, ____ feet below (above, below) land surface, and pumping level during test, 163 feet; length of test, 12 hours; average discharge, 200 G.P.M.; specific capacity of well, 2.35 gals./min. per foot of drawdown.

5. Permanent Pump Equipment:
(a) Description of pump: Make REDA; Type Submersible turbine; size of discharge 4 inches; if turbine type, give size of column, 4 inches; diameter of bowls 6 5/8 inches; number of bowls 4; length of suction pipe 200 feet; total length of column, bowls and suction pipe 204 feet; if centrifugal type, give size of pump ____ inches: if other type, describe ____; rated capacity of pump (if known), 200 G.P.M., at 3450 rev. per min., ~~from a depth of~~ @224 ~~feet~~ TDH

(b) Description of power plant: Make REDA; Type Electric; rated horsepower (if available) 15; type of drive connection to pump direct (direct, gearhead, or belt).

(c) Actual discharge of pump, 200 G.P.M., at 3450 rev. per min., ~~from a depth of~~ @206 ~~feet~~ TDH
Date of test ____ 19__.

6. If reservoir is used, give approximate size: length ____ feet; width ____; depth ____.

7. If above well replaced an old well to be plugged or abandoned, fill out the following: the well abandoned is located in the ____ ¼ ____ ¼ ____ ¼ of Sec. ____, Twp. ____, Rge. ____.

Describe plugging method ____
Name of plugging contractor ____

8. Well Record filed with State Engineer's Office Yes (Yes or No).

78 DEC 4 10:44
STATE ENGINEER OFFICE
DISTRICT I
ALBUQUERQUE, N. MEX.

I, ARTHUR J. STUART affirm that the foregoing statements are true to the best of my knowledge and belief and that I am the AGENT (sole, partial, agent for, etc.,) owner and holder of said water right.

City of Moriarty, New Mexico, Permittee

By: Arthur J Stuart

## STATEMENT OF STATE ENGINEER'S REPRESENTATIVE

I hereby certify that I have inspected the above well and find it constructed in accordance with the conditions of the permit. Note any exceptions This Proof of Completion of Well is hereby accepted for filing without benefit of field check by the State Engineer personnel.

Well was producing ____ gpm against a ____ (measured) (estimated) head of ____ feet at ____ rpm.

Old well has been ____ (plugged) (capped) (retained for other rights).

By: C. R. Connaughton
C. R. Connaughton
Title: Geologist
Date: January 16, 1979

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well TOWN OF MORIARTY

Street and Number Recreation Area

City Moriarty State New Mexico

Well was drilled under Permit No. E-890 and is located in the SE ¼ NE ¼ SE ¼ of Section 14 Twp. 9N Rge. 8E

(B) Drilling Contractor Cecil Kellogg License No. W.D. 192

Street and Number

City Moriarty, State New Mexico

Drilling was commenced 9/17 (Sept. 17) 19 59

Drilling was completed 9/22 (Sept. 22) 19 59

Elevation at top of casing in feet above sea level Total depth of well 182 ft.

State whether well is shallow or artesian Shallow Depth to water upon completion 57 ft

Section 2

## PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 60 | 65 | 5 | Fine Sand |
| 2 | 95 | 101 | 6 | Sand Gravel |
| 3 | 120 | 182 | 60 | Sand Gravel |
| 4 | | | | |
| 5 | | | | |

Section 3

## RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 7" OD | 15 | Welded | 0 | 182 | 182 | none | 100 | 120 |
| | | | | | | | 140 | 182 |
| | | | | | | | | |
| | | | | | | | | |

Section 4

## RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5

## PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

STATE ENGINEER OFFICE
ALBUQUERQUE, N. MEX.

Date Received 1961 JUL 19 AM 8:17

File No. Use Location No.

Section 6

## LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 4 | 4 | Soil | Dirt |
| 4 | 60 | 56 | White | Caliche |
| 60 | 65 | 5 | Gray | Fine Sand |
| 65 | 95 | 30 | White | Caliche |
| 95 | 101 | 6 | | Sand & Gravel |
| 101 | 120 | 19 | | Conglomerate |
| 120 | 182 | 60 | | Sand & Gravel |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

H L Kellogg
Well Driller

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Town of Moriarty

Street and Number

City Moriarty State New Mexico

Well was drilled under Permit No. E-917 and is located in the yale Avenue between blk 19 & 20 Irvin Addition

¼ ¼ ¼ of Section Twp. Rge.

(B) Drilling Contractor Dan Pino License No. D-98

Street and Number

City Moriarty State New Mexico

Drilling was commenced Feb. 10, 19 60

Drilling was completed Feb. 19, 19 60

Elevation at top of casing in feet above sea level Total depth of well 125'

State whether well is shallow or artesian Shallow Depth to water upon completion 50 ft.

Section 2

## PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 60 | 65 | 5 | Sand |
| 2 | 100 | 110 | 10 | Sand & Gravel |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3

## RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 | 1 | P.E. | 0 | 125 | 125 | none | 95 | 125 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4

## RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | |

Section 5

## PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. Use Location No.

Section 6

## LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 5 | 5 | | Top Soil |
| 5 | 60 | 55 | Brown | Clay |
| 60 | 65 | 5 | | Sandy Silt - 1st water |
| 65 | 100 | 35 | Grey | Clay |
| 100 | 110 | 10 | | Sand & Gravel - 2nd water |
| 110 | 125 | 10 | Grey | Clay |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Don Pine

Well Driller

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 19 | 19 | Tan Sandy Clay |
| 19 | 21 | 2 | Tan Fractured Gravel |
| 21 | 69 | 48 | Tan Sandy Clay |
| 69 | 78 | 9 | Tan Sandy Clay/Sharp gravel Stringers |
| 78 | 96 | 18 | Blue Clay |
| 96 | 117 | 21 | Tan Sandy Clay |
| 117 | 146 | 29 | Tan Sandy Sharp Gravel/Clay Stringers |
| 146 | 158 | 12 | Yellow Sand |
| 158 | 172 | 14 | Red Sandy Clay |
| 172 | 181 | 9 | Rusty Tan Sandy Clay |
| 181 | 192 | 11 | Red Sandy Clay |
| 192 | 214 | 22 | Tan Sand |
| 214 | 265 | 51 | Red Fractured Sandstone |
| 265 | 277 | 12 | Red & White Limestone |
| 277 | 295 | 18 | Lost Circulation -Regained Cir. Fairly Firm Cavity 277-283 |
| 295 | 346 | 51 | Red Clay |
| 346 | 362 | 16 | Red Sandstone & Clay Stringers |
| 362 | 370 | 8 | Red Hard Sandstone |
| 370 | 374 | 4 | Red Clay |
| 374 | 432 | 58 | Red Sandstone/Clay Stringers |
| 432 | 449 | 17 | Red Clay |
| 449 | 482 | 33 | Red Sandstone/Blue Limestone streeks |
| 482 | 507 | 25 | Red Clay |
| 507 | 566 | 59 | Red Sandy Shale/clay stringers |
| 566 | 589 | 23 | Red Clay |
| 589 | 600 | 11 | Sandy Shale /Clay |

Section 7. REMARKS AND ADDITIONAL INFORMATION

| | | | |
|---|---|---|---|
| 600 | 656 | 56 | Red Clay |
| 656 | 683 | 27 | Red Sandy Shale |
| 683 | 700 | 17 | Red Clay |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Don [signature]
Driller

INSTRUCTIONS: This form should b xecuted in triplicate, preferably typewritten, an' ubmitted to the appropriate district office of the State Engineer. All sections, pt Section 5, shall be answered as completely d accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

## STATE ENGINEER OFFICE
## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well City of Moriarty Owner's Well No. UC 50473
Street or Post Office Address Drawer 130
City and State Moriarty, N.M.

Well was drilled under Permit No. E-890-S-3 and is located in the:

a. ____ ¼ SE ¼ SW ¼ SW ¼ of Section 14 Township 9N Range 8E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Shield Drilling License No. WD-536

Address South Rt. Edgewood N.M.

Drilling Began Oct. 10, 1973 Completed Oct. 12, 1973 Type tools rotary Size of hole 8 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 175 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 85 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 70 | 170 | 100 | gravel, boulder, clay | |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 6 5/8 | 10 | | | | 176 | | 130 | 175 |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

DEC 20 ... 8:08
ALBUQUERQUE, N. MEX. ... OFFICE

### Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____ State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

### FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ____ FWL ____ FSL ____

File No. E-890-S-3 Use Irrig. Location No. 9.8.14. 334 Torrance

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 18 | 18 | brown top soil |
| 18 | 20 | 20 | white rock |
| 20 | 47 | 27 | brown gravel, clay |
| 47 | 70 | 23 | brown clay |
| 70 | 170 | 100 | brown gravel, boulders, clay |
| 170 | 175 | 5 | brown clay |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Bob Shields
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and su itted to the appropriate district office of the State Engineer. All sections, excep ction 5, shall be answered as completely an curately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Town of Moriarty

Street and Number comb.

City Moriarty E 890. E 917 State N Mex

Well was drilled under Permit No. Enlgd-S and is located in the SE¼ NE¼ SE¼ of Section 14 Twp. 9N Rge. 8E

(B) Drilling Contractor Jack J Lamb License No. WD63

Street and Number

City Moriarty State N Mex

Drilling was commenced Mar 18 1964

Drilling was completed Mar 23 1964

Elevation at top of casing in feet above sea level ______ Total depth of well 150

State whether well is shallow or artesian shallow Depth to water upon completion 60

Section 2

## PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 60 | 150 | | Sand beds, |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3

## RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 8" | 17, | pipe | line | 150' | | none | 60 | 150 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4

## RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5

## PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19__

Plugging approved by:

______ Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

STATE ENGINEER OFFICE

Municipal

File No. E-890 & E-917-Comb. Enlg. & S Use ______ Location No. 9N.8E.14 424

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| top | 60 | | | Sandy clay |
| 60 | 150 | | | clay Streaks, Sand beds, |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Jack Y Gaunt,
Well Driller

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well City of Estancia

Street and Number

City Estancia State N Mex

Well was drilled under Permit No. E 650 and is located in the NW¼ SE¼ SE¼ of Section 11 Twp. 6 Rge. 8

(B) Drilling Contractor R T Floyd License No. WD54

Street and Number

City Estancia State N Mex

Drilling was commenced 3/3 1956

Drilling was completed 3/10 1956

Elevation at top of casing in feet above sea level ______ Total depth of well 110

State whether well is shallow or artesian ______ Depth to water upon completion 5-3

Section 2

## PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | | 72 | Drilled | By Virgil L Whites Jan 2/55 |
| 2 | 72 | 75 | 3 | Sand |
| 3 | 75 | 80 | 5 | Sandy clay |
| 4 | 80 | 85 | 5 | Sand Some water |
| 5 | 85 | 110 | 25 | Sand & clay |

Section 3

## RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 12 | 46 | Welded | 0 | 75-6 | 75-6 | | 0 | 75-6 |
| 6 5/8 | 20 | Welded | 74-6 | 110 | 42-9 | Liner | | 42-9 |
| | | | | | | | | |
| | | | | | | | | |

Section 4

## RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5

## PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19__

Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received March 13, 1956

File No. E-650 Use Irrigation Location No. 6.8.11.441

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 72 | Drilled by Virgil L White | | |
| 72 | 75 | 3 | Red | Sand |
| 75 | 80 | 5 | Red | Sandy clay |
| 80 | 85 | 5 | Red | Sand |
| 85 | 110 | 25 | Red | Sand & clay |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

T. L. Stump

Well Driller

Form WR-23

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Town Of Estancia
Street and Number
City Estancia State New Mexico
Well was drilled under Permit No. E-1718-E-650 and is located in the
NE ¼ SW ¼ ¼ of Section 11 Twp. 6N Rge. 8E
(B) Drilling Contractor Dennison Cont. Inc. License No. WD-15584
Street and Number P.O. Box 91
City Stanley State New Mexico
Drilling was commenced June 10 19 64
Drilling was completed July 20 19 64

Elevation at top of casing in feet above sea level ______ Total depth of well 170' 7"
State whether well is shallow or artesian Shallow Depth to water upon completion 55'

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 50 | 54 | 4 | Sand and Gravel |
| 2 | 130 | 140 | 10 | Sand Gravel |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 12" ID | 27# | P.E. | | 170'7" | 170'7" | None | 55 | 170 |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______
Street and Number ______ City ______ State ______
Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______
Plugging method used ______ Date Plugged ______ 19___
Plugging approved by:

______ Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE 1964 OCT 13 AM 8:39

File No. E-1718-E-650 Use Municipal Location No. 6.8.11.320

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 8 | | gravel | |
| 8 | 50 | | brown | hard clay and gravel |
| 50 | 54 | | gray | sand and gravel, water bearing |
| 54 | 100 | | brown | sandy clay |
| 100 | 130 | | brown | hard sand rock |
| 130 | 140 | | gray | sand and gravel, water bearing |
| 140 | 190 | | brown | hard sand rock |
| 190 | 193 | | red | red bed |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

H. H. Patton, Well Driller
[illegible]
by [illegible]

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well City of Estancia Owner's Well No. E-18-S-3
Street or Post Office Address P. O. Box 166
City and State Estancia, New Mexico 87016

Well was drilled under Permit No. E-18-S-3 and is located in the:

a. NW ¼ NE ¼ SW ¼ ____ ¼ of Section 11 Township 6N Range 8E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor H & W Enterprises License No. WD675

Address P. O. Box 437, Artesia, New Mexico 88210

Drilling Began 07-22-77 Completed 09-28-77 Type tools Cable Size of hole 14 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 280 ft.

Completed well is XX shallow ☐ artesian. Depth to water upon completion of well 165 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 154 | 194 | 40 ft. | Clay Gravel- Sand | 250 |
| | Well Screen- | | 10" Telescope 304 Standard | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 14" | 54 lbs. | P/E | 1 | 153 | 154 | P/E | 154 | 194 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 9-21-78

Quad ____ FWL ____ FSL ____

File No. E-18-S-3 Use Municipal Location No. 6N.8E.11 320 (Torrance)

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 15 | 15 | Gravel & Rock |
| 15 | 65 | 50 | Brown Clay |
| 65 | 70 | 15 | Brown Clay, Gravel, Water in Hole up to 51' |
| 70 | 80 | 10 | Clay, Gravel |
| 80 | 120 | 40 | Gravel Cement Rock |
| 120 | 150 | 30 | Clay Gravel |
| 150 | 175 | 25 | Cement Rock |
| 175 | 182 | 8 | Clay Gravel |
| 182 | 187 | 5 | Cement Rock |
| 187 | 200 | 13 | Cement Rock with Clay Streaks |
| 200 | 204 | 4 | Brown Clay |
| 204 | 206 | 2 | Cement Rock & Clay |
| 206 | 214 | 8 | Cement Rock |
| 214 | 264 | 50 | Red Clay |
| 264 | 280 | 16 | Hard Cement Rock |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Tony Hall
Driller

INSTRUCTIONS: This form should be executed in triplicate preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, exc[illegible] Section 5, shall be answered as completely [illegible] accurately as possible when any well is drilled, repaired or deepened. When this f[illegible] is used as a plugging record, only Section 1(a) a[illegible] Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well City of Estancia Owner's Well No. E-18
Street or Post Office Address P. O. Box 166
City and State Estancia, New Mexico 87016

Well was drilled under Permit No. E-18 and is located in the:

a. SW ¼ SE ¼ NE ¼ ____ ¼ of Section 11 Township 6N Range 8E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor H & W Enterprises License No. WD675

Address P. O. Box 437, Artesia, New Mexico 88210

Drilling Began 10-04-77 Completed 10-19-77 Type tools Cable Size of hole 14 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 158 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well 75 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 118 | 158 | 40 ft. | Fine Sand, Gravel, Clay | 150 |
| | | Well Screen- 10" Telescope- 304 Standard | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 14 | 54 | PE | 1 | 158 | 159 | PE | 118 | 158 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____ State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

78 SEP 21 PM 12:09
ALBUQUERQUE, N. MEX.

FOR USE OF STATE ENGINEER ONLY

Date Received 9-21-78

Quad ____ FWL ____ FSL ____

File No. E-18 Use Municipal Location No. 6N.8E.11.240 (Torr.)

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 20 | 20 | Top Soil |
| 20 | 35 | 15 | Calechi |
| 35 | 45 | 10 | Gravel |
| 45 | 65 | 20 | Gravel, Sand |
| 65 | 85 | 20 | Brown Clay, Gravel |
| 85 | 110 | 25 | Gravel, Cement Rock |
| 110 | 135 | 25 | Clay Gravel |
| 135 | 150 | 15 | Coarse Sand, Brown & Water |
| 150 | 158 | 8 | Fine Sand |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Tony Hand
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, exc Section 5, shall be answered as completely a accurately as possible when any well is drilled, repaired or deepened. When this f. is used as a plugging record, only Section 1(a) a l Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Town of Estancia Owner's Well No. E-18
Street or Post Office Address Box 116
City and State Estancia, New Mexico

Well was drilled under Permit No. E-18 and is located in the:

a. ____ ¼ ____ ¼ SE ¼ NE ¼ of Section 11 Township 6N Range 8E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Verol May Drilling License No. WD608

Address ____

Drilling Began 9/21/78 Completed 11/14/78 Type tools cable Size of hole 16-13-12 in.

Elevation of land surface or ____ at well is 6200 ft. Total depth of well 350 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 37 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 70 | 90 | 20 | pink clay/lg. gravel/sand | |
| 105 | 125 | 20 | red sand/lg. white rock | |
| 145 | 155 | 10 | red sand rock | |
| | | | | 500 |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 14 | .250 | welded | 0 | 128 | 128 | none | 0 | 128 |
| 10 | .250 | welded | 0 | 248 | 248 | none | 0 | 248 |
| 8 | .250 | welded liner | 237 | 331 | 94 | none | 237 | 331 |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received November 22, 1978

Quad ____ FWL ____ FSL ____

File No. E-18 Use ____ Location No. 6N.8E.11. 420

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 5 | 10 | 5 | top soil |
| 10 | 20 | 10 | white sandstone |
| 20 | 35 | 15 | pink clay |
| 35 | 50 | 15 | rock/clay mix (pink) |
| 50 | 70 | 20 | white caliche |
| 70 | 80 | 10 | pink clay/gravel/water |
| 80 | 90 | 10 | red clay/sand/water |
| 90 | 105 | 15 | brown sand/water |
| 105 | 130 | 25 | red sand/white rock/water |
| 130 | 140 | 10 | grey lime 128 to 138 |
| 140 | 160 | 20 | red clay/sand rock/water? |
| 160 | 180 | 20 | red sandy shale |
| 180 | 210 | 30 | grey sandrock/red clay |
| 215 | 250 | 35 | red shale |
| 250 | 270 | 20 | blue clay |
| 270 | 315 | 45 | red sandrock/red shale |
| 315 | 320 | 5 | red sandrock |
| 320 | 325 | 5 | grey lime rock |
| 325 | 350 | 25 | grey sandrock /red clay |

Section 7. REMARKS AND ADDITIONAL INFORMATION

This hole was so cavey and muddy it was very difficult to determine water stratas and formation changes.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.*

Wendel C. May
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 3 | 3 | Sand |
| 3 | 18 | 15 | Sand Silt Blue |
| 18 | 57 | 39 | Sand and Silt Light blue |
| 57 | 60 | 3 | Hard Gravel |
| 60 | 90 | 30 | Sandy Clay |
| 90 | 103 | 13 | Stickey Clay Reddish brown |
| 103 | 117 | 14 | Sandy Clay |
| 117 | 122 | 5 | Gravel |
| 122 | 184 | 62 | Clay |
| 184 | 193 | 9 | Conglomerate |
| 193 | 195 | 2 | Clay |
| 195 | 210 | 15 | Conglomerate Very hard 197-210 |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

SHAMROCK DRILLING COMPANY
Dan Laughlin Larry Parnell
Driller

By:

INSTRUCTIONS: This form should be e ited in triplicate, preferably typewritten, and mitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

# STATE ENGINEER OFFICE

## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well: Town of [illegible] — Owner's Well No. ______
Street or Post Office Address ______
City and State: [illegible]

Well was drilled under Permit No. ______ and is located in the:

a. ___ ¼ SW ¼ SW ¼ SW ¼ of Section 31 Township 5N Range 9E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor: J. J. [illegible] — License No. ______

Address: [illegible] Fort Sumner, New Mexico

Drilling Began [illegible] Completed 1-8-76 Type tools [illegible] Size of hole [illegible] in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 306 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well ______ ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| * Test hole drilled for samples [illegible] | | | | |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| NONE | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

STATE ENGINEER OFFICE
ALBUQUERQUE, N. MEX.
6 JAN 13 PM 12:05

______
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ______ FWL ______ FSL ______

File No. E-2382 Use ~~Municipal~~ Exploratory well Location No. 5.9.31.SW.SW.SW

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 55 | 55 | gray sandy clay & clay |
| 55 | 59 | 4 | sand & gravel |
| 59 | 88 | 29 | red & gray clay |
| 88 | 91 | 3 | gravel |
| 91 | 109 | 18 | white sandy clay with little sandstone |
| 109 | 110 | 1 | sand & gravel |
| 110 | 170 | 60 | red sandy clay with spots gravel |
| 170 | 176 | 6 | red clay |
| 176 | 182 | 6 | red sandy clay with spots gravel |
| 182 | 187 | 5 | conglomrate |
| 187 | 192 | 5 | red clay with little gravel |
| 192 | 210 | 18 | conglomrate with little clay |
| 210 | 213 | 3 | One boalder |
| 213 | 214 | 1 | red sandy shale |
| 214 | 216 | 2 | yellow sandstone |
| 216 | 263 | 47 | red & yellow sandstone |
| 263 | 264 | 1 | gray lime |
| 264 | 292 | 28 | hard red sandstone |
| 292 | 295 | 3 | gray lime & shale |
| 295 | 300 | 5 | red sandstone |
| 300 | 306 | 6 | gray lime & red sandstone |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

J. J. [illegible]
Driller

INSTRUCTIONS: This form should be exec[illegible]d in triplicate, preferably typewritten, and subm[illegible]ed to the appropriate district office of the State Engineer. All sections, except [illegible]ion 5, shall be answered as completely and [illegible]rately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

## Section 1

(Plat of 640 acres)

(A) Owner of well Village of Willard

Street and Number

City ______ State ______

Well was drilled under Permit No. ______ and is located in the

______ ¼ ______ ¼ ______ ¼ of Section ______ Twp. ______ Rge. ______

(B) Drilling Contractor ______ License No. ______

Street and Number

City ______ State ______

Drilling was commenced 6-15-71 19__

Drilling was completed 6-25-71 19__

Elevation at top of casing in feet above sea level ______ Total depth of well 170

State whether well is shallow or artesian shallow Depth to water upon completion 41

## Section 2 — PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 90 | 125 | 35 | Gravel and [illegible] clay |
| 2 | 135 | 160 | 25 | light gray sand and gravel |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

## Section 3 — RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 5/8 | 19 | welded | 0 | 170 | 170 | factory | | |
| | | | | | | | | |
| | | | | | | | | |

## Section 4 — RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5 — PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19__

Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received [illegible]

File No. ______ Use ______ Location No. ______

Section 6

# LOG OF WELL

| Depth in Feet | | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| From | To | | | |
| 0 | 5 | 5 | Yellow | Topsoil |
| 5 | 20 | 15 | Yellow | Clay |
| 20 | 36 | [illegible] | Yellow | Sandy Clay |
| 35 | 50 | 15 | Yellow | Clay and Gravel |
| 50 | 65 | 15 | red | Clay and Gravel |
| 65 | 90 | 5 | red | Clay |
| 90 | 125 | [illegible] | red | Clay and Gravel |
| 125 | 135 | [illegible] | red | clay and Gravel |
| 135 | 160 | 25 | Gray | sand and Gravel |
| 160 | 170 | [illegible] | Red | Clay |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

# WELL RECORD

File No. E-143

**INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, P. O. Box 1079, Santa Fe, New Mexico, or in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.**

[illegible] & file no. [illegible] 1951

| | |
|---|---|
| NW | NE |
| SW | SE |

(Plat of 640 Acres)
Locate Well Accurately

Owner of well: Felipe Alderete

Street and Number:

Post Office: Estancia, N.M.

Well was drilled under Permit No. E-143 and

is located in the ~~NW~~ SE NW ¼ NW ¼ NE ¼ of Section 6

Township 4N, Range 9E

Drilling Contractor: Ray O. Brown

Street and Number:

Post Office: Estancia, N.M.

Drilling was commenced September 1, 1950 Drilling was completed September 15, 1950

Elevation at top of casing in feet above sea level 6200

State whether well is shallow or artesian Artesian

Total depth of well 200 feet. Water level upon completion of well 35 feet below land surface.

## Sec. 2 PRINCIPAL WATER-BEARING STRATA

| No. | From | To | Thickness in feet | Formation |
|---|---|---|---|---|
| No. 1 | 40 | 42 | | Shale |
| No. 2 | 70 | 82 | | Coarse Gravel |
| No. 3 | 82 | 180 | | Sand and clay |
| No. 4 | | | | |
| No. 5 | | | | |

## Sec. 3 RECORD OF CASING

| Diameter in Inches | Pounds per Foot | Threads per Inch | Name of Manufacturer | Feet of Casing | Type of Shoe | Perforated From | Perforated To | Purpose |
|---|---|---|---|---|---|---|---|---|
| 18 | 55 | 0 | 0 | 118 | 0 | 40 | 118 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## Sec. 4 RECORD OF MUDDING AND CEMENTING

| Diameter of Hole in Inches | Number of Sacks of Cement | Methods Used | Specific Gravity of Mud | Tons of Clay Used |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the ........ ¼ ........ ¼ ........ ¼ of Section ........, Township ........

Range ........ Name of plugging contractor ........

Street and Number ........ Post Office ........

Tons of clay used ........ Tons of roughage used ........ Type of roughage ........

........ Was plugging approved by Artesian Well Supervisor? ........

Cement plugs were placed as follows:

No. 1 was placed at ........ feet. Number of sacks of cement used ........

No. 2 was placed at ........ feet. Number of sacks of cement used ........

No. 3 was placed at ........ feet. Number of sacks of cement used ........

No. 4 was placed at ........ feet. Number of sacks of cement used ........

No. 5 was placed at ........ feet. Number of sacks of cement used ........

(over)

FILED MAR 30, 1951
OFFICE ARTESIAN WELL SUPERVISOR
ROSWELL, NEW MEXICO

ALBUQUERQUE Rec'd.
MAY 14 1951

4.9.6.21[illegible]

# LOG OF WELL

| FROM (Depth in Feet) | TO (Depth in Feet) | THICKNESS IN FEET | CLASSIFICATION OF FORMATION |
|---|---|---|---|
| 1 | 40 | | Top soil and clay |
| 40 | 70 | | Sandy Clay - Dry |
| 70 | 82 | | Coarse Gravel |
| 82 | 180 | | Sand and clay |
| 180 | 200 | | Red Lime-Dry |

I, Ray O. Brown, do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 27th day of March, A.D., 19 51

James C. Hall
Notary Public

My Commission Expires Nov. 22, 1954

Signed Ray O. Brown

Position Drilling Contractor

Street and Number

Post Office

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(A) Owner of well Breedlove Enterprises Inc

Street and Number Box 109

City Willard State N. M.

Well was drilled under Permit No. E-907 and is located in the SW ¼ SE ¼ NE ¼ of Section 7 Twp. 4N Rge. 9E

(B) Drilling Contractor H. M. Marlow License No. WD 168

Street and Number Box 66

City Moriarty State N. M.

Drilling was commenced Aug 1 1959

Drilling was completed Aug 9 1959

(Plat of 640 acres)

Elevation at top of casing in feet above sea level ______ Total depth of well 158

State whether well is shallow or artesian shallow Depth to water upon completion 40' 6"

Section 2

PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 50 | 90 | 40 | Sand + Gravel |
| 2 | 130 | 158 | 28 | Sand + Gravel |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3

RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 10 | | | | 158 | | | 58 | 158 |
| | | | | | | | | |
| | | | | | | | | |

Section 4

RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5

PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19__

Plugging approved by:

______ Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

STATE ENGINEER-ALBUQUERQUE, N. M.
RECEIVED
AUG 21 1959
A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

File No. E-907 Use domestic Location No. 4.9.7 243

Section 6

## LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 4 | 4 | | Soil |
| 4 | 20 | 16 | | adobie |
| 20 | 50 | 30 | | Caliche |
| 50 | 90 | 40 | | Sand + Gravel |
| 90 | 130 | 40 | | Red Sandy Shale |
| 130 | 158 | 28 | | Sand + Gravel |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

H. M. Marlow
Well Driller

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Edwin F Woods
Street and Number 4848 Southern Ave S.E
City Albuquerque State New Mex.
Well was drilled under Permit No. E 1075 and is located in the
¼ SW ¼ SE ¼ of Section 5 Twp. 4N Rge. 9E
(B) Drilling Contractor D.O. Shields License No. WD140
Street and Number
City Estancia State New Mexico
Drilling was commenced Sept 30 1965
Drilling was completed Oct 27 1965

Elevation at top of casing in feet above sea level Total depth of well 180 ft.
State whether well is shallow or artesian Shallow Depth to water upon completion 41 ft

Section 2

PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 38 | 44 | 6 | Coarse sand and Gravel |
| 2 | 66 | 75 | 9 | Sand and gravel |
| 3 | 95 | 117 | 22 | fine sand and gravel |
| 4 | 167 | 180 | 13 | fine sand and gravel |
| 5 | | | | |

Section 3

RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 16 | | Welded | 1 | 137 | 137 | | 40 | 137 |
| 14 | | Welded | 130 | 180 | 50 | | 130 | 180 |

Section 4

RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.
Street and Number City State
Tons of Clay used Tons of Roughage used Type of roughage
Plugging method used Date Plugged 19
Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |

FOR USE OF STATE ENGINEER ONLY

STATE ENGINEER OFFICE
DISTRICT 1
ALBUQUERQUE, NEW MEXICO

Date Received NOV 18 10 27 AM '65

File No. E-1075 Use Irrigation Location No. 4N.9E.5

4111

Section 6

# LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 3 | 3 | | Top soil |
| 3 | 17 | 14 | | Clicke |
| 17 | 38 | 21 | | Clay |
| 38 | 44 | 6 | | Sand and gravel Carrying Water |
| 44 | 66 | 22 | | Red Clay |
| 66 | 75 | 9 | | Sand and gravel Carrying Water |
| 75 | 95 | 20 | | Red shale |
| 95 | 117 | 22 | | Sand and gravel Carrying Water |
| 117 | 167 | 50 | | gray shale |
| 167 | 180 | 13 | | Sand and gravel Carrying Water |

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Emmet Shield
Well Driller

# WELL RECORD

File No. E-155

INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, P. O. Box 1079, Santa Fe, New Mexico, or in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

RECEIVED
FEB 12, 1951
STATE ENGINEER
BY

| | |
|---|---|
| NW | NE |
| SW | SE |

(Plat of 640 Acres)
Locate Well Accurately

Owner of well Leo Koger

Street and Number 525 N. W. 5th Street

Post Office Tulia, Texas.

Well was drilled under Permit No. E-155 and

is located in the NW ¼ NW ¼ SW ¼ of Section 6

Township 4 N., Range 9 E.

Drilling Contractor Tulia Drilling & Pump Service, Leo Koger, owner

Street and Number 525 N. W. 5th St.

Post Office Tulia, Texas

Drilling was commenced Oct. 25, 19 50 Drilling was completed Dec. 17, 19 50

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian shallow

Total depth of well 150 feet. Water level upon completion of well feet below land surface.

Sec. 2

## PRINCIPAL WATER-BEARING STRATA

No. 1, from 50 to 57, Thickness in feet 7, Formation soft sand

No. 2, from 90 to 95, Thickness in feet 5, Formation Gravel sand

No. 3, from to, Thickness in feet, Formation

No. 4, from to, Thickness in feet, Formation

No. 5, from to, Thickness in feet, Formation

Sec. 3

## RECORD OF CASING

| Diameter in Inches | Pounds per Foot | Threads per Inch | Name of Manufacturer | Feet of Casing | Type of Shoe | Perforated From | Perforated To | Purpose |
|---|---|---|---|---|---|---|---|---|
| | | | | NONE | | | | IRRIGATION |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Sec. 4

## RECORD OF MUDDING AND CEMENTING

| Diameter of Hole in Inches | Number of Sacks of Cement | Methods Used | Specific Gravity of Mud | Tons of Clay Used |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Sec. 5

## PLUGGING RECORD OF OLD WELL

Well is located in the ¼ ¼ ¼ of Section, Township

Range Name of plugging contractor

Street and Number Post Office

Tons of clay used Tons of roughage used Type of roughage

Was plugging approved by Artesian Well Supervisor?

Cement plugs were placed as follows:

No. 1 was placed at feet. Number of sacks of cement used

No. 2 was placed at feet. Number of sacks of cement used

No. 3 was placed at feet. Number of sacks of cement used

No. 4 was placed at feet. Number of sacks of cement used

No. 5 was placed at feet. Number of sacks of cement used

(over)

ALBUQUERQUE Rec'd. MAY 14 1951 GW

4.9.6.311

LOG OF WELL

| FROM (Depth in Feet) | TO (Depth in Feet) | THICKNESS IN FEET | CLASSIFICATION OF FORMATION |
|---|---|---|---|
| 0 | 4 | 4 | Top soil |
| 4 | 6 | 2 | Hard Clay |
| 6 | 46 | 40 | Caliche and sand |
| 46 | 50 | 4 | Red sand |
| 50 | 57 | 7 | Water sand |
| 57 | 76 | 19 | Gravel and sand |
| 76 | 78 | 2 | Clay and Gravel |
| 78 | 85 | 7 | Gravel and sand |
| 85 | 90 | 5 | Clay |
| 90 | 95 | 5 | Gravel and sand |
| 95 | 115 | 20 | Soft sand, gravel |
| 115 | 140 | 25 | Red clay, and gravel |
| 140 | 150 | 10 | Red sand and gravel |

I, (signed) Leo Koger, do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 9th day of January, A.D., 1951

(signed) L.R. Hulto
Notary Public
Notary Public
Swisher County, Texas.
My Commission Expires NOTARY PUBLIC SEAL

Signed Leo Koger

Position

Street and Number

Post Office

Form WR-23

STATE ENGINEER OFFICE

WELL #9

# WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

(Plat of 640 acres)

(A) Owner of well Torrance County Land & Livestock Company

Street and Number P. O. Box 1738

City Roswell State New Mexico

Well was drilled under Permit No. E-518 and is located in the

SE ¼ SW ¼ ¼ of Section 7 Twp. 4N Rge. 9E

(B) Drilling Contractor J. D. Gibson License No. WD-327

Street and Number Route 2, Box 254-A

City Roswell State New Mexico

Drilling was commenced June 8 19 67

Drilling was completed June 14 19 67

Elevation at top of casing in feet above sea level ______ Total depth of well 190

State whether well is shallow or artesian shallow Depth to water upon completion 57

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | Cleaned & Deepened from | | | |
| 2 | 145 | 154 | sand | |
| 3 | 154 | 187 | sand & gravel | |
| 4 | 187 | 190 | blue clay | |
| 5 | | | | |

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| Run | 55 feet of 12¼ liner top of Line 145. | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19 ______

Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | ALBUQUERQUE N. MEX. | | |
| | | | |
| | STATE ENGINEER OFFICE | | |
| | 1967 JUL 18 AM | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1967 JUL -5 PM 5:01

File No. E-518 Use Irrig Location No. 4N 9E 7

NO BACK

HC - 137856 - $25.00

# APPLICATION FOR PERMIT

TO ENLARGE AREAS OF USE OF UNDERGROUND WATERS

*To Appropriate the Underground Waters of the State of New Mexico*

File No. E-2298 thru E-2298-S-30 44

Date Received

1. Name of applicant T. C. Horton Family

Mailing address NSR 2 Box 150

City and State Edgewood, New Mexico 87015

2. Source of water supply Shallow Water Aquifer located in Estancia Basin
(artesian or shallow water aquifer) (name of underground basin)

The applicant is permitted for a diversion of 2615.7 acre-feet per annum for the purpose of providing water for domestic, light commercial, housing subdivisions, agricultural and related purposes in sections 1,2,3,11,12,13,14,15,23,24,25, T10N, R6E: sections 19 20,22,23,24,25,26,28,29,34,35,36, T11N, R6E: sections 3,4,5,6,7,8,19,30,31, T10N, R7E: sections 19,20,21.22,27,28,29,30,31,32,33,34,35, 14,15, T11N, R7E: the San Pedro Grant in Bernalillo County: NMPM and adjacent areas if service is not available

The applicant has applied for an additional 1600 acre-feet of water to serve an additional area of enlargement of use to include Sections 21, 27, 32, 33, T11N, R6E: Sections, 4, 5, 6, 7, 8, 9, 10, 16, 17, 21, 22, 26, 27, 35, 36, T10N, R6E: Section 12, T10N, R5E: Sections 1, 2, 11, 12, 13, 14, T9N, R6E: Sections 6, 7, 17, 18, T9N, R7E NMPM in Bernalillo and Torrance Counties and adjacent areas if service is not available for domestic, light commercial, housing subdivisions agricultural and related purposes.

Permitted wells include the following:

| Well No. | Subdivision | Section | Township | Range |
|---|---|---|---|---|
| E-2298 | NW¼NW¼ | 20 | 11N | 7E |
| E-2298-S | W½NW¼NE¼ | 19 | 11N | 7E |
| E-2298-S-2 | NW¼NW¼ | 20 | 11N | 7E |
| E-2298-S-3 | SE¼SE¼SE¼ | 28 | 11N | 7E |
| E-2298-S-4 | NW¼NW¼NE¼ | 29 | 11N | 7E |
| E-2298-S-5 | NE¼NE¼NE¼ | 32 | 11N | 7E |
| E-2298-S-6 | NE¼SE¼SE¼ | 28 | 11N | 7E |
| E-2298-S-7 | NE¼NE¼NE¼ | 32 | 11N | 7E |
| E-2298-S-9 | NE¼SE¼SE¼ | 33 | 11N | 7E |
| E-2298-S-10 | NE¼ | 4 | 10N | 7E |
| E-2298-S-11 | S½SE¼ | 33 | 11N | 7E |
| E-2298-S-12 | W½ | 20 | 11N | 7E |
| E-2298-S-13 | SW¼ | 29 | 11N | 7E |
| E-2298-S-14 | N½ | 29 | 11N | 7E |
| E-2298-S-15 | SW¼NW¼NE¼ | 30 | 11N | 7E |
| E-2298-S-16 | E½ | 19 | 11N | 7E |
| E-2298-S-17 | NE¼ | 32 | 11N | 7E |
| E-2298-S-18 | SE¼SE¼ | 29 | 11N | 7E |
| E-2298-S-19 | N½SW¼SE¼ | 29 | 11N | 7E |
| E-2298-S-20 | SW¼ | 33 | 11N | 7E |
| E-2298-S-21 | SW¼ | 33 | 11N | 7E |
| E-2298-S-22 | NE¼ | 33 | 11N | 7E |
| E-2298-S-23 | SW¼ | 29 | 11N | 7E |
| E-2298-S-24 | NW¼ | 29 | 11N | 7E |
| E-2298-S-25 | NW¼ | 20 | 11N | 7E |
| E-2298-S-26 | SW¼ | 20 | 11N | 7E |
| E-2298-S-27 | NE¼ | 19 | 11N | 7E |
| E-2298-S-28 | SE¼ | 19 | 11N | 7E |
| 3-2298-S-29 | SE¼ | 28 | 11N | 7E |
| E-2298-S-30 | NW¼ | 35 | 11N | 7E |
| Applied for permit | | | | |
| E-2298-S-31 | SW¼NW¼ | 35 | 11N | 7E |
| E-2298-S-32 | SE¼NW¼ | 35 | 11N | 7E |
| E-2298-S-33 | GOV. LOT 3 | 6 | 10N | 7E |
| E-2298-S-34 | NW¼NW¼ | 3 | 10N | 7E |
| E-2298-S-35 | NE¼SW¼ | 3 | 10N | 7E |
| E-2298-S-36 | S½SW¼SE¼ | 29 | 11N | 7E |
| E-2298-S-37 | S½SE¼ | 30 | 11N | 7E |
| E-2298-S-38 | E½SW¼ | 30 | 11N | 7E |
| E-2298-S-39 | E½NW¼ | 30 | 11N | 7E |
| E-2298-S-40 | SE¼ | 30 | 11N | 7E |
| E-2298-S-41 | S½NE¼ | 33 | 11N | 7E |
| E-2298-S-42 | N½SE¼ | 33 | 11N | 7E |
| E-2298-S-43 | S½SE¼ | 34 | 11N | 7E |
| E-2298-S-44 | S½SW¼ | 34 | 11N | 7E |

For this application the applicant proposes to increase the permitted and applied for diversions by 3000 acre-feet per annum with the addition of all recharge water rights resulting from the pumping of water from the Estancia Basin into the Sandia Administrative Basin.and the addidion of area of service to include: all remaining sections in Townships 9N, R5E; 9N, R6E; 10N, R5E: 10N, R6E: 11N, R6E, 11N R5E

T. S. Horton

And adjacent areas if water is not avaliable. And sections 9, 10, 11, T10N, R7E

I, ________, affirm that the foregoing statements are true to the best of my knowledge and belief and that development shall not commence until approval of the permit has been obtained.

________, Permittee,

By: ________

Subscribed and sworn to before me this 30th day of October, A.D., 1990.

My commission expires 2-16-92 ________ Susan J. Raffay
Notary Public

2-16-92

Number of this permit ________

ACTION OF STATE ENGINEER

~~After notice pursuant to statute and by authority vested in me, this application is approved provided it is not exercised to the detriment of any others having existing rights; further provided that all rules and regulations of the State Engineer pertaining to the drilling of ________ wells be complied with; and further subject to the following conditions:~~

This application is hereby denied for the reason that applicant has not provided plans for expanding the place of use of water produced from wells E-2298 et.al., including projected water requirements at projected system intervals or for system segments, and a schedule for the development of systems phased or coordinated for the accomplishment of beneficial use within a reasonable period of time; furthermore, applicant has not provided a method or mechanism for calculating the amounts, timing and disposition of such waters that could be reasonably expected to be returned to the same underground reservoir from which said waters originated; moreover, there is no data available to the State Engineer to indicate that water sold by applicant for distribution through waterworks under other ownerships remains a comodity over which the applicant retains jurisdiction for the purpose of claiming return flow credit.

Proof of completion of well shall be filed on or before N/A, 19____

Proof of application of water to beneficial use shall be filed on or before N/A, 19____

Witness my hand and seal this 4th day of June, A.D., 1993.

Eluid L. Martinez, State Engineer

By: ________

93 JUN 7 A 8:

INSTRUCTIONS

This form shall be executed, preferably typewritten, in triplicate and shall be accompanied by a filing fee of $5.00.
Each of triplicate copies must be properly signed and attested.

A separate application for permit must be filed for each well used.

Secs. 1-4—Fill out all blanks fully and accurately.

Sec. 5—Irrigation use shall be stated in acre feet of water per acre per annum to be applied on the land. If for municipal or other purposes, state total quantity in acre feet to be used annually.

Sec. 6—Describe only the lands to be irrigated or where water will be used. If on unsurveyed lands describe by legal subdivision "as projected" from the nearest government survey corners, or describe by metes and bounds and tie survey to some permanent, easily located natural object.

Sec. 7—If lands are irrigated from any other source, explain in this section. Give any other data necessary to fully describe water right sought.

Applicant hereinbelow summarizes its existing permits and applications including the present application. Applicant has a existing permit E-2298 through E-2298-5-29 issued by the New Mexico State Engineer for the consumption of 2,615.7 acre feet of water dated May 15, 1986. Applicant filed application E-2298-5 thru E-2298-S-44 for a permit to consume an addtional 1,600 acre feet of water on December 30, 1988. The present application entitled E-2298 thru E-2298-S-44 Enlarged, filed October 30, 1990 is for a permit to appropriate and consume an additional 3,000 acre feet of water beyond that already permited and applied for. The total amount of water to be consumed, both permitted and applied for, is 7,215.7 acre feet per annum. Applicant requests the State Engineer recognize a return flow credit of 80 percent which will result in a total diversion of 36,078.5 acre feet per annum.

90 NOV 2 A10:12
DISTRICT I
ALBUQUERQUE, N. MEX.
93 JUN 7 10 38

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Roy C. Horton, T. C. & Rita S Horton Owner's Well No. F-1723-S-2

Street or Post Office Address NSR Box 150

City and State Edgewood, New Mex. 87015

Well was drilled under Permit No. ~~Exploratory # E2936~~ and is located in the:

a. ____ ¼ NE ¼ SE ¼ NE ¼ of Section 4 Township 10N Range 7E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____ Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Garcia Drilling License No. ~~WD 539~~

Address Star Route Box 327, Tijeras, New Mex.

Drilling Began ~~April 15, '79~~ Completed ~~[illegible] 22, '79~~ Type tools Rotary Hammer Size of hole ____ in.

Elevation of land surface or 6615 at well is 6615 ft. Total depth of well 448 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 306 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 333 | 448 | | Fissured limestones, Sandstones & Conglomerates | 500 |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 8" | | | 0 | 415 | 415 | | 305 | 415 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____

Address ____

Plugging Method ____

Date Well Plugged ____

Plugging approved by:

____ State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received July 10, 1979

Quad ____ FWL ____ FSL ____

File No. E-2936-Explore Use Exploratory Location No. 10.7.4 NE SE NE

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 25 | 25 | Tan | Top soil & Clays |
| 25 | 30 | 5 | Tan | Clay & Gravel |
| 30 | 45 | 15 | Tan | Clay |
| 45 | 65 | 20 | Tan | Pea Gravel & Clay |
| 65 | 75 | 10 | Tan | Clay |
| 75 | 105 | 30 | Tan | Clay & Gravel |
| 105 | 110 | 5 | Tan | Clay |
| 110 | 115 | 5 | Tan | Clay & Gravel |
| 115 | 130 | 15 | Tan | Clay |
| 130 | 133 | 3 | Grey | Hard Qts. Mons. |
| 133 | 140 | 7 | Tan | Clay |
| 140 | 160 | 20 | Tan | Clay & Gravel |
| 160 | 165 | 5 | Tan | Clay |
| 155 | 170 | 5 | Tan | Clay & Gravel |
| 170 | 180 | 10 | Tan | Clay |
| 180 | 190 | 10 | Gray | Clay |
| 190 | 198 | 8 | Grey | Clay, Limestone, Gravels |
| 198 | 200 | 2 | Grey | Limestone |
| 200 | 210 | 10 | Yellow | Clay & Large Sandstone Cuttings |
| 210 | 212 | 2 | Dark Brown | Schist (dyke?) |
| 212 | 215 | 3 | Red | Clays & Large Brown Sands |
| 215 | 228 | 13 | Dark Brown | Schist (dyke?) |
| 228 | 239 | 11 | Dark Red | Clays with large Sand Crystals |
| 239 | 247 | 8 | Grey | Clay |
| 247 | 255 | 8 | Red | Shales & Yellow Sandstones |
| 255 | 257 | 2 | Green Clay, | Clay, Grey & Yellow Sandstone Cuttings |
| 257 | 265 | 8 | Rusty Yellow | Sandstone cuttings |
| 265 | 270 | 5 | Black | Clay & Limestone |
| 270 | 290 | 20 | Black | Shale |
| 290 | 295 | 5 | Brown | Clays & Brown Sandstone Cuttings |
| 295 | 300 | 5 | Grey | Sandstone Cuttings |
| 300 | 303 | 3 | Black | Shale & Black Sandstone Cuttings |
| 303 | 310 | 7 | Grey | Clay && Black Sandstone Cuttings |
| 310 | 315 | 5 | Grey | Clay |
| 315 | 323 | 8 | Red | Shale |
| 323 | 329 | 6 | Tan | Clay |
| 329 | 333 | 4 | Red | Clay |
| 333 | 335 | 2 | Grey | Limestone---First Water |
| 335 | 337 | 2 | | Fissure--Lost Circulation |
| 337 | 339 | 2 | Grey | Conglomerates |
| 339 | 342 | 3 | | Fissure---Lost Circulation |
| 342 | 350 | 8 | Tan | Conglomerates, Fractured Limestones (good water) |
| 250 | 355 | 5 | Tan | Limestone |
| 355 | 371 | 16 | Green | Sandstone |
| 371 | 448 | 67 | | Lost Circulation--no cuttings |
| | 448 | | | Very Dense Formation |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Air Line @ 378'
Pump in-take supply pipe 3" to meter and valve
Inlet to pump 392'
Pump is of insufficient size to achieve a drawdown when pumping @ 97.77 gpm for 24 hrs.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, e[illegible]t Section 5, shall be answered as complete[illegible]d accurately as possible when any well is drilled, repaired or deepened. When thi[illegible]form is used as a plugging record, only Section 1[illegible] and Section 5 need be completed.

Revised June 1972

# STATE ENGINEER OFFICE

## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well [illegible] Owner's Well No. ______

Street or Post Office Address [illegible]

City and State Albuquerque

Well was drilled under Permit No. E 1723 and is located in the:

a. SE ¼ NE ¼ ____ ¼ ____ ¼ of Section 3 Township 10N Range 7E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______ Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Sandia Well Drilling License No. WD 641

Address PO 573 Cedar Crest

Drilling Began ______ Completed ______ Type tools Rotary Size of hole 6 1/4 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 400 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 380 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 6 | | | 0 | 380 | | | | |
| 4 | | | 380 | 400 | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

…ng Contractor ______

…s ______

…g Method ______

…ll Plugged ______

approved by: '90 MAY 24 AM 11:06

State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

…ved

Quad ______ FWL ______ FSL ______

______ Use ______ Location No. ______

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 300 | 400 | | BLACK SHALE |

Section 7. REMARKS AND ADDITIONAL INFORMATION

THIS IS A RECORD OF THE DEEPENING OF THIS WELL FROM 300' TO 400' WHETHER THE YIELD WAS INCREASED WILL NOT BE KNOWN UNTIL THE OWNER TEST PUMPS IT.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except ion 5, shall be answered as completely and rately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and ction 5 need be completed.

Revised June 1972

## STATE ENGINEER OFFICE
# WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Philip B. Horton Owner's Well No. E-2575 Expl 1
Street or Post Office Address P.O. Box 145
City and State Edgewood, NM 87015

Well was drilled under Permit No. E-2575- Explor-1 and is located in the:

a. ____ ¼ W½ ¼ SE ¼ SE ¼ of Section 29 Township 11N Range 7E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Santa Fe County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Garcia Drilling License No. WD-539

Address ST.RT. box 327 Tijeras, NM 87059

Drilling Began 4-8-82 Completed 4- Type tools Rotary Size of hole 6¾ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 305 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well ____ ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 305 | 330 | 25 | black shael | less than ½ gal min |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| | | | NO CASING | | NO CASING | | | |
| | | | | | | | | |
| | | | | | | | | |

82 NOV 22

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

### FOR USE OF STATE ENGINEER ONLY

Date Received 11-22-82

Quad ____ FWL ____ FSL ____

File No. E-2575-Explor-1 Use Exploratory Location No. 11N.7E.29.440 (TF)

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 16 | 60 | 54 | Massive gray limest ne |
| 60 | 80 | 20 | gray shale |
| 80 | 105 | 25 | purple clay |
| 105 | 123 | 18 | yellow clay |
| 123 | 150 | 27 | red clay |
| 150 | 165 | 15 | red shale |
| 165 | 170 | 5 | gray limestone |
| 170 | 191 | 21 | gray shale |
| 191 | 194 | 3 | black shale |
| 194 | 205 | 11 | gray shale |
| 205 | 212 | 7 | yellow sand |
| 212 | 215 | 3 | yellow clay |
| 215 | 239 | 24 | purple shale or purple sand stone |
| 239 | 250 | 11 | red shale |
| 250 | 253 | 3 | gray limestone |
| 253 | 258 | 5 | black shale |
| 258 | 259 | 1 | red shale |
| 259 | 266 | 7 | limestone |
| 266 | 300 | 34 | lenses of black gray sand st ne |
| 300 | 330 | 30 | black shell Water |
| 330 | 332 | 2 | red shale |
| 332 | 340 | 8 | limestone |
| 340 | 350 | 10 | black shell |
| 350 | 355 | 5 | limestone |
| 355 | 390 | 40 | limest ne |
| 390 | 420 | 30 | black slate |
| 420 | 445 | 25 | black spotted limest ne |
| 445 | 447 | 2 | black shale |
| 447 | 451 | 4 | gray limestone |
| 451 | 459 | 8 | light gray limestone |
| 459 | 460 | 1 | brown shale |
| 460 | 480 | 20 | dark gray limest ne |
| 480 | 486 | 6 | brown sandy shale |
| 486 | 500 | 14 | gray limestone' |
| 500 | 515 | 15 | black slate |
| 515 | 530 | 15 | limestone |
| 530 | 550 | 20 | black shale |
| 550 | 553 | 3 | limestone |
| 553 | 559 | 4 | black slate' |
| 559 | 588 | 29 | light gray limestone |
| 588 | 590 | 2 | black shale |
| 590 | 630 | 40 | light gray limextone |
| 630 | 640 | 10 | black shale |
| 640 | 645 | 5 | light gray limestone |
| | | | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Raymond Garcia
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When thi m is used as a plugging record, only Section 1 d Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Roy Horton Owner's Well No. ____
Street or Post Office Address 4825 Pal[illegible] NE
City and State Albuquerque, New Mexico

Well was drilled under Permit No. E-1723-S-3-Explor and is located in the:

a. NW ¼ NE ¼ NE ¼ ____ ¼ of Section 4 Township 10N Range 7E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the Estancia Underground Water Basin

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Lloyd Scott License No. WD 506

Address 1205 California, NE Albuquerque, New Mexico 87110

Drilling Began 11/1/78 Completed 11/3/78 Type tools Rotary Rig Size of hole 6 3/4 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 330 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well ____ ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 310 | 320 | 10 | Lime stone | Unknown |
| 320 | 330 | 10 | white sand | " |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

NOV 14 PM 12:40

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received November 14, 1978 Quad ____ FWL ____ FSL ____

File No. E-1723-S-3-Explor Use ____ Location No. 10N.7E.4.122

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 10 | 10 | Brown sandy clay |
| 10 | 135 | 125 | Brown Gravel & Boulders |
| 135 | 160 | 25 | Red shale |
| 160 | 195 | 35 | Green shale |
| 195 | 210 | 15 | Red shale with sand strks |
| 210 | 215 | 5 | Brown gravel |
| 215 | 225 | 10 | Red Shale |
| 225 | 245 | 20 | Green Hard sand |
| 245 | 300 | 45 | Gray shale |
| 300 | 305 | 5 | Gray lime stone |
| 305 | 310 | 5 | Red shale |
| 310 | 320 | 10 | Gray limestone |
| 320 | 330 | 10 | Gray White sand |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Floyd Scott

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, exc Section 5, shall be answered as completely accurately as possible when any well is drilled, repaired or deepened. When this ...m is used as a plugging record, only Section 1(a) ..d Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

E-2298-S-6

## Section 1. GENERAL INFORMATION

(A) Owner of well T.C. Horton & Rita S. Horton Owner's Well No. ____
Street or Post Office Address RSR Box 150
City and State Edgewood, New Mex

Well was drilled under Permit No. ____ and is located in the:

a. ____ ¼ SE ¼ SE ¼ SE ¼ of Section 28 Township 11N Range 7E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor W.H. Atkinson License No. ____

Address ____

Drilling Began ____ Completed ____ Type tools Rotary Size of hole ____ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 420 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 275 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ____ FWL ____ FSL ____

File No. ____ Use ____ Location No. ____

Section 6. LOG OF HOLE

| Depth in Feet | | Thickne in Feet | Color and Type of M[illegible]rial Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 32 | 32 | Brown Clay |
| 32 | [illegible] | 36 | [illegible] lime[illegible] |
| 67 | [illegible] | 11 | [illegible] |
| [illegible] | [illegible] | 18 | [illegible] Shale |
| [illegible] | [illegible] | 19 | Yellow Clay |
| [illegible] | [illegible] | 18 | [illegible] |
| [illegible] | [illegible] | 22 | [illegible] Shale |
| [illegible] | [illegible] | 25 | Red [illegible] Shale |
| 166 | [illegible] | 34 | Red Shale |
| [illegible] | [illegible] | 21 | Yellow Shale |
| [illegible] | [illegible] | 19 | [illegible] Shale |
| [illegible] | [illegible] | 32 | [illegible] |
| [illegible] | [illegible] | 22 | [illegible] water @ 294' |
| [illegible] | 328 | [illegible] | [illegible] |
| [illegible] | [illegible] | 26 | [illegible] water @ 35[illegible]' |
| 354 | [illegible] | 33 | [illegible] lime[illegible] |
| [illegible] | [illegible] | 14 | [illegible] water @ 341' |
| [illegible] | [illegible] | 19 | [illegible] |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed i[illegible] [illegible]plicate, preferably typewritten, and submitted to the appropriate district offic[illegible] of the State Engineer. All section[illegible] except Sec[illegible] [illegible], shall be answered as comple[illegible]ly and accurately as possible when any well [illegible]

E-22498-5-6

| | | | |
|---|---|---|---|
| 0 | 32 | Brown clay | 275' to Water |
| 32 | 67 | Brown Gray lime | 145' feet to Water |
| 67 | 71 | Blue lime | 420' Total Depth of Well |
| 71 | 89 | Gray shale | |
| 89 | 101 | yellow clay | |
| 101 | 119 | Gray Brown lime | |
| 119 | 141 | Gray shale | |
| ~~144~~ 141 | 164 | Red + Gray shale | |
| 164 | 220 | Red shale | |
| 222 | ~~241~~ 241 | yellow shale | |
| 241 | 260 | Gray shale | |
| 260 | 292 | Gray shale | |
| 292 | 314 | Gray lime | |
| 314 | 328 | Gray shale | |
| 328 | 354 | Gray shale + streaks lime | |
| 384 | 387 | Gray lime | |
| 387 | 401 | Fractured shale lime | |
| 401 | 420 | Gray lime | |

water at 394 / 359 / 3? / 391

Mr. Scott called and said Do not

use muriatic acid on plastic casing it will build up to much heat.
Use Dry acid

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 2 | 2 | ro.n t. soil |
| 2 | 3 | 28 | R d sandy clay |
| 3. | 95 | 65 | .n sandy clay |
| 95 | 115 | 20 | Gray boulders |
| 115 | 138 | 23 | Yellow clay and boulders |
| 138 | 147 | 9 | Gray shale |
| 147 | 156 | 9 | Gray limestone |
| 156 | 180 | 34 | Light gray limestone |
| 1.. | 190 | 1. | Gray shale |
| 1.. | 202 | 12 | Gray ~~xx~~ clay |
| 202 | 210 | 8 | .urple shale |
| 210 | 220 | 20 | Gray shale |
| 22. | 263 | 43 | .urple shale |
| 263 | 335 | 72 | Gray shale |
| 335 | 355 | 20 | Tan conglomerate |
| 355 | 378 | 23 | Gray shale |
| 378 | 38. | 8 | Gray sandstone |
| 38. | 395 | 9 | Gray shale |
| 395 | 397 | 2 | Gray limestone |
| 397 | 4.5 | . | Gray shale |
| 405 | 415 | 10 | limestone |
| 415 | 501 | 86 | Gray shale |
| 5.1 | 546 | 45 | Gray limestone |
| 54. | 549 | 3 | Gray shale |
| 549 | 57. | 21 | Gray limestone |
| 57. | 625 | 55 | Gray shale |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Lloyd J. Dennisson
Driller
Dennisson Contractors, Inc.

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When thi m is used as a plugging record, only Section 1( nd Section 5 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Tom Horton & Rita Horton — Owner's Well No. E-2298-S-3 E-2897
Street or Post Office Address NSR Box 150
City and State Edgewood, New Mexico 87015

Well was drilled under Permit No. #2298-S-3-Explore — Now used under Permit E-2298-S-3 and is located in the:

a. NE¼ ¼ NE¼ ¼ SE¼ ¼ SE¼ ¼ of Section 28 Township 11N Range 7E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennisson Contractors, Inc. License No. WD 49

Address PO Box 91 STanley, New Mexico 87056

Drilling Began Dec. 78 Completed Sept 79 Type tools Cable Size of hole 10 in.

Elevation of land surface or ______ at well is 6640 ft. Total depth of well 567 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 334 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 315 | 326 | 11 | Limestone | 17 |
| 420 | 435 | 15 | Limestone with quartz | 30 |
| 460 | 567 | 107 | Limestone with quartz | 100 |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 8 5/8 | - | - | 0 | 465 | 466 | none | 310 | 330 |
| | | | | | | | 410 | 465 |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | RECEIVED |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received December 19, 1979

Quad ______ FWL ______ FSL ______

File No. E-2897 Use Explore Location No. 4422.T11N.R7E.Sec.28

Section 6. LOG OF HOLE

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 287 | 287 | Reamed (drilled by Jewel Atkinson pre-basin and abandoned by atkinson) |
| 287 | 315 | 28 | Blue Shale |
| 315 | 326 | 11 | Limestone0Gray |
| 326 | 420 | 94 | Blue Shale |
| 420 | 435 | 15 | Limestone with quartz |
| 435 | 460 | 25 | Blue-black shale |
| 460 | 567 | 107 | Limestone with quartz |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Originally drilled by J Atkins (287') 1972

Formation seems to be laying flat. Hit water at 315'-water rose to 190' then caved in.

Ran in casing to shut off cavein. Second water @ 420 water level 360'

Picked up more water at 460' and had same type of material to 567'-mostly limestone (water level rose to 345) Now 334'
Water at 315 sealed off

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office [illegible] State Engineer. All sections, e[illegible] t Section 5, shall be answered as completely [illegible] accurately as possible when any well is [illegible] repaired or deepened. When this [illegible]orm is used as a plugging record, only Section 1[illegible] and Section 5 need be completed.

Revised June 1...

## STATE ENGINEER OFFICE

## WELL RECORD

### Section 1. GENERAL INFORMATION

2897

(A) Owner of well Tom Horton & Rita Horton Owner's Well No. ~~E-2298-S-3~~

Street or Post Office Address NSR Box 150

City and State Edgewood, New Mexico 87015

Well was drilled under Permit No. #2298-S-3-Explore and is located in the:

a. NE¼ ¼ NE¼ ¼ SE¼ ¼ SE¼ ¼ of Section 28 Township 11N Range 7E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennisson Contractors, Inc. License No. WD 49

Address PO Box 91 STanley, New Mexico 87056

Drilling Began Dec. 78 Completed Sept 79 Type tools Cable Size of hole 10 in.

Elevation of land surface or ______ at well is 6640 ft. Total depth of well 567 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 334 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 315 | 326 | 11 | Limestone | 17 |
| 420 | 435 | 15 | Limestone with quartz | 30 |
| 460 | 567 | 107 | Limestone with quartz | 100 |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 8 5/8 | - | - | 0 | 465 | 466 | none | 310 | 330 |
| | | | | | | | 410 | 465 |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | RECEIVED |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

### FOR USE OF STATE ENGINEER ONLY

Date Received December 19, 1979

Quad ______ FWL ______ FSL ______

File No. E-2897 Use Explore Location No. 4422.T11N.R7E.Sec.28

Section 6. LOG OF HOLE

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 287 | 287 | Reamed (drilled by Jewel Atkinson pre-basin and abandoned by atkinson) |
| 287 | 315 | 28 | Blue Shale |
| 315 | 326 | 11 | Limestone0Gray |
| 326 | 420 | 94 | Blue Shale |
| 420 | 435 | 15 | Limestone with quartz |
| 435 | 460 | 25 | Blue-black shale |
| 460 | 567 | 107 | Limestone with quartz |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Originally drilled by J Atkins (287') 1972

Formation seems to be laying flat. Hit water at 315'-water rose to 190' then caved in.

Ran in casing to shut off cavein. Second water @ 420 water level 360'

Picked up more water at 460' and had same type of matdrial to 567'-mostly limestone (water level rose to 345) Now 334'
Water at 315 sealed off

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, e[illegible]t Section 5, shall be answered as completel[illegible] [illegible]d accurately as possible when any well is drilled, repaired or deepened. When this [illegible]rm is used as a plugging record, only Section 1[illegible] [illegible]nd Section 5 need be completed.

Revised June 1972

# STATE ENGINEER OFFICE

## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well Tom Horton Owner's Well No. ______
Street or Post Office Address E-2298-S-3-Explor.
City and State Edgewood, New Mexico

Well was drilled under Permit No. ______ and is located in the:

a. ______ ¼ NW ¼ SE ¼ SE ¼ of Section 28 Township 11N Range 7E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennisson Contractors, Inc. License No. WD 49

Address P.O. Box 91, Stanley, New Mexico, 87056

Drilling Began Oct. 78 Completed Oct. 78 Type tools Cable Size of hole 15 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well ______ ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well 85 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| | | | NM | |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | ...E ENGINEER-ALBUQUERQUE, N. M. RECEIVED ... 1979 |
| | | | | | |
| | | | | | |

### Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by: ______

State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received December 20, 1979

Quad ______ FWL ______ FSL ______

File No. E-2298-S-3- Use Explore Location No. 441, T11N.R7E.Sec.28

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 2 | 2 | Brown Top Soil |
| 2 | 43 | 41 | Tan sandy clay |
| 43 | 68 | 25 | Yellow sandstone with boulders |
| 68 | 79 | 13 | Gray shale |
| 79 | 83 | 4 | Red clay |
| 83 | 85 | 2 | Gray limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Stooped and abandoned at 85' on high angle east west fault dipping steeply to north

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, exc Section 5, shall be answered as completely accurately as possible when any well is drilled, repaired or ...

STATE ENGINEER OFFICE

**WELL RECORD**

**Section 1. GENERAL INFORMATION**

(A) Owner of well T.C. Horton Or Rita S. X Horton Owner's Well No. ~~S2583~~

Street or Post Office Address NSR Box 150

City and State Edgewood, N.M.

Well was drilled under Permit No. S-583 F-2533 and is located in the:

600 South of San Pedro Grant Fence & 600' East of half-mile partition fence

a. ___ ¼ NW ¼ NW ¼ NE ¼ of Section 19 Township 11N Range 7E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___ Subdivision, recorded in ___ County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor Garcia Drilling License No. ~~WD-539~~

Address ST.RT. Box 327 Tijeras, N.M.

Drilling Began 12-1-77 Completed ~~XX~~ 12-10-77 Type tools Rotary Size of hole 7 in.

Elevation of land surface or ___ at well is 6990 ft. Total depth of well 370 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 250 ft.

**Section 2. PRINCIPAL WATER-BEARING STRATA**

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 300 | 353 | 53 | Decomosing brecciated quatrz monzonite, | |
| | | | dark red mud stones, vari-colored sand stones | |
| | | | | |
| | | | | |

**Section 3. RECORD OF CASING**

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 5/8 | 188w | | 1 | 370 | 200 | none | 300 | 370 |
| | | | | | | | | |
| | | | | | | | | |

**Section 4. RECORD OF MUDDING AND CEMENTING**

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

78 JAN 9 P 2:16
STATE ENGINEER OFFICE
ALBUQUERQUE, N. MEX.

**Section 5. PLUGGING RECORD**

Plugging Contractor ___

Address ___

Plugging Method ___

Date Well Plugged ___

Plugging approved by: ___

State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

**FOR USE OF STATE ENGINEER ONLY**

Date Received January 9, 1978

Quad ___ related FWL ___ FSL ___

File No. ~~E-2583~~ Use domestic & Location No. 11N.7E.19.211 ((Santa Fe))

Section 6. LOG OF HOLE

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 1 | 15 | 15 | Brown top soil |
| 15 | 25 | 10 | Tan clay with brecciated quartz monzonite&Abo Sandxx stone |
| 25 | 35 | 10 | Yellow clay with very fine breccia |
| 35 | 45 | 10 | Light grey clays & shals with light grey qtz-monz breccia |
| 45 | 75 | 30 | tan sands with qtz-monz &abo SS breccia |
| 75 | 85 | 10 | Readish tan soft shale with fine breccia |
| 85 | 95 | 10 | Brown-red shale--soft |
| 95 | 105 | 10 | Brown shale--soft |
| 105 | 115 | 10 | Tan sands with breccia of qtz-monz, SS, decomposing granite |
| 115 | 125 | 10 | Grey xx green shale |
| 125 | 145 | 20 | Soft brown shale with Abo breccia |
| 145 | 165 | 20 | Red & xx grey shales |
| 165 | 185 | 20 | Dark red shales with Abo breccia |
| 185 | 205 | 20 | Brownish-red shales |
| 205 | 215 | 10 | Brown-tan shales |
| 215 | 245 | 30 | Brown clay with breccia (blk SS, LS, Abo mud-stone |
| 245 | 265 | 20 | Brown sandy clay with qta-monz sands, trace of xwater |
| 265 | 290 | 25 | X Red & grey shales |
| 290 | 292 | 2 | More grey than red shales |
| 292 | 298 | 6 | Green-grey compitent shales |
| 298 | 300 | 2 | red shale & large x grained red sand stones |
| 300 | 353 | xx53 | Sharp breccias of Qtz-monz, decomposing qtz-monz, Brecciated |
| | | | xsandstones ( pink, tan, brown, white, red) |
| 353 | 365 | 12 | Sampling --1st brownish red shale, 2nd rusty-red shal 3rd brown shale, 4th brown sandy shale, 5th red& grey shale 6th dark red shale |
| 365 | 374 | 9 | no samples |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, ex ' Section 5, shall be answered as completely ' accurately as possible when any well is drilled, repaired or deepened. When thi n is used as a plugging record, only Section 1(a, d Section 5 need be completed.

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well T. C. Horton & Rita S. Horton Owner's Well No. E2298-58
Street or Post Office Address Box 150
City and State Edgewood, New Mex. 87015

Well was drilled under Permit No. Started pre-basin and is located in the:

a. NW ¼ NW ¼ ¼ ¼ of Section 20 Township 11N Range 7E N.M.P.M.

b. Tract No. of Map No. of the

c. Lot No. of Block No. of the
Subdivision, recorded in County.

d. X= feet, Y= feet, N.M. Coordinate System Zone in the Grant.

(B) Drilling Contractor W. H. Atkinson License No.

Address Edgewood, New Mex. 87015

Drilling Began Completed Type tools Rotary Size of hole in.

Elevation of land surface or 7040 at well is ft. Total depth of well 360 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 290 ft.
Airline measurement 299.5

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 327 | 360 | 33 | Brown Sandstone/Grey & Red Shale/Granites/Gravels | |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 5/8" | | | 0 | 360 | 360 | | 340 | 360 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor
Address
Plugging Method
Date Well Plugged
Plugging approved by:

State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad FWL FSL

File No. Use Location No.

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 10 | 10 | Red Sandy Clay |
| 10 | 43 | 33 | Boulders & Red Clay |
| 43 | 73 | 30 | Yellow Sandstone & Clay |
| 73 | 138 | 65 | Red Clay & Red Shale |
| 138 | 167 | 29 | Brown Sandstone & Clay |
| 167 | 180 | 13 | Red Clay & Red Shale |
| 180 | 230 | 50 | Yellow Sandstone |
| 230 | 270 | 40 | Yellowsandstone & Red Clay |
| 270 | 327 | 57 | Red Clay with stringers of Brown Sandstone |
| 327 | 350 | 23 | Brown Sandstone with Red & Grey Shale, Granites, Gravels |
| | | | Water hit at 345 |
| 350 | 360 | 10 | Brown Sandstone/Red & Brey S"ale/Granites/Gravels |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

W. H. [signature]
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office the State E[illegible]er. All section[illegible] [illegible]xcept Secti[illegible] be answered as complete[illegible]

Form WR-23

STATE ENGINEER OFFICE

# WELL RECORD

Original

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(A) Owner of well Tom Horton

Street and Number

City Edgewood State New Mexico

Well was drilled under Permit No. and is located in the SE ¼ SE ¼ SE ¼ of Section 28 Twp. 11 Rge. 7E

(B) Drilling Contractor Dennisson Cont. Inc. License No. 49

Street and Number Box 91

City Stanley State New Mexico

Drilling was commenced 19

Drilling was completed 19

(Plat of 640 acres)

Elevation at top of casing in feet above sea level Total depth of well 385

State whether well is shallow or artesian shallow Depth to water upon completion 261'

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 5/8 OD | | PE | 0 | 385 | 385 | None | 310 | 365 |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. Use Location No.

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 4 | 4 | topsoil |
| 4 | 120 | 116 | Yellow clay and boulders |
| 120 | 150 | 30 | Red clay & boulders |
| 150 | 200 | 50 | Red shale-(water) |
| 200 | 210 | 10 | Red sandstone |
| 210 | 225 | 15 | Red Shale |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

C.C. Dennisson
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well T.C. Horton or Rita S. Horton Owner's Well No.
Street or Post Office Address Box 150
City and State Edgewood, New Mex. 87015

Well was drilled under Permit No. no basin and is located in the:

a. ____ ¼ SE ¼ SE ¼ SE ¼ of Section 28 Township 11N Range 7E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Dennisson Contractors Inc. License No. 49

Address Box 91, Stanley, New Mex.

Drilling Began ____ Completed March, 1968 Type tools spudder Size of hole ____ in.

Elevation of land surface or ____ at well is 6645 ft. Total depth of well 385 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 261 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

'73 JUN 23 31
STATE ENGINEER OFFICE
ALBUQUERQUE, N.M.

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 5/8 | | PE | 0 | 385 | 385 | none | 310 | 365 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ____ FWL ____ FSL ____

File No. E-2298-S-3 Use ____ Location No. ____

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 2 | 2 | brown topsoil |
| 2 | 25 | 23 | reddish brn-sand & gravel |
| 25 | 62 | 37 | tan sand, gravel & boulders |
| 62 | 96 | 34 | yellow clay with boulders |
| 96 | 106 | 10 | black shale |
| 106 | 109 | 3 | red clay |
| 109 | 143 | 34 | tan limestone |
| 143 | 152 | 9 | blue shale |
| 152 | 163 | 11 | purple shale |
| 163 | 167 | 4 | red conglomerate |
| 167 | 180 | 13 | purple shale |
| 180 | 190 | 10 | blue shale |
| 190 | 198 | 8 | yellow sandy clay |
| 198 | 210 | 12 | red clay |
| 210 | 320 | 110 | blue shale |
| 320 | 345 | 25 | blue lime (hole-cave) |
| 345 | 365 | 20 | white sand |
| 365 | 385 | 20 | grey sandy shale |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Dennisson Contractors Inc.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office [illegible]

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well T. C. Horton or Rita S. Horton Owner's Well No. ______

Street or Post Office Address Box 150

City and State Edgewood, New Mex. 87015

Well was drilled under Permit No. Not in a water district at that time and is located in the: [illegible] S 4

a. ______ ¼ NW ¼ NW ¼ NE ¼ of Section 29 Township 11N Range 7E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor ______ License No. ______

Address ______

Drilling Began spring of 1972 Completed spring 1972 Type tools spudder Size of hole ______ in.

Elevation of land surface or ______ at well is 6812 ft. Total depth of well 251 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 238'11" ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 238 | 251 | 13 | Precambrian wash boulders | 440 |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 6 5/8 | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

STATE ENGINEER OFFICE ALBUQUERQUE, N. MEX.
JUN 23 11:22

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______ State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ______ FWL ______ FSL ______

File No. E-2298-S-4 Use ______ Location No. ______

Section 6. LOG OF HOLE

| Depth in Feet From | To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 90 | 145 | 55 | granites |
| 145 | 165 | 20 | red shale |
| 165 | 180 | 15 | brown sand stone |
| ~~180~~ | ~~200~~ | ~~20~~ | ~~red sand stone~~ |
| 200 | 210 | 10 | lime stone |
| 210 | 220 | 10 | yellow sand stone |
| 220 | 230 | 10 | brown shale |
| 230 | 238 | 8 | light sand stone |
| 238 | 251 | 13 | precambrian wash boulders |
| 251 | 252 | 1 | limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that; to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Horton's rig-Richard Gonzales driller
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office

STATE ENGINEER OFFICE

WELL RECORD

STATE ENGINEER OFFICE ALBUQUERQUE, N. MEX.

90 JAN 18 P 1:28

## Section 1. GENERAL INFORMATION

(A) Owner of well Tom Horton Owner's Well No. ______

Street or Post Office Address Box 150

City and State Edgewood, NM 87015

E-2298-S-16

Well was drilled under Permit No. E-5044 (Explorotory) and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ NE ¼ of Section 19 Township ______ Range ______ N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______ Subdivision, recorded in ~~XXX~~ Santa Fe County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD-49

Address P.O. Box 86 Stanley, NM 87056

Drilling Began 12/28/89 Completed 01/8/90 Type tools Rotary Size of hole 7 7/8 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 500 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 342 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| | | | NO RETURNS | |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 5/8 Steel | 188 Wall | | 0 | 500 | 500 | Weld On | 323 | 373 |
| | | | | | | | 407 | 417 |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ______

Address ______

Plugging Method ______

Date Well Plugged ______

Plugging approved by:

______ State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1-18-90

Quad ______ FWL ______ FSL ______

File No. E-5044-EXPLORE Use Explor Location No. 11N.07E.19

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 2 | 2 | Top Soil |
| 2 | 15 | 13 | Tan Sandy Clay |
| 15 | 22 | 7 | Caliche |
| 22 | 41 | 19 | Gravel |
| 41 | 82 | 41 | Tan Sandy Clay |
| 82 | 102 | 20 | Red Clay |
| 102 | 103 | 1 | Yellow Sandstone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Well was drilled blind from 103' to 500'. NO Returns.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Ronnie J. Dennison
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office ... All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well T. C. HORTON FAMILY  Owner's Well No. E-2208-S-12
Street or Post Office Address HCR 84 BOX 10505
City and State EDGEWOOD, NEW MEX. 87015

Well was drilled under Permit No. ~~EXPLORE 4989~~ and is located in the: SANTA FE COUNTY

a. ___ ¼ NW ¼ SW ¼ NW ¼ of Section 20 Township 11N Range 7E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in ___ County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in
the ___ Grant.

(B) Drilling Contractor FRANK DENNISSON License No. ~~WD-49~~
Address PO BOX 91, STANLEY, NM 87035

Drilling Began SEPT. 1989 Completed JAN. 1990 Type tools SPUDDER Size of hole 8" in.

Elevation of land surface or 700 at well is 7000 FT. ft. Total depth of well 590 FT ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 311 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 309 | 323 | 14 | SHALE & SANDROCK | |
| 440 | 449 | 9 | BROKEN LIMESTONE | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 6 7/8 | | | 500 | 590 | 590 | | 309 | 339 |
| | | | | | | | 409 | 490 |
| | | | | | | | 500 | 590 |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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ALBUQUERQUE, N.M.

## Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by: ___
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 5-15-90

Quad NW¼SW¼NW¼ FWL ___ FSL ___

File No. E-4989-EXPL Use Explore Location No. 11N.07E.20

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Ma[illegible]l Encountered |
|---|---|---|---|
| 0 | 4 | 4 | BROWN TOP SOIL |
| 4- | 30 | 26 | TAN BOULDERS |
| 30 | 160 | 130 | SHALE & CLAY RED & MIXED COLORS |
| 160 | 173 | 13 | SANDSTONE & STREAKS OF CLAY RED |
| 173 / 193 | 175 / 209 | 2 / 15 | HARD |
| 175 | 193 | 18 | CLAY & SHALE RED |
| 193 | 209 | 16 | SANDSTONE |
| 209 | 222 | 13 | CLAY & SHALE |
| 222 | 228 | 6 | SANDSTONE |
| 228 | 245 | 17 | CLAY & SHALE BLUE, RED, PURPLE |
| 245 | 319 | 74 | CLAY & SHALE MIXED COLORS |
| 319 | 323 | 4 | SAND ROCK RED WATER |
| 323 | 332 | 9 | CLAY & SHALE |
| 332 | 337 | 5 | RED SAND ROCK |
| 337 | 412 | &+ | SHALE & CLAY |
| 412 | 440 | 28 | HARD & SHARP LIMESTONE/MIXED COLORS & QUARTZ |
| 440 | 449 | 9 | LIMESTONE MIXED COLORS MAY BE WATER |
| 440 | 480 | 31 | HARD & SHARP LIMESTONE, DARK GRAY & QUARTZ |
| 480 | 497 | 17 | DARK GRAY SHALE & CLAY |
| 497 | 527 | 30 | HARD & SHARP LIMESTONE, DARK GRAY & QUARTZ |
| 527 | 550 | 23 | SHALE BLUE & BLACK |
| 550 | 563 | 13 | HARD & SHARP DARK GRAY LIMESTONE & QUARTZ |
| 563 | 578 | 15 | SHALE BLUE & BLACK |
| 578 | 597 | HARD DARK GRAY LIMESTONE | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is [illegible] and Section 5 need be completed.

Revised June 1972

**STATE ENGINEER OFFICE**

## WELL RECORD

### Section 1. GENERAL INFORMATION

(A) Owner of well T. C. HORTON FAMILY Owner's Well No. E2298-S-[illegible]

Street or Post Office Address HCR 84 BOX 10505,

City and State EDGEWOOD, NEW MEX. 87015

E-2298-S-27

Well was drilled under Permit No. E-5084-EXPLORE and is located in the:

a. ___ ¼ ___ ¼ NW ¼ NE ¼ of Section 19 Township 11 N Range 7 E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___ Subdivision, recorded in ___ County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor DENNISSON License No. WD 49

Address ___

Drilling Began 8/9/90 Completed 9/21/90 Type tools Cable Size of hole 6 in.

Elevation of land surface or ___ at well is 7064 ft. Total depth of well 495' ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 368 ft.

### Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 383 | 387 | 4' | Limestone Red S/stone | 30 |
| | | | | |
| | | | | |
| | | | | |

### Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 6 5/8 | N/A | N/A | 0 | 450 | 450 | | 450 | 350 |
| | | | | | | | | |
| | | | | | | | | |

### Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

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STATE ENGINEER OFFICE
ALBUQUERQUE, N. MEX.

### Section 5. PLUGGING RECORD

Plugging Contractor ___

Address ___

Plugging Method ___

Date Well Plugged ___

Plugging approved by:

___
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

**FOR USE OF STATE ENGINEER ONLY**

Date Received 10-15-90

Quad NW¼ NE¼ FWL ___ FSL ___

File No. E-5084-EXPL. Explore. 11N.07E.19.

| From | To | in Feet | |
|---|---|---|---|
| 0 | 4 | 4. | Top soil |
| 4 | 70 | 66 | Tan Sandy Clay |
| 70 | 154 | 84 | Red Clay |
| 154 | 175 | 21 | Lite Red Clay |
| 175 | 165 | 10 | Lite Brown Clay |
| 185 | 217 | 32 | Red Clay |
| 217 | 262 | 45 | Purple - Gray Clay |
| 262 | 264 | 2 | Red Sand Stone |
| 264 | 288 | 24 | Brown Sand Stone |
| 288 | 290 | 2 | Brown Clay |
| 290 | 327 | 37 | Red Clay |
| 327 | 334 | 7 | Tan Clay |
| 334 | 385 | 51 | Red Clay |
| 385 | 390 | 5 | Limestone Red Sand Stone |
| 390 | 417 | 27 | Gray Shale |
| 417 | 420 | 3 | Red Clay |
| 420 | 427 | 7 | Red Gray Clay |
| 427 | 430 | 3 | Gray Shale |
| 430 | 440 | 10. | Red Clay |
| 440 | 447 | 7 | Gray Shale |
| 447 | 472 | 25 | Gray Shale |
| 472 | 480 | 8 | Limestone |
| 480 | 487 | 7 | Gray Shale |
| 487 | 495 | 8 | Limestone |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Crack at 95 ft and 147 ft.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completelv and accurately as possible when any well is drilled, repaired or deepened. When thi rm is used as a plugging record, only Section and Section 5 need be completed.

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

Owner of well Tom Horton Owner's Well No. ______

Street or Post Office Address P.O. Box 150

City and State Edgewood, NM 87015

Well was drilled under Permit No. E-5041 (Exploratory) and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ____ Township ____ Range ____ N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Santa Fe County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD-49

Address P.O. BOX 86 Stanley, NM 87056

Drilling Began 12/11/89 Completed 12/27/89 Type tools Rotary Size of hole 11" in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 476 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 327 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| | | | NO RETURNS | |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 8 5/8" | 188 Wall | | 0 | 447 | 447 | Weld On | 305 | 447 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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## Section 5. PLUGGING RECORD

Plugging Contractor ______

Address ______

Plugging Method ______

Date Well Plugged ______

Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1-4-90

Quad NE¼ SE¼ SW¼ FWL ______ FSL ______

File No. E-5041-EXPLOR Use Exploratory Location No. 11N.07E.33

Section 6. LOG OF HOLE

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 1 | 1 | Top Soil |
| 1 | 21 | 20 | Tan Sandy Clay |
| 21 | 150 | 129 | Sand & Gravel |
| 150 | 156 | 6 | Yellow Clay |
| 156 | 164 | 8 | Yellow Sandstone |
| 164 | 221 | 57 | Gray Shale |
| 221 | 245 | 24 | Red Clay |
| 245 | 251 | 6 | Gray Shale |
| 251 | 264 | 13 | Green Shale |
| 264 | 274 | 10 | Gray Sandy Shale |
| 274 | 284 | 10 | Yellow Sandstone |
| 284 | 315 | 31 | Gray Shale |
| 315 | 316 | 1 | Green Limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

316' to 476' was drilled blind. (No Returns).

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Ronnie J. Dennis
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office

Revised June 1972

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Tom Horton Owner's Well No. ______
Street or Post Office Address P.O. Box 150
City and State Edgewood, NM 87015

Well was drilled under Permit No. E-5041 (Exploratory) and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ______ Township ______ Range ______ N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Santa Fe County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD-49

Address P.O. BOX 86 Stanley, NM 87056

Drilling Began 12/11/89 Completed 12/27/89 Type tools Rotary Size of hole 11" in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 476 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 327 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| | | | NO RETURNS | |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 8 5/8" | 188 Wall | | 0 | 447 | 447 | Weld On | 305 | 447 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

JAN 4 27

## Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1-4-90

Quad NE¼ SE¼ SW¼ FWL ______ FSL ______

File No. E-5041-EXPLOR Use Exploratory Location No. 11N.07E.33

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| 0 | 1 | 1 | Top Soil |
| 1 | 21 | 20 | Tan Sandy Clay |
| 21 | 150 | 129 | Sand & Gravel |
| 150 | 156 | 6 | Yellow Clay |
| 156 | 164 | 8 | Yellow Sandstone |
| 164 | 221 | 57 | Gray Shale |
| 221 | 245 | 24 | Red Clay |
| 245 | 251 | 6 | Gray Shale |
| 251 | 264 | 13 | Green Shale |
| 264 | 274 | 10 | Gray Sandy Shale |
| 274 | 284 | 10 | Yellow Sandstone |
| 284 | 315 | 31 | Gray Shale |
| 315 | 316 | 1 | Green Limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

316' to 476' was drilled blind. (No Returns).

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Ronnie J. Dennison

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE

Revised June 1972

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well Tom Horton Owner's Well No. ____

Street or Post Office Address 294 Broken Arrow Trail

City and State Edgewood, NM. 87015

Well was drilled under Permit No. E-2298-S-17 and is located in the:

a. SE ¼ SE ¼ SE ¼ NE ¼ of Section 32 Township 11N Range 7E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Santa Fe County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD 49

Address POBox 91 Stanley, NM. 87056

Drilling Began 3-2-95 Completed 11-30-95 Type tools Cable Size of hole 18 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 602 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 395 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet | | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| From | To | | | |
| 530 | 565 | 35 | Sandstone | 50 + |
| | | | | |
| | | | | |
| | | | | |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet | | Length (feet) | Type of Shoe | Perforations | |
|---|---|---|---|---|---|---|---|---|
| | | | Top | Bottom | | | From | To |
| 12 3/4 | | | 0 | 498 | 500 | Welded | 425 | 495 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet | | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| From | To | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## Section 5. PLUGGING RECORD

Plugging Contractor ____

Address ____

Plugging Method ____

Date Well Plugged ____

Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet | | Cubic Feet of Cement |
|---|---|---|---|
| | Top | Bottom | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 12/1/95

Quad ____ FWL ____ FSL ____

File No. E-2298-S-17 Use Sub Location No. 11N.07E.32.2444

STATE ENGINEER OFFICE 95 DEC 1 PM 12:21

Section 6. LOG OF HOLE

| Depth in Feet | | Thickness in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 3 | 3 | Brown top soil |
| 3 | 35 | 32 | Tan clay |
| 35 | 40 | 5 | Tan gravel |
| 40 | 65 | 25 | Tan clay |
| 65 | 80 | 15 | Tan gravel |
| 80 | 95 | 15 | Light tan clay |
| 95 | 135 | 40 | Tan sand |
| 135 | 136 | 1 | Tan boulders |
| 136 | 174 | 38 | Yellow clay |
| 174 | 176 | 2 | Yellow boulders |
| 176 | 183 | 7 | Red clay |
| 183 | 185 | 2 | Red boulders |
| 185 | 195 | 10 | Purple clay |
| 195 | 200 | 5 | Tan boulders |
| 200 | 205 | 5 | Grey boulders |
| 205 | 215 | 10 | Tan boulders |
| 215 | 245 | 30 | Grey shale |
| 245 | 258 | 13 | Tan boulders |
| 258 | 260 | 2 | No return - crack |
| 260 | 270 | 10 | Tan shale |
| 270 | 280 | 10 | Purple shale |
| 280 | 285 | 5 | Yellow shale |
| 285 | 295 | 10 | Tan shale |
| 295 | 310 | 15 | Tan boulders |
| 310 | 315 | 5 | Tan limestone |
| 315 | 335 | 20 | Black shale - streaks of tan limestone |
| 335 | 384 | 49 | Tan limestone |
| 384 | 386 | 2 | No return - crack |
| 386 | 404 | 18 | Tan limestone - water @ 404 |
| 404 | 410 | 6 | Yellow clay and shale |
| 410 | 415 | 5 | Tan limestone - hard |
| 415 | 442 | 27 | Yellow clay and shale |
| 442 | 450 | 8 | Yellow limestone hard |
| 450 | 455 | 5 | Yellow shale |
| 455 | 470 | 15 | Grey limestone - hard |
| 470 | 475 | 5 | Blue shale |
| 475 | 480 | 5 | Purple - deep red shale |
| 480 | 495 | 15 | Grey limestone - hard |
| 495 | 512 | 17 | Blue shale |
| 512 | 525 | 13 | Grey shale |
| 525 | 530 | 5 | Brown limestone |
| 530 | 565 | 35 | Yellow sandstone - sharp and hard |
| 565 | 575 | 10 | Blue shale |
| 575 | 602 | 27 | Grey limestone - hard |
| | | | |
| | | | |
| | | | |

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this f is used as a plugging record, only Section 1(a d Section 5 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

# WELL RECORD

## Section 1. GENERAL INFORMATION

(A) Owner of well T. C. Hortor Family Owner's Well No. E-2298-S-25
Street or Post Office Address 294 Broken Arrow Trail
City and State Edgewood, NM, 87015

Well was drilled under Permit No. Ex-5571 & E-2298-S-25 and is located in the:

a. ____ ¼ NE ¼ SE ¼ NW ¼ of Section 4 Township 10N Range 7E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Santa Fe County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Dennisson Drilling License No. WD 49

Address P.O. Box 91, Stanley, NM, 87056

Drilling Began 6-10-93 Completed 8-4-93 Type tools Cable Size of hole 15 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 510 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 308 ft.

## Section 2. PRINCIPAL WATER-BEARING STRATA

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation | Estimated Yield (gallons per minute) |
|---|---|---|---|---|
| 309 | 328 | 19 | 318 water - red sand - light gravel | 70 |
| 403 | 408 | 5 | Brown fracture - sandstone | 300 |
| 424 | 431 | 7 | Limestone | 200 |
| 435 | 463 | 28 | Brown sand - small hard gravel | 200 |

## Section 3. RECORD OF CASING

| Diameter (inches) | Pounds per foot | Threads per in. | Depth in Feet Top | Depth in Feet Bottom | Length (feet) | Type of Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| 12 | | | 0 | 490 | 490 | Weld on | 290 | 490 |
| | | | | | | | | |
| | | | | | | | | |

## Section 4. RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Hole Diameter | Sacks of Mud | Cubic Feet of Cement | Method of Placement |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

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## Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

| No. | Depth in Feet Top | Depth in Feet Bottom | Cubic Feet of Cement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 5-13-94

Quad ____ FWL ____ FSL ____

File No. E-2298-S-25 Use Irrig Location No. 10N.07E.04.142

Section 6. LOG OF HOLE

| Depth in Feet | | Thick in Feet | Color and Type of Material Encountered |
|---|---|---|---|
| From | To | | |
| 0 | 12 | 12 | Brown sandy top soil |
| 12 | 44 | 32 | Red sandy clay - light gravel |
| 44 | 48 | 4 | Light brown - tan sand |
| 48 | 67 | 19 | Tan sandy clay - cobblestones 2" - 3" |
| 67 | 78 | 11 | Red clay |
| 78 | 84 | 6 | Tan sandy clay - large hard gravel |
| 84 | 92 | 8 | Limestone |
| 92 | 98 | 6 | Tan sandy clay - light gravel |
| 98 | 207 | 109 | Hard small gravel - tan light clay 2" - 6" loose rock - boulders |
| 207 | 213 | 6 | Brown sandy clay - same rocks |
| 213 | 234 | 21 | Yellow clay - light gravel |
| 234 | 263 | 29 | Light brown clay - same gravel - same rocks |
| 263 | 276 | 13 | Tan sandy clay |
| 276 | 288 | 12 | Red clay - light gravel |
| 288 | 299 | 11 | Tan sand - hard |
| 299 | 304 | 5 | Yellow hard clay |
| 304 | 309 | 5 | Tan clay - small hard gravel - sandy |
| 309 | 328 | 19 | Red clay - same small hard gravel |
| 328 | 334 | 6 | Tan sandy clay |
| 334 | 348 | 4 | Red clay - sticky light gravel |
| 348 | 362 | 14 | Yellow - gold clay - sticky |
| 362 | 367 | 5 | Red sandy clay - big gravel |
| 367 | 373 | 6 | Brown sandy clay - light gravel |
| 373 | 387 | 14 | Gray - tan light gravel |
| 387 | 390 | 3 | Tan sand |
| 390 | 396 | 6 | Red - purple heavy clay - sticky |
| 396 | 403 | 7 | Tan sandy clay - large gravel |
| 403 | 408 | 5 | Brown fractured sandstone |
| 408 | 424 | 16 | Tan sandy clay - light gravel |
| 424 | 431 | 7 | Limestone |
| 431 | 435 | 4 | Tan hard clay - gravel |
| 435 | 463 | 8 | Brown sand - thick small gravel - hard |
| 463 | 482 | 19 | Tan sandy clay - same small gravel |
| 482 | 490 | 8 | Limestone |

Section 7. REMARKS AND ADDITIONAL INFORMATION

Set casing on limestone at 490'. Drilled through bottom 4 feet of limestone. Sand under limestone. Drilled to 510'. Sand is free moving and caving in.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Bill Dennisson

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is

## Appendix 8.

## Federal and New Mexico Water Quality Standards.

# STATE OF NEW MEXICO

# GROUND AND SURFACE WATER QUALITY PROTECTION

# REGULATIONS

# (20 NMAC 6.2)

# AND

# UTILITY OPERATOR CERTIFICATION

# REGULATIONS

# (20 NMAC 7.4)

New Mexico Water Quality Control Commission
Harold Runnels Building
1190 St. Francis Drive P.O. Box 26110
Santa Fe, New Mexico 87502

December 1, 1995

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contaminants specified with a definition of dissolved being that given in the publication "Methods for Chemical Analysis of Water and Waste of the U.S. Environmental Protection Agency," with the exception that standards for mercury, organic compounds and non-aqueous phase liquids shall apply to the total unfiltered concentrations of the contaminants. [2-18-77, 11-17-83, 3-3-86, 12-1-95]

A. Human Health Standards-Ground water shall meet the standards of Subsection A and B unless otherwise provided. If more than one water contaminant affecting human health is present, the toxic pollutant criteria as set forth in the definition of toxic pollutant in Section 1101 for the combination of contaminants, or the Human Health Standard of Section 3103.A. for each contaminant shall apply, whichever is more stringent.

Non-aqueous phase liquid shall not be present floating atop of or immersed within ground water, as can be reasonably measured.

| | |
|---|---|
| Arsenic (As) | 0.1 mg/l |
| Barium (Ba) | 1.0 mg/l |
| Cadmium (Cd) | 0.01 mg/l |
| Chromium (Cr) | 0.05 mg/l |
| Cyanide (CN) | 0.2 mg/l |
| Fluoride (F) | 1.6 mg/l |
| Lead (Pb) | 0.05 mg/l |
| Total Mercury (Hg) | 0.002 mg/l |
| Nitrate ($NO_3$ as N) | 10.0 mg/l |
| Selenium (Se) | 0.05 mg/l |
| Silver (Ag) | 0.05 mg/l |
| Uranium (U) | 5.0 mg/l |
| Radioactivity: Combined Radium-226 & Radium-228 | 30.0 pCi/l |
| Benzene | 0.01 mg/l |
| Polychlorinated biphenyls (PCB's) | 0.001 mg/l |
| Toluene | 0.75 mg/l |
| Carbon Tetrachloride | 0.01 mg/l |
| 1,2-dichloroethane (EDC) | 0.01 mg/l |
| 1,1-dichloroethylene (1,1-DCE) | 0.005 mg/l |
| 1,1,2,2-tetrachloroethylene (PCE) | 0.02 mg/l |
| 1,1,2-trichloroethylene (TCE) | 0.1 mg/l |
| ethylbenzene | 0.75 mg/l |
| total xylenes | 0.62 mg/l |
| methylene chloride | 0.1 mg/l |
| chloroform | 0.1 mg/l |
| 1,1-dichloroethane | 0.025 mg/l |
| ethylene dibromide (EDB) | 0.0001 mg/l |
| 1,1,1-trichloroethane | 0.06 mg/l |
| 1,1,2-trichloroethane | 0.01 mg/l |
| 1,1,2,2-tetrachloroethane | 0.01 mg/l |
| vinyl chloride | 0.001 mg/l |

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| | |
|---|---|
| PAHs: total naphthalene plus monomethylnaphthalenes | 0.03 mg/l |
| benzo-a-pyrene | 0.0007 mg/l |

[2-18-77, 1-29-82, 3-3-86, 12-1-95]

B. Other Standards for Domestic Water Supply

| | |
|---|---|
| Chloride (Cl) | 250.0 mg/l |
| Copper (Cu) | 1.0 mg/l |
| Iron (Fe) | 1.0 mg/l |
| Manganese (Mn) | 0.2 mg/l |
| Phenols | 0.005 mg/l |
| Sulfate ($SO_4$) | 600.0 mg/l |
| Total Dissolved Solids (TDS) | 1000.0 mg/l |
| Zinc (Zn) | 10.0 mg/l |
| pH | between 6 and 9 |

[2-18-77]

C. Standards for Irrigation Use - Ground water shall meet the standards of Subsection A, B, and C unless otherwise provided.

| | |
|---|---|
| Aluminum (Al) | 5.0 mg/l |
| Boron (B) | 0.75 mg/l |
| Cobalt (Co) | 0.05 mg/l |
| Molybdenum (Mo) | 1.0 mg/l |
| Nickel (Ni) | 0.2 mg/l |

[2-18-77]

**3104. DISCHARGE PLAN REQUIRED.**

Unless otherwise provided by this Part, no person shall cause or allow effluent or leachate to discharge so that it may move directly of indirectly into ground water unless he is discharging pursuant to a discharge plan approved by the secretary. When a plan has been approved, discharges must be consistent with the terms and conditions of the plan. In the event of a transfer of the ownership, control, or possession of a facility for which an approved discharge plan is in effect, the transferee shall have authority to discharge under such plan, provided that the transferee has complied with Section 3111 of this Part, regarding transfers. [2-18-77, 12-24-87, 12-1-95]

**3105. EXEMPTIONS FROM DISCHARGE PLAN REQUIREMENT.**

Sections 3104 and 3106 of this Part do not apply to the following: [2-18-77]

A. Effluent or leachate which conforms to all the listed numerical standards of Section 3103 and has a total nitrogen concentration of 10 mg/l or less, and does not contain any toxic pollutant. To determine conformance, samples may be taken by the

COMPARISON OF NEW MEXICO GROUND-WATER STANDARDS AND U.S. EPA DRINKING-WATER STANDARDS, OCTOBER 1992

All units are mg/L unless otherwise specified. Microbiological parameters are not included. All standards listed are health based except for those followed by (a) aesthetic standard or (i) irrigation standard.

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| INORGANICS | | | | | |
| Aluminum | 5.0 (i) | 0.05-0.2(a) | | | |
| Ammonia | | | | | 30 |
| Antimony | | 0.006 | | 0.006 | |
| Arsenic | 0.1 | 0.05 | | Zero | |
| Asbestos-fibers/liter (longer than 10 um) | | 7 million | | 7 million | |
| Barium | 1.0 | 2 | | | |
| Beryllium | | 0.004 | | 0.004 | |
| Boron | 0.75 (i) | | | | 0.06 |
| Cadmium | 0.01 | 0.005 | | 0.005 | |
| Chlorate | | | | | 0.01 |
| Chloride (a) | 250 | 250 | | | |
| Chlorine | | | | | 1 |
| Chlorine Dioxide | | | | | 0.08 |
| Chlorite | | | | | 0.03 |
| Chromium | 0.05 | 0.1 | | 0.1 | |
| Cobalt (i) | 0.05 | | | | |
| Copper | | 1.3 (AL) | | 1.3 | |
| Copper (a) | 1.0 | 1.0 | | | |
| Fluoride | 1.6 | 4.0 | | | |
| Fluoride (a) | | 2 | | | |
| Gross Alpha (pCi/L)* | | 15 | | Zero | |
| Gross Beta (mrem/yr)** | | 4 | | Zero | |
| Iron (a) | 1.0 | 0.3 | | | |
| Lead | 0.05 | 0.015 (AL) | | Zero | |
| Manganese (a) | 0.2 | 0.05 | | | |
| Mercury | 0.002 | 0.002 | | 0.002 | |
| Molybdenum | 1.0 | | | | 0.05 |
| Nickel | 0.2 (i) | 0.1 | | 0.1 | |
| Nitrate-N | 10 | 10 | | 10 | |
| Nitrite-N | | 1 | | 1 | |
| Nitrate + Nitrite (as N) | | 10 | | 10 | |
| pH (units) (a) | 6-9 | 6.5-8.5 | | | |
| Radium (226 & 228; pCi/L) | 30 | 5 | 20 | Zero | |
| Radon 222 (pCi/L) | | | 300 | Zero | |
| Selenium | 0.05 | 0.05 | | 0.05 | |
| Silver | 0.05 | 0.05 | | | |
| Silver (a) | | 0.1 | | | |
| Sodium | | | | | 20 |
| Strontium | | | | | 17 |
| Sulfate | 600 (a) | 250 (a) | 400 | 400 | |
| Thallium | | 0.002 | | 0.0005 | |
| Total Dissolved Solids (a) | 1000 | 500 | | | |
| Uranium | 5.0 | | 0.02 | Zero | |
| Vanadium | | | | | 0.02 |
| Zinc (a) | 10.0 | 5 | | | |

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| **BENZENES** | | | | | |
| Benzene | 0.01 | 0.005 | | Zero | |
| Alkyl Benzenes | | | | | |
| Toluene | 0.75 | 1 | 0.04 (a) | 1 | |
| Ethylbenzene | 0.75 | 0.7 | 0.03 (a) | 0.7 | |
| Xylenes | 0.62 | 10 | 0.02 (a) | 10 | |
| Styrene | | 0.1 | | 0.1 | |
| Chlorinated Benzenes | | | | | |
| Chlorobenzene | | 0.1 | | 0.1 | |
| o-Dichlorobenzene | | 0.6 | | 0.6 | |
| p-Dichlorobenzene | | 0.075 | 0.005 (a) | 0.075 | |
| 1,2,4-Trichlorobenzene | | 0.07 | | 0.07 | |
| 1,3,5-Trichlorobenzene | | | | | 0.04 |
| Hexachlorobenzene | | 0.001 | | Zero | |
| 1,3-Dinitrobenzene | | | | | 0.001 |
| Toluenes | | | | | |
| o-Chlorotoluene | | | | | 0.1 |
| p-Chlorotoluene | | | | | 0.1 |
| 2,4,6-Trinitrotoluene (TNT) | | | | | 0.002 |
| Phenols | | | | | |
| Phenol | | | | | 4 |
| 2-Chlorophenol | | | | | 0.04 |
| 2,4-Dichlorophenol | | | | | 0.02 |
| Pentachlorophenol | | 0.001 | | Zero | |
| Pentachlorophenol (a) | | | 0.03 | | |
| Phenols (a) | 0.005 | | | | |
| **METHANES** | | | | | |
| Chloromethane | | | | | 0.003 |
| Methylene Chloride | 0.1 | 0.005 | | Zero | |
| Chloroform | 0.1 | | | | |
| Trihalomethanes*** | | 0.1 | | | |
| Carbon Tetrachloride | 0.01 | 0.005 | | Zero | |
| Bromomethane | | | | | 0.01 |
| Bromochloromethane | | | | | 0.09 |
| Chlorodibromomethane | | | | | 0.1 |
| Dichlorodifluoromethane | | | | | 1 |
| Fluorotrichloromethane | | | | | 2 |
| Formaldehyde | | | | | 1 |

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| ETHANES | | | | | |
| 1,2-Dibromoethane (EDB) | 0.0001 | 0.00005 | | Zero | |
| 1,2-Dichloroethane (EDC) | 0.01 | 0.005 | | Zero | |
| 1,1,1-Trichloroethane | 0.06 | 0.2 | | 0.2 | |
| 1,1,2-Trichloroethane | 0.01 | 0.005 | | 0.003 | |
| 1,1,1,2-Tetrachloroethane | | | | | 0.07 |
| 1,1,2,2-Tetrachloroethane | 0.01 | | | | |
| Ethylene Glycol | | | | | 7 |
| ETHENES (ETHYLENES) | | | | | |
| Vinyl Chloride | 0.001 | 0.002 | | Zero | |
| 1,1-Dichloroethene | 0.005 | 0.007 | | 0.007 | |
| cis-1,2-Dichloroethene | | 0.07 | | 0.07 | |
| trans-1,2-Dichloroethene | | 0.1 | | 0.1 | |
| Trichloroethene (TCE) | 0.1 | 0.005 | | Zero | |
| Tetrachloroethene (PCE) | 0.02 | 0.005 | | Zero | |
| PROPANES | | | | | |
| 1,2-Dichloropropane (PDC) | | 0.005 | | Zero | |
| 1,2,3-Trichloropropane | | | | | 0.04 |
| DBCP | | 0.0002 | | Zero | |
| Epichlorohydrin | | TT | | Zero | |
| MTBE | 0.1 (a) | | | | 0.04 |
| POLYCYCLICS | | | | | |
| Benz(a)anthracene | | | 0.0001 | Zero | |
| Benzo(a)pyrene | 0.0007 | 0.0002 | | Zero | |
| Benzo(b)fluoranthene | | | 0.0002 | Zero | |
| Benzo(k)fluoranthene | | | 0.0002 | Zero | |
| Chrysene | | | 0.0002 | Zero | |
| Dibenz(a)anthracene | | | 0.0003 | Zero | |
| Indeno(1,2,3-c,d)pyrene | | | 0.0004 | Zero | |
| Naphthalene | | | | | 0.3 |
| Naphthalenes**** | 0.03 | | | | |
| PCBs | 0.001 | | | | |
| PCBs as Decachlorobiphenyl | | 0.0005 | | Zero | |
| MISCELLANEOUS | | | | | |
| Acrylamide | | TT | | Zero | |
| Acrylonitrile | | | | | 0.004 |
| Bis-2-Chloroisopropyl Ether | | | | | 0.3 |
| Chloral Hydrate | | | | | 0.05 |
| Chloramine | | | | | 0.3 |

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| **MISC. CONTINUED** | | | | | |
| Cyanide | 0.2 | 0.2 | | 0.2 | |
| Dibromoacetonitrile | | | | | 0.02 |
| Dichloroacetic Acid | | | | | 0.003 |
| Dichloroacetonitrile | | | | | 0.006 |
| Di(2-Ethylhexyl)Adipate | | 0.4 | | 0.4 | |
| Di(2-Ethylhexyl)Phthalate | | 0.006 | | Zero | |
| Diisopropyl Methylphosphonate | | | | | 0.6 |
| p-Dioxane | | | | | 0.568 (10day) |
| Hexachlorobutadiene | | | | | 0.001 |
| Hexachlorocyclopentadiene | | 0.05 | | 0.05 | |
| Hexachlorocyclopentadiene (a) | | | 0.008 | | |
| n-Hexane | | | | | 4.0 (7 year) |
| HMX | | | | | 0.4 |
| Isophorone | | | | | 0.1 |
| MEK | | | | | 0.2 |
| Nitroglycerin | | | | | 0.005 |
| Nitroguanidine | | | | | 0.7 |
| Petroleum | | | | | |
| Floating Product | NP | | | | |
| Undesirable Odor | NP | | | | |
| RDX | | | | | 0.002 |
| Trichloroacetic Acid | | | | | 0.2 |
| **OTHER PESTICIDES** | | | | | |
| Acifluorfen | | | | | 0.1 |
| Alachlor | | 0.002 | | Zero | |
| Aldicarb | | | 0.003 | 0.001 | |
| Aldicarb Sulfoxide | | | 0.003 | 0.001 | |
| Aldicarb Sulfone | | | 0.003 | 0.002 | |
| Aldrin | | | | | 0.001 |
| Ametryn | | | | | 0.06 |
| Ammonium Sulfamate | | | | | 2 |
| Atrazine | | 0.003 | | 0.003 | |
| Baygon | | | | | 0.003 |
| Bentazon | | | | | 0.02 |
| Bromacil | | | | | 0.09 |
| Butylate | | | | | 0.35 |
| Carbaryl | | | | | 0.7 |
| Carbofuran | | 0.04 | | 0.04 | |
| Carboxin | | | | | 0.7 |
| Chloramben | | | | | 0.1 |
| Chlordane | | 0.002 | | Zero | |
| Chlorothalonil | | | | | 0.5 |
| Chlorpyrifos | | | | | 0.02 |
| Cyanazine | | | | | 0.01 |
| 2,4-D | | 0.07 | | 0.07 | |
| Dacthal | | | | | 4 |
| Dalapon | | 0.2 | | 0.2 | |

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| OTHER PESTICIDES CONTINUED | | | | | |
| Diazinon | | | | | 0.0006 |
| Dicamba | | | | | 0.2 |
| 1,3-Dichloropropene | | | | | 0.01 |
| Dieldrin | | | | | 0.002 |
| Dimethrin | | | | | 2 |
| Dinoseb | | 0.007 | | 0.007 | |
| Dioxin | | 0.00000005 | | Zero | |
| Diphenamid | | | | | 0.2 |
| Diquat | | 0.02 | | 0.02 | |
| Disulfoton | | | | | 0.0003 |
| Diuron | | | | | 0.01 |
| Endothall | | 0.1 | | 0.1 | |
| Endrin | | 0.002 | | 0.002 | |
| Ethylene Thiourea | | | | | 0.001 |
| Fenamiphos | | | | | 0.002 |
| Fluometuron | | | | | 0.09 |
| Fonofos | | | | | 0.01 |
| Glyphosate | | 0.7 | | 0.7 | |
| Heptachlor | | 0.0004 | | Zero | |
| Heptachlor Epoxide | | 0.0002 | | Zero | |
| Hexazinone | | | | | 0.2 |
| Lindane | | 0.0002 | | 0.0002 | |
| Malathion | | | | | 0.2 |
| Maleic Hydrazide | | | | | 4 |
| MCPA | | | | | 0.011 |
| Methomyl | | | | | 0.2 |
| Methoxychlor | | 0.04 | | 0.04 | |
| Methyl Parathion | | | | | 0.002 |
| Metolachlor | | | | | 0.1 |
| Metribuzin | | | | | 0.2 |
| Oxamyl (Vydate) | | 0.2 | | 0.2 | |
| Paraquat | | | | | 0.03 |
| Picloram | | 0.5 | | 0.5 | |
| Prometon | | | | | 0.1 |
| Pronamide | | | | | 0.05 |
| Propachlor | | | | | 0.09 |
| Propazine | | | | | 0.01 |
| Propham | | | | | 0.1 |
| Simazine | | 0.004 | | 0.004 | |
| 2,4,5-T | | | | | 0.07 |
| Tebuthiuron | | | | | 0.5 |
| Terbacil | | | | | 0.09 |
| Terbufos | | | | | 0.0009 |
| Toxaphene | | 0.003 | | Zero | |
| 2,4,5-TP (Silvex) | | 0.05 | | 0.05 | |
| Trifluralin | | | | | 0.005 |

## COMPARISON OF NEW MEXICO GROUND-WATER STANDARDS AND U.S. EPA DRINKING-WATER STANDARDS, OCTOBER 1992

All units are mg/L unless otherwise specified. Microbiological parameters are not included. All standards listed are health based except for those followed by (a) aesthetic standard or (i) irrigation standard.

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| INORGANICS | | | | | |
| Aluminum | 5.0 (i) | 0.05-0.2(a) | | | |
| Ammonia | | | | | 30 |
| Antimony | | 0.006 | | 0.006 | |
| Arsenic | 0.1 | 0.05 | | Zero | |
| Asbestos-fibers/liter (longer than 10 um) | | 7 million | | 7 million | |
| Barium | 1.0 | 2 | | | |
| Beryllium | | 0.004 | | 0.004 | |
| Boron | 0.75 (i) | | | | 0.06 |
| Cadmium | 0.01 | 0.005 | | 0.005 | |
| Chlorate | | | | | 0.01 |
| Chloride (a) | 250 | 250 | | | |
| Chlorine | | | | | 1 |
| Chlorine Dioxide | | | | | 0.08 |
| Chlorite | | | | | 0.03 |
| Chromium | 0.05 | 0.1 | | 0.1 | |
| Cobalt (i) | 0.05 | | | | |
| Copper | | 1.3 (AL) | | 1.3 | |
| Copper (a) | 1.0 | 1.0 | | | |
| Fluoride | 1.6 | 4.0 | | | |
| Fluoride (a) | | 2 | | | |
| Gross Alpha (pCi/L)* | | 15 | | Zero | |
| Gross Beta (mrem/yr)** | | 4 | | Zero | |
| Iron (a) | 1.0 | 0.3 | | | |
| Lead | 0.05 | 0.015 (AL) | | Zero | |
| Manganese (a) | 0.2 | 0.05 | | | |
| Mercury | 0.002 | 0.002 | | 0.002 | |
| Molybdenum | 1.0 | | | | 0.05 |
| Nickel | 0.2 (i) | 0.1 | | 0.1 | |
| Nitrate-N | 10 | 10 | | 10 | |
| Nitrite-N | | 1 | | 1 | |
| Nitrate + Nitrite (as N) | | 10 | | 10 | |
| pH (units) (a) | 6-9 | 6.5-8.5 | | | |
| Radium (226 & 228; pCi/L) | 30 | 5 | 20 | Zero | |
| Radon 222 (pCi/L) | | | 300 | Zero | |
| Selenium | 0.05 | 0.05 | | 0.05 | |
| Silver | 0.05 | 0.05 | | | |
| Silver (a) | | 0.1 | | | |
| Sodium | | | | | 20 |
| Strontium | | | | | 17 |
| Sulfate | 600 (a) | 250 (a) | 400 | 400 | |
| Thallium | | 0.002 | | 0.0005 | |
| Total Dissolved Solids (a) | 1000 | 500 | | | |
| Uranium | 5.0 | | 0.02 | Zero | |
| Vanadium | | | | | 0.02 |
| Zinc (a) | 10.0 | 5 | | | |

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| **BENZENES** | | | | | |
| Benzene | 0.01 | 0.005 | | Zero | |
| Alkyl Benzenes | | | | | |
| Toluene | 0.75 | 1 | 0.04 (a) | 1 | |
| Ethylbenzene | 0.75 | 0.7 | 0.03 (a) | 0.7 | |
| Xylenes | 0.62 | 10 | 0.02 (a) | 10 | |
| Styrene | | 0.1 | | 0.1 | |
| Chlorinated Benzenes | | | | | |
| Chlorobenzene | | 0.1 | | 0.1 | |
| o-Dichlorobenzene | | 0.6 | | 0.6 | |
| p-Dichlorobenzene | | 0.075 | 0.005 (a) | 0.075 | |
| 1,2,4-Trichlorobenzene | | 0.07 | | 0.07 | |
| 1,3,5-Trichlorobenzene | | | | | 0.04 |
| Hexachlorobenzene | | 0.001 | | Zero | |
| 1,3-Dinitrobenzene | | | | | 0.001 |
| Toluenes | | | | | |
| o-Chlorotoluene | | | | | 0.1 |
| p-Chlorotoluene | | | | | 0.1 |
| 2,4,6-Trinitrotoluene (TNT) | | | | | 0.002 |
| Phenols | | | | | |
| Phenol | | | | | 4 |
| 2-Chlorophenol | | | | | 0.04 |
| 2,4-Dichlorophenol | | | | | 0.02 |
| Pentachlorophenol | | 0.001 | | Zero | |
| Pentachlorophenol (a) | | | 0.03 | | |
| Phenols (a) | 0.005 | | | | |
| **METHANES** | | | | | |
| Chloromethane | | | | | 0.003 |
| Methylene Chloride | 0.1 | 0.005 | | Zero | |
| Chloroform | 0.1 | | | | |
| Trihalomethanes*** | | 0.1 | | | |
| Carbon Tetrachloride | 0.01 | 0.005 | | Zero | |
| Bromomethane | | | | | 0.01 |
| Bromochloromethane | | | | | 0.09 |
| Chlorodibromomethane | | | | | 0.1 |
| Dichlorodifluoromethane | | | | | 1 |
| Fluorotrichloromethane | | | | | 2 |
| Formaldehyde | | | | | 1 |

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| OTHER PESTICIDES CONTINUED | | | | | |
| Diazinon | | | | | 0.0006 |
| Dicamba | | | | | 0.2 |
| 1,3-Dichloropropene | | | | | 0.01 |
| Dieldrin | | | | | 0.002 |
| Dimethrin | | | | | 2 |
| Dinoseb | | 0.007 | | 0.007 | |
| Dioxin | | 0.00000005 | | Zero | |
| Diphenamid | | | | | 0.2 |
| Diquat | | 0.02 | | 0.02 | |
| Disulfoton | | | | | 0.0003 |
| Diuron | | | | | 0.01 |
| Endothall | | 0.1 | | 0.1 | |
| Endrin | | 0.002 | | 0.002 | |
| Ethylene Thiourea | | | | | 0.001 |
| Fenamiphos | | | | | 0.002 |
| Fluometuron | | | | | 0.09 |
| Fonofos | | | | | 0.01 |
| Glyphosate | | 0.7 | | 0.7 | |
| Heptachlor | | 0.0004 | | Zero | |
| Heptachlor Epoxide | | 0.0002 | | Zero | |
| Hexazinone | | | | | 0.2 |
| Lindane | | 0.0002 | | 0.0002 | |
| Malathion | | | | | 0.2 |
| Maleic Hydrazide | | | | | 4 |
| MCPA | | | | | 0.011 |
| Methomyl | | | | | 0.2 |
| Methoxychlor | | 0.04 | | 0.04 | |
| Methyl Parathion | | | | | 0.002 |
| Metolachlor | | | | | 0.1 |
| Metribuzin | | | | | 0.2 |
| Oxamyl (Vydate) | | 0.2 | | 0.2 | |
| Paraquat | | | | | 0.03 |
| Picloram | | 0.5 | | 0.5 | |
| Prometon | | | | | 0.1 |
| Pronamide | | | | | 0.05 |
| Propachlor | | | | | 0.09 |
| Propazine | | | | | 0.01 |
| Propham | | | | | 0.1 |
| Simazine | | 0.004 | | 0.004 | |
| 2,4,5-T | | | | | 0.07 |
| Tebuthiuron | | | | | 0.5 |
| Terbacil | | | | | 0.09 |
| Terbufos | | | | | 0.0009 |
| Toxaphene | | 0.003 | | Zero | |
| 2,4,5-TP (Silvex) | | 0.05 | | 0.05 | |
| Trifluralin | | | | | 0.005 |

## EXPLANATION FOR STANDARDS COMPARISON TABLE

### Footnotes

* The existing standard excludes radon and uranium activity. The proposed standard also will exclude Radium 226 activity.

** This standard includes photon activity and excludes Radium 228 activity.

*** This standard applies to the sum of the four regulated trihalomethanes: chloroform, dichlorobromomethane, dibromochloromethane and bromoform.

**** This standard applies to the sum of naphthalene and monomethylnaphthalene isomers.

### Abbreviations

| | |
|---|---|
| AL | action level that, if exceeded, requires water treatment |
| 2,4-D | 2,4-dichlorophenoxyacetic acid |
| DBCP | 1,2-dibromo-3-chloropropane |
| Dioxin | 2,3,7,8-tetrachlorodibenzo-p-dioxin |
| EDB | ethylene dibromide, a synonym for 1,2-dibromoethane |
| EDC | ethylene dichloride, a synonym for 1,2-dichloroethane |
| HA | health advisory |
| HMX | octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine |
| MCL | maximum contaminant level |
| MCLG | maximum contaminant level goal |
| MEK | methyl ethyl ketone |
| mg/L | milligrams per liter |
| mrem/yr | millirem per year |
| MTBE | methyl tertiary butyl ether, a synonym for 2-methoxy-2-methyl propane (the standard includes other ether-based gasoline additives) |
| N | nitrogen |
| NP | not present |
| o | ortho |
| p | para |
| PCE | perchloroethylene, a synonym for tetrachloroethylene |
| pCi/L | picocuries per liter |
| PCBs | polychlorinated biphenyls |
| PDC | propylene dichloride, a synonym for 1,2-dichloropropane |
| PMCL | proposed maximum contaminant level |
| RDX | hexahydro-1,3,5-trinitro-s-triazine |
| TCE | trichloroethylene |
| TDS | total dissolved solids |
| 2,4,5-T | 2,4,5,-trichlorophenoxyacetic acid |
| 2,4,5-TP | 2,4,5-trichlorophenoxypropionic acid |
| TT | treatment technique that public water system operators must adhere to instead of a numerical standard |
| um | micrometer |
| U.S. EPA | United States Environmental Protection Agency |

Use and Applicability of Standards

All New Mexico standards are enforceable, including aesthetic and irrigation standards. The aesthetic "secondary" standards of U.S. EPA are merely recommended limits.

All New Mexico standards are adopted by the N.M. Water Quality Control Commission except for the MTBE and petroleum (floating product and undesirable odor) standards which are adopted by the N.M. Environmental Improvement Board.

U.S.EPA's MCLGs are set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety. MGLGs do not take treatment costs into consideration and are not enforceable. Health-based PMCLs and final enforceable MCLs are set as close to MGLGs as feasible with use of best technology, treatment techniques and other means.

U.S. EPA's HAs serve as informal technical guidance to assist Federal, State and local officials responsible for protecting public health when emergency spills or contamination situations occur. They are not to be construed as legally enforceable Federal standards and are subject to change as new information becomes available. HAs are developed for one-day, ten-day, 7-year and lifetime exposures. All HAs listed above are for lifetime exposure unless otherwise indicated.

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Ground Water Protection and Remediation Bureau
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P.O. Box 26110
Santa Fe, NM 87502

**MICA MINE** ○ 3
**Mica**
KMG Minerals, Div. of Franklin Industries, Inc.
P.O. Box 130, Velarde, NM 87582
(505) 852-2727
Type of Operation: Surface Mine
Status: Active
MSHA Number: 2900608
Location: Sec 24, 25 T23N R12E
USGS Quad: Taos
Mineral Estate: Private
Surface Estate: Same

**MOLYCORP QUESTA MINE/MILL** □ 4
**Molybdenum**
Molycorp, Inc.
P.O. Box 469, Questa, NM 87556
(505) 586-0212
Type of Operation: Mill/Mine
Status: Standby
MSHA Number: 2901267
Location: T28,29N R13,14E
USGS Quad: Questa
Mineral Estate: Private; Molycorp, Inc.
Surface Estate: Same

**NO AGUA MINE/MILL** □ 5
**Perlite**
Harborlite Corp.
P.O. Box 338, Antonito, Colorado 81120
(719) 376-5484; (719) 376-5666
Type of Operation: Surface Mine/Mill
Status: Active
MSHA Number: 2900248
Location: Sec 1,14,23 T29N R9E
USGS Quad: Questa
Mineral Estate: Private; Manville Sales Corporation
Surface Estate: Same

## *TORRANCE COUNTY*

**3 IN 1** ○ 1
**Copper, Gold, Platinum, and Silver**
3 In 1 Mining Co.
Rt. 2, Box 76, Mountainair, NM 87036

Type of Operation: Surface Mine
Status: Under development
Capacity: Unknown
Location: Sec 35 T5N R5E
USGS Quad: Manzano Peak
Mineral Estate: Federal; Cibola National Forest
Surface Estate: Same

## *UNION COUNTY*

**TWIN MOUNTAIN ROCK QUARRY** ○ 1
**Scoria (Volcanic Cinders)**
Twin Mountain Rock Company
P.O. Box 37, Des Moines, NM 88418
(505) 278-2694
Type of Operation: Surface Mine
Status: Active
MSHA Number: 2900194
Location: SE4 Sec 19 T30N R29E
Directions: 5 mi N of Des Moines on Hwy 87
USGS Quad: Folsom
Mineral Estate: Private; Meridian Minerals Co., 5613 DTC Parkway, Englewood, CO 80111

## *VALENCIA COUNTY*

**LUCERO QUARRY** ○ 1
**Travertine**
New Mexico Travertine
Box 439, Belen, NM 87002
(505) 864-6300
Type of Operation: Surface Mine
Status: Active
Capacity: 4,800 tons/yr
Location: Sec. 12,13 T5N R3W
Directions: 23 mi W of Belen
USGS Quad: Mesa Mojinas
Mineral Estate: Federal; BLM
Surface Estate: Same

**NEW MEXICO TRAVERTINE PLANT** ■ 2
**Travertine**
New Mexico Travertine
Box 439, Belen, NM 87002
(505) 864-6300
Type of Operation: Mill
Status: Active
Capacity: 2,000 square feet/day
Location: Sec. 12,13 T5N R1E
Directions: 2 mi W of Belen
USGS Quad: Belen
NOTE: Township and Range are projected values

**UNITED DESICCANTS PLANT** ■ 3
**Clay (Calcium Smectite)**
United Desiccants–Gates
Box 105, Belen, NM 87002
(505) 864-6691
Type of Operation: Mill
Status: Active
Capacity: 16 tons/day
Location: T4N R2E (approx.)
Directions: S of Rio Communities on SR 47
USGS Quad: Turn
NOTE: Township and Range are projected.

**TAOS PIT** ◆ 11
**Gravel**
Robert Medina & Sons Concrete & Sand, Inc.
P.O. Box 1685, Taos, NM 87571
(505) 758-8661
Type of Operation: Pit
Status: Active
Capacity: 500 tons/day
MSHA Number: 2902050
Location: Sec 20 T26N R11E
Mineral Estate: Private; Robert Medina, P.O. Box 1685, Taos, NM 87571
Surface Estate: Same

**TAOS PIT II** ◆ 12
**Sand and Gravel**
Robert Medina & Sons Concrete & Sand, Inc.
P.O. Box 1685, Taos, NM 87571
(505) 758–3217
Type of Operation: Pit
Status: Active
Capacity: 300 tons/hr
Location: Sec 26 T26N R12E
Directions: Highway 64 West
Mineral Estate: Private; Robert Medina, P.O. Box 1685, Taos, NM 87571, (505) 758–3217
Surface Estate: Same

## *TORRANCE COUNTY*

**CANNON SAND & GRAVEL** ◆ 1
**Sand and Gravel**
Cannon Sand & Gravel
Box 133 Moriarty, NM 87035
(505) 832-4266
Type of Operation: Quarry
Status: Active
Capacity: 2,744 cu yds/yr (1991)
Location: E2 NW2 SE Sec 23 T8N R9E
Mineral Estate: Federal; BLM, 435 Montano NE, Albuquerque, NM, (505) 761-8900
Surface Estate: Private; Carl Cannon, Box 133, Moriarty, NM 87035, (505) 832-4266

**DAVIS PIT** ◆ 2
**Crushed Aggregate**
Mountain States Constructors, Inc.
P.O. Box 6325, Albuquerque, NM 87197
(505) 345-4401
Type of Operation: Pit
Status: Active
Capacity: 3000–5000 tons/day
Location: Sec 33 T9N R9E
Directions: 4 mi SE of Moriarty
Mineral Estate: Private; Shane Davis, P.O. Box 1575, Moriarty, NM 87005, (505) 832-4293
Surface Estate: Same

**LOYD'S PIT** ◆ 3
**Gravel, Rocks, Caliche, and Dirt**
Everett W. Loyd
Loyd's Dirt and Gravel Company
366 State Hwy 217, Tijeras, NM 87059
(505) 281-3750
Type of Operation: Pit
Status: Active
Capacity: 6,553 cu yds/yr
MSHA Number: 2901536
Location: Sec 7 T9N R7E
USGS Quad: Edgewood
Mineral Estate: Private; Everett W. Loyd
Surface Estate: Same

**PAUL DAVIS JR. PIT** ◆ 4
**Aggregate**
Mountain States Constructors, Inc.
P.O. Box 6325, Albuquerque, NM 87197
(505) 345-4401
Type of Operation: Pit
Status: Intermittent; temporarily closed
Capacity: 1,500 tons/hr
MSHA Number: 2901823
Location: Sec 27 T9N R9E
Directions: 4 mi E of Moriarty on Martinez Rd., 2 mi S on Gutierrez
USGS Quad: Lobo Hill
Mineral Estate: Private; Paul Davis, Jr., P.O. Box 366, Moriarty, NM 87035
Surface Estate: Same

**PEDERNAL QUARRY** ◇ 5
**Crushed Rock, Riprap**
Western Rock Products, Inc.
P.O. Box 135, Encino, NM 88321
(505) 888-3815
Type of Operation: Quarry/Mill
Status: Active
Capacity: 700,000 tons/yr
MSHA Number: 2901854
Location: Sec 18 T5N R13E
USGS Quad: Negra
Mineral Estate: Private; Santa Fe Pacific Minerals
Surface Estate: Same

## *UNION COUNTY*

**AMISTAD CATTLE COMPANY** ◆ 1
**Rock and Dirt**
New Mexico State Highway and Transportation
P.O. Box 30, Las Vegas, NM 87701
(505) 425-7527
Type of Operation: Pit
Status: Temporarily closed
Capacity: 320 tons/day
Location: Sec 32 T30N R34E
Mineral Estate: Private; Amistad Cattle Company
Surface Estate: Same

# MINES, MILLS AND QUARRIES IN NEW MEXICO

# 1995


compiled by

**Kay S. Hatton**

MINING AND MINERALS DIVISION
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**Lynne Hemenway**

NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY
Socorro, New Mexico 87801
(505) 835-5420

Status: Active
MSHA Number: 2900047
Location: Sec 36 T12N R3E
Directions: I-25 and Tramway
USGS Quad: Alameda
Mineral Estate: Indian; Pueblo of Sandia, P.O. Box 608, Bernalillo, NM 87004
Surface Estate: Same

**SAN FELIPE PUEBLO PIT** ◆ 9
**Sand and Gravel**
Corn Construction Co.
2701 Miles Rd, SE, Suite 175, Albuquerque, NM 87106
(505) 764-9791
Type of Operation: Pit
Status: Active
Location: Sec 27,28,33 T14N R5E
USGS Quad: San Felipe Pueblo
Mineral Estate: Indian; San Felipe Pueblo, P.O. Box A, San Felipe Pueblo, NM 87000; (505) 867-3381

**SANTA ANA PIT** ◆ 10
**Sand and Gravel**
Western Mobile NM
P.O. Box 91570, Albuquerque, NM 87199
(505) 281-4541
Type of Operation: Pit
Status: Active
MSHA Number: 2901634
Location: Sec 24 T13N R4E
USGS Quad: Bernalillo, Placitas
Mineral Estate: Indian; Santa Ana Pueblo, 1000 Indian School, NW, P.O. Box 1667, Albuquerque, NM 87103, (505) 766-3029
Surface Estate: Same

**SANTA FE RIVER PIT** ◆ 11
**Sand and Gravel**
Central Concrete Products, Inc.
P.O. Box 4115, Santa Fe, NM 87502
(505) 471-3553
Type of Operation: Pit
Status: Active
MSHA Number: 2900822
Location: Sec 32 T16N R6E
Directions: In village of Peña Blanca, NM
Mineral Estate: Private; Nevarez C de Baca, 217 Mildred NW, Albuquerque, NM 87107; (505) 344-6454
Surface Estate: Same

**WYLIE NO. 1 20/22N/1W** ◆ 12
**Aggregate**
The Wylie Corporation
P.O. Box 3921, Albuquerque, NM 87190
(505) 821-3622
Type of Operation: Quarry
Status: Intermittent; temporarily closed
Location: Sec 20 T22N R1W

## SANTA FE COUNTY

**AIRPORT ROAD MINE** ◆ 1
**Sand and Gravel**
Associated Asphalt
Rt. 20 Box 29AM, Santa Fe, NM 87501
(505) 438-0390
Type of Operation: Quarry
Status: Active
Capacity: 10,000 tons/yr
MSHA Number: 2900821
Directions: Hwy 85 2.5 mi S of city limits of Santa Fe west on Airport Rd
Mineral Estate: State; State of NM, Commission of Public Lands
Surface Estate: Private; Española Mercantile Co., P.O. Box 38, Española, NM, (505) 753-2176

**BASSETT PIT** ◆ 2
**Sand and Gravel**
High Valley Sand & Gravel
P.O. Box 1070, Edgewood, NM 87015
(505) 281–8096
Type of Operation: Pit
Status: Active
MSHA Number: 2901386
Location: E2 of SW4, W2 of SW4 Sec 32 T10N R8E
Mineral Estate: Private
Surface Estate: Private; George Basset, Suite 500, West Tower, 6400 Uptown Blvd., Albuquerque, NM, (505) 881–5155

**BLOTTER CONSTRUCTION PIT** ◆ 3
**Fill Dirt, Gravel, Base Course**
Blotter Construction Company
P.O. Box 4012, Santa Fe, NM 87502
(505) 989–9095
Type of Operation: Pit
Status: Active
MSHA Number: 2901961
Location: Sec 9 T16N R8E
Directions: Approximately 5 mi SW of Santa Fe at the end of Airport Rd
USGS Quad: Agua Fria
Mineral Estate: Private

**CERRILLOS GRAVEL PIT** ◆ 4
**Gravel**
Cerrillos Gravel Products, Inc.
P.O. Box 81, Cerrillos, NM 87010
(505) 473-4128
Type of Operation: Pit
Status: Active
Location: Sec 8 T14N R8E
Mineral Estate: Private; Mr. Robert C. Aitken, 11321 Todd Street, Houston, TX 77055
Surface Estate: Same

**CERRILLOS SAND AND GRAVEL** ◆ 5
**Riprap**
Becho, Inc.
1815 West 500 South, Salt Lake City, UT 84104
(801) 973-2035
Type of Operation: Pit
Status: Active
Capacity: 300 tons/day
MSHA Number: 2902100
Directions: Gravel pit road at Los Cerrillos, NM
Mineral Estate: Private; Cerrillos Gravel Products, Inc, P.O. Box 55306, Houston, TX 77255, (713) 473-7729
Surface Estate: Same

**EDGEWOOD PIT** ◆ 6
**Sand and Gravel**
Western Mobile New Mexico, Inc.
P.O. Box 91570, Albuquerque, NM 87199-1570
(505) 345-7800
Type of Operation: Pit
Status: Intermittent
Capacity: 6000 tons/day
Location: SW4 NW4 Sec 35 T10N R7E
Directions: 1 mi E of intersection of 222 and 344 on Hwy 333
Mineral Estate: Private; Donoovan and Josie Bassett, P.O. Box 276, Wagon Mound, NM 87752; (505) 666-2440
Surface Estate: Same

**GALISTEO RIVER SAND AND GRAVEL** ◆ 7
**Sand and Gravel**
Galisteo River Sand and Gravel
HC 75 Box 34, Lamy, NM 87540
(505) 989-7032
Type of Operation: Quarry
Status: Active
Capacity: 100,000 tons/yr
Location: T15N R10E
Directions: US-285 and NM-41 SE corner
Mineral Estate: Private; Onderdonk Livestock Co., Philadelphia, PA
Surface Estate: Private; Joe and Alma Miller, HC 75 Box 34, Lamy, NM 87540

**LEEDER PIT** ◆ 8
**Sand and Gravel**
R. L. Stacy Construction
P.O. Box 15147, Santa Fe, NM 87506-5147
(505) 473-1360
Type of Operation: Pit
Status: Active
Capacity: 500 cu yds/day
MSHA Number: 29-01378
Location: Sec 1 T16N R8E
Directions: Lower Agua Fria at Dead Man's curve
Mineral Estate: State; State of new Mexico, P.O. Box 1148, Santa Fe, NM 87504, (505) 827-5744
Surface Estate: Same

**M&R SAND AND GRAVEL** ◆ 9
**Sand and Gravel**
M&R Construction
611 Valarde Street, Santa Fe, NM 87501
(505) 982-4174
Type of Operation: Quarry
Status: Active
Capacity: 2,000 tons/yr
Location: Sec 32 T17N R9E
Directions: Corner Aqua Fria
Mineral Estate: Private; Mike Roybal, 611 Valarde St., Santa Fe, NM 87501; (505) 982-4174
Surface Estate: Same

**RODRIGUEZ BROTHERS INC.** ◆ 10
**Adobe Dirt, Sand and Gravel**
Rodriguez Brothers Adobes
Rt. 6 Box 222, Santa Fe, NM 87501
(505) 471-3375
Type of Operation: Quarry
Status: Temporarily closed
Capacity: 500 tons/yr (combined)
MSHA Number: 2902085
Mineral Estate: Private; Rodriguez Brothers Inc., Rt. 6 Box 22, Santa Fe, NM 87501, (505) 471-3375
Surface Estate: Same

**SAN LAZARUS GULCH** ◆ 11
**Sand and Gravel**
Mansal Gravel Company
P.O. Box 12781, Jackson, MS 39236
(601) 981–9533
Type of Operation: Quarry
Status: Temporarily closed
Capacity: 100 yds/day
MSHA Number: 2902111
Directions: Off Old Quay Rd N of Hwy-344
USGS Quad: San Pedro
Mineral Estate: Federal
Surface Estate: Private

**SILICA QUEEN** ◆ 12
**Silica from Sand**
Oro Mountain Mining Corp.
Box 421, Cedar Crest, NM 87008
(505) 281-2690
Type of Operation: Quarry
Status: Intermittent
MSHA Number: 29-01161
Location: SE4 Sec 23 T12N R7E
Mineral Estate: Federal; BLM, 435 Montano Rd. NE, Albuquerque, NM, (505) 761-8700
Surface Estate: Same

**SUN AND SOIL PIT** ◆ 13
**Base Course, Screened Sand, Top Soil**
Sun and Soil, Inc.
P.O. Box A, Edgewood, NM 87015
(505) 281-9006
Type of Operation: Pit
Status: Active

MSHA Number: 2901434
Location: W2 Sec 24 T10N R7E
USGS Quad: Edgewood
Mineral Estate: Private; Huston Family Trust, P.O. Box A, Edgewood, NM 87015
Surface Estate: Same

**TOTAVI GRAVEL PIT** ◆ 14
**Base Course, Crushed Rock, Riprap, Sand**
Paul Parker Construction
P.O. Box 459, Los Alamos, NM 87544
Type of Operation: Pit
Status: Active
MSHA Number: 2900824
Location: Sec 7 T19N R8E
USGS Quad: Puye
Mineral Estate: San Ildefonso Pueblo
Surface Estate: Same

## *SIERRA COUNTY*

**CUCHILLO PIT** ◆ 1
**Sand and Gravel**
Bartoo Sand & Gravel, Inc.
P.O. Box 769, T or C, NM 87901
(505) 894-7181
Type of Operation: Pit
Status: Active
MSHA Number: 2901392
Location: Sec 21 T13S R4W
USGS Quad: Cuchillo
Mineral Estate: Private; Bartoo Sand & Gravel, Inc.
Surface Estate: Same

**CUCHILLO PIT** ◆ 2
**Sand and Gravel**
James Hamilton Construction Co.
P.O. Box 1287, Silver City, NM 88062
(505) 388-1546
Type of Operation: Pit
Status: Intermittent
Capacity: 500 tons/hr
MSHA Number: 29-02016
Location: SE4 SW4 Sec 17 T12S R4W
USGS Quad: Elephant Butte
Mineral Estate: Federal; BLM Las Cruces District Office, 1800 Marquess St., Las Cruces, NM 88005
Surface Estate: Same

**DOOLITTLE** ◆ 3
**Sand and Gravel**
Sierra Valley Construction
P.O. Box 1089, Elephant Butte, NM 87935
(505) 744-5919
Type of Operation: Quarry
Status: Intermittent
Capacity: 250-300 tons/day
MSHA Number: 2902044
Location: SW4 SE4 Sec 4 T14S R4W
Mineral Estate: Private; Marshall Doolittle, T or C, NM 87901; (505) 744-5919
Surface Estate: Same

**N.M. LAND OFFICE LEASE #20647 - SIERRA VALLEY CONSTRUCTION** ◆ 4
**Sand and Gravel**
J. W. Jones Construction Co.
8800 Susan Ave. SE, Albuquerque, NM 87123
(505) 256-1561
Type of Operation: Quarry
Status: Closed
Location: Sec 16 T13S R4W
Mineral Estate: New Mexico State Land Office Lease #20647, Sierra Valley Construction, Elephant Butte, NM

**PERCHA–HILLSBORO PIT** ◆ 5
**Sand and Gravel**
Johnson Construction
P.O. Box 848, Deming, NM 88031
(505) 546-3497
Type of Operation: Pit
Status: Intermittent; temporarily closed
MSHA Number: 2901461
Location: Sec 17 T16S R7W
Directions: 1 mi W of Hillsboro
USGS Quad: Hillsboro
Mineral Estate: Private; Bason-Cox, Inc, Hillsboro, NM
Surface Estate: Same

**STEVE BELL CONSTRUCTION CO.** ◆ 6
**Gravel**
Steve Bell Construction Co.
P.O. Box 813, Elephant Butte, NM 87935
(505) 744-5576
Type of Operation: Quarry
Status: Intermittent
Location: Sec 15 T13S R4W

## *SOCORRO COUNTY*

**ARMIJO** ◆ 1
**Aggregate**
Ribble Contracting, Inc.
P.O. Box 25423, Albuquerque, NM 87125
(505) 247-4313
Type of Operation: Pit
Status: Active
Capacity: 30,000 tons/yr
MSHA Number: 2901999
Location: Sec 33 T3S R1W
Mineral Estate: Private; Esequiel B. Armijo, Trustee, P.O. Box 1311, Socorro, NM 87801, (505) 835-1476
Surface Estate: Same

TABLE 3 (continued)

| District (synonyms) | Precious-metal production in troy ounces reported/ (estimated) Gold | Silver | Other commodities produced/ (present) | Type(s) of deposit(s) | Description | References |
|---|---|---|---|---|---|---|
| 91. Rociada (Mora County) | — | — | (Cu, Pb, Ag, Au, Zn, U, Mo) | M, L | Mineralized quartz veins in Precambrian granite. Minor stratabound sedimentary-copper deposits in coarse sandstone of Pennsylvanian–Permian Sangre de Cristo Formation. | Harley, 1940; Anderson, 1957; Soulé, 1956; McLemore and North, 1985; Robertson et al. (in press) |
| 92. Sabinoso | — | — | U (Cu, Ag) | L | Stratabound sedimentary-copper–uranium deposits in channel sandstones of the lower and middle members of the Triassic Chinle Formation. | McLemore and Menzie, 1983; McLemore and North, 1985 |
| 93. Tecolote | 19 | 128 | Cu, Pb (U) | L | Stratabound sedimentary-copper deposits in arkose and sandstone, probably of the Pennsylvanian–Permian Sangre de Cristo Formation. | Soulé, 1956; Harley, 1940; Anderson, 1957; McLemore and North, 1985 |
| 94. Willow Creek (Pecos) | 172,562.16 (178,300) | 5,296,499 (6,200,000) | Zn, Pb, Cu | N | Volcanogenic massive sulfide deposits in metamorphosed sequence of Precambrian subaqueous volcanic rocks and volcaniclasitic sedimentary rocks. Also disseminated volcanogenic sulfide deposits. | Riesmeyer, 1978; Riesmeyer and Robertson, 1979; Harley, 1940; Krieger, 1932; Robertson et al. (in press) |
| **Santa Fe County** | | | | | | |
| 95. Cerillos | 930.68 | 27,864 | Cu, Pb, Zn, turquoise (U, Mo) | D(?) | Veins filling shear zones and faults in Oligocene hornblende monzonite, augite–biotite monzonite, and Espinoso Volcanics, and Cretaceous Mancos Shale. | Disbrow and Stoll, 1957; Elston, 1967; Akright, 1979 |
| 96. El Cuervo Butte (Crow) prospects | — | — | (Pb, Ba, Ag) | E | Barite–galena (± silver) veins along fault in Permian Yeso Formation and Glorieta Member of Permian San Andres Formation. | McLemore, 1984; McLemore and Barker, 1985; North and McLemore, 1985 |
| 97. Glorieta | — | — | (Cu, Ag, U) | L | Stratabound sedimentary-copper deposits in sandstones and arkoses of the Pennsylvanian–Permian Sangre de Cristo Formation. | Soulé, 1956; Elston, 1967; McLemore, 1983a |
| 98. La Bajada | — | 52 | Cu, U (Zn) | C | Base-metal (with silver and uranium) vein filling a fault that cuts Oligocene Cieneguilla Limburgite and Espinasa Volcanics. Formed under low-temperature, near-surface conditions. | Lustig, 1957; Elston, 1967; McLemore, 1983a; Chenoweth, 1979; McLemore and North, 1984 |
| 99. New Placers | 19,560 (117,000) | 304,625 (305,000) | Cu, Pb, Zn (W) | D, A | Skarn deposits in limestone of the Pennsylvanian Madera Formation adjacent to Tertiary latite–monzonite-porphyry laccolith and rhyolite dikes. Also veins filling fissures in porphyry and Madera Formation and placers derived from the lode deposits. | Atkinson, 1961; Koschmann and Bergendahl, 1968; Elston, 1967 |
| 100. Old Placers | (200,000) | 311 | Ag, Cu, Pb (W) | D, A | Mineralization filling faults and fissures in Tertiary monzonite stock and adjacent Cretaceous Mesaverde Formation shales and sandstones. Disseminated mineralization in Ortiz mine breccia (Mesaverde Formation and latite porphyry clasts) associated with latite sills and dikes. Placers derived from lodes. | Elston, 1967; Wright, 1983; Bachman, 1975; Dale and McKinney, 1959 |
| 101. Santa Fe | — | — | (Cu, Pb, Zn, Ag, Au) | N | Disseminated volcanogenic sulfide deposits in Precambrian schist and phyllite. | Fulp, 1982; Robertson et al. (in press) |
| **Sierra County** | | | | | | |
| 102. Caballo Mountains | 83.6 | 4,769 | Cu, Pb, V, F, Mn (U, Th, Ba) | E, L | Veins filling fissures in Pennsylvanian Bar B Formation and Cambrian Bliss Formation. Stratabound sedimentary-copper deposits in Permian Abo Formation. | Kelley and Silver, 1952; Harley, 1934; McAnulty, 1978 |

TABLE 3 (continued)

| District (synonyms) | Precious-metal production in troy ounces reported/ (estimated) | | Other commodities produced/ (present) | Type(s) of deposit(s) | Description | References |
|---|---|---|---|---|---|---|
| | Gold | Silver | | | | |
| 133. Rosedale | 27,750 | 5,363 (10,000) | (F) | B | Veins in faults cutting Oligocene South Canyon Tuff. | North, 1983; Neubert, 1983; Koschmann and Bergendahl, 1968 |
| 134. San Jose | 887.8 | 12,917 | Cu, Pb, Zn | B | Veins in faults cutting Oligocene Spears Formation and Vicks Peak Tuff. | North, 1983; Neubert, 1983; Lasky, 1932 |
| 135. San Lorenzo | — | — | Cu, Ag (U) | B | Veins filling faults in middle Tertiary andesite. | North, 1983 |
| 136. Socorro Peak | — | (750,000) | Pb (Ba, F) | B | Veins filling faults in late Miocene Socorro Peak Rhyolite and underlying Popotosa Formation. Some veins also cut Pennsylvanian Sandia and Madera Formations. | Chamberlin, 1980; Lasky, 1932 |
| 137. Taylor (Ojo Caliente #2) | — | — | Cu, Pb, Ag | B | Veins filling fissures in Oligocene andesite–latite flow in an intensely altered area. | Hillard, 1969; Lasky, 1932; North, 1983; Griffitts and Alminas, 1968 |
| 138. Water Canyon | 196.32 | 2,064 | Cu, Pb, Zn (Mn) | F | Vein, skarn, and replacement deposits in Mississippian Kelly Limestone, commonly localized by faults and veins filling faults between Precambrian and younger rocks. | Lasky, 1932; North, 1983; Hewitt and Radtke, 1967 |
| **Taos County** | | | | | | |
| 139. La Virgen | — | — | (Cu, Ag, Pb, Zn) | N(?) | Volcanic-sulfide deposits(?) in Precambrian schists. | Robertson et al. (in press) |
| 140. Picuris | 14.75 | 1,351 | Cu, W (U, Sb) | M | Mineralized quartz veins, disseminated mineralization, and oxidized-copper mineralization filling fractures in Precambrian Ortega Quartzite. | Williams, 1982; Montgomery, 1953; Lindgren et al., 1910; Schilling, 1960; USBM Minerals Yearbooks |
| 141. Red River (Rio Hondo) | 364.89 | 8,051 | Cu, Pb, Zn, U (Mo) | D(?), M, A | Veins in Precambrian granitic rocks and Tertiary biotite granite, rhyolite, latite, and quartz veins. Mineralization is of Tertiary age. Placer deposits. | Clark and Read, 1972; Schilling, 1960; Park and McKinlay, 1948; Ludington et al., 1984 |
| 142. Rio Grande valley | (<1,000) | — | — | A | Placer-gold deposits in Recent gravels of the Rio Grande and Red River. | McLemore and North, 1984; Johnson, 1972 |
| 143. Twining | (80) | (1,000) | Cu | M | Veins and disseminated mineralization in Precambrian mafic gneiss. Mineralization is of Precambrian age. | Clark and Read, 1972; Restrepo, 1972; Park and McKinlay, 1948; Daggett, 1984; Robertson et al. (in press) |
| **Torrance County** | | | | | | |
| 144. Chupadera Iron prospects | — | — | Fe (Au) | D(?) | Iron deposits, either skarn or hydrothermal. Samples assay 0.02 oz/ton (0.7 ppm) Au. | McLemore, 1984, field notes 8/11/83 |
| 145. Edgewood | — | — | Ba (F, Pb, Ag) | E | Ba–F veins in Pennsylvanian Madera Formation. | McLemore and Barker, 1985 |
| 146. Manzano Mountains (Valencia County) | — | — | (Cu, Au, Ag, Pb) | M | Veins filling faults and shear zones in Precambrian argillaceous metasediments. | McLemore, field notes 1984; Maxwell and Light, 1984; Maxwell and Wobus, 1982; McLemore, 1984; Maxwell et al., 1984 |
| 147. Pedernal Hills | — | — | (Cu, Ag, Au, U) | M | Veins filling fissures in Precambrian granite and greenstones. | McLemore, 1984; J. Setter, pers. comm. 1984; Robertson et al. (in press) |
| 148. Scholle (Socorro and Valencia Counties) | 9.96 | 8,147 | Cu, Ra, Pb (U, V) | L | Stratabound sedimentary-copper deposits in sandstones, limestones, siltstones, and shales of the Permian Bursum, Abo, and Yeso Formations. | Soulé, 1956; McLemore, 1982b, 1984; LaPoint, 1979 |
| **Union County** | | | | | | |
| 149. Black Mesa | — | 10 | Cu (U, V) | L | Mineralization in clastic plugs and sandstones in Triassic Sheep Pen Sandstone. | Fay, 1983; Soulé, 1956; Baldwin and Muehlberger, 1954; USBM Minerals Yearbooks |

TABLE 3 (continued)

| District (synonyms) | Precious-metal production in troy ounces reported/ (estimated) Gold | Silver | Other commodities produced/ (present) | Type(s) of deposit(s) | Description | References |
|---|---|---|---|---|---|---|
| 91. Rociada (Mora County) | — | — | (Cu, Pb, Ag, Au, Zn, U, Mo) | M, L | Mineralized quartz veins in Precambrian granite. Minor stratabound sedimentary-copper deposits in coarse sandstone of Pennsylvanian–Permian Sangre de Cristo Formation. | Harley, 1940; Anderson, 1957; Soulé, 1956; McLemore and North, 1985; Robertson et al. (in press) |
| 92. Sabinoso | — | — | U (Cu, Ag) | L | Stratabound sedimentary-copper-uranium deposits in channel sandstones of the lower and middle members of the Triassic Chinle Formation. | McLemore and Menzie, 1983; McLemore and North, 1985 |
| 93. Tecolote | 19 | 128 | Cu, Pb (U) | L | Stratabound sedimentary-copper deposits in arkose and sandstone, probably of the Pennsylvanian–Permian Sangre de Cristo Formation. | Soulé, 1956; Harley, 1940; Anderson, 1957; McLemore and North, 1985 |
| 94. Willow Creek (Pecos) | 172,562.16 (178,300) | 5,296,499 (6,200,000) | Zn, Pb, Cu | N | Volcanogenic massive sulfide deposits in metamorphosed sequence of Precambrian subaqueous volcanic rocks and volcaniclasitic sedimentary rocks. Also disseminated volcanogenic sulfide deposits. | Riesmeyer, 1978; Riesmeyer and Robertson, 1979; Harley, 1940; Krieger, 1932; Robertson et al. (in press) |
| **Santa Fe County** | | | | | | |
| 95. Cerillos | 930.68 | 27,864 | Cu, Pb, Zn, turquoise (U, Mo) | D(?) | Veins filling shear zones and faults in Oligocene hornblende monzonite, augite-biotite monzonite, and Espinoso Volcanics, and Cretaceous Mancos Shale. | Disbrow and Stoll, 1957; Elston, 1967; Akright, 1979 |
| 96. El Cuervo Butte (Crow) prospects | — | — | (Pb, Ba, Ag) | E | Barite–galena (±silver) veins along fault in Permian Yeso Formation and Glorieta Member of Permian San Andres Formation. | McLemore, 1984; McLemore and Barker, 1985; North and McLemore, 1985 |
| 97. Glorieta | — | — | (Cu, Ag, U) | L | Stratabound sedimentary-copper deposits in sandstones and arkoses of the Pennsylvanian–Permian Sangre de Cristo Formation. | Soulé, 1956; Elston, 1967; McLemore, 1983a |
| 98. La Bajada | — | 52 | Cu, U (Zn) | C | Base-metal (with silver and uranium) vein filling a fault that cuts Oligocene Cieneguilla Limburgite and Espinasa Volcanics. Formed under low-temperature, near-surface conditions. | Lustig, 1957; Elston, 1967; McLemore, 1983a; Chenoweth, 1979; McLemore and North, 1984 |
| 99. New Placers | 19,560 (117,000) | 304,625 (305,000) | Cu, Pb, Zn (W) | D, A | Skarn deposits in limestone of the Pennsylvanian Madera Formation adjacent to Tertiary latite–monzonite-porphyry laccolith and rhyolite dikes. Also veins filling fissures in porphyry and Madera Formation and placers derived from the lode deposits. | Atkinson, 1961; Koschmann and Bergendahl, 1968; Elston, 1967 |
| 100. Old Placers | (200,000) | 311 | Ag, Cu, Pb (W) | D, A | Mineralization filling faults and fissures in Tertiary monzonite stock and adjacent Cretaceous Mesaverde Formation shales and sandstones. Disseminated mineralization in Ortiz mine breccia (Mesaverde Formation and latite porphyry clasts) associated with latite sills and dikes. Placers derived from lodes. | Elston, 1967; Wright, 1983; Bachman, 1975; Dale and McKinney, 1959 |
| 101. Santa Fe | — | — | (Cu, Pb, Zn, Ag, Au) | N | Disseminated volcanogenic sulfide deposits in Precambrian schist and phyllite. | Fulp, 1982; Robertson et al. (in press) |
| **Sierra County** | | | | | | |
| 102. Caballo Mountains | 83.6 | 4,769 | Cu, Pb, V, F, Mn (U, Th, Ba) | E, L | Veins filling fissures in Pennsylvanian Bar B Formation and Cambrian Bliss Formation. Stratabound sedimentary-copper deposits in Permian Abo Formation. | Kelley and Silver, 1952; Harley, 1934; McAnulty, 1978 |

**CERRILLOS SAND AND GRAVEL** ◆ 5
**Riprap**
Becho, Inc.
1815 West 500 South, Salt Lake City, UT 84104
(801) 973-2035
Type of Operation: Pit
Status: Active
Capacity: 300 tons/day
MSHA Number: 2902100
Directions: Gravel pit road at Los Cerrillos, NM
Mineral Estate: Private; Cerrillos Gravel Products, Inc, P.O. Box 55306, Houston, TX 77255, (713) 473-7729
Surface Estate: Same

**EDGEWOOD PIT** ◆ 6
**Sand and Gravel**
Western Mobile New Mexico, Inc.
P.O. Box 91570, Albuquerque, NM 87199-1570
(505) 345-7800
Type of Operation: Pit
Status: Intermittent
Capacity: 6000 tons/day
Location: SW4 NW4 Sec 35 T10N R7E
Directions: 1 mi E of intersection of 222 and 344 on Hwy 333
Mineral Estate: Private; Donoovan and Josie Bassett, P.O. Box 276, Wagon Mound, NM 87752; (505) 666-2440
Surface Estate: Same

**GALISTEO RIVER SAND AND GRAVEL** ◆ 7
**Sand and Gravel**
Galisteo River Sand and Gravel
HC 75 Box 34, Lamy, NM 87540
(505) 989-7032
Type of Operation: Quarry
Status: Active
Capacity: 100,000 tons/yr
Location: T15N R10E
Directions: US-285 and NM-41 SE corner
Mineral Estate: Private; Onderdonk Livestock Co., Philadelphia, PA
Surface Estate: Private; Joe and Alma Miller, HC 75 Box 34, Lamy, NM 87540

**LEEDER PIT** ◆ 8
**Sand and Gravel**
R. L. Stacy Construction
P.O. Box 15147, Santa Fe, NM 87506-5147
(505) 473-1360
Type of Operation: Pit
Status: Active
Capacity: 500 cu yds/day
MSHA Number: 29-01378
Location: Sec 1 T16N R8E
Directions: Lower Agua Fria at Dead Man's curve
Mineral Estate: State; State of new Mexico, P.O. Box 1148, Santa Fe, NM 87504, (505) 827-5744
Surface Estate: Same

**M&R SAND AND GRAVEL** ◆ 9
**Sand and Gravel**
M&R Construction
611 Valarde Street, Santa Fe, NM 87501
(505) 982-4174
Type of Operation: Quarry
Status: Active
Capacity: 2,000 tons/yr
Location: Sec 32 T17N R9E
Directions: Corner Aqua Fria
Mineral Estate: Private; Mike Roybal, 611 Valarde St., Santa Fe, NM 87501; (505) 982-4174
Surface Estate: Same

**RODRIGUEZ BROTHERS INC.** ◆ 10
**Adobe Dirt, Sand and Gravel**
Rodriguez Brothers Adobes
Rt. 6 Box 222, Santa Fe, NM 87501
(505) 471-3375
Type of Operation: Quarry
Status: Temporarily closed
Capacity: 500 tons/yr (combined)
MSHA Number: 2902085
Mineral Estate: Private; Rodriguez Brothers Inc., Rt. 6 Box 22, Santa Fe, NM 87501, (505) 471-3375
Surface Estate: Same

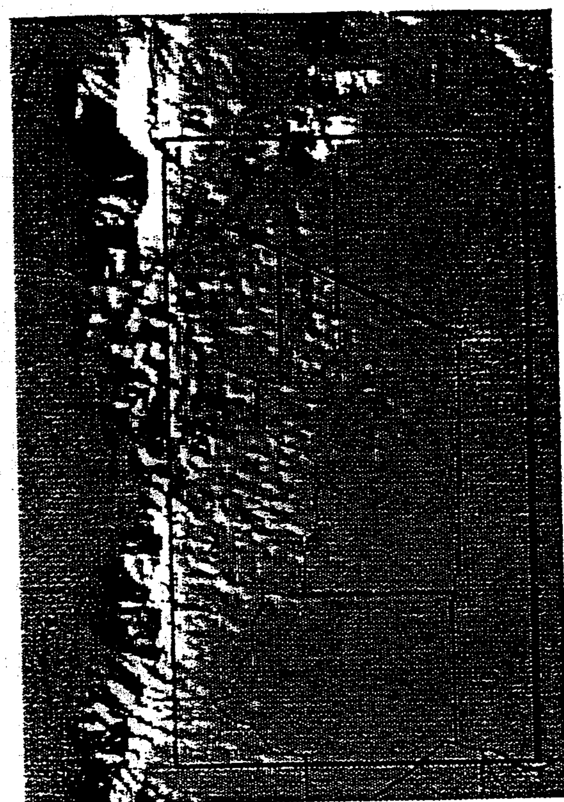
**SAN LAZARUS GULCH** ◆ 11
**Sand and Gravel**
Mansal Gravel Company
P.O. Box 12781, Jackson, MS 39236
(601) 981–9533
Type of Operation: Quarry
Status: Temporarily closed
Capacity: 100 yds/day
MSHA Number: 2902111
Directions: Off Old Quay Rd N of Hwy-344
USGS Quad: San Pedro
Mineral Estate: Federal
Surface Estate: Private

**SILICA QUEEN** ◆ 12
**Silica from Sand**
Oro Mountain Mining Corp.
Box 421, Cedar Crest, NM 87008
(505) 281-2690
Type of Operation: Quarry
Status: Intermittent
MSHA Number: 29-01161
Location: SE4 Sec 23 T12N R7E
Mineral Estate: Federal; BLM, 435 Montano Rd. NE, Albuquerque, NM, (505) 761-8700
Surface Estate: Same

**SUN AND SOIL PIT** ◆ 13
**Base Course, Screened Sand, Top Soil**
Sun and Soil, Inc.
P.O. Box A, Edgewood, NM 87015
(505) 281-9006
Type of Operation: Pit
Status: Active

# EAST MOUNTAINS
# WASTEWATER FEASIBILITY STUDY

## FINAL REPORT



Septic System Data

Nitrate Conc. data

## DECEMBER 1995

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
ALBUQUERQUE DISTRICT

IN COOPERATION WITH:

BERNALILLO COUNTY
TORRANCE COUNTY
AND
SANTA FE COUNTY

PREPARED BY:

NEW MEXICO ENGINEERING RESEARCH INSTITUTE
1001 UNIVERSITY BLVD, SE
ALBUQUERQUE, NM 87106

# EAST MOUNTAIN AREA PLAN

ADOPTED

Bernalillo County: June 23, 1992

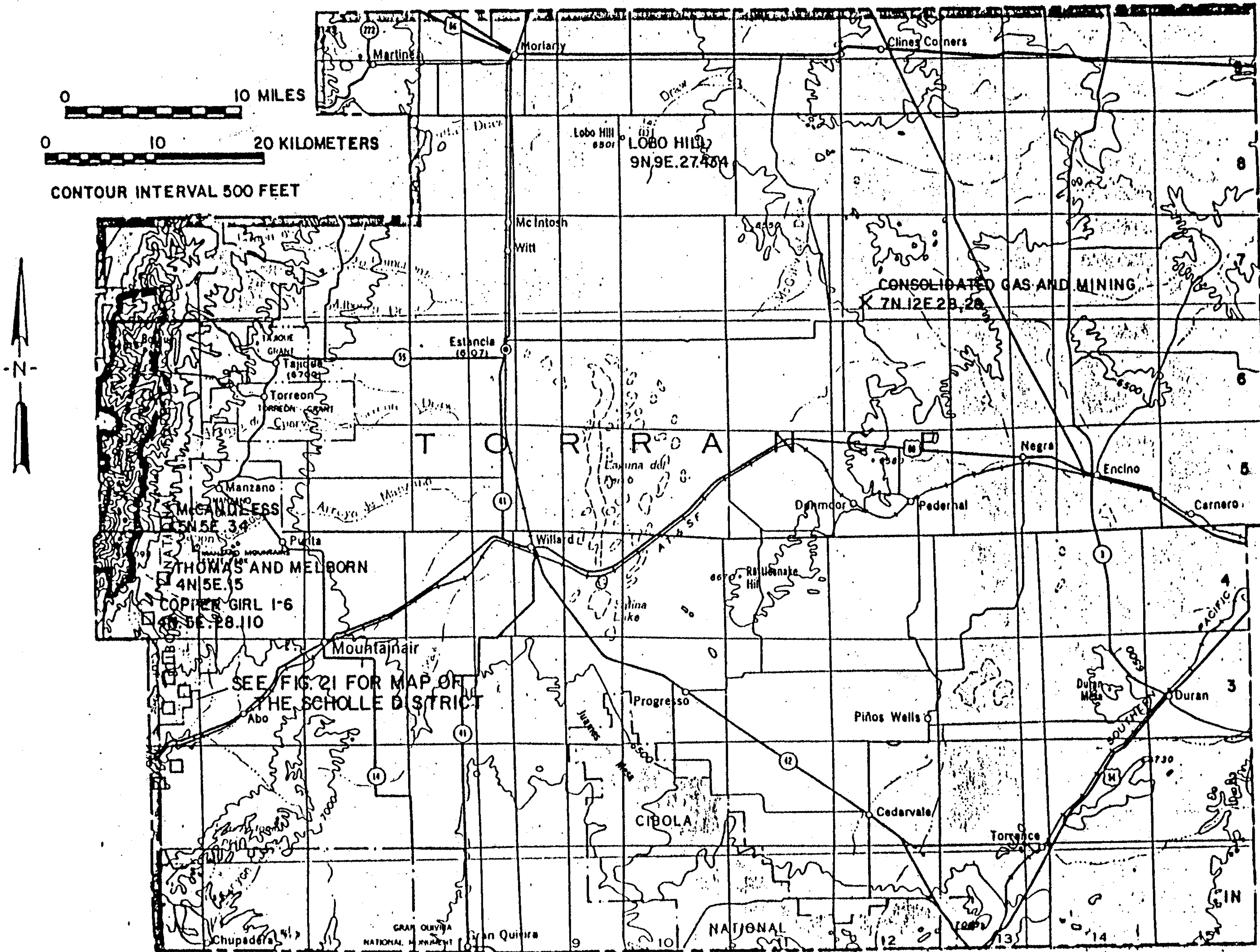
City of Albuquerque: August 17, 1992

**Table 1.A**
GROUNDWATER CONTAMINATION

| Location | Contaminants | Source | Estimated Extent | Hydrologic Conditions |
|---|---|---|---|---|
| Cedar Crest, Bernalillo Co. | Gasoline | LUST | 120 ft. (largest dimension) | Shallow alluvial aquifer |
| 10N.5E.29.1 10N.5E.30.2 2.5M.SW of Tijeras, Bernalillo Co. | Leaded gasoline, explosives, solvents, other organics, nitrate | Unknown-landfill, munitions, LUSTs, illegal injection well suspected | 1200 ft. X 500 ft.; thickness not determined | Shallow alluvium over fractured granite aquifer at water table conditions |
| Monticello Subdivision, Tijeras Canyon | Nitrates | Septic Tanks | 8 wells contaminated | Shallow alluvium over crystalline bedrock |
| Town of Carnue | Nitrates | Septic Tanks | 32 wells contaminated | Shallow alluvium over crystalline bedrock |
| Town of Chilili | Nitrates | Septic Tanks | 1 well contaminated | Shallow bedrock aquifer |
| Tijeras Canyon | Gasoline | LUST | Unknown | DTGW 60 to 70 ft. alluvium over fractured bedrock |
| Tijeras Canyon | Gasoline Diesel Explosives | Multiple; old gasoline station and unknown | 1.5 ac. areally thickness not determined | DTG =40 ft. alluvium over fractured bedrock |

Source: Ground-water Report, CH2M Hill, February 20, 1990

FIGURE 1-31- RADIOACTIVE OCCURRENCES IN TORRANCEE COUNTY, NEW MEXICO



TORRANCE COUNTY

Alphabetical (14 occurrences)

| | |
|---|---|
| Abo Mine | 2N.5E.3.414 |
| Abo Mining Claims | 3N.5E.23.111 |
| Consolidated Gas and Mining | 7N.12E.28,29 |
| Copper Girl 1-6 | 4N.5E.28.110 |
| Lobo Hill | 9N.9E.27.434 |
| McCandless Prospect | 5N.5E.34 |
| Old Abo Claims | 3N.5E.27.200 |
| Pioneer Mine | 3N.5E.15.441 |
| Rattlesnake #1-4 | 3N.5E.15.233 |
| Scholle-1 | 3N.5E.10.312 |
| Scholle | 2N.5E.10 |
| Thelma | 3N.5E.15.423 |
| Thomas and Melborne | 4N.5E.15 |
| Unknown | 2N.5E.17 |
| Unknown | 3N.5E.10.314 |

| Alias | Name | Number |
|---|---|---|
| Abel | Abo Mine | 2N.5E.3.414 |
| Abo | Thelma | 3N.5E.15.423 |
| Abo Claims | Old Abo Claims | 3N.5E.27.200 |
| Hannie | Pioneer Mine | 3N.5E.15.441 |
| Laurita | Scholle #1 | 3N.5E.10.312 |
| McTerry | Thelma | 3N.5E.15.423 |
| Miners Dream | Thelma | 3N.5E.15.423 |
| Pioneer Copper Mine | Pioneer Mine | 3N.5E.15.441 |
| Prospect #17 | Abo Mine | 2N.5E.3.414 |
| Sandstone Copper | Abo Mining Claims | 3N.5E.23.111 |
| Scholle | Abo Mine | 2N.5E.3.414 |
| Thelma-Ann | Thelma | 3N.5E.15.423 |
| Tom Arnett prospect | Abo Mine | 2N.5E.3.414 |
| Unknown | Pioneer Mine | 3N.5E.15.441 |
| Uranium prospect | Abo Mine | 2N.5E.3.414 |

Numerical

| | |
|---|---|
| 2N.5E.3.414 | Abo Mine |
| 2N.5E.10 | Scholle |
| 2N.5E.17 | Unknown |
| 3N.5E.10.312 | Scholle-1 |
| 3N.5E.10.314 | Unknown |
| 3N.5E.15.233 | Rattlesnake #1-4 |
| 3N.5E.15.423 | Thelma |
| 3N.5E.15.441 | Pioneer Mine |
| 3N.5E.23.111 | Abo Mining Claims |
| 3N.5E.27.200 | Old Abo Claims |
| 4N.5E.15 | Thomas and Melborne |
| 4N.5E.28.110 | Copper Girl 1-6 |
| 5N.5E.34 | McCandless Prospect |
| 7N.12E.28,29 | Consolidated Gas and Mining |
| 9N.9E.27.434 | Lobo Hill |

1: 2N.5E.3.414
2: Abo Mine (Prospect #17, Uranium prospect, Abel, Scholle, Tom Arnett Prospect)
3: SE1/4 3 T2N R5E 34°25'29"N 106°24'30"W
4: Scholle 7-1/2 Elevation 5,910 ft
5: Scholle district-Manzano Mountains
6: Cu, Ag, Au, U, V
7: 2 shafts (one 75-ft deep), dumps, open pit, 40-ft decline
8: no uranium production
9: bkgd 30 cps, high 200 cps
10: Permian Abo Formation
11: radioactive minerals associated with copper minerals and organic debris in red and gray (bleached) sandstone
12: secondary uranium minerls reported, 0.014-0.107% $U_3O_8$ (Gibson, 1952)
13: Sandstone-tabular
14: site of mill and leaching operation
15: FN 7/2/80; Pierson and others (1981, #59); Myers (1977); U.S. Atomic Energy Commission (1970, p. 219); Hilpert (1969); Phillips (1960); Collins and Nye (1957b); Soulè (1956); Hilpert and Corey (1955, #84, 86); Gibson (1952, #2); Gott and Erickson (1952; 1951, #17, 18); PRR D-245 (1951); RG-1-51 (1951); USAEC files (1953)
16: figure 21

1: 3N.5E.23.111
2: Abo Mining Claims (Sandstone copper)
3: NE1/4 22, NW1/4 23 T3N R5E 34°28'30"N 106°24'00"W
4: Scholle 7-1/2 Elevation 6,240 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 40-ft adit, open cut, dumps
8: radium ore shipped in 1916 (USBM), copper production
9: bkgd 30-50 cps, adit 50-100 cps, along face of outcrop 300-400 cps, along boulders in pit 700 cps
10: Permian Abo Formation
11: radioactive minerals associated with copper oxides and organic debris in red and bleached gray limey conglomerates
12: 0.001%, 0.002% $U_3O_8$; 6.36%, 11.11% Cu (NMBMMR chem lab, 11/30/81, #1527, 1528), 2-inch seam of 13% $U_3O_8$ reported
13: Sandstone-tabular
14: claim post south of workings-SW corner Abo #5
15: FN 6/24/81; Pierson and others (1981, #60, 62); Myers (1977); U.S. Atomic Energy Commission (1970, p. 215); Hilpert (1969); Hilpert and Corey (1955, #84); PRR DEB-RRA-569 (1955); DEB-RRA-1401 (1954), 1 supplement; NMBMMR files (1954); USBM files (1949)
16: figure 21

1: 7N.12E.28,29
2: Consolidated Gas and Mining
3: 28, 29 T7N R12E
4: Pedernal Mountain 7-1/2
5: Pedernal Hills
6: U
7: pits
8: no uranium production
9: bkgd 50 cps, high 150-200 cps
10: Paleozoic syenite intruding Precambrian schists
11: radioactive fracture zone, N 78 W
13: Hydrothermal-vein
15: FN 9/21/83; Loring and Armstrong (1980); U.S. Atomic Energy Commission (1970, p. 217)

1: 4N.5E.28.110
2: Copper Girl #1-6
3: NW1/4 28 T4N R5E 34°32'55"N 106°25'55"W
4: Torreon 15' Elevation 6,820 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 2 open cuts (decline-adit), decline adit, 30- to 50-ft deep
8: no uranium production
9: bkgd 20-30 cps, high 150-225 cps, average 50-100 cps
10: Permian Abo Formation
11: radioactive minerals associated with copper oxides in fractured red and bleached bluff conglomerate and arkose, 1 to 2-ft thick
12: uraninite with chalcocite reported; 0.005% $U_3O_8$, 0.83% Cu (NMBMMR, chem lab, 11/30/81, #1526)
13: Sandstone-tabular
14: mine map fig. this report
15: FN 6/17/81, 6/26/81; Anderson, O.J. (1980); Pierson and others (1981, #65); Myers and McKay (1974); U.S. Atomic Energy Commission (1970, p. 218); Phillips (1960); Collins and Nye (1957b); Lovering (1956); USAEC files (1955)
16: figure 21, 22

1: 9N.9E.27.434
2: Lobo Hill
3: 27, 34 T9N R9E
4: Lobo Hill 15
5: Estancia Basin
6: U, Th
7: pits
8: no uranium production
9: bkgd 50 cps, high 1,000 cps
10: syenite intruding Precambrian schists
11: vein trending N40E
13: Hydrothermal-vein
15: FN 9/20/83; Loring and Armstrong, 1980

1: 5N.5E.34
2: McCandless Prospect
3: 34 T5N R5E
4: Scholle 7-1/2
5: Manzano district
6: Cu, U
7: no workings found, 3 ft x 4 ft x 3 ft pit reported
8: no production
9: no anomalous radioactivity on 7/2/80, twice background reported
10: Permian Abo Formation
12: malachite, azurite
13: Sandstone-tabular
14: could not locate on 7/2/80
15: FN 7/2/80; U.S. Atomic Energy Commission (1970, p. 214)
16: figure 21

1: 3N.5E.27.200
2: Old Abo Claims (Abo Claims)
3: NE1/4 27 T3N R5E 34°27'30"N
4: Scholle 7-1/2 Elevation 6,180 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: several shallow prospect pits, open stope
8: no production
9: no anomalous radioactivity found on 6/24/81
10: Permian Abo Formation
12: 0.046 - 13% $U_3O_8$ reported in PRR supplement
13: Sandstone-tabular
14: ore may occur at depth
15: FN 6/24/81; Myers (1977); U.S. Atomic Energy Commission (1970, p. 195) plus supplement (DEB-RRA-1401(1954)); Collins and Nye (1957b)
16: figure 21

1: 3N.5E.15.441
2: Pioneer Mine (Hannie, Pioneer Copper Mine, Unknown)
3: SE1/4 15 T5N R5E 34°29'10"N 106°24'00"W
4: Scholle 7-1/2 Elevation 6,200 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 20-ft adit, pits
8: no uranium production
9: bkgd 30-50 cps, high 150 cps
10: Permian Abo Formation
11: uranium minerals associated with copper minerals and organic debris in bleached sandstones and conglomerates
12: carnotite or tyuyamunite reported, 0.002% $U_3O_8$, 4.18% Cu (NMBMMR chem lab, 11/30/81, #1525)
13: Sandstone-tabular
15: FN 6/24/81; Pierson and others (1981, #64); Myers (1977); Collins and Nye (1957b); PRR DEB-RRA-569 (1953); DEB-RR-464 (1953)
16: figure 21

1: 3N.5E.15.233
2: Rattlesnake #1-4
3: SW1/4 NE1/4 15 T3N R5E 34°29'10"N 106°24'30"W
4: Scholle 7-1/2 Elevation 6,090 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: pit, trench, dumps
8: no uranium production
9: bkgd 30-50 cps, high on dumps 130 cps
10: Permian Abo Formation
11: radioactive minerals associated with copper oxides in arkosic conglomerate (bleached)
12: yellow-green uranium mineral reported
13: Sandstone-tabular
15: FN 6/24/81; Pierson and others (1981, #63); Myers (1977); Hilpert (1969); Hilpert and Corey (1955, #84); PRR DEB-RRA-1180 (1954)
16: figure 21

1: 3N.5E.10.312
2: Scholle-1 (Laurita)
3: SW1/4 10 T3N R5E 34°30'00"N 106°24'55"W
4: Scholle 7-1/2 Elevation 5,900 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: pits, adits, tunnels (one reported to be 70-ft long)
8: no uranium production
9: bkgd 30 cps, high 80 cps
10: Permian Abo Formation
11: radioactive minerals associated with copper oxides and organic debris in bleached red-bed sandstones
13: Sandstone-tabular
14: north of claim post-SW corner Laurita
15: FN 7/2/80, 6/26/81; Pierson and others (1981, #56); Myers (1977); Phillips (1960); Soulè (1956); Lovering (1956); Gibson (1952, p. 28, #6); PRR RG-6-51 (1951)
16: figure 21

1: 2N.5E.10
2: Scholle
3: 10 T2N R5E 34°24'30"N 106°24'30"W
4: Scholle 7-1/2 Elevation 5,900 ft
5: Scholle district-Manzano Mountains
6: U, Cu
7: pits
8: no production
10: Permian Abo Formation (red beds)
12: 0.008% U reported
13: Sandstone-tabular
14: could not locate on 3/2/82
15: FN 3/2/82; Pierson and others (1981, #56); Bachman, Baltz, and O'Sullivan (1953)
16: figure 21

1: 3N.5E.15.423
2: Thelma (Miners Dream, McTerry, Thelma-Ann, Abo)
3: SE1/4 15, NE1/2 22 T3N R5E 34°29'ØØ"N 16°24'1Ø"W
4: Scholle 7-1/2 Elevation 6,4ØØ ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 3Ø-ft adit
8: no uranium production
9: bkgd 3Ø-5Ø cps, adit walls 1ØØ cps, high in fracture 15Ø cps
1Ø: Permian Abo Formation
11: radioactive minerals associated with copper oxides in red
and bleached gray arkose
13: Sandstone
14: north of claim post-SW corner Thelma
15: FN 6/24/81; Pierson and others (1981, #6Ø, 61); Myers
(1977); PRR DEB-RRA-569 (1953)
16: figure 21

1: 4N.5E.15
2: Thomas and Melbourn
3: 15 T4N R5E 34°34'2Ø"N 1Ø6°24'3Ø"W
4: Torreon 15'
5: Scholle district-Manzano Mountains
6: U, Cu, Au
7: no workings found
8: no production
9: no anomalous radioactivity
1Ø: Permian Abo Formation
12: 2.15% U reported
13: Sandstone
14: could not be located on 6/17/81
15: FN 6/17/81; Pierson and others (1981, #66)
16: figure 21

1: 2N.5E.17
2: Unknown
3: 17 T2N R5E
4: Scholle 7-1/2
5: Scholle district-Los Pinos Mountains
6: Cu, U
7: pits
8: no production
1Ø: Permian Abo Formation
11: radioactive carbonized woody hydrocarbon
12: Ø.Ø14% U reported
13: Sandstone
14: could not be located on 3/2/82
15: FN 3/2/82; Lovering (1956)
16: figure 21

1: 3N.5E.1Ø.314
2: Unknown
3: SW1/4 1Ø T3N R5E 34°2Ø'ØØ"N 1Ø6°24'55"W
4: Scholle 7-1/2
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: pits
8: no uranium production
9: bkgd 3Ø cps, high 8Ø cps
1Ø: Permian Abo Formation
13: Sandstone-tabular
15: FN 7/2/8Ø, 6/26/81; Myers (1977);Phillips (196Ø); Soulè (1956)
16: figure 21

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| ETHANES | | | | | |
| 1,2-Dibromoethane (EDB) | 0.0001 | 0.00005 | | Zero | |
| 1,2-Dichloroethane (EDC) | 0.01 | 0.005 | | Zero | |
| 1,1,1-Trichloroethane | 0.06 | 0.2 | | 0.2 | |
| 1,1,2-Trichloroethane | 0.01 | 0.005 | | 0.003 | |
| 1,1,1,2-Tetrachloroethane | | | | | 0.07 |
| 1,1,2,2-Tetrachloroethane | 0.01 | | | | |
| Ethylene Glycol | | | | | 7 |
| ETHENES (ETHYLENES) | | | | | |
| Vinyl Chloride | 0.001 | 0.002 | | Zero | |
| 1,1-Dichloroethene | 0.005 | 0.007 | | 0.007 | |
| cis-1,2-Dichloroethene | | 0.07 | | 0.07 | |
| trans-1,2-Dichloroethene | | 0.1 | | 0.1 | |
| Trichloroethene (TCE) | 0.1 | 0.005 | | Zero | |
| Tetrachloroethene (PCE) | 0.02 | 0.005 | | Zero | |
| PROPANES | | | | | |
| 1,2-Dichloropropane (PDC) | | 0.005 | | Zero | |
| 1,2,3-Trichloropropane | | | | | 0.04 |
| DBCP | | 0.0002 | | Zero | |
| Epichlorohydrin | | TT | | Zero | |
| MTBE | 0.1 (a) | | | | 0.04 |
| POLYCYCLICS | | | | | |
| Benz(a)anthracene | | | 0.0001 | Zero | |
| Benzo(a)pyrene | 0.0007 | 0.0002 | | Zero | |
| Benzo(b)fluoranthene | | | 0.0002 | Zero | |
| Benzo(k)fluoranthene | | | 0.0002 | Zero | |
| Chrysene | | | 0.0002 | Zero | |
| Dibenz(a)anthracene | | | 0.0003 | Zero | |
| Indeno(1,2,3-c,d)pyrene | | | 0.0004 | Zero | |
| Naphthalene | | | | | 0.3 |
| Naphthalenes**** | 0.03 | | | | |
| PCBs | 0.001 | | | | |
| PCBs as Decachlorobiphenyl | | 0.0005 | | Zero | |
| MISCELLANEOUS | | | | | |
| Acrylamide | | TT | | Zero | |
| Acrylonitrile | | | | | 0.004 |
| Bis-2-Chloroisopropyl Ether | | | | | 0.3 |
| Chloral Hydrate | | | | | 0.05 |
| Chloramine | | | | | 0.3 |

| PARAMETER | New Mexico | U.S. EPA Existing MCL | U.S. EPA PMCL | U.S. EPA MCLG | U.S. EPA Lifetime HA |
|---|---|---|---|---|---|
| **MISC. CONTINUED** | | | | | |
| Cyanide | 0.2 | 0.2 | | 0.2 | |
| Dibromoacetonitrile | | | | | 0.02 |
| Dichloroacetic Acid | | | | | 0.003 |
| Dichloroacetonitrile | | | | | 0.006 |
| Di(2-Ethylhexyl)Adipate | | 0.4 | | 0.4 | |
| Di(2-Ethylhexyl)Phthalate | | 0.006 | | Zero | |
| Diisopropyl Methylphosphonate | | | | | 0.6 |
| p-Dioxane | | | | | 0.568 (10day) |
| Hexachlorobutadiene | | | | | 0.001 |
| Hexachlorocyclopentadiene | | 0.05 | | 0.05 | |
| Hexachlorocyclopentadiene (a) | | | 0.008 | | |
| n-Hexane | | | | | 4.0 (7 year) |
| HMX | | | | | 0.4 |
| Isophorone | | | | | 0.1 |
| MEK | | | | | 0.2 |
| Nitroglycerin | | | | | 0.005 |
| Nitroguanidine | | | | | 0.7 |
| Petroleum | | | | | |
| Floating Product | NP | | | | |
| Undesirable Odor | NP | | | | |
| RDX | | | | | 0.002 |
| Trichloroacetic Acid | | | | | 0.2 |
| **OTHER PESTICIDES** | | | | | |
| Acifluorfen | | | | | 0.1 |
| Alachlor | | 0.002 | | Zero | |
| Aldicarb | | | 0.003 | 0.001 | |
| Aldicarb Sulfoxide | | | 0.003 | 0.001 | |
| Aldicarb Sulfone | | | 0.003 | 0.002 | |
| Aldrin | | | | | 0.001 |
| Ametryn | | | | | 0.06 |
| Ammonium Sulfamate | | | | | 2 |
| Atrazine | | 0.003 | | 0.003 | |
| Baygon | | | | | 0.003 |
| Bentazon | | | | | 0.02 |
| Bromacil | | | | | 0.09 |
| Butylate | | | | | 0.35 |
| Carbaryl | | | | | 0.7 |
| Carbofuran | | 0.04 | | 0.04 | |
| Carboxin | | | | | 0.7 |
| Chloramben | | | | | 0.1 |
| Chlordane | | 0.002 | | Zero | |
| Chlorothalonil | | | | | 0.5 |
| Chlorpyrifos | | | | | 0.02 |
| Cyanazine | | | | | 0.01 |
| 2,4-D | | 0.07 | | 0.07 | |
| Dacthal | | | | | 4 |
| Dalapon | | 0.2 | | 0.2 | |

## EXPLANATION FOR STANDARDS COMPARISON TABLE

### Footnotes

* The existing standard excludes radon and uranium activity. The proposed standard also will exclude Radium 226 activity.

** This standard includes photon activity and excludes Radium 228 activity.

*** This standard applies to the sum of the four regulated trihalomethanes: chloroform, dichlorobromomethane, dibromochloromethane and bromoform.

**** This standard applies to the sum of naphthalene and monomethylnaphthalene isomers.

### Abbreviations

| | |
|---|---|
| AL | action level that, if exceeded, requires water treatment |
| 2,4-D | 2,4-dichlorophenoxyacetic acid |
| DBCP | 1,2-dibromo-3-chloropropane |
| Dioxin | 2,3,7,8-tetrachlorodibenzo-p-dioxin |
| EDB | ethylene dibromide, a synonym for 1,2-dibromoethane |
| EDC | ethylene dichloride, a synonym for 1,2-dichloroethane |
| HA | health advisory |
| HMX | octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine |
| MCL | maximum contaminant level |
| MCLG | maximum contaminant level goal |
| MEK | methyl ethyl ketone |
| mg/L | milligrams per liter |
| mrem/yr | millirem per year |
| MTBE | methyl tertiary butyl ether, a synonym for 2-methoxy-2-methyl propane (the standard includes other ether-based gasoline additives) |
| N | nitrogen |
| NP | not present |
| o | ortho |
| p | para |
| PCE | perchloroethylene, a synonym for tetrachloroethylene |
| pCi/L | picocuries per liter |
| PCBs | polychlorinated biphenyls |
| PDC | propylene dichloride, a synonym for 1,2-dichloropropane |
| PMCL | proposed maximum contaminant level |
| RDX | hexahydro-1,3,5-trinitro-s-triazine |
| TCE | trichloroethylene |
| TDS | total dissolved solids |
| 2,4,5-T | 2,4,5,-trichlorophenoxyacetic acid |
| 2,4,5-TP | 2,4,5-trichlorophenoxypropionic acid |
| TT | treatment technique that public water system operators must adhere to instead of a numerical standard |
| um | micrometer |
| U.S. EPA | United States Environmental Protection Agency |

## Use and Applicability of Standards

All New Mexico standards are enforceable, including aesthetic and irrigation standards. The aesthetic "secondary" standards of U.S. EPA are merely recommended limits.

All New Mexico standards are adopted by the N.M. Water Quality Control Commission except for the MTBE and petroleum (floating product and undesirable odor) standards which are adopted by the N.M. Environmental Improvement Board.

U.S.EPA's MCLGs are set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety. MGLGs do not take treatment costs into consideration and are not enforceable. Health-based PMCLs and final enforceable MCLs are set as close to MGLGs as feasible with use of best technology, treatment techniques and other means.

U.S. EPA's HAs serve as informal technical guidance to assist Federal, State and local officials responsible for protecting public health when emergency spills or contamination situations occur. They are not to be construed as legally enforceable Federal standards and are subject to change as new information becomes available. HAs are developed for one-day, ten-day, 7-year and lifetime exposures. All HAs listed above are for lifetime exposure unless otherwise indicated.

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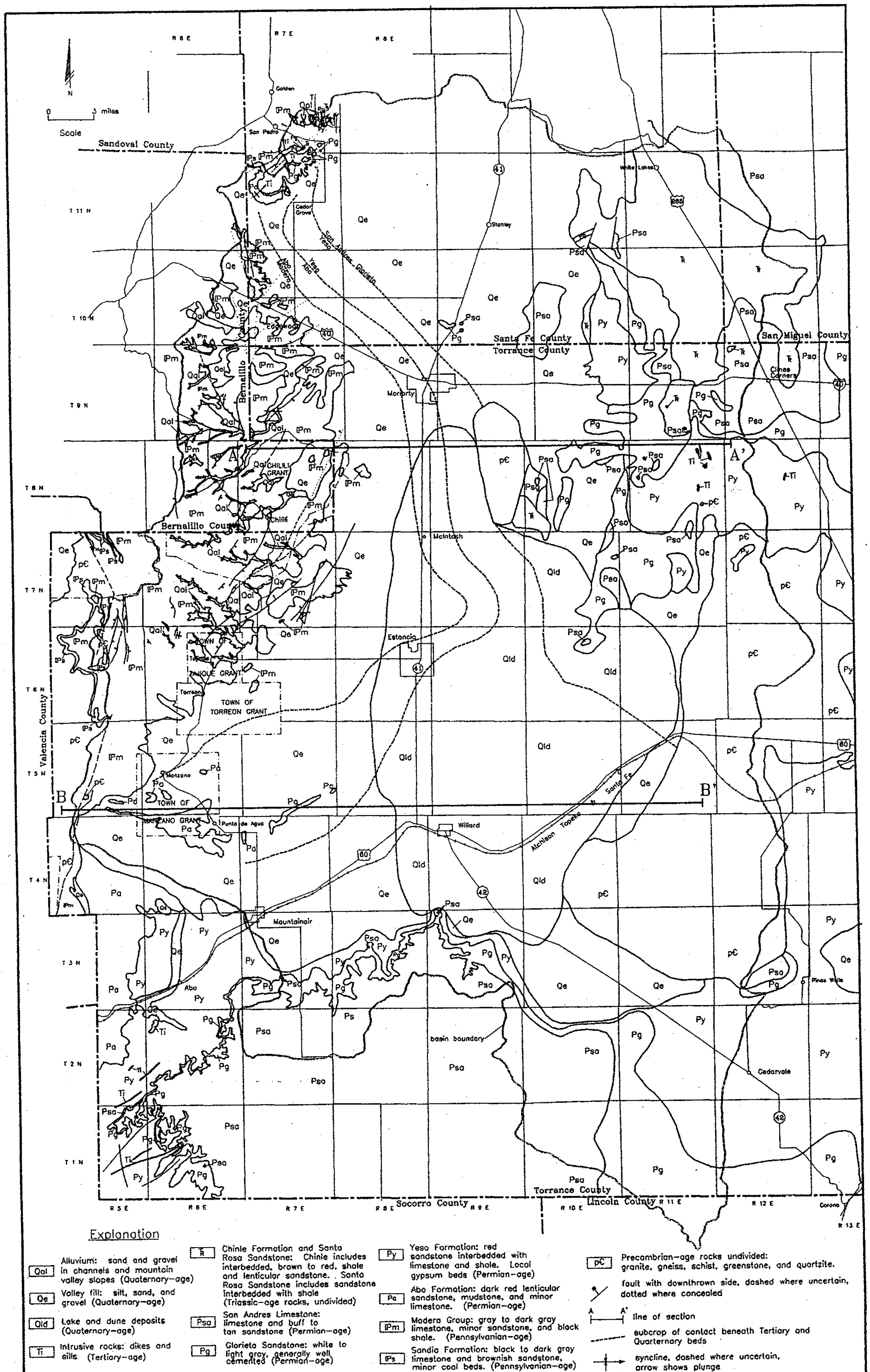


Figure 10. Map showing geology and lines of section, Estancia Underground Water Basin (modified from Smith, 1957 and Titus, 1969 and 1980).

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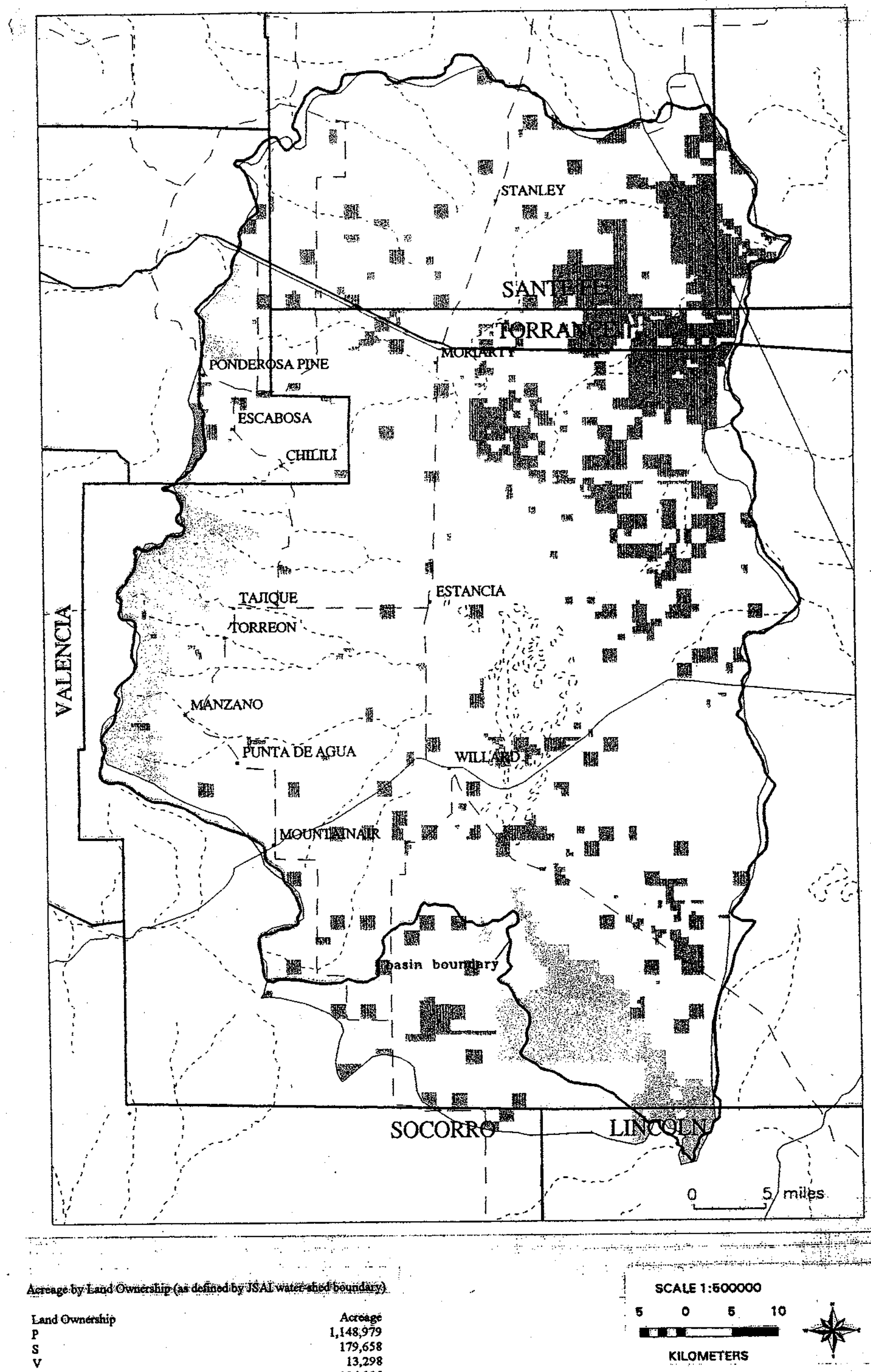


Acreage by Land Ownership (as defined by JSAI water-shed boundary)

| Land Ownership | Acreage |
|---|---|
| P | 1,148,979 |
| S | 179,658 |
| V | 13,298 |
| F | 104,385 |
| I | 80 |
| Total Acreage | 1,446,400 |

SOURCE: BLM, Land Ownership Cover Digital, Data from 1:100,000–Scale. Included (100K) OWNERSHIP coverages were created at the University of New Mexico's, Earth Data Analysis Center, Fall 1993 –Spring 1994. Data were provided by the Bureau of Land Management –New Mexico State Office, Mapping Sciences.

COMPILED BY: NM Water Resources Research Institute, May 1996. New Mexico State University, Las Cruces, New Mexico 88003. 1-505-646-4337. Universal Transverse Mercator. Zone 13. NAD83, GRS1980.

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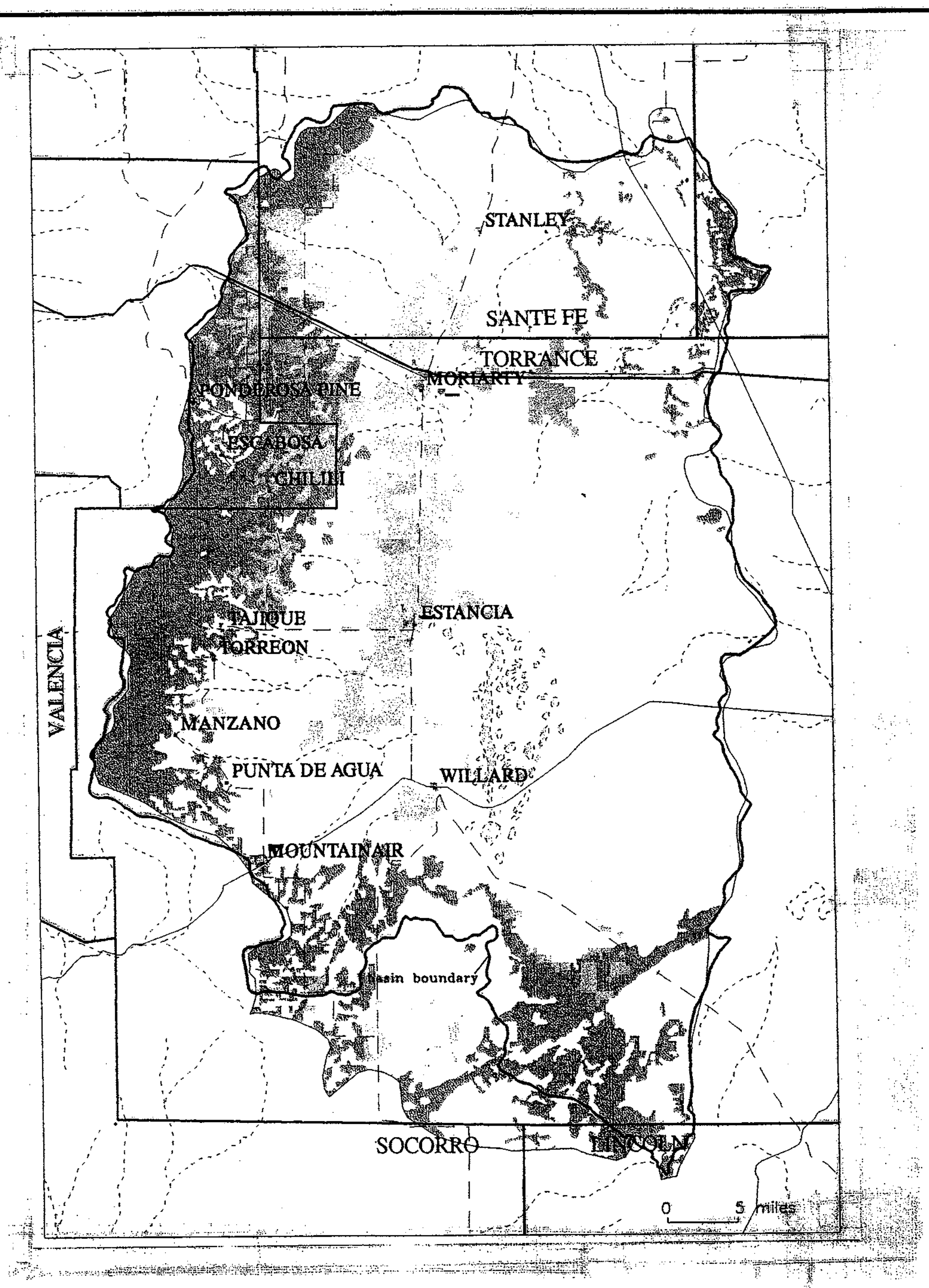
Explanation

- Cities
- Estancia Basin Boundary
- Interstate
- US Highway
- State Highway
- County Line
- Perennial Stream
- Intermitent Stream
- Canal
- A –Acquired Land, BLM
- F –Forest Service Land
- F NG/LU –National Grassland/Bankhead Jones
- H –National Park Service
- I –Indian Land
- J –Fish & Wildlife Service
- LU –Bankhead Jones Acquired, BLM
- M –Military
- P –Private Land
- R –Bureau of Reclamation
- S –State Land
- V –Public Land
- W –Withdrawn

Figure 8. Map showing land ownership in the Estancia Basin area.




Acreage by Land Use

| Land Use | Acreage | Land Use | Acreage |
|---|---|---|---|
| Herbaceous Rangeland | 330,484 | Reserviors | 40 |
| Evergreen Forest Land | 286,494 | Other Urban or Built-up Land | 71 |
| Mixed Rangeland | 658,469 | Confined Feeding Operations | 125 |
| Strip Mines, Qarries, and Gravel Pits | 654 | Transporation, Communications, and Utilities | 2,282 |
| Other Agricultural Land | 529 | Transitional Areas | 14,952 |
| Noneforested Wetland | 586 | Industrial | 10 |
| Cropland and Pasture | 130,959 | Mixed Urban or Built-up Land | 182 |
| Residential | 3,122 | Dry Salt Flats | 14,634 |
| Commercial and Services | 870 | Shrub and Brush Tundra | 60 |
| Lakes | 32 | Decidous Forest Land | 30 |
| Shrub-Brushland Rangeland | 2,562 | | |
| | | Total Acreage | 1,446,400 |

SCALE 1:600000

5 0 5 10

KILOMETERS

LAND USE SOURCE: U.S. Geological Survey, 1990, EPA Land Use and Land Cover Digital, Data from 1:250,000–and 1:100,000–Scale Maps —Data Users Guide 4, 1:250,000 QUAD LAND USE, 1982. Contact: Ed Partington at EPA, Phone (703) 235-5595.

COMPILED BY: NM Water Resources Research Institute, August 1996. New Mexico State University, Las Cruces, New Mexico 88003. 1-505-646-4337. Universal Transverse Mercator. Zone 13. NAD83, GRS1980.

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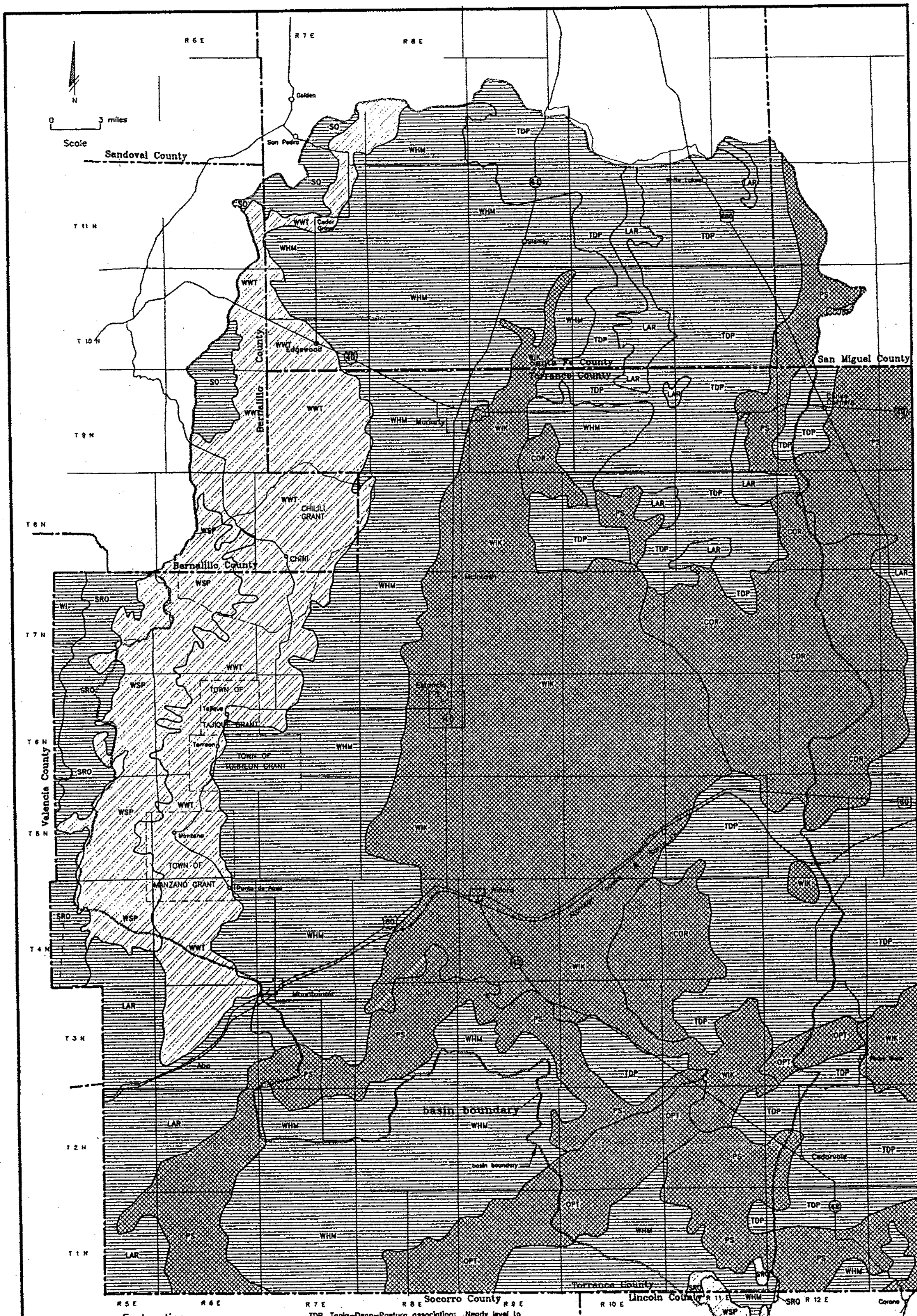
Explanation

- Cities
- Estancia Basin Boundary
- Interstate
- US Highway
- State Highway
- County Line
- Perennial Stream
- Intermitent Stream
- Canal
- Herbaceous Rangeland
- Evergreen Forest Land
- Mixed Rangeland
- Strip Mines, Quarries, and Gravel Pits
- Other Agricultural Land
- Nonforested Wetland
- Cropland and Pasture
- Residential
- Commercial and Services
- Lakes
- Shurb-Brushland Rangeland
- Reservoirs
- Other Urban or Built-up Land
- Confined Feeding Operations
- Transportation, Communications and Utilities
- Transitional Areas
- Industrial
- Mixed Urban or Built-up Land
- Dry Salt Flats
- Shrub and Brush Tundra
- Decidous Forest Land

Figure 6. Map showing land use in the Estancia Basin area.




R 5 E R 6 E R 7 E R 8 E Socorro County R 9 E

R 10 E Lincoln County R 11 E R 12 E R 13 E

## Explanation

SRO, Salas–Rock outcrops and slides association: Steep or very steep, stony soils on mountains, and Rock land. Low permeability.

WSP, Wilcoxson–Supervisor–Pino association: Gently sloping to very steep soils formed over limestone, sandstone, schist, and felsite. Low permeability

WWT, Witt–Wilcoxson–Turkeysprings association: Gently sloping to very steep soils formed over limestone, sandstone, and shale and in valley fill, on foothills. Low permeability.

WHM, Witt–Harvey–Manzano association: Nearly level to strong sloping soils formed in valley fill or mixed alluvium. Moderate permeability.

COR, Clovis–Otero–Rock land association: Gently sloping to very steep soils formed over acid igneous rocks and in valley fill. High permeability.

TDP, Tapia–Dean–Pastura association: Nearly level to strongly sloping soils formed over caliche on uplands. Moderate permeability.

PS, Penistaja–Steep rock land association: Nearly level to strongly sloping soils on uplands, and moderately sloping to very steep rocky areas on hillsides, mesa escarpments, and breaks. High permeability.

LAR, La Fonda–Alicia–Rock outcrop association: Gently sloping to strongly sloping soils formed in alluvium from red beds; moderately sloping to very steep rock outcrops. Moderate permeability.

OPT, Otero–Palma–Trail association: Undulating to rolling soils formed in wind-reworked materials on upland alluvial fans. High permeability.

SO, Seis–Orthids association: Shallow or moderately drained, very cobbly, stony, and very stony loam. Moderate permeability.

WI, Washoe, Ildefonso association: Strongly sloping to steep, stony soils formed in mixed alluvium. Moderate permeability.

TSR, Tuloso–Sombordoro–Rock outcrop: Very shallow and shallow moderately rolling to steep, well drained soils that formed in material weathered form sandstone, and rock outcrop; on mesas, ridges, and uplands. High permeability.

WIK, Willard–Ildefonso–Karde association: Level to strongly sloping soils formed in lake sediments on terraces; gently sloping to steep soils formed in wind-deposited material on hills. High permeability.

| Permeability range inches/hour | Relative permeability map designation |
|---|---|
| 0.05 to 0.2 | low |
| 0.2 to 0.63 | moderate |
| 0.63 to 6.3 | high |

Figure 4. Map showing soil associations and relative permeabilities of the associations in the Estancia Underground Water Basin.

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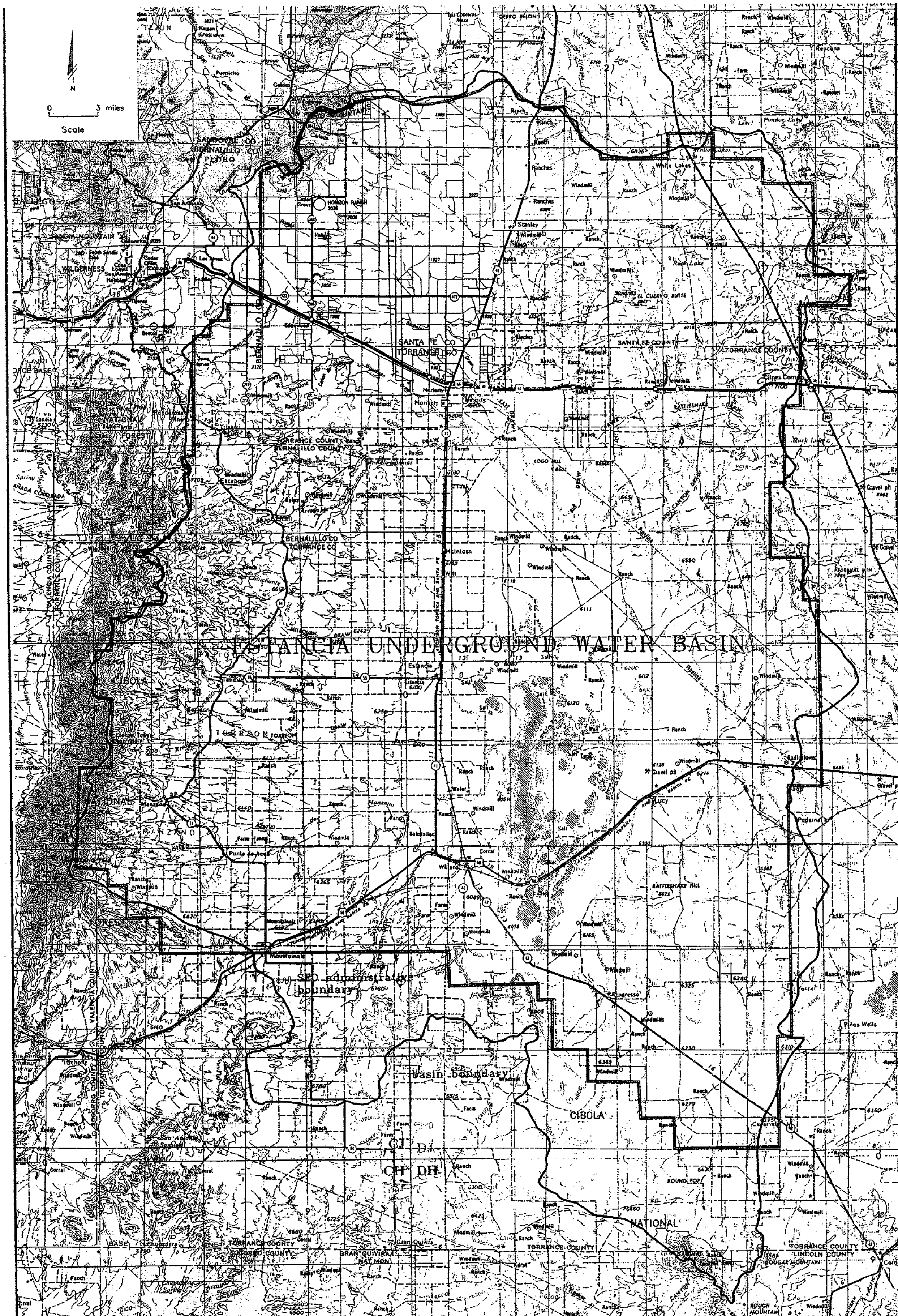


Figure 3. Topographic map of the Estanica Underground Water Basin, SEO administrative boundary, and watershed basin boundary.

# ILLUSTRATIONS

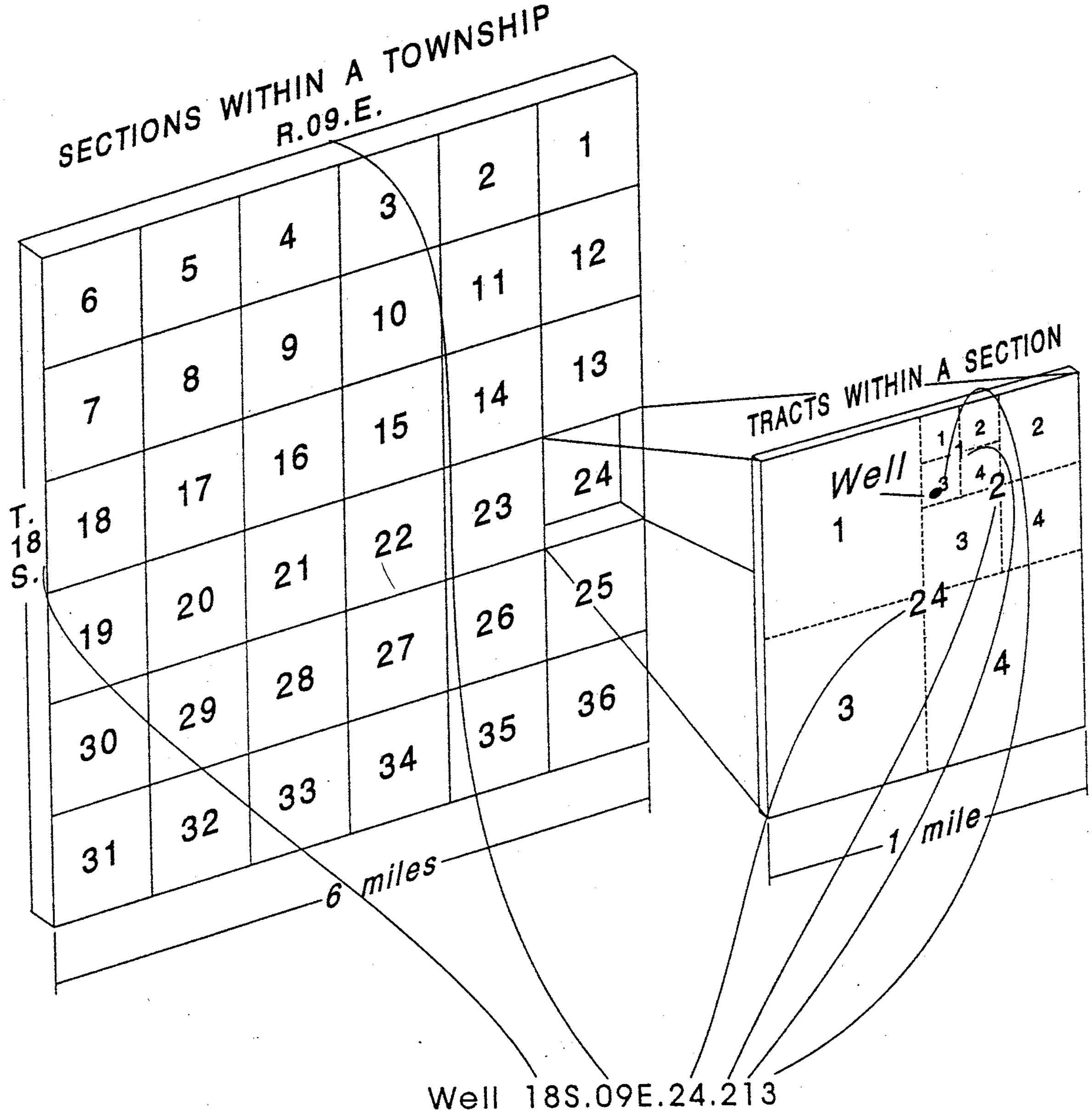


Figure 1. Well–numbering system used in New Mexico.

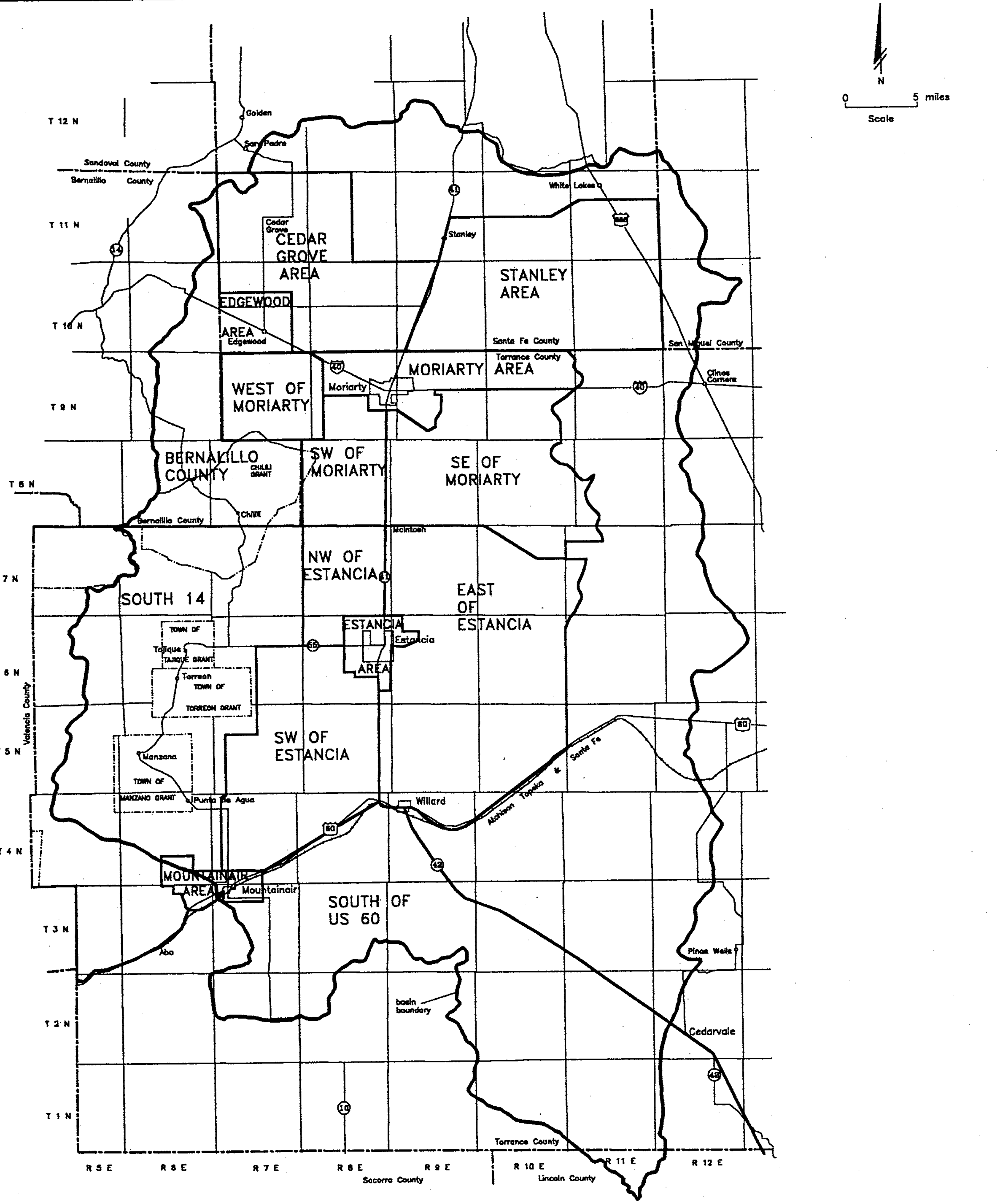


Figure 2. Map showing subcounty boundaries for population and housing in the Estancia Underground Water Basin. (See Table 2 for values.)

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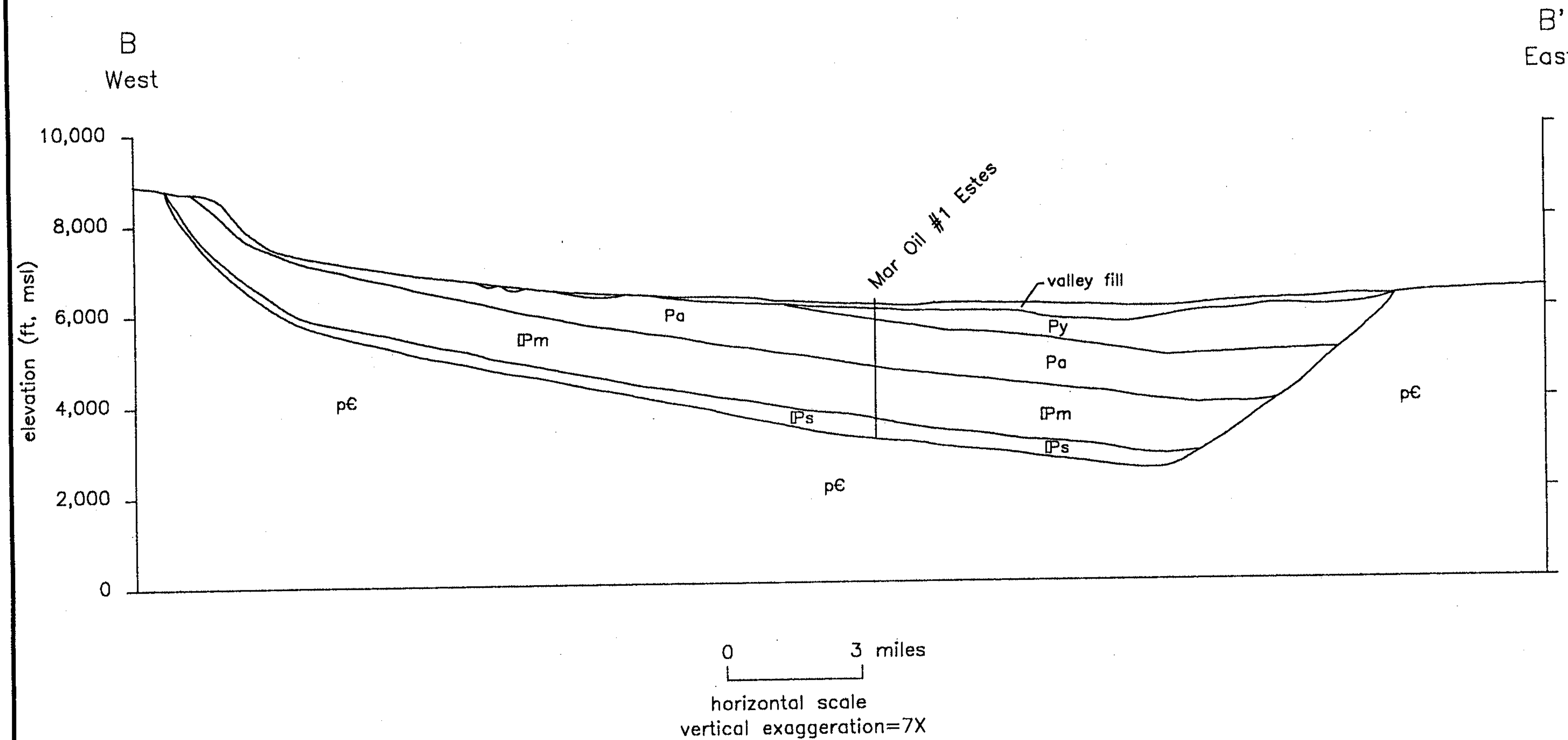


Figure 12. Geologic cross-section B–B', Estancia Underground Water Basin. (See Figure 9 for line-of-section and explanation of symbols).

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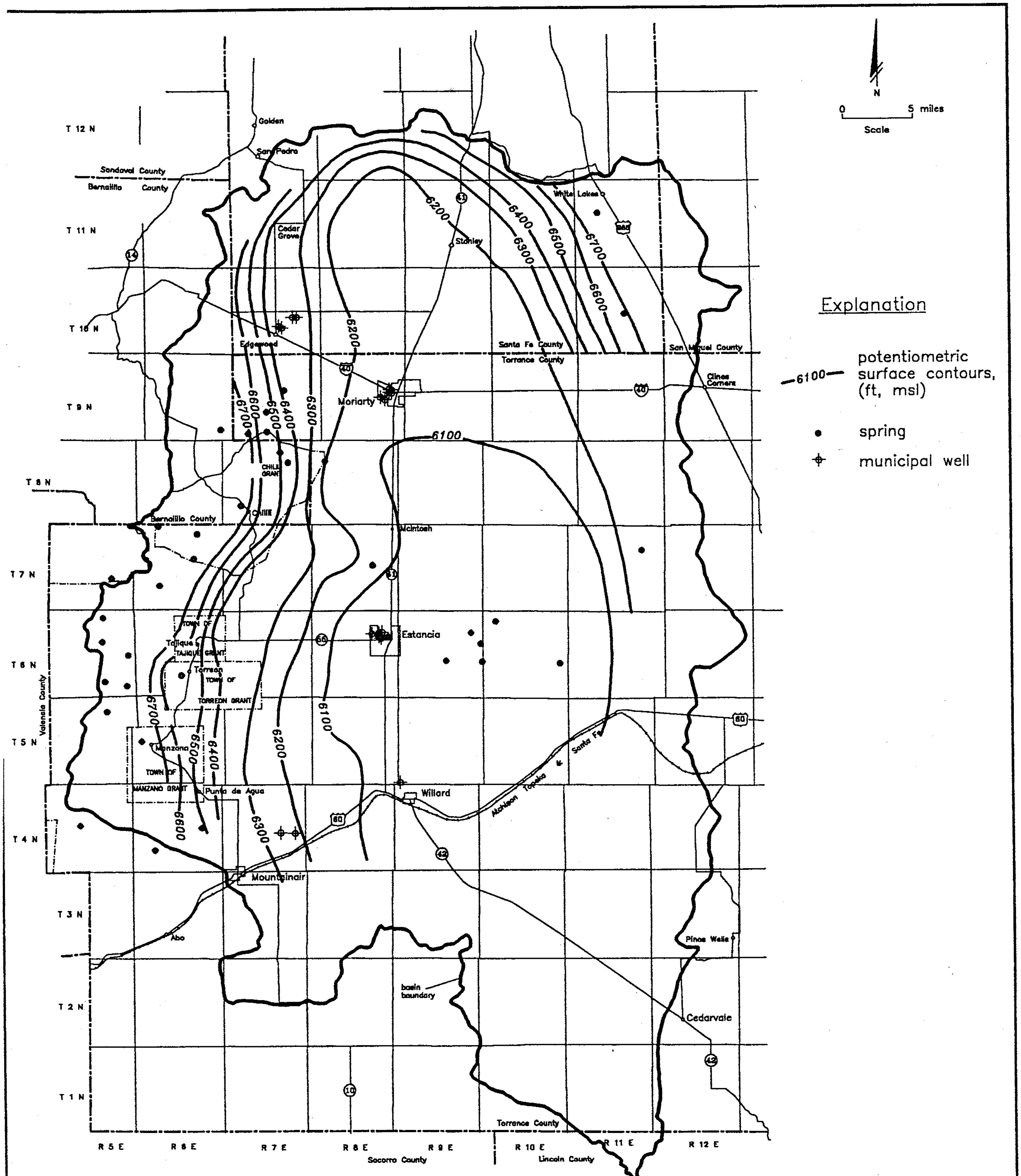


Figure 13. Map showing 1995 potentiometric surface elevation contours and springs in the Estancia Underground Water Basin.

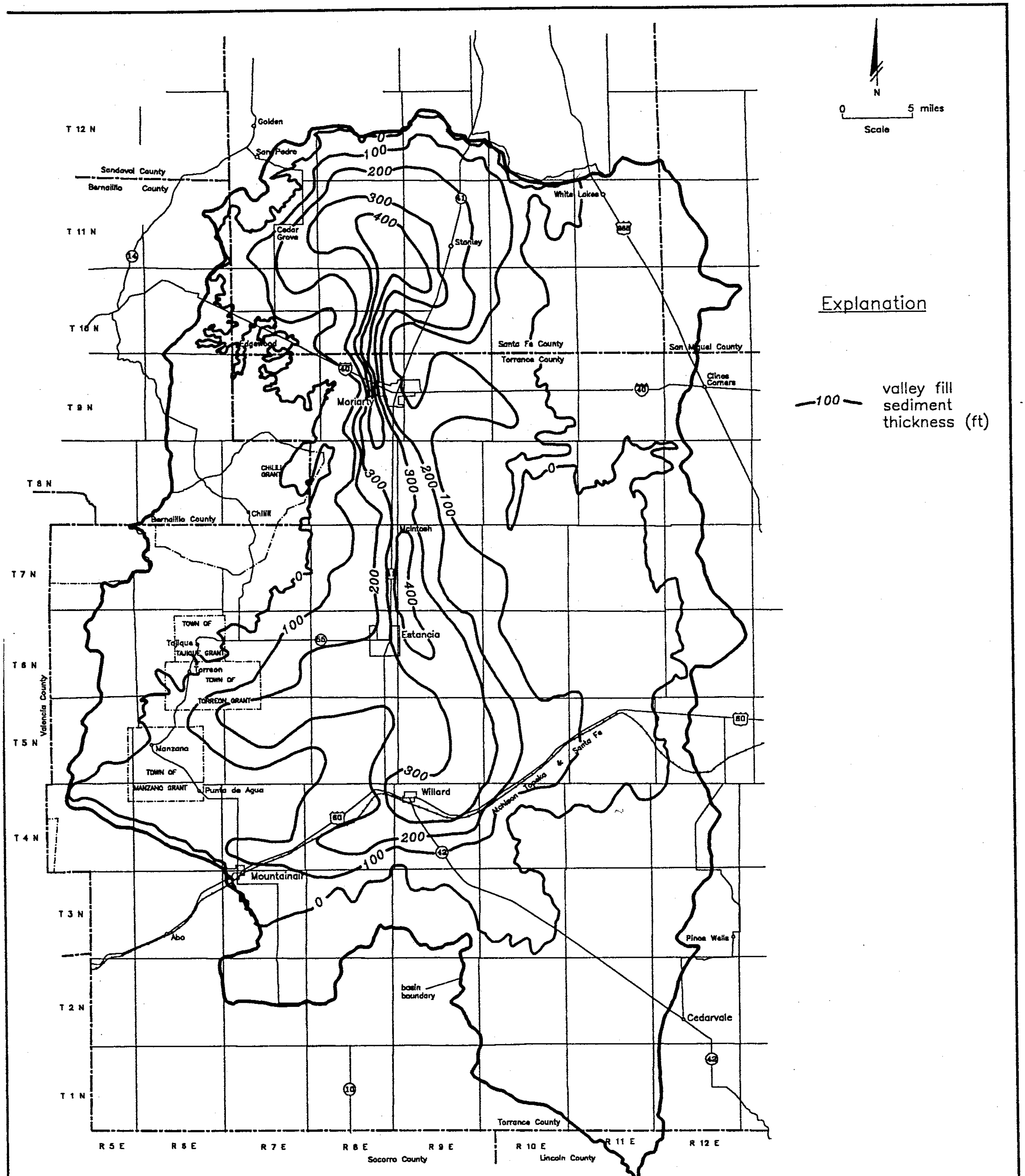


Figure 14. Map showing the extent and thickness of the valley fill sediments in the Estancia Underground Water Basin (modified from unpublished New Mexico State Engineer Office data).

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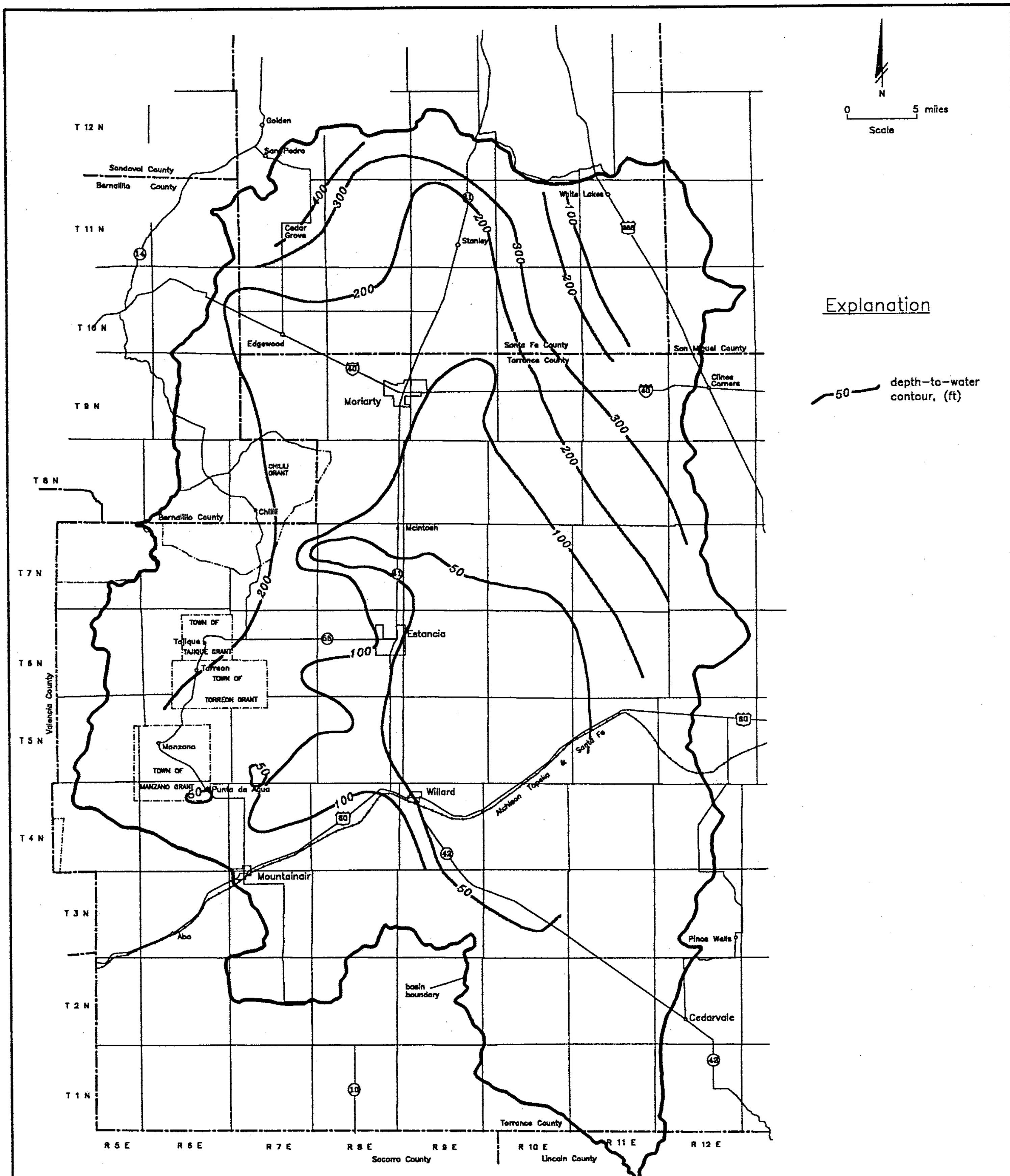


Figure 16. Map showing approximate depth–to–water contours for 1995 in the Estancia Underground Water Basin.

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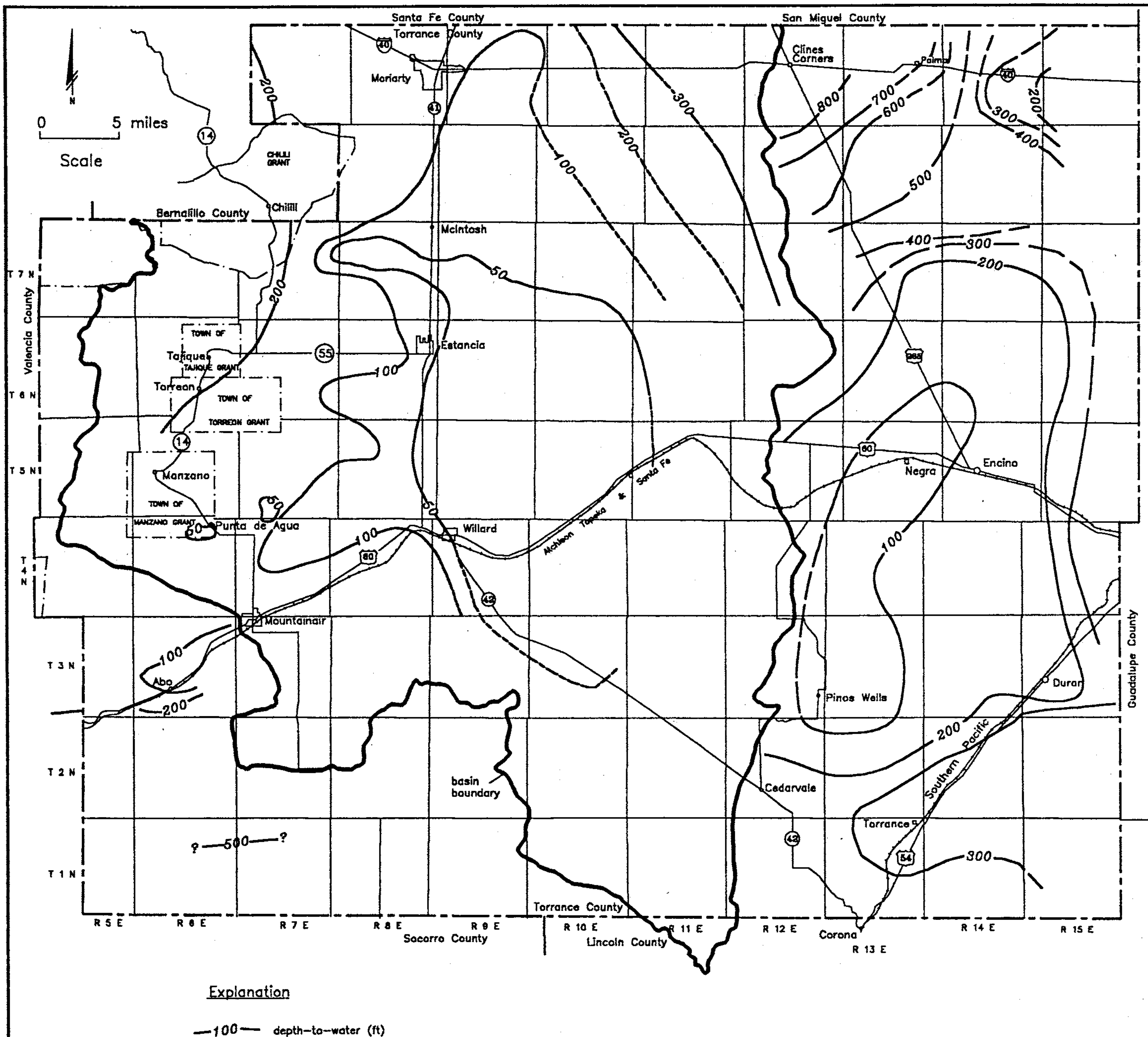


Figure 17. Map showing approximate 1995 depth-to-water for Torrance County.

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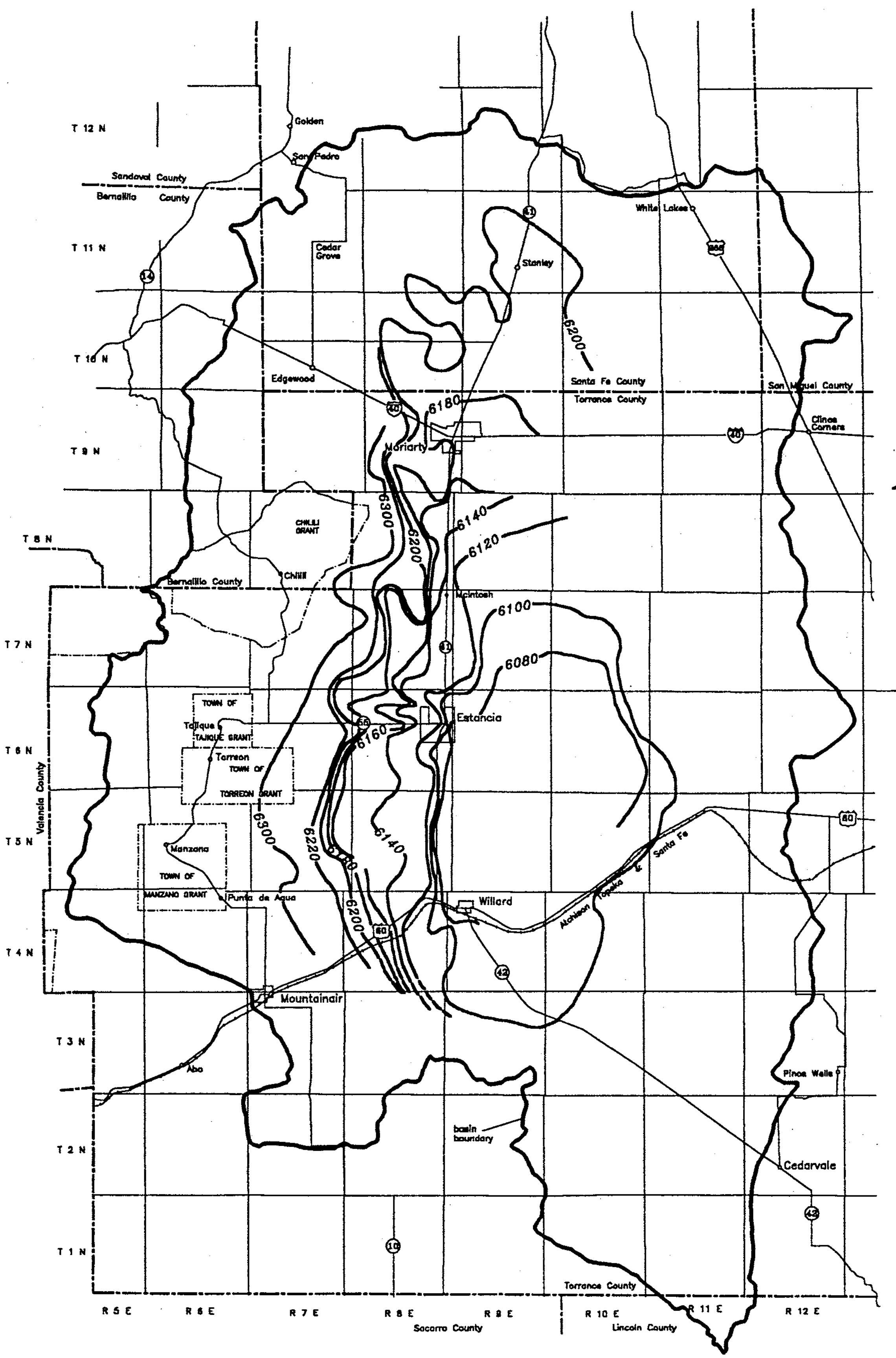


## Explanation

6140 potentiometric surface contours, (ft, msl)

Figure 18. Map showing 1910 potentiometric surface elevation contours in the Estancia Underground Water Basin (modified from Meinzer, 1911).

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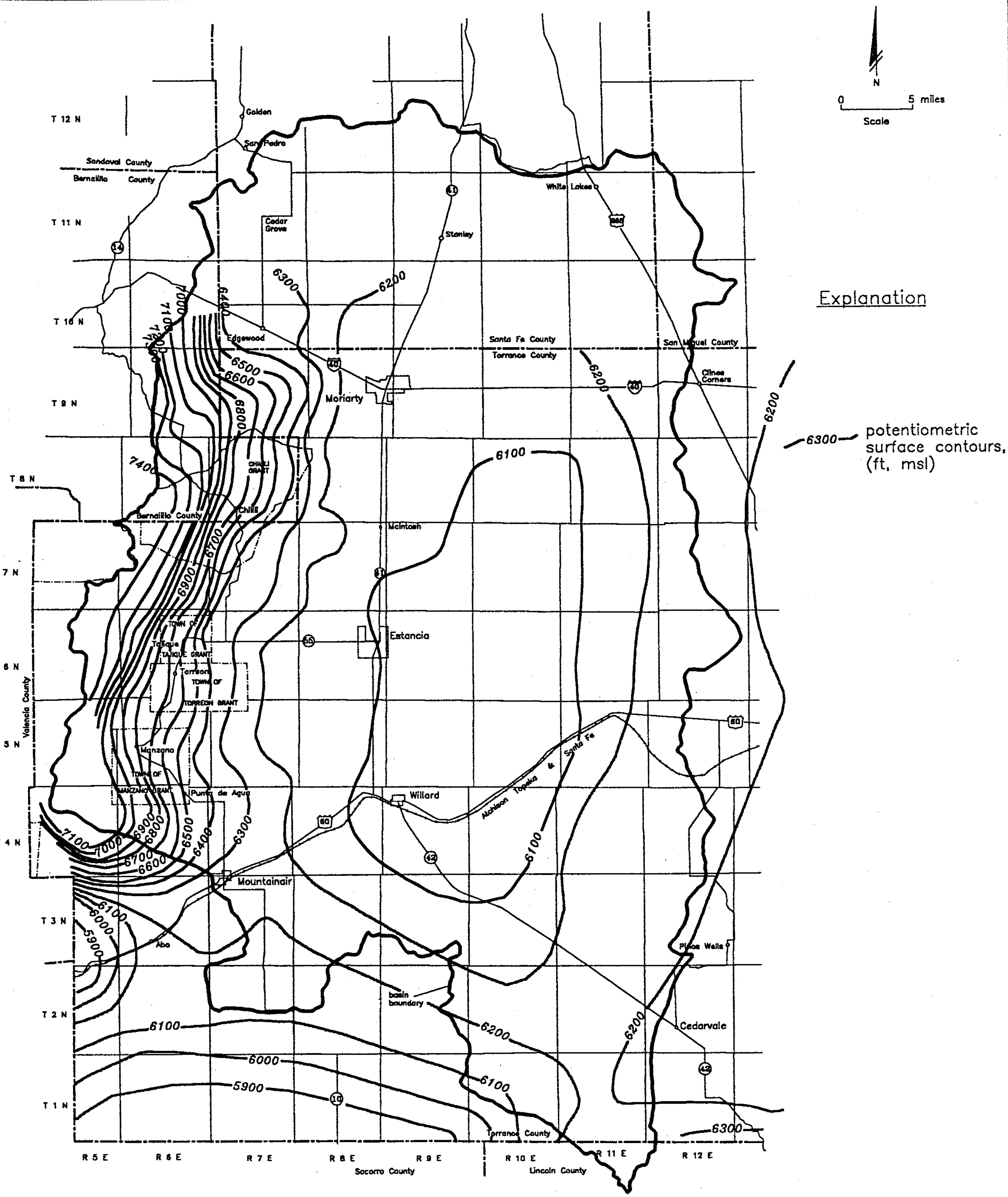


Figure 19. Map showing 1956 potentiometric surface elevation contours for the Estancia Underground Water Basin (modified from Smith, 1957).

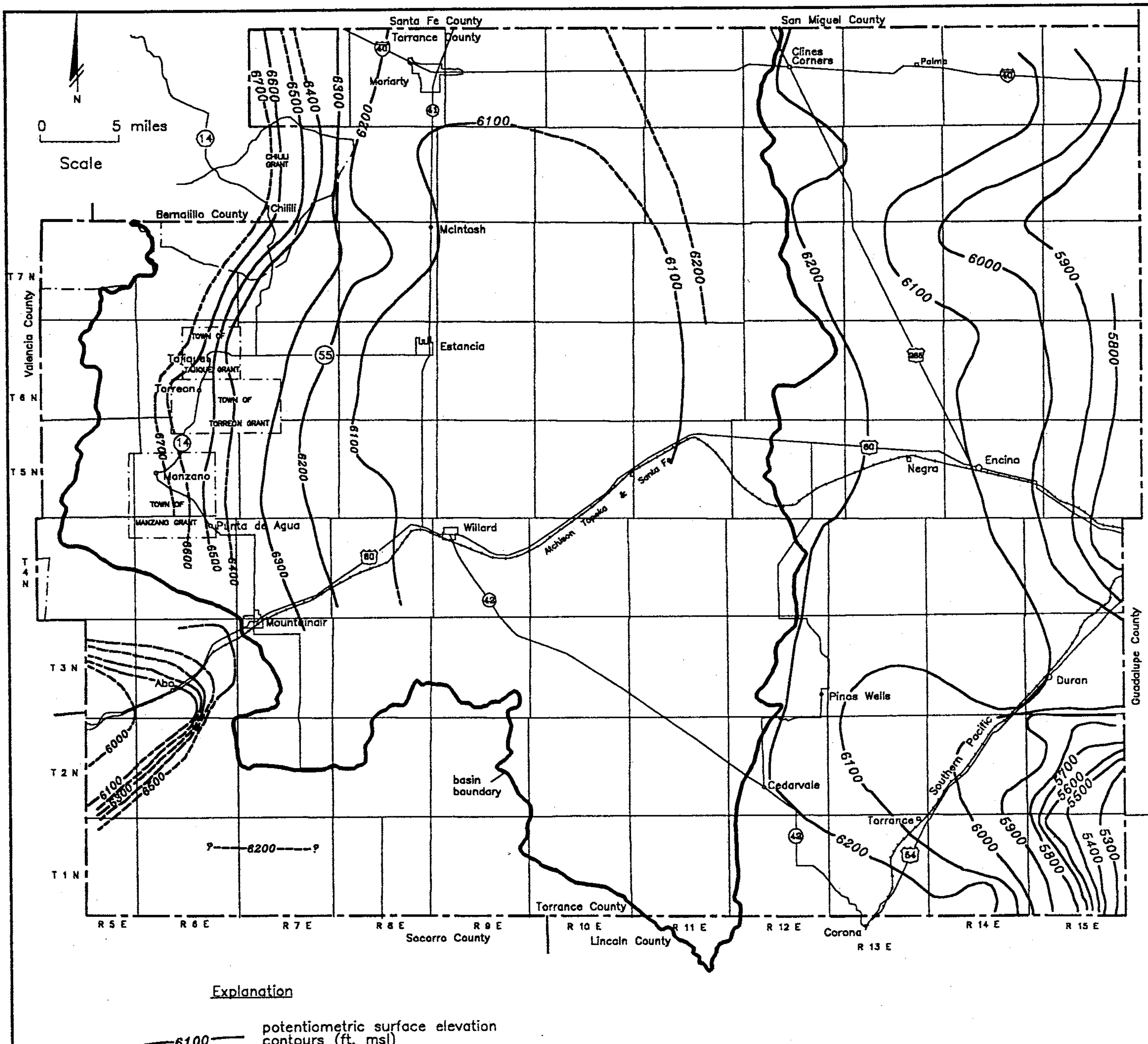


Figure 20. Map showing 1995 potentiometric surface elevation contours in Torrance County.

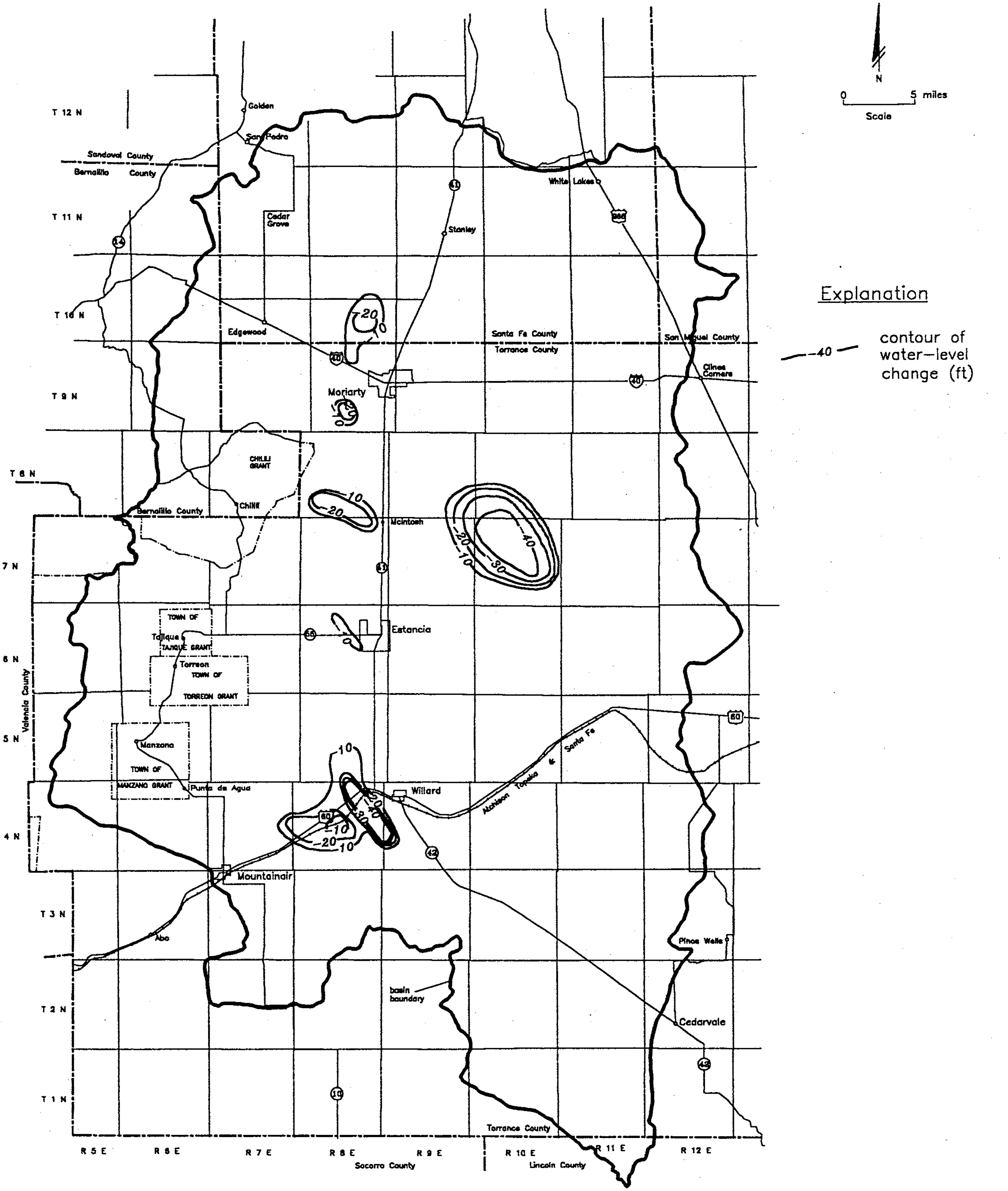

Figure 21. Map showing water—level changes from 1910 to 1956 in the Estancia Underground Water Basin.

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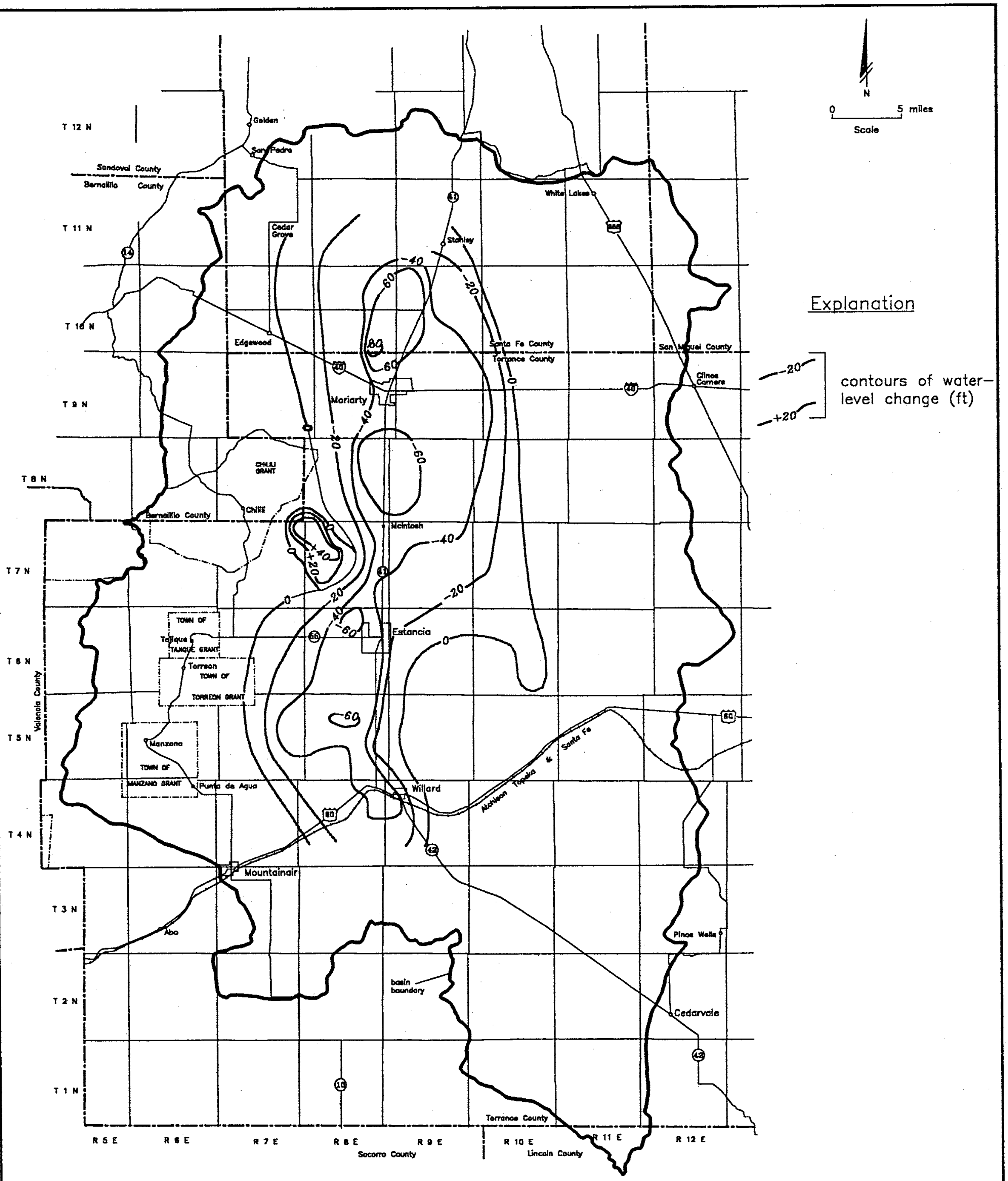


Figure 22. Map showing water-level changes in the valley fill aquifer from approximately 1956 to 1995 in the Estancia Underground Water Basin.

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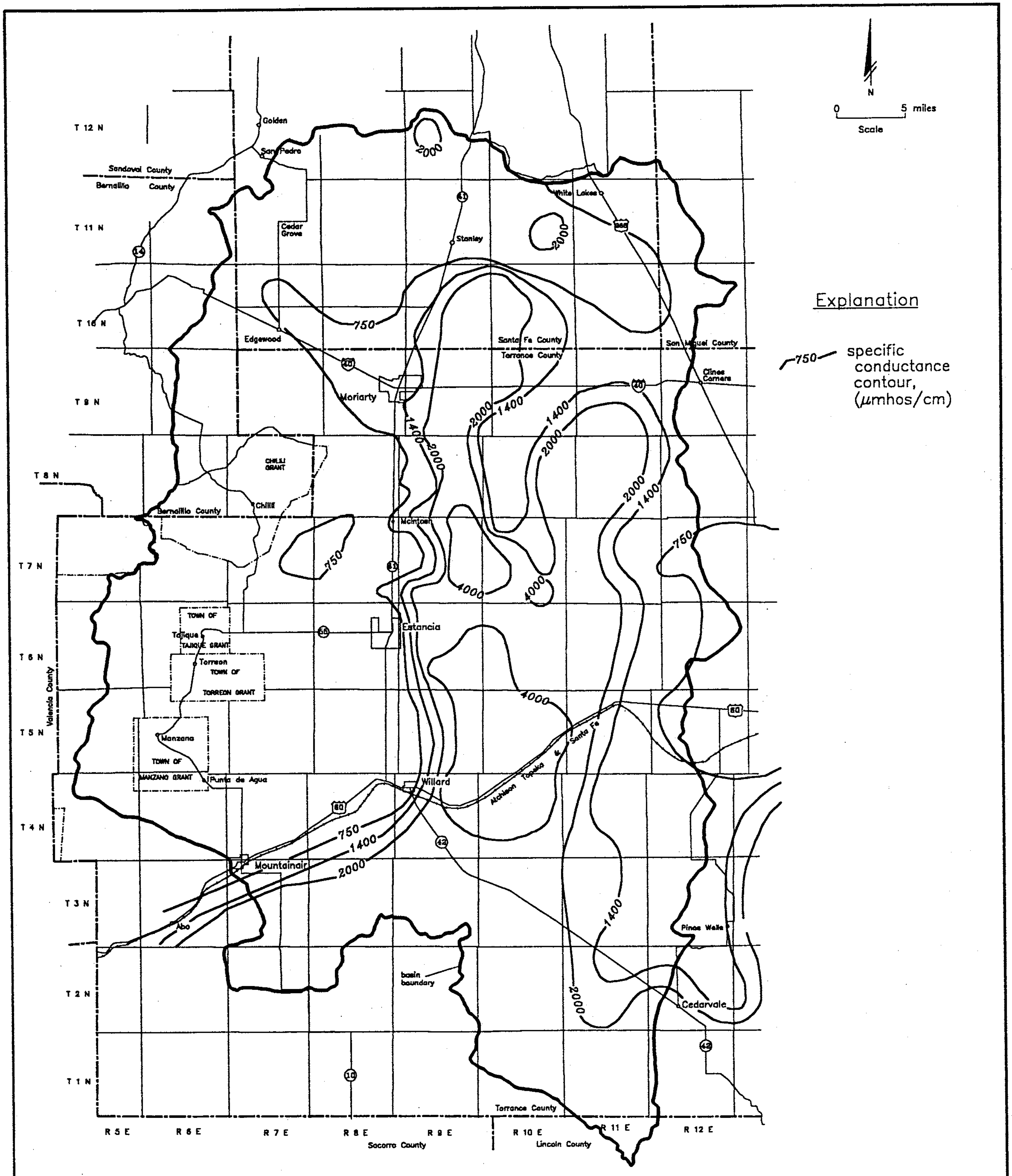


Figure 23. Map showing specific conductance of ground water based primarily on 1956 data (modified from Smith, 1957).

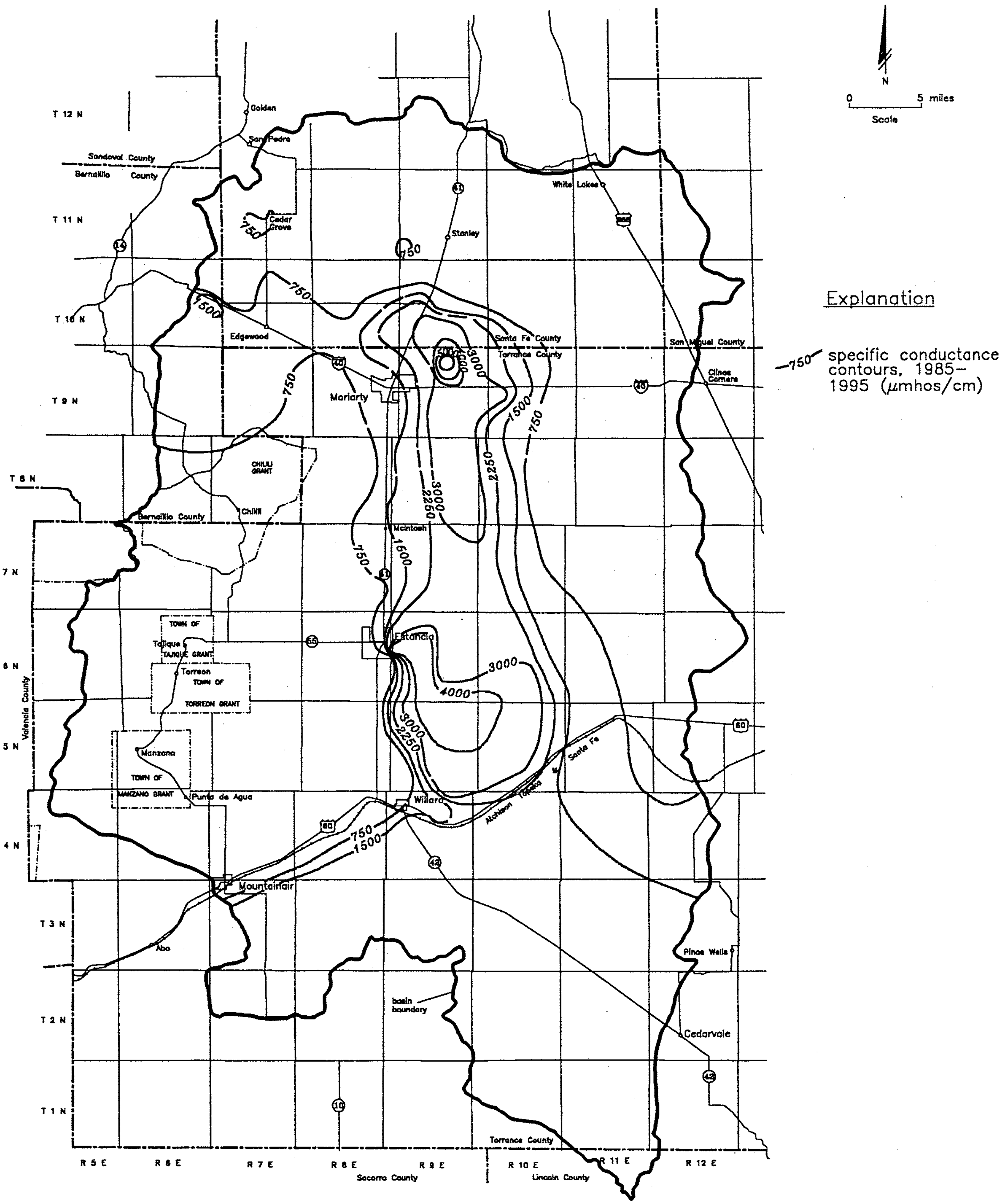


Figure 24. Map showing specific conductance of ground water based on 1985–1995 data, Estancia Underground Water Basin.

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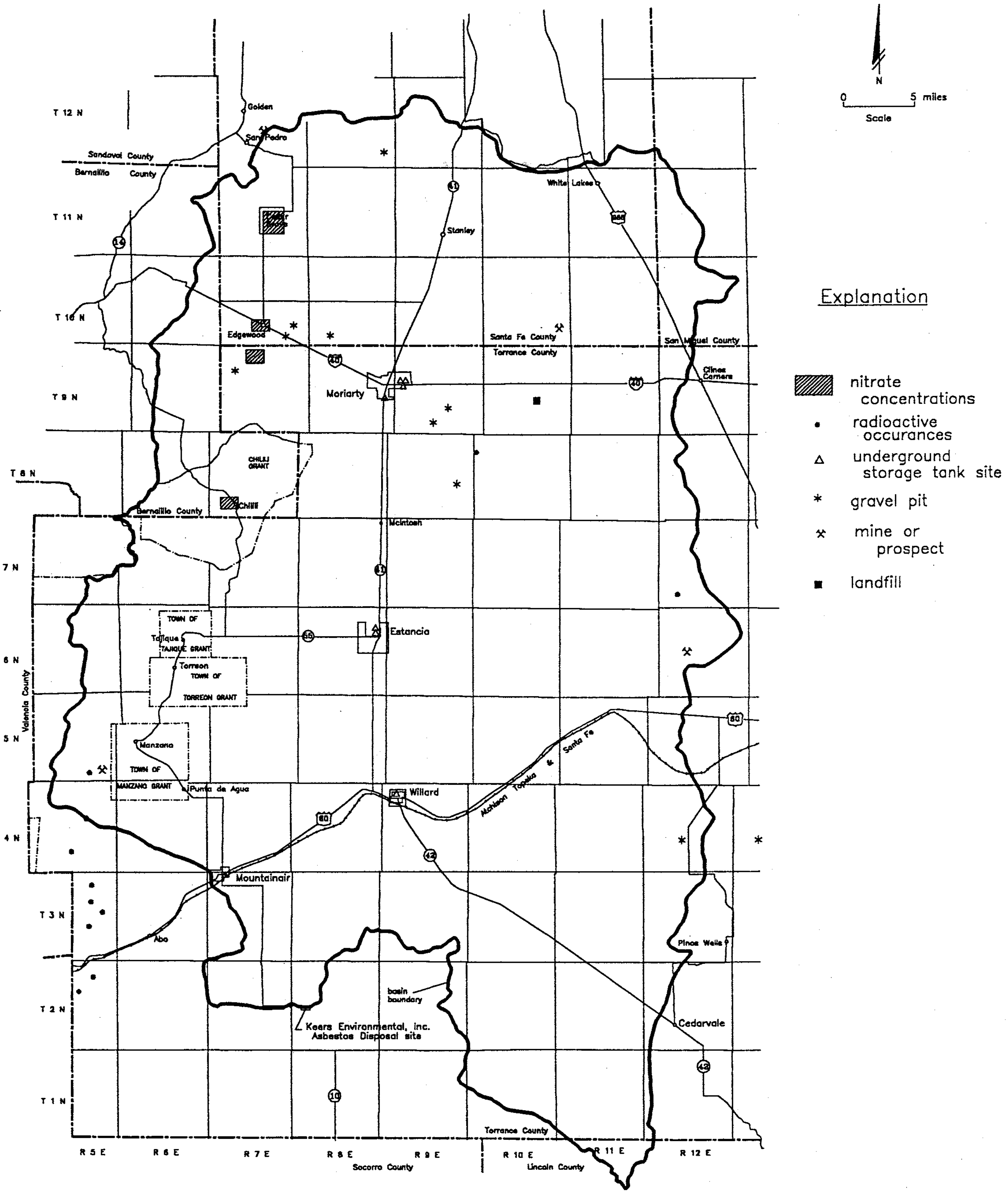


Figure 25. Map showing areas of potential ground-water contamination and possible contaminants present in 1996 in the Estancia Underground Water Basin.

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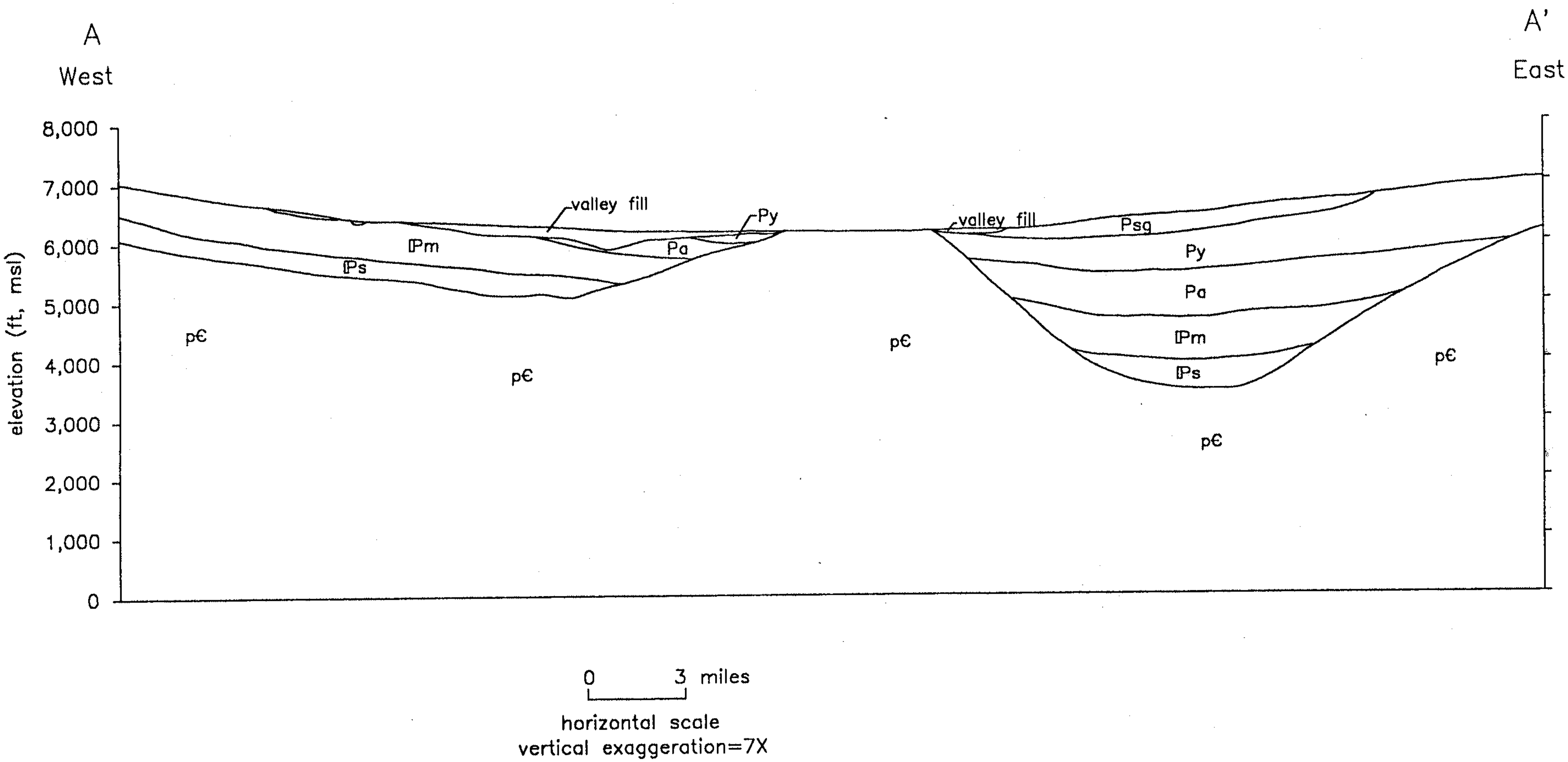


Figure 11. Geologic cross-section A–A', Estancia Underground Water Basin (See Figure 9 for line-of-section and explanation of symbols).

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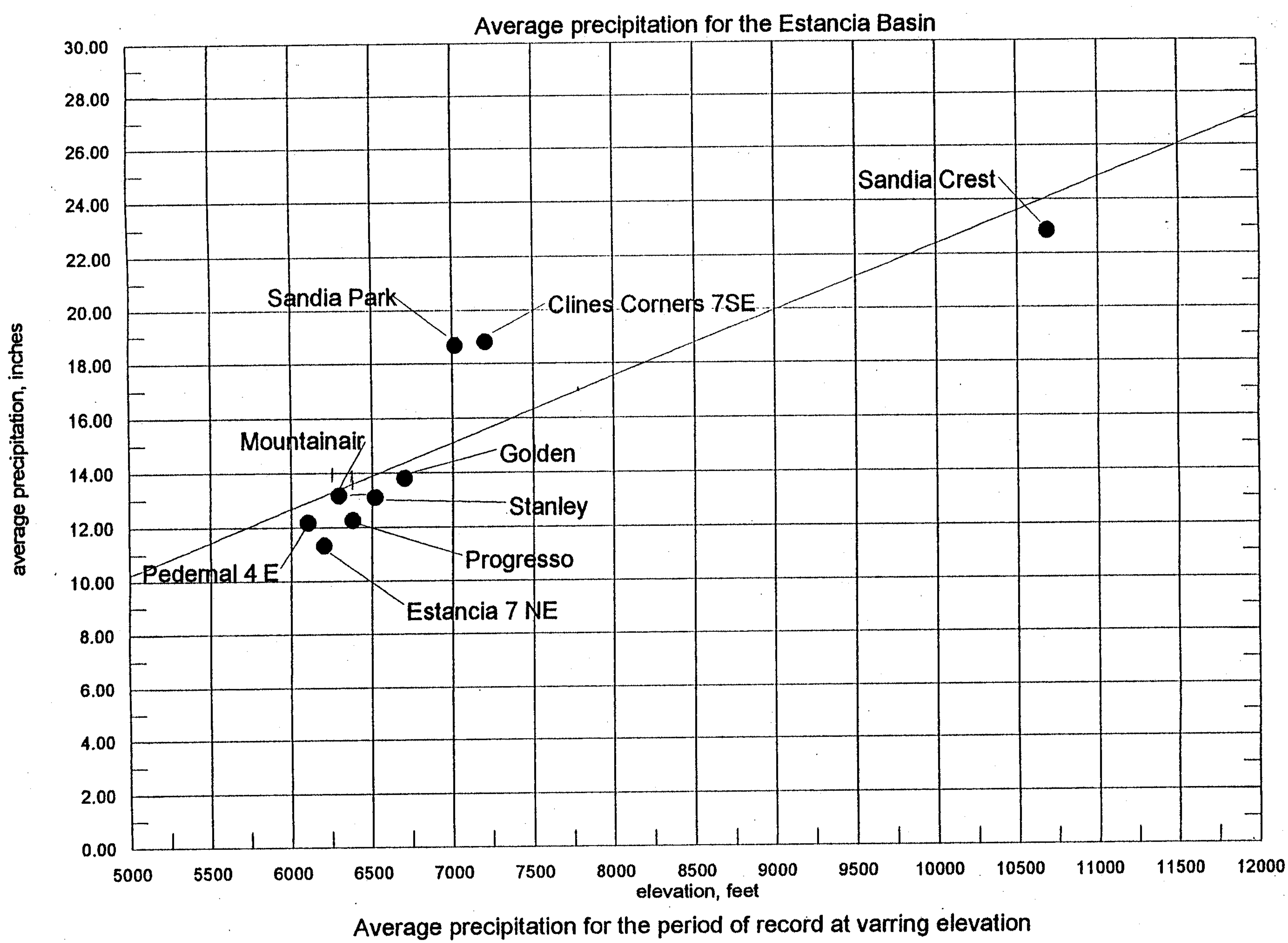


Figure 9. Graph of total annual precipitation versus elevation for weather stations in and near the Estancia Underground Water Basin.

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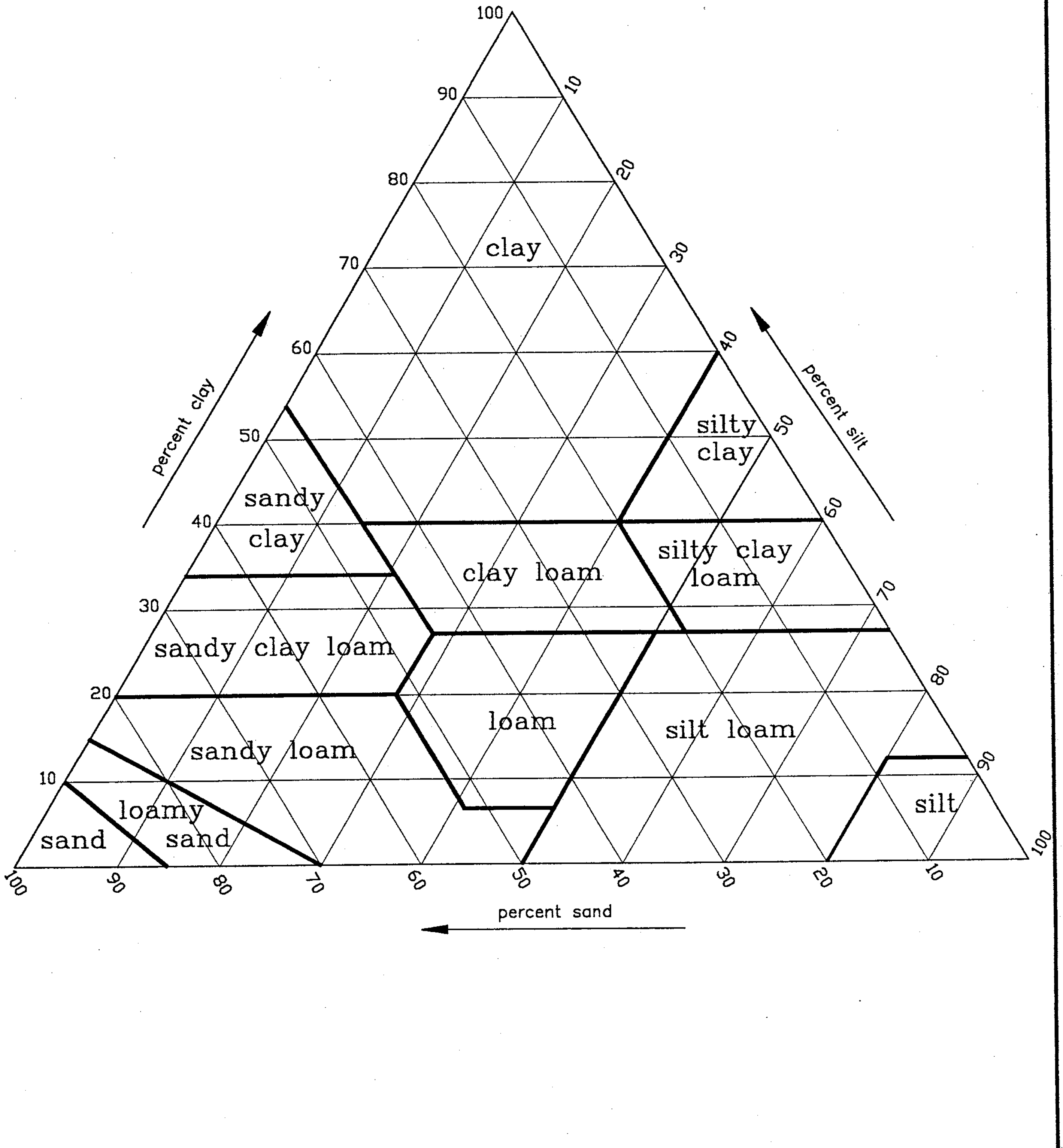


Figure 5. Guide for textural classification, U.S. Department of Agriculture Soil Conservation Service.

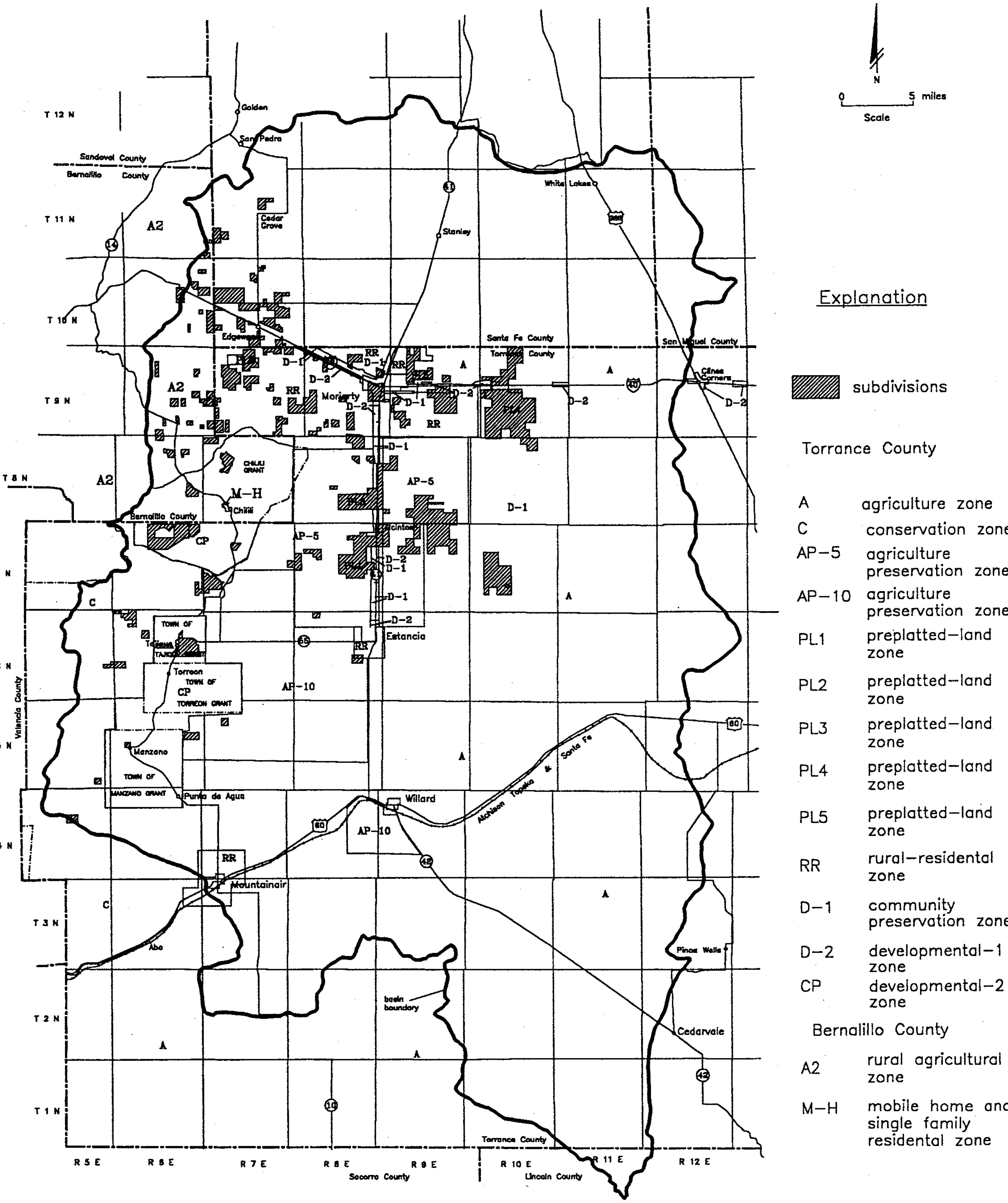


Figure 7. Map showing 1996 subdivisions and zoning areas for the Estanica Underground Water Basin excluding Santa Fe County.