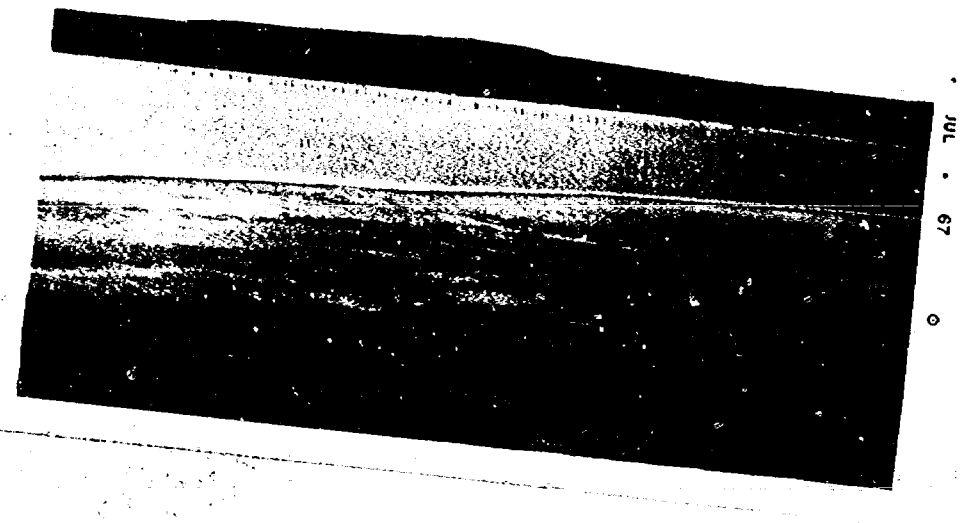
CASE 3636: Application of NEW MEXICO SALT WATER DISPOSAL CO. for salt water disposal, Lea Co.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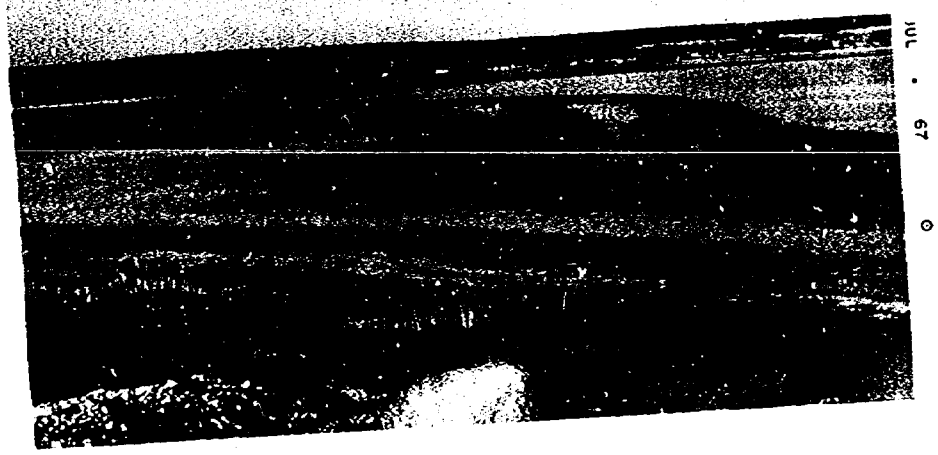
JUL • 67

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. 7
Case No. 3636

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BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. 6
Case No. 3636

Case No.

3636

Application, Transcript,
Small Exhibits, Etc.

GOVERNOR
DAVID F. CARGO
CHAIRMAN

State of New Mexico
Oil Conservation Commission

LAND COMMISSIONER
GUYTON B. HAYS
MEMBER

STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

P. O. BOX 2088
SANTA FE

August 19, 1968

Re: Case No. 3636
Order No. R-3300-A
Applicant:
N. M. Salt Water Disposal Co.

Mr. John Russell
Attorney at Law
Post Office Drawer 640
Roswell, New Mexico 88201

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Carbon copy of drder also sent to:

Hobbs OCC x
Artesia OCC
Aztec OCC
Other Mr. Bill LeMay, Jason Kellahin, F. L. Heidel
Claude E. Neeley and State Engineer Office

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
August 16, 1967

REGULAR HEARING

IN THE MATTER OF:

Application of New Mexico Salt Water Disposal Company, Inc., for salt water disposal, Lea County, New Mexico.

Case No. 3636

BEFORE: GOVERNOR DAVID F. CARGO
COMMISSIONER GUYTON B. HAYS
A. L. "PETE" PORTER, SECRETARY-DIRECTOR

TRANSCRIPT OF HEARING

MR. PORTER: We will take up Case 3636.

MR. HATCH: Application of New Mexico Salt Water Disposal Company, Inc., for salt water disposal, Lea County, New Mexico.

MR. MORRIS: May I have my exhibits marked and put on the board, please?

MR. PORTER: Yes. We will take a five minute recess while the exhibits are posted.

(Recess.)

(Whereupon, Applicant's Exhibits marked for identification.)

MR. PORTER: The Hearing will come to order, please. The Commission will recognize Mr. Morris.

MR. MORRIS: I am Dick Morris with the Santa Fe law firm of Montgomery, Federici and Andrews, representing the applicant, New Mexico Salt Water Disposal Company, Incorporated, in Case 3636. We will have two witnesses, Mr. Charles C. Lovelace and Mr. Ed Reed. I ask that they both stand and be sworn at this time.

(Witnesses sworn.)

C H A R L E S C. L O V E L A C E, J R., called as a witness herein, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. MORRIS:

Q Mr. Lovelace, please state your name and where you reside.

A Charles C. Lovelace, Junior, Roswell, New Mexico.

Q What is your profession, Mr. Lovelace?

A I'm a Professional Engineer and an independent oil operator.

Q With regard to engineering matters, have you previously testified before the New Mexico Oil Conservation Commission and had your qualifications established as a matter of record?

A I have.

Q What is your position with the New Mexico Salt Water Disposal Company?

A I am President of the company and its organizer.

Q What is sought by the application of New Mexico Salt Water Disposal Company in this case?

A We're applying for the right to dispose of oil field brines produced in the proximity of a playa lake located in Sections 2 and 3, Township 11 South, Range 34 East, and in Section 32, Township 10 South, Range 34 East, this lake being located about three and a half miles south southeast of the so-called Middle Lane Inbe-Bough C producing area.

Q Where is the lake located with respect to the north boundary of the Lea Underground Water Basin as designated by

the State Engineer?

A Approximately three miles north, I believe, of the north line of the Lea County Water Basin.

Q The lake area is not within the declared basin?

A Not within the declared basin, true.

Q How many barrels of water do you seek authority to inject into this lake?

A We requested in our application 15,000 barrels a day. However, we have reconsidered, in view of the data that we have accumulated and which will be commented upon by the hydrologist, we will probably seek 12,500 barrels a day.

Q What will be the source of this water?

A This water is being produced in conjunction with the production of oil from the Bough C Formation in the Middle Lane-Inbe Fields, which lie primarily in 10, 33 and 10, 34 in Lea County.

Q How will this water be transported from the point of production to the playa lake?

A We propose to build a gathering system within the field and carry the water to a lined sump at a low point in the field by gravitation and then move the water about 23,000 feet from the sump to the lake through a six-inch pipeline.

Q Now, in addition to water from the Middle Lane and the Inbe Lane Pools, is it also possible that you may be able

to handle produced salt water from other fields in this area?

A Yes. I think the potential would include an area within six to eight miles in any direction of the lake. At the moment, the immediate need is for the Middle Lane-Inbe area. However, I would imagine that over a period of time, we should need to accomodate other producers in the general area.

Q What commitments do you now have from operators in this area to deliver produced salt water to this system, if it is approved by the Commission?

A We have a total of twenty wells in the Middle Lane Field committed under written contract to the system, provided we are able to furnish the service and the start date under the present contract is September the 15th of this year.

We have contracts out to several other operators and we have been approached by two operators who are not in the Middle Lane but expect to have salt water problems in the very near future, Mobil on a deep well they're drilling southeast of Middle Lane and by Sunray DX on their produced water in the so-called Simanola Field about four miles north of the lake.

Q What will be the expected cost of your installation?

A We're estimating the cost for the gathering system and the lateral line to the lake to be in the order of $100,000.00.

Q If approval of this application is granted by the Commission, when do you intend to begin construction?

A We'll order material the day we get the Commission's approval.

Q And you would hope to have it in operation by the middle of September?

A By September the 15th.

Q How is the produced salt water now being handled in this area that you propose to serve?

A Well, at the risk of contradiction by the Land Commissioner, it's being trucked, it's being trucked, picked up at the batteries at the heater treaters and the storage facilities at the battery, and being moved in trucks to salt water disposal wells some distance away.

Q What is the economics presently facing the operators with respect to this trucking operation?

A Let me say I'm not producing in the area but my investigations indicate the average cost for handling this water today is about seventeen cents a barrel.

Q In the face of the no pit orders that have been entered by the Commission, what other alternatives do the operators in this area have other than to continue trucking?

A Well, of course, they could shut in their production and that has been suggested, to avoid violation of the present field rule. The only other alternative would be to find another disposal method other than the playa lake, such as

disposing in dry holes in the area at some considerable expense, more so, I would suggest, than we're proposing if we put the water in the playa lake.

Q Would the playa lake be the most economic means available for the disposal of this produced salt water, in your opinion?

A As far as I'm able to ascertain, it will be the most economical way. There is one system in the general area that I know about that's collecting water and putting it into an old Devonian dry hole some six or eight miles south of the field. I do not know the economics of their operation, I do know that the cost of converting a Devonian hole, assuming no problems in getting on bottom, cleaning out, will be considerably more than the system we are proposing to use at the lake. In fact, we have made a study in that regard and found it impractical.

Q Does this consideration of economics present the specter of premature abandonment in this area?

A Well, in my opinion, it would. Economics always dictates the cutoff date of production from any well when the return from the sale of production is less than the operating costs and certainly under the present system of disposal, that is namely trucking, I would assume there would definitely be some premature abandonment. However, I think

it would be absurd to assume that some method would not be devised that would take care of that present figure because it's almost reached a point of uneconomic condition right now from trucking because of the amounts of produced water in the Middle Lane Field.

Q Is the water problem in this general area also presenting any problem with respect to development of this area?

A Well, I should imagine that anyone preparing a budget for a well in the area would have to give consideration to the cost of water disposal. So far as I know, there are several or at least two suggested services in addition to the one that we're proposing, but certainly the economics of the drilling of the well would have to be taken into account.

Q Would you comment upon the prevalence of State land in the area to be served by your system, and also as constituting the area on which the playa lake is located?

A A cursory examination of the State's records indicates that the minerals in the general area of service are almost 100 percent State minerals. They're, as far as I know, I know of one 40 acre tract within five or six miles. It's not State mineral.

Q Is the land on which the lake is located also State land?

A Yes, it is State surface and mineral.

Q Would you briefly comment on the importance of this project to the State from a royalty standpoint?

A Well, the twenty wells that have agreed to subscribe to our service are currently,all but one, I believe, producing their full allowable, which if I'm not mistaken, would be approximately 8,000 barrels per month per well and this would translate into 160,000 barrels and I presume the State would have an eighth of that, or roughly 20,000 barrels, and I believe with the new price of crude, roughly $3.00 a barrel, this would amount from these twenty wells to about $60,000.00 a month to the State. Since the State predominates in ownership throughout this whole trend, in fact, extending down toward the Bagley, I should imagine that the State's royalties derived from the general area are quite substantial. I would say in the order of, I'm guessing, based on the twenty wells, there are 60 wells in the Inbe, at my last count, the State's royalties in there must amount in the order of $250 or $300,000.00 would be my guess, in the general area.

Q It's not your purpose here as a witness to comment with respect to the hydrology of the area at this time?

A No. I'm really not qualified.

Q Will it be agreeable with the New Mexico Salt Water Disposal Company to drill additional wells to establish a

monitoring system for this project if that should be the wish of the Commission?

A Yes. As a matter of fact, we have discussed the probability of the need, not only for the State's protection, but for our own protection. I should imagine that we would want to take equal precautions and would be very happy to do so, to afford assurance to all involved that no unreasonable damage were being done.

Q And I assume it would be agreeable with the New Mexico Salt Water Disposal Company to make full reports and full disclosures of this information about this to the Commission and to the office of the State Engineer?

A Yes. We would propose to do that.

Q Do you have anything further you wish to comment upon with respect to this application at this time?

A Well, I think anything I would say in connection of the critical nature would be a reiteration of what has already been said and what this Commission is well aware of. There is a real problem out there. Some of those operators are suffering a real hardship and certainly there is, as in all cases, an extreme temptation to use whatever means possible to get rid of salt water, and I think this system that we propose would be the most expeditious and economical at the moment that I know about.

There are -- Mr. Stolts, I believe, is proposing a service in playa lake to the west of the one on which we are making this application, but it's my observation that the capacity of that lake has already been exceeded and assuming that he does get his system in in a reasonable time because I believe an examination of the water production in the Bagley area alone will demonstrate that his lake will be fully reserved by the present demands from Bagley, which I think he has already signed up quite a few contracts.

There is another service in the area, Rice Engineering, which I am told and several of the operators have indicated that Rice Engineering will have to double its capacity or enlarge its capacity to take care of the Middle Lane and Inbe unconnected wells.

MR. PORTER: Would that require additional wells to be drilled?

WITNESS: You mean in the Rice?

MR. PORTER: Rice Service, yes.

WITNESS: I imagine it would. Just as a rule of thumb, on 12,000 feet of two inch tubing, just the head to dispose of it, I believe you have about 750 pounds differential working pressure, your optimum is about ten to 12,000 barrels a day into a Devonian well, so I would think that they would be getting mighty close to capacity, though I can't speak for

them. I certainly would not want to.

Q (By Mr. Morris) I take it that it is your opinion based on the contracts that you already have and your investigation in this area, that there is a definite need for this service that you propose?

A Yes, very definite need.

MR. MORRIS: That's all I have on direct, Mr. Porter.

MR. PORTER: Mr. Lovelace, I believe that earlier in your testimony you indicated that the plan would be to convey the water to a central line sump?

WITNESS: Yes.

MR. PORTER: Where it would be picked up by pipeline and taken to this lake, if approved?

WITNESS: Right.

MR. PORTER: Would this go into the sump by pipeline from the well?

WITNESS: Yes, it would. It would be gravitated into the sump by use of water legs or pressure legs to be set at or near the battery and the water discharge from the heater treater into the water leg and be gravitated into the low spot where we would locate the sump.

MR. PORTER: What kind of a lining would you propose?

WITNESS: Probably concrete. It would not require much of a sump, all we want to do is provide a means to

skim any oil to avoid the possibility of getting any oil into playa lake, and I should imagine it would be a rather modest area, the engineers are working on that right now. In other words, it's not going to be a large affair.

MR. PORTER: Does anyone else have a question? Mr. Nutter.

MR. NUTTER: Mr. Lovelace, now, in this Middle Lane-Inbe area, how many facilities are currently operating for the disposal of salt water?

WITNESS: Two, I presume one is by truck and the other is Rice Engineering.

MR. NUTTER: Well, now, several years ago, I think, Rice put in a system here and didn't L. R. French put in a system of his own in this particular area?

WITNESS: Very possibly he has some production in the Inbe Field, though I do not know. I know he produces a lot of water there, he has to be going somewhere with it, so possibly he does have a place for his water. I don't know, Mr. Nutter.

MR. NUTTER: You don't know then, what the capacity of Rice is and what amount of water they are presently taking and you don't know what the capacity of the French well would be?

WITNESS: No.

MR. NUTTER: Or how much water he has taken?

WITNESS: No. All I can tell you is, about the Rice system, that they have advised some of the operators in the Lane Field that it will be necessary to loop their line in order to take care of them and sell them into a co-op system on a per well basis. Here again, don't be mistaken, I am not trying to tell you what Rice's business is because I don't really know. It's my understanding it would encounter some delay because it requires committee approval of the co-op members.

MR. NUTTER: But right now, the problem would be looping the lines?

WITNESS: Assuming their present Devonian well, they have one Devonian well about six miles south, I believe, that they are disposing of the water now. I don't know how near the capacity of that well is. I would guess it would not, I'm just guessing here, again, based on the water that I know is being produced in the Middle Lane, that certainly it must come awfully close to filling their Devonian well.

MR. PORTER: Are you referring to what Mr. French called the Useless Disposal System?

MR. NUTTER: I believe that is the name of the system, Useless Number 1 or Needless Number 1.

Mr. Lovelace, now, you mentioned that you had 20 wells already committed to this produced system. What's the total production of water per day from those wells at this

time?

WITNESS: Around -- When the twenty wells get on production, and judging from the present production, it would appear about 4500 barrels per day.

MR. NUTTER: That would be their present rate or their ultimate maximum?

WITNESS: I think this would probably be their ultimate maximum from the twenty wells.

MR. NUTTER: You are figuring just over 200 barrels a day from the wells, then?

WITNESS: Yes, and I think a further check with the field will reveal that's a pretty close figure. They vary all over the lot. There are some of the wells that is producing 17, 18,000 barrels of water a month. Yet there are some that are producing 50 or 60 barrels. I believe the average in Inbe is in the order of 200 barrels per well.

MR. NUTTER: Does the contract that you have signed and have offered to others provide that you can shut the intake of water into your system off in the event that the wells should exceed 10,000 or 15,000 or 12,000 whatever you limited to?

WITNESS: This is true. We have to have a safety clause because we have no way of knowing what the total ultimate production of water will be from the wells that we tie on

but we have a clause, a last on, first off clause in the contract.

MR. NUTTER: And also I presume that this shut off would be subject to some water level in the event that the Commission would establish a maximum water level for the lake?

WITNESS: Yes, very definitely.

MR. NUTTER: It would be the same thing, last on, first off?

WITNESS: Right.

MR. NUTTER: You mentioned to Mr. Porter that you were planning a similar tank or receptacle in which you could remove the oil from the water. You would also meter the water, I presume?

WITNESS: Yes, we would plan to install a meter on the downstream side of the turbine pump to meter the water into the lake. It's the only way we would know how much water we were disposing of because otherwise there are no provisions for meters at the batteries.

MR. NUTTER: But you would have a total metered stream with corrosion resistance type meters?

WITNESS: Yes.

MR. NUTTER: You could also install gauge marks to determine the water levels in the lake?

WITNESS: Yes, we would propose to do that. As a

matter of fact, we will, for our own convenience and protection, gauge. We have drilled several monitor wells already which we would propose to gauge and sample every month for our own information.

MR. NUTTER: And you would be willing to drill such other wells as the Commission might deem necessary?

WITNESS: Yes, this is true.

MR. NUTTER: I think that's all.

MR. PORTER: Does anyone else have a question? Mr. Utz.

MR. UTZ: You mention 12,500 barrels per day that you intended to run into the lake, and your application says 15,000, is that an amendment?

WITNESS: Yes, at the time we put that application in we had not finished the engineering studies, Mr. Reed had not concluded his studies and we feel that's a little high based on his findings.

MR. UTZ: So your 12,500 would be maximum that you intend to put in?

WITNESS: Yes.

MR. UTZ: Is there any other formation in this area that would take water except the Devonian that you know of?

WITNESS: There are formations that are currently being injected, it's my understanding but if I'm not wrong,

they're requiring considerable pressure and elaborate pumping system to get any appreciable rate of injection into, for example, to the Glorieta or San Andres formation. I believe those are the only other two that I know about. There may be others. Rice did for a while inject into the San Andres adjacent to the pool but that has been abandoned and I am told by some of the co-op partners that the cost became excessive because of the necessity to pump salt water with that kind of equipment. It gets pretty, as you know, pretty expensive.

MR. UTZ: In your opinion, the Devonian is the only practical formation to dispose of this water?

WITNESS: In quantities of this amount, I certainly do.

MR. UTZ: Did you state what a Devonian well would cost for a disposal well?

WITNESS: Well, I did not, but in my opinion, a safe figure on the average abandonment, assuming no junk in the hole, somewhere in the order of $125,000, I would budget. I think a great deal would depend on how you completed the well, whether you completed with liners or a full string from top to bottom.

MR. UTZ: You mentioned that it's costing you about 17¢ a barrel to truck the water away now. Did you say anything about how much it's going to cost with your proposed system?

WITNESS: My estimate is about three cents a barrel. The basis of our charge will be a per well charge regardless of the amount of water, for the reason that I think it's going to be very difficult to meter water at the battery with any degree of success because of the attrition occasioned by the corrosion of the meters and other costs that would be encountered.

MR. UTZ: I believe that's all I have.

MR. PORTER: If no further questions, the witness may be excused.

(Witness excused.)

ED L. REED, called as a witness herein, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. MORRIS:

Q Mr. Reed, will you please state your name and where you reside?

A My name is Ed L. Reed. I live at Midland, Texas.

Q What is your profession, Mr. Reed?

A I'm a consulting hydrologist.

Q Have you previously testified before the New Mexico Oil Conservation Commission and established your qualifications as a matter of record?

A Yes, sir.

Q When was the last time you testified before the Commission?

A I believe in July.

Q Was that in connection with the case also related to disposal of salt water in playa lakes?

A Yes, sir.

Q Just to make it clear, that was the Stolts application in the Lane Lake area, is that correct?

A Yes, sir.

Q Have you made a study of the playa lake that is involved in this application?

A Yes, sir.

Q Will you relate to the Commission, referring to the exhibits that have been marked and posted on the bulletin board, what basic data you have derived in the course of this study and what conclusions you have reached with respect to the fact of the present lake on the fresh water zones in the immediate area?

MR. PORTER: Mr. Reed, before you do that, would you explain to the Commission just what is meant by playa lake?

A Yes, sir. Playa lake is a lake area generally considered to be at or near the water table which derives its water from a combination of inflow, which cannot get out by reason of the fact that the basin is closed and by a ground water

discharge by reason of the fact that the lake is at or near the water table. The water is flowing into the lake both at the surface and underground water zones escape by evaporation and occasionally by ground water outflow.

MR. PORTER: Thank you.

Q (By Mr. Morris) Along those same lines, Mr. Reed, in playa lakes do you customarily find a high degree of concentration in dissolved solids?

A Yes, sir. The investigation we have made of the North Lake of what has been called Four Lakes, has consisted in a review of the published geologic and hydrologic data in this area by the USGS. It has consisted of field work connected with the determination of water levels in wells adjacent to the lake, the taking of water samples for chemical analysis purposes in the lake, and in the wells adjacent to the lake. It has consisted of the examination of drillers' logs from a large number of seismic shot holes that have been drilled in the vicinity of the Four Lakes. It has consisted in the field, supervision of the drilling of four test holes around the lake, microscopic examination of the drill cuttings and collection of water level data and water samples for quality data.

It has consisted in a review of surveyed data, topographic data prepared by West Engineering Company of the lake in the immediate environs and the additional determination of

elevations of critical water wells by West Engineering and the staking and running of elevations of the four monitor wells.

In addition, three exhibits have been constructed from the compilings of this data. One exhibit which I will discuss shortly relates the topography of the Pre-Ogallala surface which, in this area, is a little bit complicated. The second exhibit which describes the attitude of the water table in the two aquifers that are present, and lastly, the two cross-sections that cross the critical area which demonstrate the geological and hydrological relationships of the lake to the surrounding area.

You have copies of all of these exhibits before you. We have additionally examined the performance of this lake under four separate conditions which I will describe later. All of this data has been furnished first in a preliminary form, and this data in the final form to the State Engineer's Office.

First, let me describe the topographic map which has been prepared by John West Engineering Company, and which would be this exhibit here, I presume it has been marked Exhibit 1. This is a topographic map of the north one of the Four Lakes which occupies a portion of Section 32, Township 10 South, Range 32 East, and a portion of Section 2 and a portion of Section 3 in 11 South, 32 East.

Q You mean 34 East, don't you, Mr. Reed?

A 34 East. Well, I do, but it's been shown as 32. I had not noticed that but it should be 34.

Q That is Section 32?

A That's right. That is 32. This is in Section 34 East. This topographic map indicates that the lowest point in the lake is at an elevation of 4118.4 which is an estimated point since the water was in the lake at the time this survey was made. It indicates that the water line at the time this survey was made was at elevation 4118.5 and within that contour the total land surface is about 54 and a fraction acres.

It shows the high water mark which is inferred by reason of the intersection of the flat lake bottom surface with the steep cliffs that surround this lake at elevation 4120. Inside that contour there is 158.1 acres. This map also shows two springs or seeps which are situated at the west end of the lake and are at elevation 4119.5 and 4119.4. The map shows typical aquifer configuration in that there is a closure of the topography all the way round. Surface water comes in from the northeast, from the northwest and in two smaller ravines which have small watersheds on the west side of the lake.

This map then gives the basic geography of the lake, it's location, it's elevations, critical elevations and the

area. The area has been plenimetered directly from the map. Are there any questions about this exhibit?

Q Mr. Reed, it may be out of order in your presentation, but what is the concentration in dissolved solids in the lake at the present time?

A The chloride concentrations are 73,500. The sulphate concentrate at the time this sample was taken in June of 1967, 4100.

MR. PORTER: Is that parts per million?

A That is parts per millliliter.

MR. PORTER: You wouldn't want to drink that water?

A No.

Q (By Mr. Morris) Go ahead.

A Are there any other questions about Exhibit 1?

MR. PORTER: There might be one. Go ahead with your other exhibits.

A Exhibit 2 is a map which has been prepared under my supervision, mostly by me, describing by means of a 25-foot contour topography of the surface underlying the Ogallala. In this area under the Ogallala, there is present a body of cretaceous rocks, great lays, limestones and a basal sand, this underlies the Ogallala in part. We have drawn on the map a line across the map in a genrally northerly direction which we have labeled the cretaceous subcrop. This line

reflects the western or southwesternmost limits of an exposure of cretaceous age rocks underlying the Ogallala which covers the entire area. West of this line, the Ogallala rests directly upon triassic red clays, east of the line the Ogallala rests upon cretaceous sediments and a further fine dotted line has been drawn upon this map, which extends on parallel with the western limit of the cretaceous which outlines that portion of the area in which the Ogallala is above the water table and the ground water in this area in the north central part of the map is derived entirely from beds of cretaceous age and in this instance basal sands which have been referred to as the Trinity.

Although the Ogallala does come across this high area, it is then above the water table. This map shows a trough in this general area which I believe will tie in with a buried stream channel which we have examined in Township 10 South, Range 33 East. The contours were not extended to tie in with the other map for the reason that the base used for the elevations seemed to be somewhat different and we were not able to correlate directly in terms of elevation.

This map shows a cretaceous hill located west of North Lake in Sections 3 and 4 of 11 South, 34, a very steep escarpment facing south and shows a rather broad low area around the lake itself. Apparently a structural trough. On

this map also I have shown the location of the north-south cross section which is the upper one of Exhibit 4, and the location of the east-west cross section, the lower one of Exhibt 4. The north-south cross section starts actually just about Middle Lake and extends northward back into the Ogallala ground water north of the lake. Now, at this time, are there any questions about this exhibit, Exhibit 3?

GOVERNOR CARGO: What kind of evaporation do you have on this lake?

WITNESS: We have these figures, I will give those to you in just a minute. I can't remember them from memory. I have them in the file. Exhibit 3 is a water table contour map in which we have shown in the central part of the area, in the area labeled cretaceous water, the attitude of the water table in the Trinity sand. In the Trinity sand, the water table is dipping in a southeasterly direction and at a very relatively steep rate which we infer to be related to lower permeabilities in the Trinity sand. Outside the limits of Ogallala water, as described by the dashed line, we have shown the configuration of the water table in the Ogallala.

It shows a broad trough extending northward in the vicinity of Middle Lake and South Lake and a trough extending northwestward up toward Lane Lake, which also is shown on the

Sidney Ash's map in the hydrologic atlas but not in such detail. It also shows a little zone of Ogallala water on the north end of the map which probably comes around the cretaceous side and ties back into the Ogallala to the east. We have inferred on this map and, based upon any cross-sections and careful study of the logs of the cretaceous wells and of the Ogallala wells, we have inferred leakage from the Trinity sand of cretaceousage into the Ogallala on the western or south-western margin of the cretaceous high. We think somewhere in this area there is hydrologic continuity between the cretaceous and the Ogallala.

We have also inferred in the cross-section and from the contours that the Trinity water dips under the lake. The water table dips under North Lake and occupies some position under the lake and continues dipping southward until we again reach the outcrop of the cretaceous, and there would again, in all probability, be hydrologic continuity between the Trinity and the Ogallala.

Additionally on this map, we have shown the results of the chemical analysis of the waters taken from the wells in the area. From previous work, Ogallala water in the north-west part of the area in 10 South, 33, chlorides is 196, the sulphates are 439. Ogallala water north of North Lake and north of the cretaceous outlayer, the chlorides are 89, the

sulphates are 161, good quality water.

In the area of cretaceous water a well in Section 29 of 10 South, 34, cretaceous well chlorides are 177, sulphates are 284. Test hole number 1, which was drilled as a part of this investigation and for which you have sample descriptions and statistical data in your file, the chlorides were 71, the sulphates were 184, very closely similar to Ogallala water.

Coming south a seep sample in the west end of North Lake in June of this year had a chloride concentration of 725 parts per million, a sulphate concentration of 80 parts per million. The chlorides are high. As I have testified before the lake itself has a chloride concentration of 73,500 milli equivalents per liter. A sulphate concentration of 4100. Test hole number 6 also drilled as part of this investigation and which found what we considered to be Ogallala water, has a chloride concentration of 184, sulphate of 270, still good quality water.

The windmill immediately south of the south bank of North Lake sampled in June of this year, chloride concentration of 200, a sulphate of 90. Coming eastward, test hole number 5, again drilled as a part of this investigation, and each of these four test holes have been equipped with two and a half-inch tubing slotted at the bottom and equipped as monitor holes both for water level data and water quality data. Test hole

number 5 had a chloride concentration of 2387 parts per million and a sulphate concentration of 2973 parts per million. This is brackish water. Test hole number 4, the last one of the four that we drilled in this investigation, has a chloride concentration in August of this year of 1512 parts per million, a sulphate concentration of 5341. Without going into detail, the balance of the wells south of North Lake, all of which we believe to be Ogallala wells, have relatively good quality water, one exception and in this instance, we were not able to sample directly from the well. We had to sample from the stock tank supplied by the well but I think the quality should be relatively representative, the chlorides were 530, the sulphates were 166. This is the only deviation from the general pattern of chlorides in the order of 75 to 200 parts per million and sulphates in the range of 150 to 350 parts per million.

Composite sample of three irrigation wells here, for example, chlorides 184, sulphates 391. Coming now in some more detail, the water level data derived both from the drilling of the test holes and that obtained in the wells themselves revealed the following data; test hole number 1, which was drilled north of the limit of Ogallala water and which found no water in the Ogallala sediments, has a water level elevation of 4,098 feet. This is Trinity water and occupies a position lower regionally than the other wells. Again, the

spring in the west end of the lake has an elevation of 4119, which is several feet above the water elevation in test hole number one. Test hole number four has a water level elevation of 4123, which is about three feet above at this time, about three feet above the 4120 maximum contour. Test hole number five has a water level of 4119 which is just lower than the spring, which is 4119.5 or .4, and a foot below the high water mark or the strand line in the lake. The windmill opposite the south margin of the lake has a water level of 4121, which is very close to the maximum elevation in the lake. Test hole number six has a water level of 4123, that is the detail.

The other water level data fits nicely into this general picture, as I say, showing a trough in the water table in the central part of 11 South, 34, with the exception of test hole number four, which might be explained by a number of ways.

The quality data relates itself very nicely to the water level elevations as determined in this study. Test hole number six, 4123, four feet above the spring, approximately, has good quality water. Test hole number one, 4121 has good quality water, test hole number five, 4119, which is below the level of the lake, is brackish water. Test hole number four, 4123 has brackish water. We don't know the answer to this entirely, it has been suggested and I would certainly not argue, that the

limits of the lake may have been larger at one time and this may represent initial or in-place brackish water.

An additional explanation which I think is equally valid and which we have observed in other playa lake areas would refer this water level elevation which was taken at a time of heavy rainfall to a higher position than it would occupy in other times of the year. It is not uncommon to have ranges of one and a half feet plus or minus or a total of perhaps three feet in the total range of the water level in shallow water of this nature, in response to secretions to the ground water by rainfall and water utilization by plants during the critical periods of the year, so this 4123 may represent a maximum level, it may occupy a lower position at other times of the year.

Be that as it may, I believe that this map and the cross-section which I will describe reveals that there is hydrologic connection, hydrologic continuity at this time and has been for many hundreds of years in the past, many thousands of years in the past, hydrologic continuity between North Lake and the Ogallala water which occupys a position to the south and at a lower elevation and to speak simply, water from North Lake at times does discharge into the ground water zone.

I think this can be shown a little more clearly in the north-south cross section which starts at this point in

Section 20 of 10 South, 34 and extends across the area down to Middle Lake in Section 10 of 11 South, 34. This cross section shows on the north end a little remnant of Ogallala water coming up against this hill of the cretaceous as shown in the western end of the section. This water probably actually goes around the hill, shows the steep dip of the cretaceous water table into and probably under the lake. It shows the cretaceous coming to the surface in North Lake of the cretaceous as the outcrop around the north and west margins of North Lake.

It shows the Ogallala lapping up against the lake on the south side overriding the Triassic, on to the cretaceous and shows the water table from North Lake dipping southward in the manner that we have indicated on the water table map, water table dip and water movement from the lake southward into this big, broad trough. The east-west cross section simply serves to clarify some of the complex relationships across the cretaceous mound, which builds up in the area immediately west of the lake at this point, the Ogallala resting directly on triassic rocks to the west, resting on cretaceous rocks around the lake and potential leakage along the boundary.

It shows the cretaceous outcropping under the lake and Ogallala again to the east, saturated Ogallala to the east. In summary, this study and the chemical data most precisely suggests to me that at times, and we don't know whether this

is continuous, obviously it is not continuous or probably not continuous, but at times, cyclically depending upon the rainfall, the inflow into North Lake water has discharged historically from North Lake into the Ogallala, it is reflected in the quality of test hole four and test hole five, where this water goes, the extent we do not know, the water table data would suggest movement into the central trough and creation of a whole hydrologic system which involves South Lake, Middle Lake, East Lake and North Lake.

The precise position of this brackish water we do not know. We simply know that it is there. Are there any questions on these exhibits up to this point?

Q Mr. Reed, do you know whether the water that is in the other three of the four lakes that you've mentioned in this area is also brackish water?

A Yes, I am quite sure it is. I believe that this lake has been sampled by the State Engineer. I am sorry but I can't quote the figure but it has been described as brackish water.

Q You are referring to South Lake?

A Yes, and I believe that I said that Ash's report refers to each of these lakes as brackish lakes, yes, sir. I've not sampled them.

Q So your conclusion is that there is an area south of North Lake in which brackish waters already are present?

A Yes, sir.

Q Mr. Reed, did you carry your study on further to determine what the effect would be on this lake and on the Ogallala formation and Ogallala water south of the North Lake area by the disposal of produced salt water into this lake in the volumes that the application in this case proposes to dispose it?

A I have examined the disposal of brine into this lake under four conditions to determine the amount of water that would be present in the lake at various times and under various conditions. This study has been predicated upon the assumption that at the time brine was disposed of into the lake, the water would be present in the lake at contour 4120. At which point there would be 158.1 surface acres of water. Now, to the extent that this would be true, I can't answer. I don't think the water actually naturally reaches 4120 very frequently or for very long at a time, but we had to have some starting point and we felt that this would provide a reasonable approach to the abilities of putting brines into this lake at certain rates and under certain conditions.

The four conditions that we have examined are first, the input of 10,000 barrels per day under average conditions, average conditions of evaporation and rainfall. Second condition would be the disposal of 10,000 barrels per day under

minimum evaporation conditions and I will take a little time to describe this. We have gone to the evaporation records at Portales and have determined the year since about 1934, the beginning of the record, the year at which minimum evaporation took place. This, I believe, was the year 1949. These evaporation rates by months were then corrected for the Tatum area by the same factor that was used in the extrapolation of the average conditions and the rainfall for that particular year of 1949 at Tatum was used to derive minimum evaporation figures.

The average net evaporation at this area has been calculated at 61.14 inches, this is under average conditions, annually. The minimum evaporation has been calculated to be 37.40 inches. To go back to any three 12,500 barrels per day under average conditions, condition four, the same input under minimum evaporation conditions. In summary, under condition one, of 10,000 barrels per day under average conditions, the maximum depth of water in the lake would be two and a fraction inches, a little under two and a quarter inches, and there would be an accumulated amount for evaporation of inflow water of about 24.77 inches.

Under this condition, there would be some water in the lake for four months out of the year. Under condition two, of 10,000 barrels per day under minimum conditions, the maximum depth on top of the 4120-foot contour would be about 6.9

inches and there would be no room for evaporation of inflow water on an annual accounting basis, and the water would be in the lake at sometime or in some amount for about eleven months out of the year.

Under condition three, at 12,500 barrels per day under average conditions, the maximum depth of water would be about 4.8 inches on top of the 4120 contour and there would be available about sixteen and a half inches to evaporate inflow water. Water would be in the lake something over six months but less than seven.

Under condition four, 12,500 barrels per day under the minimum year for which we have the record, the maximum depth of water would be 12.14 inches. There would be a carry-over at the end of that year of seven and a quarter inches and of course, the water would be in the lake for something over twelve months.

Q What conclusions can you draw from this study, Mr. Reed?

A The conclusions that I can draw from this study are first, that under natural conditions, the brackish water which is in the lake and which occurs in the lake both by ground water discharge and by inflow and solution of the evaporates does go by discharge into the ground water zones at certain periods of time, presumably at certain critical elevations,

depending upon the amount of inflow water. The addition of brines to this lake will undoubtedly increase the time at which water will be present in the lake, will increase the depths in the amounts that I have indicated, ranging from two inches to a maximum of twelve inches under minimum conditions. There will be some additional amount of brine put into the ground water reservoir by reason of the additional time and perhaps additional elevation that might occur.

My further conclusion is that based upon the heads that we're talking about here and we're speaking now about maximum heads starting from the 4120 contour, the pattern of movement of the brines will in my judgment not materially change from those which have historically occurred. We can't define with the existing data the precise position of this brackish water in the Ogallala south of the lake, we don't have enough data, but whatever position it does have, is dependent upon local permeability factors as well as the hydrologic gradient.

Within certain limits of angle, depending upon the amount of the gradient and the amount of maximum variation in permeability within certain angular limits, the permeability can be the deciding factor in the actual position of movement of the brine and I suspect this is true in this particular instance, within certain limits permeability variations are

the controlling factors. We don't have the data to define this but within the limits that we are speaking of here as to depth of water, it is my judgment that the path of movement would not materially change the concentrations, yes, the amounts, yes, the pattern, no, with one possible exception, there is in my judgment there is a possibility that the wind mill on the extreme south end of the lake and near the lake and which has an elevation of near top of the lake itself, could possibly be affected other than that, I would say the effect would not materially change from that which already exists and any modification of quality by discharge would probably take place regardless of whether the brine is put in the lake or not, I believe this to be true.

Q Mr. Reed, if the Commissior sees fit to grant this application and should further see fit to establish the requirement that the applicant monitor the system, monitor the lake area, what recommendations would you have for the drilling of additional wells or the provision for further control data in this area?

A To begin with, I think it would be desirable, I think it would be required that an additional test hole be drilled on the east side of the lake in the eastern or southeastern portion of Section 32, 10 South, 34, to be drilled and cased in the same manner that the present test holes have been drilled.

It might be desirable to have a test hole somewhere in the center of Section 11, 11 South, 34 for the purpose of defining at this time the quality of water at that location. I can't believe that this would have much value as a monitor hole because of the distance from the lake, the hydrologic gradient and the probable rate of velocity of flow in the reservoir. I would be more dependent upon those test holes which are near enough to the lake to provide some measure of data within a reasonable time limit. We're probably talking about only 200 feet a year or less of movement in this reservoir. So, a monitor hole any distance from the lake would have value to me only in defining with more certainty the nature, the quality of the Ogallala water in this unknown area dividing these two lakes, the East Lake and South Lake and North Lake in this triangle. It is my judgment that at least one more test hole east of the lake, together with the four test holes now drilled and the wind mill which is situated on the south bank of the lake, examined periodically both as to water level and as to quality would provide answer to the questions that I think are of importance.

Additionally, since there is no data so far accumulated on this lake or any other lake which would relate leakage to a stage in the lake, an elevation, a critical elevation, since there is no data relating runoff in terms of acre feet,

or stage in the water, water in the lake itself, it's my judgment that measurements of the lake to begin with a little bit more accurate contouring of the lake bed itself, in order to produce an area capacity curve and an elevation area curve in order to examine hydrologically the inflow into this lake would be desirable.

This is a minimum effort, it would require very little additional work but I think it would be desirable in order to produce one-foot contours of the critical lake bed surface, hopefully at a time when it is dry, so that accurate data can be accumulated, then accumulation of a hydrologic information, hydrology of the lake itself in terms of runoff area, capacity curves, evaporation data, determination of critical elevations would be in my judgment, necessary to make a complete appraisal of this problem.

Q Mr. Reed, you mentioned that you might reasonably expect a lateral movement, the water out of the lake, something in the nature of 200 feet a year --

A Velocity would be somewhere in this vicinity, I should think. We don't have any precise figures but I am guessing. That would be in the range of the rate of movement in the ground water zone, yes, sir.

Q If that rate, 200 feet a year, could be taken as a basis,then it would take some 25 years or more for water to

actually move across a whole section?

A This is true. In the absence of additional pumpage, if you impose additional pumpage, of course, this figure will change materially. Under present conditions, yes, I think this is true.

MR. PORTER: What was that term you used, "impose additional pumpage"?

A Yes, sir. Unless you drill more wells that carry water heavily in the area.

Q (By Mr. Morris) As I understand, carrying you with the question Mr. Porter asked you, you are talking about additional withdrawals from the Ogallala?

A Yes, sir.

Q Assuming no further withdrawals from the Ogallala then, the rate somewhere in the neighborhood of 200 feet a year of lateral movement, you would consider accurate?

A I think this is to be reasonable, yes, sir.

Q Mr. Reed, you have prepared as Exhibit 5 in this case a collection of some of the basic data that you have used in this case?

A Yes, sir.

Q Would you just briefly identify what you have included in that exhibit?

A Yes, sir. What has been included in that exhibit are,

first a tabulation of microscopic sample description of the drill cuttings taken from the four test holes with the statistical data derived form these holes. Secondly, copies of Southwestern Laboratories analyses of those samples which we personally took in the field. Thirdly, a tabulation of chemical analyses, I believe, prepared by Halliburton Corporation referring to certain specific wells and lastly, a tabulation of chemical analyses by Core Laboratories which were furnished to me by the client and which have been included in the maps.

Q Have you also reviewed an analysis of the produced water that the applicant proposes to inject into the lake?

A Yes, sir, and that is not posted upon the map and I do not have a copy of the analysis but I have examined it and I will read it into the record for the purposes of the record. The brine which is proposed under this application to be disposed of in this lake is an average calcium concentration of 4200 and I presume this is equivalent parts per liter. Magnesium concentration of 830 and chloride concentration of 59,000. A sulphate concentration of 820 and a bicarbonate concentration of 160 perts per milliliter or parts per million.

MR. PORTER: What was the 4200 parts per million?

A Clacium.

MR. PORTER: And 59,000 parts per million, chlorides?

A Chlorides, yes, sir.

MR. PORTER: Thank you.

COMMISSIONER HAYES: Mr. Reed, what is the highest water level that you think this lake has been?

WITNESS: I suspect it has been to 4120. The evidence would indicate this.

COMMISSIONER HAYES: What is the water level on that section, I mean the elevation on Section 11, that's to the south of it?

WITNESS: In the windmill in Section 11?

COMMISSIONER HAYES: Yes.

WITNESS: 4121, I believe. Just a minute, 4121.

COMMISSIONER HAYES: 4121?

WITNESS: Yes, sir.

COMMISSIONER HAYES: Thank you.

WITNESS: That's a static level, we shut the well in and measured the static level. The pump level would be something lower than that, 4115 or 20. We don't know, we didn't measure the pumping level.

COMMISSIONER HAYES: It wouldn't be too hard to keep the fresh water out, the rainfall drainage that goes into this lake, it wouldn't be too hard to keep that water out of this lake if it only covered 150 acres, right?

WITNESS: I suppose most of the water could be diverted. I don't have enough topographic data to answer the

question directly, but it's my judgment that most of the water comes in at northeast and southwest corner. I believe that concrete blocks and rechanneling could divert this water around the lake, yes, sir. Now, what problems would be involved, I can't answer. I have not examined, we don't have enough topography at this time to make a judgment.

COMMISSIONER HAYS: I'll direct this question to Mr. Lovelace. Have you-all ever looked into that situation?

MR. LOVELACE: No, we have not. I have been around the lake several occasions and it would be my judgment to try to divert the water by any real system of dikes would be rather prohibitive. The lake itself is in a depressed, as indicated by the topography there. I don't believe there would be any place to conduct the water.

WITNESS: Unless you went some distance away, these short tributaries are not contributing much of the water. The main contribution from the watershed is to the northeast and to the northwest.

MR. LOVELACE: We have aerial photographs taken before those rains that were in July and pictures taken after, and as far as we can tell, there's no appreciable increase of water in the lake, so I don't believe that the drainage area is of great consequence, at least, I think something like eight inches of water had fallen out there.

COMMISSIONER HAYES: Okay. Thank you, gentlemen.

MR. PORTER: Mr. Morris, do you have very much more direct examination?

MR. MORRIS: No, as a matter of fact, I would like to add to the official Exhibit Number 5 a copy of the water analyses that Mr. Reed read into the record. At this time, I would like to offer into evidence Exhibits 1 through 5.

MR. PORTER: And you would like for this to be attached to Exhibit 5?

MR. MORRIS: Yes, sir.

MR. PORTER: Are there any objections? The exhibits will be admitted.

(Whereupon, Applicant's Exhibits offered and admitted.)

MR. MORRIS: That's all I have on direct examination.

MR. PORTER: We're going to recess the Hearing until 1:15. I am sure there will be some cross examination of the witness. He will be available for cross examination at that time.

MR. PORTER: The hearing will come to order, please. Mr. Morris, I believe you had concluded your direct examination of Mr. Reed?

MR. MORRIS: Yes, sir.

MR. PORTER: Does anyone have a question? Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Reed, as I understand it here, all of this fresh water in this area is produced from the Ogallala formation with the exception of that one small area, north and northwest of the lake which you have labeled as being cretaceous water?

A Yes, sir. The cretaceous water actually extends on north and northwest.

Q According to the area of your maps, everything is Ogallala water with the exception of that area?

A Yes, sir, this is my opinion.

Q Well, now, you have got water levels on numerous wells here, most of them being Ogallala wells and then you have got a composit sample of three wells down here in the southern part of the plat. Do you have any production figures or any knowledge of the rates of withdrawal from any of the wells in the area?

A No, sir, the only ones that I think would be signif-icant, would be the irrigation wells and I do have some

information on their apparent capacities, I have nothing on their producing schedules but, we do have tabulated, some information. There are three wells in the vicinity of well number 8. And, our record reflects that three are about five or six inch wells. That's three hundred, maybe five hundred gallons per minute. We have not measured. Well number 9, actually is an abandoned irrigation well. Well number 10, we have no data on.

Q Where is well number 10, Mr. Reed?

A It's in the south, it's in the south quarter corner of Section 24, 11 South, 34.

Q Right, I had my hand on top of it.

A Yes, sir.

Q Now, the composit is for the three wells there in Section 23?

A Yes, sir, I believe Mr. Nutter that those three wells pump into a common line. We sample from the common line.

Q Are those irrigation wells in the Lea County basin?

A I believe they are, sir.

Q Do you know what the proration is for the three wells?

A No, sir, I do not.

Q But, those are the only irrigation wells that you know of that are on this exhibit?

A Yes, sir.

Q And the rest are all stock or domestic wells?

A Yes, sir. The State Engineer's office has records on some wells that we could not find in the field and the rancher, the grant leasee, had no knowledge of these wells. We think we have gone to all of the wells that are in existence in the general area of the lake.

MR. HAYES: Where is the irrigation well that you're talking about?

MR. NUTTER: Down there in Section 23.

MR. HAYES: How far is that from the lake?

A The north would be two and a half.

MR. HAYES: Go ahead, I was just lost.

Q (By Mr. Nutter) Now, all of the water levels that you have shown us on your exhibit, were obtained this summer in preparation for this exhibit here, Mr. Reed?

A Yes, sir.

Q Are there any water tables available to you or the State Engineer's office on any of these wells previous to the summer of 1967?

A Let me back up a little bit. The water level on an irrigation well in Section 23 is a 1954 level, I believe. I believe that's 1954. We had some 1961 levels but I believe we did not use those. I believe we used our own measurements.

Let me be sure that's the truth. For example, here is a well, number 4, 2-14-61, measured at 10.61, we measured it on August 2nd, 1967, at 10 feet even.

Q Where is that well, Mr. Reed?

A That well is in Section 15, 11, 34. It's well number 4, northwest of south lake.

Q Now, what was the water level in 1961, again?

A 10.61 feet.

Q Well, we show here on this exhibit, a water level of 4100 feet. Can you equate that --

A That's from our measurement of 10.00. Well number 5 in the south quarter corner of Section 15, is a State Engineer's measurement of February 14th, 1966.

MR. LOVELACE: Mr. Reed, what he asked, do you have that correlated with sub-sea data?

A Oh, all of these are referred to as ground elevations of the well, yes, sir.

Q (By Mr. Nutter) In other words, for that number 4 well, you said your measurement was 10.00? And that correlates to a water level of sub-sea, forty-one hundreds?

A Above sea, forty-one hundreds, yes, sir.

Q And the previous measurement was 10.61?

A Yes, sir.

Q So, actually, the water level is higher than it was

previously?

A Yes, sir. Here is a well number 7, it's in Section 16.

Q Yes, sir.

A February 14th, 1966, State Engineer's measurement was 25.03. Our measurement of August 2nd, '67, 24.3 or one foot higher, approximately.

Q How would you account for the fact that you have two comparitive water levels here and the water levels have increased when this is in fact, a ground water mining operation going on in this area, and we are withdrawing at a rate faster than is appreciative?

A It would be my judgment Mr. Nutter that the irrigation development has not progressed to the point of affecting the water levels at this distance, from irrigation. This would require a good many years and it's my opinion that these wells that I have given you figures on are not affected by irrigation development and the differences in water level measurements is of the order that I have testified to this morning, probable ranges at water levels at different periods of time during the year, in response to rainfall and evapotranspiration losses or other natural discharges.

Q And one of your explanations for the high water level in your test hole number 4 was the fact that it was taken after a period of heavy rains?

A Yes, sir. And it is in an area of rather sandy, near surface materials.

Q And this water level down here in well number 7, in Section 16, which also was taken after a period of heavy rain, but on February 14th, 1967, would be at a minimum period of rainfall?

A This is correct.

Q So, we have no actual knowledge then of any decline of the water level in this particular area?

A Not in the area of the lake, no, sir. I'm sure there have been or if not, there will be some in this north extension of the irrigation district. I have no historical records in this irrigation area, I don't know. But, I'm sure it will.

Q You don't know how long these irrigation wells have been in use, other than the fact that you do have a 1954 water level on one of them?

A Let me see if I have the dates those wells were drilled. No, I do not have the dates those wells were drilled.

Q Now, Mr. Reed, on your exhibit showing, entitled "The Ground Water Conditions", this line that comes around on the east side of the lake and down the east side of the exhibit, what contour level would that line be, forty-one twenty?

A Yes, sir. I'm sorry, it's not identified. That's an oversight. That is the 4120 contour.

Q So, anything to the west of that is at the level of the high water mark in the lake and anything east of it is above the high water level in the lake?

A Yes, sir.

Q Now, you have heard Mr. Lovelace testify, Mr. Reed, that he had some aerial pictures of this lake that were taken before and after the July rains, and that he couldn't detect any essential differences in the level of the water in the lake. Now, as I understood your testimony this morning, during periods of high water levels in the lake, there's probably a flow of water from the lake into the Ogallala formation, and it would be between this forty-one -- It would be to the south and west of this 4120 foot line, is that correct?

A Would be between the two 4120 foot lines and south.

Q And south. Well, would you suppose then, if he didn't detect any differences in the levels of the water in the lake, before and after the heavy July rains, that was the period in which the water was flowing from the lake to the south?

A This is very probable.

Q And then if water levels decreased in the lake, and evaporation takes place faster than the seeps are going in, then the flow would be back in the other direction?

A Yes, if the water level immediately adjacent to the lake is higher than the bottom of the lake, yes, this is true.

Q Well, it couldn't evaporate out of the formation if the formation was charged by the lake during high water level?

A That is true.

Q It would have to flow back?

A That's correct.

Q And you have a hydraulic flow then, from period to period?

A This is true. The critical elevation at which seepage begins to occur is one of the things we don't know. There is undoubtedly a critical elevation above which seepage begins to take place. This is something we can't answer.

Q Now, this high level mark, 4120, how does that appear on the surface, Mr. Reed, does it look like that's the highest the water ever came up on the bank or is that the place where the vegetation quits growing, or just what is that 4120?

A The 4120 is actually the outer limit of the evaporates on the surface. It's the point, the break in slope between the flat bottom of the lake and the bluffs that surround the lake. It is the apparent maximum elevation of the water surface in the lake and may occupy this elevation only for a short period of time.

Q Does it look like its been up to that point recently?

A That, I can't tell.

Q You can't tell?

A No, sir. The photographs taken after the heavy rains of this summer, did not reach that point. I think this might clarify that some.

MR. MORRIS: Excuse me, Mr. Reed. If you're going to refer to one of these photographs, let's have them marked as exhibits, please.

(Whereupon, Applicant's Exhibit 6 and 7 were marked for identification.)

A We only have one copy.

MR. PORTER: Do these two pictures reflect the water levels both before and after the rains?

A No, these are of the same dates, actually they are dated July of '67. They show the high water mark which is below this bluff and the edge of the water, at that time.

Q (By Mr. Nutter) Well, Mr. Reed, is there any relationship underground between North Lake and East Lake, Middle Lake and South Lake? Would there be any interconnection or any hydrological connection there?

A The evidence at this point would indicate there is hydraulic connection between the four individual lakes and an area in between. As I suggested this morning, this may be all part of one large hydrologic system, involving ground water discharge and surface water discharge into the lakes and ground

water discharge out of some of the lakes but perhaps not all of them. And I say that for the reason that we have a very narrow outlet as the record shows, as the data shows, a very narrow outlet for poor quality water to escape this area. That would be between well 5 and well 8. And if the hydraulic gradient does indeed dip to the west as the data suggests, it can't go to the east. This may be at one complete closed system, I can't answer the question.

Q All four lakes are within the 4120 foot contour, is that correct?

A Yes, I believe they are.

Q Now, we know that there has been contamination of the water by this lake in some number of acres to the south and east but without additional holes, we don't know how many acres but, is it possible, Mr. Reed -- Now, this lake has been there for probably hundreds of thousands of years, at least. Is it possible that there was no contamination of any waters outside of the lake bed itself, during a period of time when the water levels were higher in the Ogallala and prevented the migration from the lake bed to the formation?

A Yes, sir.

Q And that this results in contamination which apparently at this time doesn't cover too terribly many acres but this contamintion had resulted from withdrawals from the Ogallala

formation and the lowering of the water table, and the consequential flow from the lakebed into the formation?

A I think not on the withdrawal of water, Mr. Nutter because, I don't believe, I have not made calculations but, I have made similar calculations, I think it would be rather difficult to extend any major zone of influence from the existing irrigation wells out to the south edge of the lake within the time available.

Q But, we do have wells in here that are withdrawing from the Ogallala formation and they are within a contour line which is 4120. They are inside that 4120 foot contour line and they are lower than the high water level in the lake?

A Yes, sir, this is true. This is true. The path, the position of the brackish water in the Ogallala, whatever it may have been before these wells were drilled, if it has not already been changed, will undoubtedly be changed by imposing this discharge pattern upon the reservoir, and changing the hydraulic gradient.

Q Well, two things could change that gradient, couldn't they, Mr. Reed? Either withdrawal of additional waters from the Ogallala, that can change the gradient?

A Yes, sir.

Q And leaving the lake as it is, under natural conditions, or shedding (shutting) off of the water from the Ogallala and increasing

the input into the lake, could also change that gradient, right? If you raise the head of the lake?

A Yes, if you raise the head of the lake any substantial amount it would, yes. I think you would have to raise it quite a number of feet to have any material effect on the hydraulic gradient, at distance.

Q Well, I realize that.

A Because of the head loss.

Q The head loss?

A Yes, sir. That's correct. There is another factor that may be involved, to answer your question. In the first place, this is not an unusual situation. This is the usual relationship of ground water to a playa lake in West Texas and Southeastern New Mexico.

Q I realize that.

A Additionally, there may have been historically declines from the water level from the natural causes, changes in the climatic pattern, this has happened in many areas of West Texas and Southeastern New Mexico. This discharge of brackish water into the Ogallala may be of only a hundred years age, it may be a hundred and fifty years. It may be dated by times at which the water levels in the reservoir from natural causes has declined. This we don't know.

Q And it could have been in equilibrium, prior to the

time that these wells were drilled, these wells were the cause for the migration of the water in the lake bed, too?

A I don't believe, if I understand your question, I don't believe the irrigation has caused the brackish water we see in test hole number 5.

MR. HAYES: Go through that again.

A I said, well, maybe I better back up. I have not made any calculations to establish but it would be hard for me just from the witness stand to say or to visualize that the discharge of water in the irrigation wells in Section 23 has been the approximate cause of the high chloride-high sulfate concentration in test hole number 5. I think this is a natural problem, unrelated to human endeavor. This is my opinion. Now, as I said, at whatever position this brackish water had before the development of the irrigation, if it hasn't been changed already, it will be, if they continue pumping.

Q (By Mr. Nutter) And the more that is withdrawn, the more likely the migration will take place farther south?

A Correct. It may already be there or it may be in the closed basin which could be opened up and made into a discharging basin by the development of this irrigation water. This is possible, if it had been initially a closed ground water basin, which doesn't happen too often.

Q Now, we take a situation Mr. Reed, like we have

around that Cedar Lake over there in West Texas, I believe there are several hundred acres or several thousand acres around that lake?

A Tens of thousands of acres.

Q That has been contaminated?

A Yes, sir.

Q Has this been due to a change in the climatic conditions or has this been due to the withdrawal of the Ogallala water and the lowering of the water table?

A Neither one. This has been due to natural discharges from the lake into the ground water zone.

Q During periods of high levels in the lake?

A Yes, sir. There probably is very little discharge back into the lake from the southeast side. There is constant discharge into the lake on the updip side.

Q I see.

A But, this halo of brackish water extends out a distance of 20 or more miles, and is quite extensive. There has been no irrigation in the area because it has always been a brackish water area. And, even though there have been changes in the water levels naturally, this in my judgment, predates anything we could put our finger on.

Q In other words, in the Cedar Lake area, this predates man's activities in the area?

A Yes, sir.

Q But, we don't know for sure that this contamination here predates man's activities?

A Well, I feel that it is, yes, sir. Insofar as the test hole data is concerned, adjacent to the lake, yes, sir, I do.

MR. PORTER: Is Cedar Lake being used for brine disposal?

A Cedar Lake and McKenzie Lake to the south of it are being used for brine disposal, yes, sir.

MR. PORTER: How does Cedar Lake compare in size with this one?

A Cedar Lake has a surface area of 6850 acres and McKenzie Lake is about 500 acres, as I recall. I have not measured McKenzie Lake. I have measured Cedar Lake.

Q You don't know what the discharge is into these lakes, at the present time?

A No, sir. I do not.

MR. HAYES: Now, in this survey in the lake around there, did you all drill any water wells?

A Four of them, yes, sir.

MR. HAYES: And you just drilled until you got water?

A We drilled, test hold number 1 was drilled to the

base of the cretaceous.

MR. HAYES: Explain that a little more clearly?

A The cretaceous is an older formation, it occupies just this small area in here, and the water in the basal sand is the bottom limestone shale sequence, and in this case, it's deeper than the Ogallala.

MR. HAYES: How deep did you drill that?

A As I remember, it was forty-one some odd feet.

MR. HAYES: Where did you hit the water, your first water?

A Excuse me. We drilled to 92 feet and the water was 92.6. A very small amount of water.

Q And was this sweet water?

A Yes, sir, it was.

MR. HAYES: Where did you find your contaminated water?

A In test hole four in the northeast corner of the forty, quarter-quarter section 2.

MR. HAYES: Okay. Now, where did you hit your bad water?

A 36.7.

MR. HAYES: And did you hit any more water?

A No, sir. That's all we got. From 36.7 to 58 feet.

MR. HAYES: In other words, you didn't go on down to

see if there was any sweet water underneath there?

A We didn't go into the cretaceous.

MR. HAYES: And if you hit sweet water down underneath this, and everything, why, you would know that this bad water couldn't get to the fresh water, right?

A This is true. I believe this is true because locally, the clays and limestones and cretaceous are affective in separating.

MR. HAYES: And if there is sweet water down underneath, then it would never be contaminated from this lake if you put brackish water in it?

A Yes, sir.

MR. HAYES: Regardless of how high you raised the water level, right?

A That's right. Test hole five is the other one.

MR. HAYES: And you can find, in your opinion, you feel like you could find some sweet water down underneath this brackish water, right?

A Yes, sir.

MR. PORTER: Do you have any idea how long that water has been brackish?

A No, sir. This is the first knowledge that I know of that anyone has that there is brackish water south and east of north lake.

MR. HAYES: And then that one over there, that's contaminated and everything, it was an old well, you didn't drill that one?

A No, the only two that are -- Which one is this now, Mr. Hayes?

MR. HAYES: The one over there where you have the sweet water, did you all drill that, too, you pointed to it over here, I believe. Where is the one you were pointing to here?

A This one right here, and this one.

MR. HAYES: Is this an old brackish?

A No, we drilled this. It was brackish. We drilled this one and it was good.

MR. PORTER: You drilled two brackish wells?

A Yes, and two good ones. And one was cretaceous.

MR. PORTER: Mr. Nutter, would you continue?

Q (By Mr. Nutter) Well, Mr. Reed, I was trying to correlate these elevations and the water levels on your tabulations of your test holes here.

A Yes, sir.

Q Now, on test hole number 1, you have an elevation of 4180. The water in the well, the level is static water level, of 82.6 which would be below the surface?

A Yes, sir.

Q You have the water level elevation then of 4098, which corresponds to the 4098 on the exhibit?

A Yes, sir.

Q And if we go to number 6. The last one, we have an elevation of 4127, and a water level of .46 or .5, to round it off, and that would give us a water level of 4122, which very closely corresponds to the 4123 on the exhibits?

A Well, I'm sorry. I used 4147. The measuring point, sir, was 4147 in that actually. Yes, 41 -- Wait a minute. 4148. The measuring point was 4148. And the depth of the water was 25 feet essentially. That would yield 4123.

Q 4123?

A That's correct.

Q On the exhibit?

A Yes, sir.

Q And then it's on test hole 4 and 5, I have difficulty correlating.

A All right, sir.

Q Take the elevation of 4123, in test hole number 4, take the 36.7 feet off, we have a water level of about forty-eight six, compared with 4123 as shown on the exhibit?

A The elevation that we used on that well was 4159.5. These are some of the corrections that were made since last week, Mr. Nutter.

Q Forty-one what?

A 4159.5.

Q For the surface level?

A Yes, sir. Oh, this is incorrect, that's the water level elevation.

Q And would that be true also in test hole number 5?

A Test hole number 5, the elevation is, let me see. Test hole number 5, 4140.8. Well, it's forty-one -- Oh, here it is. 4138.9. It yields 4118.9 or 4119 feet. The elevation is 4138.9.

MR. NUTTER: Okay. I believe that's all, Mr. Reed, thank you.

A Yes, sir.

MR. PORTER: Does anyone else have a question of Mr. Reed? Mr. Reed, I believe you testified that you think that some degree of contamination will eventually occur in the area south of this lake, whether or not there is any brine disposal into the lake?

A Yes, sir.

Q And, I believe you also testified that the discharge of the amounts requested in this application, in your opinion would not cause any great acceleration in the rate of contamination, perhaps?

A That's correct.

MR. PORTER: Does anyone else have a question? Mr. Utz?

MR. UTZ: You gave some figures on the chloride content of the produced water?

A Yes, sir.

MR. UTZ: We seem to be a little confused on that, could you give them to us, again?

A 59,000.

MR. UTZ: 59,000?

A Yes, sir.

Q You had some sulfates to, didn't you?

A Yes, sir, eight-twenty, bicarbonates, one-sixty. Calcium, forty-two hundred. Magnesium, eight-thirty.

MR. UTZ: Thank you, very much.

MR. PORTER: Mr. Reed, in that connection, isn't this a greater contamination of chloride than we found over in the Lane Lake that was the subject of a previous hearing?

A I believe so, yes, sir. I believe so. I believe there we were talking about thirty-seven or eight thousand, as I remember.

MR. PORTER: Does anyone else have a question? The witness may be excused. Does that conclude your testimony, Mr. Morris?

MR. MORRIS: Yes, it does, Mr. Porter, and at the

appropriate time, I would like to make a very brief statement.

MR. PORTER: Would anyone else like to make a statement or comment in this case?

MR. MORRIS: Excuse me, Mr. Porter. I would like to offer in evidence exhibits 6 and 7, being photographs.

MR. PORTER: No objection, the exhibits will be admitted.

(Whereupon, Applicant's Exhibits 6 and 7 were offered and admitted into evidence.)

MR. PORTER: Would anyone else like to make a statement?

MR. STEVENS: Sir, my name is Norman Stevens, I'm a partner with Charles Reed, we're operating in the middle lane, and we are currently trucking our water. It's very excessive in cost, we have checked Mr. Lovelace's proposal, we have signed a contract with him. We have checked Rice Engineering and we have checked Stoltz' contract and as far as we are concerned as an operator in this area, this is the most economical route for us to pursue. In addition, I would like to say that we would appreciate any expeditious treatment that you can give this because if this can not be approved, we have got to make other arrangements quickly. Thank you.

MR. PORTER: Thank you. Mr. Morris, I believe no

one else is going to have anything, go ahead.

MR. REITER: Mr. Porter, I'm Fred Reiter, with Louisiana Land Exploration Company, and I would like to join Mr. Stevens' comment, we have the same problem and are solving it in the same way.

MR. PORTER: In other words, you want an answer?

MR. REITER: We would appreciate it.

MR. PORTER: Is there anyone else before Mr. Morris?

MR. HOOD: I'm Mr. Hood from Midland, H. C. Hood, and I operate in the area also and I'm surprised that some of the other operators are not here, too. This is a big concern to all of us. Now, when you're paying the lifting costs and the operator is disposing of the water, the royalty owner and the owner are free and clear but this is a big problem and it's something that we have to face immediately. If you go down there and look today, you might see a little dripping from the separator but we have to get rid of it. With the Rice Engineering proposal at about $8,000.00 a well for the system, it's pretty expensive.

MR. PORTER: Did Rice give you a date?

MR. HOOD: I talked to Rice in June when I completed the first well and they said they would get back in touch with me and so far, I haven't heard from them.

MR. PORTER: Could you answer that question?

MR. REITER: Well, I can't answer it but, I could amplify it a little further. The Rice system has about 42, 44 wells, approximately forty plus wells in the system and at about $8,000.00 a well, equity fee, will amount to roughly $32,000.00 for four wells in our case. If and when their devonian reservoir, into which they are now injecting becomes saturated as it ultimately must, then another devonian well would have to be re-entered if it was available and if not, a new well drilled, at a cost of approximately $250,000.00 to drill, at which time, every operator would be re-billed in the portion of the share and would likely be another $32,000.00 a well.

MR. PORTER: I believe we had testimony earlier this morning, Mr. Lovelace testified that the trucking costs were approximately seventeen cents a barrel. Do you know what the per barrel cost is in the Rice System? Mr. Lovelace, would you have an answer to that?

MR. LOVELACE: Well, I testified this morning that it would proximate in our plan of about three cents a barrel and that is very comparable as near as I can figure out from reading Rice's contracts and talking to the contractors on the system, they have this large initiation tie-on fee of $8,000.00 and then they have a monthly charge per well and over what I compute the life of this field will proximate about three cents,

based on studies of similar fields that are not salt water produced.

MR. PORTER: Both systems would be trucking?

MR. HAYES: You testified this morning, it was about seventeen cents a barrel. Where did we get the forty cents a barrel? Would that come out of the other hearing we had? Have you guys heard anything about that?

MR. HOOD: Four cents is what Mr. Stoltz will charge to transport for you.

MR. HAYES: Four cents?

MR. HOOD: Yes.

MR. LOVELACE: Probably that is an isolated case. Because, the distance they have to move it to get it to the disposal well, most of these truckers truck on an hourly basis. As a matter of fact, they don't quote you a barrelage charge.

MR. REITER: I don't know, it wasn't a bid but, I understand when we first had this problem, and we checked, there was a disposal well, the first clue that we had to the solution, there was a disposal well, I believe Mr. French owns it in the Gladiola field. That he will allow us to use it and it would cost us thirty-nine cents a barrel from our lease to his well in the Gladiola field, to dispose of it.

MR. HAYES: We still haven't got the forty cents?

MR. NUTTER: I can tell you where that came from,

after the hearing.

MR. LOVELACE: If I may say something?

MR. PORTER: Mr. Lovelace.

MR. LOVELACE: The cost of the hauling of the salt water is bad enough. The attendant disruption occasioned by the traffic over those roads are indirect and added expense, believe me. I don't know if you've driven over those roads, lately, and I really don't know where the truckers are putting that water but, the condition occasioned by this necessity to do all this hauling is really distressing to the operators and I don't say that facetiously, it is a fact to consider.

MR. HAYS: Do you suspicion that maybe all the water isn't getting to the well?

A I would say there may be a drop or two to fall out of that truck, I don't know.

MR. HAYES: I don't suppose that that is why the pavement is flying apart down in that part of the country, do you?

A That could be.

MR. PORTER: Mr. Morris, would you like to make a statement?

MR. MORRIS: I think a closing statement almost is superfluous but I'll make a short one, anyway, as is customary.

I would like to point out to the Commission that

under Section 65-3-11, sub-section 15, it specifically has the power and the duty to regulate the disposition of water produced or used in connection with the drilling for or producing of oil or gas or both and to direct surface and subsurface disposal of such water in a manner that will afford reasonable protection against contamination of fresh water supplies, designated by the State Engineer.

Now, that statute does not say that it's the duty of this Commission to insure that there will be absolutely no contamination. It doesn't say that the protection has to be absolute. It says, "reasonable protection." And that's really what we're talking about here, what's reasonable under the circumstances as we see them here today and in view of the problem that the operators in this pool have. I think the questions that you, Mr. Porter, asked of Mr. Reed at the close of his testimony, pretty well sums up in few words, the overall gist of his opinion on this subject, that is, that there will be some increase in concentration in an area south of the proposed lake where there is already water of poor quality and it will not materially increase the area into which salt water will be distributed. I think it boils down to this: That any pollution that we're talking about here is diminimous. And especially, it occurs to me that in the final analysis, the Commission here has to balance the utility

of this project and its value to the State of New Mexico, against the prospect of a minimal amount of pollution that will not extend outside of an area that is already polluted. I'm sure that in weighing this matter, the Commission will consider the no pit orders that it has entered, and recognize that this is not a case where the operators are in here griping about a no pit order that you've entered. It's a situation of coming in here trying to comply with it and find a means that will be satisfactory and economic. Now, the applicant here is willing to take the financial risk to develop this system. Again, injecting water into this lake, in order to meet this September 5th deadline that it has established in its contract. We would be more than willing to abide by whatever protective measures the Commission wishes to place upon the granting of this application to drill further wells, to collect data, to set up some sort of monitoring device to be sure that the matter does not get out of hand and, we would be willing to go a step further than that if the Commission should desire, to come back to the Commission a year from now or after some reasonable time period has elapsed to show the Commission how our project is functioning and what the data shows that we have developed from the monitoring system during the interim.

The only thing else that I would underscore would be what the other operators in the field have said in their statements

and that is, obviously there is some urgency in the situation. We would very much appreciate a prompt action by the Commission, approving the application. Thank you, very much.

MR. PORTER: You want a prompt answer, I understand. Does anyone else have anything further to offer in this case? The Commission will take your request for promptness into consideration and we'll take the case under advisement.

Take up next Case 3637.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission, pages 2 through 45 were reported by me; that I, JOE JAMESON, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission, pages 46 through 75 were reported by me; and that the same is a true and correct record of the said proceedings, to the best of our knowledge, skill and ability.

Witness our Hand and Seal this 25th day of August, 1967.

Ada Dearnley
Notary Public

My Commission Expires:

June 19, 1971

Joe B Jameson
Notary Public

My Commission Expires:

June 25, 1971

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
June 19, 1968

REGULAR HEARING

IN THE MATTER OF:

Case 3636 being reopened at the request of the applicant, New Mexico Salt Water Disposal Company, Inc.

Case 3636 (reopened)

BEFORE: David F. Cargo, Governor
A. L. Porter, Secretary-Director
Guyton B. Hays, Land Commissioner
George M. Hatch, General Counsel

TRANSCRIPT OF HEARING

MR. HATCH: Case 3636 being reopened at the request of the Applicant, New Mexico Salt Water Disposal Company, Inc. Do you care to hear the full style?

MR. PORTER: I don't think that's necessary. It has been printed both in the newspapers and on the docket. At this time I would like to call for appearances in Case 3636. Mr. Russell, you represent the applicant?

MR. RUSSELL: I represent the applicant. John F. Russell of Roswell, New Mexico.

MR. PORTER: And you have two witnesses?

MR. RUSSELL: I'll have two witnesses, Mr. Commissioner, Mr. LeMay and Mr. **Loveless** and it may be of assistance that I make a very brief statement of what will be presented and it might expedite matters.

MR. PORTER: Yes. May I ask for other appearances before you do that, Mr. Russell? Does anybody else desire to present testimony in the case?

MR. HEIDEL: I am F. L. Heidel, Attorney at Law, of Lovington, New Mexico and I represent a group of interested individuals, residents of Lea County who are concerned with the matter of water pollution and at this time we do not desire to -- say intervene -- or make an appearance in the case. As the case proceeds, we might desire to offer various matters for consideration.

MR. PORTER: I see. Anyone else? You may proceed, Mr. Russell.

MR. RUSSELL: If the Commission please, this case has been reopened at the request of New Mexico Salt Water Disposal Company in order to present to the commission some new evidence which will reflect, we believe, the possibility of contamination of the Ogallala as shown or brought out in the prior hearing, was of a source other than the seepage from the lake. I will have two witnesses; Mr. LeMay, who will present testimony from the exhibits concerning the geological data and Mr. Loveless who will bring up to date his prior testimony and as to the need for salt water disposal in this area and what has been done since the prior hearing in attempts to take care of it. He will also testify as to the evaporation studies which he has conducted in this area.

Now the exhibits which Mr. LeMay has prepared, I would anticipate that we would start with number 8 since number 7 in theoriginal case was the last one. Now, these exhibits, I would like to say, to a fairly large degree, are more or less inter-related and I think it may help on cross examination if we got them all -- testimony as to all of them -- because one without the other is not going to be too helpful. So, I would like at this time to have my two witnesses sworn. I might add first that we do not have large size exhibits, but I do have a

set for each of the members of the Commission, the Attorney and Staff, so that you can go along as the witness testifies.

MR. PORTER: Would you stand please and be sworn.

(Witness sworn.)

MR. RUSSELL: Mr. LeMay, would you please take the chair?

W. J. LeMAY, called as a witness, having been first duly sworn, was examined and testified as follows:

(Whereupon, Applicant's Exhibits 8 through 12 were marked for identification)

DIRECT EXAMINATION

BY MR. RUSSELL:

Q Will you please state your name, address and occupation and by whom you are employed?

A My name is William J. LeMay. I am a Consulting Geologist in Santa Fe, New Mexico and a partner in the firm of LeMay and Stevens.

Q Have you previously qualified to give expert testimony before the Commission?

A Yes, I have.

MR. RUSSELL: Are his qualifications acceptable?

MR. PORTER: Yes, they are.

Q (By Mr. Russell) Mr. LeMay, did you testify in the original hearing?

A No, I did not.

Q Have you had an opportunity to examine the transcript in that case and look at the various exhibits that were put in there?

A Yes, I have.

Q Have you gathered some additional data and from such data made certain interpretations which you have reflected in the form of exhibits?

A Yes, sir, I have. I have gathered additional points and interpreted the area around North Lake from existing data plus published information.

Q When, in your testimony, you may be using any figures, points or so forth which are not reflected on exhibits or perhaps in testimony in the original hearing, would you please identify the source of that data or information?

A All right.

Q All right. Now, I will refer you to what has been marked for identification as Applicant's Exhibit Number 8 and ask if you will explain to the Commission what this particular exhibit shows?

A Exhibit Number 8 is a subsurface structure map drawn on the top of the post-Mesozic erosion surface, which in this

particular area is the top of the cretaceous or the base of the Ogallala. The contour used is 25 feet. It also shows the location of the four lakes and the position of the three wells producing in the Sand Springs Devonian Field, being the Hill and Meeker Number 1 State 11; Trainer Number 1 Kelce State and the Sinclair Number 1 State Lea Number 40.

These wells have associated brine pits and I have shown the projection of the cross section from the Trainer Well with the Hill and Meeker and Sinclair Number 1 wells, or their salt water disposal pits projected into the cross section running through test holes 4 and 5 which were the holes shown to be contaminated on the previous hearing. Through a new point, the Ash point, I call it, which was reflected in 1957 into the North Lake.

The test holes have a datum which is identified as the top of the cretaceous. I think the previous exhibit by Mr. Reed in Case 3636, showed a similar interpretation of the North Lake area, but without the datum so that I had no access to his points. These points were picked off of drillers logs and as I will show, the Ash 1957 point, was estimated from a publication which I will be referring to from the testimony. This publication is a U.S.G.S. publication entitled, The Hydrologic Investigations Atlas, HA-62, which was -- the work

was done by Mr. Sidney Ash and it was published in 1963. This is actually a ground water study of northern Lea County and there is substantial datum in this report and was considered a very reliable piece of work.

MR. PORTER: What was the date of that study?

A 1963.

MR. PORTER: Thank you.

A I might point out at this time, the points were derived from drillers logs, interpreted by myself. These points, the top of the cretaceous points, were picked by the U.S.G.S., where you encounter yellow or green clays. This is in contrast to the Ogallala formation which is characterized by sandy members, red sandstone, and, it is on this basis that the points, the test hole points were picked. The Ash point was a point measured in Mr. Ash's study in 1957, the data was collected in 1957 as shown on the last exhibit, Exhibit Number 12.

Mr. Ash measured a water level in this well of 4136. This is in feet above sea level. This was a pumping measurement and therefore, the water level had static condition, would be probably higher than this. How high I do not know, but this probably could be considered a minimum elevation point.

Also, Mr. Ash identified the point as a cretaceous point, meaning the aquifer was from a cretaceous formation. Utilizing this information and studying his countour map drawn

on the Post-Mesozic Erosion Surface, I have produced an estimated point of 4152. This is within 5 feet of error, I estimate it from the countours and the 4150 foot line passed very close to this well. So that is where the point 4152 comes from.

I would like to point out to the Commission the existence of a ridge, a cretaceous ridge which crosses the subject area at the south boundary of North Lake. And this ridge surrounds Mr. Ash's point of 4152 because this point is an anonymously high point. The reservoir was identified as cretaceous and therefore, much of the ridge holding up the South Lake is of cretaceous formation. There is also additional control, 4139 from test hole number 4 is a high point and this point -- I might point out -- was picked because of the excessive gypsum that was encountered in test hole number 4 which is not characteristic of the Ogallala and which is more indicative of cretaceous and could possibly cause some of the local sulphate contamination in test hole 4 which has an anonymously high sulphate contamination.

These datums and their elevations, the top of the cretaceous is explained in Exhibit Number 9.

I would like to go on now to Exhibit Number 10 and 11 which are tied together because they are calculations which show the possibility of salt water contamination by the salt

water disposal pits associated with the three wells in the Sand Springs field.

Q Mr. LeMay, if I may stop you for just a moment.

A Yes.

Q Mr. LeMay, I'm not sure that on all copies of the Exhibits, we have the color. Could you identify the lines going from top to bottom by number and color?

MR. PORTER: And also what is Exhibit 10? These exhibits that we got weren't numbered.

MR. RUSSELL: They start with number 8 and are in order. Let me have you identify number 10 so that they can understand it.

A Exhibit Number 10 is a diagrammatic cross section, AA.

MR. RUSSELL: All right.

A This is shown as the cross section identified in Exhibit 8, extending from the North Lake area south and east to the Trainer Disposal Pit. I have shown the vertical exaggeration of ten times in order to better focus any differences in gradients that appear in nature, but, this is the reason for the excessive steep dips you see on the diagrammatic cross section. The things that are brought out by this cross section are the points of either entry or discharge from the ground water into or out of the ground water system, being the lake bed, the

Ash 1957 point, test holes 4 and 5 which are projected into this cross section, the brine disposal pits, both the Sinclair and the Hill and Meeker Disposal pits which are at the same elevation. So, they are projected at the same relative position on the cross section, this being 4139. And the brine disposal pit of Mr. Trainer, projected in at its elevation of 4145.

MR. HATCH: Excuse me, Mr. Russell. We still have a little difficulty.

MR. PORTER: Let's go through the series and number them all.

MR. RUSSELL: Do you all have Number 8?

MR. PORTER: Yes.

Q (By Mr. Russell) Would you go to Number 9 and identify that, please?

A Number 9 is the cretaceous datums which were used in conjunction with Exhibit 8 to identify the top of the cretaceous.

MR. PORTER: All right. Number 10 we are testifying from?

A Number 10 is a diagrammatic cross section AA Prime.

MR. PORTER: And Number 11?

A 11 is the possible brine velocity movements. And Exhibit number 12 is the Ground Water Table Map.

MR. PORTER: Thank you.

Q (By Mr. Russell) Now, go back to your Exhibit Number 10.

A Exhibit Number 10 also shows the ground water table, both accepting and rejecting the Ash point. Is the dotted line on Exhibit Number 10. It shows the cretaceous, the top of the cretaceous, which is non conformith, which was the mapping horizon for Exhibit Number 8. And it shows the possible gradients from the brine disposal pits to the test holes number 4 and 5 which were shown at the previous hearing to be contaminated water, high in chlorides and sulphates. These gradients, I might mention, are straight line gradients. They are labeled possible, because the movement of this water is the subject of much speculation and I would like to make it clear that it is not my judgment that this is the path that the water has taken to these wells. I am only showing it as a possible factor in the contamination of these wells because I don't think that anyone really knows or has a definite proof of how these wells were contaminated and this is only one piece of speculation that is supported by hydraulic calculations and distants gradient measurements which are shown in Exhibit Number 11.

Exhibit Number 11 is a -- actually a timed gradient study which utilizes quite a bit of math and at this point I would like to bring up the fact that item P, there is a coeffecient of permeability of a thousand gallons per day per

foot squared, or this breaks down to a thousand divided by 7.48 which equals 120. This number is more or less a constant which was given to me by Don Akin with the State Engineer's office -- hydrologist with the State Engineer's Office. And, it is really above my scope of competency. However, it is a figure taken from emperical measurements by the U.S.G.S. and it is valid for movement in the Ogallala and consolidated sediments.

Using this figure, movements, regional movements in the ground water table from 130 to 300 feet per year are derived or at least universally accepted or generally accepted by hydrologists and ground water geologists for the Ogallala water movement.

The other factors in the equation, V equals PI over porosity in feet per day, are the hydraulic head, item I which is feet over feet. In this particular case being the difference in elevation between the Brine disposal pits and the ground water table as measured in test hole numbers 4 and 5. The other factor, the porosity, as it was used, -- 45% was the figure used here. I thought this was slightly high, however, this is Mr. Akin's figure and as you can see by the equation, this being in the denominator, the reduction in this figure, lower porosity would cause a quicker movement from the disposal pits to the test holes. And therefore, I consider this

to be a conservative figure in calculating the movements, the possible movements of the brine. Rather than go through the calculations in each case, I would just like to point something out in this exhibit, what I have done, I have taken the formula and worked it out in feet per day and then transposed this to feet per year and estimated from this or calculated from this the time it would take brine water to move in a straight line from the disposal pits to the intersection of the ground water table with the test holes.

In those cases where this possible movement was within the life, the producing life of the well, and before the date -- I think it's 9-67, the date that the measurements were taken in test holes 4 and 5, an asterisk was placed after the various well movements to test holes. These calculations show that it is possible for water from the Sinclair pit to reach test holes number 4 and 5. It is not possible for the Hill and Meeker test hole pit to reach test hole 4. It is possible for the Hill and Meeker salt brine to reach test hole number 5. It is not possible for Trainer Number 1 to reach test hole 4, but it is possible for Trainer Number 1 to reach test hole 5.

Q One minute, Mr. LeMay. You say it is not possible for the brine from the disposal pit to reach a particular well. You are referring to -- it is not possible within the time that

the well was drilled and the date the test was made?

A This is correct.

Q It is not possible for it to ever get there?

A No. No, in fact if this is the movement of the brine, these wells should become more contaminated as the years go on or at least this movement should reach the test holes. At this point, I should like to state one thing to the Commission. I would like to emphasize again that this is only a possible movement, it does require a set of geologic conditions in the subsurface which we cannot measure, but would be anomalous to what would be expected. In elaborating on this, I would like to say that the normal movement of brine from a disposal pit would be vertical. When this brine intersects the water table, then the gradient of the water table would take over the movement of the brine and in this particular case, if the movement is regional, scutheast, the brine would move away from the test hole and not toward it.

I have to interject impervious strata between the ground water table and the surface which would channel this movement in a northwesterly direction or would have to be a reversal, a local reversal in the gradient of the ground water table for this brine to get to the test wells.

But, the exhibits were prepared only to show a possibility for this contamination with the set of geologic

conditions and this is not a probable or it is not a definite opinion of mine that this happened. The last and final exhibit is a summary of the reservoirs, the water reservoirs in the North Lake area with the test holes identified, the oil wells identified, salt water pits and also a contact shown between the cretaceous and the Ogallala water aquifers.

I might say, at this point, that I probably differ from Mr. Reed in that I extend the cretaceous aquifer over a larger portion of North Lake and I would like to point out why I do this.

First of all, the Ash point, the 1957 Ash point, was identified as a cretaceous reservoir. I think point number 4 was identified initially with the Ogallala and I think that this is cretaceous because of the excessive presence of gypsum in the characteristics of the formation, more resemble the cretaceous in the Ogallala.

Test hole number 6, this is also true. But, the main body of evidence I present, is also a publication by Mr. Alexander Nicholson and Mr. Alfred Klebish, entitled Geology And Ground Water Conditions in Southern Lea County. This is a report -- ground water report number 6 from the State Bureau of Mines and the date is 1961. In this report, Mr. Klebish and Mr. Nicholson identified fossils which were collected in the North Lake bottom. Even though the scope of their report was

more confined to the southern section of Lea County, they did have fossil identifications in North Lake which shows that the bottom of North Lake was in the cretaceous formation. The fossils labeled the lake bottom as cretaceous. I think that this combined with the lithologic evidence of the evidence of the drillers logs, the test hole data surrounding North Lake, makes this interpretation more valid because the cretaceous is a more extensive ground water aquifer in the North Lake area than the Ogallala. Although there are still Ogallala points being the seep at the west end of the lake, probably test hole number 1 and the windmill test hole number 5.

I think, when analyzing exhibit number 12 in conjunction with exhibit number 8, you can see the conclusions that I reached and I will summarize these for you. If you accept the Ash point, you have to accept the fact that there is a steep ridge at the south end of the lake, and this produces a gradient in the ground water table from the south end of the lake into North Lake. The other point, I should say there is another Ash point there in Section 31 which Mr. Reed incorporated in his report, and this point has a level of 4166. This is the water level in Section 31 which Mr. Reed used. However, he did not use the Ash point in Section 2. Why, I do not know. But, the condition of the ground water at

the south end of the lake with this ridge would produce a local gradient reversal of the regional gradient in the local gradient into the lake which would prevent leakage of the waters in North Lake out of the lake, at least to the south end. I have shown on both exhibits 8 and number 12, that the lake and area north and west of the lake, occupy a closed depression both in the ground water contours and in the contours drawn on the top of the cretaceous. This would suggest to me that North Lake was definitely influenced at a very early stage, at least during the erosion period of the cretaceous or the post-Mesozoic period.

The depression was created in this area, the Ogallala deposited, but this depression has persisted as a factor in the existence of the lake today. Possibly many of the questions or much of what I have done might be brought up in the period of cross examination, but I would like to point out just one or two other things, these being test holes number 4 and 5, the contaminated holes, I don't believe can be ascribed to any certain set of conditions, at least in operation today. Much concerning the contamination of these holes does involve speculation and probably -- my own personal opinion -- that these holes were contaminated a long time in the geologic past, we are talking about a million years, during the pliocene, the pliocene was a period when the Ogallala was laid down, so that

you are given a large range of climactic conditions in which the Lake could possibly have been much higher and contaminated the lake or the system or there could have been other circumstances in operation to cause this contamination. But, be this as it may, I would like to make a point of effect that test hole number 4 does have a ground water elevation of 4123 which would produce in itself a very small local gradient into the lake and the fact that this well is contaminated above the present line of evaporites on the lake, or as we interpret it the high water line of the lake of 4120, it is very difficult to account for ground water discharge into the lake, subsequent increase in concentration and evaporation and the discharge into test hole number 4 because of its present ground water conditions.

Finally, there is no exhibit to cover this final point, but I would like to point out geologically -- and this has been in discussion with both soil people, people with the U.S.G.S. and some of my associates -- that in Playa Lake, by this period of evaporation, discharge of water into the ground water table, subsequent evaporation, that you are going to collect solids on the bottom of this lake. We know that salt, gypsum, calcium carbonate, calcium sulphates, and, these, when projected into the subsurface after you get layer **and layer** on top of this when you get below, say, five feet, these layers get

compacted and I think we know that this degree of compaction should serve somewhat as a permeability barrier to migrations downward.

This isn't true on the surface, because gypsum is relatively soluble, but, given enough time -- and I wish there would be test holes in North Lake or other Playa Lakes -- I checked literature and I could find no case where they did identify the lithology between the ground water table and the surface because this is the zone that probably deserves much more study. I understand that the Air Force is doing some research on this now, but I have no data to support this opinion. But, it would be my opinion that with compaction and time, that the concentration of the calcium sulphates and carbonates would produce an impervious layer at the lake bottom.

Q Mr. LeMay, you made one mistake, I don't recall the exact wording, but you can rephrase it. That, as I recall, you indicated that because of the elevation of the water table in test hole 4 and the high water line into the lake, that it is more or less precluded the movement into -- did you mean into or out of?

A No, out of. Yes, it wouldpreclude movement out of the gradient set up in test hole number 4 into the lake which would make it very difficult for the water to get out of the

lake into test hole 4.

MR. RUSSELL: I have no further questions.

MR. PORTER: Does anyone have any questions of the witness? Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. LeMay, I believe the whole substance of your testimony here is based on the high in this cretaceous ridge which you have drawn on your Exhibit Number 8 swinging across the south end of the lake; is it not, sir?

A Yes, this is true.

Q Well, how do we know that that well is producing from the cretaceous?

A Well, the well was identified in Mr. Ash's report as a cretaceous aquifer well.

Q And Mr. Ash, at the time that he prepared this report, didn't have the benefit of some of these test holes which were drilled last year --

A This is true.

Q -- in conjunction with this case.

A This is true. This is why his interpretation would not be valid in the vicinity of North Lake because he did not have access to the test holes.

Q So, the only thing you can go by is the fact that he

probably had a water sample and analyzed that water and said, maybe this is cretaceous water, so he picked a point there on the cretaceous map.

A I don't really think so, Mr. Nutter, because I really wanted to get hold of a Ogallala map, one that the datums are already on them. I think that this would clarify a lot of the situation, if all the test hole data were made available. I did check the U.S.G.S. in Albuquerque and they do not show the datums on their maps that they draw the Ogallala maps from. In other words, you have the map, the interpretation but not the data to go by, and this is because the majority of the holes are seismic shot holes and the oil companies do not want to release the information to the general public because the public could see where they are concentrating their shot holes. So, I do believe that Mr. Ash did examine at least a driller's log or identify the cretaceous reservoir not from the water sample, but probably from lithologic information, which I do not have access to.

Q Well, from his point, you estimated that the cretaceous would have a high there of 4052 is it?

A This is correct, 4152.

Q 4152?

A Yes, sir. He also showed a water level in that well of 4136, pumping well.

Q And in order to have that 4152 for the cretaceous immediately south of the lake, you have to swing a 4150 foot line into the area from the west, extend it clear across the south end of the lake, swing it back to the west again, and all this is within the distance of two 4125 foot contour lines that are 650 feet apart?

A Yes, I do.

Q And swing a ridge almost a mile long across there within a 600 foot -- it would be a dyke.

A It looks that way. I might point out test hole number 4 with a 4139 datum somewhat supports the high position of the cretaceous at the south end or at least, this would be the southeast end of the lake. It's a very sharp structure, I might say, accepting this point, yes, sir.

Q Well, now, is the water produced from that well characteristically cretaceous water?

A There were no analysis of the water, on the Ash report, he did analyze some water, but he did not have an analysis of that water. So, I really do not know if this is true or not.

Q Well, Mr. Reed in his analysis last year, reported that sulphates from that water were only 90 parts per million. This is not characteristic of cretaceous water, necessarily?

A Not necessarily, no, sir.

Q As a matter of fact, cretaceous water in this general

area would have chloride-sulphate contents of upwards of a thousand parts per million.

A Is this test hole number 4 or are you referring to the Ash well?

Q No, I am referring to the Ash well.

A Yes, sir.

Q Mr. Reed's analysis reports that it had chlorides of 200 and sulphates of 90 which sounds more like possibly Ogallala water than cretaceous water, to me.

A It sounds that way. I was taking thatpoint completely off Mr. Ash's interpretation. He did show it as a cretaceous aquifer point. This is identified on the map and I assume that he had probably a water sample as well as driller's logs.

Q Well, how deep is the well, do you know?

A I do not, no, sir.

Q Now, in referring to your Exhibit Number 8, the Structure Map, you have contoured this on the top of the Post-Mesozoic Erosion surface --

A This is correct.

Q -- or basically, this is Ogallala?

A This is correct.

Q And in Mr. Reed's exhibit number 2 in this case, he has contoured on what he calls the pre-Ogallala point?

A It's the same point, sir.

Q This would be the base of the Ogallala?

A Correct.

Q On both of your exhibits?

A They were.

Q That's what I thought. And, essentially, they are the same except that you have given credence to this 1957 point taken off of Ash's map and Mr. Reed's as you mentioned, for some reason, you did not?

A Yes, sir.

Q Now, Mr. Reed's Exhibit Number 4 which is the cross sections, being from east to west and north to south on his cross section AA Prime, the north-south cross section running across North Lake and down through Middle Lake, he shows that the --

A I think I have that here.

Q Okay. If we refer to the cross section and show the cretaceous and the triasic as being the bed rocks in here, underlying the Ogallala formation. As you extend the cross section from north to south, we show the bed rocks dipping to the south; is this correct?

A This is correct.

Q On your Exhibit Number 10, you got as far as test hole 4 and 5 and you didn't extend the base -- the elevation of the bed rocks anywhere there. They would presumably dip to the

south and off of the map, would they not?

A Yes, sir. You will notice in the south end they go 4150, 4125, 4100; which shows the regional dip to be to the south-southeast.

Q And the original dip would be to the southeast in that which is the normal dip of the Ogallala formation?

A That is correct.

Q Or particularly in Northern Lea County?

A Yes, sir.

Q Therefore, were it not for this high in the cretaceous, the migration of water would be from the lake bed and into the Ogallala formation and would migrate southward were it not for the cretaceous high?

A Yes, sir. I don't think it would migrate into test hole number 4, however, because of the differences there in water gradients established at the previous hearing. I do say it would migrate -- without the ridge -- without the Ash point, would migrate to test hole number 5.

Q Well, now if we take test hole number 4, the water level was reported at 4123?

A Yes, sir.

Q The elevation of the well is 4159. Do you know how deep the well is?

A Yes, sir. The well was drilled to 58 feet.

Q My notes say 60 feet, Mr. LeMay.

A This is test hole number 4?

Q Oh, I beg your pardon. I'm on test hole number 5. How deep was test hole number 5?

A I show 60 feet.

Q 60 feet? And what is the elevation of test hole number 5?

A 4138.9.

MR. HATCH: Excuse me. They are referring to Exhibits from the case that was originally incurred. It is reopened, I think it is incorporated. Would the Commission officially incorporate this case 3636 reopened into the original case 3636 and the orders?

MR. PORTER: Counsel for the Commission has requested that the record for the previous case be made a part of this record. Is there any objection? The record for the previous case will be made a part of this case.

Q (By Mr. Nutter) The elevation was 4139?

A Yes, sir, I have 4138.9; correct.

Q And it is bottomed in the cretaceous, we don't know how far into the cretaceous. That would mean that the cretaceous was apparently 4079 or would be -- where the well was bottomed would be below the base of your exhibits here.

A Correct.

Q Now, these calculations where you have derived the distance or the time it would take water to move, is this the total amount of water or would this be the first drop of water?

A The first drop, sir, this is minimum. This is minimum water just when it hits the well. Those are your figures.

Q And these are under ideal imperical formulas without any obstacles in the reservoir that would impede the flow of that water?

A Correct.

Q You also mentioned that in order for the ground waters to move in this direction, there would have to have been some impermeable layers between the surface of the ground and the base of the Ogallala that would cause the waters to move northwest?

A There would have to be some circumstance that would differ from the regional because the normal path of brine would be straight down. Once it hits the water table, the water takes over the gradient.

Q And then it moves to the southeast?

A That is correct.

Q Is there any other evidence of any impermeable layer in the Ogallala formation throughout this area south of the Lake?

A No, sir, I don't think there is any evidence of the subsurface mythology of the area. As I pointed out, I think, in my testimony, and labeling of the exhibits, this is only possible and it is an outside chance. It is not --

Q As a matter of fact it wasn't even a probability, it was for -- maybe even a slight possibility.

A That is correct. It is within the realm of possibility.

Q If all the circumstances were right and if you had this impermeable layer which we don't know to exist, and if there were no obstacles to impede the flow of water, then from three to eight years, first drop -- three to nine years, the first drop of water could have gotten there?

A Yes, it takes a lot of extenuating circumstances, to produce this condition. And that is why the odds would certainly be against it happening, but it is a possibility and I thought it should be brought before the Commission because of the difficulty in explaining the contamination of test holes 4 and 5. I don't see a logical explanation, or any overpowering body of evidence which points to any way these test holes have become contaminated.

Q Well, if it's possible to have a dyke a hundred to two hundred feet wide extending a mile, it would also be possible for the cretaceous to be just standing there as a

little pimple and the water just moving around that pimple, wouldn't it?

A It's possible.

Q It would be just as possible as the dyke?

A Yes, sir, I think that test hole number 4, where I took the cretaceous, at 4123 -- I'm sorry -- that's the water level. 4139, led to support some kind of structure at the south end. I, myself, wonder about the Ash point because it is so anolamous, but if you aren't, you have to show this type of interpretation.

MR. NUTTER: I believe that's all.

MR. PORTER: Does anyone else have a question of Mr. LeMay? You may be excused. We will take a very short recess.

(Whereupon, a short recess was taken).

MR. RUSSELL: If the Commission please, I have no additional exhibits. At this time, I would like to introduce into evidence, Applicant's Exhibits 8 through 12 inclusive.

MR. PORTER: Are there any objections to these exhibits being admitted? They will be admitted.

(Whereupon, Applicants Exhibits 8 through 12 were admitted into evidence.)

MR. RUSSELL: I would like to call Mr. Loveless.

MR. PORTER: The record will show that the witness

has already been sworn.

CHARLES LOVELESS, called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. RUSSELL:

Q Would you please state your name and address?

A Charles Loveless, Roswell, New Mexico.

Q And you are the applicant in this case, are you not?

A Yes, sir.

Q And President of the New Mexico Salt Water Disposal Company?

A That's right.

Q Now, Mr. Loveless, would you run through the differences and factual situations since the prior hearing as to what your operations have been, the need for the service, what has been done in that regard, how you plan to conduct your operations and the controls you suggest to insure at the earliest possible moment if there is any additional contamination?

A I would like to say at the outset, for the Commission's sake, that I think they should note the candor of our witnesses in both cases, as a demonstration of our good faith. We certainly do not want to do anything that will be adverse to the best interests of the land owners, the surface owners or anyone else concerned in the multiple use of this land, and that

I want to assure you that we want to conserve and not pollute and it is our best interest not to do so.

Since our last hearing, at that time I think the testimony will show that we have twenty wells under contract on our salt water disposal system in the Lane-Embe area and at that time, did not have provisions for underground storage of oil field brines. Subsequent to the time of that hearing, we did acquire a deep hole drilled by Mobil Oil Company in Section 10 and completed as a salt water disposal well.

We have currently and are currently, undertaking the construction of additional facilities and have acquired the Trainer Well which was the subject of this testimony as a Devonian disposal well and, based on a hearing before this Commission, were granted the right to put brine into that well and we will do so when the present system is completed.

We now have 86 wells under contract, which will involve a large disposal problem. With the two wells we have now, we will have probably a safe capacity of 25,000 barrels of salt water per day for disposal purposes. We are actively attempting to acquire additional deep well capacity within the general area and within a reasonable economic limit of the area we are serving which is the Vada-Seminole-Embe area. Our renewed application for the use of this Playa Lake is simply an effort to acquire additional economic salt water

capacity which we will utilize,plus additional capacity we expect to have in the future if we are to serve the demands of the operators in 10 South 33, 10 South 34, 9 South 34 and goodness knows where else, because the whole area is expanding at an **exponential** rate. It would now appear that the so-called Vada-Seminole-Embe complex or the Bough C production zone may cover four or five townships and this will require a large additional capacity for the disposal of oil brines, whether we provide it or someone else provides it. I can say that we have daily applications from unexpected sources for the utilization of our systems and I am sure as Messrs. Johnson out here will explain to you, that the rate at which we have had to expand is faster than we can get supplies from the manufacturers of our pipe. Be that as it may.

I would like to point out something else in connection with this application. I think that we are all aware that there has been a reasonable doubt raised as to the situation existing around the lake insofar as the salt water that has been detected in the test holes, is concerned. Our witness has testified that it is probably only remotely possible that the disposed waters in the Sand Springs Pool did in fact invade these test holes. But, it would also be followed that if they did not invade and contaminate the test holes, that the waters that have been disposed of in the Sand

Springs Pool, must certainly have invaded the fresh water aquifers. To what extent, no one would certainly want to say, and I certainly would not want to impugn or indict those operators because they were doing something that had been practiced by everyone else. But, I would like to point out that because we know that there has been salt water in the Ogallala because of some source and because of the uncertainty of that source, it is my proposal to drill additional test holes on the rim of those lakes for early detection and testing every 30 days would, certainly in my opinion,and I hope in yours, not jeopardize further the land owners, the water users and other concerned parties.

Q At that point, Mr. Loveless, will you start and explain to the Commission your actual proposed operation of getting the water into the lake?

A We have or will have,in fact, it is partially installed, a main trunk line from about 10 miles north of the Trainer Well in the Vada Pool, which will pass within a short distance of the east rim of the North Lake and it is my proposal that we be permitted to divert not to exceed 10,000 barrels per day into the Lake on a metered basis and on a controlled basis and that we add additional test holes to those already in existence and that adequate security devices be placed on the

surface to insure no tampering with the test holes by either the State's providing a means for sealing those wells or to lock them. And, that the State have access only to the test holes which we would provide the economic arrangements that if the State would like to send a retained engineer or someone of their choice, to test these holes every 30 days, and take the water to the laboratory for their own testing, at our expense, we would be happy to cooperate on that basis. Also, to drill in case of the test holes as the State's engineer might feel it is essential to detect an early warning or an early detection of the system from any moving of the waters from the Lake into the Ogallala formation.

In that connection, I believe that the testimony in the earlier case shows that the bottom of the lake, at least the evaporites cover approximately 158 acres. As you know, and by your authority, I have been conducting lined pit experiments utilizing measured waters in the south end of the Embe Pool, and, of course, it is of general knowledge and much data is available to the effect that we probably have as excellent climactic situation for the evaporation of water as there is in any oil producing area in the United States. And we have found, after about seven months of experimentation, that the rates of evaporation are such that if we were to introduce 10,000 barrels of water this morning into the North

Lake, it would not reach even across the lake before it would all evaporate over that 158 acre expanse. Now, I have not looked at the lake in the last week and the recent rainfalls may have put water in it and perhaps Mr. Johnson would know that, but, it has been my observation that during the nearly a year that I have been working around that lake, I -- seldom is there water in it except after rains. I believe I noticed about a month ago, a small amount of moisture in it that disappeared pretty rapidly. But, what I am saying is that by no stretch of the imagination, in the summer months could it be possible for 10,000 barrels per day ever to traverse the bottom of the lake because, based on our observation, a 158 acres of that lake can evaporate up to 50,000 barrels per day during the month of June, the surface.

So, that by taking certain precautions, by installing water depth gauges in the lake which could be read weekly or twice a month or once a month, at whatever interval the Commission would feel would insure that the excessive waters were not in the lake either from natural sources or from our putting them there, I cannot see how any further damage could be done in the area of this North Lake. Certainly, we would expect to withdraw or this right to be withdrawn from us if there should appear to be any contamination from any source in any of the test holes. I think that the people who are

ranching around the lake would tell you that the lakes have no value for livestock waters for the simple reason that the brines in the lake when they do contain water, exceed 79 to 80 parts -- 79,000 parts per million, chloride. Mr. Tipps,who is the superintendent for Mr. Bogel on whose land or whose leased land, half of that lake lies, states that now that fresh waters are available to the livestock, in his opinion, there would never be any occasion when livestock would attempt to drink any of the water. And, we would, as a precaution, construct an intermediate pit between the point where we took the water to insure that no oil films carried into the lake. In other words, we would provide oil traps ahead of the affluent into the Lake.

Q Mr. Loveless, would you give a little more detail as to the testing you have done to determine the rate of evaporation to correlate into the lake, how you conducted evaporation?

A Well, our closed or lined experimental pits are about 3 miles west of this North Lake. We are metering into these lined pits on a daily basis from one of our pumping facilities which is utilized in connection with our main disposal system, at measured rates to determine the capacity of these lined pits to evaporate salt water. At this present time, we are introducing about 60 barrels per day into these

evaporative pits which have about 9,000 square feet of surface or about a fifth of an anchor so that the pits are disposing of the water at that rate.

If you translate that into 158 acres, literally, it translates into 68,000 barrels per day in the month of June, which we realize, of course, is the peak month for evaporation in Southeastern New Mexico. During the winter months, at the bottom, I believe at the Bitter lakes, the Fish and the Wildlife conducted an experiment over nine years on a daily measured basis in shallow pans, evaporative pans, during the winter months, and the rate -- the low rate is about 2.6 inches per month. And even at the low rate in that playa lake, still 10,000 barrels per day would scarcely dent it as far as accumulating water in that lake.

Now, this is not to deny that if you had an unusually heavy rainfall, which I'm sure Mr. Johnson has observed out there in years past, you would accumulate more water than that in the lake, but, at the same time, I think we would certainly want to establish some level figures that when the lake did exceed a certain limit, we would stop putting water into it to safeguard any chance that water would move horizontally out of the lake into the shallow beds around it.

Q Mr. Loveless, in addition to your application to the Commission, what have you done to get permission of the

surface owners to use the lake for the purposes you suggest?

A Last year, in September and October, application was made to utilize this lake to acquire a commercial lease from the Land Commissioner, for use of this lake for water disposal and that application is pending in the Commission office.

Q That is land that is owned by the State, isn't it?

A Yes, it is.

MR. RUSSELL: I have no further questions.

MR. PORTER: Is that an application by the New Mexico Salt Water Disposal Company?

A It is by one of the stockholders.

MR. PORTER: In his name?

A Yes.

MR. PORTER: Who applied for that?

A Norman Stevens.

MR. PORTER: Norman Stevens?

A Right.

MR. RUSSELL: Was he acting on behalf of the Corporation when he did that?

A No, I think not. He was probably acting on self preservation, economic self preservation. This was prior to the time that any visible means for economic disposal of water was apparent and he was simply trying to find a way to do it.

MR. RUSSELL: No further questions.

A Suffice it to say,that application was on record in the Land Office last summer.

MR. PORTER: Does anybody have any questions of Mr. Loveless? Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Loveless, in the event this new hypothesis is true, there is a cretaceous ridge running east to west along the south boundary of this lake and the migration of water to the disposal pits south of the area, have been to the north west, then we should suspect that as you went further south towards the disposal pits, you would encounter more salinity in the ground water; is that correct?

A I should imagine, Mr. Nutter, that you would. Because --

Q If we took test hole number 5 on Mr. LeMay's Exhibit number 8 and extrapolated a line from left to the Hill and Meeker site and then to Mr. Trainer's well and drilled a row of test holes, we should get increasingly saltier water as we went farther away from the lake.

A Yes, if the brine from the oil field operations did indeed go into the Ogallala formation.

Q And that is the only way the water can be salty, is, if Mr. LeMay's theory is correct?

A Well, what you are saying is, if there is a cretaceous

barrier then the only way that water could have gotten into test hole 5 -- I know -- let me say this, I'm not qualified Mr. Nutter, but I do believe that in geological times, it's possible for that water to have been -- to have gotten in to the test holes from other ways and to have been there from geological times.

Q Well, that gets back to Mr. Reed's theory that it has been occurring over hundreds of thousands of years.

A Well -- I believe it was his testimony. It could have been there, could have been the static condition. In other words, to answer your question categorically, I would not know whether if you started a gradient of test holes, checking the gradient through test holes, between test hole 5 and the Trainer pit or the Ashmon-Hilliard pit, that you would get a progressively greater amount of salt water. I just can't say.

Q This theory -- if this is where the water came from, this is where the salinity of the test holes came from?

A Yes, I assume if the remote possibility that that water did get to the test holes is true, then, you would expect a diminishing salinity in the direction of the test hole from the --

Q Because Mr. LeMay said these calculated times are for the first drop of water to get there.

A Right.

Q And as you went further south toward the pit, you would get two drops and three drops and finally many drops?

A Right, right.

Q Would you be willing, in the event the Commission approves your application -- would you be willing for the approval to be contingent on finding that there is increased salinity as you went farther from the lake?

A Well, if you are saying that your decision would be hinged 100 percent on the question of whether there was a salt gradient in that direction, I would say that because of the -- I mean, I would hate for you to tell me that your decision would hinge on that one bit of data.

Q This would be the evidence that would substantiate Mr. LeMay's theory of an impermeable cretaceous dyke across here, wouldn't it?

A No, I don't think it necessarily would because, as I say, that brine could have been deposited in there through other means of geological times. It could have been existent there when the topography of the whole area was different from what it is now.

Q Well, if for that reason, there is no reason to consider Mr. LeMay's argument?

A Other than that his is an observed bit of data based on Mr. Ash's point and mine would be based on supposition.

Q But whether all of the salinity down closer to the lake was the result of the disposal into the pits or not, you should have an increase in the bed of water as you went toward the the pit or an increase in salinity as you went towards the pit?

A Well, I'm just not in position to say that geologically.

Q You wouldn't be willing for your order --

A Well, I would be happy to drill you some test holes out there for the sake of science, to see and happily hope that it did demonstrate your thesis. Although, I would say that the odds that it did are about as remote as the odds that the Trainer water did get into those test wells.

Q So, the odds for the contamination coming from the Lake or some other source, would be equal to the odds for it to be coming from these wells, and therefore, if you did not find salinity, then you would say it came from some other source?

A Well, I should think so.

MR. NUTTER: I believe that's all.

MR. PORTER: Does anyone else have any questions?

MR. HATCH: I have a question.

MR. PORTER: Mr. Hatch.

CROSS EXAMINATION

BY MR. HATCH:

Q Mr. Loveless, did you say that the New Mexico Salt Water Disposal Company has the right now to use the lake for disposal purposes?

A No, we have not. We have simply made that application for a commercial lease to be utilized for such if the Commission were to grant us the right to dispose water in there.

Q Is that application still good, I mean --

A Well, it's pending. And, I don't know if there is any limitation on a pending application in your office. I don't know. It's been in the file in your office for some time. Since last summer.

Q In my office?

A In the Land Office.

Q Has it been in the Land Office?

A Yes, yes, it has. In fact, I have a copy of it -- I don't have a copy of it with me, but there is a pending application. It has been there since last June, I believe.

Q And that's under the name of Stevens?

A Norman L. Stevens, Junior, right.

MR. HATCH: That's all I have.

MR. PORTER: Does anyone else have a question of Mr. Loveless?

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Loveless, you mentioned your evaporative pit test 3 miles northwest of this North Lake. How long have you been running that?

A We put the first water in in February the 15th.

Q And you have been keeping daily records of the amount of evaporation?

A Yes. What we have been doing is running a meter of 30 barrels a day into the pits. We stepped it up to 35 barrels per day last month and we are now running 60 barrels a day, because of the increased rate of evaporation. We are trying to test the ultimate rate of evaporation in the summer.

MR. RUSSELL: Mr. Loveless, I don't think in your testimony you explained the operation of the pits, where you could determine the amount of evaporation from any one of the pits?

A Well, the system involves a so-called header pit with three modules attached to it or evaporative modules attached to it by means of siphon hoses, and we simply meter water out of one of our batteries which is utilized in

connection with our regular surface. We have a meter and we meter water into the header pit and transfer it over into the evaporative pits. And the rate we put it in will vary from day to day, but we intentionally establish a rate of injection into these pits on a monthly basis to test them for adequacy during any given period or any given month.

Q (By Mr. Utz) Well, you can then determine how much evaporation you have out there during any given month?

A Yes, on a quantitative basis. We have not attempted to measure it in vertical evaporation. We know the surface -- the useable surface is about 9,000 square feet depending on the sloping dykes. The surface area will vary with the depth of water. We are simply trying to determine feasibility of utilizing lined pits for evaporation of small quantities of water in connection with oil production.

Q What I was getting at, I was going to ask you if you could furnish us how much water evaporates?

A Yes, we file monthly reports with the Commission.

Q In gallons or --

A In barrels. In barrels which is readily reducible to vertical inches, if you want it.

Q And what did you say that was in the month of June?

A We have been running so far, in the month of June, about 60 barrels a day without any appreciable accumulation of

water per day.

MR. PORTER: Anyone else have a question of Mr. Loveless? He may be excused.

(Witness excused)

MR. RUSSELL: I have no further testimony to offer, Mr. Porter.

MR. PORTER: Does anyone else desire to present any testimony in the case? If not, we'll ask for statements at this time. Mr. Russell?

MR. RUSSELL: If the Commission please, we appreciate the opportunity of being able to come back and present this additional testimony. I don't need to go into the critical nature of getting disposal facilities and I feel that every possibility and all information that we can possibly get, should be presented to the Commission in each of these cases to make a proper evaluation.

As Mr. Loveless says, we do not want to and should not be permitted to contaminate any fresh water. There is some contamination in this area and the testimony is not inclusive as to where it comes from. There are so many factors that you just can't put your finger on it. They are under the ground and we can't look under there to make an accurate determination.

But, I do feel that under the state of the -- the

situation where we don't know, that we feel that the controls that Mr. Loveless has suggested and any additional controls that the Commission may feel is necessary that we can keep a real close check on whether or not any of this water being put into the Lake, is, in fact, seeping out of the Lake rather than evaporating and getting into the area around the Lake. And, as I understand the controls or the test holes, such additional test holes as the Commission may feel advisable and the check made every 30 days under controlled conditions so the Commission can determine, for example, in test hole 1, 2 or whatever it may be, during that 30 day period, has there been any increase in the sulphates or the salt chlorides rather, as a result of possibly leaking from the lake.

And, of course, if it should show up, we would anticipate the Commission would say that the evidence would indicate that there is some seepage from this lake and therefore, you must stop your operation which would be done immediately. Then, too, in the event -- it was brought out in the initial hearing that there appeared to be a critical elevation in the lake where seepage may occur, and that, we could run a gauge as to the depth of the water and when it got to that or near that critical point whether it was actually the critical point or not, we would immediately cease putting into the lake.

But, of course, since the first hearing, it is not

quite as violent to shut down periodically, if necessary, to either keep it below the level because we do have, since there is additional underground facilities for the disposal of it.

And, actually, I think he could control better the amount of water going into the Lake than he could before without shutting down the wells, perhaps, if he was unable to dispose of the brine.

We appreciate your reconsideration of this case and if there is any additional data that you feel is as a result of Mr. LeMay's testimony, we might be able to furnish it to you.

MR. PORTER: Anyone else have a statement that they would like to make? Mr. Heidel, do you have any comments you want to make on the case?

MR. HEIDEL: No.

MR. PORTER: Okay.

MR. HATCH: I have a letter from Mr. Claude E. Neely that I would like to read into the record.

MR. PORTER: All right, you may read that letter and any other communication that you may have.

MR. HATCH: This is from Claude E. Neeley, Midland, Texas, dated June the 12th, 1968, addressed to the New Mexico Oil Conservation Commission. This is in reference to Case Number 3636 reopened.

"On February 20, 1968 I purchased Oil and Gas Lease No. L-655 from the State of New Mexico, which covers a 90.48 acre tract of land, being the bed of Lake Playa, located in Section 32, Township 10 South, Range 34 East, and Sections 2 and 3 of Township 11 South, Range 34 East, Lea County, New Mexico. Prior to that time your Commission had denied the application of New Mexico Salt Water Disposal Company, Inc., to use the bed of this lake as a salt water disposal pit. It is my understanding that the same applicant has now asked for another hearing on the same proposal.

As owner of the above mentioned Oil and Gas Lease, I ask the Commission to deny this proposal. If said lake bed is allowed to be used for the purpose proposed, I would be unable to drill a well on this tract in search for oil and gas without acquiring surface rights on an adjacent tract and drilling a directional well to bottom under said lake bed, or acquire rights from the above mentioned applicant (if possible) to make a drillsite and roadway fill in order to drill said tract. Both of these methods would probably be financially prohibitive and therefore would cause my lease to be worthless.

By virtue of the above listed reasons, I ask the Commission to reject the proposal as set forth in the captioned Docket. Respectively submitted, Claude E. Neeley."

MR. PORTER: Do you have anything else, Mr. Hatch?

MR. HATCH: No.

MR. PORTER: If there are no further statements concerning the case, the Commission will take it under advisement and the hearing is adjourned.

INDEX

EXHIBITS

EXHIBIT	MARKED	OFFERED AND ADMITTED
Applicant's 8 through 12	4	29

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, JOE JAMESON, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me; that the same is a true and correct record of the said proceedings, to the best of my knowledge , skill and ability.

Witness my Hand and Seal this 28th day of June, 1968.

Notary Public

My Commission Expires:

June 25, 1971

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE No. 3636
Order No. R-3300-A

THE MATTER OF CASE 3636 BEING REOPENED
AT THE REQUEST OF THE APPLICANT, NEW
MEXICO SALT WATER DISPOSAL COMPANY, INC.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on June 19, 1968, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 16th day of August, 1968, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That Order No. R-3300, issued in Case 3636, dated August 17, 1967, denied to the applicant, New Mexico Salt Water Disposal Company, Inc., authority to dispose of a maximum of 12,500 barrels per day of produced salt water in a playa lake located in Section 32, Township 10 South, Range 34 East, and in Sections 2 and 3, Township 11 South, Range 34 East, NMPM, Lea County, New Mexico, said lake being known as North Lake of the Four Lakes.

(3) That the Commission denied the use of said lake for salt water disposal on the grounds that there is natural seepage of salt water from said lake into the Ogallala formation

which has resulted in the natural contamination of a portion of the Ogallala formation south of the lake to an unknown extent, and that disposal of additional salt water in said lake would increase the amount of seepage from said lake and constitute an additional hazard to the fresh water supplies existing in the Ogallala formation south of the lake.

(4) That at the request of the applicant, New Mexico Salt Water Disposal Company, Inc., said Case 3636 was reopened in order to allow the applicant to seek authority to dispose of up to 10,000 barrels of salt water per day in the subject lake and to present additional evidence concerning the source of the aforementioned contamination.

(5) That additional evidence was presented indicating the possible presence of a Cretaceous ridge near the southern boundary of the subject lake that would prevent seepage from the lake into the Ogallala formation south of the lake.

(6) That the evidence presented concerning the presence of said ridge is in conflict with the evidence presented by the applicant's own witness in Case 3636 as originally heard in August, 1967, and as incorporated into this case.

(7) That additional evidence was presented concerning a "slight possibility," but not a probability, that the aforementioned contamination of the Ogallala formation to the south of the subject lake was caused by surface disposal of produced salt water in the area south and east of the contaminated area.

(8) That the evidence concerning the possible source of contamination is in conflict with the evidence presented by the applicant's own witness in Case 3636 as originally heard in August, 1967, and incorporated into this case.

(9) That the facts and circumstances found by the Commission to be existing at the time this case was originally heard, August 16, 1967, have not materially changed and, therefore, in order to afford reasonable protection against contamination of fresh water supplies designated by the State Engineer the subject application should be denied.

IT IS THEREFORE ORDERED:

(1) That the subject application is hereby denied.

(2) That Order No. R-3300 is hereby affirmed in all respects.

(3) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

DAVID F. CARGO, Chairman

GUYTON B. HAYS, Member

A. L. PORTER, Jr., Member & Secretary

esr/

I do not concur.

June 19th Regular

NEW MEXICO SALT WATER DISPOSAL COMPANY, INC.
212 PETROLEUM BLDG. P. O. BOX 566
ROSWELL, NEW MEXICO 88201
PHONE 622-1958 AREA CODE 505

'68 MAY 15 PM 3 32

May 2, 1968

Case 3636 (Reopened)

Mr. A. L. Porter, Jr., Secretary and Member
Oil Conservation Commission of the State of New Mexico
Land Office Building
Santa Fe, New Mexico

Dear Mr. Porter:

By our Case No. 3636 heard at the regular monthly meeting of the Commission on August 16, 1967, we sought to dispose of oil field brine in a playa lake located in Section 32, Township 10 South, Range 34 East, NMPM and in Section 2 and 3, Township 11 South, Range 34 East, NMPM, Lea County. The record in the case and your Order No. R-3300 denying the application, are specifically referred to and included herein for the purpose of our application as follows:

WHEREAS, it came to our attention subsequesnt to the hearing on Case No. 3636 that large quantities of salt water produced in the Sand Springs Devonian Pool have been disposed of in open pits located such and designed in a manner to give rise to the possibility that the produced salt water has seeped in to the Ogallala formation south and east of the lake; and

WHEREAS, Mr. Ed L. Reed, consulting ground water hydrologist of Midland, Texas, principal witness in Case 3636 subsequently has proposed the drilling certain additional monitor test wells south and east of the lake, which, if tested at frequent intervals, would in his opinion, provide early

DOCKET MAILED

Date 6/6/68

evidence of seepage from the lake into the Ogallala formation which might be occasioned by disposal of oil field brine in the lake;

NOW THEREFORE, applicant, New Mexico Salt Water Disposal Company, Inc., Post Office Box 566, Roswell, New Mexico, 88201, respectfully requests the Commission to set a hearing as soon as possible to consider applicant's proposals as follows:

1) Applicant be permitted to dispose of a maximum of ten thousand barrels per day of oil field brine in the lake, the water to be metered and controlled; and if permitted to do so,

2) Applicant, in addition to present Ogallala test wells located as follows:

Test hole 4 600' FNL & 1400' FEL sec. 2
Test hole 5 2000' FNL & 1700' FWL Sec. 2
Test hole 6 1800' FNL & 600' FEL Sec. 3

be ordered to drill and equip the following additional Ogallala test holes:

2100' FSL & 400' FEL Sec. 32
600' FSL & 200' FEL Sec. 32
1500' FNL & 1600' FWL Sec. 2
700' FSL & 1000 FWL Sec. 2

and any other test wells as may be ordered; and

3) All test holes be equipped with locked and sealed capping devices which may be secured by the Commission against tampering; and

4) Applicant, after due notice to the Commission and in presence of Commission's representative, each 30 days

sample the water from the above listed wells and from a windmill located on the south side of the lake approximately on the west line of Section 2, and at applicant's expense, have the samples chemically tested in a laboratory to be designated by the Commission with results of the testing to be forwarded directly to the Commission no later than seven days after the samples are taken in the field; and

5) Applicant send to the Commission each month five copies of a report which contains the following:

a) Weekly meter reading of water put in to the lake.

b) A weekly report of the level of the surface of the water in the lake as expressed feet above mean sea level and read from a permanent gauge to be installed in the lake: and

c) Any other data which may be required by the Commission.

Respectfully,

NEW MEXICO SALT WATER
DISPOSAL COMPANY, INC.

By _____
President

ccl:nm

CLAUDE E. NEELEY
DRAWER 432
MU 4-5546
MIDLAND, TEXAS
79701

12 June 1968

68 JUN 13 AM 8:23

Staff
file in case file
No. 3636

Re: Docket No. 18-68
Case 3636 (Reopened)
New Mexico Salt Water Disposal
Company, Inc., Applicant
(State O&G Lease No. L-655)

New Mexico Oil Conservation Commission
Morgan Hall - State Land Office Building
Santa Fe, New Mexico 87501

Gentlemen:

On February 20, 1968 I purchased Oil and Gas Lease No. L-655 from the State of New Mexico, which covers a 90.48 acre tract of land, being the bed of Lake Playa, located in Section 32, Township 10 South, Range 34 East, and Sections 2 and 3 of Township 11 South, Range 34 East, N.M.P.M., Lea County, New Mexico. Prior to that time your Commission had denied the application of New Mexico Salt Water Disposal Company, Inc., to use the bed of this lake as a salt water disposal pit. It is my understand that the same applicant has now asked for another hearing on the same proposal.

As owner of the above mentioned Oil and Gas Lease, I ask the Commission to deny this proposal. If said lake bed is allowed to be used for the purpose proposed, I would be unable to drill a well on this tract in search for oil and gas without acquiring surface rights on an adjacent tract and drilling a directional well to bottom under said lake bed, or acquire rights from the above mentioned applicant (if possible) to make a drillsite and roadway fill in order to drill said tract. Both of these methods would probably be financially prohibitive and therefore would cause my lease to be worthless.

By virtue of the above listed reasons, I ask the Commission to reject the proposal as set forth in the captioned Docket.

Respectively submitted,

Claude E. Neeley

CEN:rr

Docket No. 18-68

DOCKET: REGULAR HEARING - WEDNESDAY - JUNE 19, 1968

OIL CONSERVATION COMMISSION - 9 A.M. - MORGAN HALL, STATE LAND OFFICE BUILDING SANTA FE, NEW MEXICO

ALLOWABLE: (1) Consideration of the oil allowable for July, 1968;

(2) Consideration of the allowable production of gas for July, 1968, from thirteen prorated pools in Lea, Eddy, and Roosevelt Counties, New Mexico. Consideration of the allowable production of gas from nine prorated pools in San Juan, Rio Arriba and Sandoval Counties, New Mexico, for July, 1968; also presentation of purchaser's nominations for the six-month period beginning August 1, 1968, for that area.

CASE 3636: Reopened

In the matter of Case 3636 being reopened at the request of the applicant, New Mexico Salt Water Disposal Company, Inc. Applicant, in the original hearing of this case, sought authority to dispose of up to 15,000 barrels of salt water per day in a playa lake located in Section 32, Township 10 South, Range 34 East, and in Sections 2 and 3, Township 11 South, Range 34 East, Lea County, New Mexico. The Commission, by Order R-3300, denied the use of said lake for salt water disposal on the grounds that there is natural seepage of salt water from said lake into the Ogallala formation which has resulted in the natural contamination of a portion of the Ogallala formation south of the lake to an unknown extent, and that the disposal of additional salt water in said lake would increase the amount of seepage from said lake and constitute an additional hazard to the fresh water supplies existing in the Ogallala formation south of the lake. Applicant now seeks authority to dispose of up to 10,000 barrels of salt water per day in the lake, alleging that newly discovered evidence gives rise to the possibility that produced salt water has seeped into the Ogallala formation south and east of the lake as the result of surface disposal in open pits of large quantities of salt water produced in the Sand Springs-Devonian Pool.

CASE 3787: Southeastern nomenclature case calling for an order for the creation, abolishment and extension of certain pools in Lea, Eddy, Chaves and Roosevelt Counties, New Mexico:

(a) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Wolfcamp production and designated as the Dagger Draw-Wolfcamp Gas Pool. The discovery well is the Yates Petroleum Corporation Loyd Foster AN Well No. 1, located in Unit D of Section 1, Township 20 South, Range 24 East, NMPM. Said pool should comprise:

TOWNSHIP 20 SOUTH, RANGE 24 EAST, NMPM
SECTION 1: NW/4

(b) Create a new pool in Lea County, New Mexico, classified as a gas pool for Wolfcamp production and designated as the Southeast Lea-Wolfcamp Gas Pool. The discovery well is the American Trading & Production Corporation Southeast Lea Unit Well No. 1, located in Unit J of Section 26, Township 20 South, Range 35 East, NMPM. Said pool should comprise:

TOWNSHIP 20 SOUTH, RANGE 35 EAST, NMPM
SECTION 26: SE/4

(c) Create a new pool in Eddy County, New Mexico, classified as an oil pool for San Andres production and designated as the Three Mile-San Andres Pool. The discovery well is the John A. Yates Floyd Sherrell Well No. 1, located in Unit K of Section 32, Township 17 South, Range 26 East, NMPM. Said pool should comprise:

TOWNSHIP 17 SOUTH, RANGE 26 EAST, NMPM
SECTION 32: NE/4 SW/4

(d) Abolish the Hackberry-Seven Rivers Pool in Eddy County, New Mexico, described as:

TOWNSHIP 19 SOUTH, RANGE 30 EAST, NMPM
SECTION 25: S/2 NE/4 and NE/4 SE/4

(e) Extend the vertical limits of the North Hackberry-Yates Pool in Eddy County, New Mexico, to include the Seven Rivers formation and redesignate said pool the North Hackberry Yates-Seven Rivers Pool.

(f) Extend the Baum-Upper Pennsylvanian Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 13 SOUTH, RANGE 33 EAST, NMPM
SECTION 31: S/2

TOWNSHIP 14 SOUTH, RANGE 33 EAST, NMPM
SECTION 7: NW/4

(g) Extend the South Corbin-Wolfcamp Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 18 SOUTH, RANGE 33 EAST, NMPM
SECTION 29: NE/4

(h) Extend the Crossroads-Slaughter Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 9 SOUTH, RANGE 35 EAST, NMPM
SECTION 25: E/2 E/2

(i) Extend the Justis-Blinebry Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 24 SOUTH, RANGE 37 EAST, NMPM
SECTION 26: N/2 NW/4

(j) Extend the Quail Ridge-Bone Springs Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 19 SOUTH, RANGE 34 EAST, NMPM
SECTION 16: NW/4

(k) Extend the West Ranger Lake-Devonian Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 12 SOUTH, RANGE 34 EAST, NMPM
SECTION 26: N/2

(l) Extend the Teague-Blinebry Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 23 SOUTH, RANGE 37 EAST, NMPM
SECTION 22: SE/4
SECTION 28: NW/4

(m) Extend the Tobac-Pennsylvanian Pool in Chaves County, New Mexico, to include therein:

TOWNSHIP 8 SOUTH, RANGE 33 EAST, NMPM
SECTION 18: W/2 and SE/4

(n) Extend the Todd-Lower San Andres Pool in Roosevelt County, New Mexico, to include therein:

TOWNSHIP 7 SOUTH, RANGE 36 EAST, NMPM
SECTION 32: SW/4

Docket No. 18-68

(o) Extend the East Weir-Blinebry Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 20 SOUTH, RANGE 37 EAST, NMPM
SECTION 1: SE/4
SECTION 12: NE/4

TOWNSHIP 20 SOUTH, RANGE 38 EAST, NMPM
SECTION 6: SW/4

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE No. 3636
Order No. R-3300

APPLICATION OF NEW MEXICO SALT WATER
DISPOSAL COMPANY, INC., FOR SALT WATER
DISPOSAL, LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on August 16, 1967, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 17th day of August, 1967, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That Order No. R-2526, dated July 18, 1963, prohibited the surface disposal in unlined pits of salt water produced from the South Lane-Pennsylvanian, Middle Lane-Pennsylvanian, Inbe-Pennsylvanian, and Inbe-Wolfcamp Pools, Lea County, New Mexico, and within one mile thereof, effective September 19, 1963.

(3) That the applicant, New Mexico Salt Water Disposal Company, Inc., seeks authority to dispose of a maximum of 12,500 barrels per day of salt water produced from the above-mentioned pools, and other pools in the area, in a playa lake located in Section 32, Township 10 South, Range 34 East and in Sections 2 and 3, Township 11 South, Range 34 East, NMPM, Lea County, New Mexico, said lake being known as North Lake of the Four Lakes.

(4) That the evidence establishes that fresh water as designated by the State Engineer exists in the Ogallala formation in the vicinity of North Lake.

(5) That the water in the lake is not fresh water.

(6) That there is natural seepage of salt water from the lake into the Ogallala formation to the south of the lake.

(7) That the extent of the seepage from the subject lake into the Ogallala formation varies as the level of the water in the lake fluctuates.

(8) That the aforesaid natural seepage from the subject lake has heretofore contaminated a portion of the Ogallala formation south of the lake to an unknown extent.

(9) That the addition of salt water to the lake through utilization for disposal purposes will raise the water level of the lake above its natural water level, thereby increasing the amount of seepage of salt water from the lake into the Ogallala formation.

(10) That the aforesaid increased seepage of salt water from the subject lake into the Ogallala formation that would be caused through utilization of the subject lake for salt water disposal would constitute a hazard to the fresh water supplies existing in the Ogallala formation to the south of the subject lake.

(11) That the application of New Mexico Salt Water Disposal Company, Inc., to utilize North Lake of the Four Lakes for salt water disposal should be denied.

IT IS THEREFORE ORDERED:

(1) That the subject application is hereby denied.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

DAVID F. CARGO, Chairman

GUYTON B. HAYS, Member

A. L. PORTER, Jr., Member & Secretary

esr/

MAIN OFFICE
'67 JUL 6 AM 9 00

Aug. Reg.

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

APPLICATION OF NEW MEXICO SALT WATER DISPOSAL COMPANY, INC. FOR PERMISSION TO DISPOSE OF SALT WATER INTO A PLAYA LAKE, LEA COUNTY, NEW MEXICO.

CASE NO. 3636

A P P L I C A T I O N

Comes now the applicant, New Mexico Salt Water Disposal Company, Inc., and applies to the New Mexico Oil Conservation Commission for permission to dispose of salt water into a playa lake in Lea County, New Mexico, and in support of its application states:

1. New Mexico Salt Water Disposal Company, Inc. is a corporation organized and existing under the laws of the State of New Mexico and has its principal office at P. O. Box 566, Roswell, New Mexico.

2. By Order No. R-3221 entered in case No. 3551 on May 1, 1967, the Commission prohibited the surface disposal of produced salt water in the North Bagley and Northeast Bagley Fields of Lea County, New Mexico, effective November 1, 1967.

3. By Order No. R-2526 entered in case No. 2863 on July 18, 1963, the Commission prohibited the surface disposal of produced salt water in the South Lane-Pennsylvanian, Middle Lane-Pennsylvanian, Inbe-Pennsylvanian and Inbe-Wolfcamp Pools effective September 19, 1963.

4. Substantial amounts of salt water produced from the Inbe and Middle Lane Fields are presently being disposed of by means of trucking the water to distant disposal points. Due to the increase in the amount of water produced from these fields, this method of disposal has become critically expensive to the operators and threatens the premature abandonment of wells in

DOCKET MAILED
Date 8/2/67

those fields.

5. The applicant proposes to construct a pipeline gathering system in the Inbe and Middle Lane Fields and also in the North Bagley and Northeast Bagley Fields to collect produced salt water and to dispose of it into a playa lake located in Section 32, Township 10 South, Range 34 East and in Sections 2 and 3, Township 11 South, Range 34 East, Lea County, New Mexico. The amount of water applicant proposes to gather and dispose of in this manner is not anticipated to exceed 15,000 barrels of water per day.

6. Collection and disposal of produced salt water in the manner proposed by the applicant will not contaminate any fresh water bearing formations.

7. This application should be approved in order to protect the correlative rights of all operators in the fields to be served by the proposed salt water disposal system and in order to prevent the premature abandonment of wells in those fields.

8. In order that the proposed salt water disposal system may be constructed at the earliest possible date, the applicant requests that this application be set for hearing before one of the Commission's examiners on July 26, 1967, or as soon thereafter as the matter may be heard.

10. A copy of this application has been mailed to Mr. Frank Irby, Chief, Water Rights Division, Office of the State Engineer, Capitol Building, Santa Fe, New Mexico, on this 5th day of July, 1967.

WHEREFORE, the applicant requests that this application be set for hearing on July 26, 1967, or as soon thereafter as it may be heard and that the Commission enter its order granting the applicant permission to dispose of produced salt water in the

manner set forth in this application.

MONTGOMERY, FEDERICI & ANDREWS

By Richard S. Morris

P. O. Box 2307
Santa Fe, New Mexico

Attorneys for the Applicant,
New Mexico Salt Water Disposal
Company, Inc.

GOVERNOR
DAVID F. CARGO
CHAIRMAN

State of New Mexico
Oil Conservation Commission

LAND COMMISSIONER
GUYTON B. HAYS
MEMBER

P. O. BOX 2088
SANTA FE

STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

August 17, 1967

Mr. Richard S. Morris
Montgomery, Federici & Andrews
Attorneys at Law
Post Office Box 2307
Santa Fe, New Mexico

Re: Case No. 3636
Order No. R-3300
Applicant:
N.M. Salt Water Disposal Co.

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Carbon copy of order also sent to:

Hobbs OCC x
Artesia OCC
Aztec OCC
Other Mr. Norman Stevens for Mr. Charles B. Read,
Mr. H. C. Hood, Midland, Texas, Mr. Fred H. Reiter,
Louisiana Land & Exploration Company, Midland, Texas.
and Mr. Frank Irby

Docket No. 24-67

DOCKET: REGULAR HEARING - WEDNESDAY - AUGUST 16, 1967

OIL CONSERVATION COMMISSION - 9 A.M. - MORGAN HALL, STATE LAND OFFICE BUILDING, SANTA FE, NEW MEXICO

ALLOWABLE: (1) Consideration of the oil allowable for September, 1967;

(2) Consideration of the allowable production of gas for September, 1967, from thirteen prorated pools in Lea, Eddy, and Roosevelt Counties, New Mexico. Consideration of the allowable production of gas from nine prorated pools in San Juan, Rio Arriba and Sandoval Counties, New Mexico, for September, 1967.

CASE 3635: Application of Cities Service Oil Company for an exception to Order No. R-3221, Chaves County, New Mexico. Applicant, in the above-styled cause, seeks an exception to the provisions of Order No. R-3221 to permit the continued use, for emergency purposes, of four unlined surface pits for salt water disposal in its Drickey Queen Sand Unit, Caprock-Queen Pool, Chaves County, New Mexico. The locations of said pits are as follows: Unit L of Section 2; Unit F of Section 3; Unit I of Section 3; and Unit A of Section 16, all in Township 14 South, Range 31 East.

CASE 3636: Application of New Mexico Salt Water Disposal Company, Inc., for salt water disposal, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to dispose of produced salt water in a playa lake located in Section 32, Township 10 South, Range 34 East and in Sections 2 and 3, Township 11 South, Range 34 East, Lea County, New Mexico. Applicant proposes to dispose of not more than 15,000 barrels of salt water per day into said lake.

CASE 3637: Northwestern New Mexico nomenclature case calling for an order for the extension of the following pools in San Juan County, New Mexico:

(a) Extend the Pinon-Fruitland Pool boundary to include therein:

TOWNSHIP 28 NORTH, RANGE 11 WEST, NMPM
SECTION 17: W/2

(b) Extend the Slick Rock-Dakota Pool boundary to include therein:

TOWNSHIP 29 NORTH, RANGE 16 WEST, NMPM
SECTION 6: SW/4
SECTION 7: NW/4

TOWNSHIP 29 NORTH, RANGE 17 WEST, NMPM
SECTION 1: E/2 & E/2 SW/4
SECTION 12: NE/4

CASE 3638: Southeastern New Mexico nomenclature case calling for an order for the creation of two pools and the assignment of oil discovery allowables therein, and for the abolishment and horizontal and vertical extension of certain other pools in Lea, Chaves, and Roosevelt Counties, New Mexico:

(a) Create a new pool in Lea County, New Mexico, classified as an oil pool for Abo production and designated as the Northwest Vacuum Abo Pool, comprising the following-described acreage:

TOWNSHIP 17 SOUTH, RANGE 34 EAST, NMPM
SECTION 3: NE/4 SE/4

Further, for the assignment of approximately 43,310 barrels of oil discovery allowable to the discovery well, Mobil Oil Corporation's Bridges State Well No. 122 located in Unit I of said Section 3.

(b) Create a new pool in Lea County, New Mexico, classified as an oil pool for Silurian production and designated as the South McCormack-Silurian Pool, comprising the following-described acreage:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM
SECTION 16: NE/4 SW/4

Further, for the assignment of approximately 35,930 barrels of oil discovery allowable to the discovery well, Gulf Oil Corporation's R. E. Cole (NCT-A) Well No. 8 located in Unit K of said Section 16.

(c) Abolish the North Bagley-Middle Pennsylvanian Pool in Lea County, New Mexico, described as:

TOWNSHIP 11 SOUTH, RANGE 33 EAST, NMPM
SECTION 10: W/2 and SE/4
SECTION 15: W/2
SECTION 16: E/2 and SW/4
SECTION 17: SE/4
SECTION 21: N/2
SECTION 22: W/2 and SE/4

(d) Extend the vertical limits of the North Bagley-Lower Pennsylvanian Pool in Lea County, New Mexico, to include the Middle Pennsylvanian formation with special vertical limits defined as being from 5397 feet subsea to the top of the Mississipian. Type Log: Texas Pacific Oil Company's Collier No. 1 located in Unit F of Section 10, Township 11 South, Range 33 East, NMPM.

(e) Extend the horizontal limits of the North Bagley-Lower Pennsylvanian Pool tc include therein:

TOWNSHIP 11 SOUTH, RANGE 33 EAST, NMPM
SECTION 17: SE/4
SECTION 22: W/2 and SE/4

(f) Abolish the Inbe-Wolfcamp Pool in Lea County, New Mexico, described as:

TOWNSHIP 11 SOUTH, RANGE 34 EAST, NMPM
SECTION 7: SE/4

(g) Extend the vertical limits of the Inbe-Pennsylvanian Pool in Lea County, New Mexico, to include the Wolfcamp formation and redesignate said pool as Inbe-Permo Pennsylvanian Pool.

(h) Extend the Bar U-Pennsylvanian Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 9 SOUTH, RANGE 32 EAST, NMPM
SECTION 1: NE/4

(i) Extend the Chaveroo-San Andres Pool in Chaves and Roosevelt Counties, New Mexico, to include therein:

TOWNSHIP 7 SOUTH, RANGE 32 EAST, NMPM
SECTION 36: SE/4

TOWNSHIP 7 SOUTH, RANGE 33 EAST, NMPM
SECTION 14: SW/4
SECTION 21: NE/4

TOWNSHIP 8 SOUTH, RANGE 33 EAST, NMPM
SECTION 6: SE/4
SECTION 11: NW/4

(j) Extend the Inbe-Permo Pennsylvanian Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 10 SOUTH, RANGE 33 EAST, NMPM
SECTION 23: NW/4

TOWNSHIP 11 SOUTH, RANGE 34 EAST, NMPM
SECTION 18: E/2 SW/4
SECTION 19: NW/4

(k) Extend the Middle Lane-Permo Pennsylvanian Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 10 SOUTH, RANGE 33 EAST, NMPM
SECTION 23: NE/4
SECTION 24: NW/4

POSSIBLE BRINE VELOCITY MOVEMENTS

$Va = Q/A = PI$; $V = Q/AP = PI$

where:
V = velosity
Q = quantity of water
A = area
P = coeficient of permeability (1,000 g.p.d./ft^2 - 1,000/7.48 = 120)
I = hydrolic gradient
ϕ = porpsity (Ogallala and unconsolidated sediments - 45%)

$V = PI/\phi$ (in ft. per day)

SINCLAIR to T.H. No. 4* (I = 16/2,500 = .0064)
1.) V = 120 x .0064/.45 = 1.70 ft per day or 620 ft per yr
2.) Well produced from 1957 to 1959 - estimated 50,000 ± B$W
3.) Time for Brine to reach T.H. No. 4 = 2,500/620 = 4 yrs

SINCLAIR to T.H. No. 5* (I = 20/4,200 = .0048)
1.) V = 120 x .0048/.45 = 1.28 ft per day or 467 ft per yr
2.) Same as above
3.) Time for Brine to reach T.H. No. 5 = 4,200/467 = 9 yrs

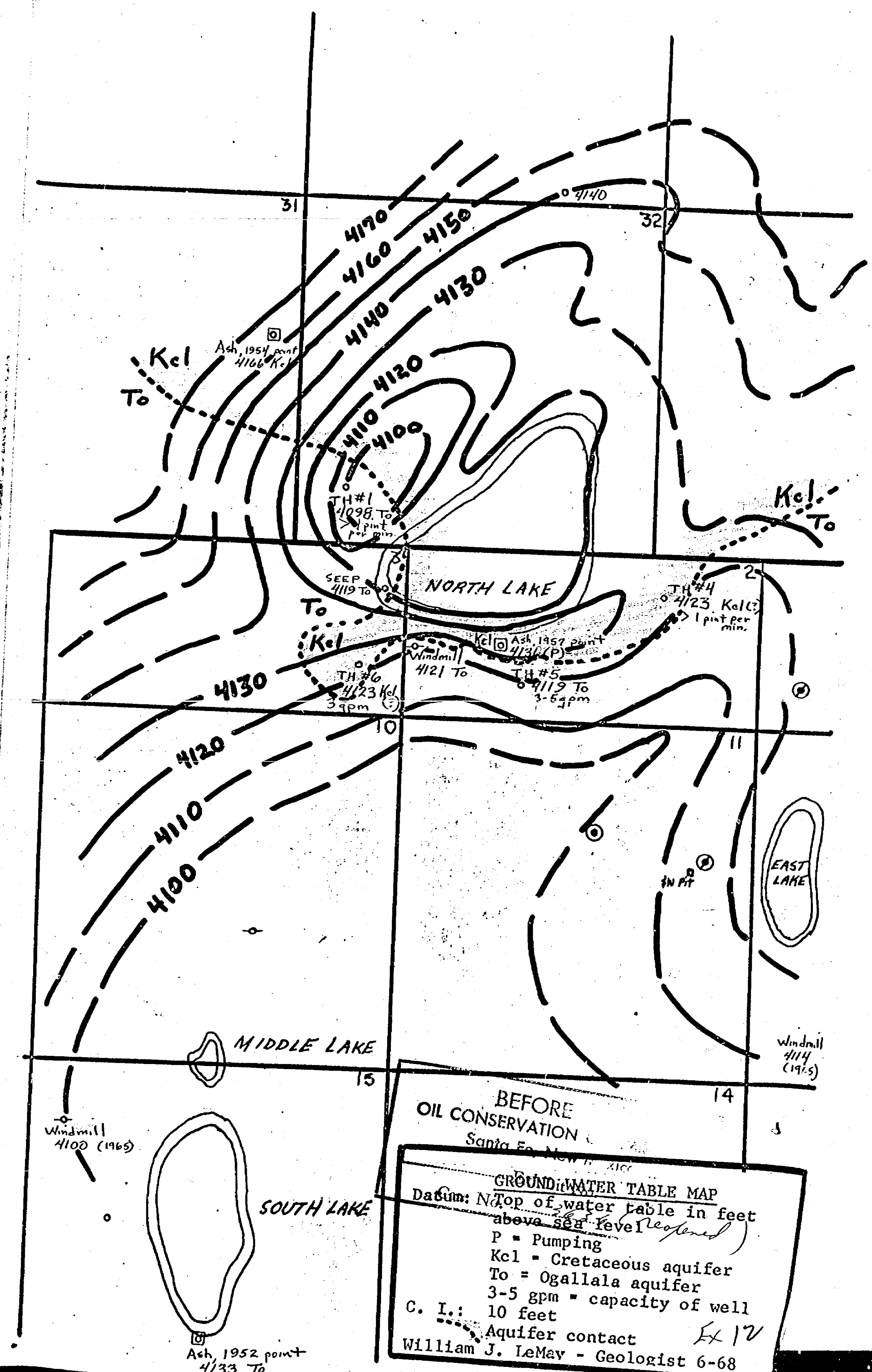
HILL & MEEKER to T. H. No. 4 (I = 16/3,700 = .0048)
1.) V = 120 x .0043/.45 = 1.15 ft per day or 420 ft per yr
2.) Well produced from 1963 through present - estimated 1 million B$W.
3.) Time for Brine to reach T.H. No. 4 - 3,700/420 - 8.8 yrs

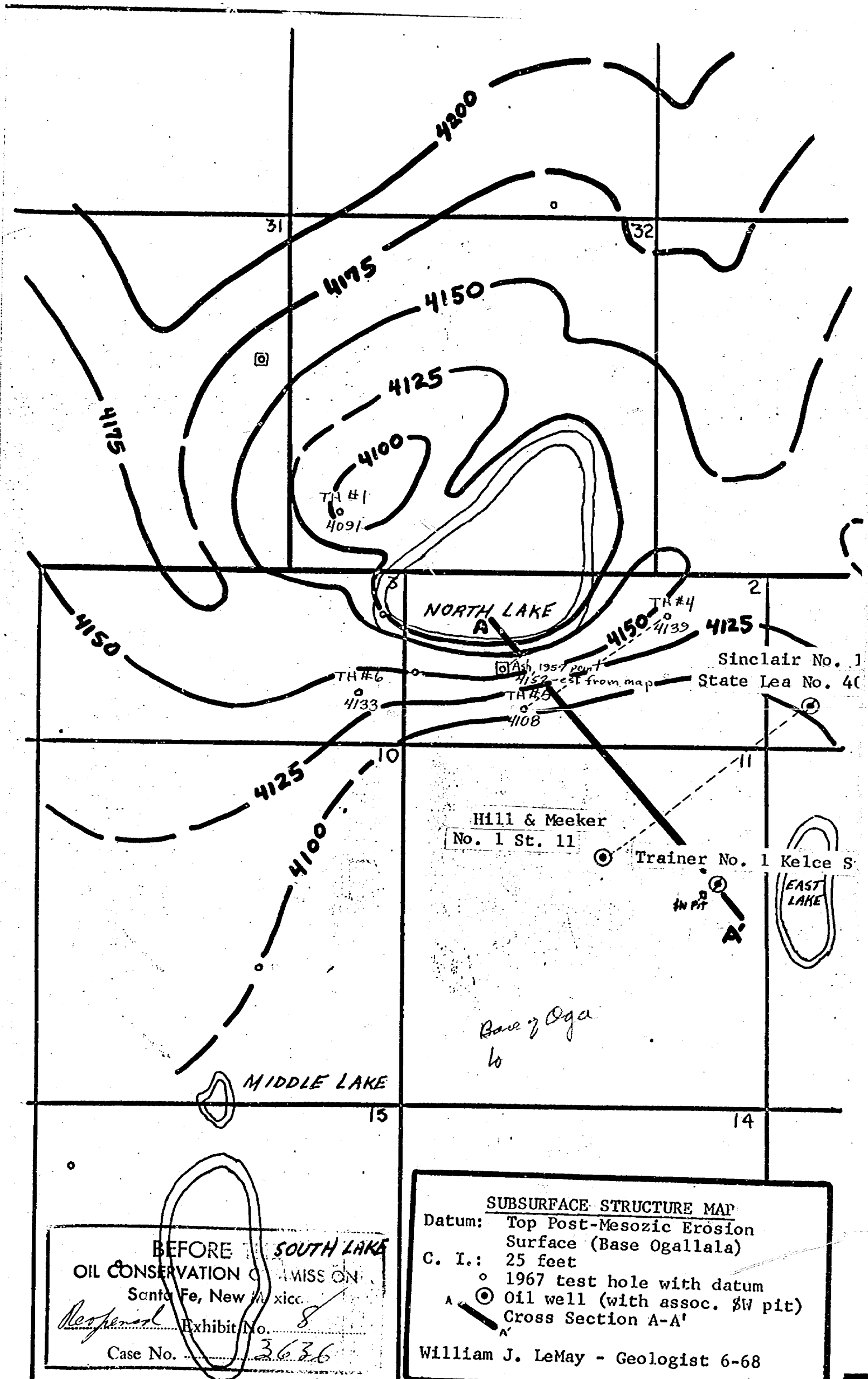
HILL & MEEKER to T.H. No. 5* (I = 20/2,500 = .0080)
1.) V = 120 x .0080/.45 = 2.14 ft per day or 781 ft per yr
2.) Same as above
3.) Time for Brine to reach T.H. No. 5 = 2,500/781 = 3.2 yrs

TRAINER to T.H. No. 4 (I = 22/4,000 = .0055)
1.) V = 120 x .0055/.45 = 1.47 ft per day or 537 ft per yr
2.) Well produced from 1961 through 1967 - estimated 2 million B$W.
3.) Time for Brine to reach T.H. No. 4 = 4,000/537 = 7.4 yrs

TRAINER to T.H. No. 5* (I = 26/3,700 = .0070)
1.) V = 120 x .0070/.45 = 1.87 ft per day or 683 ft per yr
2.) Same as above
3.) Time for Brine to reach T.H. No. 5 = 3,700/683 = 5.4 yrs

* = POSSIBLE CONTAMINATION OF TEST HOLES BY BRINE


31
32
4140
4170
4160
4150
4130
4140
4120
4110
4100
Kcl
To
Ash, 1954 point 4166 Kcl
TH#1 4098 To >1 pint per min.
Kcl
To
SEEP 4119 To
NORTH LAKE
2
TH#4 4123 Kcl (?) >1 pint per min.
To
Kcl
Kcl
Ash 1957 point 4136 (P)
Windmill 4121 To
TH#6 4123 Kcl 3 gpm (?)
TH#5 4119 To 3-5 gpm
4130
10
11
4120
4110
4100
IN PIT
EAST LAKE
MIDDLE LAKE
15
14
Windmill 4114 (1965)
Windmill 4100 (1965)
SOUTH LAKE
Ash 1952 point 4133 To
BEFORE OIL CONSERVATION
Santa Fe, New Mexico
GROUND WATER TABLE MAP
Datum: Top of water table in feet above sea level
P = Pumping
Kcl = Cretaceous aquifer
To = Ogallala aquifer
3-5 gpm = capacity of well
C. I.: 10 feet
Aquifer contact
Ex 12
William J. LeMay - Geologist 6-68



BEFORE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Hess General Exhibit No. 8
Case No. 3636

SUBSURFACE STRUCTURE MAP

Datum: Top Post-Mesozic Erosion Surface (Base Ogallala)

C. I.: 25 feet

° 1967 test hole with datum

⊙ Oil well (with assoc. SW pit)

A — A' Cross Section A-A'

William J. LeMay - Geologist 6-68

E19

CRETACEOUS DATUMS

The following Cretaceous datums (Base of the Ogallala) were picked off of the sample description made by the drillers (driller's logs). For mapping purposes, the Cretaceous is characterized by the presence of yellow or green clays in contrast to the red sandy units of the Ogallala formation (U.S.G.S. differentiation).

TEST HOLE NO. 1
Elevation: 4180.3 feet
Depth to Cretaceous from surface: 89 feet
Top Cretaceous: 4091.3 feet

TEST HOLE NO. 3
Ogallala seep - Cretaceous below

TEST HOLE NO. 4
Elevation: 4159.5 feet
Depth to Cretaceous from surface: 20 feet (There is no reported Gypsum in the Ogallala and its presence indicates Cretaceous age.)
Top Cretaceous: 4139.5 feet

TEST HOLE NO. 5
Elevation: 4138 feet
Depth to Cretaceous from surface: 30 feet
Top Cretaceous: 4108 feet

TEST HOLE NO. 6
Elevation: 4148 feet
Depth to Cretaceous from surface: 15 feet
Top Cretaceous: 4133 f[illegible]

ASH, 1957 point (at south end of Lake)
Elevation and driller's log not available but Ash indentified this well as a water well in the Cretaceous and therefore he must have used this point in drawing his "Post-Mesozoic map". From his contours, a datum of 4152 feet is estimated.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

A

A'

ELEV. 4159.5

Ash 1957 point

LAND SURFACE PROJECTED WEST

T.H. #4
(less than 1 pt. per min.)

T.H. #5
(3-5 g.p.m.)

LAND SURFACE

BRINE DISPOSAL PITS
(projected in X-Sect.)
Sinclair No. 1 State Lea No. 40
Hill & Meeker No. 1 st. 11

BRINE DISPOSAL PIT
Trainer No. 1 Kelce St.

4150'
4145'
4140'
4135'
4130'
4125'
4120'

4136 P
(1957)
Cretaceous

4123

4119

LAKE BED

POSSIBLE GRADIENT

?

?

1,000' 2,000' 3,000' 4,000' 5,000' 1 mile

VERTICAL 10X HORIZONTAL

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. 10
Case No. 3636

DIAGRAMATIC CROSS SECTION, A-A'

- Cretaceous Unconformity
- Points of fluid entry into hydrologic system -- and discharge
- Ground water table

Maximum Gradients
- Sinclair & Hill & Meeker to T.H. No. 4
- Sinclair & Hill & Meeker to T.H. No. 5
- Trainer to T.H. No. 4
- Trainer to T.H. No. 5

William J. LeMay - Geologist 6-58

TEST HOLE NO. 1
New Mexico Salt Water Disposal Company, Inc.
Lea County, New Mexico
Section 32, T10S R34E

El. 4180.3

0-10	White sandy limestone (caliche)
10-15	Tan calcareous sand
15-25	Tan-red fine-medium quartzitic sand
25-35	Tan-red fine-medium sand, some gravel, trace clay
35-60	Gray fine-medium-coarse quartzitic sand, gray limestone, dark gray clay
60-65	Gray fine-medium-coarse quartzitic sand, gray limestone
65-70	Gray shaley sand
70-89	White fine-medium quartzitic sand, clean to argillaceous
89-92	Yellow clay

TD 92' in Cretaceous
SWL 82.6'
Water: Less 1 pint per min.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Appl. Exhibit No. 5
Case No. 3636

TEST HOLE NO. 4
New Mexico Salt Water Disposal Company, Inc.
Lea County, New Mexico
Sec. 2, T11S R34E

GL. 4122.9

0-10	Gray-tan silty clay
10-20	White gypsum & quartzitic sands, trace clay
20-25	Gray gypsum sand (crystals)
25-40	White fine quartzitic sand, medium gypsum crystals
40-55	Gray medium crystalline gypsum with clay
55-58	Gray gyppy clay

TD 58' in Cretaceous
SWL 36.7'
Water: Less 1 pint per min.

4139
4123
16

TEST HOLE NO. 5
New Mexico Salt Water Disposal Company, Inc.
Lea County, New Mexico
Sec. 2, T11S R34E

4118.5

0-15	White-gray very fine quartzitic sand, trace clay
15-30	Gray sandy clay (bentonitic)
30-40	Gray-yellow-black fine gravel & sand, trace clay
40-57	White quartzitic fine-medium-coarse loose sand-gravel
57-60	Blue clay

TD 60' in Cretaceous
SWL 20.4'
Capacity: 3-5 gpm

TEST HOLE NO. 6
New Mexico Salt Water Disposal Company, Inc.
Lea County, New Mexico
Sec. 3, T11S R34E

4147.0

0- 5	Tan-white limey sand
5-15	Red fine quartzitic sand
15-25	Yellow sand & gravel with clay
25-30	Yellow-white sand & fine gravel
30-35	Yellow-white sand & fine gravel, clean
35-50	White fine-medium-coarse loose sand & fine gravel
50-67	White fine-medium-coarse loose sand & fine gravel
67-70	Yellow sandy clay

TD 70' in Cretaceous
SWL 24.6'
Capacity: 3 gpm

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico Salt Water Disposal Company, Inc. Bogle Farms, #12, Supply well TD 125 WL 25-30, Center Sec. 10, T-11s, R34E, 8-2-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	71
Sulfate	242

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Lab. No. C-3388

Jack H Barton

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed **Date Rec'd.** 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc. Carl Johnson, Test hole #11, N.E./4 Sec. 29, T-10S, R34E, 8-1-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	177
Sulfate	284

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Barton

Lab. No. C-3387

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water Date Rec'd. 8-2-67

To Mr. Ed L. Reed

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc. New Mexico, Bogle Farms, #10 Irrigation, Sec. 24R, T-11S, R34E, 8-2-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	127
Sulfate	291

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Barton

Lab. No. C-3386

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-RJ

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc., New Mexico, Bogle Farms, #8, Irrigation composite, Sec. 23, T-11S, R34E, 8-2-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	184
Sulfate	391

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Lab. No. C-3385

Jack H Barton

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc. New Mexico, Stock windmill #7, Bogle Farms, S.E./S.W./4 Sec. 16, T-11S, R34E, 8-2-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	530
Sulfate	166

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Bouton

Lab. No. C-3384

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc., New Mexico, Bogle Farms, Stock windmill, South of ranch house, #5, S.E./S.W./4 Sec. 15, T-11S, R34E, 8-2-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	78
Sulfate	216

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Bunton

Lab. No. C-3382

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Co., Inc. New Mexico, #1, S.W./S.W. Sec. 32 T-10S, R34E, Test hole #1, at 87 ft., 8-2-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	71
Sulfate	184

Copies 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Barton

Lab. No. C-3379

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc., New Mexico, Test hole #5, Sec. 2, T-11s, R34E, 2000 ft. FNL, 1700 ft. FWL.

	Mg/L
Chloride	2387
Sulfate	2973

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Barton

Lab. No. C-3381

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc., New Mexico, #4, Sec. 2, T-11S, R34E, Test hole, 600 FNL, 1400' FEL, 8-1-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	1512
Sulfate	5341

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Barton

Lab. No. C-3380

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Midland, Texas 8-7-67 File No. C-1902-R1

Report of tests on Water

To Mr. Ed L. Reed Date Rec'd. 8-2-67

Received from Mr. Ed L. Reed

Identification Marks Lea County, New Mexico, Salt Water Disposal Company, Inc. New Mexico, Test hole #6, 1800 ft. FNL, 600 ft. FEL, Sec. 3, T-11N, R34E, 8-1-67, sampled by Chester Skrabacz.

	Mg/L
Chloride	184
Sulfate	270

Copies: 3cc Mr. Ed L. Reed

SOUTHWESTERN LABORATORIES

Jack H Barton

Lab. No. C-3383

	Water Samples			
	Spring seep Sample #1	Lake water Sample #2	Windmill #1 Sample #3	South Windmill Sample #4
Resistivity	3.0 @ 78°	.070 @ 78°	7.30 @ 78°	7.62 @ 78°
Specific Gravity	1.002	1.090	1.000	1.000
P H	6.6	7.5	7.3	6.9
Calcium	150	2,300	118	113
Magnesium	40	3,420	30	29
Chloride	725	73,500	200	175
sulphate	80	4,100	90	80
Bycarbonate	420	146	207	214
total iron	trace	trace	trace	trace

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

July 18, 1967

Mr. Charles B. Read
Box 1822
Roswell, New Mexico

Subject: Water Analyses
Our File Number: IWTL-6793

Dear Sir:

This report presents the results of analyses on four samples of water submitted to our laboratory. Gravimetric procedures were used in determining the barium and the sulfate contents. Total iron determinations were made by electrophotometric means, and the remainder of the constituents were analyzed with conventional titrimetric procedures.

We are pleased to be of service.

Very truly yours,

Core Laboratories, Inc.

Dare K. Keelan, Supervisor
Industrial Water Technology Laboratory

DKK:RAL:jr
4 cc. - Addressee

CORE LABORATORIES, INC.
Petroleum Reserve Engineering
DALLAS, TEXAS

WATER ANALYSIS

File IWTL-6793

Company Charles B. Read Well Name #6 Sample No.

Formation Depth Sampled From Water Well

Location Sec. 15-T11S-R34E Field County State

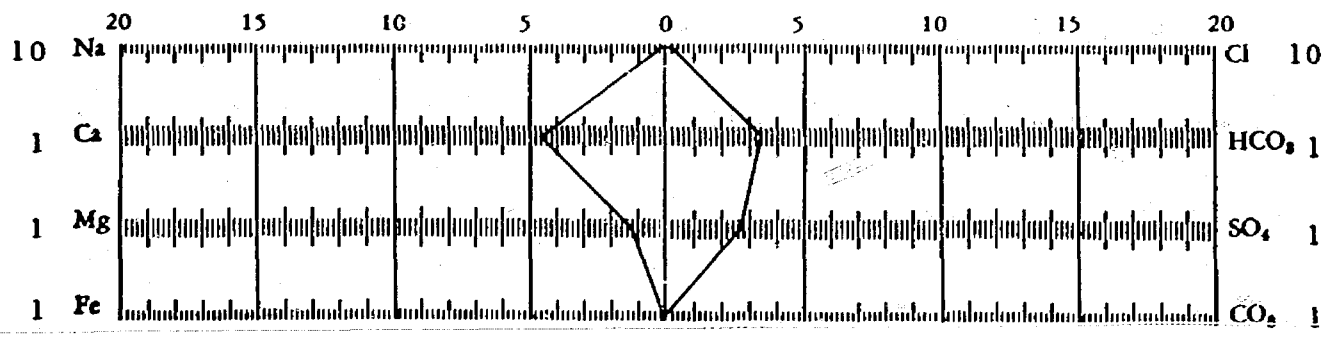
Date Sampled Date Analyzed 7/11/67 Analyst RAL

Total Dissolved Solids 542 mg/L calculated Specific Gravity 1.0001 @ 79 °F.

Resistivity 12.514 ohm-meters @ 79 °F. measured Hydrogen Sulfide absent

pH 8.21 @ 79 °F.

* Constituents	meq/L	mg/L		Constituents	meq/L	mg/L	
Sodium	1.85	42.5		Chloride	1.59	56.4	
Calcium	4.64	93.0		Bicarbonate	3.42	208.4	
Magnesium	1.18	14.4		Sulfate	2.66	127.6	(Grav.)
Iron	0.0	0.0		Carbonate	0.0	0.0	
Barium	0.0	0.0	(Grav.)	Hydroxide	0.0	0.0	



Scale: meq/L

* All analyses except iron determination performed on a filtered sample.

CORE LABORATORIES, INC.
Petroleum Reserve Engineering
DALLAS, TEXAS
WATER ANALYSIS

#13

File IWTL-6793

Company Charles B. Read Well Name _____ Sample No. _____

Formation _____ Depth _____ Sampled From Water Well

Location Sec. 20-T10-R34E Field _____ County _____ State _____

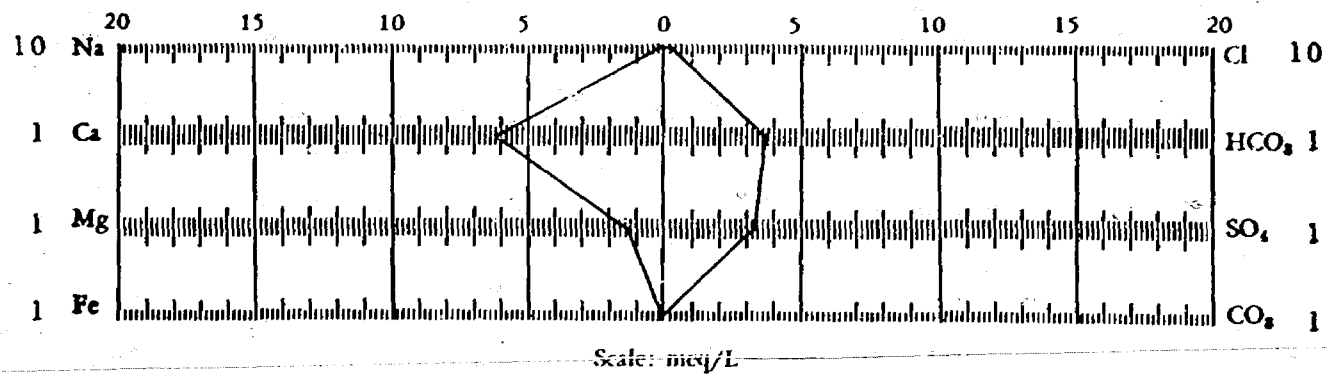
Date Sampled _____ Date Analyzed 7/11/67 Analyst RAL

Total Dissolved Solids 659 mg/L calculated Specific Gravity 1.0001 @ 78 °F.

Resistivity 10.282 ohm-meters @ 78 °F. measured Hydrogen Sulfide absent

pH 8.21 @ 78 °F.

* Constituents	meq/L	mg/L		Constituents	meq/L	mg/L	
Sodium	1.90	43.7		Chloride	2.51	88.8	
Calcium	6.18	123.8		Bicarbonate	3.65	222.9	
Magnesium	1.30	15.8		Sulfate	3.34	160.5	(Grav.)
Iron	0.12	3.3		Carbonate	0.0	0.0	
Barium	0.0	0.0	(Grav.)	Hydroxide	0.0	0.0	



* All analyses except iron determination performed on a filtered sample.

CORE LABORATORIES, INC.
Petroleum Reserve Engineering
DALLAS, TEXAS
WATER ANALYSIS

File IWTL-6793

#2

Company Charles B. Read Well Name _____ Sample No. _____

Formation _____ Depth _____ Sampled From Water Well

Location Sec. 12-11-34 Field _____ County _____ State _____

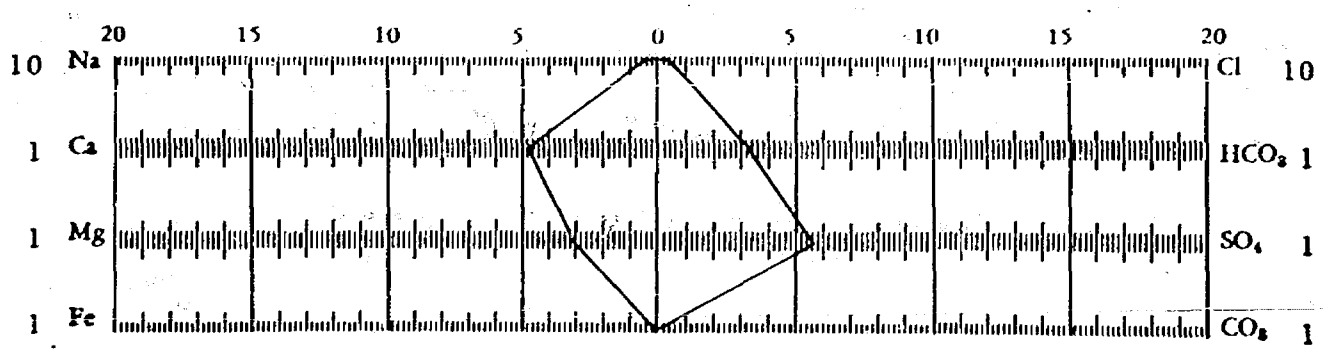
Date Sampled _____ Date Analyzed 7/11/67 Analyst RAL

Total Dissolved Solids 840 mg/L calculated Specific Gravity 1.0002 @ 78 °F.

Resistivity 8.024 ohm-meters @ 78 °F measured Hydrogen Sulfide absent

pH 8.03 @ 78 °F.

* Constituents	meq/L	mg/L	Constituents	meq/L	mg/L
Sodium	4.77	109.6	Chloride	3.62	128.3
Calcium	4.66	93.4	Bicarbonate	3.30	201.2
Magnesium	3.11	37.8	Sulfate	5.62	270.0 (Grav.)
Iron	0.002	0.06	Carbonate	0.0	0.0
Barium	0.0	0.0 (Grav.)	Hydroxide	0.0	0.0



Scale: meq/L

* All analyses except iron determination performed on a filtered sample.

CORE LABORATORIES, INC.
Petroleum Reserve Engineering
DALLAS, TEXAS
WATER ANALYSIS

File IWTL-6793

Company Charles B. Read Well Name _____ Sample No. _____

Formation _____ Depth _____ Sampled From Lake

Location Sec. 2-T11S-R34E Field _____ County _____ State _____

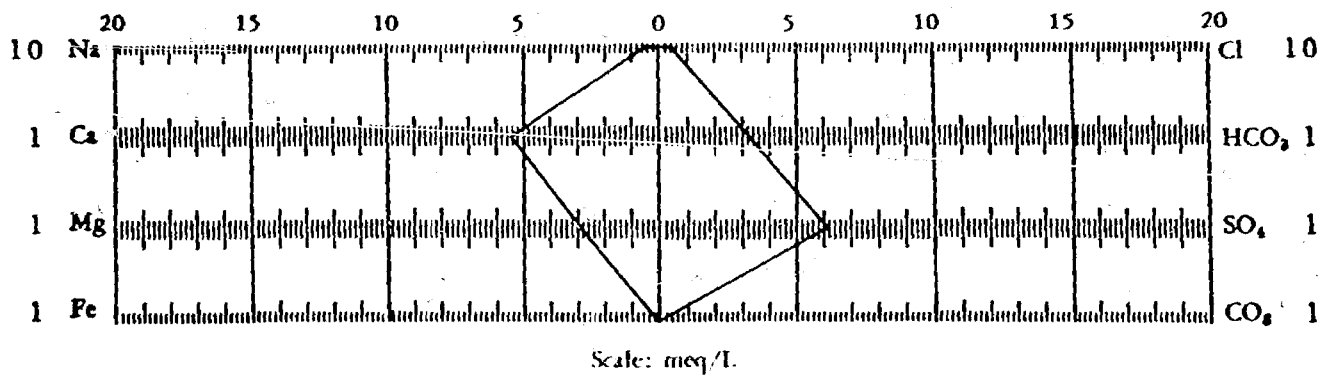
Date Sampled _____ Date Analyzed 7/11/67 Analyst RAL

Total Dissolved Solids 872 mg/L calculated Specific Gravity 1.0002 @ 78 °F.

Resistivity 7.758 ohm-meters @ 78 °F. measured Hydrogen Sulfide absent

pH 8.15 @ 78 °F.

* Constituents	meq/L	mg/L		Constituents	meq/L	mg/L	
Sodium	4.82	110.7		Chloride	3.70	131.1	
Calcium	5.35	107.3		Bicarbonate	3.22	196.3	
Magnesium	2.83	34.4		Sulfate	6.08	292.2	(Grav.)
Iron	0.005	0.14		Carbonate	0.0	0.0	
Barium	0.0	0.0	(Grav.)	Hydroxide	0.0	0.0	



Scale: meq/L

* All analyses except iron determination performed on a filtered sample.

1342-A

HALLIBURTON DIVISION LABORATORY
HALLIBURTON COMPANY
MIDLAND DIVISION

LABORATORY WATER ANALYSIS No. W 1-193-67

To Charles B. Read
Box 2126
Roswell, New Mexico

Date 4/25/67

Submitted by Mr. Buster Norris Date Rec.

Well No. Depth Formation

County Field Source

	Midwest Oil Corp. Skelly State #1	C. B. Read Skelly State #1	C. B. Read Gross #1	
Resistivity	.104 @ 69°F	.102 @ 69°F	.106 @ 69°F	
Specific Gravity	1.068	1.069	1.068	
pH	6.8	6.9	6.9	
Calcium (Ca)	4,120	4,200	4,120	*MPL
Magnesium (Mg)	750	830	700	
Chlorides (Cl)	58,500	59,000	58,500	
Sulfates (SO_4)	980	820	950	
Bicarbonates (HCO_3)	150	160	160	
Soluble Iron (Fe)	10	15	12	

Remarks:
cc: Mr. Buster Norris
Box 639
Hobbs, New Mexico

*Milligrams per liter

Respectfully submitted,

Analyst: Frank Whitfield

cc:

HALLIBURTON COMPANY

By Frank Whitfield
DIVISION CHEMIST

NOTICE

This report is limited to the described sample tested. Any user of this report agrees that Halliburton shall not be liable for any loss or damage, whether it be to act or omission, resulting from such report or its use.