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FEB 4 1988

URFO:TTO
Docket No. 40-8911

Jim Analla, Environmental
Quality Services Officer
Bureau of Indian Affairs
P.O. Box 1060
Mail Code 305E
Gallup, New Mexico 87301

Dear Mr. Analla:

The Uranium Recovery Field Office (URFO) has completed review of all pertinent information involving the Mobil Oil Corporation, Crownpoint, Section 9, In Situ Pilot Test Project, ground-water restoration and reclamation program. An Environmental Assessment (EA) has been written and based on the EA, a draft finding of no significant impact (FONSI) is being forwarded for publication in the Federal Register. The comment period for the draft FONSI will be extended to 60 days to allow all interested parties adequate time to respond. A final FONSI will not be published until we are convinced that all outstanding issues have been adequately addressed. A copy of the EA and the draft FONSI are enclosed.

As I understand it, we have tentatively scheduled two meetings for March 8, 1988. At this phase of the process, it would be beneficial to all concerned to meet for informative sessions. The two scheduled meetings are to assure that all parties are aware of the status of the project and the responsibilities of each party. One meeting will be with the Navajo Tribe Officials at Gallup, New Mexico, at 1:30 p.m., and another with local interested citizens at Crownpoint, that evening. At this time, I anticipate that NRC may have three to seven representatives at the meetings. Please let me know if there are changes to the scheduled meetings.

In terms of agendas for the meetings, I suggest that Mobil start off with a brief history of the project, followed by discussions by each agency on their role, responsibilities and future actions. We should probably try to keep the meetings rather informal with plenty of time for discussion and questions. I also suggest that you lead the meetings for us.

OFC						
NAME						
DATE	88/02/03					

If you have any questions or comments, please feel free to contact me or Mr. Tom Olsen of my staff at (303) 236-2805.

Sincerely,

/S/

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Enclosures: As stated

OFC	URFO	URFO
NAME	TOlsen/lv	EHawkins
DATE	88/02/03	2/4/88

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FEB 3 1988

URFO:TTO
Docket No. 40-8911

Mr. Roger Baer
Bureau of Land Management
Albuquerque District
435 Montano NE
Albuquerque, New Mexico 87107

Dear Mr. Baer:

The Uranium Recovery Field Office (URFO) has completed review of all pertinent information involving the Mobil Oil Corporation, Crownpoint, Section 9, In Situ Pilot Test Project, ground-water restoration and reclamation program. An Environmental Assessment (EA) has been written and based on the EA, a draft finding of no significant impact (FONSI) is being forwarded for publication in the Federal Register. The comment period for the draft FONSI will be extended to 60 days to allow all interested parties adequate time to respond. A final FONSI will not be published until we are convinced that all outstanding issues have been adequately addressed. A copy of the EA and the draft FONSI are enclosed.

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Licensing Branch 1
Uranium Recovery Field Office
Region IV

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URFO:TTO
Docket No. 40-8911

Ernest Rebuck, Program Manager
Ground Water Section
Environmental Improvement Division
New Mexico Health and Environmental Department
P.O. Box 968
Santa Fe, New Mexico 87504-0968

Dear Mr. Rebuck:

The Uranium Recovery Field Office (URFO) has completed review of all pertinent information involving the Mobil Oil Corporation, Crownpoint, Section 9, In Situ Pilot Test Project, ground-water restoration and reclamation program. An Environmental Assessment (EA) has been written and based on the EA, a draft finding of no significant impact (FONSI) is being forwarded for publication in the Federal Register. The comment period for the draft FONSI will be extended to 60 days to allow all interested parties adequate time to respond. A final FONSI will not be published until we are convinced that all outstanding issues have been adequately addressed. A copy of the EA and the draft FONSI are enclosed.

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Sincerely,

/S/

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Enclosures: As stated

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URFO:TTO
Docket No. 40-8911

Jim Cullen, Manager
Technical Services
Mobil Oil Corporation
P.O. Box 17772
Denver, Colorado 80217

Dear Mr. Cullen:

The Uranium Recovery Field Office (URFO) has completed review of all pertinent information involving the Mobil Oil Corporation, Crownpoint, Section 9, In Situ Pilot Test Project, ground-water restoration and reclamation program. An Environmental Assessment (EA) has been written and based on the EA, a draft finding of no significant impact (FONSI) is being forwarded for publication in the Federal Register. The comment period for the draft FONSI will be extended to 60 days to allow all interested parties adequate time to respond. A final FONSI will not be published until we are convinced that all outstanding issues have been adequately addressed. A copy of the EA and the draft FONSI are enclosed.

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Sincerely,

/S/

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office
Region IV

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NAME	TOlsen/lv	EHawkins
DATE	88/02/03	2/3/88

U.S. NUCLEAR REGULATORY COMMISSION

DOCKET NO. 40-8911

MOBIL OIL CORPORATION

DRAFT FINDING OF NO SIGNIFICANT IMPACT REGARDING A TERMINATION OF THE SOURCE AND BYPRODUCT MATERIAL LICENSE FOR OPERATION OF MOBIL OIL CORPORATION'S CROWNPOINT, SECTION 9, IN SITU PILOT TEST PROJECT, MCKINLEY COUNTY, NEW MEXICO.

AGENCY: U.S. Nuclear Regulatory Commission

ACTION: Notice of Draft Finding of No Significant Impact

1. Proposed Action

The proposed administrative action is to terminate the source and byproduct material license authorizing Mobil Oil Corporation to operate the Crownpoint, Section 9, In Situ Pilot Test Project facility located in McKinley County, New Mexico.

2. Reasons for Draft Finding of No Significant Impact

An environmental assessment was prepared by the staff at the U.S. Nuclear Regulatory Commission (NRC) and issued by the Commission's Uranium Recovery Field Office, Region IV. The environmental assessment performed by the Commission's staff evaluated potential impacts onsite and offsite due to radiological releases that may have occurred during the course of the operation. Additionally, an impact assessment was conducted on ground-water restoration efforts at the site. The assessment indicates that ground-water quality at the site was restored to required levels, with the exception of slightly elevated molybdenum concentrations. Documents used in preparing the assessment included the following:

- Environmental and operational information submitted by the licensee to the NRC during the period of October 1, 1986 through November 15, 1987;
- Discussions and written correspondence with the State of New Mexico;
- Site visit by NRC staff on May 11-12, 1987;
- Permit information from the New Mexico Environmental Improvement Division that was transferred to NRC at the time of NRC reassertion of authority over New Mexico licensees in 1986;
- Information derived from professional papers, journals and textbooks; U.S. NRC regulations and regulatory guides; Federal, State and local agencies; and independent consultants; and

° Mobil Oil Corporation's Irrigation Evaluation Report in Support of the Withdrawal of Discharge Plan DP-26, January 1988.

Based on the review of these documents, the Commission has determined that no significant impact will result from the proposed action.

The following statements support the draft finding of no significant impact and summarize the conclusions resulting from the environmental assessment.

A. The site reclamation and decontamination program proposed by Mobil Oil Corporation is sufficient to meet all requirements as specified in 10 CFR Part 40.

B. The ground-water quality at the site has been restored to required concentrations, with the exception of slightly elevated molybdenum concentrations. The elevated molybdenum concentrations are not considered significant due to the very small volume of affected ground water, the natural restoration that will continue to occur over time, and the low probability of use due to the depth to the aquifer and the availability of other, more easily accessible water. Further, it is highly unlikely that additional restoration will provide any more reduction in molybdenum concentration at the Mobil site.

In accordance with 10 CFR Part 51.33(a), the Director, Uranium Recovery Field Office, made the determination to issue a draft finding of no significant impact and to accept comments on the draft finding for a period of 60 days after issuance in the Federal Register.

This finding, together with the environmental assessment setting forth the basis for the finding, is available for public inspection and copying at the Commission's Uranium Recovery Field Office at 730 Simms Street, Golden, Colorado, and at the Commission's Public Document Room at 1717 H Street, Washington, D.C.

Dated at Denver, Colorado, this 4th day of February, 1988.

FOR THE NUCLEAR REGULATORY COMMISSION

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office
Region IV

UNITED STATES NUCLEAR REGULATORY COMMISSION
ENVIRONMENTAL ASSESSMENT

BY THE

URANIUM RECOVERY FIELD OFFICE

IN CONSIDERATION OF THE RELEASE OF
SOURCE MATERIAL LICENSE SUA-1479

FOR

MOBIL OIL CORPORATION
CROWN POINT, SECTION 9, IN SITU PILOT TEST PROJECT
McKINLEY COUNTY, NEW MEXICO

DOCKET NO. 40-8911

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1.0 INTRODUCTION

1.1 Background

Mobil Oil Corporation (Mobil) began uranium exploration in 1972 and commenced research and development activities for in-situ leaching (ISL) of uranium at a site known as Crownpoint, Section 9, In Situ Pilot Test Project, in 1978. This research was initially conducted under the State of New Mexico, Environmental Improvement Division (EID), Permit No. MM-MOB-UL-RI-01. Mobil presently has a USNRC Source Material License No. SUA-1479, as the authority for uranium licensing was transferred to USNRC from New Mexico in 1986, upon the State relinquishing the licensing program. Mobil had two other licenses for in-situ leaching in the same general area, but no leaching was ever performed at either site. These licenses were subsequently terminated. During the period of November 1979, through October 1980, test patterns which utilized sodium bicarbonate lixiviants were operated at the Crownpoint, Section 9 site.

Since October of 1980, Mobil has been actively conducting aquifer restoration at this research and development (R&D) test site. Since that time, several concerns have arisen regarding the adequacy of restoration and the environmental impacts of the contamination of the ground water. The remaining major concern of the NRC is the presence of somewhat elevated concentrations of molybdenum in water samples from wells throughout the site. Mobil's original license with New Mexico established a molybdenum ground-water standard at 1 mg/l concentration. This standard is based on an irrigation criteria for the State of New Mexico. When comparing present Mobil site ground-water concentrations with baseline concentrations, it is evident that molybdenum at the Mobil site is somewhat elevated, but is not considered excessive in concentration.

In addition to ground-water restoration, Mobil will be required to complete surface reclamation and decontamination of their facility. The surface reclamation will be implemented through the State of New Mexico Environmental Improvement Division and decontamination will be completed in accordance with Code of Federal Regulations, Part 40, Appendix A, Criterion 6.

The purpose of an ISL R&D facility is to ensure that all phases of a mining operation and subsequent restoration can be accomplished as a prototype to a larger full-scale mining effort. In all cases, the ISL R&D must be operated in a safe manner and restoration must show that ground water is restored to an acceptable quality. The small scale of an ISL R&D ensures that if ground-water restoration is not

successful, the subsurface contamination is not extensive and is usually confined to a very small area.

1.2 Basis of NRC Review

An impact appraisal for the termination of Source Material License SUA-1479 has been performed by Region IV, Uranium Recovery Field Office (URFO) of the U.S. Nucelar Regulatory Commission (NRC). This report documents that appraisal. The staff performed the appraisal of environmental impacts in accordance with Title 10, Code of Federal Regulations (10 CFR Part 51, Licensing and Regulatory Policy and Procedures for Environmental Protection). In conducting this appraisal, the staff considered the following sources:

- Environmental and operational information submitted by the licensee to the NRC during the period of October 1, 1986, through November 15, 1987;
- Discussions and written correspondence with the State of New Mexico, EID;
- Site visit by NRC staff on May 11-12, 1987;
- Permit information from the New Mexico EID that was transferred to NRC at the time of NRC reassertion of authority over New Mexico licenses in 1986.
- Information derived from professional papers, journals and testbooks; U.S. NRC Regulations and Regulatory Guides; Federal, State and local agencies; and independent consultants.

The purpose of this environmental assessment is to evaluate the nature of any remaining contamination, its statistical significance with respect to baseline variability, and its overall impact on the potential uses of the aquifer.

The analysis has been extremely difficult due to the hydrogeology of the site, complexities imposed by operational difficulties encountered during leaching and restoration, a high degree of natural variability and the small area of previous mining activity. Due to the high degree of uncertainty in the analysis of the ground-water quality data, no value of concentration or statistical function of concentration is used as a rigid criterion on which to base decisions.

2.0 SITE DESCRIPTION

This section describes the natural environment of the mining area and surrounding region. Data have been compiled through literature search, other projects in the vicinity and programs initiated by Mobil. More complete descriptions can be found in appendices and text of the Mobil license application (Mobil, 1978), Mobil restoration reports (Mobil, 1980-1987) and in Muck (1982).

2.1 Site Location and Topography

The Crownpoint, Section 9, In Situ Pilot Test Project (Figure 1) is located in McKinley County, New Mexico, approximately 6 miles west of Crownpoint, New Mexico. It consists of about 5 acres and is part of a single Navajo allotted lease of 160 acres.

The Crownpoint area lies within the Colorado Plateau Physiographic Province as defined by Fenneman (1931). This section is characterized by old plateaus, up-lifts, basins, dams and synclinal structures. In the vicinity of the ISL site, relief is not great as elevations in the area generally range between 5500 feet and 7000 feet. The land surface near the site dips gently to north and arroyos are in evidence throughout the area. The site elevation is approximately 6700 feet MSL.

In the project area, surface runoff generally is confined to numerous small, closed basins. These basins are characterized by poorly defined drainage networks where runoff is carried to lowland depressions. Due to the seasonal nature of runoff and to high evaporation rates, these depressions are frequently dry.

2.2 Geology

2.2.1 Regional Geology

The project site lies along the southwestern side of the San Juan Basin, a major structural basin covering most of northwestern New Mexico. The basin is a circular structure that also trends into Southwestern Colorado.

The San Juan Basin (see Figure 2) is composed of several thousand feet of Paleozoic, Mesozoic and sedimentary rocks which dip toward the center of the basin. Along the margins of the basin, synclinal and dome structures are present.

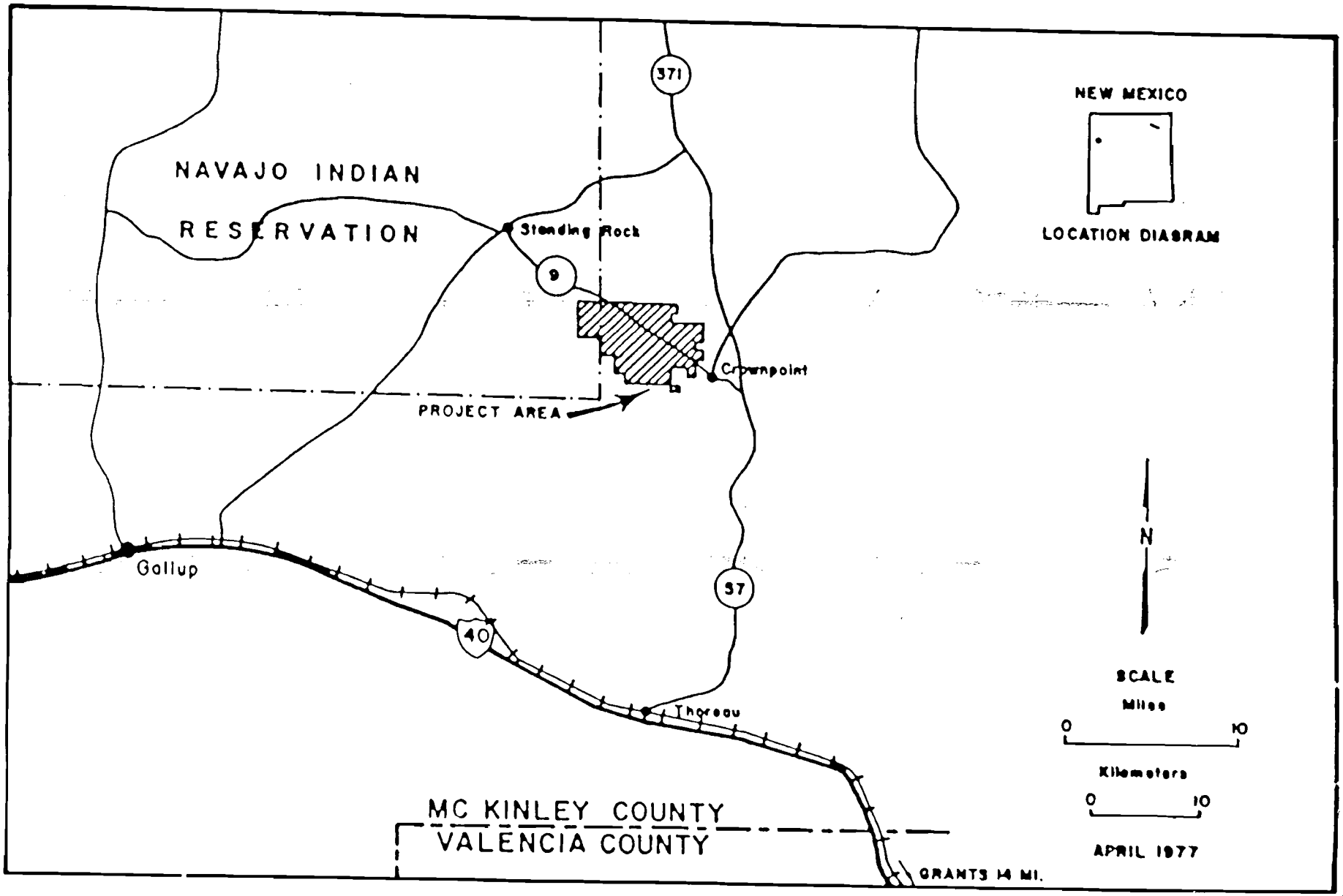
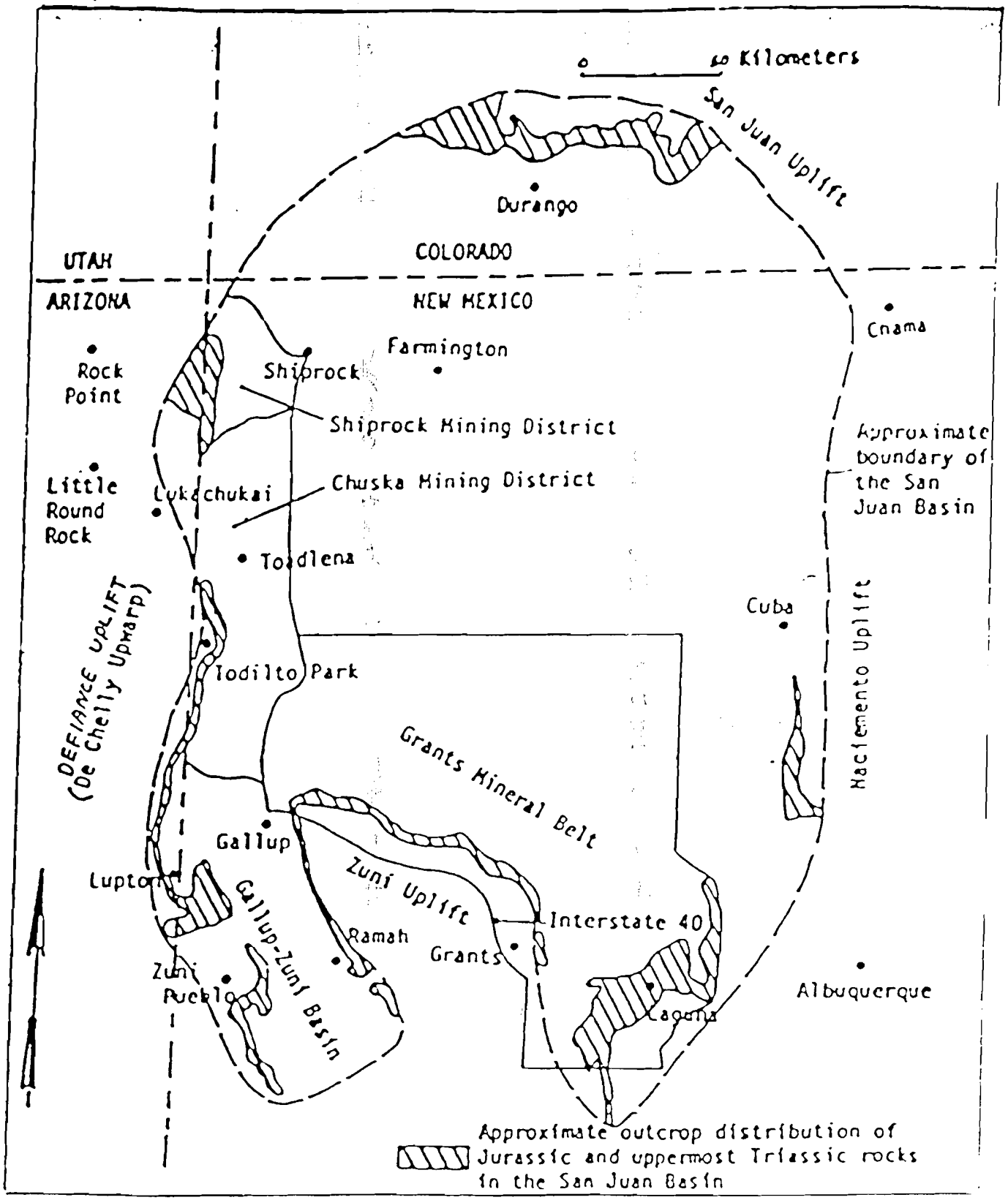


Figure 1. Crownpoint Project Area

Figure 2



Index map of the San Juan Basin and adjacent areas showing major tectonic features, outcropping uppermost Triassic and Jurassic sedimentary rocks (lined), and uranium mining areas.

Location Map of the Grants Mineral Belt.

(after Pierson and Green, 1977).

Figure 3 presents a generalized description of the formations outcropping on the southwestern side of the San Juan Basin, including the project site.

2.2.2 Site Geology

Formations exposed on the project site and immediate vicinity are mapped on Figure 4. The Westwater Canyon Member of the Middle Jurassic Morrison Formation contains the orebody in which in-situ R&D operations were conducted.

The Westwater Canyon Member consists of interbedded fluvial, red, tan and light gray arkosic sandstone, claystone and mudstone. The Westwater Canyon Member is approximately 50 feet thick near the ISL site. The Westwater Canyon Member is characterized by sandstone containing cross-bedding, pebbles and silicified logs, and is a water bearing unit throughout the San Juan Basin. At the project site, uranium occurs in coarse-grained, poorly-sorted sandstone units.

The Recapture Creek Member, the lower member of the Morrison Formation, underlies the Westwater Canyon (refer to Figure 3). This formation consists primarily of thin beds of siltstone and sandstone. No uranium deposits of any significance occur in the Recapture Member.

The Brushy Basin Member, the upper member of the Morrison Formation, overlies the Westwater Canyon (refer to Figure 3). The Brushy Basin contains mudstone and sandstone and intertongues with the Westwater. The Brushy Basin is approximately 150 feet thick at the ISL site, and contains no uranium deposits of any significance.

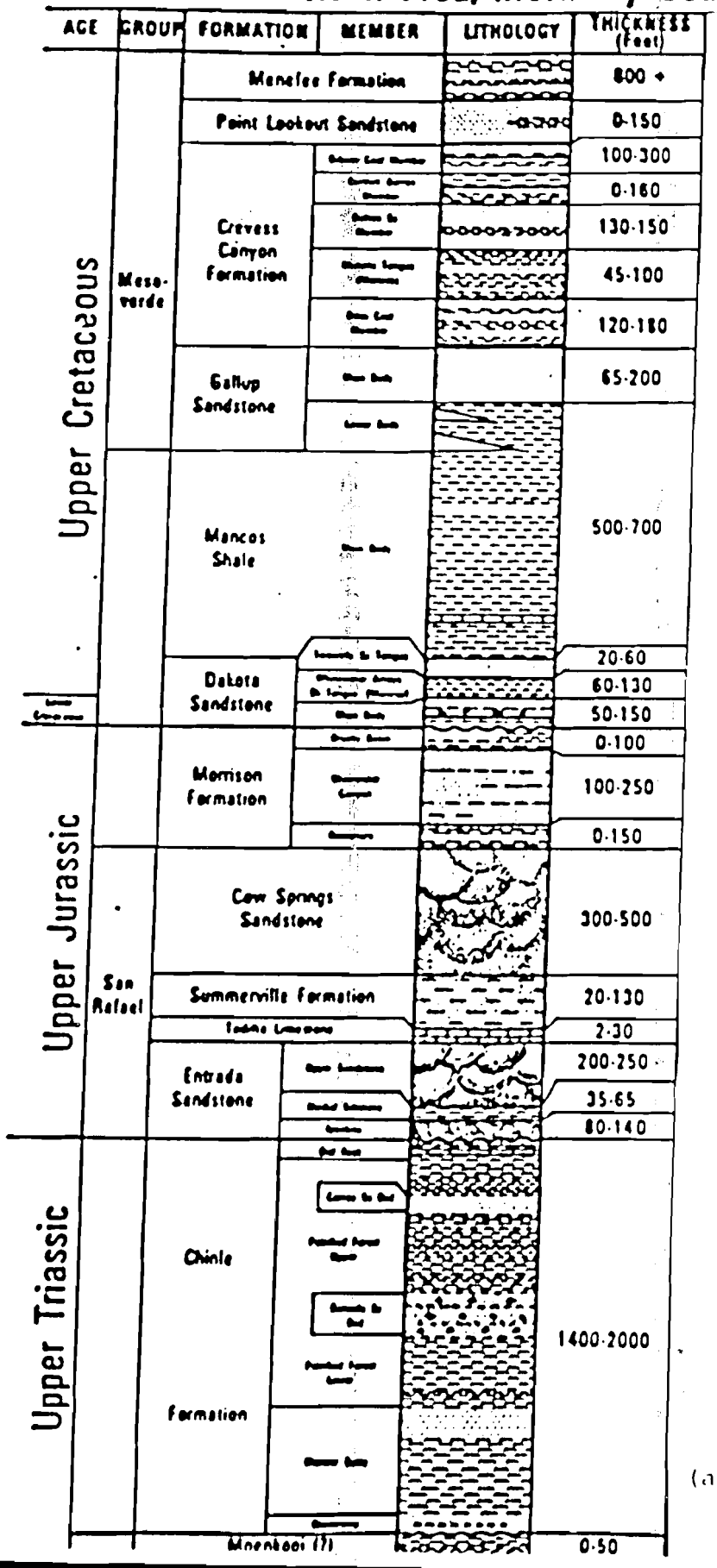
2.2.3 Uranium Mineralization

Typically, uranium mineralization is deposited by reduction and subsequent precipitation in a "roll front," which is C-shaped in vertical section with the leading edge pointing downdip. The Crownpoint deposit is a typical "roll front" deposit with discernible oxidation-reduction boundaries in the host rock. The principal uranium mineral has been identified as uranite (UO_2). Most of the uranium ore has been identified in a sandstone strata approximately 30 feet in thickness.

The uranium ore commonly occurs as lenticular, tabular or coalescing masses in the Crownpoint vicinity. The ore bodies are usually oriented parallel to the paleo-channel trends,

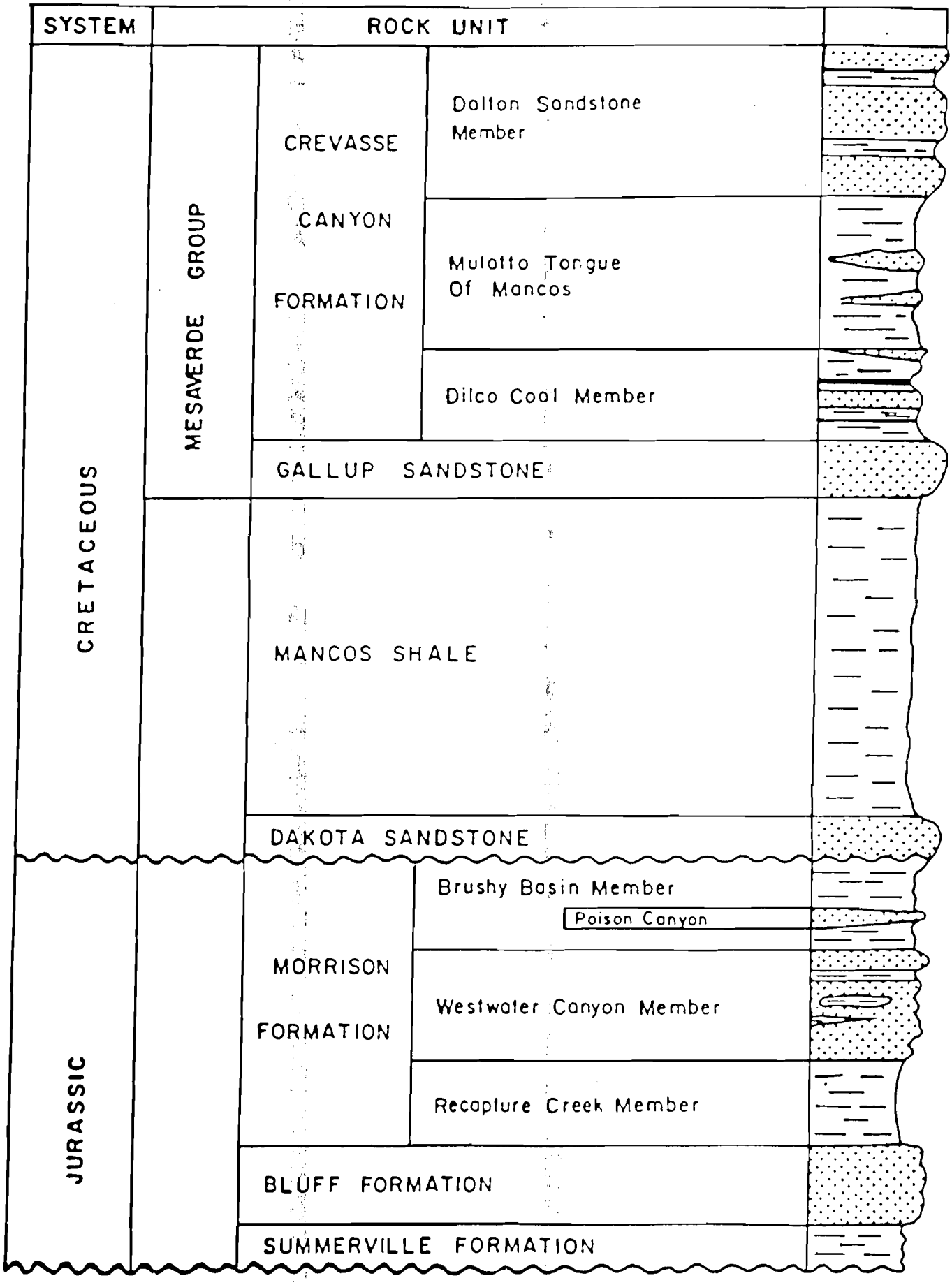
Figure 3

Stratigraphic section, Church Rock area, McKinley County, New Mexico



(after Chenoweth and Holen, 196

Figure 4



STRATIGRAPHIC COLUMN
SEDIMENTARY UNITS PRESENT IN SEC. 9-T. 17 N.-R. 13 W.

either northwest-southeast or west-east. The ore may occur in channel thicks as well as near shale-sand contacts of intervening mudstones. On a smaller scale, ore may be localized along bedding planes, clay gall horizons, fossil log jams, cross-bedding or other primary sedimentary structures.

Migrating uranyl dicarbonate complexes, (possibly $UO_2(CO_3)_3^{-4}$,) in the ground-water system were adsorbed by the organic matter. The UO_2^{+2} was captured by an ion exchange or chelation process, and the organically bound uranium was readily reduced and internally distributed. Some organic matter would be oxidized, but much more would be freed to adsorb uranium complexes. Leventhal (1979) notes organic matter may concentrate uranium 10,000 times from water.

The width of the orebody is extremely variable. Average depth is approximately 2,000 feet to the mineralized zone, but can be as much as 2,100 feet in a downdip direction.

2.3 Ground-Water Hydrology

2.3.1 Regional Flow System

Ground water in the region occurs both in unconsolidated sediments and in bedrock aquifers. Except for alluvial deposits in valley areas, unconsolidated deposits have not been developed as sources of ground water. The occurrence of ground water in bedrock aquifers is largely dictated by structure and stratigraphy associated with the San Juan Basin. Flow in these aquifers generally is downdip.

2.3.1.1 Bedrock Aquifer System

Regional aquifers have been grouped into "multiple aquifer" systems in northwestern New Mexico on the basis of hydrologic interrelationships. One of these regional systems underlies the Crownpoint Project and includes the Morrison Formation and the Dakota Sandstone.

The Dakota Sandstone is overlain by the Mancos Shale, a thick aquiclude. The Mancos Shale underlies and intertongues with the Mesaverde Group, which includes several aquifers of regional significance: the Gallup Sandstone, the Crevasse Canyon Formation, the Point Lookout Sandstone and the Menefee Formation (refer to Figure 2), all of which are utilized as water sources in McKinley County.

Regional water movement is northward, generally downdip. movement of ground water in the Mesaverde Group is impeded by low permeabilities (generally less than 10 gpd/ft^2), by facies changes and by thinning of the aquifers downdip.

Recharge to the aquifers is by precipitation and by runoff in ephemeral stream channels in the outcrop areas. The Jurassic and Cretaceous rocks crop out in narrow bands on the south and west sides of the San Juan Basin divide.

Ground-water discharge is believed to occur to the San Juan River. Some discharge to springs occurs within the region, where fractures provide avenues for upward movement, but no such springs are known within the project area vicinity.

Alluvial deposits are used as aquifers in places within the region, but they are generally limited and are mostly less than 50 feet thick. The permeability of alluvial deposits is higher than that of older materials, allowing rapid infiltration of storm runoff and snowmelt.

2.3.2 Site Hydrogeology

Detailed information on the ground-water hydrology of the site was obtained by conducting several multiple well aquifer tests. The tests were made to determine drawdown, capacity, direction of flow, and establish control boundaries.

2.3.2.1 Aquifers

In the vicinity of the Crownpoint Project area, the Westwater Canyon Member of the Morrison Formation is the principal aquifer, in that potential yield of good-quality water is greater than for other aquifers in the area. It is also the host rock for most of the uranium ore. Most wells in the vicinity of the Crownpoint Project, however, are in the Mesaverde Group, of which the most commonly used aquifer is the Gallup Sandstone.

The basal unit of the Morrison Formation is the Recapture Creek Member and it consists of of siltstone, shale and fine-grained sandstone, which does not yield significant amounts of water.

The Westwater Canyon Member overlies and in places intertongues with the Recapture Creek Member and consists of poorly sorted, fine- to coarse-grained sandstone

containing claystone and mudstone. At the Crownpoint Project, the formation is about 260 feet thick. Dip of the formation is northward at about 100 ft/mi.

The Brushy Basin Member of the Morrison Formation overlies and intertongues with the Westwater Canyon Member. It consists of 150 feet of gypsiferous and bentonitic mudstone containing lenses of coarse sandstone and a few thin beds of limestone. It has been shown from testing to be a confining layer for water in the underlying Westwater Canyon Member.

2.3.2.2 Aquifer Test Results

An aquifer pump test in the Westwater Canyon Member of the Morrison Fromation was made on the proposed pilot ISL site (see Appendix A) in February, 1978.

Seven observation wells (see Appendix A), Wells 9U-208, 9U-210, 9U-218, 9U-220, 9U-221, 9U-222 and 9U-224, were drilled and equipped to monitor the water level in the Westwater aquifer during pumping operations. Wells 9U-208, 9U-210, 9U-218 and 9U-220 were also designed to be used as injection wells in the pilot test. The pumped well, Well 9U-214, was located at the center of the injection-recovery well array for the ISL pilot testing. An eighth well, Well 9U-207, was constructed specifically to determine if the Dakota and Westwater Canyon members are in direct pressure communication in the area affecting the pilot project. They are separated by the Brushy Basin Member.

The pump test was comprised of a 72-hour constant yield (79 gpm) test followed by a 72-hour recovery period. Water level measurements in the observation wells were obtained with water level recorders.

The pump test results also indicated that the net sandstone contributing to flow on a regional basis can vary as a result of the interbedding of the shale and sandstone members of the Westwater Canyon aquifer. Transmissivity was found to vary from 1100 gallons per day per foot (gal/d/ft) to 2200 gal/d/ft, for an average of 1400 gal/d/ft. This change is due to both thickness and permeability changes in the area tested during pumping operations. A pressure decline of approximately 0.5 feet was noted in the Dakota Sandstone well during the pumping

operation. The results of the aquifer test are presented in Appendix A of this report.

A 13-day constant yield test was made in the Westwater Canyon sandstone in Section 16, approximately 2 miles southeast of the pilot leach area on Mobil property in March-April, 1977. A transmissivity of about 2000 gal/d/ft and a storage coefficient of $1X10^{-4}$ were indicated.

There was not any indication of geological boundaries (i.e., faults, fractures) being encountered in either of the two pump tests. The time length of the tests suggests the area of influence in each test overlapped. The order of magnitude of the hydrologic properties indicated are similar and support the contention that the Westwater is a very large regional aquifer.

2.3.3 Baseline Ground-Water Quality

2.3.3.1 Regional

Chemical analyses of ground water in the region indicate that sodium sulfate is the predominant type of water. The absence of calcareous rocks in the Upper Cretaceous and Tertiary rock has resulted in the lower concentrations of calcium and bicarbonate. In general, ground water is of low quality by drinking water standards. Much of the ground water is not suitable for irrigation because of its high salinity.

2.3.3.2 Mining Area

Chemical and radiochemical composition of ground water from the mining area is typical of the ground-water quality in the region. The water contains sodium sulfate, with calcium and bicarbonate as secondary constituents. Total dissolved solids (TDS) range between 250 and 10,000 mg/l. Sulfate concentrations range between 40 and 1,800 mg.l, while chlorides range from 5 to 1,100 mg/l. Radioactive constituents in the orebody are not pronounced, with radium-226 ranging up to 500 pCi/l. the present ground water in much of the orebody is of fair quality and is, in most cases, suitable for a variety of uses.

2.3.3.3 ISL Site

Baseline chemical and radiochemical analyses of ground water from wells in the Crownpoint ISL R&D site are summarized in Appendix B. Ground water from the site is typical of regional waters in that it is fair quality sodium sulfate water. As indicated in Appendix B, chemical composition is moderately variable with TDS concentrations ranging from 200 to 400 mg/l, sulfate concentrations ranging from 40 to 100 mg/l, and chloride concentrations ranging from 50 to 100 mg/l.

3.0 HISTORY OF OPERATIONS

3.1 Description of the In Situ Leaching Process

If hydrogeologic conditions are favorable, in situ leaching of uranium is presently the foremost technical and cost effective mining method in use today. There are many advantages to this method, and the environmental impacts from in situ leaching are much less severe than the impacts from conventional mining methods. The potential for the greatest impact of the in situ method is the contamination of ground water in the host aquifer. In most cases, the ground water can be restored to baseline quality or premining use category. The in situ leaching method also will permit economical recovery of deep, low-grade roll-front deposits that are not economically recoverable with conventional methods. The extent to which in situ techniques are effective is limited by the hydrologic and mineralogic characteristics of the ore zone.

Basically, the in situ leaching method involves: (1) the injection of a leach solution (called the lixiviant) into a permeable uranium ore body via injection wells to mobilize the uranium; (2) the recovery of the pregnant solution via recovery wells; and (3) the separation of the uranium from the leach solution by ion exchange. The mobilization of uranium in the ore zone involves oxidation of tetravalent uranium to hexavalent uranium and subsequent anionic complexing of the hexavalent uranium. In a carbonate lixiviant, uranium is oxidized by oxygen and complexed with carbonate ions to form mobile complexes of uranyl dicarbonate and uranyl tricarbonate. The leaching process also introduces other chemical reactions in the ore body, causing mobilization of some ions and precipitation of others. After the leaching phase is completed, the aquifer must be restored so that the ground-water quality is within baseline variability or at least within the premining use category. To achieve this objective, residual lixiviant must be removed from the host aquifer. This can be accomplished by pumping the residual lixiviant out of the aquifer and discharging the solution to the

surface (commonly called ground-water sweep) or by pumping residual lixiviant out of the aquifer and injecting the solution back into the aquifer after treatment (recirculation). Water discharged to the surface during a ground-water sweep must either be discharged to an evaporation pond or treated to meet water quality standards before releasing to surface waters. Reverse osmosis and electrodialysis are commonly used water treatment procedures.

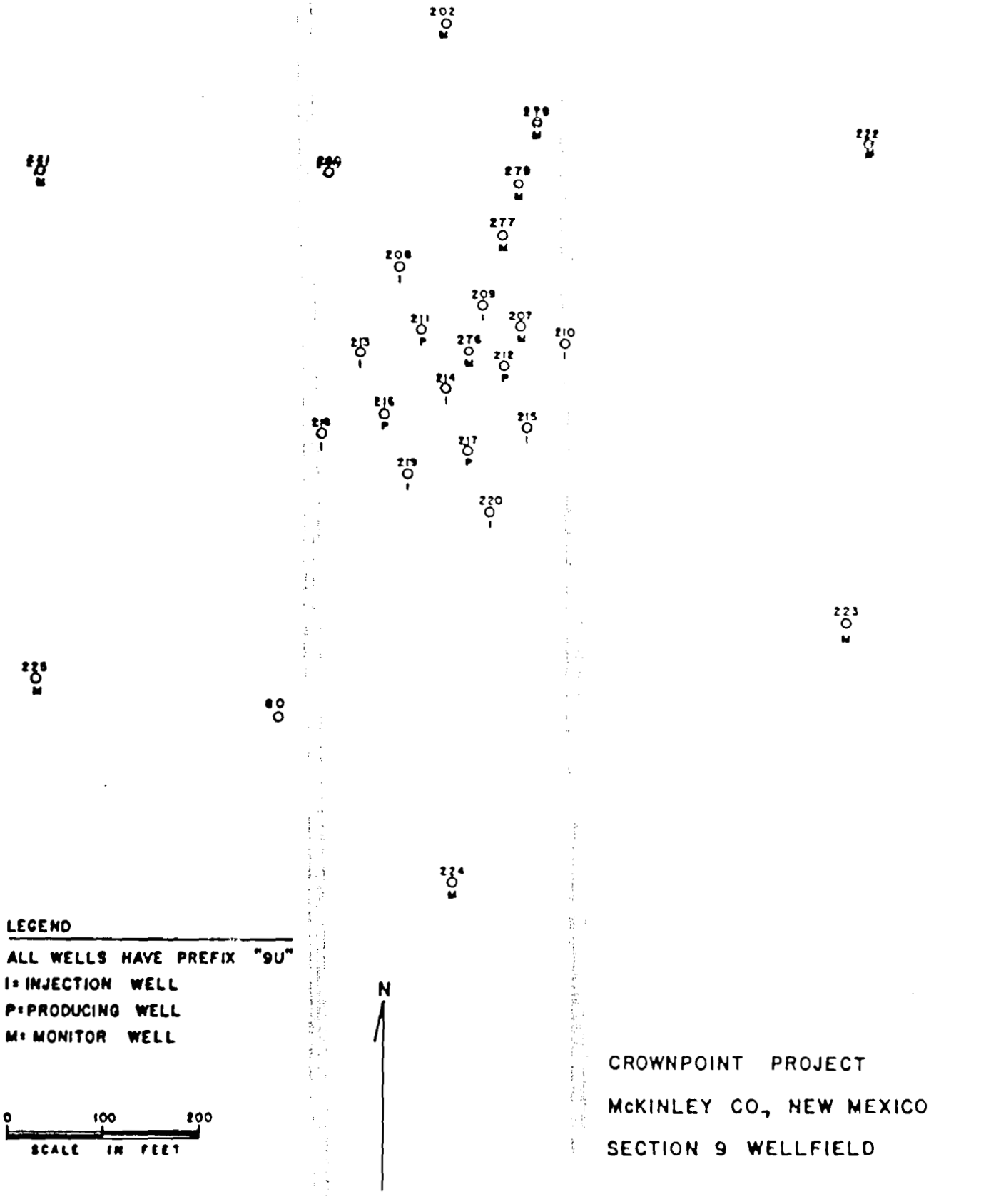
There are many geochemical processes that complicate restoration procedures. One process is the adsorption of undesirable ions on formation clays during leaching and the slow release of these ions into the ground water during restoration and stability phases of operation. To remove these contaminating ions from the clays during restoration, solutions containing high concentrations of exchangeable ions are often injected into the aquifer. Another process which complicates restoration is the slow release of contaminants that have precipitated or co-precipitated during leaching or previous restoration activity. One problem associated with the Crownpoint ISL site is the release and solubility of molybdenum during the leaching process. References providing more complete descriptions of the geochemical and mass transport mechanisms associated with aquifer restoration include Guilinger and others (1979), Kidwell and Humenick (1981), Markos and Bush (1981), Runnels and others (1983), and Thompson and others (1978).

3.2 Well Field Design and Operation at the Crownpoint ISL Site

The site is comprised of one in situ leach well pattern consisting of 9 injection wells and 4 production (recovery) wells; numerous monitoring wells; a pilot plant; and two evaporation ponds. Figure 5 illustrates the locations of wells pertinent to the analysis. The purpose of this section is to provide an account of the operational history of all well patterns at the site.

Chemical injection at the Crownpoint site began on November 6, 1979. The initial injection rate was 73 gpm and was gradually reduced to 55 gpm. Uranium production, after a 3-month period, reached 100 ppm and remained at this level throughout the life of the project. Concurrent with uranium production, molybdenum was liberated in the well field. Its concentrations were very near that of uranium. Due to this, a separation circuit was divised to remove the molybdenum from the production stream, thereby maintaining the uranium production and the ion exchange (IX) resin beads at an optimum performance level.

Figure 5


202
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LEGEND
ALL WELLS HAVE PREFIX "9U"
I= INJECTION WELL
P=PRODUCING WELL
M= MONITOR WELL
0
100
200
SCALE IN FEET
N
CROWNPOINT PROJECT
McKINLEY CO., NEW MEXICO
SECTION 9 WELLFIELD

The R&D well field leaching was terminated on October 1, 1980. At this time, it was concluded that approximately 15 percent of the uranium had been recovered from the mining zone. Water quality data at this point in time, indicated that most of the parameters sampled in the well field had been elevated.

Following the mining period, Mobil initiated a restoration effort consisting of fifteen stages. The restoration work began in October of 1980, and ended in October of 1986.

Stage 1 involved well field recirculation without the injection of lixiviant. During this 1-month period, well field water was circulated through the ion exchange columns to remove uranium. As a consequence of this action and the molybdenum strip circuit, molybdenum was also reduced. Waste waters were routed to the evaporation ponds.

Stage 2 lasted from the first week of December until December 24, 1980. During this time period, a lime water softener was utilized to reduce water hardness. This process prepared the well field water for reverse osmosis treatment.

Stage 3 involved six days of ground-water sweep at a rate of 260 gpm. Approximately 2.2 million gallons of water were swept through the well field and discharged to the waste evaporation ponds.

Stage 4, which took place from December 30, 1980, until the end of January, 1981, did not directly involve the well field. During this restoration phase, waste pond water was run through the water softener and back to the pond to reduce hardness.

Stage 5 involved the utilization of reverse osmosis. The unit was installed in late January, 1981, and operated until July, 1981. Water from the well field was run through the unit at approximately 70 gpm. It was at this time in the restoration process that molybdenum was targeted as a problem parameter.

Stage 6 lasted from July, 1981, until May, 1982. During this period, lime was added to the reverse osmosis permeate to reduce dissolved molybdenum. This process resulted in a molybdenum reduction from 32 mg/l to 9.7 mg/l.

Stage 7 utilized the ion exchange columns in combination with a ground-water sweep operation. From May, 1982, to November, 1982, the well field was pumped at 40 gpm, routed through the ion exchange columns for the removal of uranium and molybdenum and pumped back into the well field. At this point in the restoration process, all

major cations and anions were below restoration values. However, molybdenum remained above agreed to restoration values.

Stage 8 began on November 8, 1982, and continued until April 15, 1983. During this time period, sodium sulfide was added to the water coming from the IX columns. The object of this process was to eliminate dissolved oxygan from the well field water and re-establish the reducing environment which would make molybdenum unavailable for dissolution into the well field waters.

Stage 9 began on April 15, 1983, and terminated on July 14, 1983. During this period, the well field was allowed to "sit-and-soak." This phase allowed an equilibrium to establish itself throughout the well field due to the prior addition of sodium sulfide.

Stage 10 was a ground-water sweep. The well field was pumped, beginning on July 14, 1983, until January 13, 1984, at rates varying from 20 to 40 gpm. During the initial 10 weeks of this time period, the well field was pumped and the evaporation ponds filled with approximately 1 million gallons of water. During the remainder of the time, the ground-water sweep program maintained a 1 gpm bleed to the evaporation ponds. During this 5-month period, molybdenum concentrations did not change significantly and remained to be the single elevated parameter above restoration target values in the well field.

Stage 11 began on January 18, 1984, and ended on May 1, 1984. During this period, the well field ground water was pumped at a rate of 34 gpm and routed through a reverse osmosis unit. Twenty-nine gpm was reinjected to the well field, while the remaining 9 gpm was discharged to the evaporation ponds.

Stage 12 began on May 1, 1984, and extended until March 18, 1985. During this period, hydrogen sulfide gas (reducing agent) was injected into the well field. This was another attempt at reducing the well field environment and thereby taking molybdenum out of the solution. At the conclusion of this stage of restoration, six wells showed lower concentrations of molybdenum, three wells remained constant and four wells rose slightly.

Stage 13 involved a "sit-and-soak" period. During the period of March 18, 1985, until April 15, 1986, the well field was allowed to equilibrate with the hydrogen sulfide injection. Laboratory data indicated that ten wells showed a decrease in molybdenum concentrations and three wells showed a slight rise.

Stage 14 began on April 15, 1986, and ended on May 20, 1986. During this period, ground water in the well field was recirculated to

ensure flushing of any well cleaning fluids and equal dispersion of the residual hydrogen sulfide.

Stage 15 began on May 20, 1986, and ended November 10, 1986. During this period, the well field was left idle.

The restoration process utilized at the Crownpoint site involved many stages. It was apparent by Stage 5 that the dissolved salts in the well field waters were responding to the restoration efforts and that molybdenum would be a restoration problem. As an overview of the restoration progress, Table 1 shows water quality based upon annual average of values for the well field.

On November 20, 1986, stability monitoring began and continued until July 20, 1987. The stability period has shown through monthly sampling that the well field is stable, with the exception of a slightly elevated molybdenum species.

4.0 IMPACTS OF ISL OPERATIONS ON GROUND-WATER QUALITY

4.1 Water Quality and Geochemistry

Although influenced by precipitation-dissolution reactions and ion exchange phenomena, concentrations of major cations and anions are useful indicators of the presence of residual lixiviant. Due to their high mobilities relative to trace metals and radionuclides, major ions are removed most easily during restoration. Reactions that do occur are usually predictable and provide insight into the more complex reactions involving trace elements. In addition, concentrations of major ions in individual wells tend to be more representative of spatial variation in the aquifer than concentrations of trace elements.

Concentrations of trace elements and radionuclides are important to analyses of environmental impacts, but are usually much more difficult to interpret than concentrations of major ions. Mobilities are highly dependent on solution Eh, pH, and ionic strength, and are governed by complex adsorption, ion exchange, oxidation-reduction, coprecipitation, and solid-solution reactions. Concentrations in wells may reflect very localized conditions not representative of the aquifer (e.g., localized mineralization, contaminated well screens, etc.).

Elevated concentrations of molybdenum have been observed in a number of wells throughout the site. To reduce concentrations of trace elements (specifically molybdenum) from prerestoration levels to restoration target levels, trace elements often must be diluted to a

Table 1. - Historical Water Quality Data for the Crownpoint Insitu Leach Site

Chemical Constituent	New Mexico Standard mg/liter	Restoration Standard mg/liter	1981 Average of Values	1982 Average of Values	1983 Average of Values	1984 Average of Values	1985 Average of Values	1986 Average of Values
Aluminum, dissolved	5.0	5.0	0.500	0.700	0.550	0.500	0.500	0.808
Arsenic	0.1	0.1	0.086	0.073	0.069	0.057	0.032	0.014
Barium	1.0	1.0	0.227	0.200	0.325	0.262	0.215	0.277
Boron	0.75	0.75	0.191	0.155	0.088	0.108	0.215	0.238
Cadmium	0.01	0.036	0.005	0.005	0.005	0.005	0.007	0.006
Chloride	250.0	250.0	127.273	156.000	372.500	115.5	111.5	54.538
Chromium	0.05	0.074	0.004	0.005	0.005	0.007	0.011	0.005
Cobalt, dissolved	0.05	0.05	0.016	0.020	0.020	0.020	0.026	0.021
Copper, dissolved	1.0	1.0	0.007	0.005	0.005	0.005	0.012	0.008
Cyanide	0.2	0.780	0.005	0.005	0.005	0.005	0.009	<0.005
Fluoride	1.6	1.6	0.336	0.309	0.413	0.500	0.508	<0.5
Iron, dissolved	1.0	5.50	0.130	0.018	0.015	0.065	0.372	0.146
Lead, dissolved	0.05	0.063	0.005	0.022	0.009	0.005	0.006	0.016
Manganese, dissolved	0.2	0.456	0.217	0.053	0.142	0.048	0.096	0.035
Molybdenum, dissolved	1.0	1.0	27.667	9.076	13.250	8.231	4.803	1.118
Mercury, total	0.002	0.002	0.0002	0.0019	0.0001	0.0001	0.0001	0.0003
Nickel, dissolved	0.2	0.2	0.030	0.020	0.070	0.021	0.021	0.022
Nitrate (as N)	10.0	10.0	0.050	0.075	0.050	0.941	0.050	0.556
PH	6 to 9	6 to 9	6.665	8.402	*	8.438	8.446	9.062
Phenols	0.005	0.047	0.005	0.012	0.003	0.002	0.004	0.008
Combined Ra-226 & 228	30.0	97.2	*	30.525	*	22.077	48.677	59.939
Selenium, dissolved	0.05	0.05	0.017	0.149	0.067	0.017	0.032	0.006
Silver, dissolved	0.05	0.05	0.007	0.005	0.005	0.005	0.006	<0.005
Sulfate (as SO4)	600.0	600.0	131.091	44.182	46.500	81.538	80.846	47.615
TDS (at 180 C)	1000.0	1000.0	623.182	329.727	785.000	479.231	556.923	356.154
Uranium (as U)	5.0	5.0	*	0.166	0.370	0.590	0.303	0.319
Zinc, dissolved	10.0	10.0	0.014	0.031	0.014	0.027	0.027	0.039

NOTE:
* Data not available.

Source: Mobil Mining and Minerals Company, November 14, 1986

much higher degree than major ions. However, the effectiveness of trace element removal is reduced further by the limitations of water treatment procedures at low concentrations, the dissolution of precipitates found during leaching, desorption and ion exchange processes and oxidation and mobilization of redox-sensitive species (Bell and others, 1983).

5.0 EVALUATION OF ALTERNATIVES

5.1 Introduction

As part of this report, alternatives have been evaluated. At this stage, there are two alternatives which are addressed, and they will be discussed below.

5.2 No Further Remedial Action

This alternative would result in Mobil initiating decommissioning of the plant and well field and reclamation of the site in accordance with 10 CFR Part 40. It is considered that the concentration of the redox-sensitive trace element (molybdenum) would gradually approach baseline as natural conditions are eventually established within the aquifer.

5.3 Additional Aquifer Restoration

The use of additional restoration methods has been evaluated, and these are described in the following text. The additional restoration synopsis would probably involve the utilization of one or more of the described methodologies.

1. Traditional methods of aquifer restoration, such as ground-water sweep and recirculation. These would probably result in little improvement in the overall ground-water quality at the site. Concentrations of redox-sensitive species may actually increase due to a re-establishment of oxidizing conditions in the aquifer.

2. Injection of reductants. Although this is a potentially viable method for lowering concentrations of redox-sensitive species, the technique does not always give entirely satisfactory results in the field. This is evident from past restoration programs implemented at the Irigaray and Exxon mines in Wyoming and the Ferret mine in Nebraska. The above mentioned facilities were similar in circumstance to the Mobil site and a parallel can be drawn here.

3. Restoration of trace elements through natural processes. Due to the unknowns and the risks involved, this appears to be the preferable method for restoration of molybdenum. It has been shown at the Irigaray and Exxon facilities that natural flushing is a viable alternative.

It is apparent from past restoration efforts (described in the Mobil November 1986 Restoration Report), that molybdenum levels were reduced to their concentrations by a combination of restoration methods (ground-water sweep and reductant treatment).

It is highly unlikely, as indicated by the Mobil monitoring data, that additional ground-water sweep and reductant treatment will provide any more reduction in molybdenum concentration at the Mobil site. Natural restoration processes such as mineral precipitation and adsorption that occur between the residual lixiviant and the aquifer sediment will eventually reduce the concentration of molybdenum from solution. Reducing conditions exist downgradient from the ore zone and under these conditions, the redox-sensitive trace element molybdenum will form a relatively insoluble compound. As a consequence, molybdenum solution concentration will be lowered, perhaps to the restoration level or lower, after a period of contact with the aquifer sediment adjacent to the leached ore zone. The transport of the trace element molybdenum at its present level would be very slow at best. Calculations for transport indicate that ground water in the Westwater Canyon Formation moves at a rate which is approximately 15 feet per year in a North-Northwesterly direction. Accordingly, it would take ground water on the order of hundreds of years to move 1 mile. This, together with the fact that over time the trace element molybdenum will undergo dilution, would indicate that any problems associated with elevated concentrations of molybdenum at present are minimal and temporary. The limited extent of contamination, together with the slow movement of ground water in the Westwater Canyon Formation, suggest that the most realistic approach is to allow natural conditions to restore water quality at the Mobil site. The potential for agricultural use of this water also appears to be very small, as evidenced by Mobil's evaluation of ground-water use (Mobil, 1988).

6.0 PROPOSED NRC ACTION

Due to the extreme depth of the affected zone, the potential for human use of the ground water, the limited areal extent of mining and the cost and limited success of additional restoration, the NRC has determined that further remedial action would result in minimal improvement to the ground water in the aquifer. Therefore, the proposed administrative action is to terminate Mobil Oil Corporation's Source Material License

SUA-1479 after successful decommissioning of the Crownpoint ISL R&D site in accordance with 10 CFR Part 40.

Thomas T. Olsen

Thomas T. Olsen, Project Manager
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Approved by: Edward F. Hawkins

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office, Region IV

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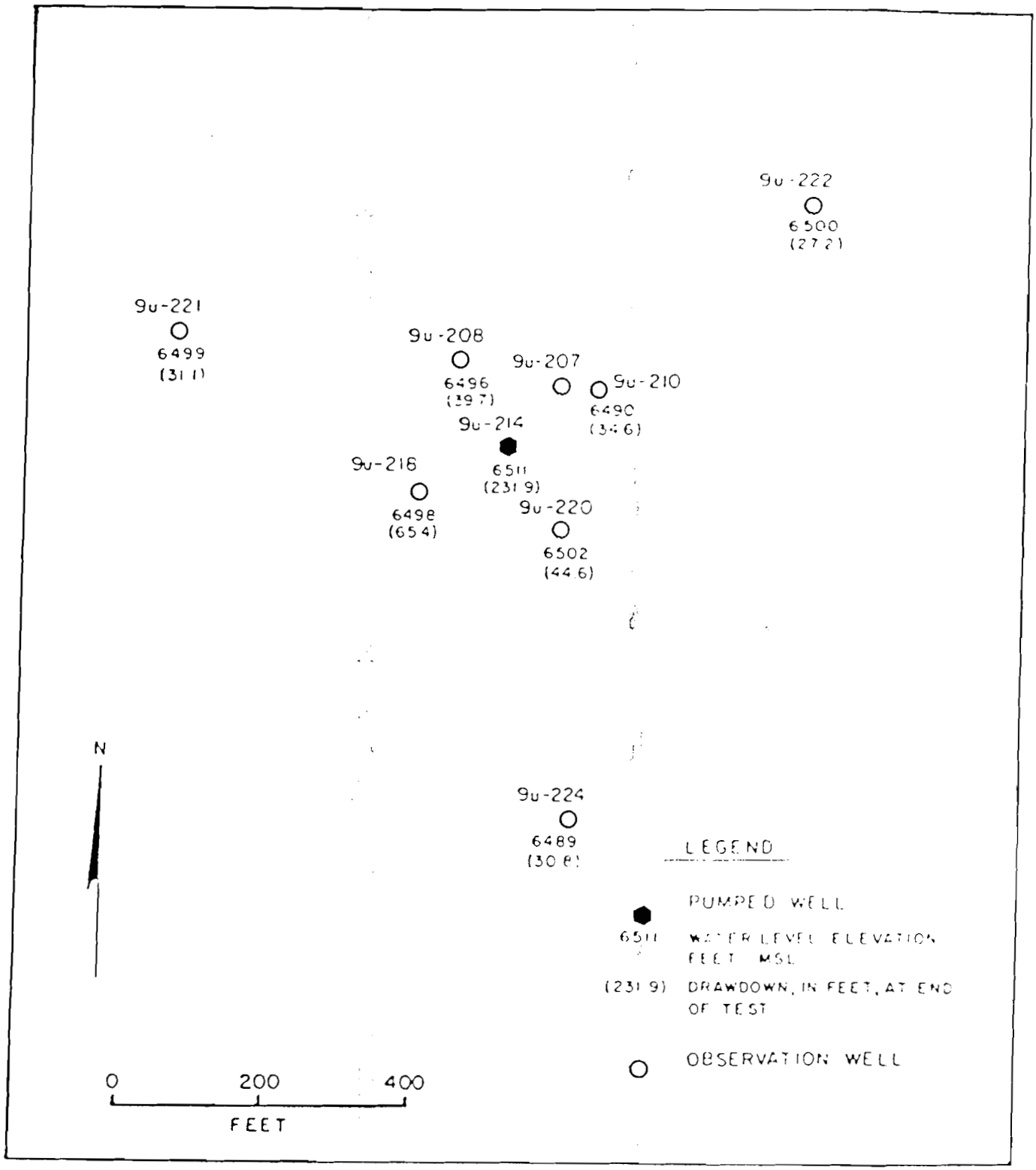
APPENDIX A

Aquifer Test Data



HYDROLOGY TEST CONFIGURATION

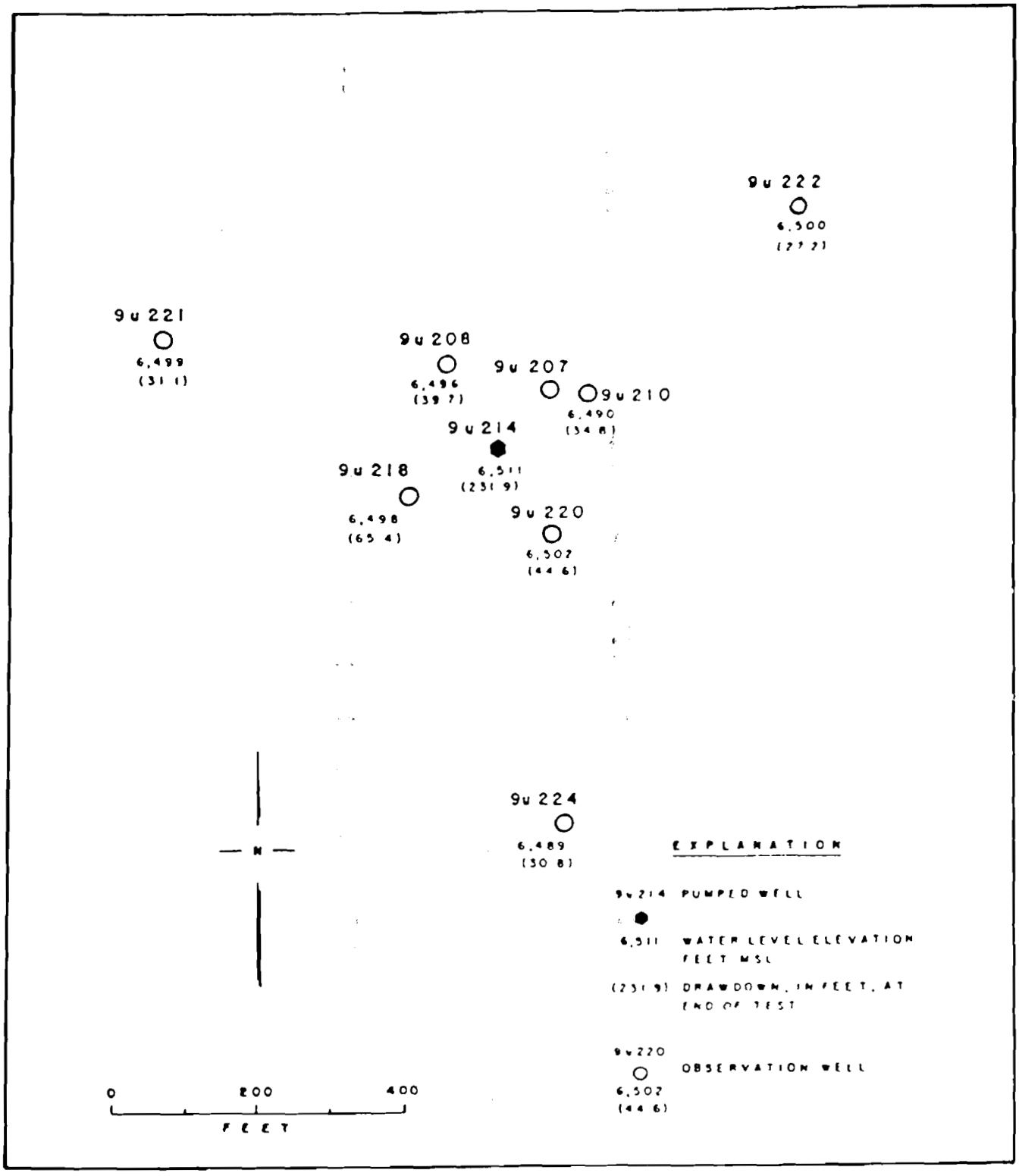
--PRE-PUMPING WATER LEVELS
FEBRUARY 6, 1978

WELL	ELEVATION OF MEASURING POINT (Ft, msl)	DEPTH TO WATER (Ft)	WATER LEVEL ELEVATION (Ft, msl)
9u214	6708.1	197.1	6511.0
9u208	6699.8	203.6	6496.2
9u210	6703.1	213.6	6489.5
9u218	6705.2	206.8	6498.4
9u220	6721.1	219.3	6501.8
9u221	6688.9	189.8	6499.1
9u222	6717.5	217.5	6500.0
9u224	6724.8	235.7	6489.1
9u207	6705.1	31.7	6673.4

CONSTRUCTION DETAILS FOR
PUMPED WELL 9u214 AND OBSERVATION WELLS

WELL	TOTAL DEPTH (Feet)	AQUIFER DEPTH (Feet) From	To	PERFORATED INTERVAL (Feet below land surface)
9u214	2,100	1,890	2,100	1,946 - 1,969
9u208	2,115	1,893	2,115	1,946 - 1,974
9u210	2,107	1,902	2,107	1,948 - 1,976
9u218	2,103	1,896	2,103	1,946 - 1,972
9u220	2,113	1,903	2,113	1,956 - 1,982
9u221	2,065	1,887	2,065	1,936 - 1,966
9u222	2,149	1,925	2,149	1,972 - 2,000
9u224	2,096	1,907	2,096	1,959 - 1,989
9u207[1/]	1,788	1,639	1,768	1,640 - 1,752

1/ Dakota Sandstone monitor well



PRE-PUMPING WATER LEVELS

SUMMARY OF HYDROLOGIC DATA FOR
MONITOR WELL NETWORK, PUMP TEST WELL 9u214
FEBRUARY 6-9, 1978

WELL	DISTANCE FROM PUMPED WELL (Feet)	DRAWDOWN AT END OF TEST (Feet)
9u214	-	231.9
9u208	140	39.7
9u210	140	34.8
9u218	140	65.4
9u220	140	44.6
9u221	500	31.1
9u222	540	27.2
9u224	530	30.8
9u207	107	

AVERAGE PUMPING RATE FOR THE 3-DAY
PERIOD WAS 79 GALLONS PER MINUTE

SUMMARY OF AQUIFER PARAMETERS FOR

PUMP TEST AT PILOT TEST SITE

WELL	TRANSMISSIVITY (GPD/FT)[1]			STORAGE[2]	
	Cooper-Jacob	Theis	Horner	Cooper-Jacob	Theis
9u214	1,200	--	1,100	--	--
9u208	1,400	1,800	1,300	1×10^{-4}	2×10^{-4}
9u210	1,400	1,500	1,200	3×10^{-4}	2×10^{-4}
9u218	1,000	1,200	1,100	3×10^{-5}	1×10^{-5}
9u220	1,200	1,600	1,200	1×10^{-4}	2×10^{-5}
9u221	1,400	1,400	1,200	4×10^{-5}	3×10^{-5}
9u222	2,200	1,400	1,500	1×10^{-5}	3×10^{-5}
9u224	1,100	1,300	1,100	8×10^{-5}	6×10^{-5}
DISTANCE DRAWDOWN		1,600			3×10^{-5}

1/ Gallons per day per foot width of aquifer at 1:1 hydraulic gradient

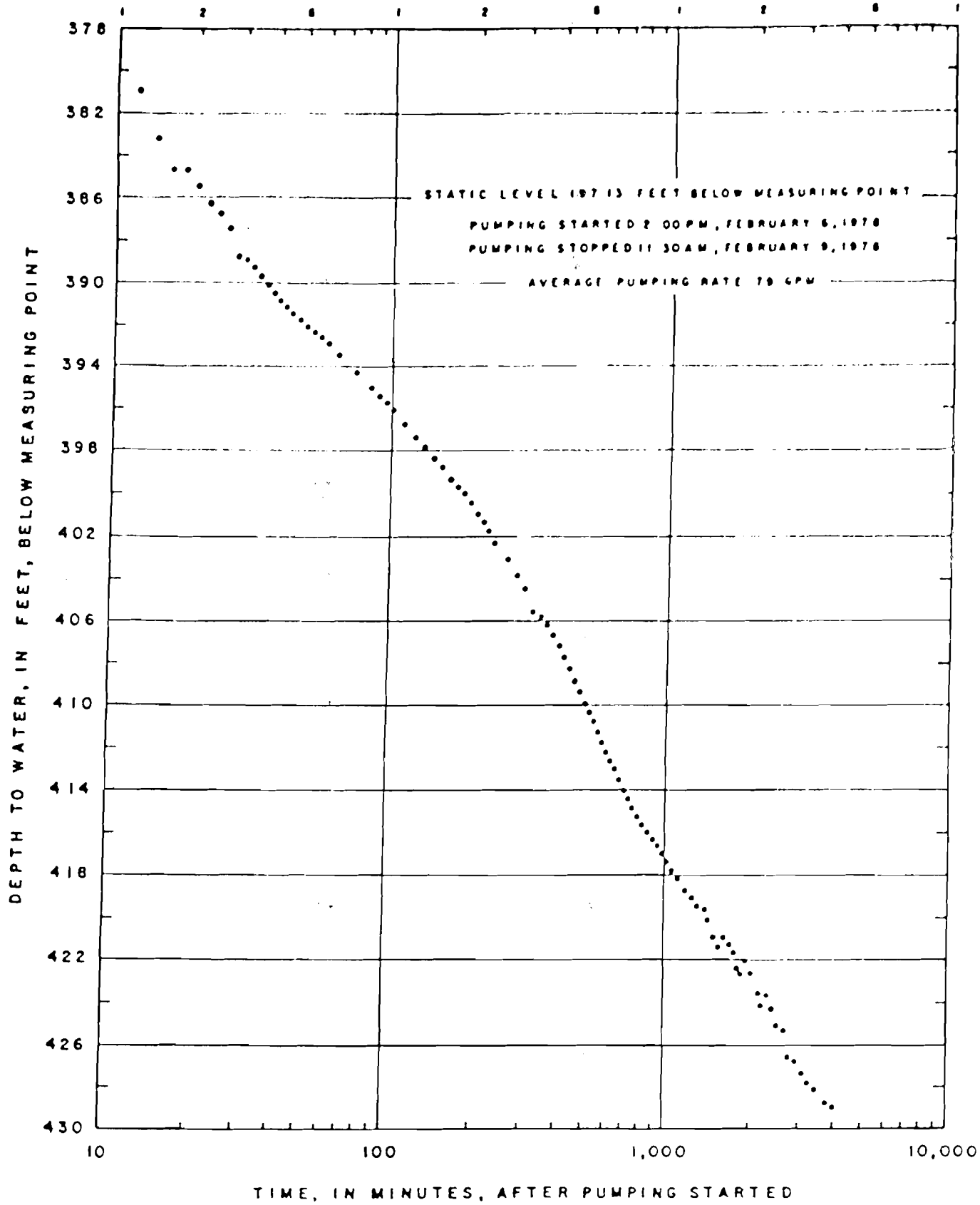
2/ Dimensionless; ratio of volume of water released per unit area of aquifer per unit decline in head

SUMMARY OF AQUIFER PARAMETERS FOR
PUMP TEST 9u214, FEBRUARY 6-9, 1978

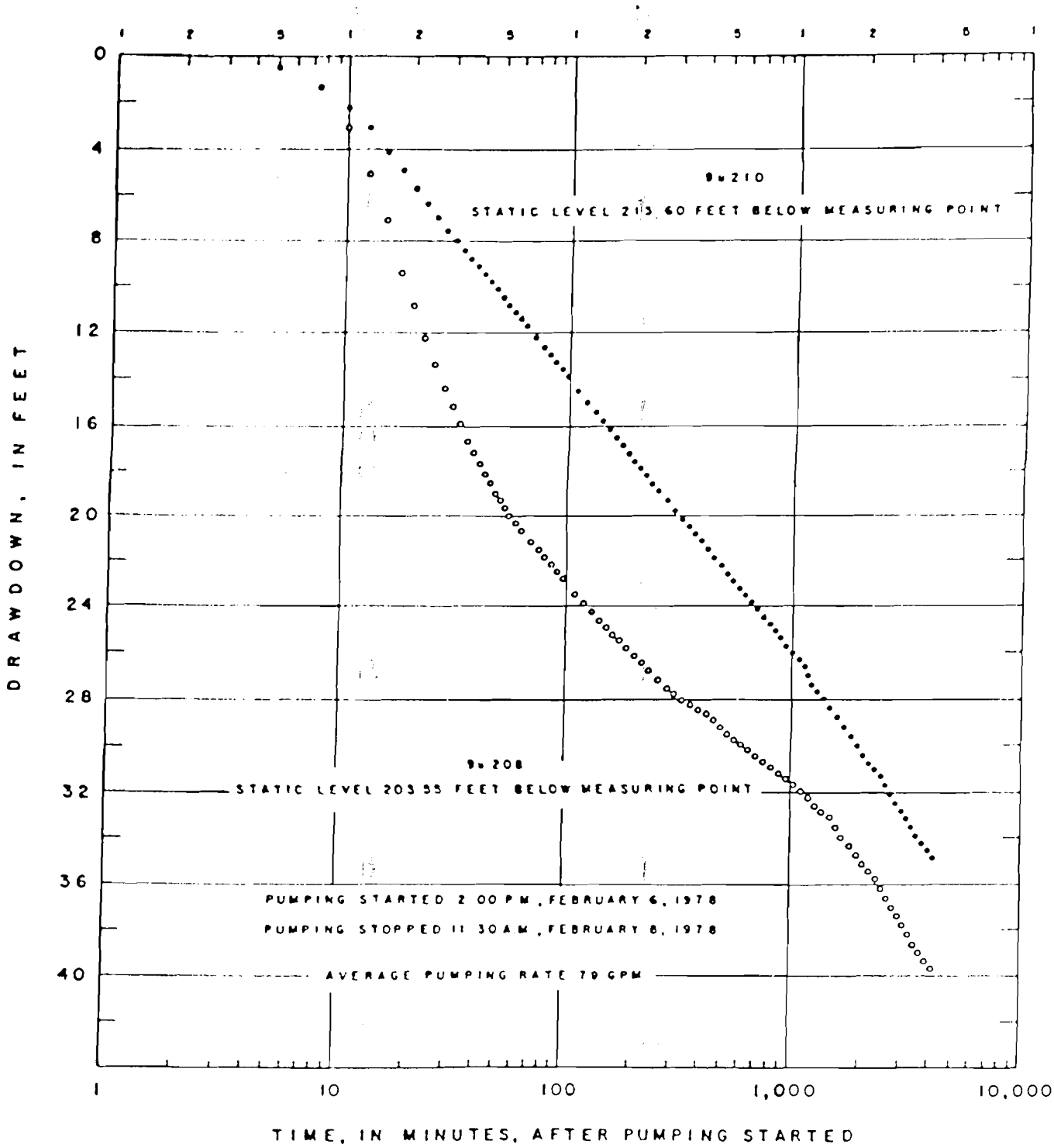
WELL	TRANSMISSIVITY (GPD/FT)[1]			STORAGE[2]	
	Semi-log	Log-Log	Recovery	Semi-Log	Log-Log
9u214	1,200	--	1,100	--	--
9u208	1,400	1,800	1,300	1×10^{-4}	2×10^{-4}
9u210	1,400	1,500	1,200	3×10^{-4}	2×10^{-4}
9u218	1,000	1,200	1,100	3×10^{-5}	1×10^{-5}
9u220	1,200	1,600	1,200	1×10^{-4}	2×10^{-5}
9u221	1,400	1,400	1,200	4×10^{-5}	3×10^{-5}
9u222	2,200	1,400	1,500	1×10^{-5}	3×10^{-5}
9u224	1,100	1,300	1,100	8×10^{-5}	6×10^{-5}
DISTANCE DRAWDOWN	1,600			3×10^{-5}	

1/ Gallons per day per foot width of aquifer at 1:1 hydraulic gradient

2/ Dimensionless; ratio of volume of water released per unit area of aquifer per unit decline in head

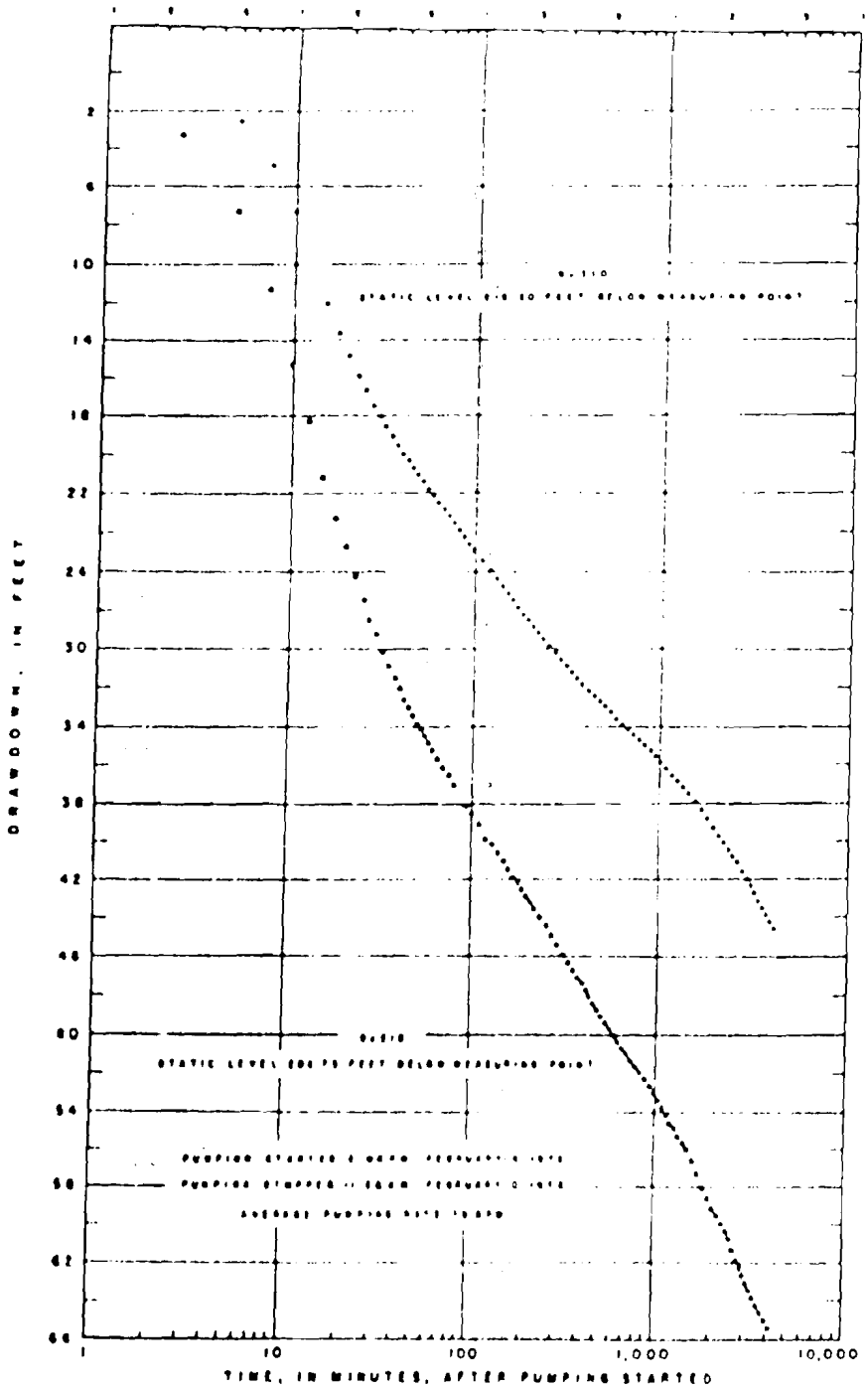


DRAWDOWN GRAPH FOR PUMPED WELL 9-214

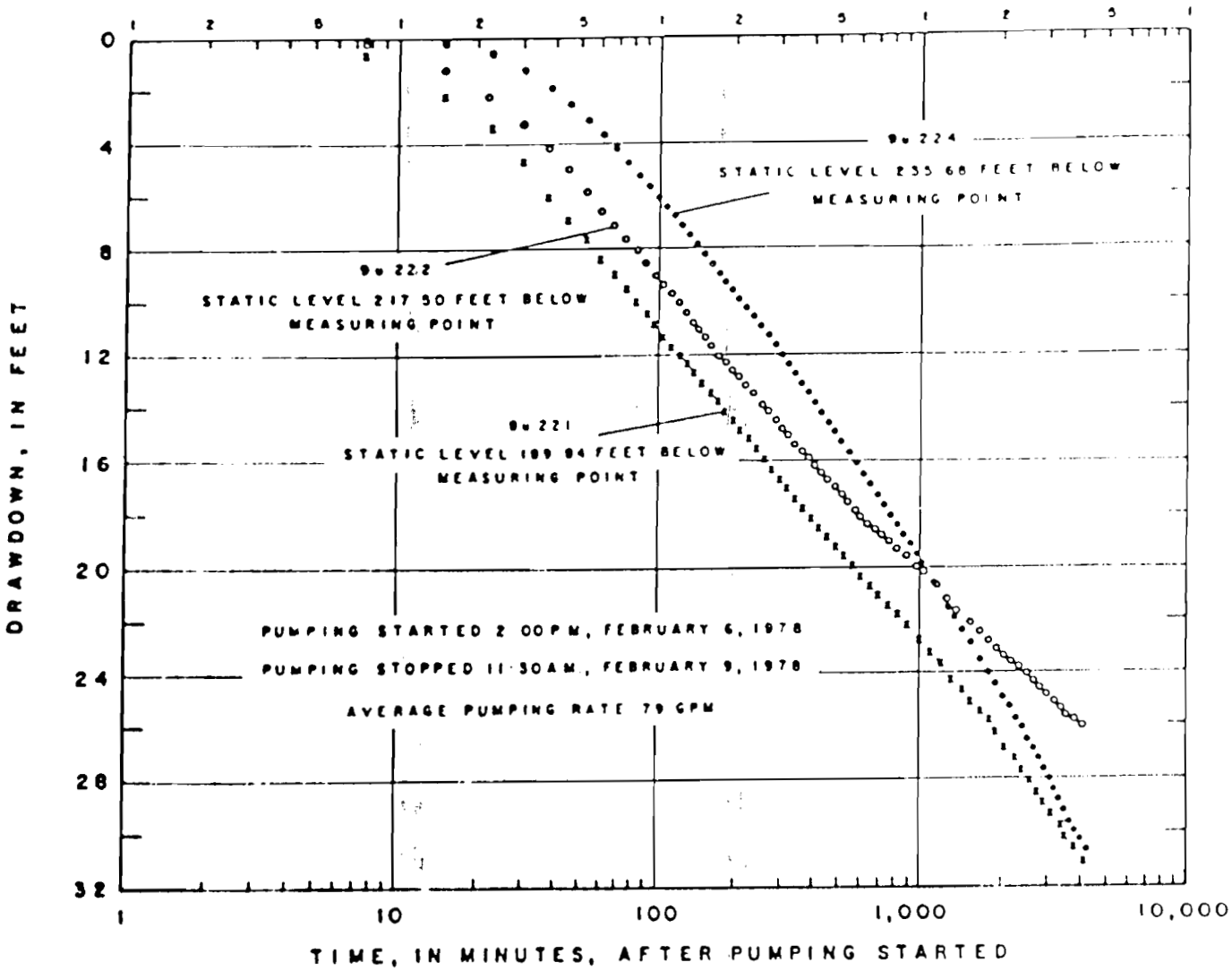


DRAWDOWN GRAPH FOR OBSERVATION WELLS

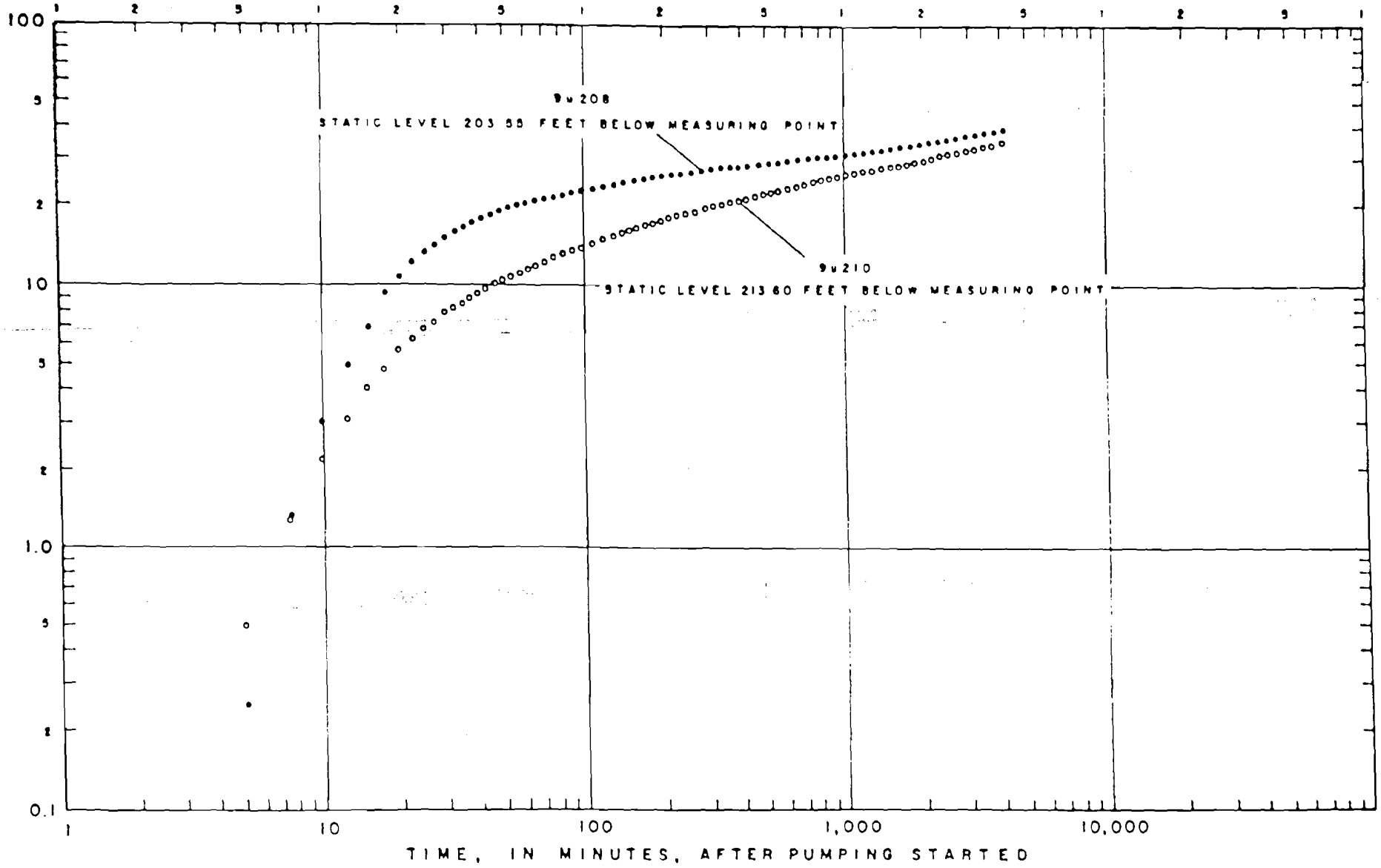
9-208 AND 9-210



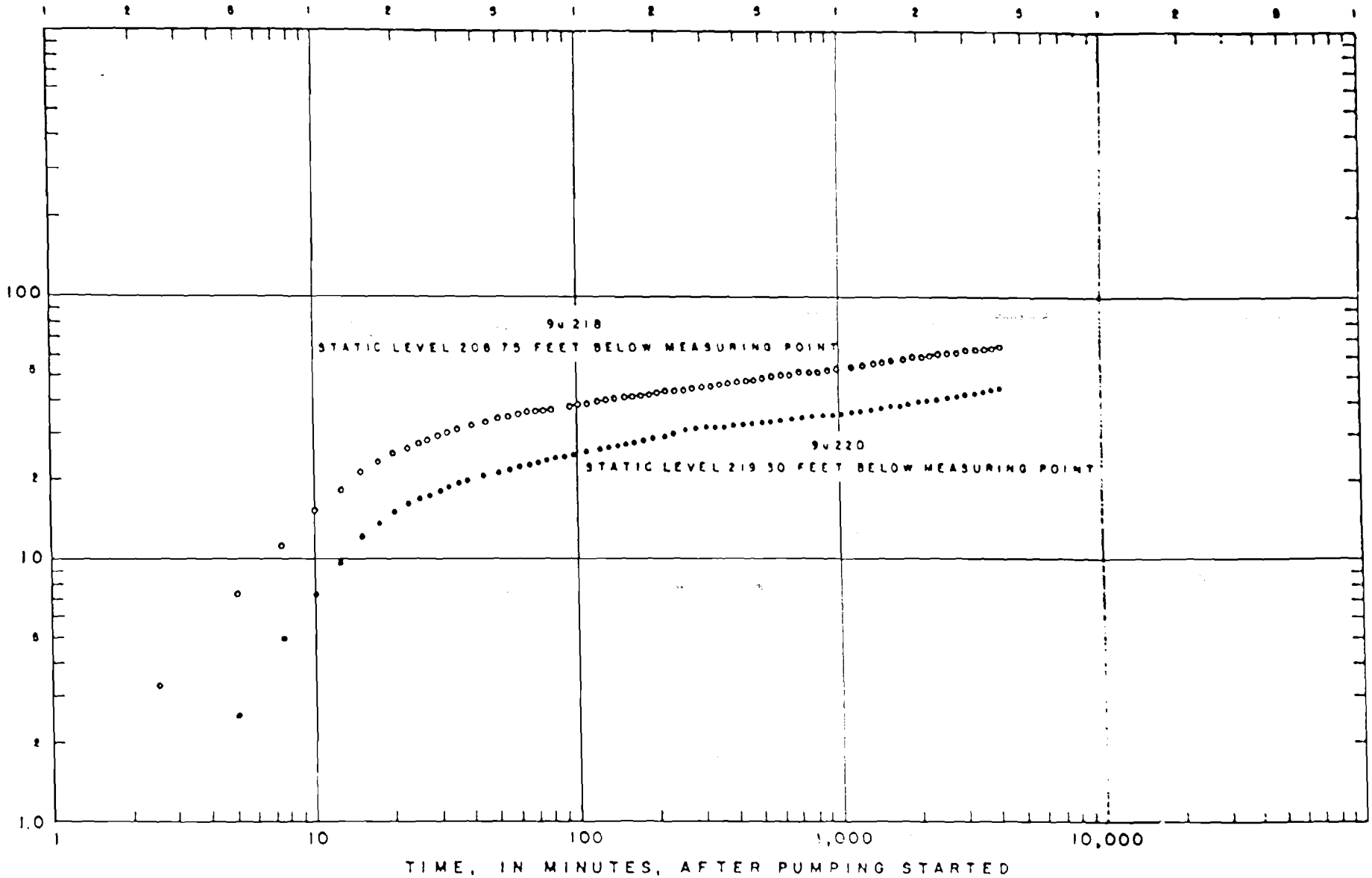
DRAWDOWN GRAPH FOR OBSERVATION WELLS



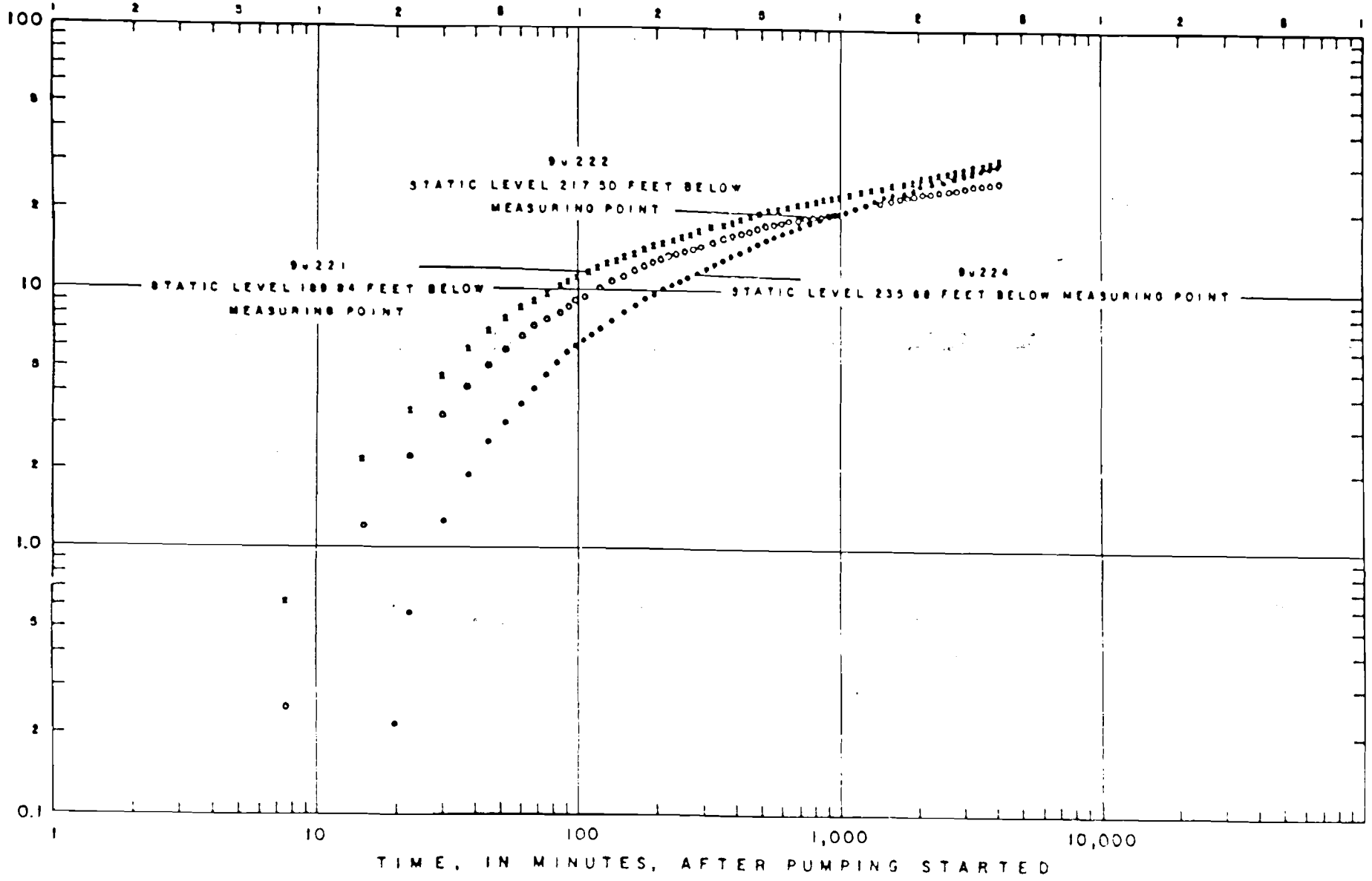
DRAWDOWN GRAPH FOR OBSERVATION WELLS
9u221, 9u222, AND 9u224



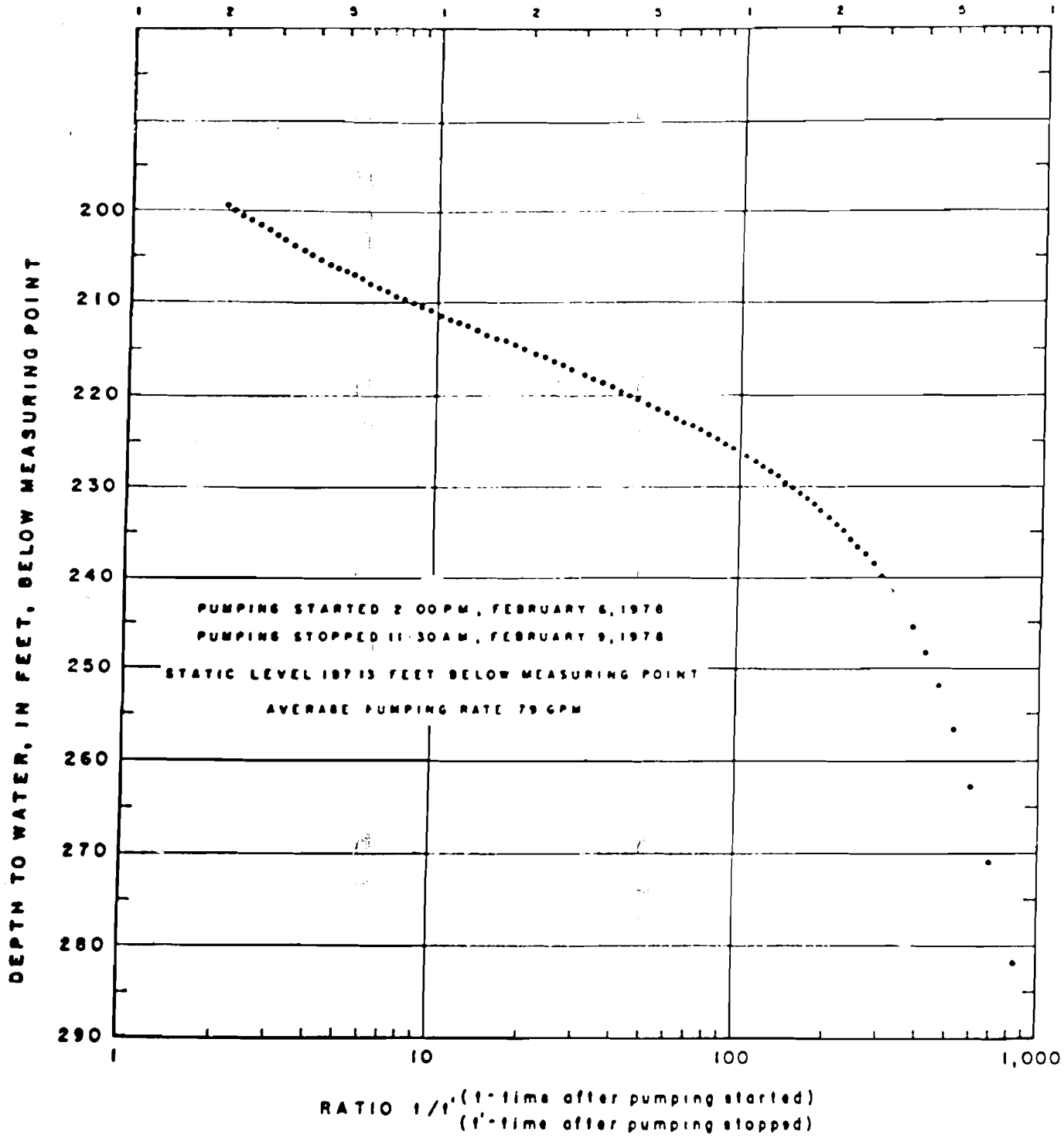
LOG-LOG GRAPH OF WATER LEVEL DRAWDOWN IN OBSERVATION WELLS 9u208 AND 9u210



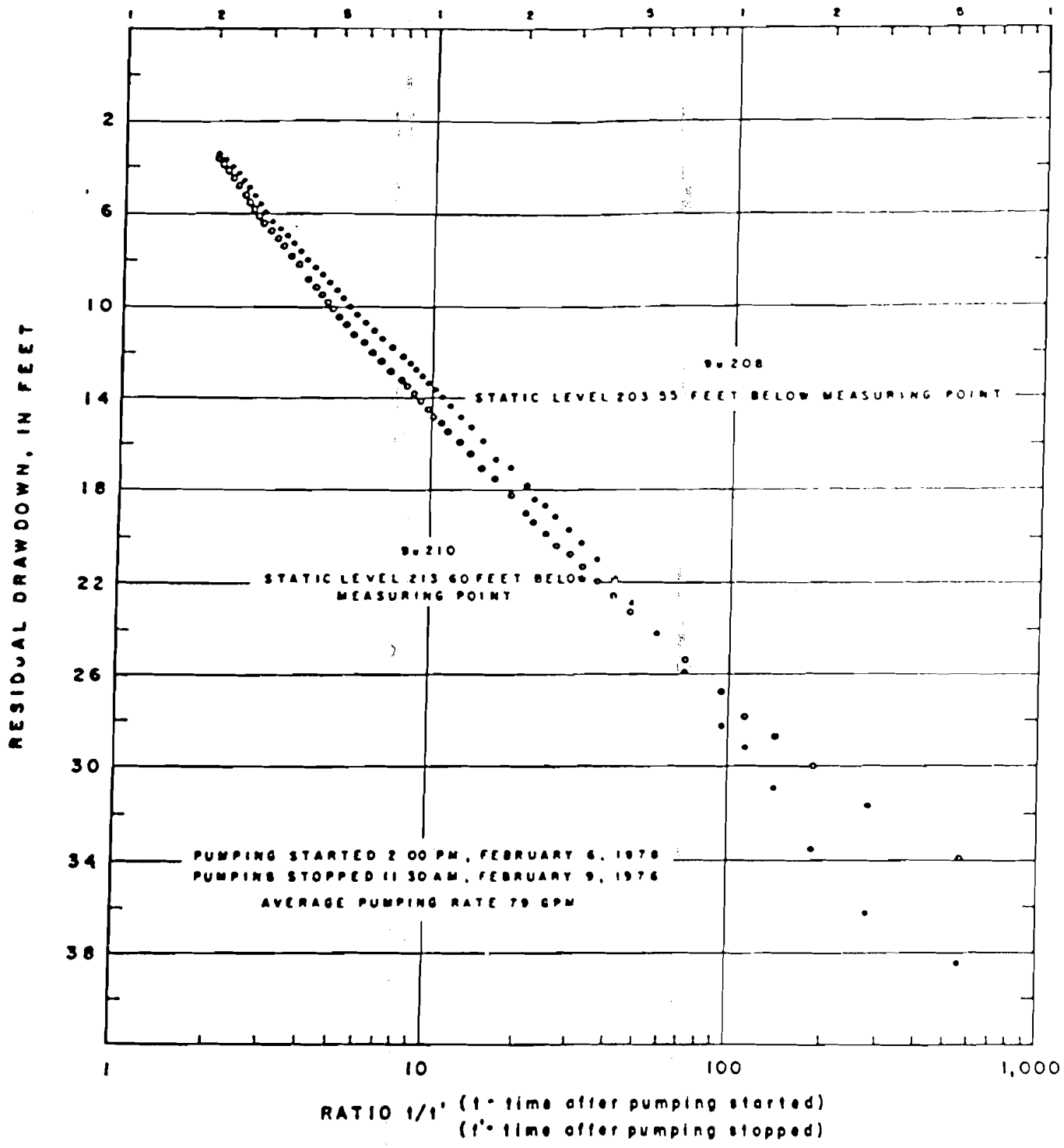
LOG-LOG GRAPH OF WATER LEVEL DRAWDOWN IN OBSERVATION WELLS 9u218 AND 9u220



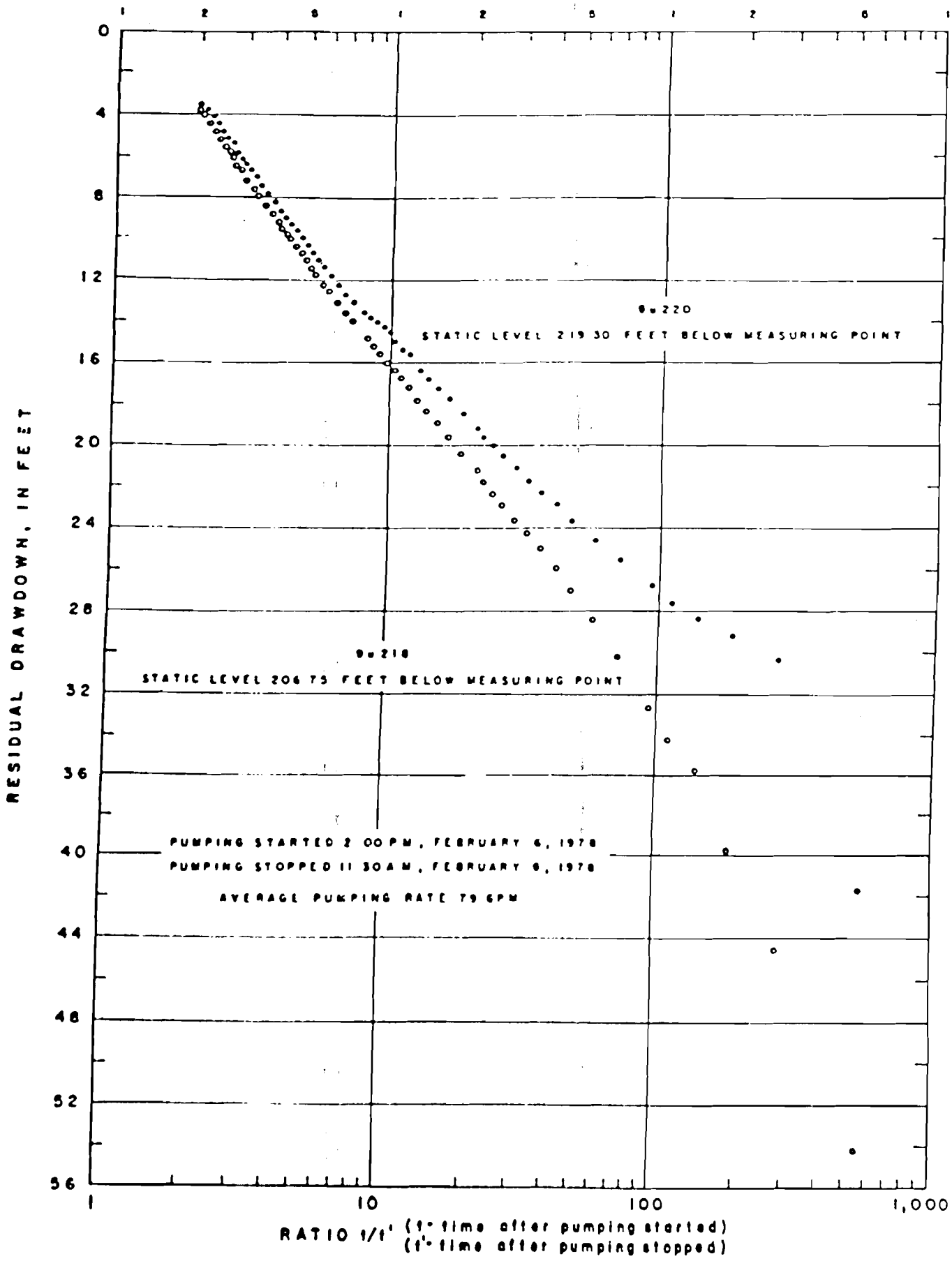
LOG-LOG GRAPH OF WATER LEVEL DRAWDOWN IN OBSERVATION WELLS 9u 221, 9u222, AND 9u 224

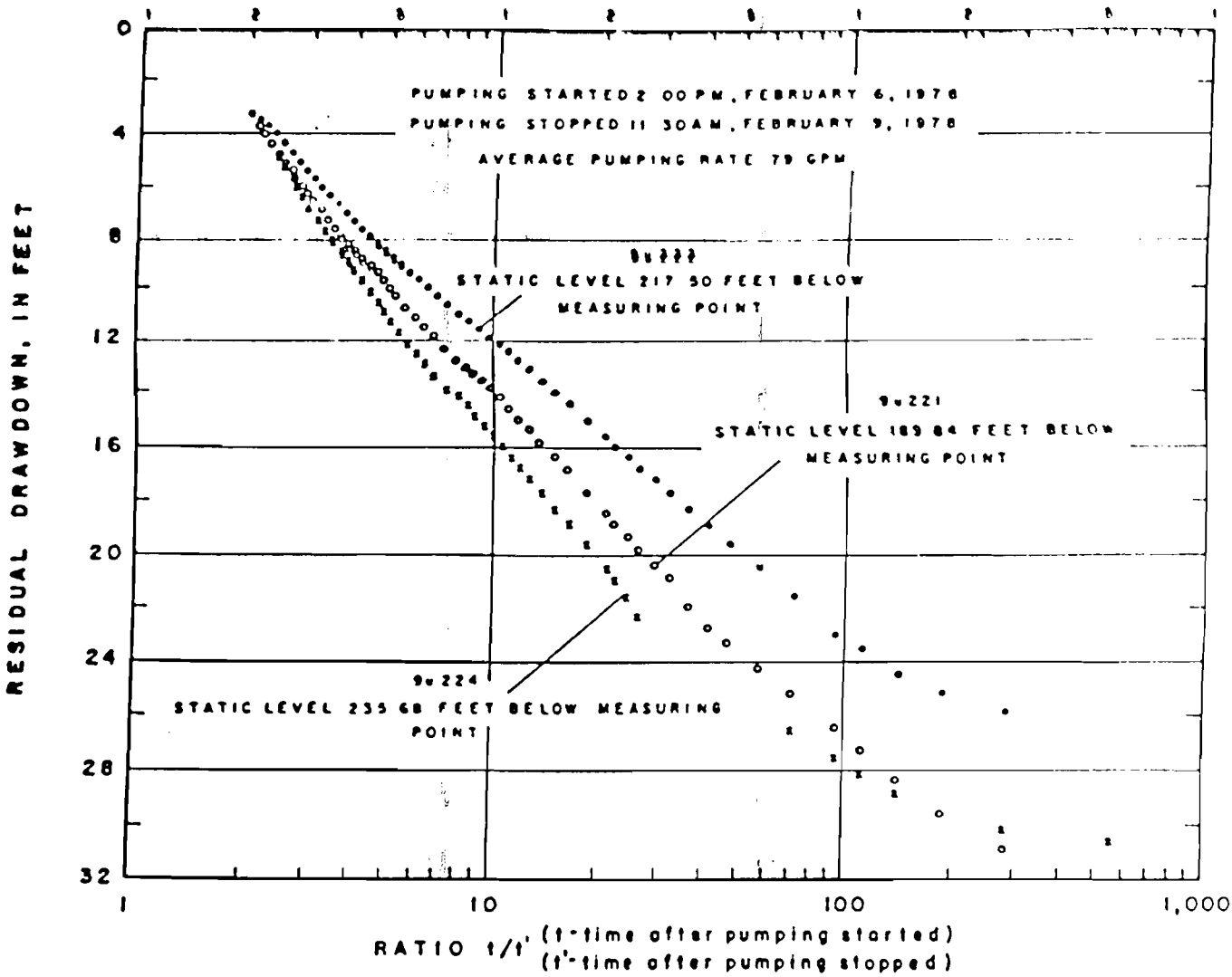


RECOVERY GRAPH FOR PUMPED WELL 9u214



RECOVERY GRAPH FOR OBSERVATION WELLS
9u208 AND 9u210


RESIDUAL DRAWDOWN, IN FEET
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
1
2
5
1
2
5
1
2
5
1
10
100
1,000
RATIO t/t' (t = time after pumping started) (t' = time after pumping stopped)
s = 22.0
STATIC LEVEL 219.30 FEET BELOW MEASURING POINT
s = 21.8
STATIC LEVEL 206.75 FEET BELOW MEASURING POINT
PUMPING STARTED 2:00 P.M., FEBRUARY 6, 1978
PUMPING STOPPED 11:30 A.M., FEBRUARY 8, 1978
AVERAGE PUMPING RATE 79 GPM



RECOVERY GRAPH FOR OBSERVATION WELLS

9u 221, 9u 222, AND 9u 224

APPENDIX B

Baseline Ground-Water Data

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

ALUMINUM
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.2	0.2	1.3	1.6	5.0	5.0
209	0.1					
210	0.3					
211	0.1					
212	0.1					
213	0.2					
214	0.3					
215	0.2					
216	0.4					
217	0.1					
218	0.2					
219	0.1					
220	0.5					
202	0.1				5.0	5.0
221	0.3				5.0	5.0
222	0.2				5.0	5.0
223	<0.1				5.0	5.0
224	0.6				5.0	5.0
225	0.1				5.0	5.0
207	0.3				5.0	5.0
277	<0.5	<0.5	<0.5	<0.5	5.0	5.0
278	<0.5					
279	<0.5					
280	<0.5					
276-A	<0.5				5.0	5.0
276-B	<0.5				5.0	5.0

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

ARSENIC
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.002	0.004	0.025	0.04	0.100	0.10
209	0.003					
210	0.017					
211	0.003					
212	0.002					
213	0.003					
214	0.003					
215	0.002					
216	0.003					
217	0.005					
218	0.003					
219	0.002					
220	0.004					
202	0.003				0.100	0.100
221	0.003				0.100	0.100
222	0.002				0.100	0.1
223	0.003				0.100	0.100
224	0.002				0.100	0.100
225	0.003				0.100	0.100
207	0.002				0.100	0.100
277	0.008	0.005	0.015	0.01	0.100	0.100
278	0.003					
279	0.005					
280	0.003					
276-A	0.002				0.100	0.100
276-B	0.006				0.100	0.100

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

BARIUM
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.1	0.2	0.7	0.6	1.0	1.0
209	0.2					
210	0.1					
211	0.3					
212	0.2					
213	0.2					
214	0.1					
215	0.1					
216	0.1					
217	0.2					
218	0.2					
219	0.1					
220	0.1					
202	0.2				1.0	1.0
221	<0.1				1.0	1.0
222	0.1				1.0	1.0
223	0.1				1.0	1.0
224	0.1				1.0	1.0
225	0.1				1.0	1.0
207	<0.1				1.0	1.0
277	<0.1	<0.1	0.1	0.1	1.0	1.0
278	0.1					
279	<0.1					
280	<0.1					
276-A	0.1				1.0	1.0
276-B	<0.1				1.0	1.0

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

BORON
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.1	0.1	0.5	0.4	0.75	0.75
209	0.1					
210	0.1					
211	0.1					
212	0.1					
213	0.1					
214	0.1					
215	0.1					
216	0.2					
217	0.1					
218	0.1					
219	0.2					
220	0.1					
202	0.2				0.75	0.75
221	0.2				0.75	0.75
222	0.2				0.75	0.75
223	0.1				0.75	0.75
224	0.1				0.75	0.75
225	0.1				0.75	0.75
207	0.3				0.75	0.75
277	0.1	0.1	0.1	0.1	0.75	0.75
278	0.1					
279	0.1					
280	0.1					
276-A	0.1				0.75	0.75
276-B	0.1				0.75	0.75

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CADMIUM
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	<0.001	0.007	0.036	0.03	0.01	0.036
209	<0.001					
210	0.005					
211	0.009					
212	0.004					
213	0.007					
214	0.008					
215	0.007					
216	0.011					
217	0.009					
218	0.007					
219	0.011					
220	0.004					
202	0.001				0.01	0.010
221	0.011				0.01	0.011
222	0.007				0.01	0.010
223	0.011				0.01	0.011
224	0.005				0.01	0.010
225	<0.001				0.01	0.010
						0.010
207	0.001				0.01	
277	<0.01	<0.01	<0.01	<0.01	0.01	0.01
278	<0.01					
279	<0.01					
280	<0.01					
276-A	<0.01				0.01	0.010
276-B	<0.01				0.01	0.010

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CHLORIDE
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	37.2	25.3	99.8	146.0	250	250.0
209	19.8					
210	28.0					
211	31.2					
212	8.8					
213	13.9					
214	20.4					
215	37.8					
216	10.2					
217	47.0					
218	15.5					
219	21.0					
220	30.1					
202	9.4				250	250.0
221	8.5				250	250.0
222	5.6				250	250.0
223	5.8				250	250.0
224	26.3				250	250.0
225	9.2				250	250.0
207	30.0				250	250.0
277	6.0	7.3	11.1	9.0	250	250.0
278	7.0					
279	7.0					
280	9.0					
276-A	6.0				250	250.0
276-B	95.3				250	250.0

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CHROMIUM
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.002	0.005	0.074	0.190	0.05	0.074
209	0.002					
210	0.002					
211	0.002					
212	0.003					
213	0.003					
214	0.001					
215	0.004					
216	0.002					
217	0.002					
218	0.032					
219	0.002					
220	0.002					
202	0.003				0.05	0.050
221	0.013				0.05	0.050
222	0.007				0.05	0.050
223	0.003				0.05	0.050
224	0.002				0.05	0.050
225	0.002				0.05	0.050
207	0.003				0.05	0.050
277	<0.05	<0.05	<0.05	< 0.05	0.05	0.050
278	<0.05					
279	<0.05					
280	<0.05					
276-A	<0.05				0.05	0.050
276-B	<0.05				0.05	0.050

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

COBALT
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	<0.05	<0.05	<0.05	0.06	0.05	0.05
209	<0.05					
210	<0.05					
211	<0.05					
212	<0.05					
213	<0.05					
214	<0.05					
215	<0.05					
216	<0.05					
217	<0.05					
218	<0.05					
219	<0.05					
220	<0.05					
202	<0.05				0.05	0.05
221	<0.05				0.05	0.05
222	<0.05				0.05	0.05
223	<0.05				0.05	0.05
224	<0.05				0.05	0.05
225	<0.05				0.05	0.05
207	<0.05				0.05	0.05
277	<0.06	<0.06	<0.06	0.08	0.05	0.05
278	<0.06					
279	<0.06					
280	<0.06					
276-A	<0.06				0.05	0.06
276-B	<0.06				0.05	0.06

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

COPPER
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.010	0.003	0.029	0.07	1.0	1.000
209	<0.001					
210	0.005					
211	<0.05					
212	<0.05					
213	0.002					
214	0.001					
215	0.019					
216	<0.05					
217	<0.001					
218	0.001					
219	0.013					
220	0.002					
202	0.001				1.0	1.000
221	0.029				1.0	1.000
222	0.010				1.0	1.000
223	0.015				1.0	1.000
224	0.030				1.0	1.000
225	0.025				1.0	1.000
207	0.005				1.0	1.000
277	0.04	0.040	0.058	0.05	1.0	1.000
278	0.04					
279	0.04					
280	0.04					
276-A	0.04				1.0	1.000
276-B	0.04				1.0	1.000

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CYANIDE
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.083	0.097	0.780	1.4	0.2	0.780
209	0.100					
210	0.050					
211	0.200					
212	0.175					
213	0.150					
214	0.050					
215	0.133					
216	0.020					
217	0.120					
218	0.050					
219	0.180					
220	0.067					
202	0.020				0.2	0.200
221	0.017				0.2	0.200
222	0.017				0.2	0.200
223	0.380				0.2	0.380
224	0.017				0.2	0.200
225	0.200				0.2	0.200
207	0.050				0.2	0.200
277	<0.005	<0.005	<0.005	<0.005	0.2	0.200
278	<0.005					
279	<0.005					
280	<0.005					
276-A	<0.005				0.2	0.200
276-B	<0.008				0.2	0.200

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

FLOURIDE
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.44	0.43	0.93	0.92	1.6	1.60
209	0.62					
210	0.38					
211	0.34					
212	0.37					
213	0.46					
214	0.42					
215	0.51					
216	0.33					
217	0.34					
218	0.42					
219	0.71					
220	0.26					
202	0.45				1.6	1.60
221	0.27				1.6	1.60
222	0.28				1.6	1.60
223	0.41				1.6	1.60
224	0.26				1.6	1.60
225	0.49				1.6	1.60
207	0.35				1.6	1.60
277	0.30	0.30	0.30	0.30	1.6	1.60
278	0.30					
279	0.30					
280	0.30					
276-A	0.30				1.6	1.60
276-B	0.40				1.6	1.60

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

IRON
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	1.29	0.64	5.50	8.50	1.00	5.50
209	0.18					
210	1.88					
211	0.06					
212	0.08					
213	0.41					
214	0.43					
215	0.83					
216	0.34					
217	0.08					
218	0.59					
219	0.19					
220	1.46					
202	2.05				1.00	2.05
221	0.14				1.00	1.00
222	0.24				1.00	1.00
223	0.42				1.00	1.00
224	2.46				1.00	2.46
225	0.19				1.00	1.00
207	2.20				1.00	2.20
277	0.08	0.16	0.51	0.38	1.00	1.00
278	0.35					
279	0.15					
280	0.09					
276-A	0.06				1.00	1.00
276-B	0.04				1.00	1.00

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

LEAD
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.001	0.003	0.063	0.170	0.05	0.063
209	0.004					
210	0.002					
211	< 0.001					
212	0.006					
213	0.001					
214	0.001					
215	0.001					
216	0.001					
217	0.001					
218	0.029					
219	0.001					
220	0.001					
202	0.001				0.05	0.050
221	0.007				0.05	0.050
222	0.001				0.05	0.050
223	0.002				0.05	0.050
224	0.001				0.05	0.050
225	0.001				0.05	0.050
207	0.003				0.05	
277	< 0.01	< 0.01	< 0.01	< 0.01	0.05	0.050
278	< 0.01					
279	< 0.01					
280	< 0.01					
276-A	< 0.01				0.05	0.050
276-B	< 0.01				0.05	0.050

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

MANGANESE
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.181	0.066	0.456	0.94	0.2	0.456
209	0.062					
210	0.108					
211	0.052					
212	0.009					
213	0.044					
214	0.041					
215	0.150					
216	0.018					
217	0.022					
218	0.069					
219	0.050					
220	0.031					
202	0.096				0.2	0.20
221	0.027				0.2	0.20
222	0.016				0.2	0.20
223	0.010				0.2	0.20
224	0.050				0.2	0.20
225	0.006				0.2	0.20
207	0.121				0.2	0.20
277	<0.01	<0.01	0.013	0.02	0.2	0.20
278	<0.01					
279	<0.01					
280	0.01					
276-A	<0.01				0.2	0.20
276-B	0.19				0.2	0.20

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

MOLYBDENUM
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.291	0.238	0.661	2.3	1.0	1.0
209	0.078					
210	0.582					
211	0.020					
212	0.165					
213	0.209					
214	0.044					
215	0.077					
216	0.078					
217	0.066					
218	0.486					
219	0.673					
220	0.272					
202	0.099				1.0	1.0
221	0.012				1.0	1.0
222	0.011				1.0	1.0
223	0.052				1.0	1.0
224	0.010				1.0	1.0
225	0.329				1.0	1.0
207	0.003				1.0	1.0
277	0.042	0.033	0.042	0.046	1.0	1.0
278	0.033					
279	0.036					
280	0.021					
276-A	0.020				1.0	1.0
276-B	0.007				1.0	1.0

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

TOTAL MERCURY
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.00087	0.00053	0.00194	0.0055	0.002	0.0020
209	0.00040					
210	0.00094					
211	0.00018					
212	0.00013					
213	0.00088					
214	0.00080					
215	0.00042					
216	<0.00004					
217	0.00008					
218	0.00008					
219	0.00024					
220	0.00080					
202	0.0010				0.002	0.0020
221	0.00083				0.002	0.0020
222	0.00010				0.002	0.0020
223	0.00002				0.002	0.0020
224	<0.00004				0.002	0.0020
225	<0.00004				0.002	0.0020
207	<0.00004				0.002	<0.0020
277	<0.00003	<0.00003	<0.00003	<0.00003	0.002	0.0020
278	<0.00003					
279	<0.00003					
280	<0.00003					
276-A	<0.00003				0.002	0.0020
276-B	<0.00004				0.002	0.0020

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

NICKEL
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.01	0.02	0.11	0.10	0.2	0.20
209	0.02					
210	0.02					
211	0.03					
212	0.02					
213	0.02					
214	0.02					
215	0.02					
216	0.03					
217	0.04					
218	0.02					
219	0.03					
220	0.03					
202	0.01				0.2	0.20
221	0.02				0.2	0.20
222	0.03				0.2	0.20
223	0.03				0.2	0.20
224	0.03				0.2	0.20
225	0.03				0.2	0.20
207	0.02				0.2	0.20
277	0.03	0.02	0.08	0.06	0.2	0.20
278	0.04					
279	<0.02					
280	<0.02					
276-A	0.03				0.2	0.20
276-B	<0.02				0.2	0.20

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

NITRATE (asN)
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.08	0.08	0.69	1.9	10.0	10.0
209	0.08					
210	0.12					
211	0.08					
212	0.22					
213	0.08					
214	<0.10					
215	0.10					
216	0.09					
217	0.04					
218	0.07					
219	0.11					
220	0.05					
202	0.08				10.0	10.0
221	0.07				10.0	10.0
222	0.07				10.0	10.0
223	0.04				10.0	10.0
224	0.32				10.0	10.0
225	0.12				10.0	10.0
207	0.08				10.0	10.0
277	<0.04	0.05	0.23	0.15	10.0	10.0
278	<0.04					
279	0.08					
280	0.14					
276-A	<0.04				10.0	10.0
276-B	<0.05				10.0	10.0

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

pH

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	7.9	7.4	N/A	9.1	6 to 9	6 to 9
209	7.4					
210	7.3					
211	7.8					
212	8.0					
213	7.4					
214	7.4					
215	7.2					
216	7.8					
217	8.3					
218	7.4					
219	7.3					
220	7.8					
202	7.6				6 to 9	6 to 9
221	7.9				6 to 9	6 to 9
222	7.9				6 to 9	6 to 9
223	7.8				6 to 9	6 to 9
224	7.5				6 to 9	6 to 9
225	7.6				6 to 9	6 to 9
207	7.2				6 to 9	6 to 9
277	8.9	8.2	N/A	9.2	6 to 9	6 to 9
278	8.7					
279	8.6					
280	9.0					
276-A	8.8				6 to 9	6 to 9
276-B	7.6				6 to 9	6 to 9

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

PHENOLS
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.004	0.011	0.047	0.066	0.005	0.047
209	0.010					
210	0.010					
211	0.020					
212	0.023					
213	0.012					
214	0.008					
215	0.011					
216	0.011					
217	0.016					
218	0.004					
219	0.012					
220	0.009					
202	0.010				0.005	0.010
221	0.004				0.005	0.005
222	0.009				0.005	0.009
223	0.015				0.005	0.015
224	0.009				0.005	0.009
225	0.020				0.005	0.020
207	0.004				0.005	0.005
277	0.003	0.004	0.008	0.007	0.005	0.008
278	0.004					
279	0.005					
280	0.003					
276-A	0.003				0.005	0.005
276-B	0.009				0.005	0.009

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

COMBINED DISSOLVED
RADIUM 226 & RADIUM 228 pCi/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORAT N VALUE
208	<32.3	<21.6	<97.2	89.4±3.0	30.0	97.2
209	<48.2					
210	4.5					
211	<43.8					
212	<6.9					
213	<4.2					
214	<11.6					
215	<58.4					
216	3.8					
217	<6.6					
218	<12.3					
219	<29.0					
220	<23.7					
202	<1				30.0	30.0
221	<2.2				30.0	30.0
222	<1				30.0	30.0
223	<1				30.0	30.0
224	<1.1				30.0	30.0
225	<8.3				30.0	30.0
207	<1.1				30.0	30.0
277	5.1	2.4	8.3	7.2±5.8	30.0	30.0
278	1.6					
279	0.5					
280	2.5					
276-A	0.6				30.0	30.0
276-B	2.4				30.0	30.0

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

SELENIUM
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	<0.01	<0.01	<0.01	0.01	0.05	0.05
209	<0.01					
210	<0.01					
211	<0.01					
212	<0.01					
213	<0.01					
214	<0.01					
215	<0.01					
216	<0.01					
217	<0.01					
218	<0.01					
219	<0.01					
220	<0.01					
202	<0.01				0.05	0.05
221	<0.01				0.05	0.05
222	<0.01				0.05	0.05
223	<0.01				0.05	0.05
224	<0.01				0.05	0.05
225	<0.01				0.05	0.05
207	<0.01				0.05	0.05
277	0.014	0.015	0.025	0.022	0.05	0.05
278	0.013					
279	0.019					
280	0.014					
276-A	0.016				0.05	0.05
276-B	0.005				0.05	0.05

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

SILVER
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	<0.01	<0.01	<0.01	0.02	0.05	0.05
209	<0.01					
210	<0.01					
211	<0.01					
212	<0.01					
213	<0.01					
214	<0.01					
215	<0.01					
216	<0.01					
217	<0.01					
218	<0.01					
219	<0.01					
220	<0.01					
202	<0.01				0.05	0.05
221	<0.01				0.05	0.05
222	<0.01				0.05	0.05
223	<0.01				0.05	0.05
224	<0.01				0.05	0.05
225	<0.01				0.05	0.05
207	<0.01				0.05	0.05
277	<0.005	<0.005	<0.005	<0.005	0.05	<0.005
278	<0.005				0.05	0.05
279	<0.005				0.05	0.05
280	<0.005				0.05	0.05
276-A	<0.005				0.05	0.05
276-B	<0.005				0.05	0.05

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

TOTAL DISSOLVED SOLIDS
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	390	373	589	701	1,000	1,000
209	355					
210	388					
211	366					
212	325					
213	390					
214	443					
215	383					
216	316					
217	386					
218	376					
219	370					
220	338					
202	412				1,000	1,000
221	331				1,000	1,000
222	315				1,000	1,000
223	309				1,000	1,000
224	326				1,000	1,000
225	331				1,000	1,000
207	601				1,000	1,000
277	322	318	340	325	1,000	1,000
278	317					
279	308					
280	323					
276-A	342				1,000	1,000
276-B	558				1,000	1,000

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

TOTAL URANIUM
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	0.023	0.013	0.062	0.082	5	5.0
209	0.006					
210	0.014					
211	0.007					
212	0.010					
213	0.008					
214	0.007					
215	0.014					
216	0.008					
217	0.005					
218	0.009					
219	0.010					
220	0.043					
202	0.002				5	5.0
221	0.005				5	5.0
222	0.008				5	5.0
223	0.006				5	5.0
224	0.007				5	5.0
225	0.012				5	5.0
207	0.007				5	5.0
277	<0.002	<0.002	<0.002	0.003	5	5.0
278	<0.002					
279	<0.002					
280	<0.002					
276-A	<0.002				5	5.0
276-B	0.002				5	5.0

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

ZINC
mg/l

WELL NUMBER	AVERAGE	MEAN	MEAN + 3σ	MAXIMUM VALUE	NMWQCC STANDARD	RESTORATION VALUE
208	<0.01	0.01	0.19	0.51	10.0	10.0
209	<0.01					
210	0.01					
211	<0.01					
212	0.01					
213	<0.01					
214	<0.01					
215	0.01					
216	0.01					
217	0.01					
218	<0.01					
219	0.12					
220	0.01					
202	0.01				10.0	10.0
221	0.01				10.0	10.0
222	0.01				10.0	10.0
223	<0.01				10.0	10.0
224	0.02				10.0	10.0
225	<0.01				10.0	10.0
207	0.02				10.0	10.0
277	0.03	0.03	0.05	0.03	10.0	10.0
278	0.02					
279	0.02					
280	0.03					
276-A	0.04				10.0	10.0
276-B	0.03				10.0	10.0

APPENDIX C

Current Water Quality and Molybdenum Analyses

Current Water Quality - Crownpoint Section 9 Wellfield
July 1987

Chemical Constituent	New Mexico Standard mg/liter	Restoration Standard mg/liter	July 1987 Average mg/liter
Aluminum, dissolved	5.0	5.0	0.692
Arsenic	0.1	0.1	0.018
Barium	1.0	1.0	0.208
Boron	0.75	0.75	0.277
Cadmium	0.01	0.036	<0.005
Chloride	250.0	250.0	52.462
Chromium	0.05	0.074	0.005
Cobalt, dissolved	0.05	0.05	0.011
Copper, dissolved	1.0	1.0	<0.005
Cyanide	0.2	0.780	<0.005
Fluoride	1.6	1.6	<0.546
Iron, dissolved	1.0	5.50	0.035
Lead, dissolved	0.05	0.063	0.007
Manganese, dissolved	0.2	0.456	0.008
Molybdenum, dissolved	1.0	1.0	1.49
Mercury, total	0.002	0.002	0.0014
Nickel, dissolved	0.2	0.2	<0.02
Nitrate (as N)	10.0	10.0	0.254
PH	6 to 9	6 to 9	9.454
Phenols	0.005	0.047	0.006
Combined Ra-226 & 228	30.0	97.2	20.577
Selenium, dissolved	0.05	0.05	0.006
Silver, dissolved	0.05	0.05	0.005
Sulfate (as SO4)	600.0	600.0	65.846
TDS (at 180 C)	1000.0	1000.0	366.154
Uranium (as U)	5.0	5.0	0.102

CROWNPOINT SECTION 9

MOLYBDENUM ANALYSES