April 26, 1960
Re: [illegible] (Uranium)
Dry Lake area
Gas Resources Exploration, Inc.
Natrona County, Wyoming

Memorandum

To: W. R. Grimwald, Office of Minerals Exploration

From: Harold Kirkham, U. S. Geological Survey

Subject: Review of application for exploration assistance

A two-stage program for 8,500 feet of drilling at an estimated cost of $15,200 is proposed. The target for the exploration is uranium ore in the Fox Hills sandstone formation in the Powder River Basin about nine miles north of Casper, Wyoming.

Several aspects of the proposed project should be studied. Is a trend, channel, or structural control common to deposits in the Powder River Basin and, if so, can any of these ore guides be recognized in the Dry Lake area? Should the proposed drilling pattern be revised in order to explore the area more effectively? If the trend is easterly, is enough ground claimed to the east to protect the applicant's rights to extension of ore?

I suggest that J. W. Butler, U. S. Geological Survey, Denver, consult with U.S.A.E.C. personnel in the uranium resources unit about the Dry Lake prospect. Reference material credited to Gruner, Smith, and Evans, 1956, is reported by Butler for Dry Lake and nearby prospects.

If a contract on this prospect is considered likely, would it not be good engineering practice to provide for chemical analyses of cuttings from drilling in Phase II? The applicant proposes only gamma ray logging of holes drilled in this stage.

I recommend that the application be sent to the field office for consideration.

Harold Kirkham

cc: OMX (3)
Director's reading
Branch reading
Docket file ✓
James Paone, 3643
C.L. Gardner
Chron. file

HKirkham/mm
6-MP-4-26-60

Copy #3

MME Form 40
Dec. 1958

Budget Bureau No. 42-R1368
Approval expires Dec. 31, 1963

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF MINERALS EXPLORATION

APPLICATION FOR FINANCIAL ASSISTANCE IN MINERALS EXPLORATION

Pursuant to Public Law 85-701 (72 Stat. 700; 30 U.S.C. 641)

NAME OF APPLICANT *(Full legal name and mailing address as they should appear on contract if one is executed.)*

GeoResources Exploration, Inc.
1801 Tabor Street
Denver 15, Colorado

APPLICANT DO NOT USE THIS BLOCK

DOCKET NUMBER: OME-6084

DATE RECEIVED: 4-21-60

REGION: III

DIVISION CODE: 500

BUSINESS ORGANIZATION *(Check one)*

- INDIVIDUAL [ ]
- CORPORATION [X]
- PARTNERSHIP [ ]
- OTHER *(Specify)* [ ]

STATE IN WHICH FIRM IS ORGANIZED: Colorado

LIST CORPORATE OFFICERS OR PARTNERS HERE, IF APPLICABLE

NAME	ADDRESS	TITLE
Rollin C. Vickers	as above	President
Milton D. Litman	as above	Secretary
Kenneth H. Koenen	as above	Treasurer

MINERAL(S) FOR WHICH YOU WISH TO EXPLORE: Uranium

ESTIMATED COST OF PROJECT: $ Phase I-$5,792.00 Phase II-$9,416.00

PROPERTY NAME: Dry Lake area

LOCATION — COUNTY: Natrona STATE: Wyoming

GENERAL INSTRUCTIONS

Before filling out this application, please read the *OME Regulations for Obtaining Federal Assistance in Financing Explorations for Mineral Reserves* (30 CFR Chap. III). To assure prompt action, your application must provide all applicable material and information specified on the back of this application form. Avoid unnecessary correspondence and delays by submitting complete and accurate information. *Please submit four copies of this application and all accompanying papers* except as otherwise noted. Place your name and address on each sheet. Each item of information, maps, and reports required as a part of this application is described on the back of this form. Identify each attached statement by the item number to which it applies. If an item does not apply to your application, show the item number on your statement and after it write "not applicable." Maps or sketches should be used to supplement narrative descriptions of the property location and boundaries in item 2, existing mine workings and geology in item 3, and the proposed exploration work in item 5. When this information is not too complex, all of it may be shown on one map or sketch. All documents and other attachments submitted as a part of this application, except those in item 3(g) which you mark to be returned, become the property of the Government and will not be returned to the applicant. Send true copies, *not originals*, of leases, contracts, and other documents which are an essential part of your business records. *File this application with the Office of Minerals Exploration, Department of the Interior, Washington 25, D. C., or with the nearest OME Field Office.*

CERTIFICATION

The undersigned, whether as an individual, corporate officer, partner, or otherwise, both in his own behalf and acting for the applicant, certifies that the information set forth in this form and accompanying papers is correct and complete, to the best of his knowledge and belief, and that he would not ordinarily undertake the proposed exploration under current conditions and circumstances at his sole expense.

16 April 1960
DATED

BY *(Signature)* Rollin C. Vickers
Rollin C. Vickers, President
TITLE

Attest: Milton D. Litman
Milton d. Litman, Secretary

A wilfully false statement or certification to any Department or Agency of the United States Government is a criminal offense. U. S. Code, Title 18, Sec. 1001.

INFORMATION REQUIRED WITH THIS APPLICATION

1. Financial Eligibility:

(a) Submit evidence of efforts made within 90 days preceding the filing of this application to obtain credit from your bank of account and at least one other banking institution or other private source of credit. Such evidence shall include true copies of correspondence which show: (1) date of loan request, (2) amount and terms requested, (3) proposed use of loan funds, and (4) the replies from credit sources. If the loan was offered under terms which you consider unreasonable, state why you consider them so.

(b) List names and addresses of affiliated, parent, or controlling companies or organizations and state extent and nature of their interest.

(c) State how you propose to furnish your share of the exploration [redacted] cost.

2. Applicant's Rights in Land:

(a) State your interest in the land and mineral rights, whether owner, lessee, purchaser under contract, or other. If you are not the owner, submit one true copy of the lease, contract, or other document (with address of owner) under which you control the property. Describe all liens, mortgages, or other encumbrances on the land and state book and page number and official place where recorded.

(b) State the legal description (section, township, and range; metes and bounds; patent number of claims) of the land upon which you wish to explore and all adjacent land which you own or control. Describe any part of the land or workings which should not be subject to Government royalty and liens. If the land consists of unpatented claims, state book and page number for each recorded location notice, including amended locations, and official place where recorded. State all the names by which you know the property.

(c) For all land or mineral rights encumbered or not owned, submit five copies of Lien and Subordination Agreements on MME Form 52. If the agreements cannot be obtained, state reasons and provide copies of letters of refusal.

3. Physical Description:

(a) Describe in detail and illustrate with maps or sketches all mining or exploration operations which you know have been or are being conducted upon the land. Include existing mine workings and all production facilities.

(b) State your interest, if any, in operations described in (a).

(c) State, if you know, the past and current production, supporting your statement with copies of settlement sheets, mine records, or published data if available.

(d) Describe known ore reserves, giving quantities and grades and sampling methods used. Support your statement with copies of assay certificates and assay maps if available.

(e) Describe by narrative and maps or sketches the geologic features of the property, including ore minerals, geologic formations if known, and type of deposit (vein, bedded, etc.).

(f) State your reasons for expecting to find ore, and if you have sampled the area you propose to explore, show where the samples were taken, describe sampling methods used, and provide copies of assay certificates.

(g) Send with your application at least *two* copies of all geologic or engineering reports, assay maps, or technologic information which you have, indicating whether you require their return.

4. Accessibility of Property:

(a) To aid the OME representative who may examine the property, state name and address of person who will meet him; give directions for reaching the property; and describe accessibility of property and of any mine workings.

(b) Name the shipping and supply points and state the distances to the property.

5. Exploration Work:

(a) Describe fully the proposed exploration work giving individual footages and sizes of openings *for each item of work.* Use narrative, maps, plans, and sections as necessary. Show location of the proposed work as related to geologic features such as veins, ore-bearing beds, contacts of rock formations, etc. Show also the relation of the proposed work to any existing mine workings and to *land boundaries* or to the closest identifiable corner.

(b) If an access road must be built, show the proposed location on the property map and state the length, type and construction methods proposed.

(c) If an OME contract is executed, state how soon thereafter work would be started and finished. State your anticipated average daily or monthly rate of progress for each type of work.

6. Experience:

State your operating experience and background to conduct this exploration work and also that of the person who will supervise the work.

7. Estimate of Costs:

Furnish detailed estimates of the necessary costs *for each item of the work proposed in 5(a)* under the headings listed below with a total for each heading and the estimated total cost of the work. Costs for any work to be performed by an independent contractor should be listed separately under category (a) below. Costs for any work that is not to be performed by an independent contractor should be listed under categories (b) through (g).

(a) Independent contracts. State the total cost of any proposed independent contract for all or any part of the work, and the number of units and the unit cost for each type of work, such as per foot of drilling, per foot of drifting, per hour of bulldozer operations, or per cubic yard of material moved. Cost estimates should be supported by bids from three contractors if possible. (*Note*—If none of the work is to be contracted, write "none" after this item.)

(b) Personal services. The cost of supervision, engineering and geological services, outside consultants, and labor should be itemized by numbers and classes of employees; rates of wages, salaries or fees; and periods of employment. State whether these services are available.

(c) Operating materials and supplies. List items of material and supplies giving quantity and cost of each. Include under this heading power, water, and fuel, and units of equipment and tools costing less than $50 each.

(d) Operating equipment. List items of equipment and tools costing $50 or more per unit. Give specifications and indicate how each item is to be acquired—i.e., rented, purchased or provided by the applicant. If rented or purchased, state the estimated rental or purchase price. If furnished by the applicant, state condition and present fair market value.

(e) Initial rehabilitation and repairs. Describe the type and the cost of *initial* rehabilitation or repair of existing buildings, fixtures, installations (exclusive of mine workings), and movable operating equipment now owned by the applicant which will be used in the exploration work.

(f) New buildings, fixtures, installations. Describe each building, fixed improvement, and installation to be purchased, constructed, or installed for the exploration work, stating specifications and cost including labor, materials, and supervision.

(g) Miscellaneous. Describe the type and estimate the cost of repairs and maintenance of the operating equipment listed in 7(d). Do not repeat initial repairs listed in 7(e). Show also the costs of analytical work, accounting, workmen's compensation and employees' liability insurance, payroll taxes, and other required costs that do not fall within the previous categories. [*Note*—The Government will not contribute to costs incurred before the date of the contract, or to costs of or incident to: (1) acquiring, using, or possessing land and any existing improvements, facilities, buildings, installations, and appurtenances, or the depreciation and depletion thereof; (2) general overhead, corporate management, interest and taxes (other than payroll and sales taxes); (3) insurance (other than employees' liability insurance); and (4) damages to persons or property (other than authorized repair to or replacement of equipment or other property used in the work).]

INT.-DUP. SEC., WASH., D.C. 48740

APPLICATION FOR FINANCIAL ASSISTANCE

IN MINERALS (URANIUM) EXPLORATION

DRY LAKE AREA
NATRONA COUNTY, WYOMING

by

GeoResources Exploration, Inc.
1801 Tabor Street
Denver 15, Colorado

April, 1960

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ILLUSTRATIONS

Figure 1.- Map showing land leased by GeoResources (colored areas), Dry Lake area, Natrona County, Wyoming.	in pocket
Figure 2.- Map showing proposed exploration, Section 33, T. 35 N., R. 79 W., Natrona County, Wyoming	in pocket
Figure 3.- Dry Lake drilling results, Section 33, T. 35 N., R. 79 W., Natrona County, Wyoming	in pocket
Figure 4.- East-west cross section, Dry Lake claims, Natrona County, Wyoming.	in pocket

EXHIBITS

Exhibit A Dry Lake claims, lease.

Exhibit B Drilling bids from three contractors.

Exhibit C Financial eligibility

Exhibit D Financial eligibility

Exhibit E Financial eligibility

Exhibit F Financial eligibility

APPLICATION FOR FINANCIAL ASSISTANCE IN MINERALS (URANIUM) EXPLORATION

DRY LAKE AREA, NATRONA COUNTY, WYOMING

Application submitted by

GeoResources Exploration, Inc.
1801 Tabor Street
Denver 15, Colorado

INTRODUCTION

Uranium ore was first discovered in the Dry Lake area in 1954 and since that time about 87 tons of material containing 0.32 percent U_3O_8 has been removed from the surface. Very little exploration by drilling has been done in the area with the exception of drilling conducted by GeoResources during March, 1960. This drilling was effective in showing that ore grade material exists down-dip from the surface uranium and radioactivity anomalies. Further exploration down-dip is warranted because of several favorable geologic factors.

LOCATION, ACCESSIBILITY AND GENERAL FEATURES

The area for which financial assistance is requested is shown in Figure 1. This area consists of eight contiguous and slightly overlapping unpatented mining claims. The location of the claims is shown in Figures 1 and 2. A copy of the lease covering the four Dry Lake claims is Exhibit A. Descriptions of the claims are shown in the table below:

Leased by GeoResources Exploration, Inc.

Name of Claim	Records of Natrona County, Wyoming Book	Page No.
Dry Lake No. 1	29(LN)	528
Dry Lake No. 2	29(LN)	525
Dry Lake No. 3	29(LN)	527
Dry Lake No. 4	29(LN)	526

Above claims are all in the SE 1/4, Section 33, T. 35 N., R. 79 W. Natrona County, Wyoming.

Located by GeoResources Exploration, Inc.

Name of Claim	Records of Natrona County, Wyoming Book	Page No.
Zero No. 1	60(LN)	238
Zero No. 2	60(LN)	239
Zero No. 3	60(LN)	240
Zero No. 4	60(LN)	241

Above claims are in the SE 1/4, Section 33, and the SW 1/4, Section 34, T. 35 N., R. 79 W., Natrona County, Wyoming.

The area of proposed exploration is essentially level. The bedrock is covered with from three to perhaps as much as 10 feet of soil and wind-blown silt. The area is about nine miles north of Casper, Wyoming, and is accessible by hard-surfaced roads except for about 1/4 mile. There is no vegetation in the area except grasses and some sage.

RESULTS OF EXPLORATION

With the exception of a few holes drilled around the shallow pit (shown in Figure 2), all of the drilling conducted by GeoResources was done within the small area shown in Figure 2. The results of this drilling are shown in Figure 3. Most of the drill holes were logged with the Century Geophysical Corp. gamma ray logging equipment. The interpretation of the logs is also shown in Figure 3. All of the ore grade material was found from a depth of 55 feet in the western part of the area shown in Figure 3, to a depth of 70 feet in the eastern part of the area. Corrections for topography show that the ore zone is nearly flat-lying with a slight dip (about 2-3 degrees) to the ENE.

Sufficient quantities of radioactive material were found to justify open-pit mining, therefore core samples and sludge samples were taken to determine the ore amenability and the equilibrium ratio. Results of analyses are shown below:

Sample No.	Hole No.	Depth	eU_3O_8	U_3O_8	Remarks
GRX-1	25	64-66	0.085	0.08	Sludge sample
GRX-2	26	62-64	0.065	0.05	Sludge sample
GRX-3	5	56-58	0.240	0.135	Sludge sample
GRX-4	29	59-60	0.150	0.077	Core sample
GRX-6	29	62-63	0.250	0.009	Core sample
GRX-7	37	64-66	0.050	0.057	Sludge sample
GRX-8	27	60-62	0.043	0.040	Sludge sample

Note: Because of contamination of samples caused by hole caving and dilution, sludge samples are not necessarily representative of the grade of material in place. However, the equilibrium ratio should be about the same.

The above analyses show that the ores are considerably out of equilibrium, that is, the equivalent uranium content is considerably greater than the chemical uranium content. This is especially true of the higher grade samples.

This disequilibrium is probably caused by uranium having been leached from the rocks in preference to the radioactive daughter products.

GEOLOGY AND POTENTIAL OF THE AREA

The bedrock in the area of discussion consists mainly of the Fox Hills sandstone formation of upper Cretaceous age. The rocks consist mainly of fine- to medium-grained sandstone units, as much as 60 feet in thickness, thin beds of lignite, siltstone, and mudstone. Uranium has been found mainly within the thicker sandstone lenses in or immediately adjacent to areas where the sandstone is interbedded with mudstone and lignitic siltstone.

The potential of the property is based upon the following factual data:

1. Abnormal radioactivity at the surface in the vicinity of the shallow open cut (see Figure 2) is found over a relatively large area.

2. Red alteration of sandstone, similar to that found associated with many other sandstone type uranium deposits, is a conspicuous feature of the deposits and is found over a wide area up-dip from the uranium concentrations.

3. Drilling and probing of drill holes shows that large tonnages of sandstone have been mineralized with uranium.

4. Samples taken of the low grade ore and also core samples of the orebody shown in Figure 3, show that the samples are not in equilibrium and that probably large quantities of uranium have been leached from the near-surface rocks.

5. The largest deposits found to date (Figure 3) are immediately down dip from the surface radioactive anomalies.

Further exploration of the property is warranted because of the following considerations:

1. The uranium occurrences at the Dry Lake claims are about the only significant deposits that have been found in the Fox Hills sandstone in the Powder River Basin. Further exploration of the Dry Lake Claims has the potential not only of developing an orebody, but also of suggesting that other areas of Fox Hills sandstone may contain significant uranium deposits. Uranium-bearing solutions have migrated downward in the Fox Hills sandstone as evidenced by the known deposits at Dry Lake and the presence of many small radioactive anomalies in the surface exposures of the Fox Hills sandstone in a large area to the north.

2. The fact that large quantities of uranium have been leached from the near-surface rocks suggests that significant deposits may be present down dip where conditions would favor deposition.

3. The lithology of the Fox Hills sandstone is favorable for uranium deposition. The Fox Hills sandstone contains permeable sandstone units containing abundant carbonaceous material and interbedded with mudstone and siltstone.

4. The sandstone facies containing the known deposits is believed to change to a relatively impermeable mudstone facies down dip, a condition that would favor uranium deposition.

5. The limits of uranium deposition down dip from the surface anomalies have not been determined.

An east-west cross section, showing some of the drilling results and the area of proposed exploration, is shown in Figure 4. The drilling information to date suggests that the thickness and extent of the radioactive beds increases to the east, down dip.

PROPOSED EXPLORATION

The proposed exploration would consist entirely of drilling. The location of the proposed drill holes is shown in Figure 2. A cross section of the area of exploration is shown in Figure 4.

PHASE I

Phase I would consist of 40 drill holes aggregating 5,000 feet, with drill holes spaced 100 feet on lines spaced 200 feet apart (see Figure 2). The proposed location of 27 holes aggregating 3375 feet is shown in Figure 2. The depth of these holes would range from 100 to 150 feet. The results of this drilling would control the location of the remainder of the drilling. All of the holes would be logged with a gamma ray logging unit and the logs interpreted. Estimates of costs for Phase I are given below:

Bulldozer preparation of 40 drilling sites (16 hours @ $12.00 per hour)	$ 192.00
5,000 feet of rotary plug drilling @ $0.70 per foot (see bids from 3 contractors, Exhibit B)	3,500.00
5,000 feet gamma-ray logging of drill holes by Century Geophysical Corp. @ $0.12 per foot.	600.00
Supervision of entire exploration program, including surveying of drill hole sites, supervision of drilling, logging of drill cuttings, interpretation of gamma ray logs, compilation of maps, map reproduction costs, preparation of final report, field transportation expenses, field living expenses, and all other expenses incident to field geology and engineering.	1,500.00
Total	$5,792.00

PHASE II

If Phase I is successful in finding sufficient quantities of uranium mineralization, Phase II would be conducted to determine the character of the ore, equilibrium ratios necessary to interpret the gamma ray logs in terms of percent uranium, and the continuity of mineralization. Phase II would consist mainly of core drilling of the radioactive beds. Estimates of costs for Phase II are shown below:

Bulldozer preparation of drilling sites (8 hours @ $12.00 per hour)	$96.00
3,000 feet of plug rotary drilling @ $0.70 per foot)	$2,100.00
500 feet of coring (NX) @ $10.00 per foot. (see coring bids, Exhibit B)	$5,000.00
3,500 feet of gamma ray logging @ $0.12 per foot (Century Geophysical Corp.)	$ 420.00
50 uranium and equivalent uranium analyses @ $6.00 each.	$ 300.00
Supervision of exploration, including supervision of coring and drilling, logging of cuttings and core, furnishing core boxes, interpretation of gamma ray logs, compilation of maps, map reproduction costs, preparation of final report, field transportation expenses, field living expenses, and all other expenses incident to field geology and engineering.	$1,500.00
Total	$9,[redacted]

Note: Analyses (both chemical uranium and equivalent uranium) to determine ore equilibrium will be completed by C. O. Parker & Co., Denver, Colorado, at a cost of $6.00 each.

FINANCIAL ELIGIBILITY, EXPERIENCE OF THE APPLICANT AND OTHER INFORMATION

The following exhibits are submitted as evidence to support the unavailability of funds from commercial sources on reasonable terms.

Exhibit C - Letter from GeoResources to Rocky Mountain Bank.

Exhibit D - Letter from GeoResources to Denver-U. S. National Bank.

Exhibit E - Letter from Rocky Mountain Bank.

Exhibit F - Letter from Denver-U. S. National Bank.

There are no affiliated, parent or controlling companies or other organizations associated with GeoResources Exploration, Inc.

GeoResources' share of the exploration costs will be from funds currently available.

The exploration program outlined above will be under the direct supervision of Dr. R. C. Vickers, mining geologist and a registered engineer, who is also the president of GeoResources Exploration, Inc. Dr. Vickers has had more than 10 years of experience in the exploration, evaluation and development of uranium properties. He was employed for 5½ years with the Minerals Deposits Branch of the U. S. Geological Survey.

Each phase of the exploration would require about one month to complete. If an OME contract is executed, work would be started within 90 days.

Building 20 - Federal Center
Denver 25, Colorado

June 7, 1960

EXTRA COPY O. M. E RECEIVED JUN 13 1960		
DATE	INITIALS	CODE

Memorandum

To: George C. Selfridge, Chief
Division of Field Operations, OME

From: Hugh M. Connors, Acting Field Officer
OME, Region III

Subject: Docket No. 6004 (Uranium)
Georesources Exploration Inc.
(Dry Lake Claim et al.)
Natrona County, Wyoming

Enclosed are the original and two copies of a joint engineering and geologic report dated June 3, 1960, by J. W. Hacker, U. S. Geological Survey, and Hugh M. Connors, Bureau of Mines, covering the examination of the subject property.

The field examiners concur that the chances of finding uranium ore bodies of significant size and grade down-dip from the open pit in the Fox Hills sandstone on the applicant's property are not good. We recommend that the application be denied.

Original signed by

Hugh M. Connors

Attachments

UNITED STATES
DEPARTMENT OF THE INTERIOR
FRED A. SEATON, SECRETARY

OFFICE OF MINERALS EXPLORATION
REGION III

OME 6084

GeoResources Exploration, Inc.

Dry Lake claims, et al.

Natrona County, Wyoming

EXTRA COPY
O. M. E.
RECEIVED JUN 13 1960

DATE	INITIALS	CODE

Uranium

Joint Engineering and Geologic Report

by

J. W. Basler, Geologist
Geological Survey

H. M. Connors, Mining Engineer
Bureau of Mines

June 3, 1960

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Location, accessibility, and physical features	2
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Conclusions and recommendations	10

ILLUSTRATIONS

Figure	Follows page
1. Index map of Wyoming showing location of the Dry Lake, claims, et al	1
2. Map showing recommended exploration, section 33, T. 35 N., R. 79 W., Natrona Co., Wyoming	10

OME 6084

GEO RESOURCES EXPLORATION, INC.
DRY LAKE CLAIMS ET AL.
NATRONA COUNTY, WYOMING

INTRODUCTION AND SUMMARY

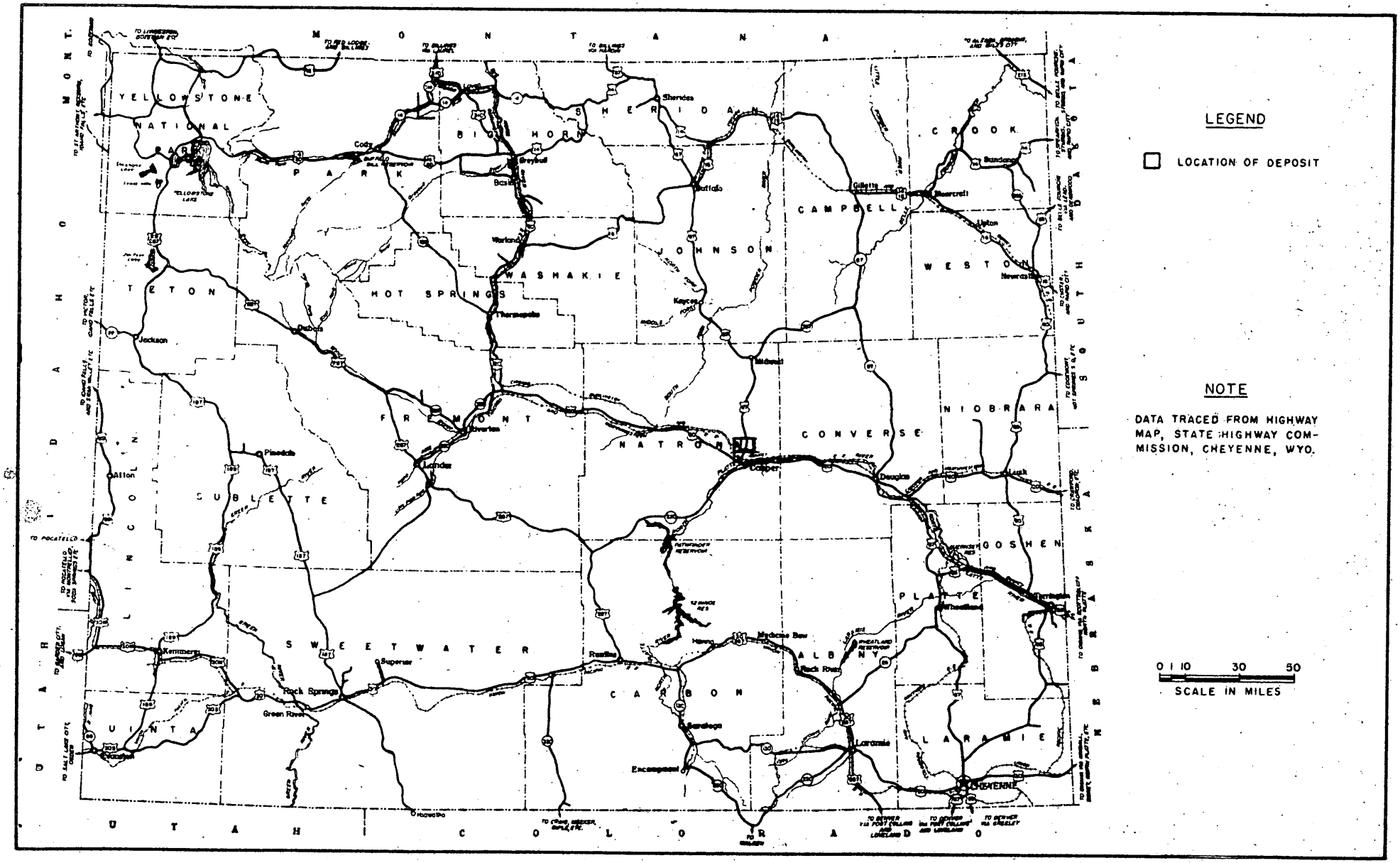
GeoResources Exploration, Inc., 1801 Tabor Street, Denver 15, Colorado, applied April 16, 1960, to the Office of Minerals Exploration for Government assistance to explore for uranium on the Dry Lake et al. claims in Natrona County, Wyoming.

The application was referred to the field, and a field examination was made on May 13, 1960, by J. W. Hasler, USGS, and Hugh M. Connors, USBM, in company with Dr. Rollin C. Vickers, President of the applicant company.

The Dry Lake claims, et al., are located about 9 miles north of Casper, Wyoming, in the extreme southwest part of the Powder River Basin. Some 87 tons of ore-grade material has been shipped from the property, and exploration drilling has since shown that an area east of the mined area contains some mineralized material.

The applicant proposes drilling at depth to test for possible enriched uranium ore bodies. The examining team thinks that the chances of finding significant bodies of ore-grade material are not good and therefore recommend denial of the application.

The uranium deposit on the Dry Lake claims, et al., is in the Fox Hills sandstone of upper Cretaceous age, and is the only significant occurrence of uranium in that formation in the Powder River Basin. Should



OME 6084 Geo Resources, Inc., Dry Lake Area, Natrona County, Wyoming

any additional work be done on the property, it should be done because the Fox Hills sandstone is a relatively unknown and new uranium-bearing formation. The major uranium deposits in the Powder River Basin are found in the Wasatch formation of Tertiary age.

LOCATION, ACCESSIBILITY, AND PHYSICAL FEATURES

The Dry Lake claims, numbers 1 through 4, and the Zero claims, numbers 1 through 4, leased by GeoResources Exploration, Incorporated, are all located in the southeast 1/4, sec. 33, T. 35 N., R. 79 W., Natrona County, Wyoming (fig. 1).

The property is easily accessible by travelling north from Casper, Wyoming, on U. S. Highway 87 for a distance of 9 miles, then turn right for one-quarter of a mile, near the old highway.

The applicant's property is in the extreme southwest portion of the Powder River Basin. The surface of the country is hilly, but not mountainous. Near the mountains the country is essentially a plain that has been deeply dissected by streams, leaving the mesas sloping gently toward the north away from the mountains. Farther away from the mountains the country is gently rolling, with a few flat topped hills, but there are a few small areas of rough country where the mantle of Tertiary and Quaternary material is removed, revealing the presence of the lower and more indurated rocks. There is little vegetation in the immediate area except for grasses and sage.

HISTORY AND PRODUCTION

Uranium ore was first discovered in the Dry Lake area in 1954 and since that time some 87 tons of material containing 0.32 percent U_3O_8 has been mined from a small open pit on the Dry Lake No. 2 claim. Very little exploration has been done on the applicant's claims except for some drilling mostly east of the open pit. This drilling was completed during March 1960. Some 33 holes were drilled and uranium-bearing material was penetrated in the Fox Hills sandstone formation that averaged 3 feet thick and assayed about 0.16 percent eU_3O_8.

OWNERSHIP AND EXTENT

The area consists of eight contiguous and slightly overlapping unpatented mining claims. The Dry Lake claims 1 through 4, and the Zero claims 1 through 4 are recorded in the records of the Natrona County recorder's office as follows:

Claim	Book	Page
Dry Lake No. 1	29 (LN)	528
Dry Lake No. 2	29 (LN)	525
Dry Lake No. 3	29 (LN)	527
Dry Lake No. 4	29 (LN)	526

The Dry Lake claims are all located in the SE¼, sec. 33, T. 35 N., R. 79 W., Natrona County, Wyoming.

Claim	Book	Page
Zero No. 1	60 (LN)	238
Zero No. 2	60 (LN)	239
Zero No. 3	60 (LN)	240
Zero No. 4	60 (LN)	241

The Zero claims are located in the SE¼ sec. 33, and the SW¼ sec. 34, T. 35 N., R. 79 W., Natrona County, Wyoming.

The claims listed above are held under a lease agreement as shown in Exhibit A accompanying the application.

PRESENT STATUS

The property is idle at the present time, as no further exploration work, or production is being made.

Exploration and development

A small open pit has been mined from which 87 tons of ore that assayed 0.32 percent U_3O_8 was produced. Some 40 diamond drill holes averaging approximately 80 feet in depth have been drilled to test the area around the open pit and especially the area east of the pit, for an estimated total footage of 3,200 feet.

GEOLOGY AND ORE DEPOSITS

The Powder River Basin which covers about 12,000 square miles of northeastern Wyoming is a broad structural and topographic basin terminated on the south by the Laramie Mountains and the Hartwell uplift, on the east by the Black Hills and related structures, and on the west by the Big Horn Mountains. The surface of the central part of the basin is characterized by moderately dissected rolling hills ranging from 4,500 to about 5,400 feet in elevation. The Pumpkin Buttes which are a prominent landmark rise to an elevation of 6,000 feet, or about 1,000 feet above the surrounding countryside.

Uranium deposits are found largely in the Wasatch formation of Tertiary age in the Powder River Basin. Uranium and vanadium are the dominant elements. The deposits are, almost without exception, associated with areas of red coloration. They are generally located east of the synclinal axis and are found in the middle or predominantly lenticular sandstone unit of the Wasatch formation. They all occur within 150 feet or less below the surface of the ground and have not been found more than a few feet below the water table. The deposits may be broadly classified into three general types on the basis of size and grade, mineralogy, and red bed association.

Some of the following observations have been made with respect to the origin of the deposits:[1]

1/ Mrak, Vernon A., 1958, "Uranium Deposits in the Tertiary sediments of the Powder River Basin, Wyoming," Wyoming Geological Association Guidebook, pp. 233-238, 1958.

(1) Most of the major uranium deposits are found in the buff to white sandstones down-dip from the predominantly red sandstone zone.

(2) The narrow zone of red coloration generally follows the trend of greatest structural disturbance in the Wasatch rocks, and it also follows the area of greatest porosity and permeability.

(3) Uranium deposits occur intermittently along a narrow trend for a distance of 6 miles through the Dry Fork area. Where uranium is found it usually occurs at two or more stratigraphic horizons.

(4) The sediments below the water table are various shades of gray and rarely if ever show any evidence of red coloration.

(5) In more than 130,000 feet of drilling in the Powder River Basin, no uranium deposits were found to extend more than a few feet below the present water table.

(6) An over-all average of uranium samples taken from the mineralized area shows the uranium to be approximately in radioactive equilibrium. However, single samples will sometimes show extreme disequilibrium which suggests that uranium is presently moving.

Groundwater samples were obtained from holes drilled on a grid pattern across the mineralized trend between the red and the buff sandstones in the Dry Fork area. A preliminary study of the groundwater samples indicates that the average uranium content of the groundwater from the red sandstone is 60.4 ppb, whereas the groundwater from the buff sandstone is 35.3 ppb. The groundwater is moving down dip from the red sandstone and loses 41.5 percent or 25.1 ppb of the contained uranium when it passes through the zone of mineralization. This uranium loss is

equivalent to 25.1 pounds of uranium per one billion pounds of groundwater. If we take a cross sectional area, normal to the dip and assume it lies at the top of the permanent water table in the transitional zone between the oxidized and non-oxidized sediments and allow groundwater to move down dip at the rate of .001 feet per minute, we find that 32.8 million pounds of water would pass through an area 10 feet by 100 feet each year. If conditions would remain relatively constant for a period of 25,000 years it is noted that 820 million pounds of groundwater would pass through the 1,000 square feet area and 20,582 pounds of uranium would be released to the zone of mineralization. This figure is equal to 4,116 tons of 0.25 percent uranium ore.

The uranium on the applicant's property is found in the Fox Hills sandstone of upper Cretaceous age, and is the only known occurrence of uranium in the Fox Hills sandstone in the Powder River Basin.

The Fox Hills sandstone crops out as a narrow band of generally steeply-dipping strata paralleling the western margin of the Black Hills. The formation continues northward and southward to outline most of the eastern border of the Powder River Basin. It is predominantly a sandstone but commonly contains beds of gray shaly claystone and siltstone of variable thickness which become more abundant near the base and locally may comprise a large part of the formation. The thickness of the formation is reported to range from 120 to 200 feet; but the lack of good exposures in the area and the gradational contact with, and similar to the overlying Lance formation makes accurate measurement difficult. The sandstones of the formation are generally gray to light-brown,

fine- to medium-grained, soft, thin-bedded, and cross laminated. The rock has a slabby appearance on weathered surfaces and locally contains numerous calcareous and ferruginous concretions.

The Fox Hills sandstone in the immediate area consists mainly of fine- to medium-grained sandstone units as much as 60 feet in thickness. Uranium has been found in the thicker sandstone lenses in or immediately adjacent to areas where the sandstone is interbedded with mudstone or lignitic siltstone.

PROPOSED EXPLORATION

The applicant proposes to drill some 40 diamond drill holes to test for continuity of the zone of mineralized material extending eastward from the pit on the Dry Lake No. 2 claim. Total cost of the proposed project is estimated to be $9,416.00.

Exploration to date has shown that the Fox Hills sandstone has been mineralized for some distance east of the pit that contained 87 tons of ore-grade material. Drilling indicated, according to the applicant, that there is a possibility of an enriched zone farther down dip in the nearly flat-lying Fox Hills sandstone. The applicant indicated that the gamma ray analyses shows the uranium to be out of equilibrium due mainly to leaching near the outcrop. The applicant further proposes that the red-gray sandstone relationship to uranium is the same in the Fox Hills sandstone as that in the Wasatch formation, and therefore basic warranty of further exploration by the applicant is given in the five reasons as follows:

1. The uranium occurrences at the Dry Lake claims are about the only significant deposits that have been found in the Fox Hills sandstone in the Powder River Basin. Further exploration of the Dry Lake claims has the potential not only of developing an ore body, but also of suggesting that other areas of Fox Hills sandstone may contain significant uranium deposits. Uranium-bearing solutions have migrated downward in the Fox Hills sandstone as evidenced by the known deposits at Dry Lake and the presence of many small radioactive anomalies in the surface exposures of the Fox Hills sandstone in a large area to the north.

2. The fact that large quantities of uranium have been leached from the near-surface rocks suggests that significant deposits may be present down dip where conditions would favor deposition.

3. The lithology of the Fox Hills sandstone is favorable for uranium deposition. The Fox Hills sandstone contains permeable sandstone units containing abundant carbonaceous material and interbedded with mudstone and siltstone.

4. The sandstone facies containing the known deposits is believed to change to a relatively impermeable mudstone facies down dip, a condition that would favor uranium deposition.

5. The limits of uranium deposition down dip from the surface anomalies have not been determined.

The Dry Lake area uranium occurence is the only significant one that has been found in the Fox Hills sandstone in the Powder River Basin. Perhaps, on this basis, some preliminary exploration work may be warranted to test the Fox Hills sandstone down dip for possible ore-grade material.

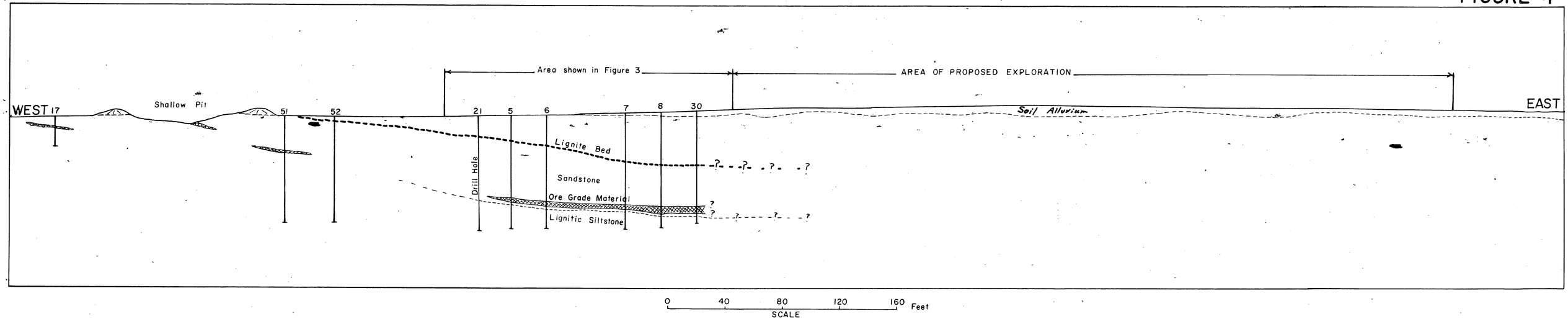
Samples assayed (gamma ray) from the limited drilling show that only three samples out of eight are out of equilibrium, indicating that not all the uranium has been leached from the sandstone, even though there was no visible uranium in the sandstone at the surface, and in only a few of the holes drilled, did the cuttings show any uranium bloom due to oxidation. The zone drilled as shown by the 33 holes, showed only 3 feet of 0.16 percent eU_3O_8. The applicant must be able to mine at least 0.20 percent U_3O_8 for the material to be considered ore.

The Fox Hills sandstone appears favorable for uranium deposition in that it is a relatively permeable sandstone and contains considerable carbonaceous material and interbedded mudstone and siltstone.

CONCLUSIONS AND RECOMMENDATIONS

The results of a field examination and considerable study indicate that the chances of finding uranium ore bodies of significant size and grade down-dip from the open pit in the Fox Hills sandstone on the applicant's property are not good, and it is therefore recommended that the application be denied. The Dry Lake area occurrence of uranium in the Fox Hills sandstone is the only significant occurrence of uranium in that formation in the Powder River Basin. Any approval of this request for Government assistance would be only on the basis that, here would be exploration in a new-found relatively unknown formation, insofar as uranium is concerned. Any drilling to be done east of the pit should be in a series of four fences of holes 400 feet apart with holes along the fences 100 feet apart (fig. 2). This will test any down dip extension of the mineralized zone as far to the east as is the applicant's property will permit and still gain any depth on the formation.

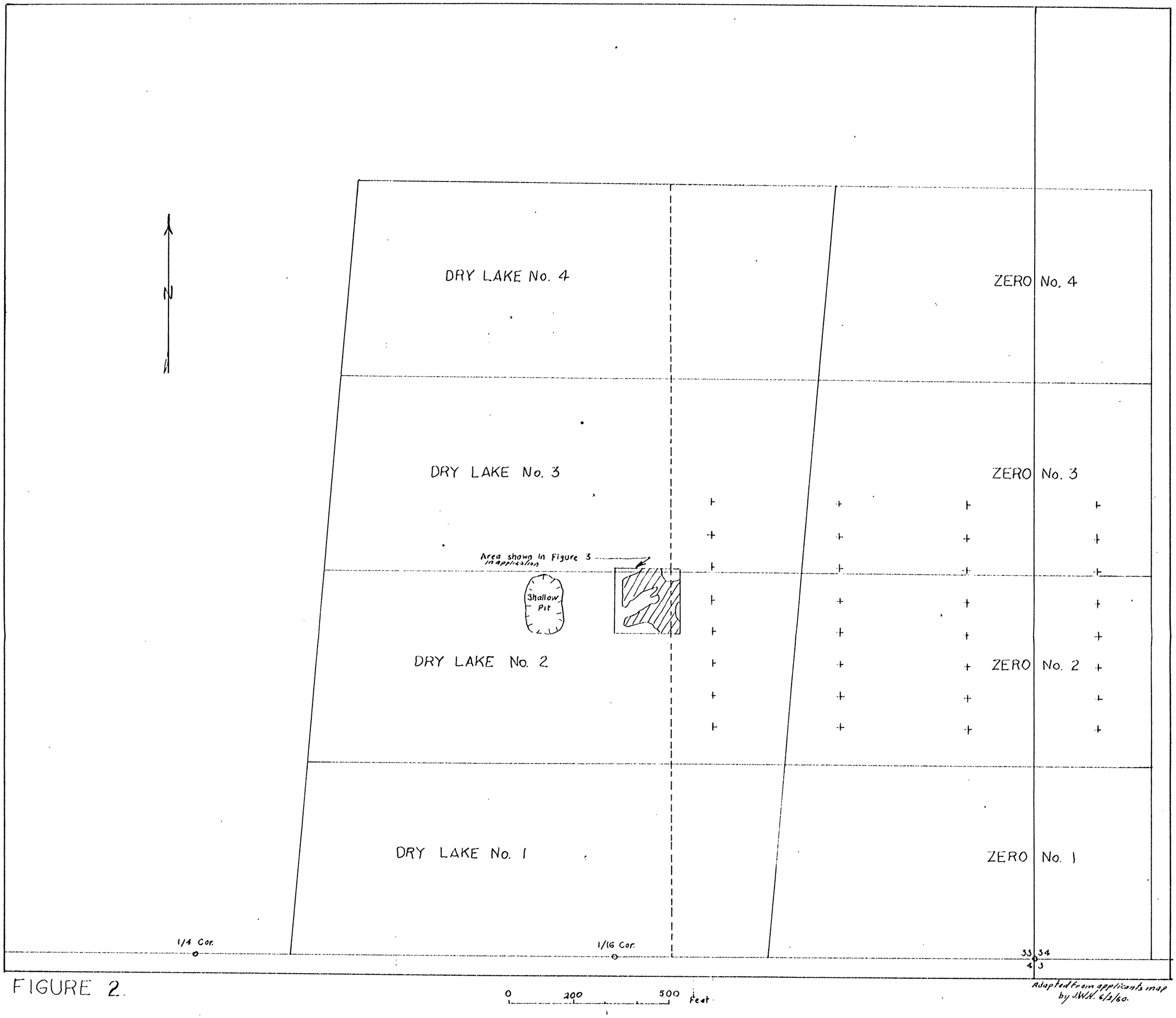
FIGURE 4



EAST-WEST CROSS SECTION, DRY LAKE CLAIMS, NATRONA COUNTY, WYOMING.

DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

OFFICE OF MINERALS EXPLORATION
DOCKET 6084 JUNE 1960

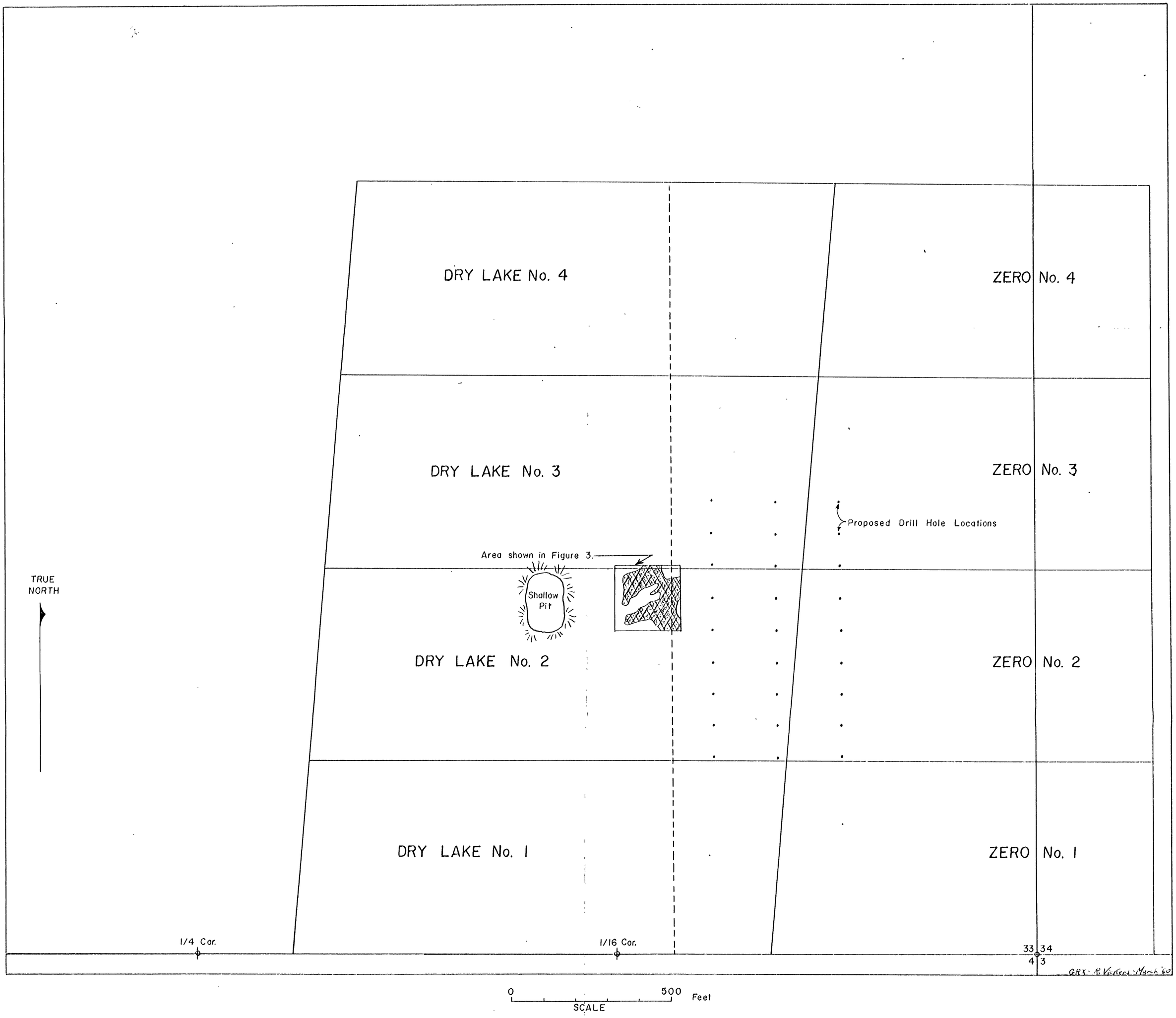


Adapted from applicant's map by J.W.H. 6/3/60.

FIGURE 2.

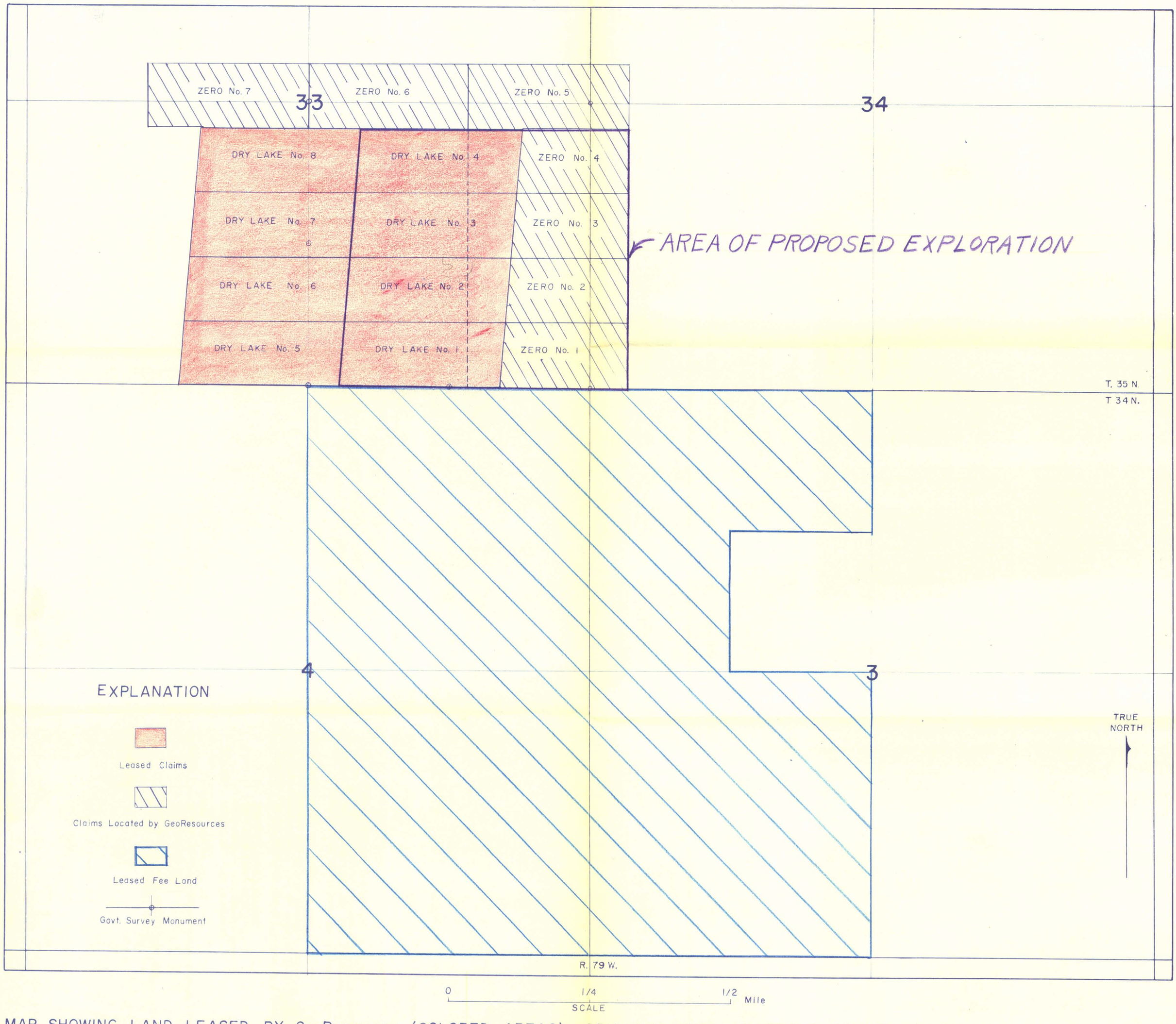
MAP SHOWING RECOMMENDED EXPLORATION, SECTION 33, T. 35 N., R. 79 W., NATRONA COUNTY, WYOMING.

FIGURE 2



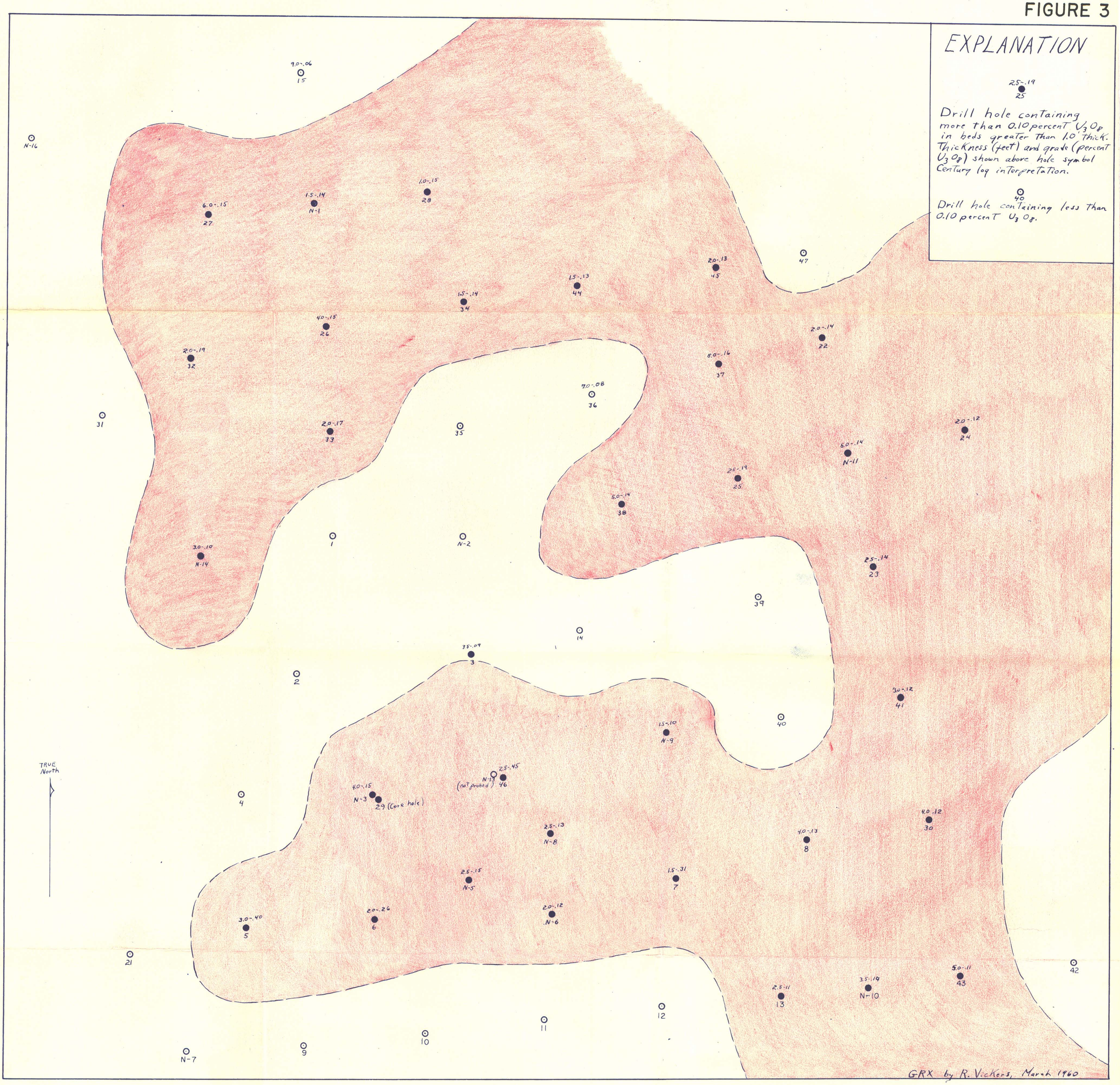
MAP SHOWING PROPOSED EXPLORATION, SECTION 33, T. 35 N., R. 79 W., NATRONA COUNTY, WYOMING.

FIGURE 1



MAP SHOWING LAND LEASED BY GeoResources (COLORED AREAS), DRY LAKE AREA, NATRONA COUNTY, WYOMING.

FIGURE 3



DRY LAKE DRILLING RESULTS

Section 33, T. 35 N., R 79 W., NATRONA Co., WYOMING