APPLICATION FOR PERMIT REVISION
TO
MINING PERMIT 304C
SOUTH POWDER RIVER BASIN
CONVERSE COUNTY, WYOMING

"O" SAND IN-SITU R&D PROJECT

JUNE 1983

KERR-McGEE NUCLEAR CORPORATION

NOTE: Please remove the following items from the initial application and insert them in this package to make a complete document.

1. Remove Figure C-1 Appendix C page C-3 (USGS Blueline Topo Map in clear plastic pocket) from the initial submittal and insert it behind page Appendix C-2.

2. Remove Figure 9-3, Attachment A page A-3 (Test Site Cross Section; East-West in clear plastic pocket) from the initial submittal and insert it behind page 9-2 in Attachment A.

3. Remove Figure 9-4, Attachment A page A-4 (Test Site Cross Section; North-South in clear plastic pocket) from the initial submittal and insert it behind page 9-3a in Attachment A.

TABLE OF CONTENTS

(1)Section designations based on DEQ LQD Form 5 requirement.

INTRODUCTION

Kerr-McGee Nuclear Corporation applied for an "In-Situ Research and Development Testing License" for the "O" sand project on February 9, 1983. The application was accepted for review and designated by DEQ as TFN 1 5/295. By letter dated May 26, 1983, DEQ Land Quality Division requested Kerr-McGee to consider converting the application to a permit revision under Mining Permit No. 304C. Kerr-McGee has made the requested change with the understanding this application would be reviewed and evaluated under the in-situ research and development testing rules and regulations and no additional data requirement or time delays would result because of this change.

The "O" sand in-situ R&D program is distinct from the "Q" sand R&D program in that it will evaluate and obtain data on the following areas:

1. Evaluate leaching in the "O" sand formation which is 250 feet deeper than the "Q" sand project.

2. Evaluate leaching and environmental control procedures in the thicker "O" sand formation, including bleed stream rates required to ensure natural groundwater flow into test area for excursion control and the dilution of leach solutions.

3. Evaluate greater spacing between wells which would reduce well field surface disturbance and impact the feasibility of commercial in-situ operations.

A copy of the original DEQ LQD Form 5 application, the project description and the supporting data are included. The application has been revised to incorporate, where appropriate, responses to comments and questions in DEQ's letter of May 25, 1983 addressed to Mr. W. J. Shelley from Ms. Cathleen McCarty.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink. Submit three (3) copies, one of which must be an original Form 11 as supplied by the Department of Environmental Quality, Land Quality Division.

STATE OF WYOMING

DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
APPLICATION
FOR
PERMIT REVISION

An application for a permit revision shall be required whenever the operator proposes to conduct a revised mining or reclamation operation, as defined in Chapter I, Section 2, Land Quality Rules and Regulations. An application for a permit revision shall be filed with the Administrator before the date on which the operator expects to conduct the revised mining or reclamation operation.

1. Name, Telephone Number, and Mailing Address of Applicant: Kerr-McGee Nuclear Corporation, Kerr-McGee Center, P. O. Box 25861, Oklahoma City, Oklahoma 73125, ATTN: Mr. W. J. Shelley, Vice President, Nuclear Licensing and Regulation (405) 270-2631

2. The permit number and date approved: Mining Permit #304C, Issued April 4, 1975

3. Location of permit revision (county): Converse

4. Attach the following information, if different from that submitted in the original permit application:

   (a) The names and last known addresses of the owners of record of the surface and mineral rights of the land covered by the permit (Appendix "A");

   (b) The names and last known addresses of the owners of record of the surface rights of the lands immediately adjacent to the permit area (Appendix "B");

   (c) The precise location of the permit area by legal subdivision, section, township, range, county, and municipal corporation, if any (Appendix "C").

5. A detailed description of the proposed revised mining or reclamation operation which shall also include:

   (a) A U.S.G.S. topographic map or equivalent of the permit area showing the land to be affected by the revised mining or reclamation operation, in detail, distinctly outlined and identified;

   (b) For any proposed newly affected lands, if not submitted and approved in the original application for the permit:

      i) The information required in W.S. 35-11-406(a)(vii) and (ix) or, for in-situ mining operations, the information required in W.S. 35-11-428 to be submitted as Appendix "D"; and

      ii) The extent to which the revised mining or reclamation operation will disturb, change or deface the lands proposed to be affected, the proposed future use or uses, and the plan whereby the operator will reclaim the affected lands to the proposed future use or uses.

   (c) Any significant changes in the estimate of the total cost of reclaiming the affected and proposed affected lands, computed in accordance with established engineering principles.

6. The provisions of this permit revision are severable, and if any provision of the permit revision or the application of any provision of this permit revision to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit revision shall not be affected thereby.

7. For surface coal mining operations, right of entry to or inspection of any operation, premises, records, or equipment shall not require advance notice.

FINAL SWORN STATEMENT

State of Oklahoma)
) ss.
County of Oklahoma)

I Rhoderic Tregenbo being duly sworn on my oath
Name (typed or printed)

that I am the applicant (President or Vice President if the application is a corporation) for the foregoing permit revision; that I have read the said application and fully know the contents thereof; that all statements contained in the permit revision application are true and correct to my best knowledge and belief, by execution of this statement I certify that Kerr-McGee Nuclear Corporation has the right and power by legal estate owned to mine
(Applicant)
from the land for which this permit revision is desired; that Kerr-McGee Nuclear Corporation
(Applicant)
has not forfeited, or is not involved in forfeiture proceedings for, a bond posted for reclamation purposes; and by completion and submission of this application, hereby give consent to allow the Director, the Administrator and/or his authorized representatives, at reasonable times and upon presentation of appropriate credentials, to enter upon and have access to any and all lands covered by this permit and amendments thereto and to inspect and copy any records or documents, obtain or monitor any samples or sampling, for any activities associated with the operation and permit.

Dated this 20th day of June, 19 83.

Signature R Tregenbo

Title Vice President, Mining and Milling

(seal)

R Hays Asst. Secy.
Notary Public or Secretary if a Corporation

Permit No. 304C
TFN No. 1 - 5/295

Do not fold this form. Use typewriter or print neatly with black ink. Submit six (6) completed copies, one of which must be an original Form 5 as supplied by the Department of Environmental Quality.

STATE OF WYOMING

DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY AND WATER QUALITY DIVISIONS
APPLICATION
FOR
IN-SITU RESEARCH AND DEVELOPMENT TESTING LICENSE

"O" Sand ISL Project

1. (a) Name, mailing address and telephone number of applicant: Kerr-McGee Nuclear Corporation
Kerr-McGee Center, P. O. Box 25861, Oklahoma City, Okla. 73125

(b) County where testing will occur: Converse

(c) If the applicant is a partnership, association or corporation, the names and addresses of all managers, partners and executives directly responsible for operations in this state:

Name: Rhoderic Tregembo Address: Same as above

Title: Vice-President Mining and Milling Phone No: 405/270-2604

Name: Marvin D. Freeman Address: Same as above

Title: Director, Chemical Mining Dept. Phone No: 405/270-2972

Name: B. J. Buntz Address: Same as above

Title: Manager Technical Services Phone No: 405/270-2636

Name: E. G. Orrell Address: P. O. Box 1120
Glenrock, Wyoming 82637

Title: General Superintendent Operations Phone No: 307/358-3744

2. Name and mailing address of the agent or person to whom any notice under the provisions of Wyoming Environmental Quality Act or Rules and Regulations adopted thereunder may be sent: Mr. W. J. Shelley, Vice-President Nuclear Licensing and Regulation, P. O. Box 25861, Oklahoma City, Oklahoma 73125 ph. 405/270-2631

3. Attach the following information as part of the specific appendices:

(a) APPENDIX "A"

Names and addresses of surface and mineral owners of record within the proposed license area.

(b) APPENDIX "B"

(i) Names and last known addresses of the owners of record of the surface rights of the lands immediately adjacent to the proposed license area.

(ii) Names and last known addresses of any other persons within one-half (½) mile having a valid legal estate of record.

NOTE: Appendices "A" and "B" shall each be accompanied by maps showing the ownership locations required by the respective appendices. Mapping of (b)(ii) is not required.

(c) APPENDIX "C"

(i) All lands to be included in the proposed license area shall be tabulated by legal subdivision, section, township, range, county, and municipal corporation, if any, and the number of acres for each subdivision listed.

(ii) Lands which are to be part of the proposed license area, for which no right to mine is claimed shall be identified in item (c)(i) above as such and tabulated separately listing the number of acres for each legal subdivision.

(iii) Lands which are located within other permit or license areas shall be identified and a copy of the agreement with the other permittee(s) or licensee(s) shall be attached as part of this application.

(iv) An original USGS topographic map, clearly outlining and identifying the lands to be within the proposed license area, shall be provided. Photo copies or other similar copies are not acceptable unless prior approval is obtained from the Land Quality Division.

(d) APPENDIX "D"

(i) The present and proposed post-reclamation land uses, vegetation and topsoil characteristics of the lands.

(ii) Location and name of surface waters and adjudicated water rights inside and within one-half (½) mile of the license area.

Research & Development License No. _____
TFN No. 1-5/295

(iii) Locations and present owners of all wells inside and within one-half (½) mile of the license area to include information concerning plugging of well completion and producing interval(s) to the extent such information is available in the public record or by a reasonable inspection of the property.

(iv) Groundwater quality data and potentiometric surface elevations for aquifers that may be effected by the proposed operation.

4. (a) Mineral(s) to be extracted: Uranium

(b) Testing method to be used: In-situ leaching using $Na_2CO_3/NaHCO_3$

5. Estimated dates of commencement and termination of the proposed research and development testing:

Start of Testing: September 1983 Termination of Restoration: September 1987

6. The total number of acres in the proposed license area and an estimate of the total number of acres to be affected by the research and development testing.

Total License Acres: 60 Estimate of Affected Acres: 5.0 acres

7. The nearest town, village, or city: Glenrock, Wyoming

8. A filing fee of $25.00 is enclosed.

9. A testing plan is required including a description of the nature and scope of the testing activity, the groundwater hydrology, the general geology, maps showing the surface facilities, access roads, communication lines, the sequence of the operation, and descriptions of the expected impacts on natural resources, mitigating measures, and operational procedures. The testing plan must show that the test will:

(a) Evaluate mineability or workability of a mineral deposit using in-situ mining techniques.

(b) Affect the land surface, surface waters and groundwater of the State to the minimum extent necessary.

(c) Provide pre-mining, operational and post-mining data, information and experience that will be used for developing reclamation techniques for in-situ mining.

10. A reclamation plan is required including descriptions of the methods to be used in groundwater restoration, surface restoration, the type of revegetation and practices to be used to achieve revegetation, and an estimate of the cost of restoration.

11. Proof of notice and mailing to all persons within one-half (½) mile of the license area having a valid legal estate of record including but not limited to surface ownership, mineral ownership, grazing leases, pipeline rights of way, roads rights of way, utility rights of way, water right appropriations, etc.

12. A reclamation bond is required by W.S. 35-11-433(a) prior to approval.

13. The name, if any, by which such lands listed in Appendix "C" are known:

_____

14. Under the provisions of W.S. 35-11-1101, certain trade secret portions of the application and supporting information may be maintained by the Department as confidential. Except for data determined to be confidential, all reports prepared in accordance with the terms of this license shall be available for public inspection at the office of the applicant. Water quality data from monitoring wells shall not be considered confidential.

15. Monitoring and Analytical Procedures:

(a) Procedures for the analysis of pollutants shall conform to provisions of the Wyoming Water Quality Rules and Regulations, Chapter VIII.

(b) For each sample or measurement taken pursuant to the requirements of this license, the licensee shall record the following information:

(i) The exact place, date, and time of sampling;

(ii) The dates the analyses were performed;

(iii) The person(s) who performed the analyses;

(iv) The analytical techniques or methods used; and

(v) The results of all required analyses.

(c) If the licensee monitors any pollutant at the location(s) designated herein more frequently than required by this license, using approved analytical methods as specified above, the results of such monitoring shall be recorded as specified above.

16. Pollutants removed in the course of treatment or control of wastewaters shall be disposed of in such a manner to prevent any pollutant from entering waters of the State.

17. At the request of the Director of the Wyoming Department of Environmental Quality, the licensee must be able to show proof of the accuracy of any flow measuring device used in obtaining data submitted in any report.

18. Nothing in this license shall be construed to relieve the licensee from civil or criminal penalties for noncompliance. Nothing in this license shall be construed to preclude the institution of any legal action or relieve the licensee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation.

19. The provisions of this license are severable, and if any provision of the license, or the application of any provision of this license to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this license, shall not be affected thereby.

20. A surface discharge is unauthorized without a permit issued by the Water Quality Division. A permit to construct, issued by the Water Quality Division, is required before construction of a wastewater treatment facility commences.

Research & Development License No. _____
TFN No 1-5/295

FINAL SWORN STATEMENT

State of Oklahoma)
) ss.
County of Oklahoma)

I Rhoderic Tregembo being duly sworn on my oath
Name (typed or printed)

that I am the applicant (or President or Vice President if the applicant is a corporation) for the foregoing license; that I have read the said application and fully know the contents thereof; that all statements contained in the license application are true and correct to my best knowledge and belief, by execution of this statement I certify that

Kerr-McGee Nuclear Corporation has the right and power by legal estate owned to mine
Applicant

from the land for which this license is desired; that Kerr-McGee Nuclear Corporation
Applicant

will conduct the testing and reclamation activities in conformance with the approved plans; that

Kerr-McGee Nuclear Corporation has not forfeited or is not involved in forfeiture proceedings
Applicant

for, a bond posted for reclamation purposes, and by completion and submission of this application, hereby give consent to allow the Director, the Administrator and/or his authorized representatives, at reasonable times and without advance notice and upon presentation of appropriate credentials, to enter upon and have access to any and all lands covered in this license thereto and to inspect and copy any records or documents, obtain or monitor any samples or sampling, for any activities associated with the operation and license.

Signature _____

Title Vice-President Mining and Milling

(seal)

_____ Asst. Secy.
Notary Public or Secretary if a Corporation

Research & Development License No. _____
TFN No. 1-5/295

THE STATE OF WYOMING)
) ss.
DEPARTMENT OF ENVIRONMENTAL QUALITY)

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This license grants only the right to affect the lands described in Appendix "C" of the application.

APPROVED: _____
W. C. Ackerman, Administrator
Land Quality Division
Dept. of Environmental Quality

APPROVED: _____
William Garland, Administrator
Water Quality Division
Department of Environmental Quality

Effective Date: _____
Research & Development
License Number: _____

THE STATE OF WYOMING)
) ss.
DEPARTMENT OF ENVIRONMENTAL QUALITY)

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit revision grants only the right to affect the lands described in Appendix "C" of the original permit and amendments.

APPROVED: _____
W. C. Ackerman, Administrator
Land Quality Division
Dept. of Environmental Quality

APPROVED: _____
Robert E. Sundin, Director
Dept. of Environmental Quality

Effective Date: _____

Permit No. _____

TFN No. _____

DEQ LAND QUALITY DIVISION FORM 5 REQUIREMENT
KERR-McGEE "O" SAND ISL PROJECT
CONVERSE COUNTY, WYOMING

Item 1. Name and Address of Applicant: The name and address is included on the LQD Form 11, item 1.

Item 2. Name and Address of Agent to Whom Notices are to be sent: The name and address is included on the LQD Form 11, item 1.

Item 3. Attach required information as Appendices A, B, C, and D: Appendices A, B, C, and D are attached.

Item 4. (a) Mineral(s) to be extracted: Uranium
(b) Testing method to be used: In-situ leaching using $Na_2CO_3/NaHCO_3$

Item 5. Estimated dates of commencement and termination.
(a) Start of Testing: Fourth Quarter 1983
(b) Termination of Restoration: 1988

Item 6. Total acres in the proposed project area and the total number of acres to be affected by the testing program.
(a) Total Project Area: 60 acres
(b) Estimate of Affected Areas: 5 acres

Item 7. Nearest town, village, or city: Glenrock, Wyoming

Item 8. A filing fee of $25.00 is required: The $25.00 filing fee has been submitted.

Item 9. Testing Plan: The testing plan is addressed in Section 9 beginning on page 9-1, immediately following Appendix D.

Item 10. Reclamation Plan: The reclamation plan is addressed in Section 10 beginning on page 10-1.

Item 11. Proof of Notice and Mailing: The proposed notice of application will be mailed by certified mail to the owners of record listed in Appendices A and B within ten (10) days of the submittal of this revision to the DEQ. The certified mail return receipts will be forwarded to the DEQ for insertion in the application when they are received.

Item 12. Reclamation Bond: A reclamation bond will be obtained and submitted to the DEQ after the amount of the required bond is established. Kerr-McGee's reclamation bond estimate for the project is included in the application as Table 10-1 (page A-15).

Item 13. Name of the Lands: The project area is not known by any specific name.

Item 14. Confidential Data: No confidential data has been included in the application.

Item 15. Monitoring and Analytical Procedures: The requested procedures are included as Section 15 beginning on page 15-1. (Note: Items 11 through 14 did not require additional data, therefore Section 15 follows immediately after Section 10).

Item 16 through 20 are conditions and/or stipulations and do not require responses.

CERTIFIED MAIL RETURN RECEIPT REQUESTED

NOTICE OF APPLICATION

Kerr-McGee Nuclear Corporation of Oklahoma City, Oklahoma has applied for a mining permit revision from the Department of Environmental Quality for the State of Wyoming. The area affected by the permit revision is located in NE¼ SW¼ and W½ NW¼ SE¼ Section 26, Township 36N, Range 74W, Converse County, Wyoming. The proposed operation is scheduled to begin fourth quarter, 1983 and is estimated to continue into 1988. The land after mining will be returned to a livestock and wildlife grazing use. Information regarding the proposed mining operation and reclamation procedures may be reviewed in the office of the Land Quality Division of the Environmental Quality Department in Cheyenne, Wyoming (LQD TFN No. 1-5/295) or the office of Kerr-McGee Nuclear Corporation, Oklahoma City, Oklahoma.

Questions in regard to the application may be addressed to:

Kerr-McGee Nuclear Corporation
P. O. Box 25861
Oklahoma City, Oklahoma 73125
ATTN: W. J. Shelley
Phone: 405/270-2631

APPENDIX "A"

KERR-McGEE "O" SAND ISL PROJECT
CONVERSE COUNTY, WYOMING

The Names and Addresses of Surface and Mineral Owners of Record Within the Project Area:

NE¼SW¼ and W½NW¼SE¼ Sec. 26, T36N, R74W

Surface:

Kerr-McGee Nuclear Corporation
P. O. Box 25861
Oklahoma City, Oklahoma 73125

Mineral:

Kerr-McGee Nuclear Corporation
P. O. Box 25861
Oklahoma City, Oklahoma 73125

Oil & Gas:

Diamond Shamrock Corporation
P. O. Box 631
Amarillo, Texas 79143

Elf Aquitane, Inc.
Suite 200
950 Threadneedle
Houston, Texas 77079

Jean Chorney
1860 Lincoln Way
Denver, Colorado 80203

Getty Oil Company
P. O. Box 66729
Houston, Texas 77006

REV: 6/20/83

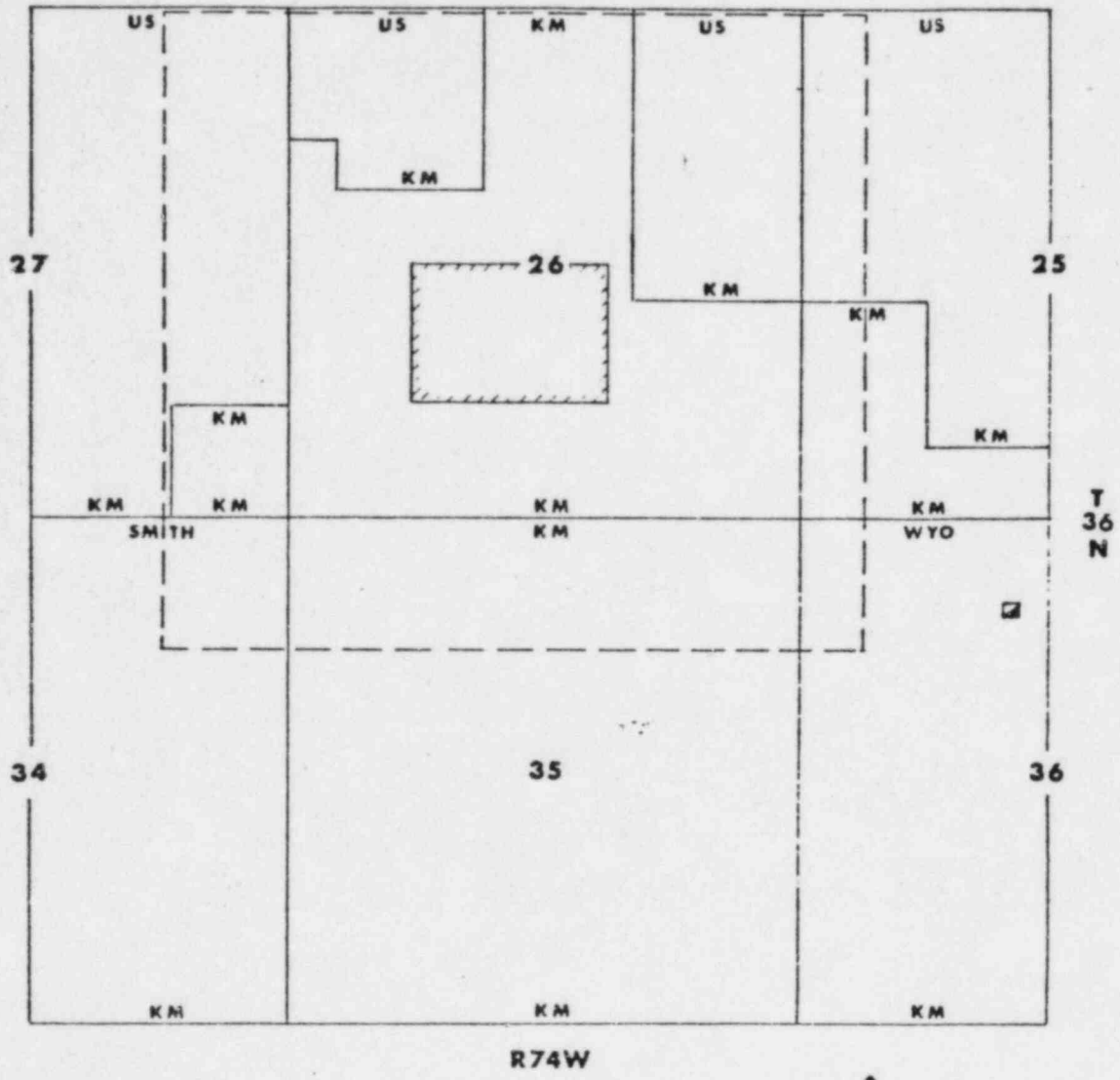
FIGURE A-1

Surface & Mineral Owners

PROJECT AREA AND ADJACENT LANDS

KERR-McGEE 'O" SAND ISL PILOT

CONVERSE COUNTY WYOMING



PROJECT AREA

LIMITS OF ADJACENT LANDS

BILL SMITH MINE SHAFT

NORTH

0 1000' 2000'

SCALE: 1" = 2000'

STATE — SURFACE OWNER

PROPERTY LIMITS

KM — MINERAL OWNER OR LESSEE

US - UNITED STATES

WYO - STATE OF WYOMING

KM - KERR-McGEE NUCLEAR CORP.

SMITH - SMITH LAND COMPANY

APPENDIX "B"

KERR-McGEE "O" SAND ISL PROJECT
CONVERSE COUNTY, WYOMING

Names and Addresses of Owners of Record of Surface Rights on Land Adjacent to the Project Area:

Surface Owners:

United States Government
Bureau of Land Management
Casper District Office
951 Union Boulevard
Casper, Wyoming 82601

State of Wyoming
Commissioner of Public Lands
2424 Pioneer Avenue
Pioneer Building
Cheyenne, Wyoming 82002

Kerr-McGee Nuclear Corporation
P. O. Box 25861
Oklahoma City, Oklahoma 73125

Smith Land Company
207 North 4th Street
Douglas, Wyoming 82633

County Road:

Converse County Commissioners
Douglas, Wyoming 82633

Grazing Lease:

Smith Land Company
207 North 4th Street
Douglas, Wyoming 82633

Right of Way:

Mountain Bell Telephone Co.
155 North Beech
Casper, Wyoming 82602

APPENDIX "B"
(Continued)

KERR-McGEE "O" SAND ISL PROJECT
CONVERSE COUNTY, WYOMING

Names and Addresses of Persons Known to Have a Valid Estate of Record Within One-Half Mile of the Project Area:

State of Wyoming
Commissioner of Public Lands
2424 Pioneer Avenue
Pioneer Building
Cheyenne, Wyoming 82002

Smith Land Company
207 North 4th Street
Douglas, Wyoming 82633

Mountain Bell Telephone Co.
155 North Beech
Casper, Wyoming 82601

Kerr-McGee Nuclear Corp.
P. O. Box 25861
Oklahoma City, Oklahoma 73125

United States Government
Bureau of Land Management
Casper District Office
951 Union Boulevard
Casper, Wyoming 82601

Raymond Chorney
1860 Lincoln Way
Denver, Colorado 80203

Robert W. Scott
11386 West 26th Place
Lakewood, Colorado 80215

John Oakason
654 South 9th East
Salt Lake City, Utah 84102

Kerr-McGee Corporation
P. O. Box 25861
Oklahoma City, Oklahoma 73125

Samedan Oil Company
633 17th Street
Denver, Colorado 80202

Wendy Louise Wolf,
Trust No. 1 and 2
First National Bank Building
Houston, Texas 77002

L.S.D. Oil Company
14575 West 54th Avenue
Arvada, Colorado 80002

Mountain States Telephone & Telegraph
931 14th Street
Denver, Colorado 80202

Apache Corporation
1660 Lincoln Street
Denver, Colorado 80264

Oklahoma Oil Company
1120 One Energy Square
4925 Greenville Avenue
Dallas, Texas 75206

Cimmaron Corporation
1120 One Energy Square
4925 Greenville Avenue
Dallas, Texas 75206

Don J. Leman
Suite 1450
50 Penn Place
Oklahoma City, Oklahoma 73118

Leman Energy Corporation
Suite 1450
50 Penn Place
Oklahoma City, Oklahoma 73118

APPENDIX "B"
(Continued)

KERR-McGEE "O" SAND ISL PROJECT
CONVERSE COUNTY, WYOMING

Bank of America N.T. & S.A. as
Trustee of Charles E. Strange
1976 Trust No. 1
1440 Troxton
Bakersfield, California 93301

Thomas Antongiovann; Trustee of
the Thomas Antongiovann Trust No. 1
4316 Charter Oaks Avenue
Bakersfield, California 93309

Green River Oil Company
P. O. Box 17389
Fort Worth, Texas 76102

H. S. Winston
4533 Claudview Road
Fort Worth, Texas 76109

Joan Chorney
1860 Lincoln Way
Denver, Colorado 80203

Diamond Shamrock Corporation
P. O. Box 631
Amarillo, Texas 79143

Elf Aquitane, Inc.
Suite 200
960 Threadneedle
Houston, Texas 77079

Getty Oil Company
P. O. Box 66729
Houston, Texas 77006

REV: 6/20/83

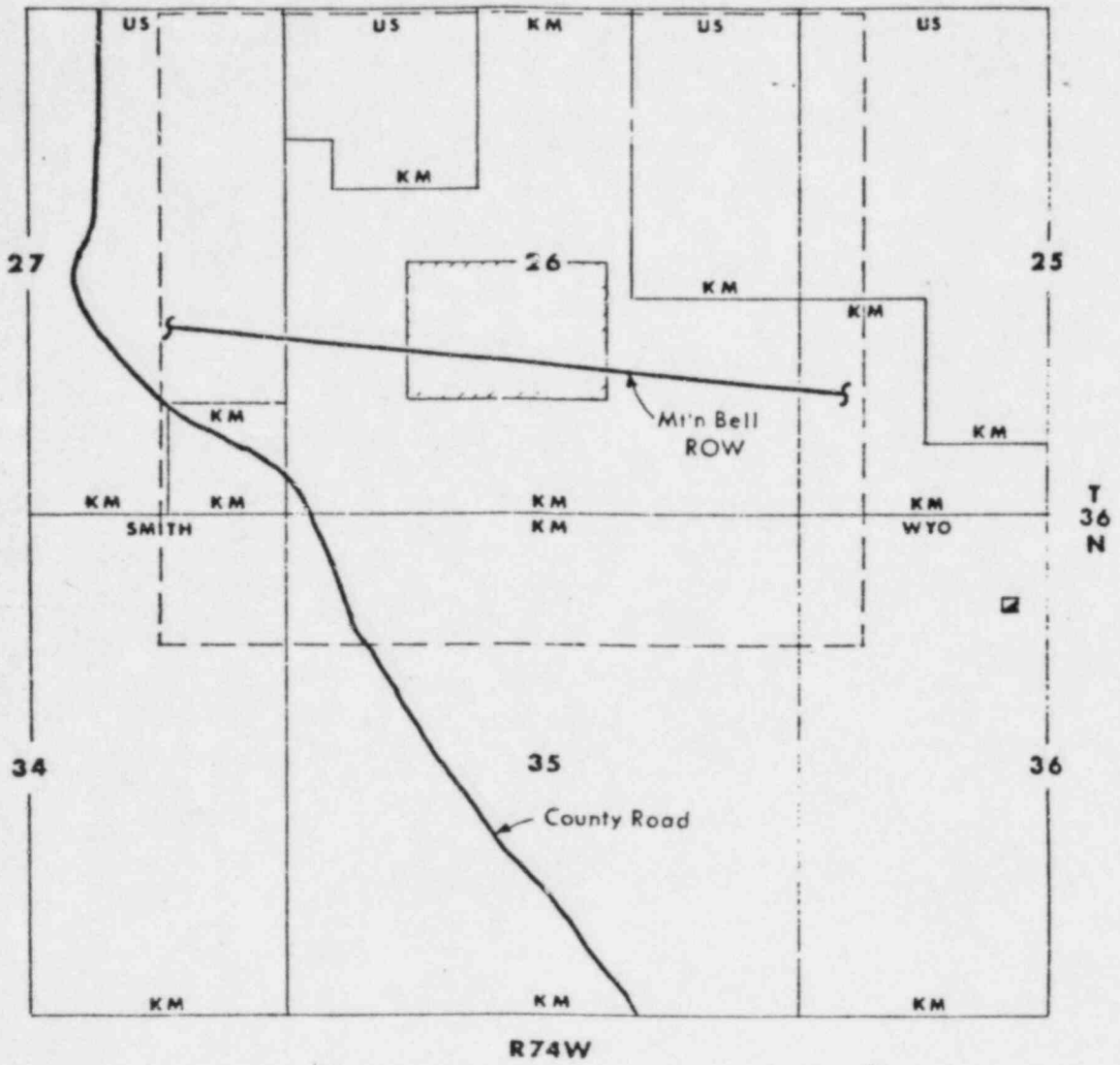
FIGURE B-1

Surface & Mineral Owners

PROJECT AREA AND ADJACENT LANDS

KERR-McGEE 'O'' SAND ISL PILOT

CONVERSE COUNTY WYOMING



PROJECT AREA

LIMITS OF ADJACENT LANDS

BILL SMITH MINE SHAFT

NORTH

0 1000' 2000'

SCALE: 1" = 2000'

STATE — SURFACE OWNER
PROPERTY LIMITS
KM — MINERAL OWNER OR LESSEE

US - UNITED STATES
WYO - STATE OF WYOMING
KM - KERR-McGEE NUCLEAR CORP.
SMITH - SMITH LAND COMPANY

Rev: 6/20/83

Appendix "C"

Kerr-McGee "O" Sand ISL Project

Converse County, Wyoming

This Appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, and the number of acres for each subdivision are listed.

(i) "O" Sand Project area (See attached Form C).

(ii) Not Applicable - Kerr-McGee Nuclear Corporation has a right to mine in all lands identified in Appendix C item (i) above.

(iii) Lands identified in Appendix C item (i) are currently contained within the Kerr-McGee Nuclear Corporation South Powder River Basin mine permit area (#304C).

(iv) A USGS map (blueline copy) "Highland Flats, Wyoming-1959" identifying the project area is attached. DEQ has approved the use of a blueline copy.

FORM "C"

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. 35-11-406,(a),(vi)) and the number of acres in each description. No mining activity may take place on land for which there is not in effect a valid mining permit (W.S.35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. 35-11-406,(a),(xii)), so care should be taken to include all lands necessary to the mining and reclamation operation as defined in W.S. 35-11-103, (e),(viii). All acreage figures should be obtained from official survey documents or recent surveys if available. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

NE¼ SW¼	Section 26, T. 36 N., R. 74 W., Acres 40
W½ NW¼ SE¼	Section 26, T. 36 N., R. 74 W., Acres 20

COUNTY OF Converse, Wyoming — Subtotal Above Acres 60

Municipal Corporation - - — Total Permit Acres 60

Reviewed (compiled), DEQ/LQD	Date	Applicant Signature	Date

Checked, DEQ/LQD

Rev: 6/20/83

Appendix "D"

Kerr-McGee "O" Sand ISL Project

Converse County, Wyoming

The following information, required for subparts of Appendix D of L.Q.D. Form 5. (In-situ R&D License) is provided in support of an application for a revised mining method in the project area.

(i) The present primary land use in the project area is grazing for livestock and wildlife. No change in post reclamation land use is anticipated. Archeological clearance has been provided (see attached).

Based upon U.S. Soil Conservation Service surveys of similar areas to the immediate north (in the proposed mill site area) topsoil typically ranges from 0-5 feet in depth. Data on four auger soil sample points are included on Table D-8. The native vegetation in the area includes western wheatgrass, blue grass, needle and thread, sagebrush and cactus.

(ii) Figures D-1 and D-2 identify surface drainage systems and major streams in vicinity of the project area. Frank Draw (intermittent drainage) is located within the project area. There are no adjudicated water rights located inside or within one-half (½) mile of the project area.

(iii) Figure D-3 and Table D-1 provide location and present owner (Kerr-McGee) of all wells inside and within one-half (½) mile of the project area. Table D-1 includes information on well depth, casing type, producing interval, and water level elevations.

(iv) Potentiometric surface elevations for the "O" Sand aquifer are provided in Figure D-4. Groundwater quality data for recently completed wells in the O Sand and underlying and overlying aquifers are provided on Tables D-2 through D-7.

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Recreation Commission

1920 THOMES CHEYENNE, WYOMING 82002

JAN L. WILSON
Director
777-7695

September 15, 1982

	INITIAL	DATE
ADM		
EC		
AO		
AA		

RECEIVED CASPER SEP 17 1982 BLM WYO

P & EC	
RES.	
OPR	
BUFFALO	
PLATTE	
NEWCASTLE	

Mr. Dale Austin
Bureau of Land Management
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Austin:

Information concerning the proposed Kerr McGee Mine Permit area was received in this office. Thank you for giving us the opportunity to comment.

Enclosed is a memorandum from our staff historian who reviewed the materials. He indicates that adequate provision has been made for cultural manifestations. Therefore, the Wyoming State Historic Preservation Officer (SHPO) recommends cultural clearance of the project for the purposes of applicable state and federal laws.

If you have any questions concerning this recommendation please contact the appropriate member of our staff.

Sincerely,

Mark Junge, Deputy
State Historic Preservation Officer

FOR:

Jan L. Wilson, Director and
State Historic Preservation Officer

MGJ:klm
Encls.

WYOMING RECREATION COMMISSION

STATE HISTORIC PRESERVATION OFFICE

REVIEW AND COMPLIANCE

Interdisciplinary Staff Comments

Archeology • History • Historical Architecture • Recreation Planning

TO: Mark Junge, Chief

FROM: Rick Ewig, Historical Review & Compliance Officer RE

DATE: September 15, 1982 (district #7)

RE: BLM, Casper District, Proposed Kerr McGee Mine Permit Area, Converse County

I have reviewed the project plans for Kerr-McGee Nuclear's proposed in-situ leach research and development well field in Section 26, T36N, R74W. The project area is located in the Bozeman Trail corridor, but an on-site investigation by myself and other members of the SHPO staff revealed no identifiable trail ruts in the immediate area. However, we did find Bozeman Trail ruts in Sections 23 and 35 which are worthy of preservation, but these will not be impacted by the Kerr-McGee Nuclear project. Therefore, I recommend historical clearance for this project.

INTRODUCTION

On Mzy 4-6, 1982 personnel from the Office of the Wyoming State Archeologist, Contracting Division, conducted a cultural resource survey of a proposed uranium mine in Converse County, Wyoming. The survey was conducted at the request of Kerr McGee Nuclear Corporation and included 800 acres (all patented land held by Kerr-McGee Corporation). The survey area was staked and is shown in Figure 1. The legal locations are:

T36N, R74W, Section 26 - S½

Section 35 - NE¼ and S½

Crew members included Jeff Hauff, crew chief; Allen Darlington and Jim Truesdale. David Eckles, Director of Contracting, served as Principal Investigator.

Purposes of the survey were to: 1) locate and record all cultural manifestations, both historic and prehistoric, within the boundaries of the study area; 2) determine the significance of each locality and provide recommendations of site eligibility for inclusion on the National Register of Historic Places; and 3) if necessary, provide a mitigation plan for those eligible sites which may be impacted.

The purposed disturbance to the area is subsurface leaching of uranium ore deposits. Major surface effects would include pumping stations, access roads and pipelines, which may impact cultural resources.

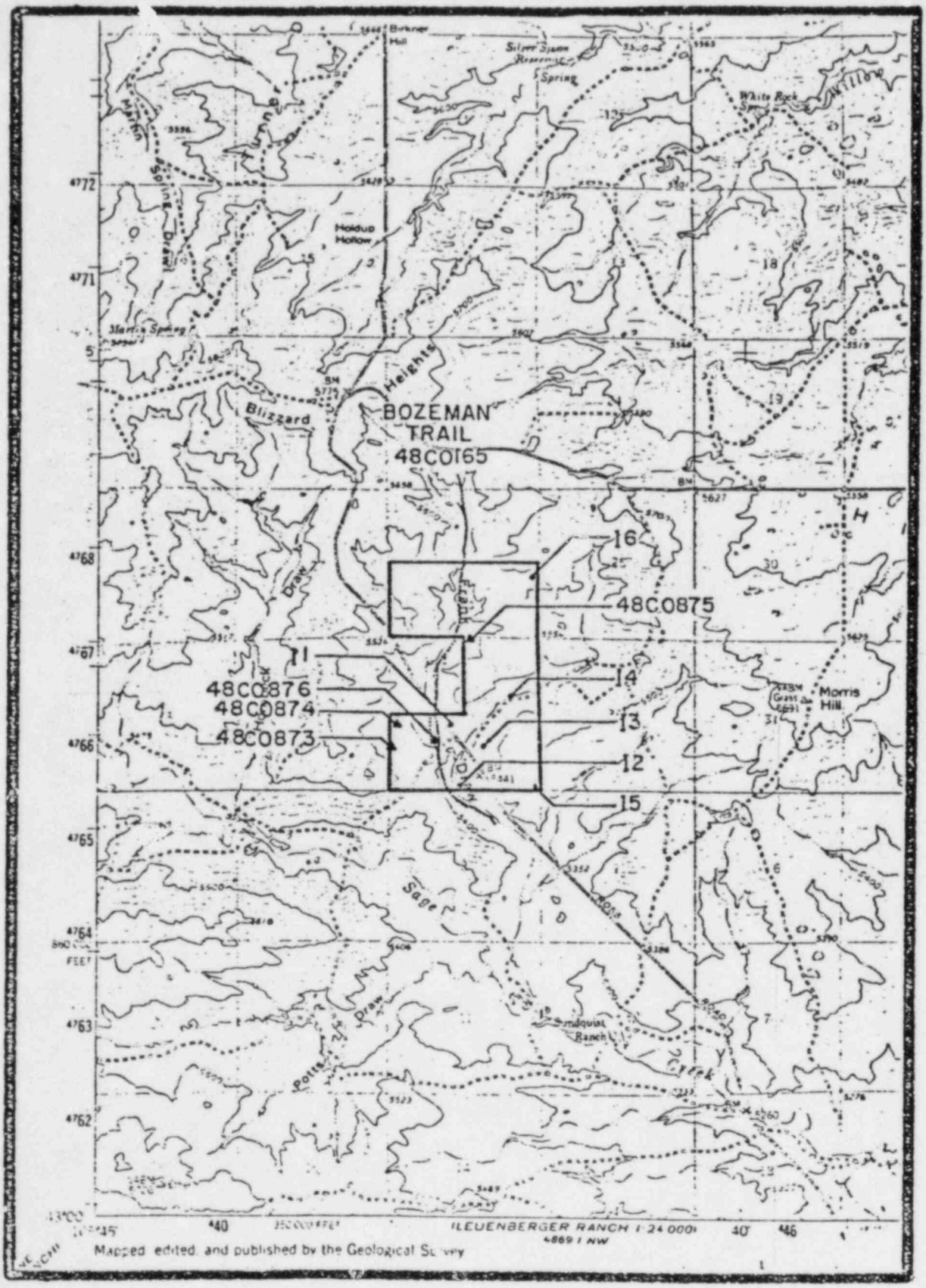


Figure 1. Location of the Survey Area and Sites Recorded. U.S.G.S. 15' Topographic Map, Highland Flats Quadrangle.

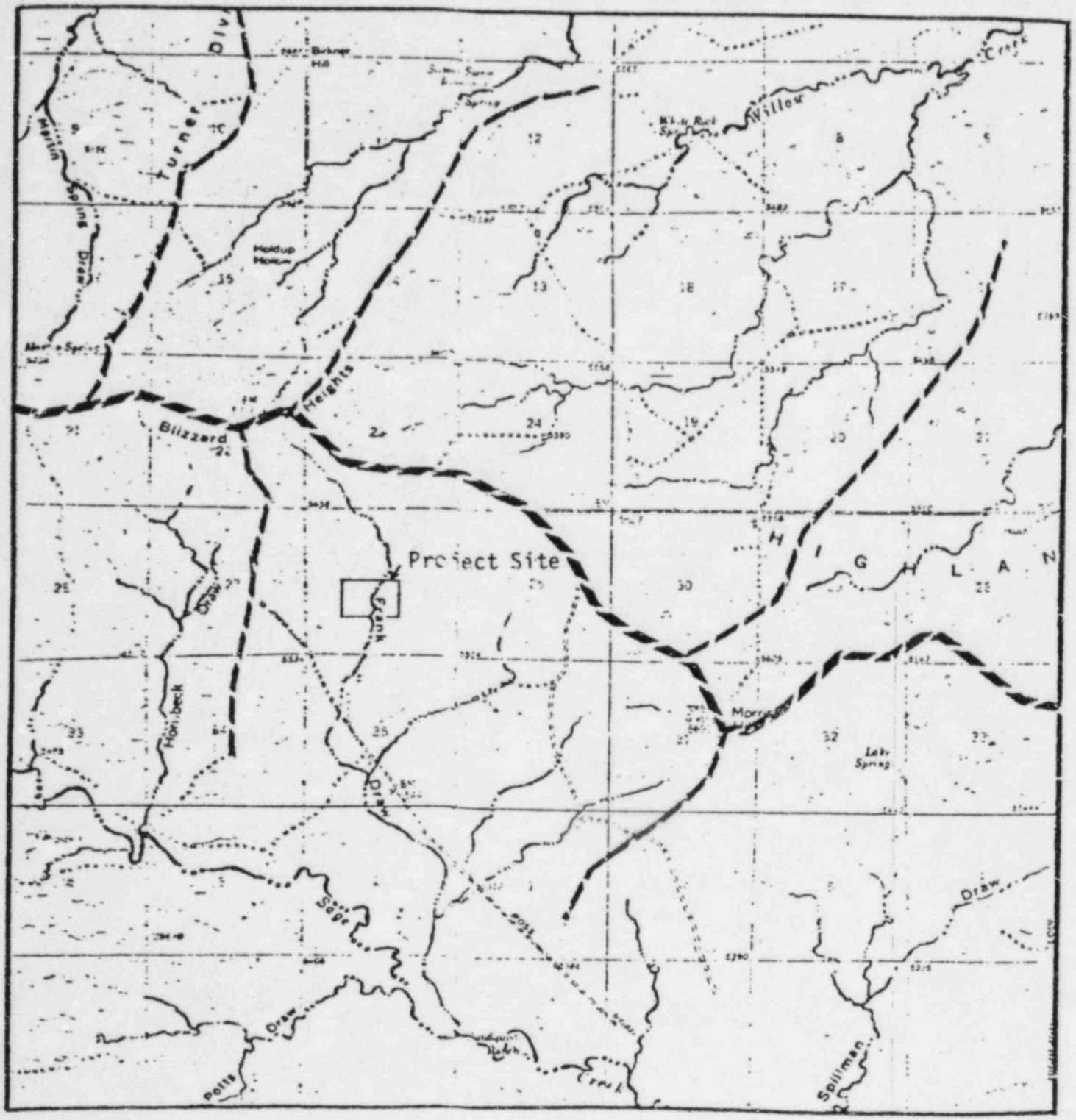
Figure D-1

REV. 6/20/83

KERR-McGEE "O" SAND PROJECT

SURFACE DRAINAGE SYSTEMS

CONVERSE COUNTY, WYOMING



- MAJOR NORTH-SOUTH DRAINAGE DIVIDE

- RIDGES DIVIDING LESSER DRAINAGE SYSTEMS

- DRAINAGE SYSTEMS

NORTH

0 1 mi. 2 mi.

SCALE: 1" = 1 MILE

FIGURE D-2

KERR-McGEE "O" SAND PROJECT

MAJOR STREAMS IN PROJECT AREA

CONVERSE COUNTY, WYOMING

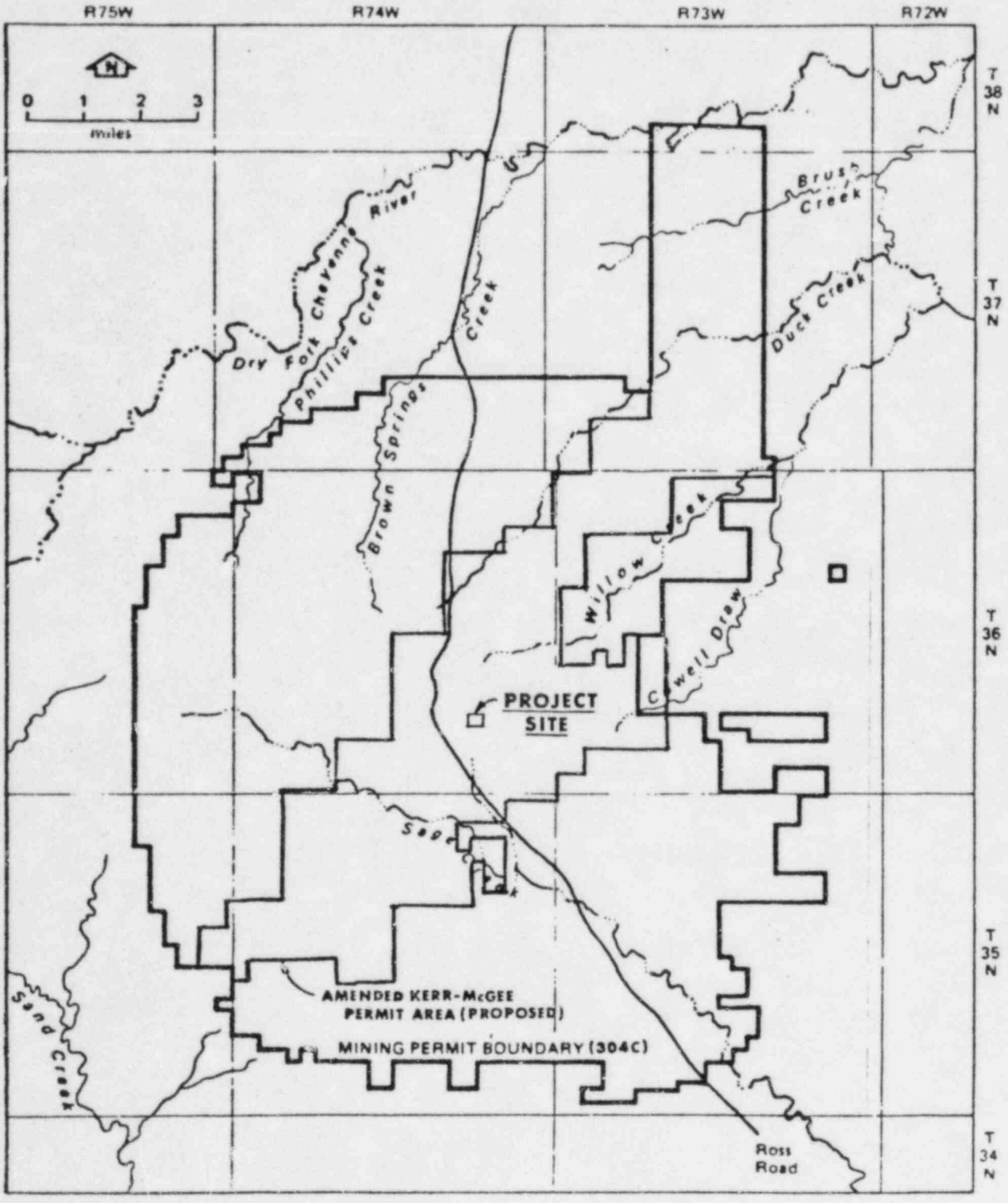
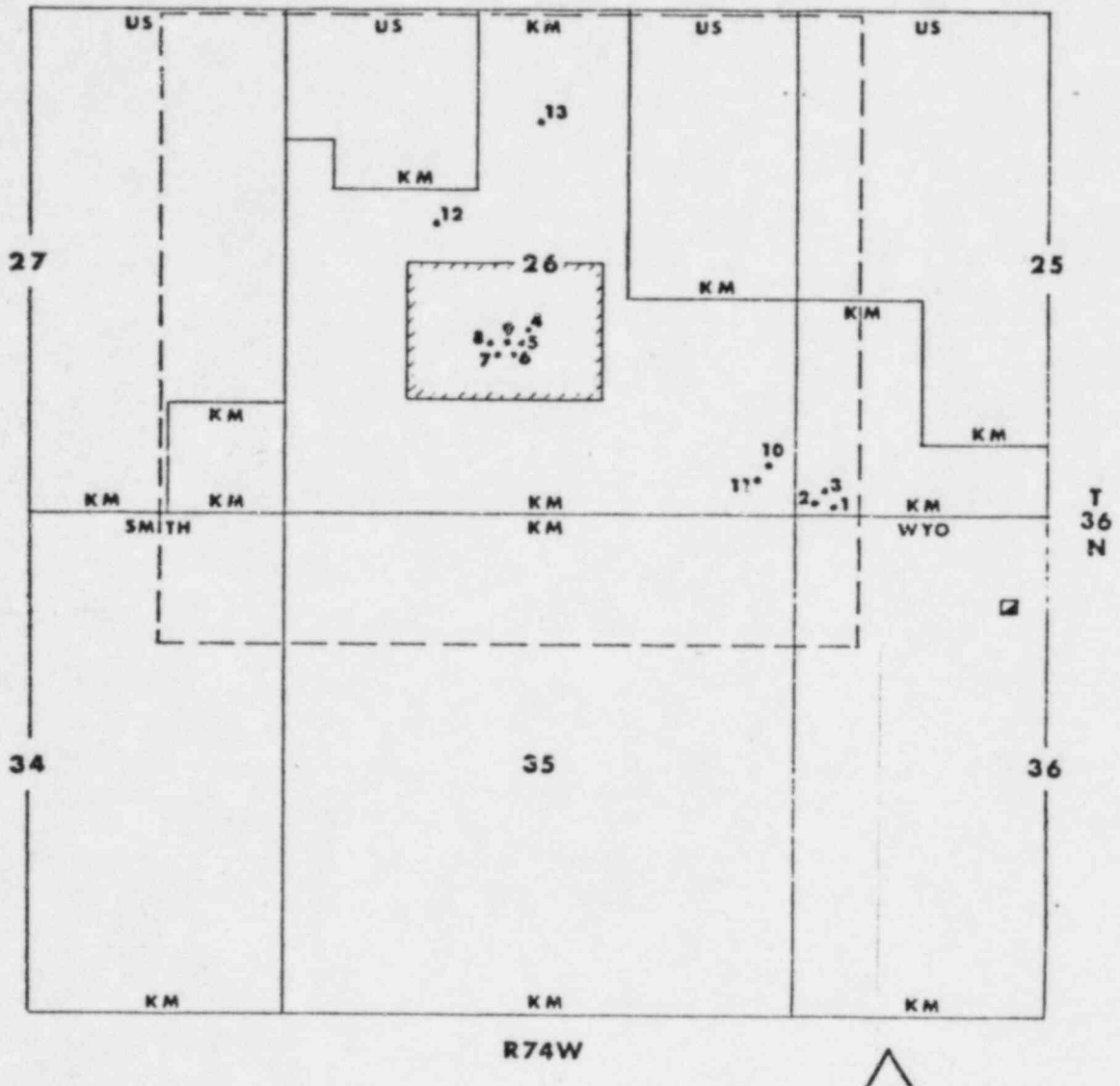


FIGURE D-3

APPROXIMATE WELL LOCATIONS
PROJECT AREA AND ADJACENT LANDS
KERR-McGEE 'O" SAND ISL PILOT
CONVERSE COUNTY WYOMING

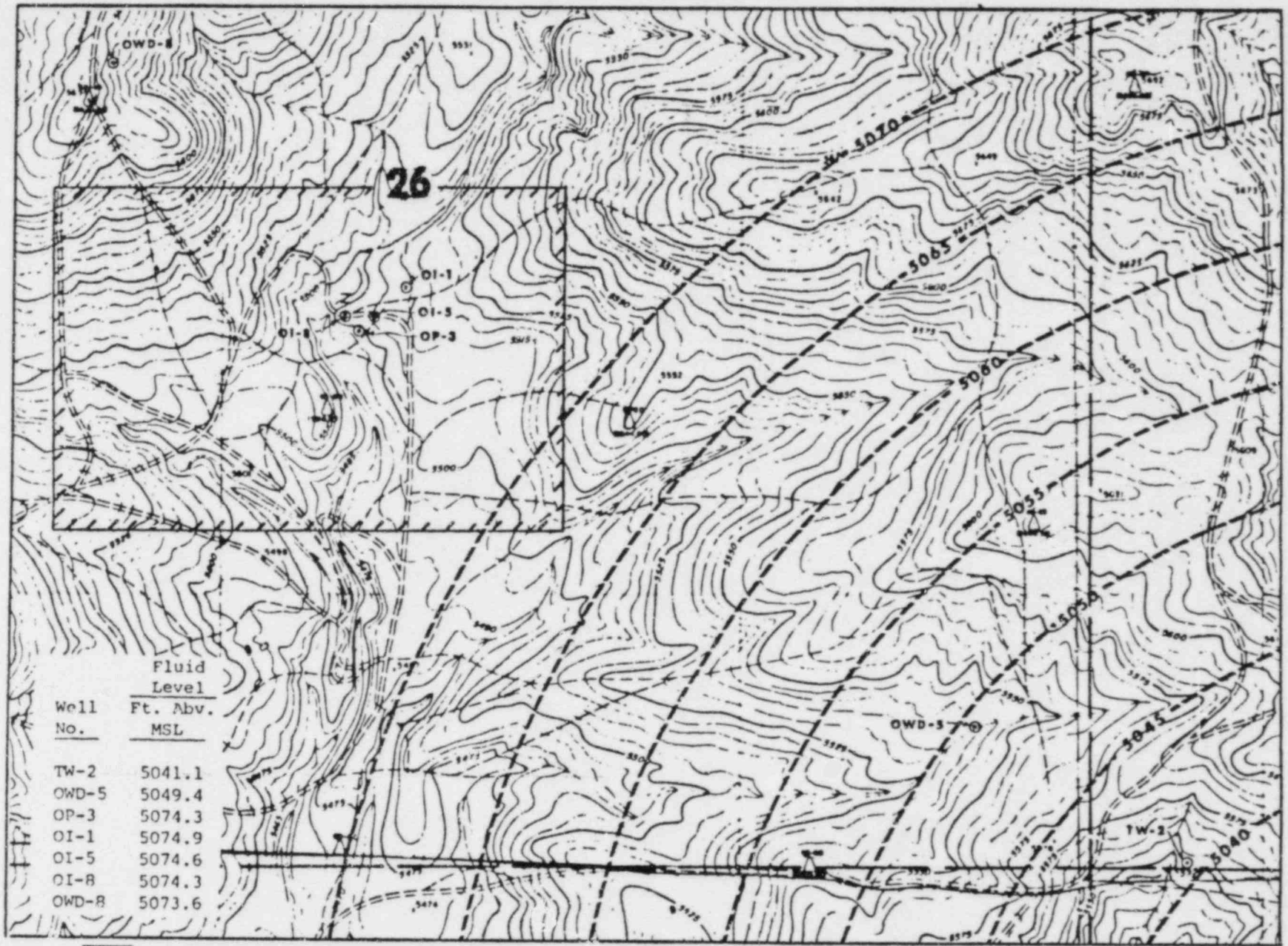


GENERAL TEST AQUIFER PIEZOMETRIC CONTOURS
PROJECT AREA AND ADJACENT LANDS
KERR-McGEE "O" SAND ISL PILOT

SCALE 0 250' 500'

REV: 6/20/83

SECTION 26, T36, R74



Well No.	Fluid Level Ft. Abv. MSL
TW-2	5041.1
OWD-5	5049.4
OP-3	5074.3
OI-1	5074.9
OI-5	5074.6
OI-8	5074.3
OWD-8	5073.6

PROJECT AREA

-5000- EXPECTED "O" SAND PIEZOMETRIC SURFACE - ABOVE MSL

NORTH

Figure D-4

Rev: 6/20/83

TABLE D-1

INVENTORY OF WELLS ON THE
PROJECT AREA AND ADJACENT LANDS
KERR-McGEE "O" SAND PROJECT
CONVERSE COUNTY, WYOMING

Figure D-3 Location Number	K-M WY/No.	Wyo. Well Permit No.	Aquifer	Surface Elevation	Depth of Well (Ft)	Depth to Water	Water Level Elevation (Feet-MSL)	Water Level Elevation Date	Water Use**	Yield (GPM)
1	KM-TW-2	UW 29277	Fort Union	5,541.9	915	500.8	5,041.1	6/16/83	A	560
2	KM OWS-4	UW 54915	Wasatch	5,546.6	546	150.0	5,396.6	6/20/83	D	
3	KM OWD-4	UW 54916	Fort Union	5,546.8	943	490.9	5,055.9	6/16/83	D	
4	KM OI-1	UW 61823	Fort Union	5,507.4	730	432.5	5,074.9	6/17/83	B	
5	KM OMS-1	UW 61838	Wasatch	5,504.6	320	202.4	5,302.2	6/17/83	D	
6	KM OMM-1	UW 61837	Fort Union	5,503.3	899	375.6	5,127.7	6/17/83	D	
7	KM OP-3	UW 61825	Fort Union	5,501.3	736	427.0	5,074.3	6/17/83	B	20
8	KM OI-8	UW 61827	Fort Union	5,501.4	736	427.1	5,074.3	6/17/83	B	
9	KM OI-5	UW 61826	Fort Union	5,503.9	730	429.3	5,074.6	6/17/83	B	
10	KM OWD-5	UW 54918	Fort Union	5,534.7	897	485.3	5,049.4	6/16/83	D	
11	KM OWS-5	UW 54917	Wasatch	5,534.9	512	142.6	5,392.3	6/20/83	D	
12	KM OWD-8	UW 52154	Fort Union	5,617.5	916	543.9	5,073.6	6/21/83	D	
13	WW-109	*	Wasatch	5,540	149	95	5,445	11/75	C	

*Livestock watering well, permit number could not be identified.

**Beneficial use code: A - Mine dewatering
B - In-situ leaching of uranium
C - Livestock
D - Monitor well (no beneficial use)

TABLE D-2

BASELINE WATER ANALYSIS
"O" SAND ISL PROJECT

"O" SAND WELL OP-3

	SAMPLE IDENTIFICATION(1)		
	11/16/82	11/23/82	11/30/82
Aluminum (Al)	0.10(2)	0.10	0.10
Arsenic (As)	0.003	0.004	0.003
Boron (B)	0.13	0.03	0.09
Barium (Ba)	0.10	0.10	0.10
Calcium (Ca)	119	122	122
Cadmium (Cd)	0.002	0.002	0.002
Cobalt (Co)	0.01	0.01	0.01
Chromium (Cr)	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	0.01
Iron (Fe)	0.28	0.16	0.01
Mercury (Hg)	0.0002	0.0002	0.0002
Potassium (K)	24	25	21
Magnesium (Mg)	24	23	27
Manganese (Mn)	.02	0.04	0.04
Molybdenum (Mo)	0.001	0.001	0.001
Sodium (Na)	24	27	27
Nickel (Ni)	0.02	0.02	0.02
Lead (Pb)	0.05	0.05	0.05
Selenium (Se)	0.001	0.001	0.001
Uranium (U)	0.026	0.025	0.025
Vanadium (V)	0.10	0.10	0.10
Zinc (Zn)	0.529	0.688	0.238
Temperature ^{o}C	15	15	15
Chloride (Cl)	2	2	2
Bicarbonate (HCO_3)	215	210	220
Carbonate (CO_3)	0	0	0
Fluoride (F)	0.51	0.57	0.51
Nitrate (as N)	0.05	0.21	0.05
pH Units	7.52	7.55	7.57
Sp. Cond. micromhos/cm	821	829	846
Sulfate (SO_4)	276	294	310
Total Dissolved Solids	631	656	610
Thorium 230 (Th), pCi/l	0.3	1.1	0.9
Radium-226 (Ra), pCi/l	335 ± 12	131 ± 7	61 ± 5
Major Cations, meq	9.56	9.79	10.02
Major Anions, meq	9.33	9.62	10.12

(1) All samples were clear, colorless and odorless.
(2) All analysis in mg/l unless otherwise specified. If the parameter was not detected the value reported is the lower detection limit for the lab.

TABLE D-3

BASELINE WATER ANALYSIS
"O" SAND ISL PROJECT

"O" SAND WELL OI-1

	SAMPLE IDENTIFICATION[1]		
	11/16/82	11/23/82	11/30/82
Aluminum (Al)	0.10[2]	0.10	0.10
Arsenic (As)	0.009	0.010	0.013
Boron (B)	0.13	0.15	0.10
Barium (Ba)	.10	0.10	0.10
Calcium (Ca)	111	109	111
Cadmium (Cd)	.002	0.002	0.002
Cobalt (Co)	0.01	0.01	0.01
Chromium (Cr)	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	0.01
Iron (Fe)	0.05	0.01	0.01
Mercury (Hg)	0.0002	0.0002	0.0002
Potassium (K)	24	24	22
Magnesium (Mg)	22	24	26
Manganese (Mn)	0.01	0.03	0.03
Molybdenum (Mo)	0.001	.001	0.001
Sodium (Na)	25	26	27
Nickel (Ni)	0.02	.02	0.02
Lead (Pb)	0.05	0.05	0.05
Selenium (Se)	0.001	0.001	.001
Uranium (U)	.225	0.275	0.152
Vanadium (V)	0.01	0.01	0.10
Zinc (Zn)	0.314	0.181	0.194
Temperature ^{o}C	16	15	15
Chloride (Cl)	3	2	4
Bicarbonate (HCO_3)	176	195	205
Carbonate (CO_3)	0	0	0
Fluoride (F)	0.27	0.57	0.4
Nitrate (as N)	0.05	0.03	0.05
pH Units	7.47	7.57	7.69
Sp. Cond. micromhos/cm	791	807	824
Sulfate (SO_4)	294	276	288
Total Dissolved Solids	579	584	596
Thorium-230 (Th), pCi/l	1.4	1.1	1.2
Radium-226 (Ra), pCi/l	204 + 9	221 + 9	232 + 9
Major Cations, meq	9.05	9.15	9.41
Major Anions, meq	9.09	9.00	9.46

(1) All samples were clear, colorless and odorless.
(2) All analysis in mg/l unless otherwise specified. If the parameter was not detected the value reported is the lower detection limit for the lab.

TABLE D-4

BASELINE WATER ANALYSIS
"O" SAND ISL PROJECT

"O" SAND WELL OI-5

	SAMPLE IDENTIFICATION[1]		
	11/16/82	11/23/82	11/30/82
Alumium (Al)	0.10[2]	0.10	0.10
Arsenic (As)	0.007	0.007	0.009
Boron (B)	0.07	0.11	0.05
Barium (Ba)	0.10	0.10	0.10
Calcium (Ca)	122	122	122
Cadmium (Cd)	0.002	0.002	0.002
Cobalt (Co)	0.01	0.01	0.01
Chromium (Cr)	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	0.01
Iron (Fe)	0.10	0.04	0.03
Mercury (Hg)	0.0002	0.0002	0.0002
Potassium (K)	23	24	21
Magnesium (Mg)	26	28	28
Manganese (Mn)	0.02	0.04	0.04
Molybdenum (Mo)	0.001	0.001	0.001
Sodium (Na)	25	25	27
Nickel (Ni)	0.02	0.02	0.02
Lead (Pb)	0.05	0.05	0.05
Selenium (Se)	0.002	0.001	0.001
Uranium (U)	1.683	1.500	1.233
Vanadium (V)	0.10	0.10	0.10
Zinc (Zn)	0.522	0.235	0.232
Temperature ^{o}C	16	15	15
Chloride (Cl)	3	5	3
Bicarbonate (HCO_3)	234	224	234
Carbonate (CO_3)	0	0	0
Fluoride (F)	0.57	0.45	0.65
Nitrate (as N)	0.05	0.04	0.05
pH Units	7.57	7.61	7.57
Sp. Cond. micromhos/cm	836	863	863
Sulfate (SO_4)	276	288	294
Total Dissolved Solids	632	645	626
Thorium 230 (Th), pCi/l	3.4	2.8	3.0
Radium-226 (Ra), pCi/l	291 ± 11	166 ± 8	145 ± 7
Major Cations, meq	9.91	10.09	10.10
Major Anions, meq	9.66	9.80	10.04

(1) All samples were clear, colorless and odorless.
(2) All analysis in mg/l unless otherwise specified. If the parameter was not detected the value reported is the lower detection limit for the lab.

TABLE D-5

BASELINE WATER ANALYSIS
"O" SAND ISL PROJECT

"O" SAND WELL OI-8

	SAMPLE IDENTIFICATION[1]		
Aluminum (Al)	0.10[2]	0.10	0.10
Arsenic (As)	0.004	0.005	0.003
Boron (B)	0.01	0.12	0.26
Barium (Ba)	0.10	0.10	0.10
Calcium (Ca)	96	103	119
Cadmium (Cd)	0.002	0.002	0.002
Cobalt (Co)	0.01	0.01	0.01
Chromium (Cr)	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	0.01
Iron (Fe)	0.04	0.01	0.01
Mercury (Hg)	0.0002	0.0002	0.0002
Potassium (K)	23	23	20
Magnesium (Mg)	23	26	21
Manganese (Mn)	0.01	0.02	0.03
Molybdenum (Mo)	0.001	0.001	0.001
Sodium (Na)	24	26	26
Nickel (Ni)	0.02	0.02	0.02
Lead (Pb)	0.05	0.05	0.05
Selenium (Se)	0.046	0.041	0.009
Uranium (U)	0.306	0.30	0.045
Vanadium (V)	0.10	0.10	0.10
Zinc (Zn)	0.187	0.275	0.432
Temperature ^{o}C	15	15	14
Chloride (Cl)	4	5	2
Bicarbonate (HCO_3)	15	185	220
Carbonate (CO_3)	0	0	0
Fluoride (F)	0.74	0.57	0.51
Nitrate (as N)	0.05	0.04	0.04
pH Units	7.59	7.76	7.51
Sp. Cond. micromhos/cm	724	738	818
Sulfate (SO_4)	270	276	280
Total Dissolved Solids	522	567	592
Thorium 230 (Th), pCi/l	1.6	1.4	1.7
Radium-226 (Ra), pCi/l	380 ± 12	375 ± 12	432 ± 13
Major Cations, meq	8.31	9.00	9.31
Major Anions, meq	8.21	8.91	9.49

(1) All samples were clear, colorless and odorless.
(2) All analysis in mg/l unless otherwise specified. If the parameter was not detected the value reported is the lower detection limit for the lab.

TABLE D-6

BASELINE WATER ANALYSIS
"O" SAND ISL PROJECT

MONITOR WELL OMS-1
OVERLYING AQUIFER

	SAMPLE IDENTIFICATION[1]		
	11/16/82	11/23/82	11/30/82
Aluminum (Al)	0.10[2]	0.10	0.10
Arsenic (As)	0.001	0.001	0.001
Boron (B)	0.16	0.14	0.13
Barium (Ba)	0.10	0.10	0.10
Calcium (Ca)	104	125	109
Cadmium (Cd)	0.002	0.002	0.002
Cobalt (Co)	0.01	0.01	0.01
Chromium (Cr)	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	0.01
Iron (Fe)	0.07	0.01	0.09
Mercury (Hg)	0.0002	0.0002	0.0002
Potassium (K)	23	18	13
Magnesium (Mg)	22	25	36
Manganese (Mn)	0.04	0.08	0.03
Molybdenum (Mo)	0.001	0.001	0.001
Sodium (Na)	29	24	27
Nickel (Ni)	0.02	0.02	0.02
Lead (Pb)	0.05	0.05	0.05
Selenium (Se)	0.001	0.001	0.001
Uranium (U)	0.024	0.041	.001
Vanadium (V)	0.10	0.10	0.10
Zinc (Zn)	0.546	0.577	0.172
Temperature °C	15	13	15
Chloride (Cl)	12	9	9
Bicarbonate (HCO_3)	259	293	312
Carbonate (CO_3)	0	0	0
Fluoride (F)	0.3	0.33	0.40
Nitrate (as N)	0.05	0.05	0.43
pH Units	7.59	7.55	7.57
Sp. Cond. micromhos/cm	815	818	840
Sulfate (SO_4)	204	220	220
Total Dissolved Solids	540	624	617
Thorium 230 (Th), pCi/l	0.9	0.8	0.7
Radium-226 (Ra), pCi/l	2.3 ± 1.0	4.2 ± 1.4	8.6 ± 1.8
Major Cations, meq	8.85	9.79	9.90
Major Anions, meq	8.83	9.64	9.95

(1) All samples were clear, colorless and odorless.
(2) All analysis in mg/l unless otherwise specified. If the parameter was not detected the value reported is the lower detection limit for the lab.

TABLE D-7

BASELINE WATER ANALYSIS
"O" SAND ISL PROJECT

MONITOR WELL OMM-1
UNDERLYING AQUIFER

	SAMPLE IDENTIFICATION[1]		
	11/16/82	11/23/82	11/30/82
Aluminum (Al)	0.10[2]	0.10	0.10
Arsenic (As)	0.001	0.001	0.001
Boron (B)	0.06	0.11	0.11
Barium (Ba)	0.10	0.10	0.10
Calcium (Ca)	47	46	43
Cadmium (Cd)	0.002	0.002	0.002
Cobalt (Co)	0.01	0.01	0.01
Chromium (Cr)	0.01	0.01	0.01
Copper (Cu)	0.01	0.01	0.01
Iron (Fe)	0.08	0.07	0.05
Mercury (Hg)	0.0002	0.0002	0.0002
Potassium (K)	14	14	13
Magnesium (Mg)	11	12	11
Manganese (Mn)	0.12	0.03	0.04
Molybdenum (Mo)	0.001	0.001	0.001
Sodium (Na)	24	25	26
Nickel (Ni)	0.08	0.02	0.02
Lead (Pb)	0.05	0.05	0.05
Selenium (Se)	0.001	0.001	0.001
Uranium (U)	0.003	0.001	0.034
Vanadium (V)	0.10	0.10	0.10
Zinc (Zn)	0.016	0.194	0.147
Temperature ^{o}C	15	15	15
Chloride (Cl)	5	5	4
Bicarbonate (HCO_3)	188	188	188
Carbonate (CO_3)	0	0	0
Fluoride (F)	0.40	0.45	0.40
Nitrate (as N)	0.05	0.01	0.04
pH Units	7.56	7.68	7.76
Sp. Cond. micromhos/cm	413	443	437
Sulfate (SO_4)	63	67	68
Total Dissolved Solids	254	251	266
Thorium 230 (Th), pCi/l	1.1	0.9	0.5
Radium-226 (Ra), pCi/l	9.9 $\pm$ 2.1	2.1 $\pm$ 1.0	2.9 $\pm$ 1.1
Major Cations, meq	4.65	4.74	4.51
Major Anions, meq	4.53	4.61	4.60

(1) All samples were clear, colorless and odorless.
(2) All analysis in mg/l unless otherwise specified. If the parameter was not detected the value reported is the lower detection limit for the lab.

TOPSOIL AUGER SAMPLES
KERR-McGEE "O" SAND PROJECT
CONVERSE COUNTY, WYOMING

Sample Point	PL-1(1)	PL-2(1)	WF-1(2)	WF-2(2)
Topsioil Depth - Inches	18	12	36	39
Topsoil pH	6.82	7.84	7.65	7.82
Electrical Conductivity Millimhos/cm	0.968	0.912	0.843	0.676
Sodium Absorption Ratio	0.85	2.95	2.10	2.25
Soil Type	Sandy - Clay Loam	Sandy Loam	Sandy - Clay Loam	Sandy - Clay Loam
Sample Date	6/15/83	6/15/83	6/15/83	6/15/83

(1)Sample point along pipeline route.

(2)Sample point in the well field area.

Kerr-McGee "O" Sand ISL Project
Converse County, Wyoming
Item 9 DEQ Land Quality Division Form 5

9.0 Testing Plan

Kerr-McGee Nuclear Corporation (Kerr-McGee), a wholly owned subsidiary of Kerr-McGee Corporation is currently conducting a Research and Development (R&D) program on the recovery of uranium from known uranium deposits in Converse County, Wyoming using in-situ leaching techniques. Kerr-McGee has operated the "Q" Sand Research and Development program under NRC License SUA-1387 and DEQ Research and Development License 5 R.D. since 1981. To continue the research and development program effort authorization is requested from the Department of Environmental Quality to develop an additional research and development in-situ leaching well field area ("O" Sand) located in Section 26, T36N, R 74W, which will utilize the existing "Q" Sand uranium recovery facility located in Section 36, T36N, R74W.

The testing plan has been designed to evaluate recovery and cost data for the uranium bearing "O" Sand deposits which have not yet been evaluated by Kerr-McGee Nuclear Corporation for mineability using well field in-situ leaching techniques.

The testing plan was designed to affect the land surface, surface water and groundwater of the State to the minimum extent necessary.

The program outlined in the following testing plan will provide pre-mining, operational and post-mining data and information useful in developing optimum recovery and reclamation techniques for the "O" sand deposits using in-situ mining methods. The testing plan addresses the items listed below. The figures and tables for this section are included as Attachment A.

(1) nature and scope of the testing activity
(2) groundwater hydrology
(3) general geology
(4) surface facilities (i.e. access roads, communication lines, etc.)
(5) sequence of operations
(6) description of expected impacts on natural resources.

(7) mitigating measures

(8) operational procedures.

9.1 Nature and Scope of Testing Activities

The activities under this R&D project will be to determine the suitability of the "O" sand for in-situ leaching of uranium by conducting a pilot program involving a leach field area of about 1.8 acres. The wells will be drilled to a depth of ± 740 feet on a conventional five-spot pattern with a spacing of approximately 120 feet between like wells. Monitor wells will be completed in the "O" sand around the test site and monitor wells will be completed in the aquifers above and below the "O" sand. (See Figure 9-1 in Attachment A).

The in-situ test will be conducted using a sodium carbonate-sodium bicarbonate leach solution with hydrogen peroxide and/or oxygen added and will have a nominal process rate of 150 gpm. The produced fluid will be pumped from the well field to the existing uranium recovery facility located at the Bill Smith Mine via pipeline. At the recovery plant, the uranium will be removed by solid resin ion exchange (IX) and a combination of the chemicals listed above will be added to the produced fluid. The fluid will then be reinjected in the leach zone to recover additional uranium. The production and injection rates will be metered and controlled to ensure that the groundwater flow in the area is toward the leach test area. A system bleed of one to five gpm is expected to be sufficient to provide this control.

The existing recovery plant, under NRC License SUA-1387, is to be used for uranium recovery from the "O" sands and for restoration of the "Q" sand program.

A header house will be installed near the "O" sand well field for distribution and metering of the injection leach solution and for collecting the produced water. A buried pipeline will connect the process plant to the header house as is presently done for the "Q" sand R&D project.

In the recovery plant, the uranium will be stripped from the ion exchange resin with a strong chloride eluant. The rich eluant will be treated to cause the uranium to precipitate forming a yellowcake slurry which will be shipped as a wet product to a uranium processing plant. The existing evaporation pond, located near the plant (LQD Permit #81-151) will be used to collect and evaporate "O" Sand process waste waters such as excess eluant from the precipitation cycle.

After leaching of the ore zone is completed, restoration of the groundwater will be initiated. The primary restoration techniques will be to use groundwater sweeping in combination with electrodialysis reversal (EDR) or reverse osmosis to reduce any contaminants remaining in the aquifer to acceptable levels. The "O" Sand R&D Program will include an evaluation of an EDR unit or a similar system and if successful, the test system would be used to accelerate the "O" Sand aquifer cleanup.

The project life for the "O" Sand Program is expected to be 3½ to 4½ years with 2½ to 3 years of leaching followed immediately by the aquifer restoration operations and a groundwater stability evaluation period. After groundwater stability has been demonstrated all structures will be removed, all wells will be plugged, and the disturbed areas will be reclaimed in accordance with Wyoming Department of Environmental Quality Regulations. If it is decided to expand the pilot to a commercial operation, the reclamation would be deferred and completed per the approved plan for the commercial operation.

9.2 The "O" Sand Site (Land use, Groundwater hydrology, Geology)

The primary use of land in the project area is grazing for livestock and wildlife. After completion of the project, the area will be reclaimed and returned to that same use. The native vegetation in the area includes western wheatgrass, blue gramma, needle and thread, threadleaf sedge, sagebrush, and cactus. Vegetation cover in the areas that will be disturbed by the project is estimated to be 20 to 30 percent.

The nearest residence is about 2½ miles to the south; however, it is used only part-time. The nearest year-round residence is the Vollman Ranch which is about four and one-half miles to the east-northeast. There is no agricultural activity in the immediate vicinity of the proposed project.

Groundwater units in the vicinity of the proposed test site consist of 0-30 feet of alluvium and several hundred feet of lenticular sandstones of Wasatch and Fort Union Age. Properly constructed wells penetrating the Wasatch and Fort Union aquifers in the vicinity of the test area generally yield from 5 to 20 gallons per minute (gpm), but some wells yield in excess of 100 gpm. In general, the groundwater in the basal Wasatch and Fort Union aquifers is under artesian pressure and appears to move to the southeast from the proposed test area.

All known deep wells in the project area and adjacent lands are owned and operated by Kerr-McGee. The one shallow well, WW109, is operated by a rancher. An inventory of the wells showing the well designation, completion aquifer, surface elevation, well depth, and the water level and yield at time of completion is included in Table 9-1. The wells which do not have a yield value were completed as observation wells and were not pumped to determine yield data. A map showing the approximate well locations relative to the project area is also attached as Figure 9-2. There are no surface water impoundments on the site. The only adjudicated water rights in the vicinity are the water rights associated with Kerr-McGee's uranium operations.

The Wasatch Formation of Eocene Age outcrops throughout the permit area. It consists of up to 500 feet of interbedded claystones, sandy siltstones, and relatively clean sandstones. The uranium bearing sandstone in the proposed test area is designated by Kerr-McGee as the "O" sandstone and is found in the top of the Fort Union Formation at a depth of approximately 750 feet. In the test area, the "O" sand averages about 300 feet in thickness. The "O" Sand is separated from overlying and underlying aquifers by essentially impermeable shale and claystone, the "P" and "N" shales. The overlying "P" shale is about 170 feet in thickness while the

underlying "N" shale is about 60 feet in thickness. Cross-sections through the test site are attached as Figures 9-3, 9-3A, and 9-4. A lithological description based on the drill hole cuttings from well OMM-1 and the well log is provided in Table 9-1A. Minerological and clay analyses data on a core of the mineralized zone in the well field area is included in Table 9-1B.

To determine the local hydrological characteristics of the "O" sand and the degree of isolation provided by the overlying and underlying shales, a pumping well and three monitor wells were completed in the "O" sand. Monitor wells were also completed in the overlying and underlying aquifers to check for vertical communication. The relative locations of the wells are shown in Figure 9-5 and the well completion data is provided in Table 9-2. Table 9-3 provides the well integrity test results for the three future injection wells completed for the "O" Sand Project and Table 9-3A outlines the well casing test procedures. A well casing mechanical integrity test will be conducted for all injection and production wells and results submitted for DEQ review prior to beginning leaching operations. The pumping test results are provided in Attachment B and do not indicate any significant communication between the "O" sand and the overlying or underlying aquifers. The "O" sand data also indicates the test site is well suited for an in-situ leach pilot program.

The hydrological report, Attachment B, discussing the pump test procedures and results includes drawdown data for the individual wells in both tabular and graphical form. A hydrogeological cross-section illustrating the pressure head relationships of the aquifers is provided in Figure 9-4A. Another pumping test will be conducted and the data will be submitted as Attachment "D" for DEQ review prior to beginning leaching operations.

Ten exploration drill holes (Nos. 52, 204, 216, 217, 461, 473, 474, 475, 484 and 485) and one core hole (No. 834C) have been drilled within the proposed leach field. All exploration holes were plugged with drilling mud. The core hole was plugged with a cement slurry.

9.3 Project Description and Operation (Surface facilities, sequence of operations).

The in-situ leaching research and development project will include a well field of approximately 1.8 acres, a 150 gpm process plant (existing facility), buried pipelines, and a small evaporation pond (existing facility).

The well field is expected to include 17 leach wells and 7 monitor wells; however, if the pilot performance indicates closer well spacing is needed, additional wells may be drilled. The leaching wells in the initial program will be drilled to a depth of ±740 feet on a conventional five-spot pattern with a spacing of approximately 120 feet between like wells. Monitor wells will be completed in the "O" sand around the test site and monitor wells will be completed in the aquifers above and below the "O" sand. The relative locations of the injection, production, and monitor wells are shown in Figure 9-1. The well field site is located about 6000 feet northwest of Kerr-McGee's Bill Smith Mine shaft which is located in Section 36, T36N, R74W. The recovery plant will be connected to the well field header building by buried pipelines (see Figure 9-6).

All wells will be drilled to the specified depth with a small rotary drilling unit using native mud and a small amount of a commercial drilling fluid additive for viscosity control, cased with fiberglass and/or steel casing, and cemented to isolate the completion interval from all other aquifers. The cement will be placed by pumping it down the casing and forcing it out and back up the casing-drill hole annulus. If the cement does not return to the surface or drops back in the annulus, the remainder of the annular space will be cemented through a small pilot tube run down in the annular space. Three casing centralizers are normally run near the bottom of the casing.

After the cement has set, the wells are drilled out and completed open-hole. The well is then air lifted for about 30 minutes to remove any remaining drilling mud and/or cuttings. A small submersible pump is then run in the well for final clean up and sampling. If sand production or

hole stability problems are expected, a slotted liner, Johnson wire wrapped screen or similar device will be installed across the completion interval.

Typical well completions are illustrated in Figure 9-7. Data on well elevations, depths, and completion intervals for the wells drilled for the pump test are included in Table 9-2. Similar data for the other operating and monitor wells will be submitted to DEQ after all the wells are drilled. A small header building will be installed near the well field to house the individual well metering and control facilities to protect them from the weather. The individual flow lines will be buried and the well heads will be covered with insulated boxes, where needed, to prevent freezing.

The injected fluid will be a sodium carbonate-sodium bicarbonate leach solution with hydrogen peroxide and/or oxygen added. The combined sodium-carbonate/sodium-bicarbonate concentration in the injected solution will be maintained at less than five grams per liter and the hydrogen peroxide and/or oxygen concentration will be less than one gram per liter. It is expected that sodium carbonate or sodium hydroxide and carbon dioxide will be used to produce the sodium bicarbonate on site. Primary chemical reactions expected in the aquifer are provided in Table 9-4.

The produced fluid will be pumped from the well field through buried pipelines to the existing uranium recovery facility at the Bill Smith mine site. At the recovery plant, the uranium will be removed by solid resin ion exchange and some of the chemicals specified above will be added to the barren fluid to return it to the desired concentration; however, these concentrations will not exceed levels specified in the preceeding paragraph. The fluid will then be reinjected in the leach zone to recover additional uranium. Figure 9-8 shows expected leach solution flow patterns in the "O" Sand well field. The production and injection rates will be metered and controlled to ensure that the natural groundwater flow is toward the leach test area. A system bleed of one to five gpm is expected to be sufficient to provide the necessary control. Injection wellhead pressures will be limited to 100 psi maximum pressure.

In the recovery plant which will have a process rate of 150 gpm, the uranium will be stripped from the ion exchange resin with a strong chloride eluant. The rich eluant will be treated to cause the uranium to precipitate forming a yellowcake slurry which will be shipped as a wet product to an uranium processing plant. All yellowcake shipments will be made in compliance with applicable regulations. The existing evaporation pond located near the plant will be used to collect and evaporate process waste waters such as excess eluant from the precipitation cycle. The pond has two cells approximately 100 feet x 100 feet each and is lined with a hypalon liner. A system of perforated pipes is installed in the sand bed under the liner and monitored under NRC license SUA-1387 to ensure that if any leaks occur, they will be detected.

After completion of the groundwater stabilization period, all structures such as tanks, buildings, and foundations will be removed and all remaining disturbed areas will be reclaimed in accordance with the regulations of the Wyoming Department of Environmental Quality. All wells will be plugged with cement and/or other approved material and the casing will be cut-off two feet below the surface. Any solids remaining in the evaporation pond will be removed and disposed of in a licensed mill tailings pond or as otherwise approved by the NRC. The evaporation pond site will be leveled and contoured to blend with the natural terrain, covered with topsoil, and revegetated. If it is decided to expand the pilot operation into a commercial scale operation, the reclamation would be deferred and completed as per the approved plan for the commercial scale operation.

Other permits required to implement the program are a U.S. Nuclear Regulatory Commission License Amendment to Source Material License SUA-1387 (submitted 1/21/83) and well permits from the State Engineer (already obtained). The surface discharges for the "O" Sand program are under the existing NPDES permit issued by the Wyoming Water Quality Division for the Bill Smith Mine. Proper notification for the proposed change in operation for NPDES Permit No. Wy 0022411 has been provided to the Wyoming Water Quality Division (Letter to J. Wagner, February 9, 1983).

9.4 Expected Impacts on Natural Resources

New surface disturbance of areas outside the existing Bill Smith mine site area will be limited to the "O" Sand well field area (1.8 acre), the pipeline right-of-way between the well field and the plant (2.8 acres), and a short segment of new road construction (.4 acres). Approximately 400 cubic yards of topsoil in the area of the new road construction and the well field header building will be removed, up to a depth of about one foot, and stockpiled for use in reclamation. The topsoil stockpile will be smoothed and seeded with a quick growing cover such as oats or crested wheatgrass to minimize wind and water erosion. Appropriate signs will be placed on the stockpiles.

Reclamation of the pipeline right-of-way and some of the disturbed areas in the well field (that not required for access) will be initiated as soon as practical after construction, normally in the next planting season. Reclamation of other disturbed areas and plugging of the wells will be in compliance with Wyoming Department of Environmental Quality Regulations and will be completed as soon as practical after completion of the operation.

The volume of water expected to be produced during reclamation of the pilot area is about 80 acre-feet. This is based on a 60 foot thick ore zone, 25% porosity and replacement of three pore volumes during the restoration cycle. If the production of six pore volumes are necessary during restoration, the total withdrawal will be about 160 acre-feet. After the aquifer reclamation is completed, no significant long-term environmental impact to the groundwater is expected.

The solid wastes generated by the program will be waste materials such as rags, trash, and packing material and the solids remaining in the evaporation pond after the waste liquids have evaporated. The non-radioactive wastes will be disposed of in the Bill Smith Mine's existing waste disposal facilities. The solids remaining in the evaporation pond will be disposed of in a licensed mill tailings disposal facility or as otherwise approved by the NRC.

The liquid wastes from the system will be the one to five gallons per minute bleed stream, excess resin rinse and elution water, and the liquids produced during aquifer reclamation. Waste liquids with high total dissolved solids such as the excess eluant will be routed to the evaporation pond for disposal. In the event that the waste volume approaches pond capacity, liquid will be transported to a licensed disposal site. The bleed stream and liquid produced during restoration will be treated as necessary and discharged under the authorization and conditions of the NPDES permit. The net volume of liquid withdrawn over the project life is expected to be between 100 and 200 acre-feet.

Since all processes are hydrometalurigical and the yellowcake produced will be transported as a wet product, no significant impact on air quality is expected from the operation. There will be a slight increase in vehicle activity which will generate some road dust; however, it will be very limited.

All of the land, water, and air impacts from the proposed program are very limited in scope and are short-term in nature.

9.5 Environmental Effects of Potential Accidents

The only potential accidents which could have a significant environmental effect are a well casing failure, excursion of leach solution, a pipeline failure between the well field and IX plant, or an accident involving the transportation of the yellowcake slurry.

An injection well casing failure could allow leach fluid to leak into other aquifers. Therefore, to minimize the risk of such an accident, all injection wells will be cased with fiberglass and/or steel casing. A casing integrity test will also be conducted on all injection wells and reported to the DEQ prior to beginning leaching operations. The monitor well completed in the overlying aquifer, will also be sampled routinely to provide monitoring of that aquifer.

An excursion of leach solution could occur if significant over injection occurred due to equipment failure or a metering system malfunction. The risk of significant over injection has been minimized by designing the process plant such that the only source of a large volume of injection fluid is from the production well field. The bleed stream of one to five gpm is planned and will aid in preventing any significant over injection. To further minimize the risk of an excursion, the monitor wells, located approximately 300 feet from the leach area, will be sampled routinely and will provide an early indication of an excursion. If an excursion does occur, the injection and production rates will be adjusted, as necessary, to draw the excursion fluids back to the leach area.

The failure of the pipeline between the well field and the process plant could result in the loss of low specific activity liquid and could contaminate the soil in the immediate vicinity of the failure. To minimize the risk of a failure, the lines will be high density polyethlene, will have pressure relief valves installed on the lines, and will be buried at a depth of five to six feet to protect it from freezing and/or physical damage. After the pipe is welded together, it will be pressure tested and inspected to be sure it is free from leaks before it is covered. Flow meters and pressure gauges will be installed on the lines and any discrepancies in flow rates and/or pressures will be investigated as soon as they are detected. In the event that a loss of low specific activity fluid did occur any contaminated soil would be removed and disposed of in accordance with the appropriate DEQ and/or NRC regulations and procedures.

An accident involving vehicles transporting the yellowcake slurry could result in some yellowcake being spilled. However, the likelihood of such an accident is considered low, due to the small volumes of yellowcake produced by the R&D project. If such an accident did occur, all yellowcake and contaminated soils would be removed and processed through a mill or disposed of in a licensed disposal facility. All disturbed areas would then be reclaimed in accordance with regulations of the Wyoming Department of Environmental Quality.

9.6 Monitoring Program and Mitigating Measures

Groundwater Monitoring

Monitor wells will be completed in the leach zone aquifer ("O" sand) encircling the injection recovery field as indicated in Figure 9-1. Monitor wells will also be completed in the overlying and underlying aquifers. All monitor wells will be sampled twice per month at approximately two (2) week intervals and analyzed for chloride, bicarbonate, sodium and specific conductivity. If indications of leach solution appear in any of the monitor wells, the production and injection rates will be adjusted as needed to move solutions back to the leach area. If any two excursion parameters exceed the upper control limits (UCL) or if one parameter exceeds the UCL value by more than 20 percent and these values are confirmed by analyses of two verification samples taken within 48 hours and 96 hours after results of the first analyses are received, it will be classified as an excursion and corrective action will be initiated. The DEQ will be notified within 24 hours (verbal) and a written report will be submitted to the Land Quality and Water Quality Administrators within seven (7) days detailing procedures for mitigating and controlling the excursion. An excursion status report will be submitted to the DEQ every 30 days until the monitor well is no longer on excursion status. The sampling frequency for the affected well(s) will be increased to once per week until the excursion parameter values are below the UCL values. The UCLs for the monitor wells will be established based on the baseline water quality data from the monitor wells. The UCL's for bicarbonate, chloride, sodium and specific conductivity will be the highest representative baseline value for that parameter plus 20 percent or the baseline value plus 15 mg/l whichever is higher. These excursion parameter analyses can be run on site with a turnaround time of less than 72 hours. Turnaround time on parameters that must be sent to an outside laboratory is expected to be about two weeks.

To date, six wells have been completed in the "O" sand and underlying and overlying sands in the project area. Water samples were collected

from each of these wells on 11/16/82, 11/23/82, and 11/30/82 and analyzed for baseline water quality data (See Appendix D Tables D-2 through D-7). Future data will be reported to the D.E.Q. following well completion and prior to commencement of injection. The monitor well UCL's will be established based upon the baseline water quality data for the respective aquifers and in accordance with procedures outlined above.

In addition to the monitor wells, a system bleed of one to five gpm will be employed to create a local low pressure area in the leach field area. This procedure will cause the natural groundwater surrounding the leach area to flow into the well field area further reducing the risk of an excursion.

An additional monitor well will be drilled and completed in the lower portion of the "O" sand (± 770 feet to ± 800 feet). This well will be sampled at the same frequency and analyzed for the same parameters as the other monitor wells however, it will not have UCL values and will not be considered an excursion monitoring well. If leach solutions move into the lower portion of the "O" sand and if restoration does not appear to be proceeding at about the same rate as restoration of the mineralized zone, the injection and production wells will be drilled to the top of the "N" shale and the lower "O" Sand interval will be reclaimed with the mineralized zone. Data from the sampling program on this well will be included in the quarterly reports to be submitted to the DEQ.

Access to the proposed "O" Sand project site is restricted through the fenced area of the Bill Smith mine site. Gates and fencing are posted with approved warning signs. Personnel protection including hard hats, safety shoes, and safety glasses will be required in the processing area. Other specific operations may require additional safety protection such as gloves, face shields, dust masks, and rubber aprons.

9.7 Reporting

Quarterly and annual reports will be prepared and submitted to the DEQ. The quarterly reports will include injection and production volumes, bleed stream volume, and excursion parameters analyses for each monitor well

compared to the respective UCL values. The annual report will address the items normally required by the DEQ, i.e. surface disturbance, reclamation efforts and progress, plans for subsequent year, etc.

If an excursion of leach solutions is indicated and confirmed, DEQ will be notified within 24 hours (verbal) and a written report will be submitted to the DEQ within seven (7) days detailing procedures for controlling the excursion. Excursion status reports will be submitted every 30 days until the well is no longer on excursion status.

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Converse County, Wyoming
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10.0 Reclamation Plan

The restoration of the groundwater in the mining zone after completion of the chemical mining phase will in itself be a R&D effort to determine the most effective way to accomplish the restoration. Restoration technology is currently in the development stage and one or more combinations of existing methods will be tried to reduce the concentration of any contaminants remaining in the groundwater to acceptable levels.

The primary restoration technique will be to use groundwater sweep and the E.D.R. or reverse osmosis units. In the groundwater sweep, by selectively withdrawing water from the existing production and injection wells, natural groundwater from the surroundings will flow into the leached zone sweeping any contaminants to the wells for withdrawal from the formation. Water withdrawn from the ore zone will be processed through the IX unit to recover any contained uranium then pumped to the existing facilities for treatment and discharge. The discharge from the Bill Smith facility is authorized by NPDES Permit No. 0022411. In addition to the use of the groundwater sweep technique, it is planned to operate an electrodialysis reversal unit (EDR) and/or similiar equipment which produces a water suitable for reinjection into the aquifer to accelerate cleanup.

The goal of the restoration program will be to return the average concentrations of the parameters in Table 9-5 to near baseline conditions; however, if this cannot be achieved in a reasonable time using the best practical technology, a secondary target shall be the value determined by the quality of use for which the water was suitable prior to the test. The restoration program will continue until the water produced from the leach area is acceptable for the quality of use for which it was acceptable prior to mining. For the

purpose of this determination, the quality of use catagories are those established by the Wyoming Department of Environmental Quality, Water Quality Division. The "O" Sand aquifer in the area being leached for uranium recovery, and within the surrounding monitor wells and a buffer zone is designated as Class V under the Water Quality Division Classification system.

After restoration is achieved, six wells designated prior to the start of restoration, will be sampled monthly for a six month period to demonstrate aquifer stability. The samples will be analyzed for the parameters listed on Table 9-5. At the end of the stability period, the data will be submitted to DEQ with a request for approval to begin the well plugging and final surface reclamation. Data from the "Q" sand in-situ pilot has demonstrated that other parameters frequently analyzed for were not affected by the leaching process (Table 9-6).

Water sample results from the six wells drilled for the "O" Sand pump test are provided in Appendix D Tables D-2 through D-7. Future analyses of water samples from the existing wells and baseline data from the wells to be drilled will be submitted to DEQ for review prior to injecting leach solutions. These data will be used to determine the groundwater restoration targets to be used for the pilot program according to the system outlined above. Only representative baseline data will be used for this determination.

New disturbance of areas outside the existing mine site will be limited to the "O" Sand well field area (1.8 acres), the pipeline right-of-way between the well field and the plant (2.8 acres), and a short segment of new road construction (.4 acres). Topsoil in the area of the new road construction and the well header building site will be removed, up to a depth of about one foot, and stockpiled for use in reclamation. Auger soil samples at two points on the pipeline route indicated topsoil depths of 12 inches and 18 inches. Two auger samples in the well field indicated topsoil depths of 36 inches and 39 inches.

Final reclamation of the pipeline right-of-way and some of the disturbed areas in the well field (that not required for access) will be initiated as soon as practical after construction, normally in the next planting season.

After aquifer stability has been demonstrated, all wells will be plugged with cement and/or other approved material and the casing will be cut-off two feet below the surface. Any solids remaining in the evaporation pond will be removed and disposed of in a licensed mill tailings pond or as otherwise approved by NRC. The evaporation pond site will be leveled and contoured to blend with the natural terrain covered with topsoil, and revegetated.

In areas where the topsoil has been removed, reclamation will include visually inspecting the area and removing any material contaminated by spills or leaks, ripping hard-packed areas, replacement of topsoil and reseeding. The available topsoil, normally 8 to 12 inches, will be spread uniformly over the area using a scraper or other similiar equipment. Other areas that have been hard-packed will also be ripped or scarified and leveled prior to seeding.

In small disturbed areas the final reclamation seed mixture may be distributed over the area using a small hand unit, however, in larger areas a seed drill will normally be used. In areas where wind and/or water erosion is a concern, a stubble mulch will be used. The stubble mulch will be established by planting oats or a similar cover in the spring and then planting the final reclamation seed mixture in the stubble in the fall.

The final reclamation seed mixture will consist of the following mixture of pure live seed planted either in the late fall or in early spring:

Western Wheatgrass (Rosana)	5 lb./acre
Thickspike Wheatgrass (Critana)	5 lb./acre

Streambank Wheatgrass (Sodar)	5 lb./acre
Green Needlegrass	2 lb./acre
Four Wing Saltbush	0.5 lb./acre

If it is decided to expand the pilot operation into a commercial scale operation, the reclamation would be deferred and completed as per the approved plan for the commercial scale operation. A bond for the total amount of the estimated reclamation costs will be posted with the Wyoming Department of Environmental Quality, Land Quality Division to ensure funds are available for the reclamation program.

If an application for a commercial operation is not made, final reclamation of areas with new disturbance caused by the "O" sand project is expected to be completed within one year after receipt of DEQ approval of aquifer stability report. Ensuring vegetation is re-established is expected to require one or two additional growing seasons.

Estimated costs for surface and groundwater restoration for the "O" Sand Research and Development Project are summarized below. A detailed reclamation bond cost estimate is included on Table 10-1.

		Bond Amount (1983 Dollars)
(1)	Groundwater Restoration (Groundwater sweep, EDR/Reverse Osmosis)	112,855
(2)	Surface Reclamation	10,223
(3)	Aquifer Stability Monitoring	8,208
(4)	DEQ Contingency (15%)	19,693
	Total amount to be bonded	150,979

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15.0 Monitoring and Analytical Procedures:

Procedures for the analysis of pollutants under the "O" Sand research and development project shall conform to provisions of the Wyoming Water Quality Rules and Regulations, Chapter VIII.

For samples or measurements taken pursuant to the requirements of the "O" Sand research and development permit, the following information shall be recorded:

(1) The place, date, time of sampling,

(2) The dates the analyses were performed,

(3) The person(s) or commercial laboratory who performed the analyses,

(4) The analytical techniques or methods used (if these differ from Chapter VIII Section 7 - Wyo. Water Quality Regulations),

(5) The results of all required analyses.

MONITOR WELL SAMPLING PROCEDURES
O SAND ISL PROJECT

A. Well Description

The O-Sand project has a total of seven (7) monitor wells to determine lixiviant confinement during chemical mining. OM-1 thru OM-5 monitor wells are completed in the O-sand aquifer and are spaced around the perimeter of the mining area. OMM-1 is completed in the M-sand aquifer which is below the O-sand aquifer. QMS-1 is completed in the sand above the O-sand aquifer.

B. Equipment For Sampling

Each well is equipped with a downhole submersible pump and the pump discharge is piped to the monitor well header in the well field header house. The discharge line from the well field header goes to the mine water treatment pond. The header is equipped with a flow meter to measure the amount of water pumped prior to taking a sample. Each monitor well line coming into the header has a sample valve where the samples are collected manually.

The ON-OFF control switches for each monitor well are located on the motor control panel in the header house.

C. Sampling Frequency & Parameters

The monitor wells shall be sampled every two (2) weeks. The samples are to be analyzed for bicarbonate, chloride, sodium, and specific conductivity. The above parameters are the designated excursion parameters. Semi-annually a set of samples from all of the monitor wells are to be analyzed for the water quality parameters listed in Table 5.1.1.01, which is attached.

C. Sampling Frequency & Parameters (Continued)

Record the sample information in a log and enter the analytical result in a summary table, and compare the excursion parameter values with the excursion upper control limit (UCL) values as soon as the data is received. If an excursion is indicated, verification samples must be collected and analyzed as soon as possible. In the event of an excursion, the sampling frequency for the affected wells will be increased to once every seven (7) days until the excursion is corrected, and the samples will be analyzed for the constituents listed previously.

D. Excursion Definition and Action Required

1) If two UCL values for a single monitor well are exceeded, or if a single UCL is exceeded by more than 20%, an excursion is probable and sampling specified below is required.
2) Collect two additional samples from the affected monitor well(s) within 48 hours and 96 hours and analyze for bicarbonate, chloride, sodium, and specific conductivity.
3) An excursion is confirmed if the analyses show that two values are exceeded or if one UCL value is exceeded by more than 20% on the resamples. Oklahoma City is to be notified immediately on any excursion confirmation.
4) Corrective action (increased net withdrawal) is to be started immediately after excursion is confirmed, and the DEQ and NRC are to be notified within 24 hours by phone followed by written notification within 7 days.
5) Sampling and water level measurement data are to be taken at 7 day intervals on the affected monitor wells for the duration of the excursion.
6) Monthly reports, describing the excursion status and corrective action taken, must be prepared and submitted to DEQ and NRC until the excursion is cleared.

E. Water Level Measurements

1) Frequency:

The water level in each monitor well is to be checked once per month prior to sampling and the measurements recorded. In the event of an excursion, the water levels will be measured every seven (7) days prior to sampling.

2) Method of Measurement:

The water levels will be measured by an electric sounder with metal markers at five (5) feet intervals. The final measurement to the nearest metal marker is made with a tape. The top of the casing is used as the surface reference point. The water level measurements are to be recorded to the nearest 0.1 feet.

3) Barometric Pressure:

The barometric pressure is to be recorded during the interval when water levels are measured.

F. Sampling and Preservation of Aqueous Environmental Samples

All monitor wells are to be sampled twice per month at approximately two week intervals and occasionally special analyses are required for these samples.

Specific requirements for the O-sand samples are as follows:

1) Before sampling of any well, the well is to be pumped until two casing volumes of water are discharged to the mine water treatment facility.

2) For the two (2) week sample, collect a one (1) liter "as is" sample, filter, label, date and have analyzed for bicarbonate, chloride, sodium, and specific conductivity.

F. Sampling and Preservation of Aqueous Environmental Samples (Continued)

3) For the special samples, repeat step 1 and then prepare the following samples from the well:

1-one gallon sample filtered "as is" with no additives.

1-one gallon sample, filtered and acidified with nitric acid ($\sim$0.5%v/vHNO_3).

1-one liter sample, filtered and acidified with sulfuric acid.

Label and date each of the samples properly. Measure the field parameters as specified and send the samples to the specified laboratory for the remaining analyses as specified in Table 5.1.1.01. Samples are to be taken on Monday, Tuesday, or Wednesday and analyzed on site as soon as possible. If samples are sent to a local laboratory they should be delivered to that laboratory within 24 hours. If it appears that samples normally scheduled for on-site analyses cannot be completed on-site within 72 hours of collection, the samples should be sent to a local laboratory for analysis.

TABLE 5.1.1.01 (Amended January 1983)
LONG LIST OF CHEMICAL PARAMETERS TO BE SAMPLED
LICENSE CONDITION NO. 43 FOR LICENSE SUA-1387

A. Trace and Minor Elements

Arsenic	Radium-226
Boron	Selenium
Iron	Thorium 230
Manganese	Uranium

B. Common Constituents

Bicarbonate	Magnesium
Calcium	Potassium
Carbonate	Sodium
Chloride	Sulfate

C. Physical Parameters

Specific Conductivity[1]	Total Dissolved Solids[3]
Temperature[2]	
pH[1]	Appearance, color, odor[2]

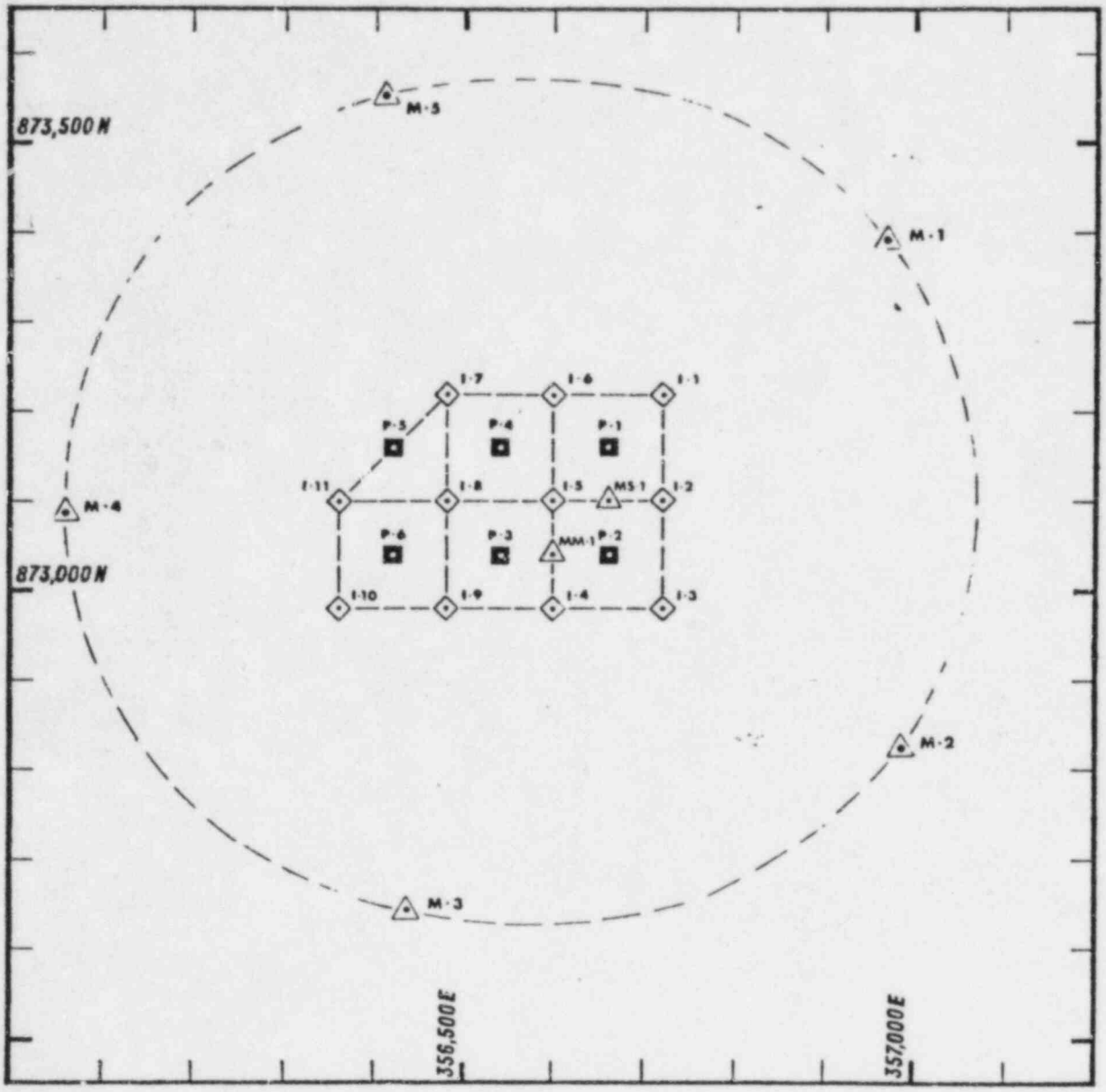
[1]Field and laboratory determination.
[2]Field only.
[3]Laboratory only.

Attachment A

FIGURE 9-1

"O" SAND WELL PATTERN

Section 26, T-36N; R-74W



Legend

- Monitor Well
- Production Well
- Injection Well
- $\triangle^{MS-1}$ Upper Zone Monitor Well
- $\triangle^{MM-1}$ Lower Zone Monitor Well

120 ft. Spacing Between Injection Wells

NORTH

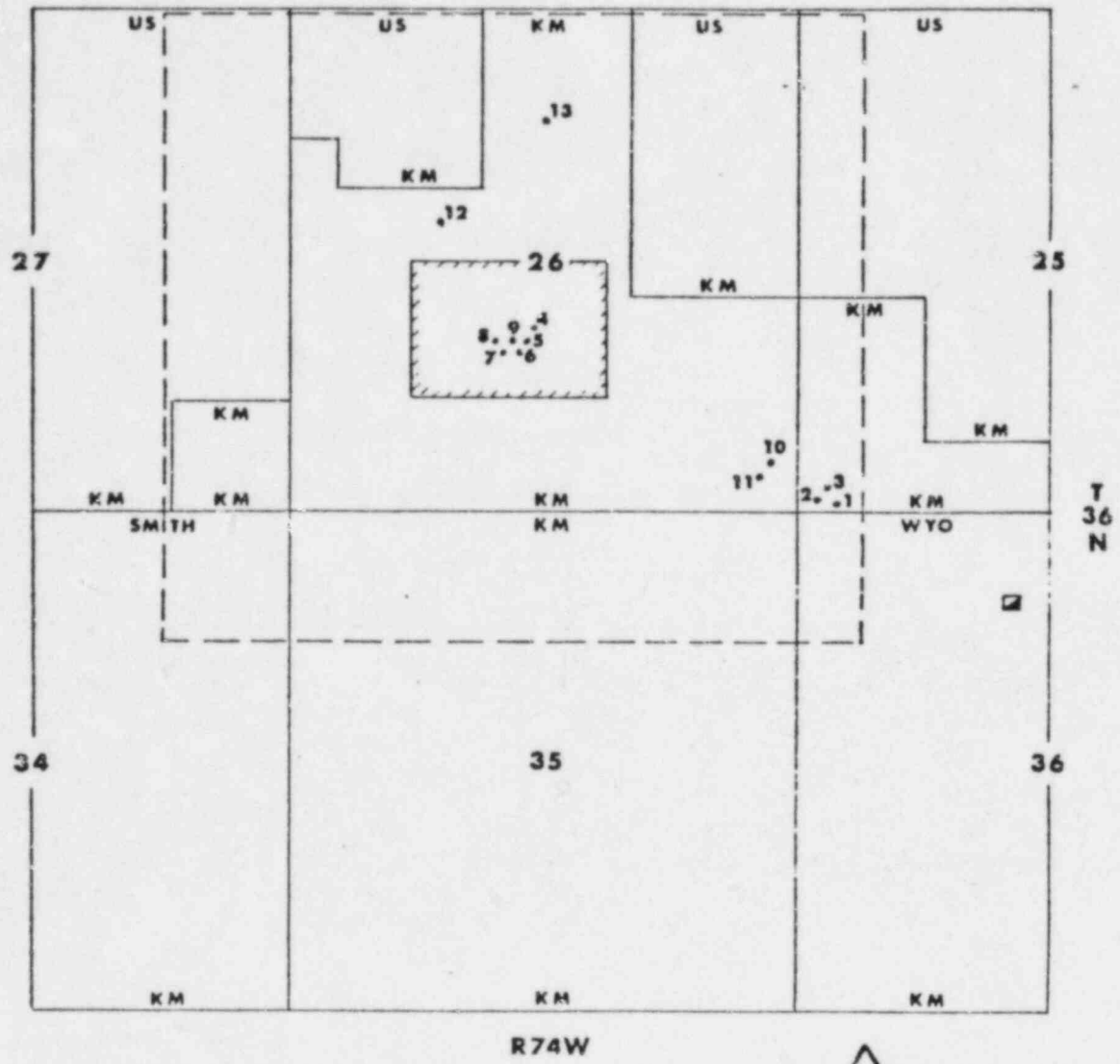
9-15-82

0 100' 200'

SCALE: 1" = 200'

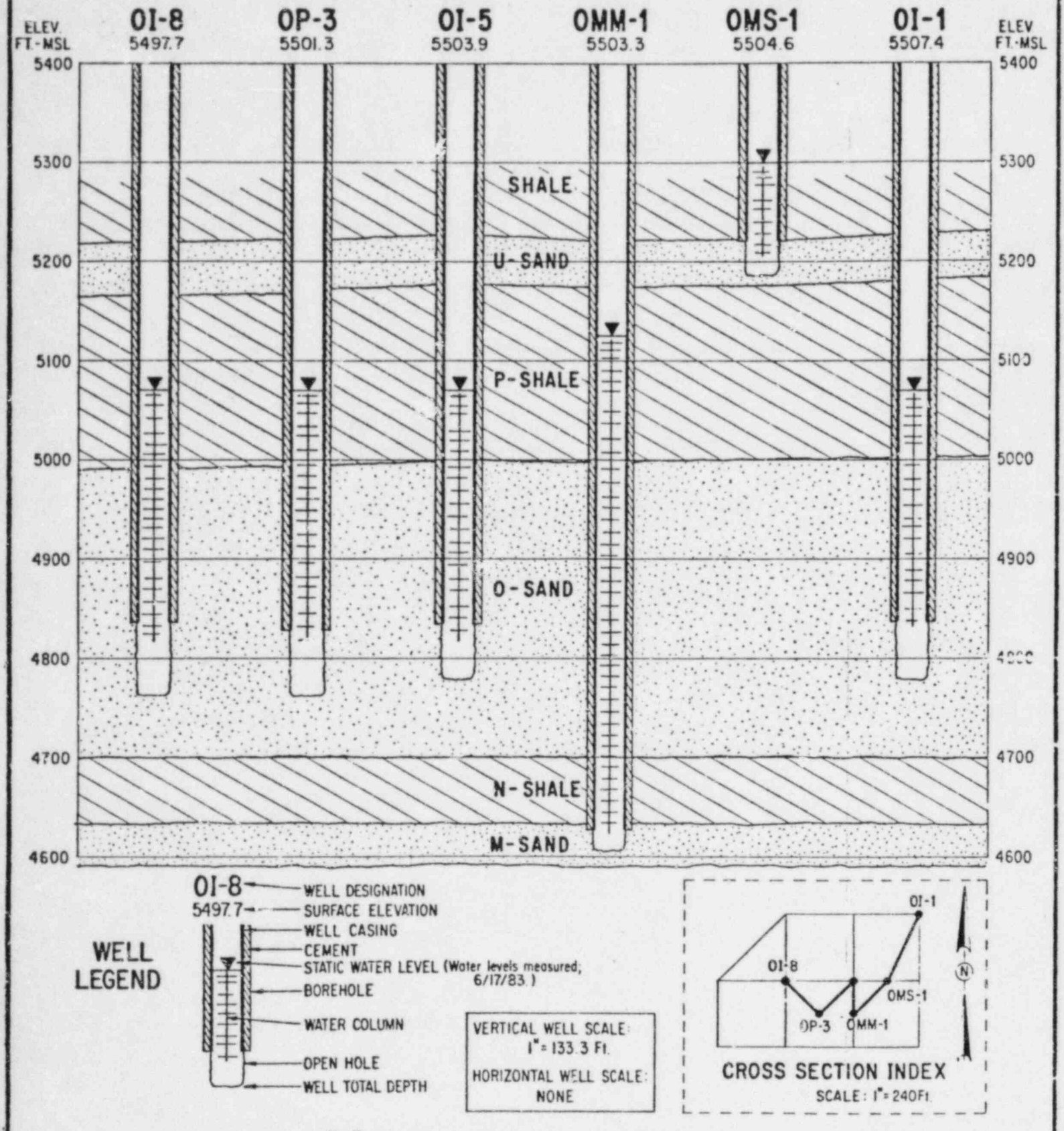
FIGURE 9-2

APPROXIMATE WELL LOCATIONS
PROJECT AREA AND ADJACENT LANDS
KERR-McGEE 'O" SAND ISL PILOT
CONVERSE COUNTY WYOMING



ADD: 6/20/83

FIGURE 9-4A



WELL LEGEND

VERTICAL WELL SCALE: 1" = 133.3 Ft.

HORIZONTAL WELL SCALE: NONE

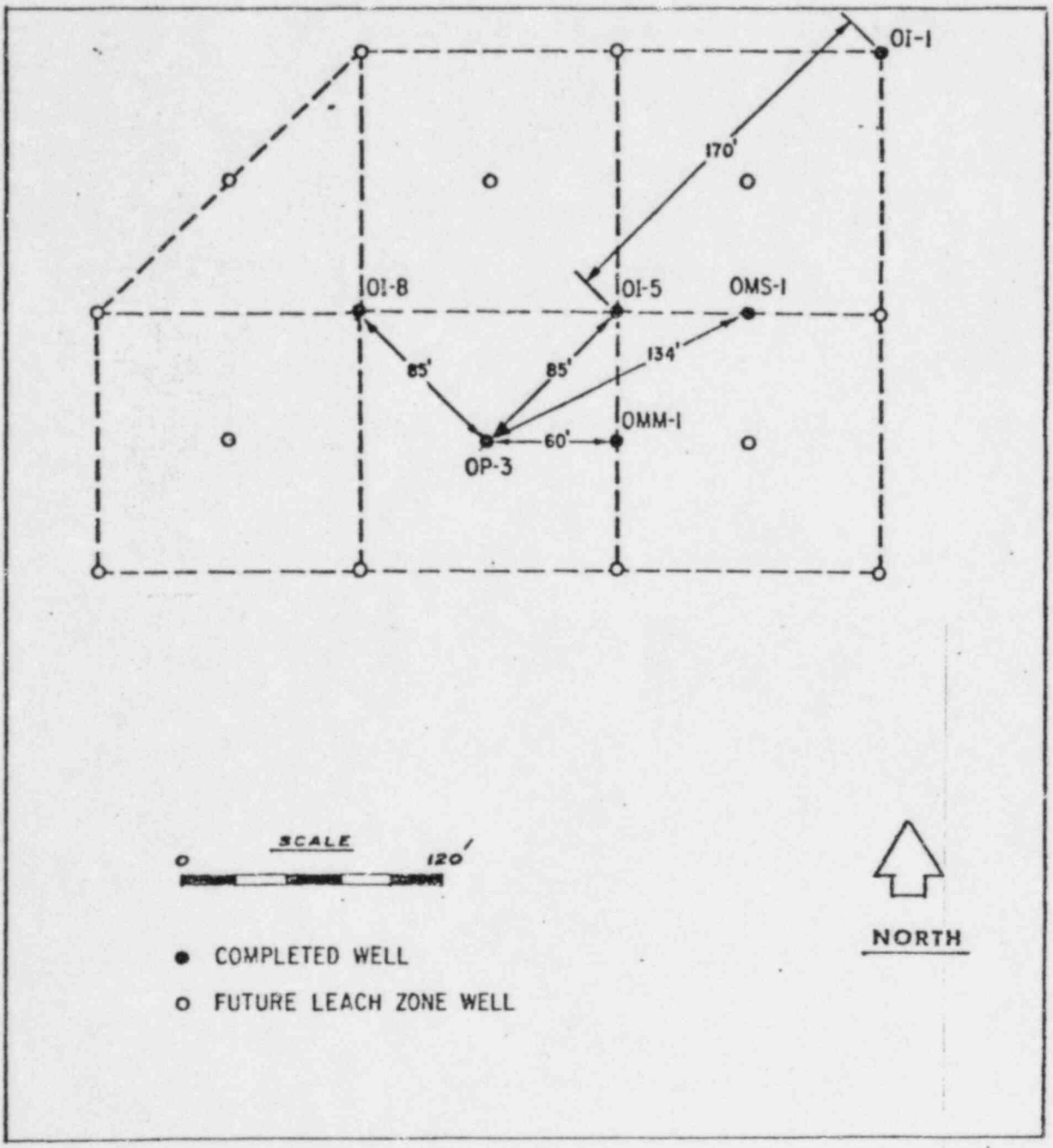
CROSS SECTION INDEX
SCALE: 1" = 240Ft.

KERR-McGEE "O" SAND PROJECT - SECTION 26, T.36N., R.74W.

HYDROGEOLOGICAL CROSS-SECTION & WELL COMPLETION SPECIFICATIONS

Figure 9-5

RELATIVE LOCATIONS OF WELLS
HYDROLOGICAL PUMP TEST *
KERR-McGEE "O" SAND ISL PILOT



* PUMP TEST OF NOVEMBER 9,1982

OP-3 ..... PUMPED WELL

OI-1, OI-5, OI-8 ..... "O" SAND MONITOR WELLS

OMM-1 ..... UNDERLYING AQUIFER MONITOR WELL

OMS-1 ..... OVERLYING AQUIFER MONITOR WELL

Figure 9-6

REV: 6/20/83

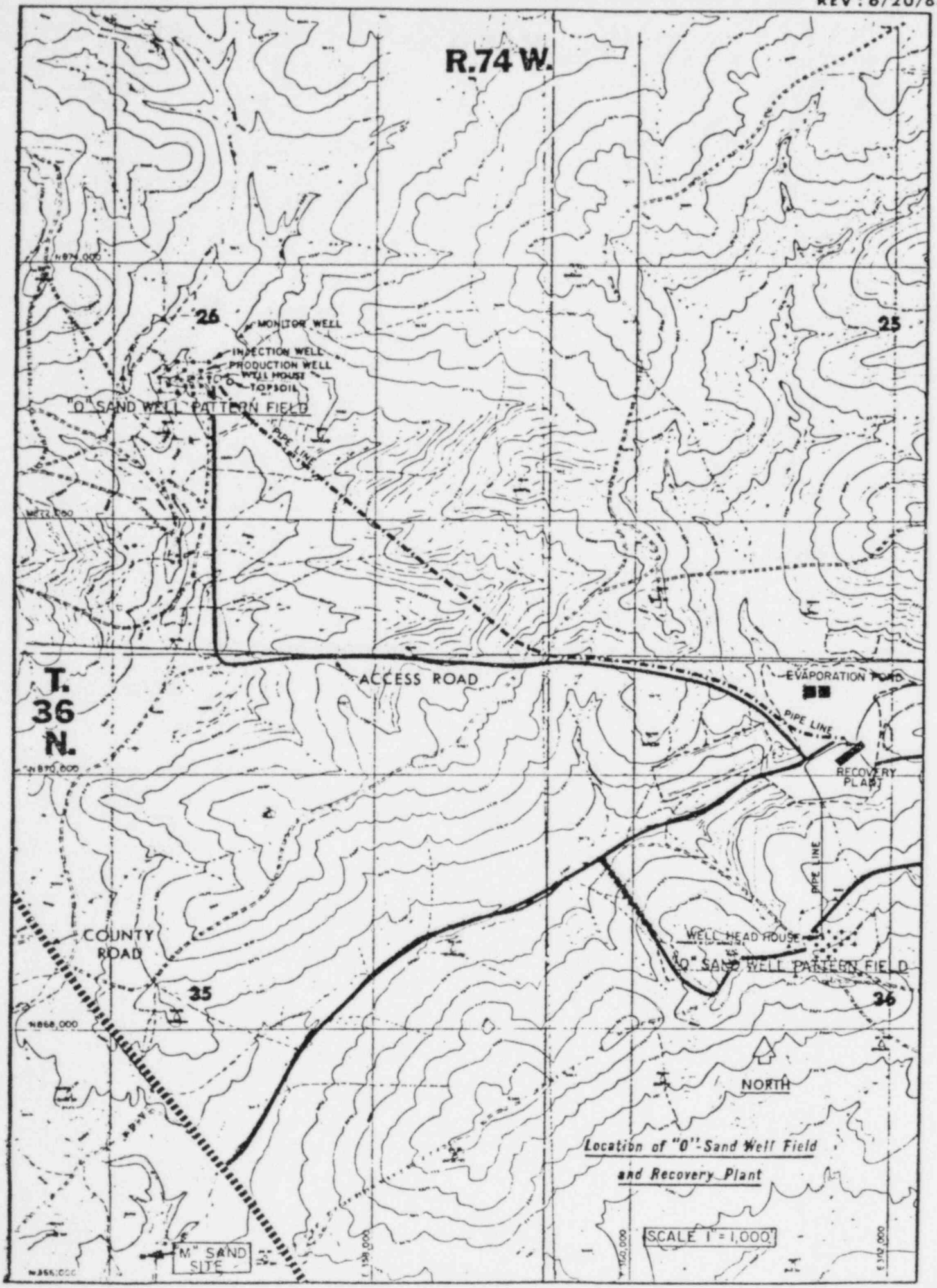
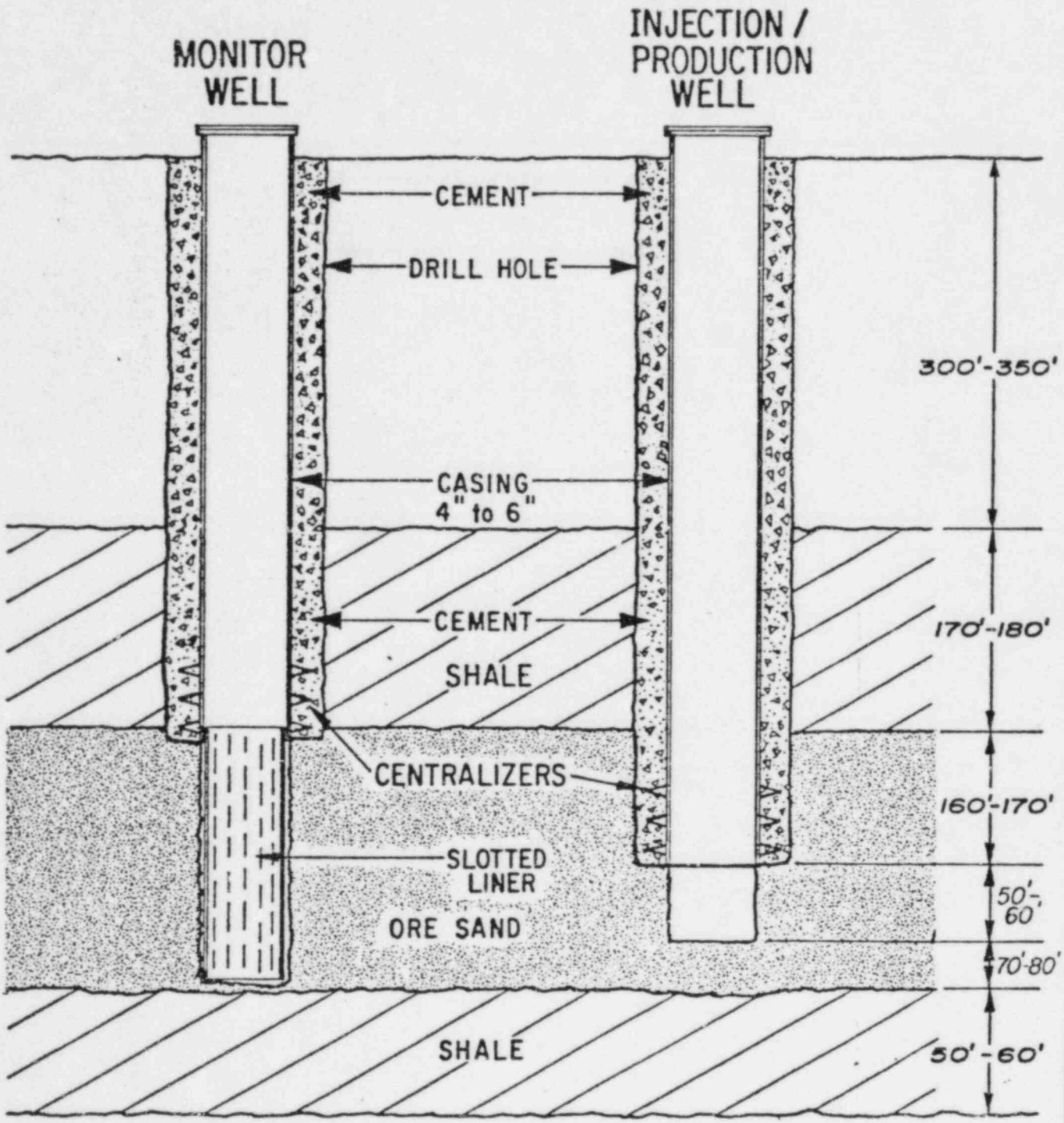


FIGURE 9-7

REV: 6/20/83

TYPICAL WELL COMPLETIONS

KERR-McGEE "O" SAND ISL PILOT



SLOTTED LINER COMPLETION

OPEN HOLE COMPLETION

NO SCALE

B.J. Buntz

FIGURE 9-8

EXPECTED LEACH SOLUTION FLOW PATTERNS
KERR-McGEE O-SAND IN-SITU
R&D PROJECT
CONVERSE COUNTY, WYOMING

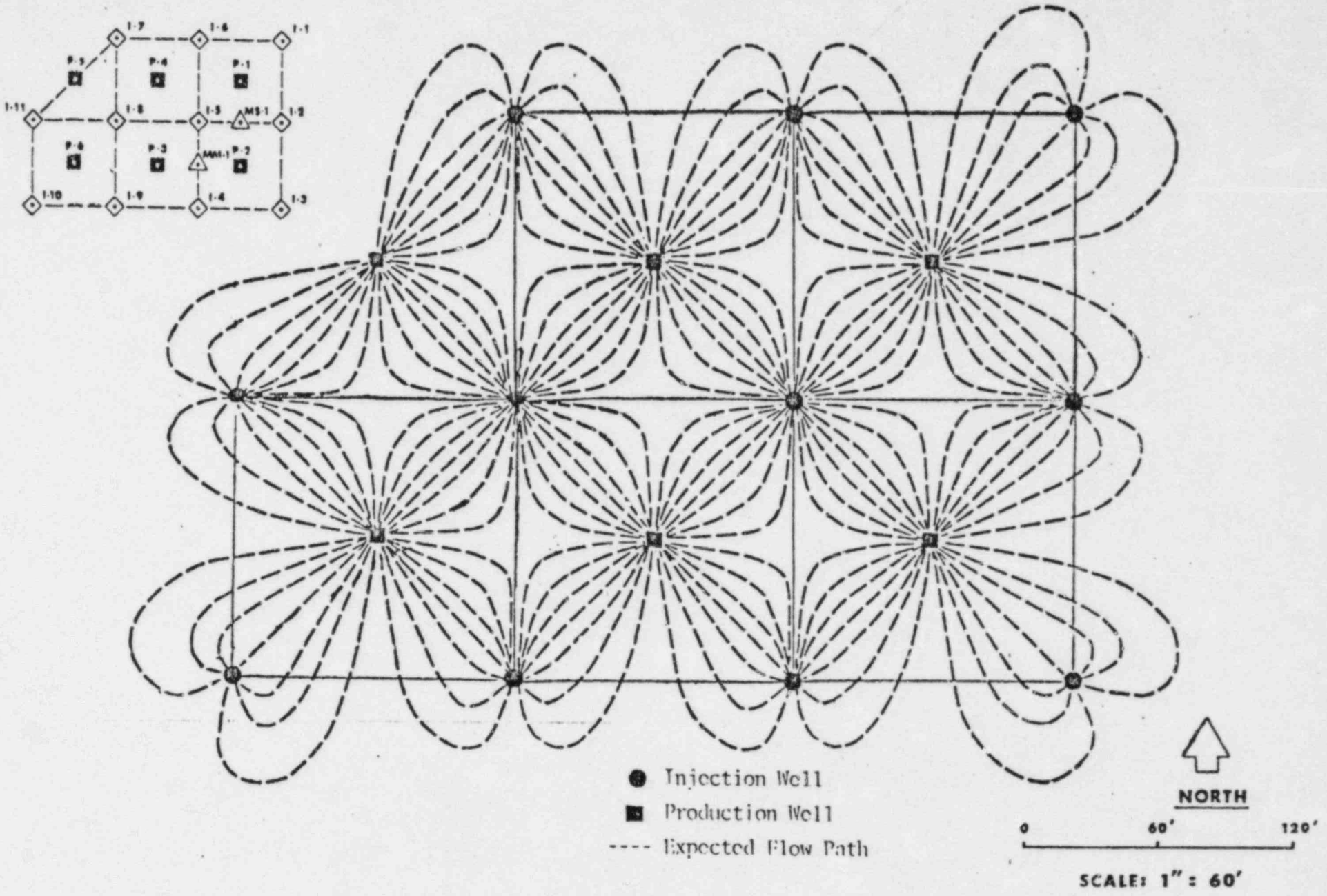
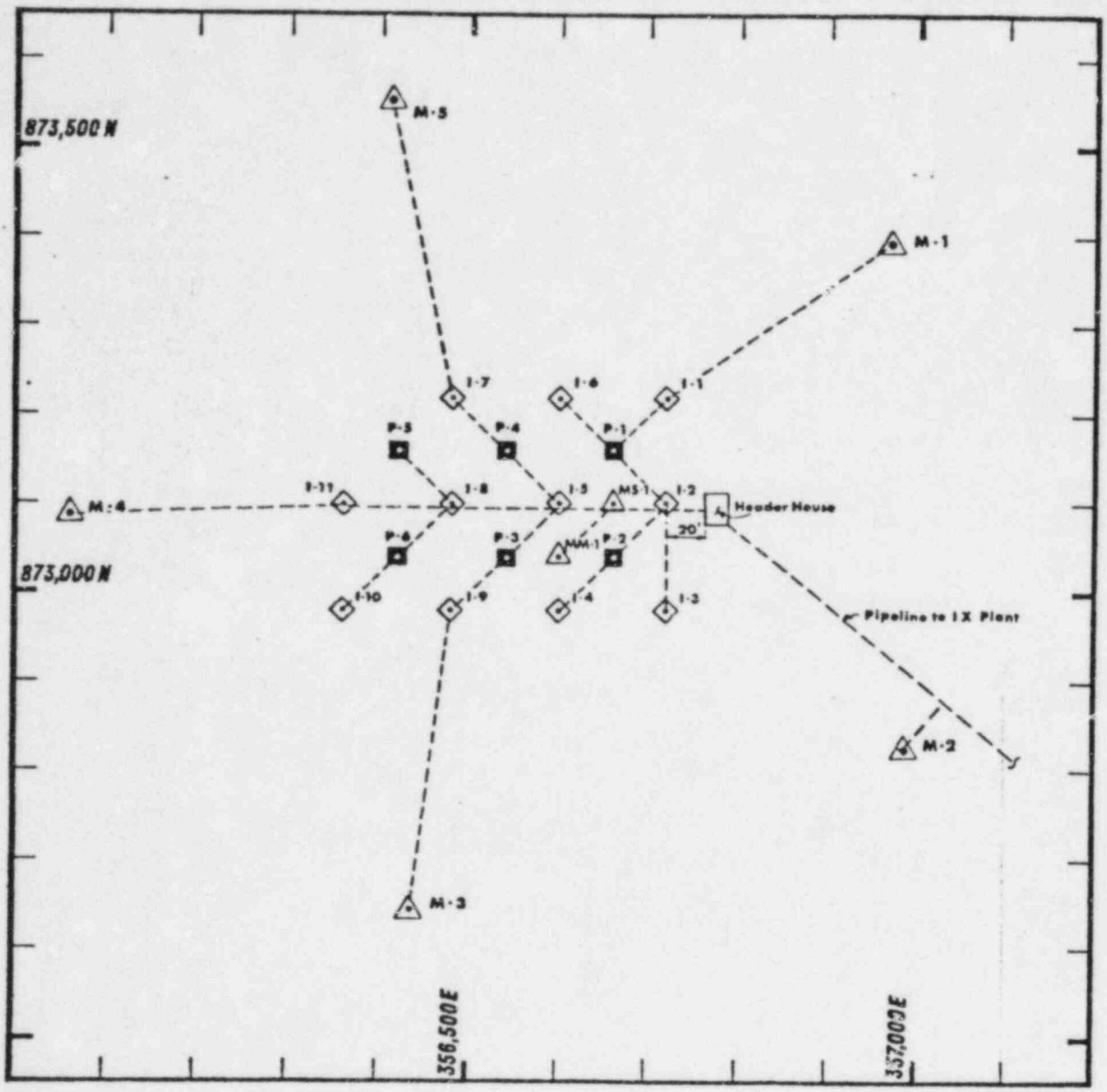


Figure 9-9

ADD: 6/20/83

"O" SAND WELL FIELD PIPING

Section 26, T-36N; R-74W



Legend

- Monitor Well
- Production Well
- Injection Well
- MS-1 Upper Zone Monitor Well
- MM-1 Lower Zone Monitor Well

120 ft. Spacing Between Injection Wells

NORTH

6-15-83

SCALE 1"=200ft.

Rev: 6/20/83

TABLE 9-1

INVENTORY OF WELLS ON THE
PROJECT AREA AND ADJACENT LANDS
KERR-McGEE "O" SAND PROJECT
CONVERSE COUNTY, WYOMING

Figure D-3 Location Number	K-M WY/No.	Wyo. Well Permit No.	Aquifer	Surface Elevation	Depth of Well (Ft)	Depth to Water	Water Level Elevation (Feet-MSL)	Date	Water Use**	Yield (GPM)
1	KM-TW-2	UW 29277	Fort Union	5,541.9	915	500.8	5,041.1	6/16/83	A	560
2	KM OWS-4	UW 54915	Wasatch	5,546.6	546	150.0	5,396.6	6/20/83	D	
3	KM OWD-4	UW 54916	Fort Union	5,546.8	943	490.9	5,055.9	6/16/83	D	
4	KM OI-1	UW 61823	Fort Union	5,507.4	730	432.5	5,074.9	6/17/83	B	
5	KM OMS-1	UW 61838	Wasatch	5,504.6	320	202.4	5,302.2	6/17/83	D	
6	KM OMM-1	UW 61837	Fort Union	5,503.3	899	375.5	5,127.7	6/17/83	D	
7	KM OP-3	UW 61825	Fort Union	5,501.3	736	427.0	5,074.3	6/17/83	B	20
8	KM OI-8	UW 61827	Fort Union	5,501.4	736	427.1	5,074.3	6/17/83	B	
9	KM OI-5	UW 61826	Fort Union	5,503.9	730	429.3	5,074.6	6/17/83	B	
10	KM OWD-5	UW 54918	Fort Union	5,534.7	897	485.3	5,049.4	6/16/83	D	
11	KM OWS-5	UW 54917	Wasatch	5,534.9	512	142.6	5,392.3	6/20/83	D	
12	KM OWD-8	UW 52154	Fort Union	5,617.5	916	543.9	5,073.6	6/21/83	D	
13	WW-109	*	Wasatch	5,540	149	95	5,445	11/75	C	

*Livestock watering well, permit number could not be identified.

**Beneficial use code: A - Mine dewatering
B - In-situ leaching of uranium
C - Livestock
D - Monitor well (no beneficial use)

Add: 6/20/83

TABLE 9 - 1A

LITHOLOGY DESCRIPTION - WELL OMM-1
KERR-McGEE "O" SAND PROJECT
SECTION 26, T36N, R74W

HOLE DEPTH FEET From	To	ROCK TYPE	COLOR	GRAIN SIZE	ACCESSORY MINERALS & REMARKS
0	76	Siltstone - sandstone	Brown, gray brown	Fine to coarse	hematite, altered feldspar limonite
76	87	Mudstone	Gray	Fine	-
87	105	Mudstone to siltstone	Gray, black, yellow, brown	Fine to medium	limonite
105	119	Mudstone	Black, brown	Fine	carbon particles
119	156	Sandstone	Gray brown	Medium to coarse	carbon particles, limonite
156	200	Mudstone	Black green	Fine	limonite, carbon particles, hematite inclusions.
200	228	Sandstone	Light gray	Medium to coarse	feldspar, limonite
228	236	Mudstone	Medium gray	Fine to medium	limonite chips, feldspar
236	243	Sandstone	Medium gray	Medium	feldspar, sparse limonite
243	282	Mudstone	Medium gray	Fine	carbon particles
282	329	Sandstone	Light gray	Medium to coarse	carbon particles, limonite
329	505	Mudstone - siltstone	Dark to medium gray	Fine	carbon particles
505	535	Sandstone	Medium gray	Fine to coarse	limonite
535	540	Mudstone to sandstone	Dark gray to medium gray	Fine to coarse	-
540	658	Sandstone	Light yellow to medium gray	Medium to coarse	limonite, carbon particles, feldspar, some mudstone within sandstone.
658	667	Mudstone	Medium gray	Fine to medium	-
667	745	Sandstone	Medium gray	Fine to coarse	organic debris and striations, shale nodules, some coal and pyrite at 682', some limonite.(1)
745	760	Mudstone - siltstone	Dark to medium gray	Fine	Mudstone grading to sandstone
760	803	Sandstone	Medium gray	Fine to medium	-
803	872	Mudstone	Medium gray	Fine	carbon particles
872	900	Sandstone	Medium gray	Fine to medium	-

(1) Observations from core removed from Hole 834C - 40 feet S, SW from OMM-1.

Figure 9 - 1B

MINERALOGICAL AND CLAY DATA
MINERALIZED INTERVAL CORE (1)
KERR-McGEE "O" SAND PROJECT

CORE INTERVAL DEPTH - FEET	CO_3 ppm	V ppm	Se ppm	As ppm	Mo ppm	T.O.C. %	Fe %	Sulfide %	Clay %	Clay Type(2)
663 to 680	163	18	23	1.9	< 35	.14	0.8	< .01	1.8	M, K, I
680 to 692	330	38	32	2.4	< 35	.17	1.0	.01	2.9	M, K, I
692 to 711	83	35	37	1.6	< 35	.06	1.2	.01	5.0	M, K, I
711 to 720	1,150	90	39	1.5	< 35	.29	1.5	.02	5.4	M, K, I
720 to 730	88	78	98	3.9	< 35	.07	1.3	.01	9.6	K, I, M
731 to 742	114	46	55	4.7	< 35	.08	1.1	.10	8.6	K, M, I

LITHOLOGY

663 to 680 - Fine to medium gray sand, organic debris, organic striations, some shale stringers in upper part. Core soft to firm.

680 to 692 - Fine medium and coarse gray sand stone layers, shale nodules, organic as debris and striations, some coal and pyrite at 682. Core soft to compact.

692 to 711 - Coarse to fine tan sand stone or tan/gray bands, organic debris and shale nodules, core soft to compact.

711 to 720 - Coarse, medium and fine dark gray sand stone layers, lots of organic debris, shale seam at 714.6-9, shale nodules, some lime stone concentrations at 715. Core firm to compact.

720 to 730 - Coarse medium and fine sand stone tan-tan and light gray bands, shale nodules and some organic debris. Core soft to firm.

731 to 742 - Coarse and fine gray sand stone, some tan bands, shale nodules, organic debris, last 0.5 feet interbedded shale and silt stone. Core soft.

(1) Core hole 834C located ± 40 feet S, SE of OMM-1.

(2) Order is Major, intermediate, and minor components: M = Montmorillonite, K = Kaolinite, I = Illite.

TABLE 9 - 1C

COMPOSITE SAMPLE SCREEN ANALYSES
MINERALIZED INTERVAL - CORE HOLE 834C[1]
KERR-McGEE "O" SAND PROJECT

SCREEN SIZE (MESH)	MATERIAL RETAINED ON SCREEN (GRAMS)	% OF MATERIAL RETAINED	CUMMULATIVE % RETAINED
8	0	0	0
10	7.5	1.4	1.4
14	46.5	8.6	10.0
20	68.7	12.7	22.8
28	63.6	11.8	34.6
35	49.7	9.3	43.8
48	46.4	8.6	52.4
65	64.1	11.9	64.3
100	63.1	11.7	76.0
150	33.4	6.3	82.2
200	18.5	3.4	85.6
325	11.3	2.0	87.7
- 325	66.2	12.3	100.0
	539.0	100.0	

[1] Section 26, T36N, R74W

TABLE 9-2

WELL CONSTRUCTION AND COMPLETION TABLE
"O" SAND IN-SITU LEACH PROJECT
CONVERSE COUNTY, WYOMING
SECTION 26, T36N, R74W

Well No.	Total Depth (Ft.)	Drill Hole Size		Casing[1]		Open Interval (Depth-Ft.)	Measuring Point - Elevation (Ft.-MSL)	November 1982 Static Water Level (Ft.-MSL/Depth)
		Depth (Ft.)	Dia. (In.)	Depth (Ft.)	Type			
OI-1	730	676 730	7-7/8 3-7/8	671	4" Fiber-glass	671-730 59'	5,507.4	5,034.7 482.7
OI-5	730	675 730	7-1/2 3-7/8	672	4" Fiber-glass	672-730 58'	5,503.9	5,025.4 478.5
OI-8	736	670 736	7-7/8 3-7/8	662	4" Fiber-glass	662-715 53'	5,501.4	5,026.8 474.6
OP-3	736	675 736	9-7/8 5-5/8	670	6" Steel	670-713 43'	5,501.1	5,025.0 476.1
OMM-1	899	877 899	7-7/8 3-7/8	877	4" Steel	877-899 22'	5,503.3	5,083.4 419.9
OMS-1	320	290 320	7-7/8 3-7/8	285	4" Steel	285-320 35'	5,504.6	5,297.4 207.2

(1) On all wells, the casing run and cemented in place by pumping the cement through the casing. After the cement had set, the wells were drilled out and completed open hole.

TABLE 9-3

INJECTION WELL INTEGRITY TEST RESULTS
"O" SAND PROJECT

	Well No.		
	OI-1	OI-5	OI-8
TEST DATE	10/26/82	10/22/82	10/20/82
Initial Pressure PSI	110	103	125
+ 1 Minute	110	100	125
+ 2 Minutes	110	100	125
+ 3 Minutes	110	100	125
+ 4 Minutes	110	100	125
+ 5 Minutes	110	100	125
+ 6 Minutes	110	100	125
+ 7 Minutes	110	100	125
+ 8 Minutes	110	100	125
+ 9 Minutes	110	100	125
+10 Minutes	110	100	125

TABLE 9-3A

Mechanical Integrity Test Procedures
Injection and Production Well Casings
Kerr-McGee O-Sand ISL Pilot

1. After the well casing is run and cemented in place, the bottom of the casing adjacent to or below the confining layer above the injection zone is sealed with a plug, downhole packer, or other suitable device. The top of the casing is then sealed in a similar manner or with a threaded cap, and a pressure gauge is installed to monitor the pressure inside the casing.

2. The pressure in the sealed casing is then increased to some pressure above the maximum anticipated operating pressure (100 psi) and the well is closed in and all fittings are checked for leaks.

3. After the pressure is stabilized at some point above 100 psi, pressure readings are taken and recorded at one minute intervals for ten minutes.

4. If there are obvious leaks or the pressure drops by more than five percent during the ten minute period, the seals and fittings are reset and/or checked and another test is conducted. If the pressure drops less than five percent the well casing is considered acceptable.

5. If the casing does not have the necessary mechanical integrity, the casing will be repaired and the well retested. If an acceptable test cannot be obtained after repairs, the well will be plugged or, if deemed acceptable, used as a monitor well or production well. If a test does not demonstrate mechanical integrity and Kerr-McGee elects to use the well as a monitor well or production well, the casing test data and data supporting the proposed use will be submitted to the DEQ for review.

6. Test results to be documented include the well designation, date, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test.

7. The well casing integrity data on a well will be submitted to the DEQ for review prior to using that well for the injection or production of leach solutions.

TABLE 9-4

PRIMARY CHEMICAL REACTIONS EXPECTED IN THE AQUIFER
KERR-McGEE O SAND IN-SITU R&D PROJECT
CONVERSE COUNTY, WYOMING

Uranium Extraction

$H_2O_2 \rightarrow \frac{1}{2}O_2 + H_2O$

Hydrogen Peroxide — Oxygen — Water

$UO_2 + \frac{1}{2}O_2 \rightarrow UO_3$

Uranium in Reduced State — Oxygen — Uranium in Oxidized State

$UO_3 + Na_2CO_3 + 2NaHCO_3 \rightarrow Na_4UO_2(CO_3)_3 + H_2O$

Oxidized Uranium — Sodium Carbonate — Sodium bicarbonate — Sodium Uranyl Tricarbonate — Water

The soluble uranyl tricarbonate complex moves to the production wells in solution and is recovered in the process plant.

Calcium Carbonate Scale

$CaClay + Na_2CO_3 \rightarrow Na_2\ Clay + CaCO_3$

Calcium Clays — Sodium Carbonate — Sodium On Clays — Calcium Carbonate

The calcium carbonate is soluble in the solution; however, after it reaches a certain level, a change in pressure or temperature may cause it to precipitate as a scale.

Pyrite Reaction

$2\ FeS_2 + 19\ H_2O_2 + 8Na^+ \rightarrow 2\ Fe(OH)_3 + 4\ Na_2SO_4 + 16\ H_2O$

Pyrite — Hydrogen Peroxide — Sodium Ions — Ferric Hydroxide — Sodium Sulfate — Water

The ferric hydroxide will precipitate when formed. The sodium ions in the above reaction could be replaced by calcium in certain conditions resulting in calcium sulfate instead of sodium sulfate. Calcium sulfate, with changes in temperature and/or pressure, can precipitate as a scale.

TABLE 9 - 5

RESTORATION AND STABILITY PARAMETERS
KERR-McGEE "O" SAND PROJECT

A. Trace and Minor Elements

- Arsenic
- Boron
- Iron
- Manganese
- Radium-226
- Selenium
- Thorium 230
- Uranium

B. Common Constituents

- Bicarbonate
- Calcium
- Carbonate
- Chloride
- Magnesium
- Potassium
- Sodium
- Sulfate

C. Physical Parameters

- Specific Conductivity
- Total Dissolved Solids
- pH

ADD: 6/20/83

TABLE 9-6

TRACE METALS & NITRATE IN Q-SAND IX FEED WATER*

Parameter	Pre-Mining Water Quality (Avg. of 5 Production Wells) Sample Date 10/8/81	IX Feed Analysis During Mining 3/31/82	6/11/82	12/13/82
Aluminum (Al)	0.23	<0.10	<0.10	<0.10
Barium (Ba)	0.15	<0.10	<0.10	<0.10
Cadmium (Cd)	<0.002	<0.002	0.012	<0.002
Chromium (Cr)	0.05	<0.01	<0.01	<0.01
Cobalt (Co)	<0.006	-	<0.05	<0.05
Copper (Cu)	0.07	<0.01	<0.01	0.02
Fluoride (F)	0.24	0.27	0.40	0.20
Lead (Pb)	0.004	<0.05	<0.05	<0.05
Mercury (Hg)	0.001	<0.0002	<0.0002	<0.0002
Molybdenum (Mo)	0.04	<0.001	0.06	<0.001
Nickel (Ni)	0.02	<0.02	0.09	0.09
Vanadium (V)	<0.10	<0.10	<0.10	<0.10
Zinc (Zn)	0.050	<0.005	0.013	0.021
Nitrate (NO_3 as N)	<1	<0.05	0.16	0.22

*Feed water represents the total stream produced from the Q-Sand well field.

TABLE 10-1

RECLAMATION BOND ESTIMATE

KERR-McGEE O-SAND PROJECT

I.	Groundwater Restoration (Groundwater Sweep and EDR/Reverse Osmosis)	
	a. EDR/Reverse Osmosis Unit (30 gpm)	$ 40,000
	b. Operating Labor (4 men @ 160 hrs./month x 6 months x $14/hr.)	53,760
	c. Chemicals	
	15#/day $BaCl_2$ x $0.25/# x 180 days	675
	300#/day CO_2 x $0.05/# x 180 days	2,700
	Other chemicals - $300/month x 6 months	1,800
	d. Operating parts & supplies - $750/month x 6 months	4,500
	e. Electrical costs - $43/day x 180 days	7,740
	f. Maintenance - 20 manhours/month x 6 months x $14/hr.	1,680
II.	Reclamation - Surface & Well Plugging	
	a. Header building removal (80 hours @ $14/hr)	1,120
	b. Remove overhead powerlines, transformers, cable, etc. (120 hrs. @ $14/hr.)	1,680
	c. Plug and cap wells and cut-off below surface - 24 wells x $200/well	4,800
	d. Reclaim Surface	
	1) Rip hard-pack - grader - 2 hrs. @ $94/hr.	188
	2) Replace topsoil - 400 c.y. x $0.80/c.y.	320
	3) Discing 5 acres @ $30/acre	150
	4) Drill oats for stubble - 5 acres @ $30/acre	150
	5) Drill grass seed - 5 acres @ $30/acre	150
	6) Seed & oats @ $5/acre & Grass @ $88/acre	465
	7) Fertilizer - 5 acres @ $40/acre	200
	8) Mobilization & demobilization	1,000
III.	Aquifer Stability Monitoring	
	a. Sampling - 12 manhours/month x 6 months x $14/hr.	1,008
	b. Analyses - 6 samples/month x 6 months x $200/sample	7,200
		$ 131,286
IV.	DEQ Contingency (15%)	19,693
		$ 150,979

ATTACHMENT B

LONG-TERM PUMP TEST
"O" SAND ISL R&D PROJECT
KERR-McGEE NUCLEAR CORPORATION
CONVERSE COUNTY, WYOMING

A long-term aquifer pump test was conducted at the "O" sand in-situ leach (ISL) pilot site so that an evaluation could be made of the hydrogeological characteristics of the "O" sand and of the degree of isolation provided by the overlying and underlying shales and mudstones. Based on the results of this test, it was concluded that the "O" sand in this area has an average transmissivity of about 4,900 gpd/ft and that the "O" sand is well isolated from the overlying and underlying aquifers.

The "O" sand in the test area is approximately 300 feet thick at an average depth of about 650 feet. The overlying shale and underlying shale average about 170 feet thick and 60 feet thick, respectively, in the test area. East-west and north-south cross-sections of the test area are included in Attachment A of the application as Figures 9-3 and 9-4 (pages A-3 and A-4 of preceding section).

The six (6) wells drilled and completed for the pump test, four (4) in the "O" sand and one (1) each in the overlying and underlying aquifers, are located as shown in Figure 1. The wells were drilled to casing depth, then cased with steel or fiberglass casing. The casing was cemented in place and the well was then drilled out and completed open hole. Casing and completion data on these wells is summarized in Table I. Three (3) "O" sand monitor wells, OI-1, OI-5, and OI-8 were used to determine the "O" sand

aquifer properties. The pumped well was designated as OP-3. Monitor wells OI-5 and OI-8 were 85 feet from the pumped well, and OI-1 was 255 feet from the pumped well. The overlying aquifer monitor well was OMS-1 and the underlying monitor well was OMM-1.

The fluid levels were measured in OMS-1 and OMM-1 prior to, during, and after the pump test and this data is tabulated in Table II. The same data is presented in graphical form in Figure 2 and does not indicate any significant communication between the overlying or the underlying aquifer and the "O" sand aquifer. The barometric pressure is also plotted in Figure 2, and there does not appear to be any significant effect on the fluid levels due to atmosphere pressure changes.

The graphical data in Figure 2 shows that the water level in the underlying aquifer, OMM-1, was continually increasing during the monitoring period. This gradual rise in the water level is due to the fact that the Bill Smith underground mine, located 6000 feet southeast of the test site, has been flooded and is undergoing recharge. The underground haulage drifts of the mine were in the underlying "M" sand. During the month of November 1982, the water level in the Bill Smith Mine shaft rose an average of 1.6 feet per day.

The long-term pump test started when the pump in the well OP-3 was turned on at 1314 hours on November 9, 1982 and pumping continued until 1315 hours on November 12, 1982. The pumping rate was maintained at nearly constant flow rate of 20.2 gal/min during the three-day test. The total gallons produced were 85,003 over the total pumping time of 4213 minutes. The time from pump start to

pump turn-off was 4321 minutes, but a snowstorm caused a utility company power failure that lasted for 108 minutes. The power failure occurred at 1055 hours on November 11, 1982, which was 2741 minutes after the pump was started.

Drawdown data for the pumped well and the three (3) "O" sand monitor wells is presented in graphical form in Figures 3 through 6, and is included in tabular form in Table III. The calculated transmissivities for the individual wells which ranged from 4371 to 5498 gpd/ft, do not indicate any significant directional transmissivity in the test area. The average transmissivity for the four (4) wells was 4896 gpd/ft.

The flattening of the drawdown curves in the latter time frame of the pump test is believed to be due to the area of influence extending beyond some of the intermittent shale members in the "O" sand (see Figure 9-3 and 9-4 of the application) and/or into the recharge area of the Bill Smith underground mine. The ore zone development in the Bill Smith Mine was in the "O" sand. Two (2) Bill Smith monitor wells, OWD-5 and OWD-8, which are completed in the "O" sand near the pilot area have shown a rise in fluid level due to the shutdown of the Bill Smith Mine. The fluid level in well OWD-5 increased 5.6 feet and OWD-8 increased 3.0 feet, between September 21st and November 3rd, 1982. The locations of these wells and a general piezometric map of the area are shown in Figure 7. Additional data on the wells is included in the Inventory of Wells for the license area, Table D-1. Because of intermittent shale members in the "O" sand, recharge at the Bill Smith Mine and the temporary power failure it was concluded that the recovery data from

the pump test would not have been meaningful, therefore that part of the test was omitted.

Based on a review of the geology, the pump test results, and a year plus operating experience with the Q-sand ISL pilot, it is concluded that:

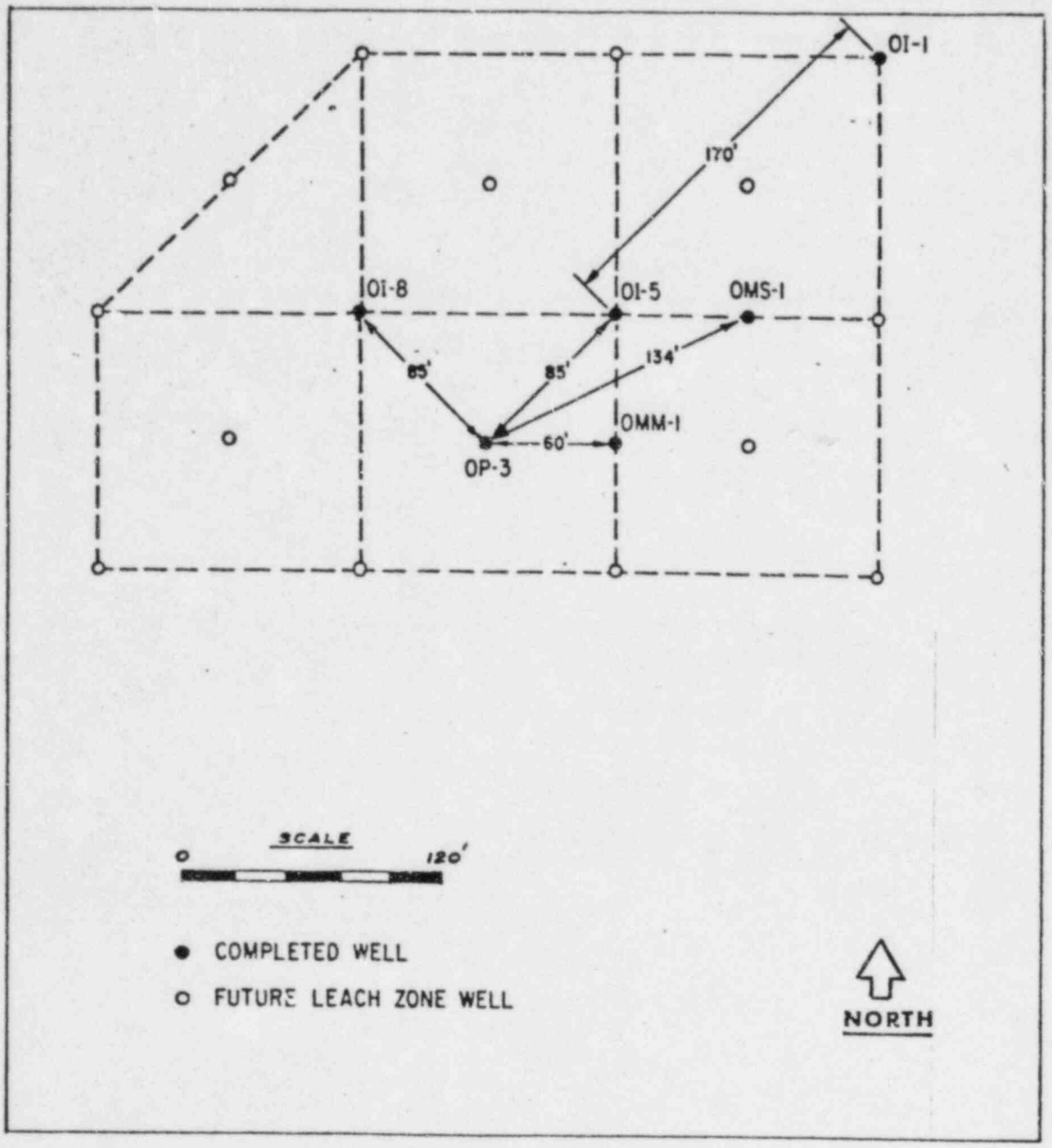
1) The "O" sand is a confined aquifer with relatively uniform hydrological properties in the test area.
2) There is no evidence of a significant vertical leakage between the "O" sand and the overlying and underlying aquifers. Furthermore, the existing fluid pressures (static water levels) in the overlying and underlying aquifers are greater than the "O" sand fluid pressure (by 270 feet and 55 feet of water, respectively); therefore, if there were any leakage it would be from the overlying or underlying aquifer into the "O" sand aquifer and would not cause migration of leach solutions out of the leach zone.
3) By operating the well field with a net bleed to insure that withdrawals exceed injection, a potentiometric cone of depression can be established and maintained in the ore zone providing further confinement of the leach solutions. This has been demonstrated in the year plus operation of the Q-sand ISL pilot where a ore zone cone of depression with about 10 feet of drawdown at the outer ring of monitor wells has been established and maintained.

4) There is no indication of local faults or other subsurface features that would disrupt the local groundwater flow or that would prevent an environmentally safe in-situ leaching operation.

5) The "O' sand aquifer has all of the hydrological and geological controls necessary for an efficient and environmentally acceptable in-situ leach pilot project. The groundwater monitoring program for the pilot will ensure protection of the environment during demonstration of this confinement.

Figure 1

RELATIVE LOCATIONS OF WELLS
HYDROLOGICAL PUMP TEST
KERR-McGEE "O" SAND ISL. PILOT



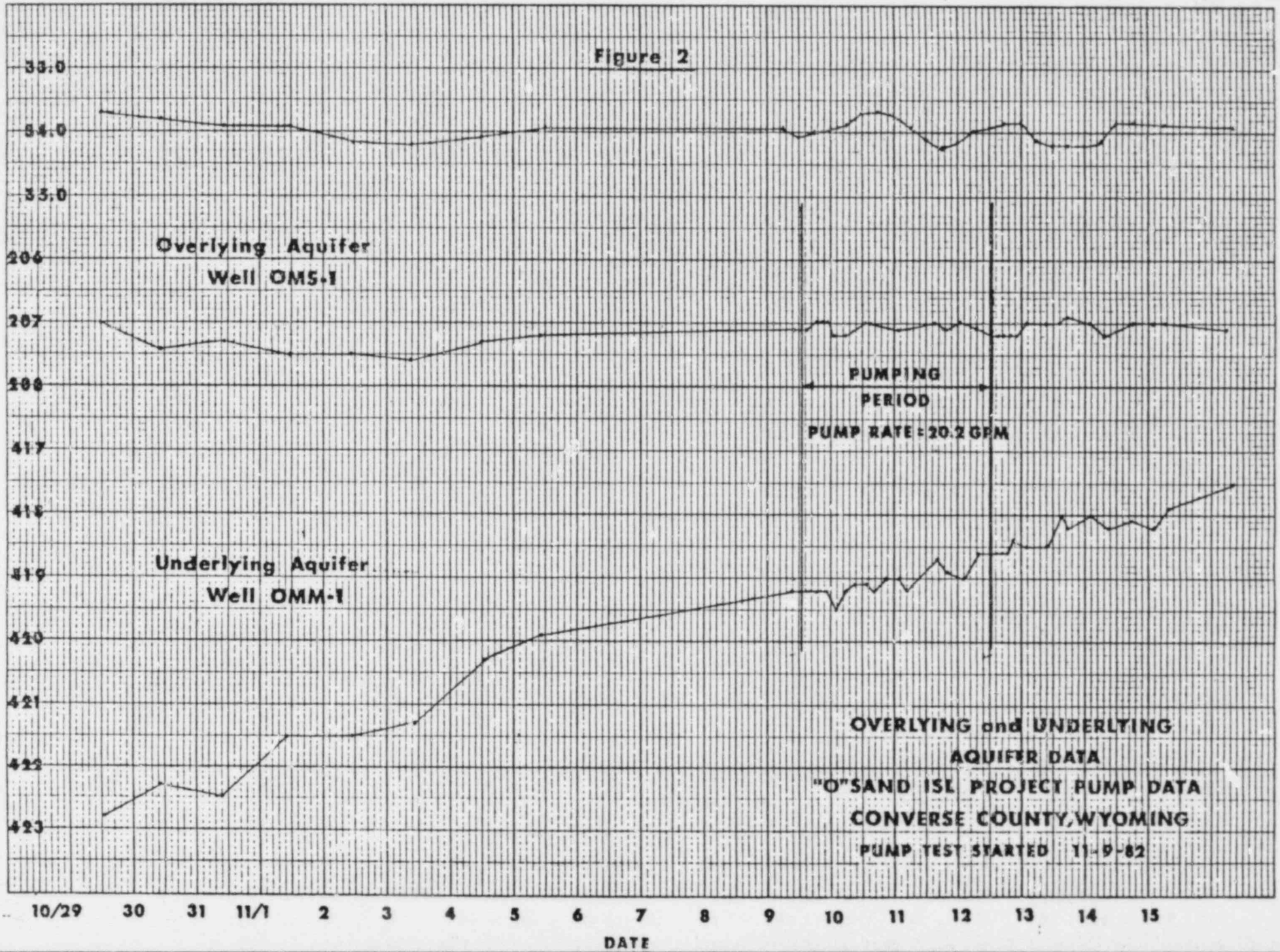
OP-3 ..... PUMPED WELL

OI-1, OI-5, OI-8 ..... "O" SAND MONITOR WELLS

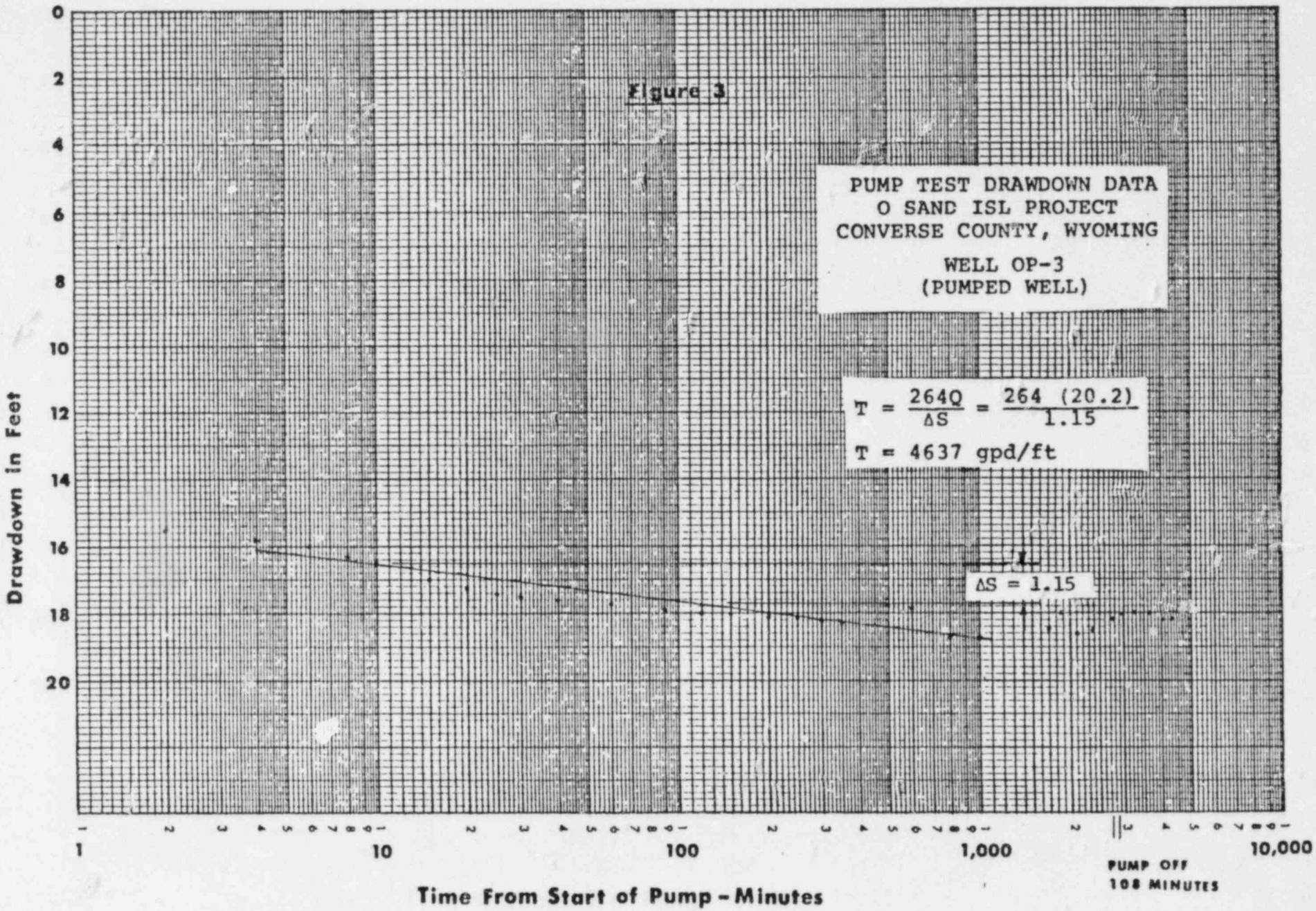
OMM-1 ..... UNDERLYING AQUIFER MONITOR WELL

OMS-1 ..... OVERLYING AQUIFER MONITOR WELL

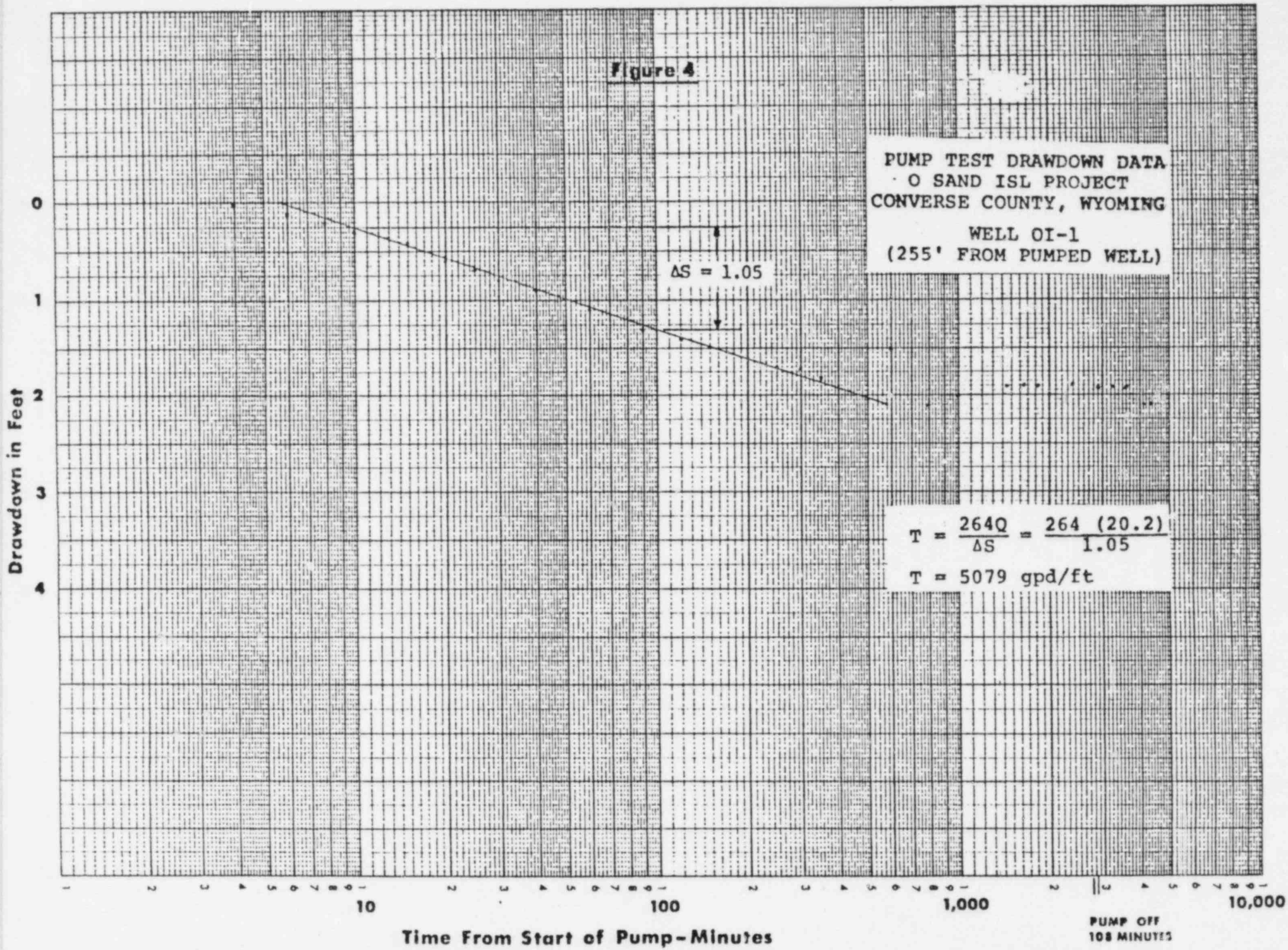
Figure 2



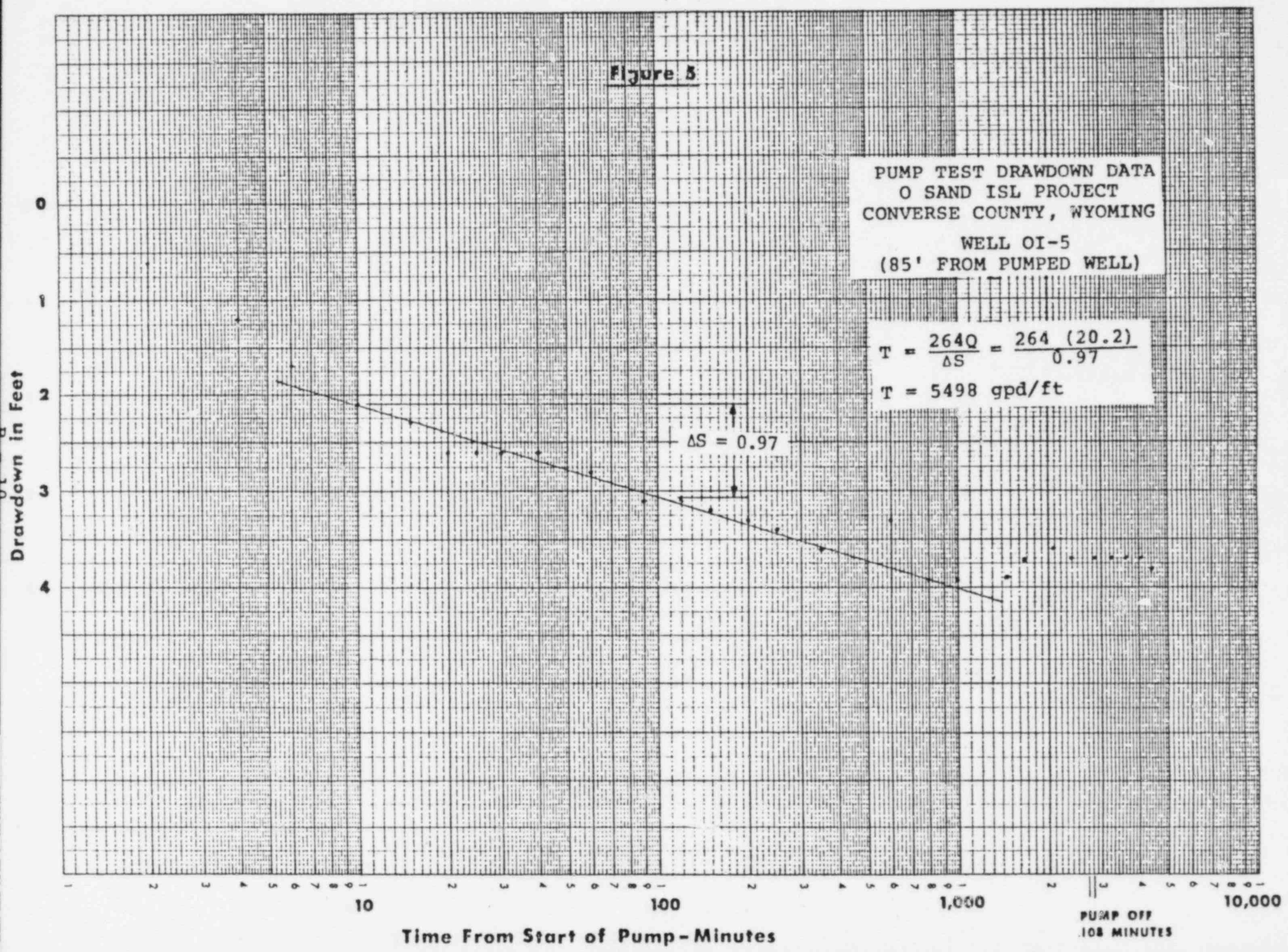
OP-3 Drawdown



OI-1 Drawdown



OI-5 Drawdown



OI-8 Drawdown

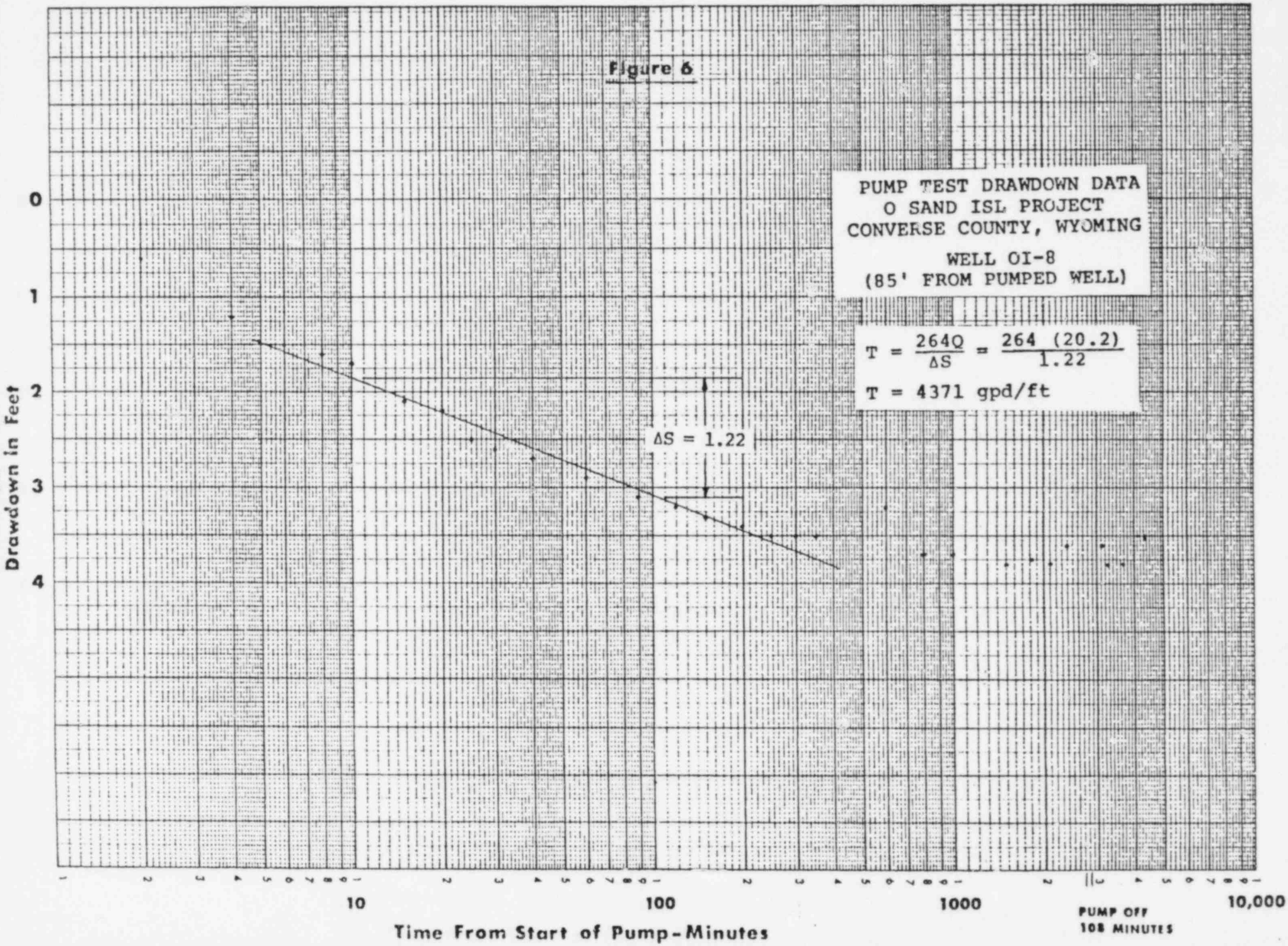


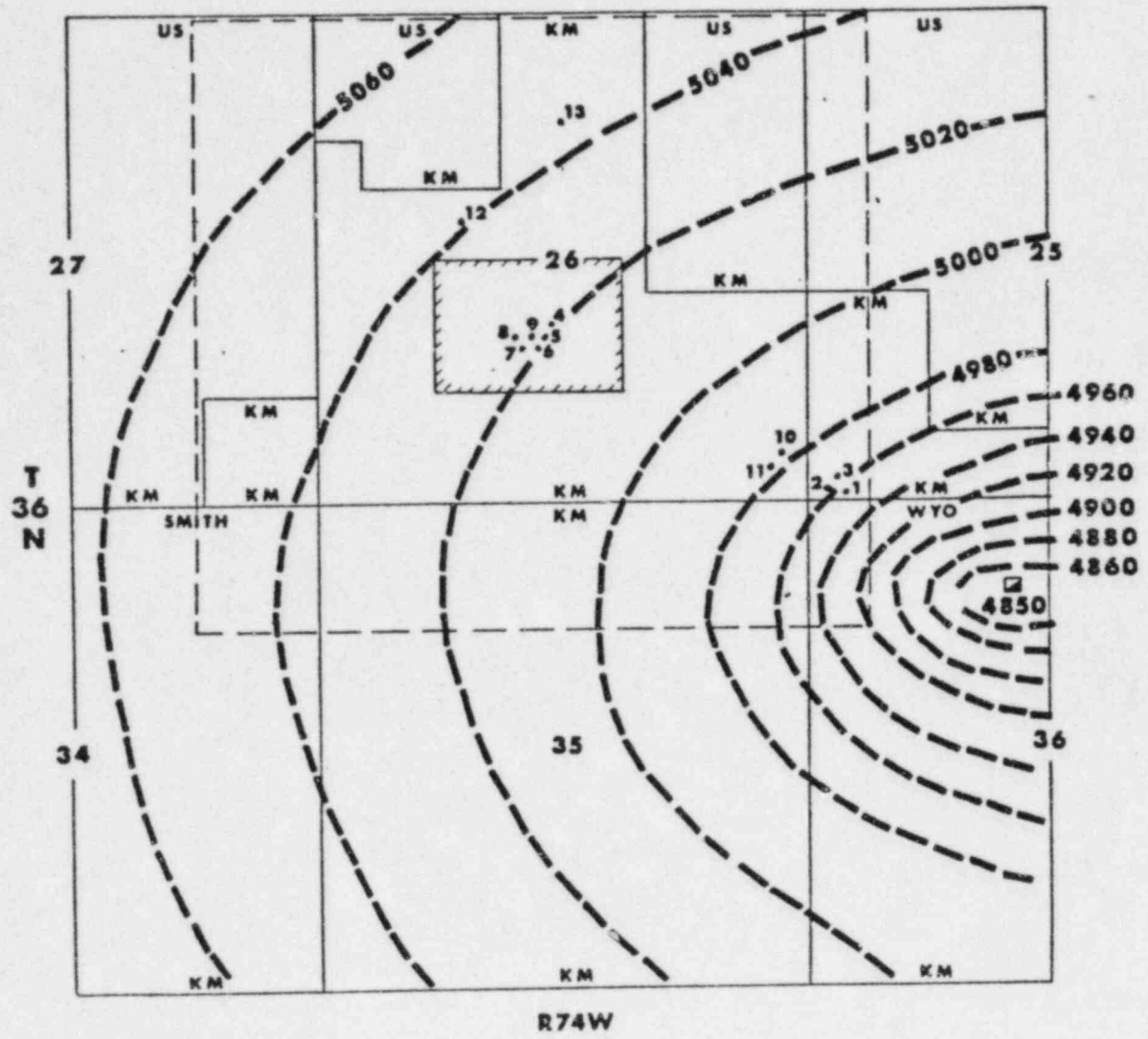
FIGURE 7

GENERAL TEST AQUIFER PIEZOMETRIC CONTOURS(1)

LICENSE AREA AND ADJACENT LANDS

KERR-McGEE "O" SAND ISL PILOT

CONVERSE COUNTY WYOMING



LICENSE AREA

LIMITS OF ADJACENT LANDS

BILL SMITH MINE SHAFT

—5000— EXPECTED 'O' SAND PIEZOMETRIC SURFACE – FEET ABOVE MSL

(1) THE CONTOURS ARE BASED ON VERY LIMITED DATA BUT ARE BELIEVED REPRESENTATIVE FOR THE TEST SITE. NOVEMBER, 1982 DATA.

Rev: 6/20/83

TABLE I

WELL CONSTRUCTION AND COMPLETION TABLE
"O" SAND IN-SITU LEACH PROJECT
CONVERSE COUNTY, WYOMING
SECTION 26, T36N, R74W

Well No.	Total Depth (Ft.)	Drill Hole Size		Casing(1)		Open Interval (Depth-Ft.)	Measuring Point - Elevation (Ft.-MSL)	November 1982 Static Water Level (Ft.-MSL/Depth)
		Depth (Ft.)	Dia. (In.)	Depth (Ft.)	Type			
OI-1	730	676 730	7-7/8 3-7/8	671	4" Fiber-glass	671-730 59'	5,507.4	5,024.7 482.7
OI-5	730	675 730	7-1/2 3-7/8	672	4" Fiber-glass	672-730 58'	5,503.9	5,025.4 478.5
OI-8	736	670 736	7-7/8 3-7/8	662	4" Fiber-glass	662-715 53'	5,501.4	5,026.8 474.6
OP-3	736	675 736	9-7/8 5-5/8	670	6" Steel	670-713 43'	5,501.1	5,025.0 476.1
OMM-1	899	877 899	7-7/8 3-7/8	877	4" Steel	877-899 22'	5,503.3	5,083.4 419.9
OMS-1	320	290 320	7-7/8 3-7/8	285	4" Steel	285-320 35'	5,504.6	5,297.4 207.2

(1) On all wells, the casing run and cemented in place by pumping the cement through the casing. After the cement had set, the wells were drilled out and completed open hole.

TABLE II

OVERLYING AND UNDERLYING AQUIFER DATA
"O" SAND ISL PROJECT PUMP TEST
Converse County, Wyoming

Date/Time		Depth to Fluid Level - Feet: Overlying Aquifer Well OMS-1	Depth to Fluid Level - Feet: Underlying Aquifer Well OMM-1	
10/29/82	1245	207.0	422.8	
10/30/82	1130	207.4	422.3	
10/31/82	1030	207.3	422.5	
11/1/82	1100	207.5	421.5	
11/2/82	1100	207.5	421.5	
11/3/82	1100	207.6	421.3	
11/4/82	1230	207.3	420.3	
11/5/82	1145	207.2	419.9	
11/9/82	1130	207.1	419.2	
	1314	207.1	419.2	
	1316	207.1	419.2	
	1318	206.5	419.2	
	1320	206.6	419.2	
	1322	206.8	419.2	
	1324	206.7	419.2	
	1329	206.8	419.2	
	1334	207.1	419.2	
	1339	206.9	419.2	
	1344	207.0	419.2	
	1354	207.0	419.2	
	1414	206.8	419.2	
	1444	207.0	419.2	
	1514	207.0	419.2	
	1544	207.0	419.2	
	1634	207.0	419.2	
	1724	207.0	419.2	
	1814	207.0	419.2	
	1904	207.0	419.2	
11/9/82	2315	206.9	419.4	
11/10/82	0230	207.2	419.5	
	0600	207.2	419.2	
	0835	207.0	419.1	
	1335	207.0	419.1	
	1614	207.0	419.2	
	2015	207.0	419.0	
11/11/82	0300	207.1	419.0	
	0445	207.0	419.2	
	1055	Pump Off Electricity Lost		Utility Co. Power Failure
	1243	Pump Back on		
	1453	207.0	Probe Not Work	
	1610	-	418.7	
	2000	207.1	418.9	
11/12	0235	207.0	419.0	
	0836	207.1	418.6	
	1315	207.2	418.6	Pump Turned Off

TABLE III

"O" SAND AQUIFER DRAWDOWN DATA
"O" SAND ISL PROJECT PUMP TEST
T36N, R74W, S 26, Converse Co., Wyoming
November, 1982

Time From Start of Pump[2] Minutes	Well Drawdown - Feet			
	Pumped Well	Monitor Wells		
	OP-3	OI-1	OI-5	OI-8
2	15.5	0	.6	.6
4	15.8	0	1.2	1.2
6	16.0	.1	1.7	1.5
8	16.3	.2	1.9	1.6
10	16.5	.3	2.1	1.7
15	17.0	.4	2.3	2.1
20	17.2	.6	2.6	2.2
25	17.4	.7	2.6	2.5
30	17.5	.8	2.6	2.6
40	17.6	.9	2.6	2.7
60	17.7	1.1	2.8	2.9
90	17.9	1.3	3.1	3.1
120	18.0	1.4	3.1	3.2
150	18.0	1.5	3.2	3.3
200	18.1	1.5	3.3	3.4
250	18.1	1.7	3.4	3.5
300	18.2	1.7	3.4	3.5
350	18.3	1.8	3.6	3.5
601	17.9	1.5	3.3	3.2
796	18.7	2.1	3.9	3.7
1006	18.7	2.0	3.9	3.7
1461	18.5	1.9	3.9	3.8
1620	18.5	1.9	3.7	3.8
1861	18.0	1.9	4.5	3.7
2106	18.6	2.0	3.6	3.8
2371	18.5	1.9	3.7	3.6
2741	18.2	(1)	(1)	(1)
2979	18.0	1.9	3.7	-
3254	18.0	1.9	3.7	3.8
3681	18.0	1.9	3.7	3.8
4042	18.2	2.1	3.7	3.5
4321	18.2	2.1	3.8	3.9
4322	Pump Shut-off			

(1) Pump-off - 108 Minutes (2741-2849): Utility Company power failure.
(2) Pump started at 1314 hours on November 9, 1982.

ATTACHMENT C

EVAPORATION POND - WQD PERMIT NO. 81-151
KERR-McGEE "O" SAND ISL PROJECT
CONVERSE COUNTY, WYOMING

Attachment C includes a copy of the Department of Environmental Quality approval of the lined evaporation ponds used for the in-situ leaching program and a copy of the original application as submitted to the Water Quality Division.

PERMIT TO CONSTRUCT

/X/ New

/ / Renewal

/ / Modified

Permit No. 81-151R

Q-SAND IN-SITU LEACH PROJECT
(Name of Facility)

This permit hereby authorizes the applicant (name and address):

Kerr-McGee Nuclear Corporation

P.O. Box 25861

Oklahoma City, Oklahoma 73125

to construct, install, or modify process wastewater evaporation ponds

facility according to the procedures and conditions of the application No. 81-151R. The facility is located in Section 36, T.36N., R.74W.

in the County of Converse, in the State of Wyoming. This permit shall be effective for a period of two (2) years (five (5) years maximum) from the date of issuance of this permit.

The issuance of this permit provides that the Department of Environmental Quality has evaluated and determined that the application meets minimum applicable construction and design standards. The compliance with construction standards and the operation and maintenance of the facility to meet the applicant's engineer's design are the responsibility of the applicant, owner, or operator.

The authority to construct granted by this permit does not mean or imply that the Wyoming Department of Environmental Quality guarantees or insures that the permitted facility, when constructed, will meet applicable discharge permit conditions or other effluent or operational requirements.

Nothing in this permit constitutes an endorsement of the construction or the design of the facility described herein. This permit indicates only that standards of design and construction required by the Environmental Quality Act have been met. The State assumes no liability for, and does not in any way guarantee the performance of, the permittee in the exercise of its activities allowed under this permit. The Permittee understands that it is solely responsible to any third parties for any liability arising from the construction or operation of the facility described herein. By the issuance of this permit, the State does not in any way waive its sovereign immunity.

The permittee shall allow authorized representatives from the Department of Environmental Quality, Water Quality Division, upon the presentation of credentials and

during working hours, to have access to inspect the facilities, at the above location, for the purpose of compliance with the provisions of this construction permit.

The permittee shall notify representatives from the Department of Environmental Quality, Water Quality Division the day construction commences and give an estimate of completion of this project. The authorized representative in your area can be contacted at the following address: Water Quality Construction Projects Control Officer, State of Wyoming, Department of Environmental Quality, Water Quality Division, 2161 Coffeen Avenue, Suite 301, Sheridan, Wyoming, 82801; telephone 672-6457.

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties established pursuant to any applicable State law or regulation.

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

AUTHORIZED BY:

REGISTERED PROFESSIONAL ENGINEER * WILLIAM L. GARLAND P.E. # 1479 * STATE OF WYOMING

William L. Garland
Administrator
Water Quality Division

REGISTERED PROFESSIONAL ENGINEER * ROBERT E. SUNDIN NO. 285 * STATE OF WYOMING

Robert E. Sundin
Director
Dept. of Environmental Quality

July 8, 1981
Date of Issuance

This permit does not supercede the requirements to obtaining any permit from local agencies.

Conditions
Attached to Permit to Construct
Reference Number 81-11R
Q-Sand In-Situ Leach Project

1. The permittee shall monitor, daily, the leak detection sumps shown on the plans. If liquid is detected in the sumps, it shall be sampled, analyzed for chloride content, and a determination made as to whether it constitutes leakage from the ponds.

2. The permittee shall keep records of the above monitoring activity and, upon request, make such records available to personnel of the Department of Environmental Quality.

3. The permittee shall report as soon as possible any suspected or confirmed leakage from the ponds to the Administration of the Water Quality Division. The permittee shall also submit a complete written report to the Division following any leakage incident, including cause, amount of leakage and mitigating actions taken.

81-151

KERR-McGEE CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

March 19, 1981

ENVIRONMENT AND HEALTH MANAGEMENT DIVISION

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Department of Environmental Quality
Water Quality Division
2161 Coffeen Avenue
Suite 301
Sheridan, Wyoming 82801

ATTN: Tom Mueller, District Engineer

RE: DEQ 5RD, SPRB Evaporation Pond Construction Permit
Kerr-McGee "Q" Sand Project

Dear Mr. Mueller:

Pursuant to Guidelines for Wastewater Pond Construction, we are enclosing four (4) copies of a construction permit application. This application is submitted in support of Kerr-McGee's research and development license, 5RD.

Please let me know if any additional information is required.

Very truly yours,

W. J. Shelley

W. J. Shelley, Vice President
Nuclear Licensing & Regulation

WJS/hmw

Enclosures

81-151

APPLICATION FOR
PERMIT TO CONSTRUCT, INSTALL OR MODIFY
PUBLIC WATER SUPPLIES AND WASTEWATER FACILITIES
IN WYOMING

1. Name of Facility Q Sand In-Situ Leach Project (DEQ License-5RD)
2. Location of Facility: Sec. 36 T. 36N R. 74W Co. Converse
3. Facility Description: [x] New Construction [ ] Modification

[ ] Public Water Supply
- [ ] Municipal
- [ ] Other Legal Entity
- [ ] Commercial
- [ ] Industrial

Type of Facility:
- [ ] Source Development
- [ ] Treatment Plant
- [ ] Distribution System

Source: Groundwater
Surfacewater
Capacity, or Demand gpm

List State Engineer permit number(s) for water sources:

[ ] Wastewater Treatment Facility
- [ ] Municipal
- [ ] Other Legal Entity
- [ ] Commercial
- [x] Industrial (small - R&D Project)
- [ ] Small

Type of Facility:
- [ ] Subsurface Disposal
- [ ] Stabilization Pond
- [x] Evaporative
- [ ] Mechanical Treatment
- [ ] Collection System

Volume of Wastewater 0.2 GPM

The State Engineer has reviewed this project and has determined that it will not interfere with existing water rights.
[x] Yes [ ] No

List State Engineer permit number(s) on the water source(s) related to this project:
UW-48319, UW 51367, UW 51368, UW-51369

RECEIVED 1981 WATER QUALITY DIVISION WYOMING

4. Briefly describe facilities proposed to be constructed: An evaporation pond consisting of two-100' square by 8' deep lined cells will be constructed. Each cell will be provided with an individual leak detection system. The pond will be lined with 20-30 mil hypalon or similar impervious type material. The wastewater will be transferred by buried pipeline from the in-situ process plant to the pond.
5. Does the proposed water supply/wastewater treatment/facility discharge? No
If yes, NPDES Permit Application No.
Name of receiving waters

Name of Applicant Kerr-McGee Nuclear Corp.
Mailing Address: Box 25861 (Street or P.O. Box)
Okla. City, OK 73125 (City) (State) (Zip)
Business Phone 405-270-2972
Home Phone 405-341-7919

Name of Engineer Steve J. Kirk
Wyoming P.E.# 3479 3479
Engineering Firm Kerr-McGee Corp.
Mailing Address: P.O. Box 25861 (Street or P.O. Box)
Okla. City OK 73125 (City) (State) (Zip)
Phone 405-270-3774

I certify that the above described facility has been submitted in accordance with local, county and State statutes, as required, and that said facility shall be constructed as authorized under the provisions specified in Wyoming Water Quality Rules and Regulations, Chapter XII, 1976.

Signature of Applicant

March 19, 1981
Date

11/79

SOLAR EVAPORATION POND
Q SAND PROJECT

Application for Permit to Construct
(T36N R74W, Section 36, Converse County, Wyoming)

Pond Construction Application

SUPPLEMENTAL INFORMATION:

I. Design Information

The source and chemical characteristics of the wastewater are provided in Table I (See PCA-5 for Index). Approximately 300 gallons per day of wastewater will be generated by the uranium recovery facility, for subsequent containment and evaporation in the solar pond.

A. Wastewater Characteristics

The wastewater discharged to the evaporation pond from uranium recovery plant will be at essentially room temperature and will contain sodium and ammonium chlorides and carbonates as well as small quantities of uranium and radium. There will be no significant bacteriological content in the water as facility sanitary waste discharges will be handled separately in an existing system.

B. Soil Tests

The proposed location of the evaporation pond is as shown on Figure 1. Six core holes were drilled (holes 7-12) in this area, pond site #2, and Standard Penetration Test results are presented in Figure 2. Gradations for typical samples of the sandy clay are presented in Figure 3 through 5.

No free water was encountered in the exploratory holes at the time of drilling. The sandy clay soils were found suitable for use in the construction of the required embankments for the evaporation pond. The pond will be lined with an impervious liner. The sandy clays, with proper moisture content, have a remolded coefficient of permeability of less than 0.1 foot per year (1×10^{-7} cm/sec) when compacted to at least 95% Standard

Proctor Density (SPD). The water table elevation in this area is at a depth of approximately 130 feet below the lined pond.

C. Engineering Design Information

The pond will be used for wastewaters from an in-situ recovery plant. This includes water from the ion exchange columns, yellow-cake wash water and miscellaneous waste streams. The estimated average flow will be 300 gallons per day (0.2 gpm). Calculations (Table II) indicate that a 100' x 100' x 8' deep pond will be adequate to handle the estimated liquid waste that will be generated from the process plant. Wave action due to wind will be insignificant. Diversion dikes will be installed to prevent surface runoff water from entering the pond. The process water will be pumped through a pipeline to the lined evaporation pond.

The pond is designed for total containment and evaporation of liquid effluent, and there will be no discharge from the pond.

D. Hydrology

The first groundwater encountered in the area is in the "W" sand which contains water at an elevation of approximately 5370' above MSL. The bottom of the pond will be at an elevation of approximately 5506' above MSL. An impervious liner will be installed over sandy clay soils that have been compacted to 95% SPD (0.1 feet/year permeability). Given these considerations, no impact to the groundwater system is expected.

The aquifers in this area are designated as the "W" sand, "S" sand, "Q" sand, and "O" sand. The respective elevations and thickness for these sands are as shown in the test site cross-sections Figures 9-5a and 9-6A of the "Q" sand permit application (Reduced Drawings; DEQ License 5RD). Copies are attached as pages A-8 and A-9.

The "S", "O" and "Q" sands are slightly artesian. Analyses of aquifer water quality have been previously given in the "Q" sand application (DEQ License 5RD: Tables D-2A through D-2D, Tables D-3A through D-3C). Copies of these tables are attached as pages A-11 through A-12B. Wells QMO-1 and QMS-1, Table D-2D, are completed in the "O" sand and "S" sand respectively. Well QMW-1, Table D-3C, is completed in the "W" sand. All other wells are completed in the "Q" sand.

An inventory of wells in the license area and adjacent lands of the Kerr-McGee "Q" Sand Project, Converse County, Wyoming are listed in the attached Table 3, page A-10.

II. Plans and Specifications

The uranium recovery plant will be installed in the existing Bill Smith mine building. The wastewater from the plant will be pumped by buried pipeline to the evaporation pond. The plot plan is as shown previously in Figure 1.

The topography of the area is also shown on Figure 1 attached. The dikes of the ponds have been designed to divert any surface runoff around them.

The evaporation pond will be located in the present disturbed area of the Bill Smith mine. Most of the topsoil in the construction area has been removed and stockpiled; however, the area will be inspected again and any remaining topsoil wil be removed and stockpiled.

Based on soil samples taken from this area, the sandy clay material is readily compacted to an essentially impermeable condition (see soil analysis in Figures 2-5 attached). The two cell pond will be formed by excavation, reworking and compaction of these in-place soils.

The pond will consist of two lined cells each measuring approximately 100' x 100' x 8' deep (Figure 6). Each cell will have a capacity of approximately 250,000 gallons with two feet of freeboard. The lined ponds will have an inside slope of 2.5 to 1 and an outside slope ? to 1. The pond will be lined with 20 to 30 mil thick hypalon or similar impervious type material. The edges of the liner will be anchored by burial as shown in the sketch.

Both cells will be provided with individual leak detection systems. The bottoms of the cells will have a two way slope toward the center. A sand layer will be placed over the bottom of the pond with the liner on top of the sand. For each cell, a perforated PVC pipe will be installed in the sand layer, parallel to the bottom slope. A solid pipe will extend beyond the cell to a sump. In the event that the liner develops a leak, the leakage will move through the sand and into the collector pipe and be deposited in the sump.

The sump will be inspected weekly and any liquids in the sump will be analyzed for chloride concentration.

Fluid levels in the pond are expected to be maintained such that all of the pond contents would be transferred to a single cell so that if a leak did develop it could be repaired. Analyses of the sump liquids and the volume of flow would be used to evaluate whether it would be necessary to empty a cell for repair. A small leak could be handled by returning the liquid in the sump to the cell.

As previously described, the wastewater will be pumped from the process plant via a buried pipeline and discharged into one of the cells. A totalizing flow meter will be installed in the pipeline to determine the quantity of fluid being pumped to the evaporation pond.

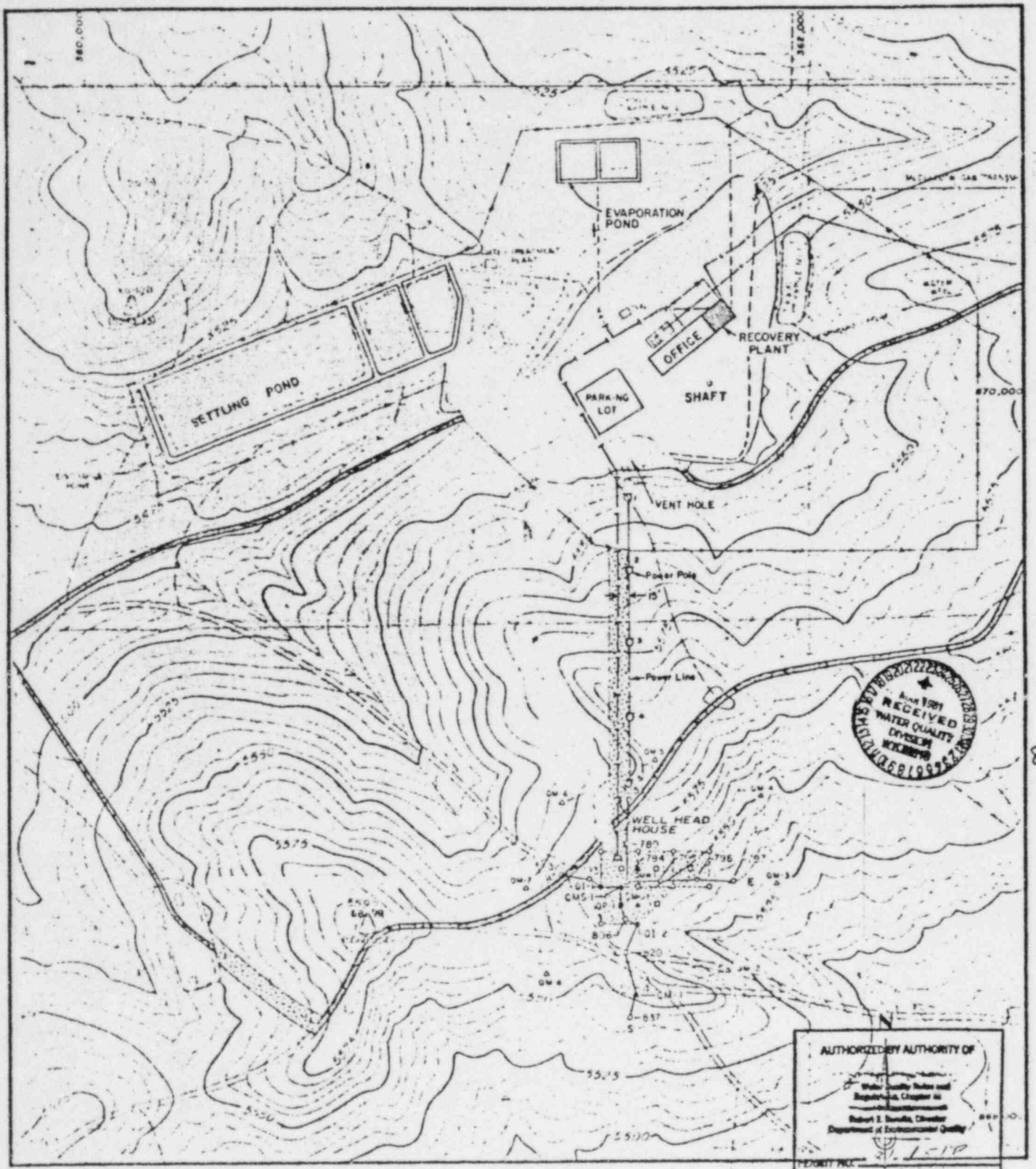
The pond will be located within the existing fenced area of the Bill Smith mine and access to this mine site is already restricted.

SOLAR EVAPORATION POND
Q SAND PROJECT

Application for Permit to Construct

SUPPLEMENTAL ATTACHMENTS:

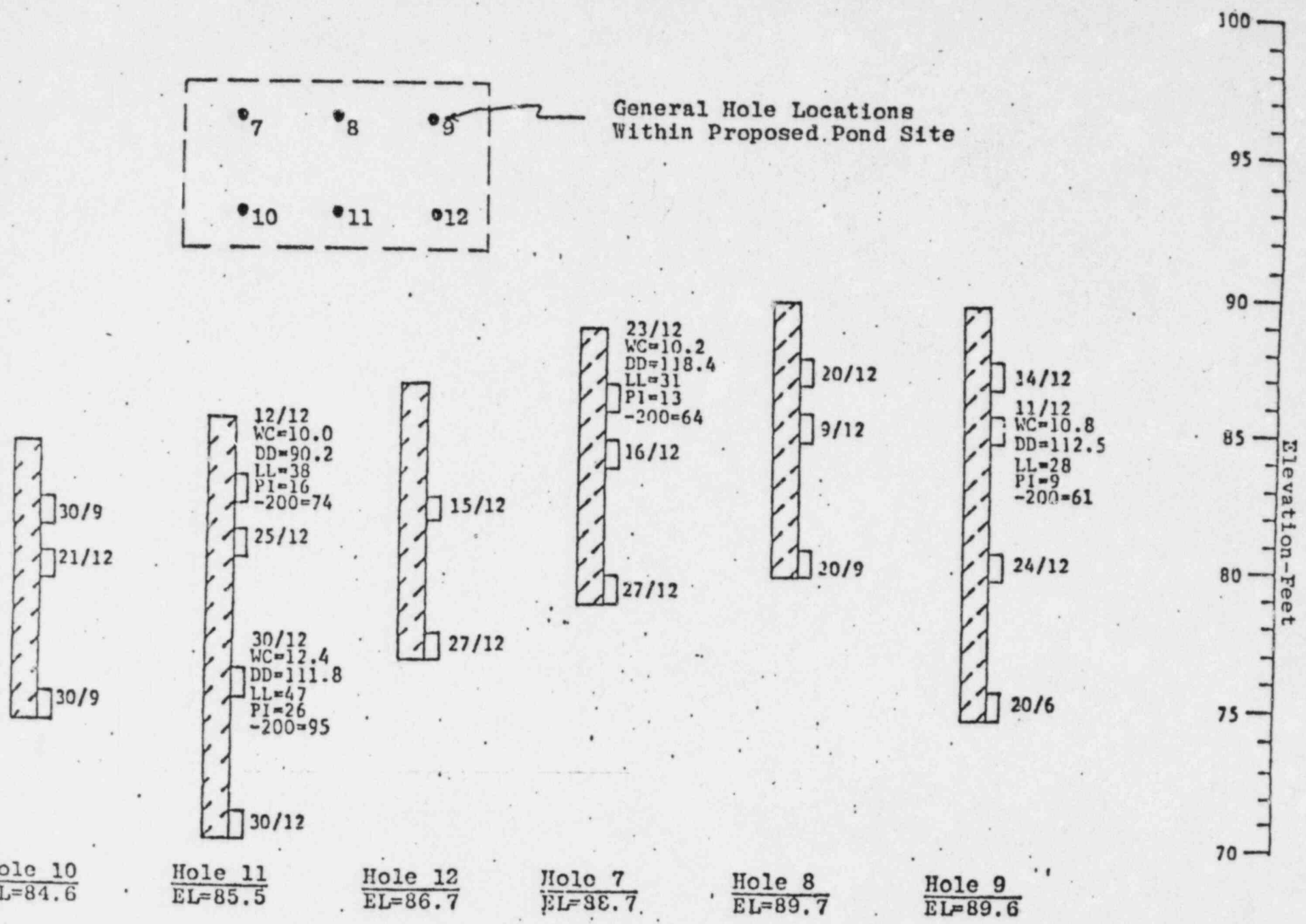
LOCATION OF Q-SAND PILOT WELL FIELD AND RECOVERY PLANT SOUTH POWDER RIVER BASIN SECTION 36 - T. 36N., R. 74W. CONVERSE COUNTY, WYOMING



81-151

Figure 2

LOGS OF EXPLORATORY HOLES
POND SITE #2



Hole 10	Hole 11	Hole 12	Hole 7	Hole 8	Hole 9
EL=84.6	EL=85.5	EL=86.7	EL=88.7	EL=89.7	EL=89.6

Figure 2 (cont'd)

LEGEND:

Fill, sand, very silty and clayey to clay, very sandy, loose to medium dense and medium stiff, interlayered, brown to grey, moist.

Clay (CL), slightly sandy to very sandy, medium stiff to stiff, minor clayey sand lenses, brown to grey, moist.

Sand (SP), clean, loose to medium dense, brown, moist.

Sand (SC-SM), clayey to silty, intergraded, loose to medium dense, brown, moist.

Claystone Bedrock, firm, grey, moist.

20/12 Undisturbed drive sample. The symbol 20/12 indicates that 20 blows of a 140 lb. hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates depth interval from which disturbed soil sample was obtained from auger cuttings.

NOTES:

(1) Test holes were drilled October 6, 1980 with a 4-inch diameter continuous flight power auger.

(2) No free water was encountered in the exploratory holes at the time of drilling.

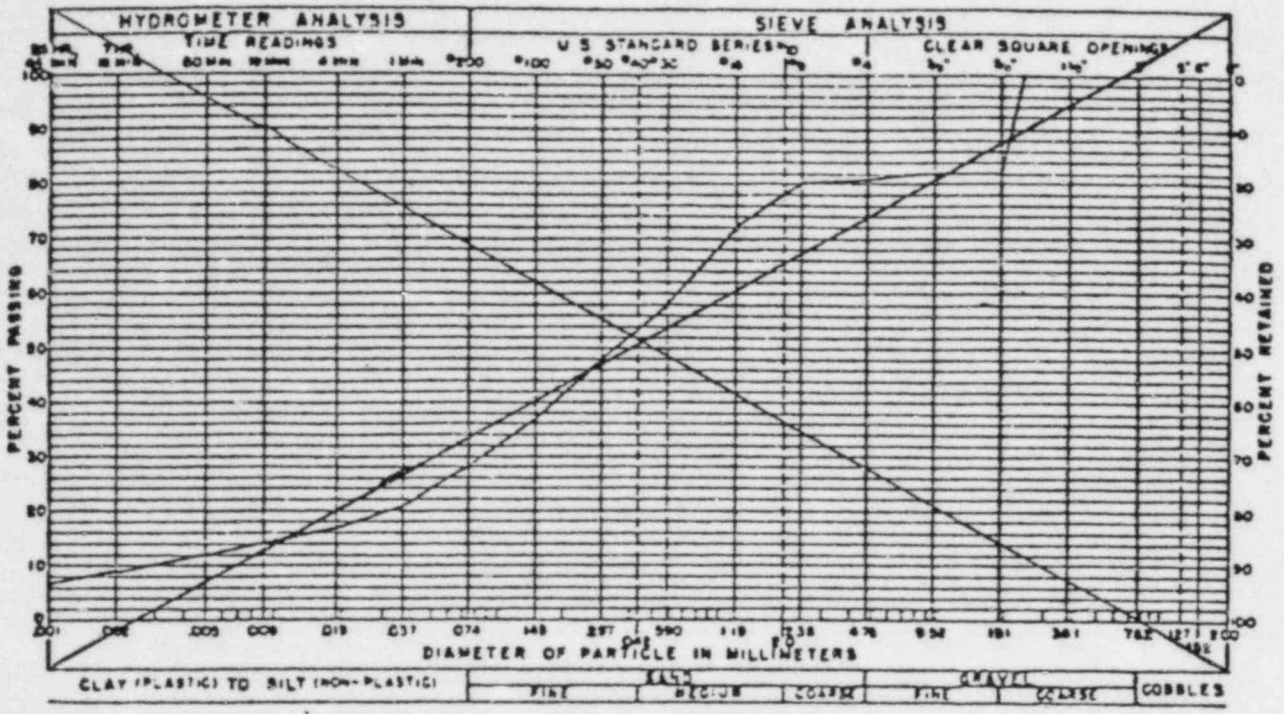
(3) Elevations of test holes refer to finished floor level of existing office building at locations shown in Fig. 1. EL=100.0' (assumed)

(4) WC = Water Content (%)
DD = Dry Density (pcf)
LL = Liquid Limit (%)
PI = Plasticity Index (%)
-200 = Passing No. 200 Sieve (%)

CHEN AND ASSOCIATES

Consulting Soil and Foundation Engineers

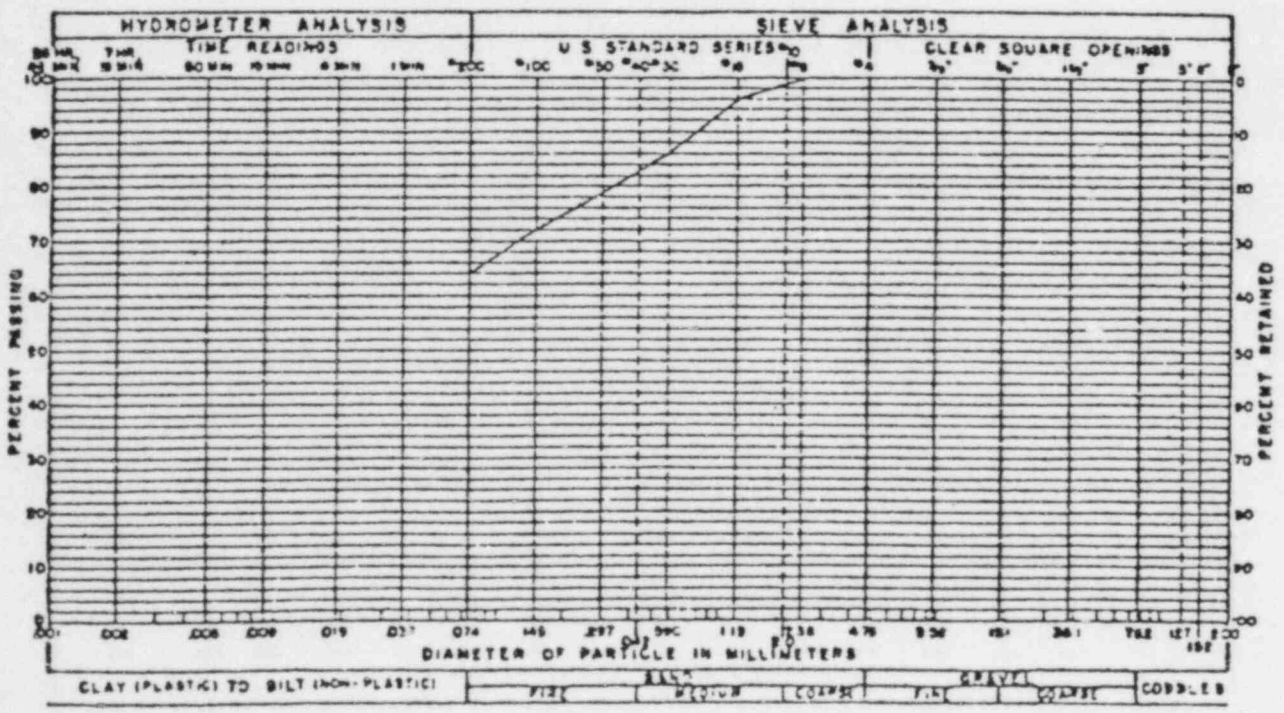
FIGURE 3



GRAVEL 19 % SAND 53% SILT AND CLAY 28 %

LIQUID LIMIT 26 % PLASTICITY INDEX 8 %

SAMPLE OF Clayey Sand FROM Hole 6 at depth 9'-0"



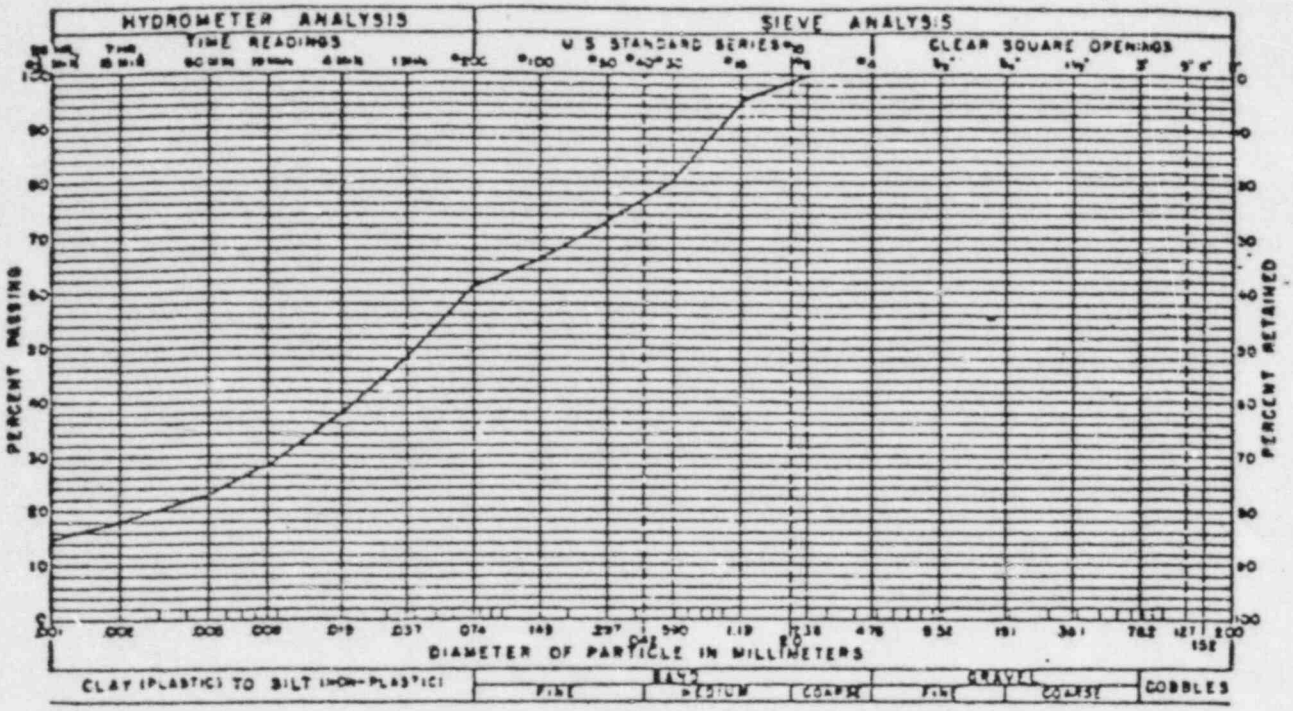
GRAVEL 0 % SAND 36% SILT AND CLAY 64 %

LIQUID LIMIT 31 % PLASTICITY INDEX 13 %

SAMPLE OF Very Sandy Clay FROM Hole 7 at depth 2'-0"

GRADATION TEST RESULTS

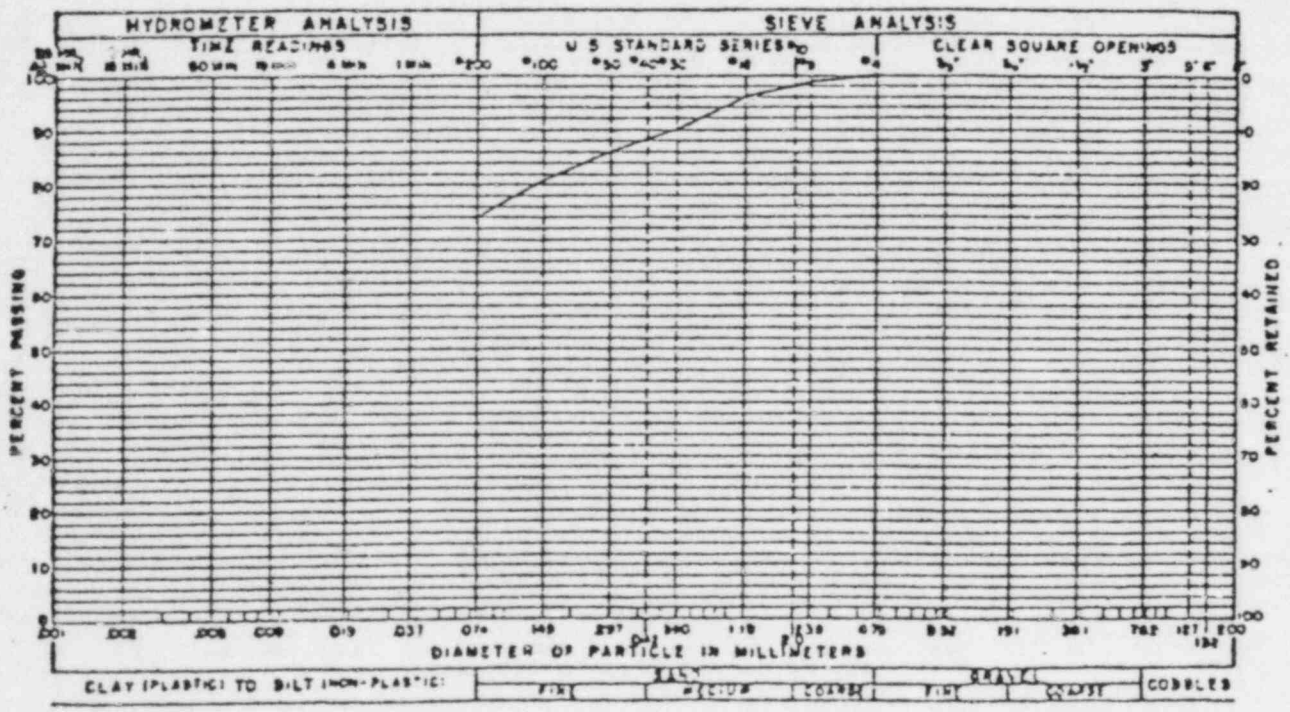
FIGURE 4



GRAVEL 0 % SAND 39% SILT AND CLAY 61 %

LIQUID LIMIT 28 % PLASTICITY INDEX 9 %

SAMPLE OF Very Sandy Clay FROM Hole 9 at depth 4'-0".



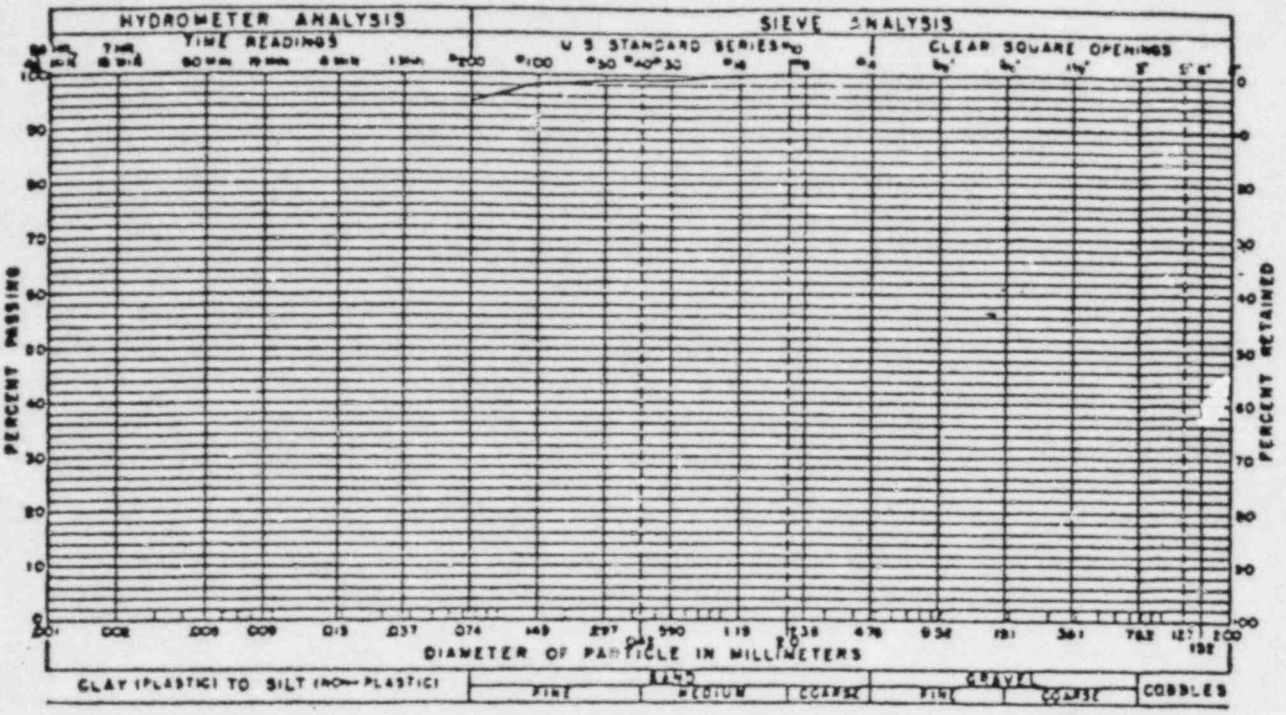
GRAVEL 0 % SAND 26% SILT AND CLAY 74 %

LIQUID LIMIT 38 % PLASTICITY INDEX 16 %

SAMPLE OF Sandy Clay FROM Hole 11 at depth 2'-0"

GRADATION TEST RESULTS

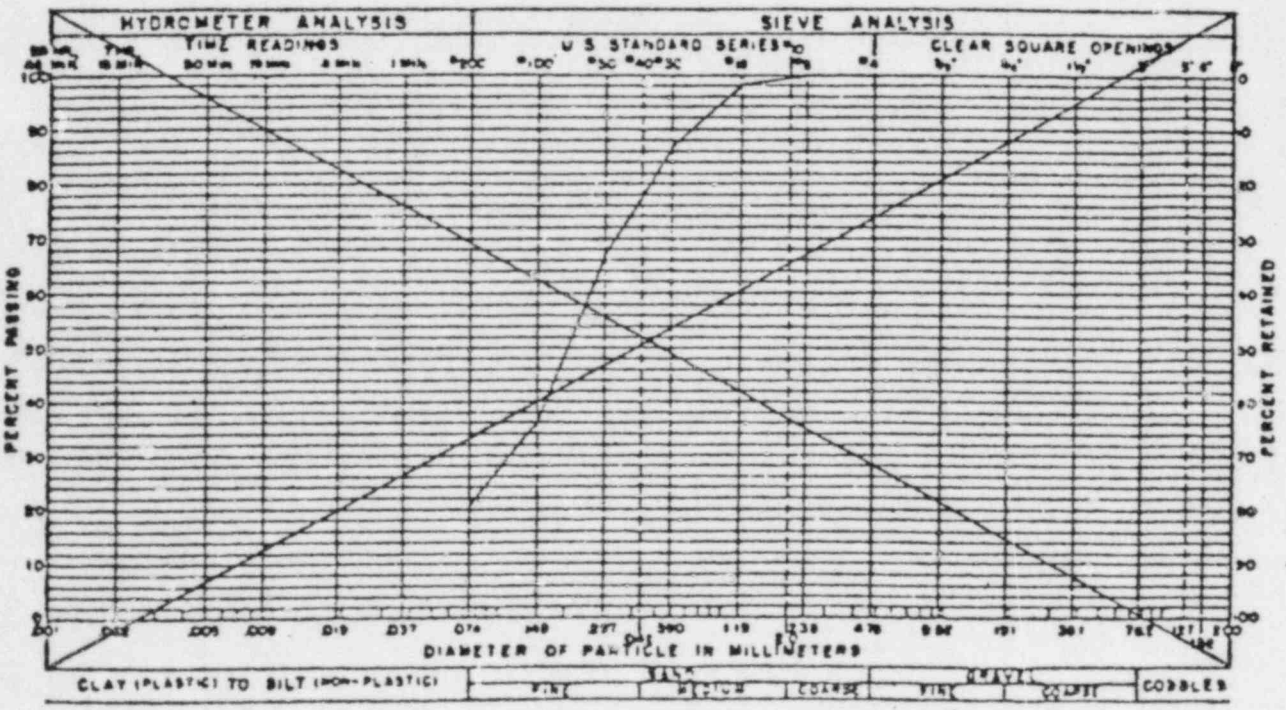
FIGURE 5



GRAVEL 0 % SAND 5 % SILT AND CLAY 95 %

LIQUID LIMIT 47 % PLASTICITY INDEX 26 %

SAMPLE OF Slightly Sandy Clay FROM Hole 11 at depth 9'-0"



GRAVEL 0 % SAND 79 % SILT AND CLAY 21 %

LIQUID LIMIT % PLASTICITY INDEX NP %

SAMPLE OF Silty Sand FROM Hole 13 at depth 4'-0"

GRADATION TEST RESULTS

TABLE I

EXPECTED SOURCES OF WASTE LIQUIDS ROUTED TO THE EVAPORATION PONDS KERR-McGEE Q SAND IN SITU R&D PROJECT CONVERSE COUNTY, WYOMING

The anticipated wastewater volumes that will result from the various process steps and the expected range of concentrations of the major ions or ions of concern in each of these streams are as follow:

Process Step	Volume	Ion	Concentration
IX Resin Rinse	200 GPD*	Na	15,000-25,000 ppm
		NH_4	500-1,000 ppm
		Cl	30,000-40,000 ppm
		HCO_3	8,000-12,000 ppm
		U	5-10 ppm
		Ra-226	50-100 pCi/l
Excess Eluant	20 GPD	Na	1,500-2,500 ppm
		NH_4	20,000-30,000 ppm
		Cl	50,000-60,000 ppm
		HCO_3	200-300 ppm
		U	10-20 ppm
		Ra-226	50-100 pCi/l
Yellowcake Wash	40 GPD	Na	600-1,000 ppm
		NH_4	5,000-10,000 ppm
		Cl	14,000-20,000 ppm
		HCO_3	200-300 ppm
		U	5-10 ppm
		Ra-226	30-40 pCi/l
Sump Liquids	50 GPD	Na	2,000-3,000 ppm
		NH_4	3,000-4,000 ppm
		Cl	6,000-8,000 ppm
		HCO_3	1,000-2,000 ppm
		U	5-10 ppm
		Ra-226	20-30 pCi/l

*Gallons Per Day

TABLE II

EVAPORATION POND CALCULATIONS
KERR-McGEE Q SAND PROJECT
CONVERSE COUNTY, WYOMING

I. Capacity Computations

Pond Size: 100' x 100' x 8' with 2.5:1 slope on the inside

$$\text{Volume} = \frac{D}{6}\,[(\text{top area}) + (\text{bottom area}) + 4\,(\text{avg. area})]$$

$$= 8/6\,[(100 \times 100) + (60 \times 60) + 4(80 \times 80)]$$

$$= 52{,}267 \text{ cubic feet}$$

Volume

8' depth

$$= 52{,}267 \text{ ft}^3 \times 7.48 \text{ gal/ft}^3 = 390{,}957 \text{ gal}$$

6' depth

$$= 34{,}200 \text{ ft}^3 \times 7.48 \text{ gal/ft}^3 = 255{,}816 \text{ gal}$$

II. Expected Wastewater Volume to Pond

Annual Volume = (300 gal/day)(350 operating days)

= 105,000 gallons/year

The 300 gal/day includes wastewaters from excess ion exchange rinse water, yellowcake wash water, and small miscellaneous waste streams.

III. Evaporation

The net evaporation rate for the project area is estimated to be a minimum of 24 inches per year.

IV. Surface Area Required to Evaporate Expected Waste

Area = 105,000 gal/year wastes ÷ 14.96 gal/sq. ft.

Area = 7,019 sq. ft.

V. Pond Fluid Level Necessary for Evaporation Rate to Equal Waste Volume To Pond

Surface area at 4.5 ft. level = 82.5 x 82.5 = 6806 sq. ft.

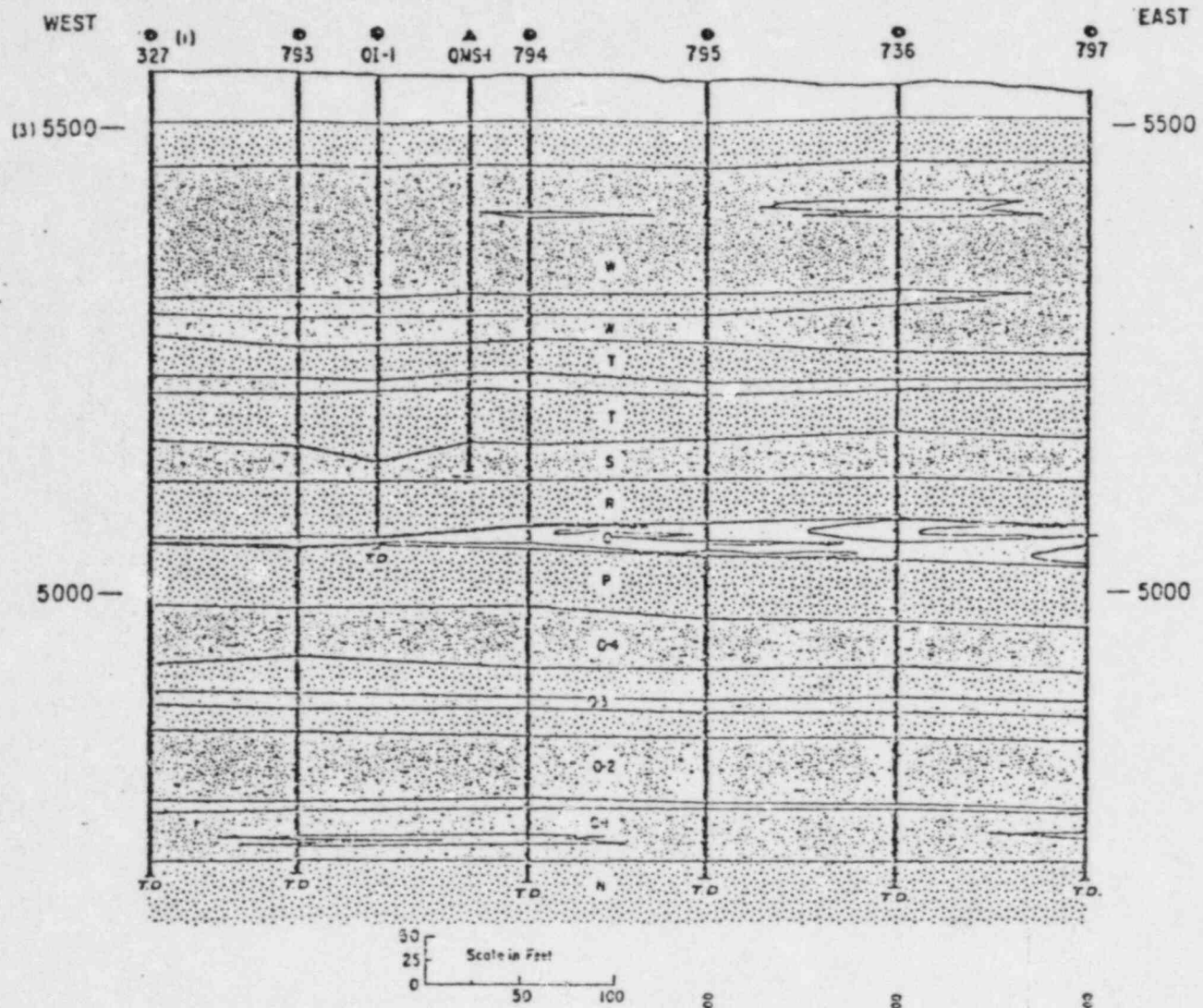
Surface area at 5 ft. level = 85 x 85 = 7225 sq. ft.

Surface area at 6 ft. level = 90 x 90 = 8100 sq. ft.

Necessary surface area will be reached when the liquid level in the pond reaches about 5 feet. However, it would require about 1.9 years to fill the pond to this level assuming no evaporation.

FIGURE 9-5A

TEST SITE X-SECTION
"Q" SAND PROJECT
SECTION 35, T36N, R74W
CONVERSE COUNTY, WYOMING



LEGEND

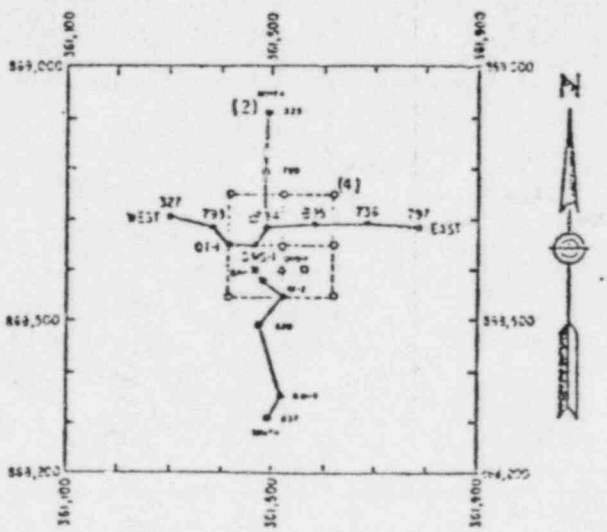
- Sandstone
- Shale
- Ore Zone
- △ Monitor Well
- □ Production Well
- ○ Injection Well
- ○ Exploration Hole

(1) Kerr-McGee Hole Designation

(2) Darkened symbols are completed holes

(3) Elevation above Mean Sea Level

(4) Open symbols are proposed pilot project holes



X-SECTION INDEX
Scale 1" = 400'

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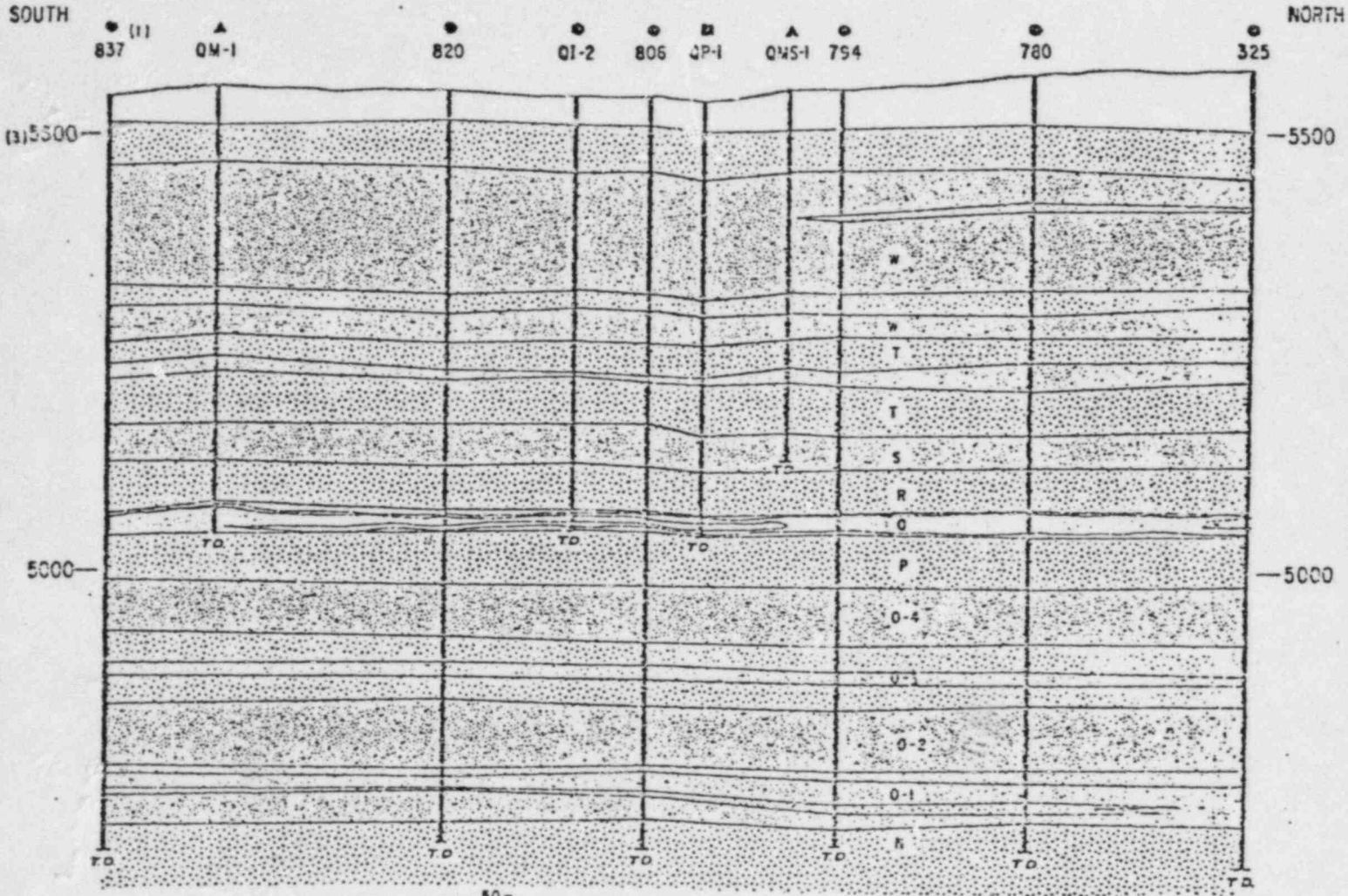
FIGURE 9-6A

TEST SITE X-SECTION
"Q" SAND PROJECT
SECTION 35, T35N, R74W
CONVERSE COUNTY, WYOMING



LEGEND

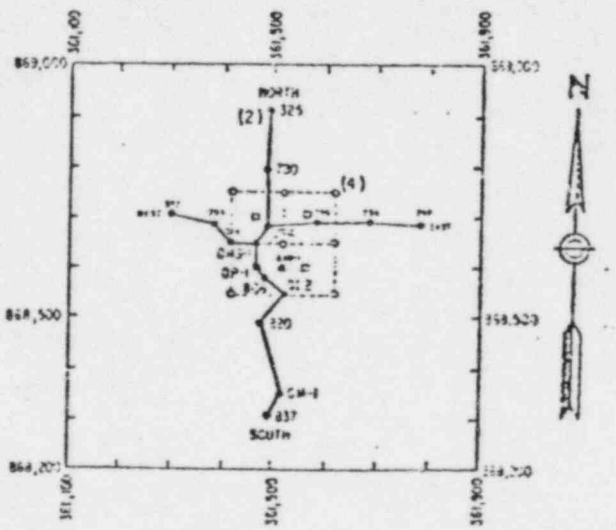
- Sandstone
- Shale
- Ore Zone
- △ Monitor Well
- □ Production Well
- ○ Injection Well
- ○ Exploration Hole

(1.) Kerr-McGee Hole Designation

(2.) Darkened symbols are completed holes

(3.) Elevation above Mean Sea Level

(4.) Open symbols are proposed pilot project holes.



X-SECTION INDEX

TABLE III

INVENTORY OF WELLS ON THE LICENSE AREA AND ADJACENT LANDS BILL SMITH 6001 AREA PROJECT CONVERSE COUNTY, WYOMING

Figure D-1 Location No.	Kerr-McGee[1] Well Number	Wyoming Well Permit Number	Aquifer	Elevation of Land Surface (Feet Above MSL)	Depth of well (feet)	Elevation of Water Level (Feet above MSL)	Date of Level Measurment (Month/year)	Yield (GPM)
1	TW-2	29,277	Fort Union	5541.9	946	4944.8	10/80	560
2	OWS-4	-	Wasatch	5546.6	546	5395.8	10/80	-
3	OWD-4	-	Fort Union	5546.7	943	4947.5	10/80	-
4	OWS-3	-	Wasatch	5562.5	570	5358.3	10/80	-
5	OWD-3	-	Fort Union	5563.1	887	4951.3	10/80	-
6	TW-1	28,276	Fort Union	5599.5	1006	4858.1	10/80	425
7	OWS-1	-	Wasatch	5585.5	567	5354.3	10/80	-
8	OWD-1	-	Fort Union	5586.1	987	4949.8	10/80	-
9	OWS-2	-	Wasatch	5593.8	584	5449.8	10/80	-
10	OWD-2	-	Fort Union	5593.9	900	4957.2	10/80	-
11	WW103	2,574	Wasatch	5540	474	5280	9/69	140
12	Mine Shaft	15,500	Fort Union	5519	949	Dry	10/80	1700
13	OWD-6	-	Fort Union	5560	868	4954.3	10/80	-
14	OI-1	-	Fort Union	5570	812	Dry	10/80	-
15	OI-2	-	Fort Union	5578	774	Dry	10/80	-

[1]All known wells in the license area and adjacent lands are owned and operated by Kerr-McGee

TABLE III (cont'd)

STATIC WATER LEVEL OF "Q" SAND
ISL WELLS
KERR-McGEE Q SAND PROJECT
CONVERSE COUNTY, WYOMING

Kerr-McGee Well Number	Elevation at Top of casing (feet above MSL)	Depth of well (feet)	Water Level Depth from Casing Top 9/11/80	Water Level MSL Elevation	Completion Internal (T.D.-up)
QP-1*	5549.65	497	375.80	5173.85	497'-475'
QP-2	5544.06	495	369.40	5174.66	495'-470'
QP-3	5557.24	513	383.97	5173.27	512'-480'
QP-4	5550.96	515	380.83	5173.13	515'-490'
QP-5	5552.11	517	378.88	5173.23	517'-465'
QI-1*	5556.17	509	382.86	5173.31	509'-492'
QI-2	5546.38	496	372.45	5173.93	496'-475'
QI-4	5548.68	513	375.22	5173.46	513'-475'
QI-5	5560.62	513	387.55	5173.07	513'-490'
QI-6	5565.42	520	392.35	5173.07	520'-495'
QI-7	5567.82	522	394.88	5172.94	522'-495'
QI-8	5553.52	503	379.59	5173.04	503'-480'
QI-9	5552.04	505	378.66	5173.38	505'-480'
QI-10	5543.38	514	369.80	5173.58	514'-465'
QI-11	5554.35	525	381.28	5173.07	525'-475'
QMW-1**	5558.71	350	188.48	5370.23	350'-170'
QMS-1**	5553.63	421	315.35	5238.28	421'-393'
QMO-1**	5545.47	612	579.34	4966.13	612'-558'
QM-1	5550.53	505	375.75	5174.78	505'-475'
QM-2	5535.80	505	361.35	5174.45	505'-460'
QM-3	5528.17	505	354.05	5173.52	505'-455
QM-4	5550.72	539	378.10	5172.62	539'-475
QM-5	5582.73	537	410.9	5171.83	537'-513
QM-6	5562.61	520	390.16	5172.45	520'-495
QM-7	5562.13	514	388.01	5173.34	514'-488
QM-8	5556.75	508	380.08	5176.67	508'-494

*6" I.D. steel casing, all other holes cased with 4.33 I.D. fiberglass
**Monitor well completed in another aquifer unit.
Well QMS-1 is completed in the Wasatch formation, all other wells are completed in the Fort Union formation.

TABLE D-2A

BASELINE GROUNDWATER QUALITY PARAMETERS
KERR-McGEE "Q" SAND PROJECT
CONVERSE COUNTY, WYOMING

"Q" SAND LEACH WELLS

mg/ℓ	Well QP-1		Well QI-1		Well QI-2	
Parameter	4/14/80	4/15/80	2/24/80	2/25/80	2/19/80	2/21/80
Aluminum(1)	.18	.18	.02	.079	.083	.073
Arsenic	.010	.006	<.002	<.002	<.002	<.002
Barium	.12	.093	.066	.034	.038	.016
Boron	.11	.06	.12	.10	.05	.07
Bicarbonate	235	245	232	227	234	232
Carbonate	--	--	--	--	--	--
Cadmium	<.1	<.1	<.1	<.1	<.1	<.1
Calcium	88	91	92	92	89	82
Chloride	6	6	5	4	7	4
Chromium	<.01	<.01	<.01	<.01	<.01	<.01
Copper	<.005	<.005	<.005	<.005	<.005	<.005
Fluoride	.25	.26	.32	.31	.30	.30
Iron	<.01	<.01	<.01	.01	.01	<.01
Lead	<.05	<.05	<.05	<.05	<.05	<.05
Manganese	<.01	.018	.024	.025	.07	.01
Magnesium	15	17	17	18	18	18
Mercury	<.001	<.001	<.001	<.001	<.001	<.001
Molybdenum	<.2	<.2	<.2	<.2	<.2	<.2
Nitrates (N)	.4	.3	<.2	<.2	<.2	.2
Selenium	<.002	<.002	.002	<.001	<.001	<.001
Silver	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	24	22	21	21	23	19
Sulphate	115	119	140	142	148	142
Zinc	.32	.25	.056	.10	.021	.045
Uranium	.15	.082	.043	.066	.023	.040
Radium-226 pCi/ℓ	769	757	882	1132	62.2	57.9
pH - Std.	7.8	7.6	7.7	7.6	7.8	7.9
Total Dissolved Solids	362	374	418	410	422	433

(1) All units are milligrams per liter unless noted otherwise.

Rev. 12/4/80

TABLE D-2B

BASELINE GROUNDWATER QUALITY PARAMETERS
KERR-McGEE Q SAND PROJECT
CONVERSE COUNTY, WYOMING

DEQ LQD LICENSE NO. 5RD

	QP-2 8-17-80	QP-3 7-16-80	QP-4 7-16-80	QP-5 7-30-80	QI-4 8-17-80	QI-5 7-21-80
Aluminum[1]	<.05	.15	.17	.14	.18	.14
Arsenic	<.001	.004	.004	.008	.008	.006
Barium	.034	.063	.078	.090	.090	.42
Boron	.24	.23	.17	.35	.40	.17
Bicarbonate	-	221	198	206	129	184
Carbonate	9	ND	ND	ND	ND	ND
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Calcium	24	75	65	75	31	68
Chloride	6	6	7	7	19	13
Chromium	<.01	<.01	<.01	<.01	<.01	<.01
Copper	<.005	<.005	<.005	<.005	<.005	<.005
Fluoride	.19	.32	.34	.34	.27	.34
Iron	<.01	<.01	<.01	<.01	.028	<.01
Lead	<.05	<.05	<.05	<.05	<.05	<.05
Manganese	<.01	<.01	.016	<.01	.032	<.01
Magnesium	3	15	15	15	15	16
Mercury	<.001	<.001	<.001	<.001	<.001	<.001
Molybdenum	<.2	<	<.2	<.2	<.2	<.2
Nickel	<.05	<.0	<.05	<.05	<.05	<.05
Nitrates (As N)	.2	.3	.3	.2	.3	.2
Potassium	11	8	8	8	34	14
Selenium	.001	.004	.002	.005	.001	.011
Silver	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	24	22	23	22	34	25
Sulphate	108	132	127	116	130	130
Zinc	<.05	<.05	<.05	<.05	<.05	<.05
Uranium	.02	.21	.14	.20	.41	.14
Vanadium	<.005	<.005	<.005	<.005	.07	.032
Total Dissolved Solids	155	351	366	374	349	392
Conductivity (umhos)	-	586	538	538	-	566
Ra-226 (pCi/ℓ)	7.5	387	330	379	56	257
pH (std. units)	10.2	8.2	8.0	8.2	8.4	8.2

[1]All units are mg/ℓ unless noted otherwise.
ND - Not Detected
- - Not Determined

Added 12/4/80

TABLE D-2C

BASELINE GROUNDWATER QUALITY PARAMETERS
KERR-McGEE Q SAND PROJECT
CONVERSE COUNTY, WYOMING

DEQ LQD LICENSE NO. 5RD

	QI-6 7-17-80	QI-7 7-17-80	QI-8 7-21-80	QI-9 8-17-80	QI-10 7-30-80	QI-11 7-30-80
Aluminum[1]	.15	.16	.11	.18	.20	.17
Arsenic	.008	.006	.010	.003	.013	.008
Barium	.045	.062	.066	.054	.075	.063
Boron	<.1	.17	.15	.19	.15	.15
Bicarbonate	181	223	143	-	204	209
Carbonate	ND	ND	ND	4	ND	ND
Cadmium	<.01	<.01	<.01	.01	<.01	<.01
Calcium	62	77	59	72	70	28
Chloride	16	11	12	30	11	7
Chromium	<.01	<.01	<.01	<.01	<.01	<.01
Copper	<.005	<.005	<.005	<.005	<.005	<.005
Fluoride	.35	.34	.36	.33	.36	.33
Iron	<.01	<.01	<.01	.02	.11	.03
Lead	<.05	<.05	<.05	<.05	<.05	<.05
Manganese	<.01	.059	.019	<.01	.019	<.01
Magnesium	16	18	11	8	15	15
Mercury	<.001	<.001	<.001	<.001	<.001	<.001
Molybdenum	<.2	<.2	<.2	<.2	<.2	<.2
Nickel	<.05	<.05	<.05	<.05	<.05	<.05
Nitrates (As N)	.3	.3	.2	.3	.3	.3
Potassium	10	12	11	16	9	8
Selenium	.009	.002	.010	.024	.002	.003
Silver	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	24	24	25	31	22	22
Sulphate	136	114	128	111	138	123
Zinc	<.05	.079	.093	.069	.14	.086
Uranium	.20	.09	.07	.17	1.19	.20
Vanadium	<.005	<.005	<.005	.087	<.005	<.005
Total Dissolved Solids	368	399	343	228	399	378
Conductivity (umhos)	547	595	518	-	566	557
Ra-226 (pCi/ℓ)	260	198	33	30	398	434
pH (std. units)	7.9	8.3	8.1	9.4	8.3	8.3

[1] All units are mg/ℓ unless noted otherwise.

ND - Not Detected

- - Not Determined

Added 12/ 4/80

TABLE D-2D

BASELINE GROUNDWATER QUALITY PARAMETERS
KERR-McGEE Q SAND PROJECT
CONVERSE COUNTY, WYOMING

DEQ LQD LICENSE 5RD

	QP I 6-25-80	QI-1 6-30-80	QI-2 6-30-80	QM-1 6-25-80	QMO-1 7-15-80	QMS-1 6-25-80
Aluminum[1]	.063	.13	.006	.12	.094	.063
Arsenic	.002	.005	.004	.008	.006	.002
Barium	.089	.039	.12	.043	.036	.096
Boron	<.01	<.01	<.01	<.01	<.01	<.01
Bicarbonate	218	224	234	232	206	193
Carbonate	ND	ND	ND	ND	ND	ND
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Calcium	69	58	68	74	94	51
Chloride	7	7	6	6	3	7
Chromium	<.01	<.01	<.01	<.01	<.01	.08
Copper	<.005	<.005	<.005	<.005	<.005	<.005
Fluoride	.29	.3	.3	.29	.31	.24
Iron	<.01	<.01	<.01	<.01	<.01	<.01
Lead	<.05	<.05	<.05	<.05	<.05	<.05
Manganese	<.01	<.01	<.01	<.01	<.01	<.01
Magnesium	12	18	20	18	31	15
Mercury	<.001	<.001	<.001	<.001	<.001	<.001
Molybdenum	<.2	<.2	<.2	<.2	<.2	<.2
Nickel	<.05	<.05	<.05	<.05	<.05	<.05
Nitrates (As N)	.2	.3	.3	.3	.2	.4
Potassium	13	12	8	7	9	16
Selenium	.004	.004	.005	.007	.004	.005
Silver	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	22	29	24	22	27	39
Sulphate	118	118	124	124	234	140
Zinc	.22	.27	.56	.49	.68	.11
Uranium	.082	.11	.077	.10	.024	.017
Vanadium	<.005	<.005	<.005	<.005	<.005	<.005
Total Dissolved Solids	394	374	402	391	535	408
Conductivity (umhos)	592	586	590	600	783	607
Ra-226 (pCi/ℓ)	604	1017	58	20	6	14
PH (std. units)	8.0	7.8	7.7	7.9	7.6	7.9

[1] All units are mg/ℓ unless noted otherwise.
ND - Not Detected

Added 12/4/80

TABLE D-3A

BASELINE GROUNDWATER QUALITY PARAMETERS
KERR-McGEE "Q" SAND PROJECT
CONVERSE COUNTY, WYOMING

"Q" SAND MONITOR WELLS

mg/ℓ	Well QM-1	
Parameters	4/14/80	4/15/80
Aluminum(1)	.11	.12
Arsenic	<.002	<.002
Barium	.05	.015
Boron	<.01	<.01
Bicarbonate	241	241
Carbonate	--	--
Cadmium	<.1	<.1
Calcium	91	92
Chloride	6	6
Chromium	<.01	<.01
Copper	<.005	<.005
Fluoride	.26	.26
Iron	<.01	<.01
Lead	<.05	<.05
Manganese	.021	.026
Magnesium	18	18
Mercury	<.001	<.001
Molybdenum	<.2	<.2
Nitrates (N)	.2	.2
Selenium	<.002	<.002
Silver	<.005	<.005
Sodium	22	20
Sulphate	120	116
Zinc	.70	.65
Uranium	.079	.082
Radium-226 pCi/ℓ	24.9	25.4
pH - Std.	7.7	7.6
Total Dissolved Solids	384	357

(1) Units are mg/ℓ unless noted otherwise.

TABLE D-3B

BASELINE GROUNDWATER QUALITY PARAMETERS
KERR-McGEE Q SAND PROJECT
CONVERSE COUNTY, WYOMING

DEQ LQD LICENSE NO. 5RD

	QM-2 7-30-80	QM-3 7-29-80	QM-4 7-29-80	QM-5 7-28-80
Aluminum[1]	.13	.11	.26	.21
Arsenic	.008	.002	.007	.009
Barium	.034	.024	.055	.037
Boron	.12	.12	.13	.54
Bicarbonate	172	227	143	204
Carbonate	ND	ND	ND	ND
Cadmium	<.01	<.01	<.01	<.01
Calcium	74	78	57	69
Chloride	8	6	6	7
Chromium	<.01	<.01	<.01	<.01
Copper	<.005	<.005	<.005	<.005
Fluoride	.35	.29	.42	.35
Iron	.03	.01	.65	.01
Lead	<.05	<.05	<.05	<.05
Manganese	.016	.04	.028	.014
Magnesium	17	17	14	17
Mercury	<.001	<.001	<.001	<.001
Molybdenum	<.2	<.2	<.2	<.2
Nickel	<.05	<.05	<.05	<.05
Nitrates (As N)	.2	.2	.4	.2
Potassium	10	9	10	11
Selenium	.028	.009	.008	.009
Silver	<.005	<.005	<.005	<.005
Sodium	22	27	22	22
Sulphate	136	124	126	118
Zinc	.072	.089	.18	.21
Uranium	.12	.13	.12	.31
Vanadium	.019	<.005	<.005	<.005
Total Dissolved Solids	386	412	337	380
Conductivity (umhos)	576	610	490	552
Ra-226 (pCi/ℓ)	20	17	16	218
pH (std. units)	8.1	8.2	8.0	8.3

[1]All units are mg/ℓ unless noted otherwise.

ND - Not Detected

Added 12/4/80

TABLE D-3C

BASELINE GROUNDWATER QUALITY PARAMETERS
KERR-McGEE Q SAND PROJECT
CONVERSE COUNTY, WYOMING

DEQ IQD LICENSE NO. 5RD

	QM-6 7-28-80	QM-7 7-22-80	QM-8 7-22-80	QMW-1 7-30-80
Aluminum[1]	1.0	.13	.14	.12
Arsenic	.009	.004	.005	.008
Barium	.11	.017	.043	.052
Boron	<.1	<.1	<.1	.15
Bicarbonate	184	197	211	172
Carbonate	ND	ND	ND	ND
Cadmium	.042	<.01	<.01	<.01
Calcium	62	70	76	50
Chloride	7	12	12	4
Chromium	<.01	<.01	<.01	<.01
Copper	.011	<.005	<.005	<.005
Fluoride	.32	.33	.31	.37
Iron	.29	<.01	.078	<.01
Lead	<.05	<.05	<.05	<.05
Manganese	.035	.041	.022	<.01
Magnesium	15	15	15	14
Mercury	<.001	<.001	<.001	<.001
Molybdenum	<.2	<.2	<.2	<.2
Nickel	<.05	<.05	<.05	<.05
Nitrates (As N)	.3	.3	.3	1.4
Potassium	8	8	9	6
Selenium	.001	.001	.015	.018
Silver	<.005	<.005	<.005	<.005
Sodium	22	23	24	15
Sulphate	125	132	125	66
Zinc	.74	<.05	<.05	<.05
Uranium	.20	.19	.08	.042
Vanadium	<.005	<.005	<.005	.015
Total Dissolved Solids	359	396	384	265
Conductivity (umhos)	528	586	586	432
Ra-226 (pCi/ℓ)	34	40	56	7
pH (std. units)	7.9	8.2	8.2	8.1

[1]All units are mg/ℓ unless noted otherwise.

ND - Not Detected

Added 12/4/80

ATTACHMENT D

SECOND LONG-TERM PUMP TEST
KERR-McGEE "O" SAND PROJECT
CONVERSE COUNTY, WYOMING

General procedures for the second long-term pump test as reviewed with the DEQ Land Quality Division staff on June 27, 1983 are as follows (figure of relative locations attached):

1. A monitor well, MO-1, will be drilled near well MM-1 and completed only in the lower "O", that portion of the "O" sand below the shale stringer located at a depth of ± 750 feet.

2. The upper "O" sand will be pumped through the existing wells and the fluid level in the lower "O", well MO-1, will be monitored during the test.

3. If the lower "O" responds to the pump test, it will be considered a part of the production zone and will be monitored as outlined in the application revision dated 6/20/83, and steps 4 through 11 will be implemented.

4. Well P-2 will be drilled and completed as a fully penetrating pump test well with a completion interval of ± 520 feet to ± 790 feet.

5. A monitor well, MN-1, will be completed and sealed in the "N" shale with a completion interval of ± 823 feet to 825 feet.

6. Well I-3 will be drilled and completed as a partially penetrating "O" sand monitor well.

7. Data will be presented to show that the leach solution could not migrate into the "U" sand under a worst case scenario or a monitor well, MP-1, will be completed and sealed in the "P" shale.

8. Existing wells I-1, P-3, MM-1 and MS-1 will also be monitored during the test.

9. Well P-2 will be pumped at 40 to 50 gpm, if possible and the test will be run for up to three days.

10. Drawdown and recovery data will be collected and calculations for aquifer properties, shale properties, directional transmissitivity, and boundaries within the circle of monitor wells will be made.

11. The outer ring of "O" sand monitor wells will be fully penetrating wells.

If the lower "O" sand is isolated from the rest of the "O" sand, i.e. there is no response in the lower "O" sand due to the pumping in Step 2 above, the program will be modified as follows:

1. The completion intervals for the pumped well, P-2, and the outer ring of monitor wells will be limited to the "O" sand interval above the shale stringer at ± 750 feet.
2. The "N" shale monitor well will be deleted and there will be no attempt to complete a monitor well in the shale stringer of ± 750 feet.
3. The overlying "P" shale monitor well will be drilled and monitored during the test.