GW - 33

GENERAL CORRESPONDENCE

YEAR(S):

1989 - 1982

El Paso
Natural Gas Company

P.O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-5050

LARRY R. TARVER VICE PRESIDENT

March 9, 1989

Mr. David G. Boyer, Hydrologist
Environmental Bureau Chief
Energy and Minerals Department
Oil Conservation Division
310 Old Santa Fe Train 206
Santa Fe, New Mexico 87501-2088

Subject: Discharge Plan for San Juan River Plant, Non-contact Wastewater

Dear Mr. Boyer:

As discussed in your February 7, 1989 meeting with representatives of Western Gas Processors, Ltd. (Western) and K. E. Beasley of El Paso Natural Gas (El Paso), the purpose of this letter is to request an extension to discharge non-contact wastewater at the San Juan River Plant without an approved discharge plan until December 15, 1989.

Western is presently negotiating to purchase the San Juan River Plant from El Paso and it is anticipated that Western will begin operating the facility in the near future. Final transfer of property ownership will take place after FERC approval. Review of New Mexico Water Quality Control Commission (NMWQCC) regulation 3-111 and discussions with NMOCD legal staff indicate that it is appropriate for El Paso and Western to jointly apply for the extension and provide you with information and commitments to justify the request. The objective of the extension is to allow time for further study of the processes and wastewater systems after transfer of operating responsibilities. This should allow more wastewater reduction methods to be identified. El Paso and Western agree to the following conditions specifically requested by NMOCD:

1. The pump-back system which collects seepage from the waste and raw water ponds must continue to operate to prevent overflow into Stephens Arroyo.

2. A discharge plan outlining process changes and end-of-pipe waste disposal plans must be submitted to NMOCD no later than September 15, 1989.

3. The discharge plan must contain a schedule for implementing the modifications.

4. The "B" cooling tower at San Juan River Plant must be placed in standby by July 1. Further operation of this cooling tower would be on an as-needed basis as required by upsets in the electrical system which would necessitate start-up of the 3 MW turbogenerator at San Juan to serve other facilities in El Paso's system.

Western and El Paso respectfully request your consideration of the extension petition. Technical questions should be directed to K. E. Beasley at 915-541-2146 and Gary W. Davis at 303-452-5603.

Sincerely yours,

Larry R. Tarver
Vice President, North Region
El Paso Natural Gas Company

Gary R. Davis
Vice President of Engineering
Western Gas Processors, Ltd.

Western Gas Processors, Ltd.

WGP Company — The General Partner

July 31, 1989

Oil Conservation Division
State of New Mexico
P.O. Box 2088
Land Office Building
Santa Fe, NM 87504-2088

ATTENTION: David Boyer

RE: SAN JUAN RIVER PLANT - FARMINGTON, NEW MEXICO

Gentlemen:

Western Gas Processors, Ltd. would like to notify the Oil Conservation Division that as of August 1, 1989 we will be the operator of the plant under an interim agreement with El Paso Natural Gas Co. The interim agreement will be in effect until Federal deregulation is complete. During the interim agreement period, Western Gas Processors, Ltd. will propose the ongoing waste water control plan.

Western Gas Processors, Ltd. is prepared to meet with you the afternoon of August 29th or the morning of August 30th whichever is better for you.

Sincerely,

Gary W. Davis

Gary W. Davis
Vice President of Engineering

GWD:jl

cc: Gary Brom

10701 Melody Drive • Suite 609 • Denver, Colorado 80234-4123 • (303) 452-5603

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

March 15, 1989

CERTIFIED MAIL
RETURN RECEIPT NO. P-106 675 486

Mr. Larry R. Tarver, Vice President
North Region Operations
EL PASO NATURAL GAS COMPANY
P. O. Box 1492
El Paso , Texas 79978

RE: **Discharge Plan GW-39**
San Juan River Plant
San Juan County, New Mexico

Dear Mr. Tarver:

The Oil Conservation Division (OCD) has received your request dated March 9, 1989 for an extension to discharge non-contact waste water from San Juan River Plant without an approved discharge plan.

An extension to discharge without an approved discharge plan until December 15, 1989 is hereby approved with the conditions as stated in your March 9, 1989 letter. This extension will allow time for study of the processes and waste water systems after transfer of operation of the plant to Western Gas Processors, Ltd.

If you have any questions, please contact David Boyer at (505) 827-5812 or Roger Anderson at (505) 827-5884.

Sincerely,

William J. LeMay
Director

cc: OCD Aztec Office
Gary Davis, Western Gas
K. E. Beasley, EPNG

El Paso
Natural Gas Company

P.O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-5858

LARRY R. TARVER VICE PRESIDENT

March 9, 1989

Mr. David G. Boyer, Hydrologist
Environmental Bureau Chief
Energy and Minerals Department
Oil Conservation Division
310 Old Santa Fe Train 206
Santa Fe, New Mexico 87501-2088

Subject: Discharge Plan for San Juan River Plant, Non-contact Wastewater

Dear Mr. Boyer:

As discussed in your February 7, 1989 meeting with representatives of Western Gas Processors, Ltd. (Western) and K. E. Beasley of El Paso Natural Gas (El Paso), the purpose of this letter is to request an extension to discharge non-contact wastewater at the San Juan River Plant without an approved discharge plan until December 15, 1989.

Western is presently negotiating to purchase the San Juan River Plant from El Paso and it is anticipated that Western will begin operating the facility in the near future. Final transfer of property ownership will take place after FERC approval. Review of New Mexico Water Quality Control Commission (NMWQCC) regulation 3-111 and discussions with NMOCD legal staff indicate that it is appropriate for El Paso and Western to jointly apply for the extension and provide you with information and commitments to justify the request. The objective of the extension is to allow time for further study of the processes and wastewater systems after transfer of operating responsibilities. This should allow more wastewater reduction methods to be identified. El Paso and Western agree to the following conditions specifically requested by NMOCD:

1. The pump-back system which collects seepage from the waste and raw water ponds must continue to operate to prevent overflow into Stephens Arroyo.

2. A discharge plan outlining process changes and end-of-pipe waste disposal plans must be submitted to NMOCD no later than September 15, 1989.

3. The discharge plan must contain a schedule for implementing the modifications.

4. The "B" cooling tower at San Juan River Plant must be placed in standby by July 1. Further operation of this cooling tower would be on an as-needed basis as required by upsets in the electrical system which would necessitate start-up of the 3 MW turbogenerator at San Juan to serve other facilities in El Paso's system.

David C. Boyer
March 9, 1989
Page 2

Western and El Paso respectfully request your consideration of the extension petition. Technical questions should be directed to K. E. Beasley at 915-541-2146 and Gary W. Davis at 303-452-5603.

Sincerely yours,

Larry R. Tarver
Vice President, North Region
El Paso Natural Gas Company

Gary R. Davis
Vice President of Engineering
Western Gas Processors, Ltd.

Western Gas Processors, Ltd.

WGP Company — The General Partner

PLEASE DELIVER THE FOLLOWING PAGES TO:

David G. Boyer

I'll call Monday Morning to

Discuss.

Gary Davis

TOTAL NUMBER OF PAGES 3 INCLUDING COVER LETTER

DATE 3/10/89 TIME 4:50 PM

IF YOU DO NOT RECEIVE ALL THE PAGES, PLEASE CALL BACK AS SOON AS POSSIBLE

Name Teresa

Phone (303) 452-5603

INCIDENT Rex Smith Complaint

INITIALS	INFORMATION RECEIVED, DIRECTIONS PROVIDED, PERSONS(S) CONTACTED	DATE	TIME
	Jim Gordon - Radiocommunication		
	— Rex Smith 598-5378 (Kirtland NM) complained about noxious fumes from refinery, Mr. Smith wanted to talk to someone responsible	2/13/89	3:15pm
	— notified Bill Hargraves EID Air Quality Bureau	2/13/89	3:20pm
	— notified David Boyer, OCD	2/13/89	3:25pm
	cc → Bill Hargraves David Boyer		

RECEIVED
FEB 15 1989
OIL CONSERVATION DIVISION
SANTA FE

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☒ Telephone ☐ Personal	Time 2:PM	Date 1/19/89

Originating Party	Other Parties
R. ANDERSON OCD	ROBIN FLEMING - KIRKLAND 325-4044

Subject Odors comming from EPNG San Juan River Plant

Discussion Charles Gholson (Aztec OCD) relayed a complaint from Robin Fleming about possible H_2S comming from EPNG's San Juan River Plant. In contacting Ms Fleming I learned she has smelled the odors all her life but wasn't concerned until she had children. She thinks it could be comming from EPNG's flare. Contacted Ken Beasley (EPNG). He is having their engineers investigate, and if they find any H_2S or other gasses being emitted from the facility above their permit

Conclusions or Agreements limitations they will take immediate action to correct the situation

Distribution File

Signed R. Anderson

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

[X] Telephone [ ] Personal	Time 2:30PM	Date 12/16/88

Originating Party	Other Parties
Henry Van, Ken Beasley EPNG	DAVID BOYER OCD

Subject - Contact wastewater Pond - San Juan River Plant

Discussion They called to say that level was full but water being trucked to Basin Disposal. Found several additional sources of contact wastewater that had not been measured previously. They are temporarily diverting filter and salt regeneration backwash to non-contact ponds. They want to build an additional cell to contain all contact and salt & filter regeneration water.

Conclusions or Agreements Will submit plans and specs by mid January. I said we could probably give 2-week turnaround, & 120-day approval while we issue public notice

Distribution EPNG - San Juan River Contact & Non-contact files

Signed D G Boyer

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

December 7, 1988

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Donald N. Bigbie
Vice President
North Region
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

RE: Discharge Plan GW-39
Non-contact wastewater
San Juan River Plant

Dear Mr. Bigbie:

The Oil Conservation (OCD) has received your request dated November 23, 1988, to continue discharging without an approved discharge plan, the non-contact wastewater at San Juan River Plant to the existing wastewater evaporation ponds. The discharge plan application was received at the OCD on December 30, 1987, and is presently under review.

Pursuant to Water Quality Control Commission Regulation 1-106.A and for good cause shown, El Paso Natural Gas Company (EPNG) is hereby granted an extension to March 15, 1989 to discharge without an approved discharge plan, the non-contact wastewater from its San Juan River Plant to the existing evaporation ponds. This extension will allow EPNG to include wastewater disposal commitments in the negotiations for the sale of the plant with prospective buyers.

If you have any questions or comments, please feel free to contact David Boyer at (505) 827-5812.

Sincerely,

William J. LeMay
Director

WJL/RA/sl

cc: OCD - Aztec Office
Kenneth Beasley - EPNG
Henry Van - EPNG

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-5215

DONALD N. BIGBIE VICE PRESIDENT

November 23, 1988

Mr. David G. Boyer, Hydrologist
Environmental Bureau Chief
Energy and Minerals Department
Oil Conservation Division
310 Old Santa Fe Trail 206
Santa Fe, New Mexico 87501-2088

RE: Discharge Plan for San Juan River Plant, Non-Contact Wastewater (GW-39)

Dear Mr. Boyer:

Confirming your November 11, 1988, telephone conversation with K. E. Beasley and H. Van, El Paso Natural Gas Company (EPNG) requests an extension to continue to discharge the non-contact wastewater at San Juan River Plant to the existing wastewater evaporation ponds until March 15, 1989. The reasons for this request are the following:

- EPNG is negotiating the sale of the San Juan River Plant and anticipates that these negotiations will be completed by early March 1989.

- The feasibility of the proposed non-contact wastewater system (Land Appication) has been completed and before undertaking considerable detailed design work EPNG would like to have time to negotiate wastewater disposal commitments with the prospective buyers. There are indications that the prospective buyers might elect to modify processes which would result in changes in wastewater volumes.

- The pumpback system used to return seepage to the wastewater system is still operational and will remain in operation until the present ponds are idled.

EPNG would appreciate your consideration of these reasons for an extension of the discharge plan approval process until the above-mentioned date. We believe that by March 15 an agreement will have been reached with the prospective buyers to allow firm commitments to be made about the non-contact wastewater discharges.

If you have questions please contact Kenneth Beasley or Henry Van at (915) 541-2146 or 2832, respectively.

Very truly yours,

Donald N. Bigbie

Donald N. Bigbie
Vice President, North Region

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

October 19, 1988

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Dr. Henry Van
Senior Environmental Engineer
Environmental and Safety
Affairs Department
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

RE: Discharge Plan for San Juan River Plant, Non-Contact Wastewater (GW-39)

Dear Dr. Van:

Enclosed is a draft copy of the SJRP monitoring and reporting summary. If you have any changes or corrections, please let me know.

As discussed on the telephone Monday, October 17, I have just a few additional monitoring items I wish El Paso Natural Gas to concur with before DP approval. These changes already have been incorporated in the draft summary.

1. Nitrite (NO_2) should be analyzed in the wastewater at least once per year. In my letter of February 22, 1988, "nitrite" was spelt as "nitrate" but the correct chemical formula was used (#8, p.5).

2. The once per year wastewater sampling for aromatic and halogenated VOC's should be a "grab" instead of a "composite" sample.

3. One of the three additional pre-operational samplings should include an analysis in all wells for VOC's.

4. Routine monitor well sampling should include MW-2.

5. Water in MW-4 should be analyzed once per year for VOC's.

6. Oil Conservation Division requests quarterly submittal of all monitoring results.

As soon as we receive written confirmation that you concur in these monitoring changes, plan approval will be given. A copy of the draft approval letter is enclosed. It includes the conditions of approval, also discussed on the phone.

If you have any questions, please call me at (505) 827-5812.

Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB:sl

Enclosure

EL PASO NATURAL GAS
SAN JUAN RIVER PLANT, NON-CONTACT WASTEWATER

Monitoring and Reporting Schedule

The schedule below summaries the routine monitoring and reporting agreed to be performed by EPNG as part of the discharge plan for the San Juan River Plant (GW-39). While this summary is meant to be inclusive, if any differences occur between the schedule presented here and that presented in the discharge plant, the discharge plan (including subsequent correspondence) is the controlling document.

Monitoring	Sampling Parameters	Reporting Frequency	Discharge Plan Reference
Wastewater:			
1. Monthly samples first year then semi-annually in January and summer. All samples shall be a composite of three samples taken eight hours apart.	Major cations/anions (sodium, potassium, calcium, magnesium, chloride, sulfate, carbonate-bicarbonate), TDS, TKN, NO_3, SAR, Flowrate, field pH and electrical conductivity (EC).	Quarterly first year thence semi-annually with submittal to OCD within 30 days of company receipt and verification.	Phase II report, p. 87-88; Discharge Plan, p. 11; EPNG 4/22/88 letter, p. 14; EPNG notes of 4/27/88 meeting; EPNG _______ letter.
2. Once per year; single grab sample, except composite for nitrite (NO_2).	Aromatic and halogenated volatile organic compounds (VOC), NO_2.	Annual with submittal to OCD within 30 days of company receipt and verification.	EPNG 4/22/88 letter, p. 14; EPNG _______ letter.
Groundwater:			
1. Water levels measured quarterly in all monitoring wells and peizometers.	Water levels.	Quarterly.	EPNG 4/22/88 letter, p. 12; EPNG 8/19/88 letter, p. 3.
2. Pre-operational - Three additional samples prior to start of land application. Taken from wells MW-2, 3, 4, 5 and 6.	Same as monthly wastewater, plus one sample from each well taken and analyzed for VOC's with resampling if detected.	Within 30 days of analysis receipt and verification.	EPNG 4/22/88 letter, p. 14; EPNG ______ letter.
3. Operational - Quarterly at wells MW-2, 3, 4, 5 and 6. At end of three years may request reduction in sampling frequency.	Same as monthly wastewater with one sample per year taken from MW-4 for VOC's.	Quarterly with submittal to OCD within 30 days of company receipt and verification.	Discharge Plan p. 11; EPNG 4/22/88 letter, p. 14; EPNG _______ letter
Soil Cores:			
1. Continuous irrigation plots - semi-annually with one sampling in the last quarter of the year after the active growing season. Five random samples taken at each depth listed below and composited for analysis. Depths are 0-12", 12-24", and 24-36".	Sampled for soil-water EC, pH, NO_3, ESP, soluble cations and anions, organic matter, gypsum requirement, and moisture content.	Semi-annually with submittal to OCD within 30 days of company receipt and verification.	Discharge Plan, p.11-12.

Monitoring	Sampling Parameters	Reporting Frequency	Discharge Plan Reference
2. Non-continuous irrigation plots - Same as above but only one sampling after end of growing season.	Same as above.	Annually.	Same as above.
Soil Moisture:			
1. Monthly sensors at 12 stations (one per acre) in each zone at 1, 5 and 10 foot depths.	Moisture potential (volumetric water content).	Quarterly.	EPNG 8/19/88 letter, p. 3.

DRAFT

October 19, 1988

<u>CERTIFIED MAIL</u>
<u>RETURN RECEIPT REQUESTED</u>

Mr. Donald N. Bigbie, Vice President
North Region
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

RE: Discharge Plan for San Juan River Plant, Non-contract Wastewater (GW-39)

Dear Mr. Bigbie:

The ground water Discharge Plan for non-contact wastewater at the San Juan River Plant located in Section 1, Township 29 North, Range 15 West, (NMPM) San Juan County, New Mexico is hereby approved with the conditions listed below. In addition to these conditions, the approved plan consists of the Discharge Plan application dated December 30, 1987, and the supplementary materials dated April 22, August 19, and __________, 1988. The discharge plan application incorporated by reference the EPNG Phase I and II reports dated August and November 1987, respectively.

The conditions of discharge plan approval and the reasons for such conditions are:

1. Engineering plans and specifications for the non-contact wastewater holding facility shall be submitted to OCD for review and approval prior to construction. This review is necessary to ensure adequate design for safety and to prevent leakage or seepage to ground water.

2. The operational manual shall be submitted to OCD for review prior to the onset of land application. Land application shall not commence until the detailed operational information in the manual has been reviewed and approved by OCD. The reason for this requirement is that final system operating details will be incorporated in the operational manual and OCD review is necessary to ensure consistency with other parts of the discharge plan for ground water protection.

3. Any herbicides used to control undesirable weeds shall be registered and approved by the Pesticide Management Bureau of the New Mexico Department of Agriculture in Las Cruces. Application amounts shall not exceed those recommended by that Bureau. Ground water monitoring for these herbicides may be necessary depending on the dosage and frequency of application. The reason for this condition is to ensure that pesticides are applied safely and in an environmentally sound manner for protection of ground water.

4. If a die-off of seeded pasture grass to below 20% of basal ground cover (with ~~no~~ any bare area larger than three (3) square feet) occurs, reseeding or discontinuance of the land application will be required. The reason for this condition is that since evapotranspiration from the grass is the predominant moisture removal mechanism, moisture and salt migration to ground water is likely to occur if the approved pasture density is not maintained.

The discharge plan was submitted pursuant to Section 3-106 of the New Mexico Water Quality Control Commission Regulations. It is approved pursuant to Section 3-109. Please note subsections 3-109.E. and 3-109.F., which provide for possible future amendment of the plan. Please be advised that the approval of this plan does not relieve you of liability should your operation result in actual pollution of surface or groundwaters which may be actionable under other laws and/or regulations.

The monitoring and reporting shall be as specified in the discharge plan and supplements thereto. These requirements are summarized on the attached sheet. Any inadvertent omission from this summary of a discharge plan monitoring or reporting requirement shall not relieve you of responsibility for compliance with that requirement.

Please note that Section 3-104 of the regulations requires that "When a plan has been approved, discharges must be consistent with the terms and conditions of the plan." Pursuant to Section 3-107.C. you are required to notify the director of any facility expansion, production increase, or process modification that would result in any significant modification in the discharge of water contaminants.

Pursuant to subsection 3-109.G.4., this plan approval is for a period of five (5) years. This approval will expire October ___, 1993, and you should submit an application for new approval is ample time before that date.

On behalf of the staff of the OCD, I wish to thank you and your staff, and consultants for cooperation during this discharge plan review.

Sincerely,

William J. LeMay
Director

WJL:DGB:sl

Attachment

cc: OCD - Aztec Office
K. Beasley - EPNG, El Paso
H. Van - EPNG - El Paso

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

August 19, 1988

Mr. David Boyer, Chief
Environmental Bureau
Oil Conservation Division
Energy Minerals and Natural Resources Department
P.O. Box 2088
State Land Offices Building
Santa Fe, NM 87504

Reference: **Discharge Plan for San Juan River Plant, Non-Contact Wastewater (GW-39)**

Dear Mr. Boyer:

In reference to your letter to Mr. Donald N. Bigbie of June 27, 1988, regarding your comments on the referenced plan, enclosed please find an addendum to the referenced plan which includes responses to your comments and information requests concerning the proposed wastewater land application project at the San Juan River Plant.

We hope that these responses will answer your questions and provide the information you requested.

If you have questions, please contact me at 915/541-2832 or Mr. Kenneth E. Beasley at 505/325-2841, extension 2175.

Sincerely,

Henry Van, Ph.D.
Senior Environmental Engineer
Environmental and Safety Affairs Department

HV:cds

Enclosure

cc: K. E. Beasley
D. N. Bigbie
J. C. Bridges
W. H. Healy
A. Pundari
G. J. Odegard
File: 5202 (w/w)

ADDENDUM TO:

RESPONSES TO SPECIFIC COMMENTS AND INFORMATION REQUESTS CONCERNING THE WASTEWATER LAND APPLICATION PROJECT at the EL PASO NATURAL GAS SAN JUAN RIVER PLANT

prepared for:

State of New Mexico
Oil Conservation Division
Santa Fe, New Mexico

by:

El Paso Natural Gas Company
Farmington, New Mexico

and

K. W. Brown & Associates, Inc.
College Station, Texas

July, 1988

ADDENDUM

RESPONSES TO SPECIFIC COMMENTS AND INFORMATION REQUESTS

A.3 p.3 Provide in the operational manual for the site the anticipated seeding and fertilizer application rates for tall fescue grass and the procedures to be used to establish the grass during the first year. Indicate whether the grass crop will be mowed and disposition clippings.

Response: A perennial pasture consisting of a pure stand of tall fescue will be established following recommendations of Leon Martinez, Conservationist, U.S. Department of Agriculture, Farmington, New Mexico. Tall fescue, variety Alta or Kentucky 31, will be planted in the fall in order to allow emergence and early stand growth before the winter months. Seedbed preparation will consist of discing the site with a moldboard plow or similar tillage implement. The seed will be planted either by drilling or broadcast several days after a rain (pre-irrigation may be used if rainfall is insufficient). High quality seed will be obtained from local seed sources and planted at 4 pounds/acre if drilled, or at 12 pounds/acre if broadcast. No fertilizer is needed for the first fall season.

During the first full growing season, and in each succeeding growing seasons, fertilizer will be applied at the rate of 175 pounds/acre, split into three applications. The first application is scheduled for March, to ensure good early season growth. The two later applications will follow two planned cuttings of the fescue crop; these cuttings are tentatively scheduled for mid June and late August of the first year. It is anticipated that chemical spraying for weed control will be necessary during the first growing season. Carmax or Banvel will be applied as a post-emergence herbicide in the spring to control mustard and other broadleaf weeds.

During the first year and perhaps during the second year, clippings from the vegetative cover will be allowed to accumulate on the site. Allowing the clippings to accumulate will increase the organic matter in the soil, thereby increasing the stability of the soil and increasing its moisture holding capacity. During subsequent years it is anticipated that the fescue will be harvested as a hay crop under contract to a local farmer/rancher. In the event that arrangements can not formulated for the harvest of the fescue as a hay crop, then the grass will be mowed frequently and the clippings will remain on the plot.

B.1 p.6 How will potential storage in the root zone be measured so that irrigation application can be scheduled when 0.5 S is approached?

Response: An automated system for monitoring soil moisture potentials in the rooting zone on a real-time basis will be installed for irrigation scheduling purposes. The system consists of 24 AGWA-II soil matric potential sensors installed at approximately 1-foot depth throughout the 12-acre wastewater irrigation site. These sensors will be interfaced with a micro-computer data processing system. When a majority of the sensors indicate that soil matric potentials have dropped below the threshold soil matric potential (corresponding to a volumetric water content of 0.5 S), the computer system will command irrigation proportional to the magnitude of the difference between the threshold and the sensor reading.

B.1 p.6 Please confirm previous conversation with EPNG Staff and consultants that approximate volume and concentration of wastewater to be land applied are calculated without inclusion of flow from the Softener Regeneration unit.

Response: Estimates offered in the Phase II report and in previous responses to OCD comments are based on values, the magnitude of which, do not include regeneration wastewater. Piping associated with regeneration units has been redesigned so all regeneration wastewater is directed to the double-lined surface impoundment. This piping is currently inplace and operating.

B.1 p.12 After 8 years of simulation, the model shows levels of soil water EC to be about 4 mmhos/cm in the top 15 cm of the soil. What EC levels are predicted after 20 years of operation, and will these predicted levels exceed the salt tolerance limits for tall fescue?

Response: In discussions with OCD personnel concerning the constraints of the model, it was agreed that a run of 16 years would be acceptable. To achieve the extended model calculation, it was necessary to reduce one years climatic input data from 12 data sets to 6 data sets. This was accomplished by averaging two months data. The end result of the exercise was a predictive model which encompassed 15 years, not the agreed upon 16 years. However, upon reviewing the data it was decided that the 15 year effort was sufficiently representative for predictive purposes.

With the exception of averaging two months values to generate climatic data, none of the input model constraints were altered from those presented in the first set of responses. The result of this latest modeling effort is graphically presented in Figure A (attached). Figure A corresponds to Figures 2 and 3 from the first round of responses. Comparison of these graphs reveals that slight differences are present. However, the magnitude of the differences are small and the overall conclusion presented is essentially unchanged. The differences realized between the two separate modeling efforts are attributed to variations resulting from averaging data.

In summary it can be stated that the EC is increasing over time in the rooting zone at the land application site. However, the magnitude of the increase is well within the tolerance range for tall fescue. Ayers and Westcot (1976) reported that the upper EC tolerance limit for tall fescue is 23 mmhos/cm. The EC value predicted by WORM after 15 years of operation is slightly over 9 mmhos.

C.2 p.13 Provide the proposed location of the additional monitoring wells to be installed.

Response: Figure B illustrates the locations of monitoring wells to be installed at the site to complete the groundwater monitoring system. The selection of the locations for these wells is based on the groundwater flow direction, controlling features of the local geology, and the desire to used existing monitoring wells which were installed during the feasibility study. Three new monitoring wells will be installed (MW-4, MW-5, MW-6) and MW-3 will be retained as an active well for the land application project. This configuration places three wells in downgradient locations and one well upgradient of the land application areas.

Additionally, all of the monitoring wells and piezometers not designated for groundwater sampling will be used to measure the depth to water during the active life of the land application project. Depth-to-water measurements from all monitoring wells and piezometers will provide a clear picture of the groundwater contours at the site.

C.9 As discussed at the April 27 meeting, a vadose zone monitoring plan is necessary to detect a major failure of the system and provide early warning. Information on the type of system, location, proposed monitoring frequency, etc. needs to be provided. Would such a system be able to measure or provide information on soil EC in addition to changes in moisture content?

Response: An automated system for measuring soil moisture (matric) potentials will be installed to monitor subsoil moisture content changes below the irrigated fields. The system consists of the AGWA-II moisture sensors manufactured by AGWATRONICS of Merced, California. Sensors will be installed at 1-foot depth for irrigation scheduling purposes, and at 5 and 10-foot depths to measure soil moisture redistribution below the rooting zone. At least one sensor will be installed per acre for each depth increment throughout the 12-acre irrigation site. The sensors will be interfaced with a micro-computer data processing system which will automatically take moisture potential measurements on a monthly basis.

The UZM system design proposed does not make measurements of soil EC. However, it will allow the soil moisture flux to be evaluated and this gives an indirect measurement of solute movement. Based on computer simulations of soil moisture redistribution over a 15-year period, it is anticipated that volumetric soil water contents will be too low to allow collection of soil-pore liquids using conventional porous ceramic lysimeters or pan-type collection devices in the unsaturated zone. Therefore, the automated soil moisture measurement system will be the sole UZM monitoring system. In the event that soil moisture potentials increase to higher levels than expected during the life of the wastewater irrigation project (indicating early breakthrough of soil drainage water and dissolved solutes), porous ceramic lysimeters can be retrofitted to attempt collection of soil-pore liquids, or soil cores can be taken in the unsaturated zone to verify and quantify the magnitude of downward salt movement below the irrigated fields.

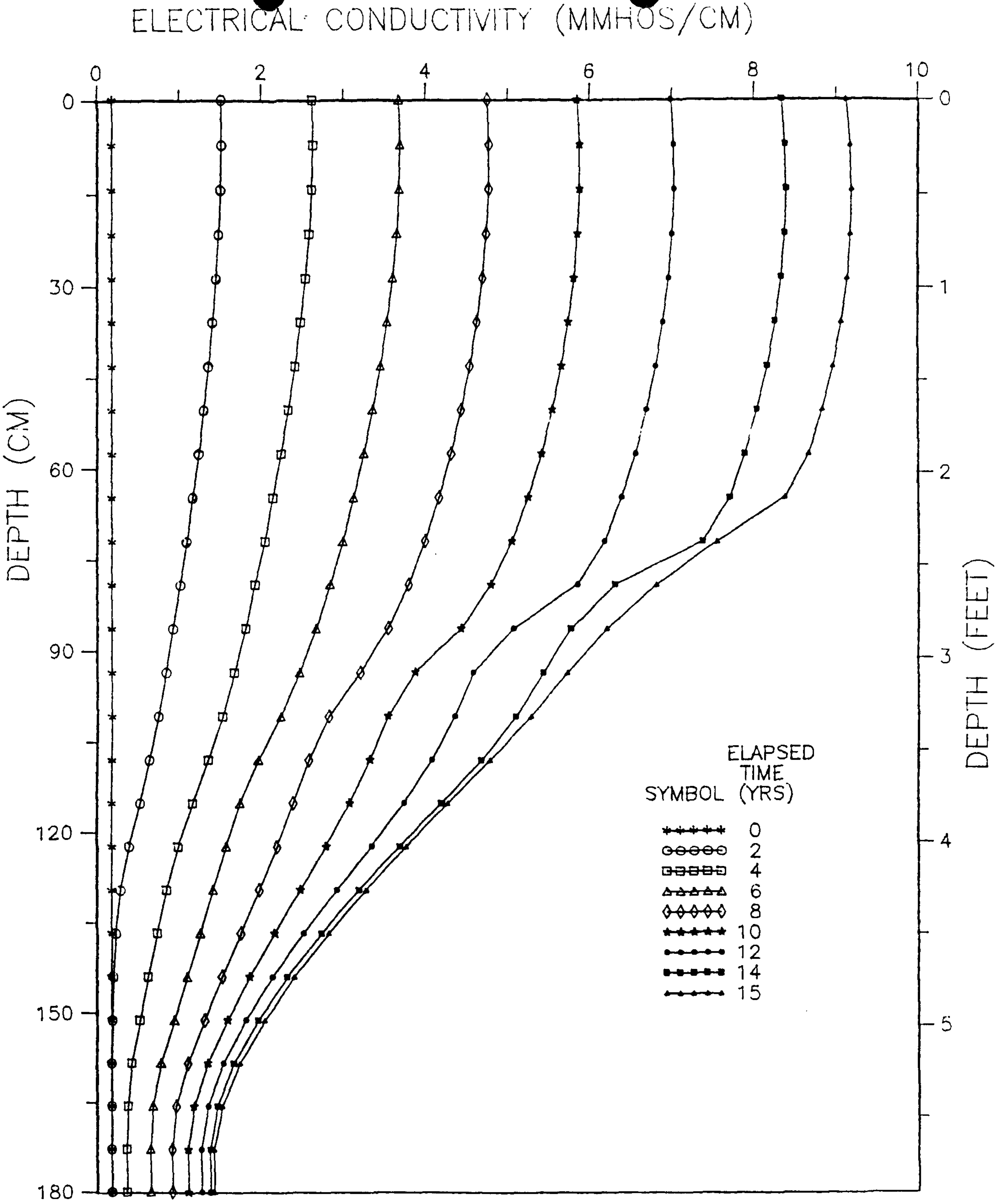

FIGURE A. VOLUMETRIC MOISTURE CONTENT VERSUS DEPTH FOR YEARS 0-15 AS PREDICTED BY WORM.

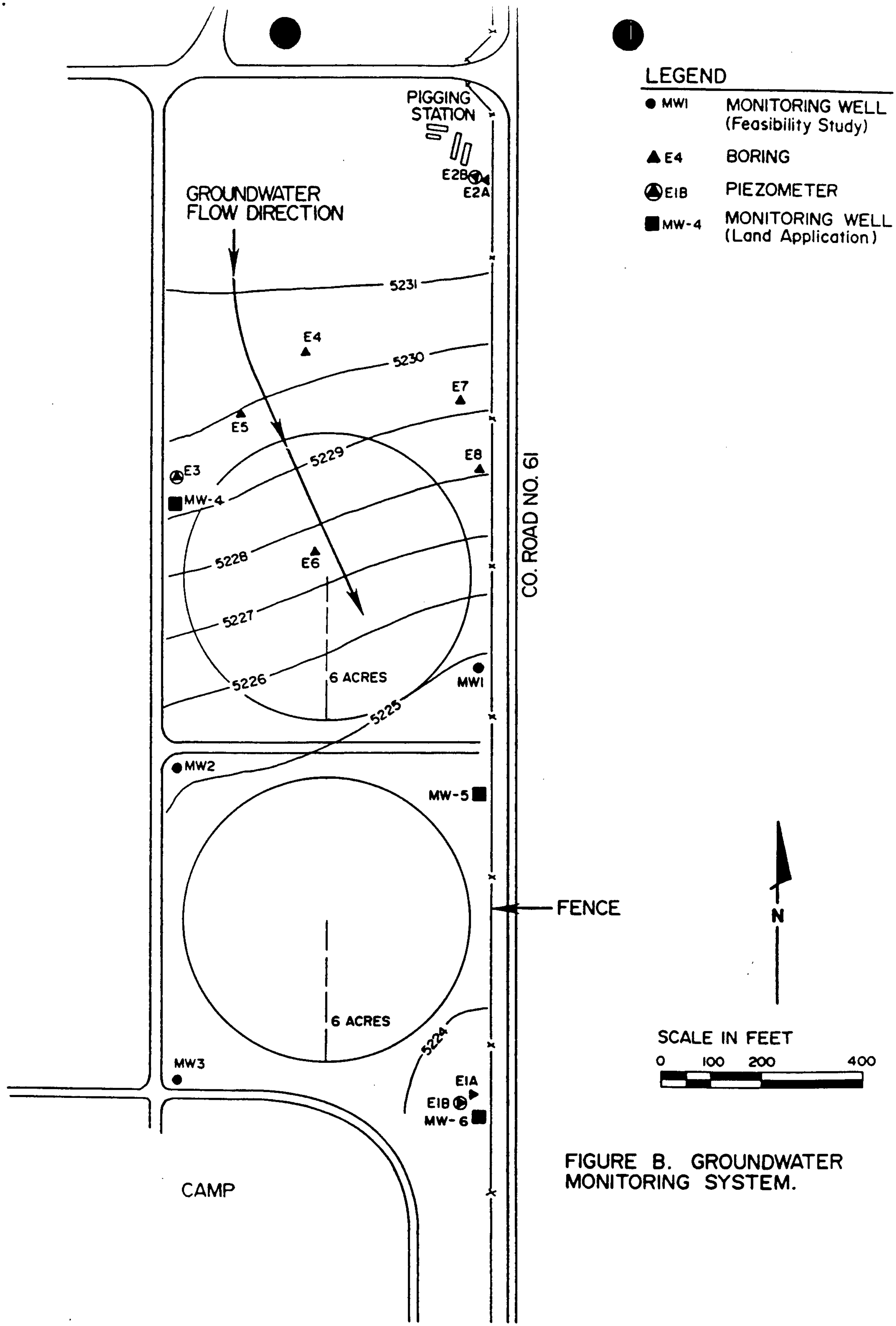

FIGURE B. GROUNDWATER MONITORING SYSTEM.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

June 27, 1988

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Donald N. Bigbie
Vice President
San Juan and Southern Divisions
El Paso Natural Gas Company
P.O. Box 1492
El Paso, TX 79978

RE: Discharge Plan for San Juan River Plant, Non-Contact Wastewater (GW-39)

Dear Mr. Bigbie:

The Oil Conservation Division (OCD) has reviewed the additional materials (dated April 22, 1988) regarding the above referenced discharge plan. This information was presented and discussed at the April 27, 1988 meeting in Santa Fe between EPNG, your consultants and OCD staff. The OCD appreciates the complete and comprehensive response of EPNG's consultants (K.W. Brown & Associates) to our technical concerns raised in my letter of February 22, 1988. Most of these questions were resolved by K.W. Brown's responses and those remaining prior to plan approval are listed below. The numbering sequence used below references item and page number in the K.W. Brown April, 1988 response.

A.3 p.2 Provide in the operational manual for the site the anticipated seeding and fertilizer application rates for tall fescue grass and the procedures to be used to establish the grass during the first year. Indicate whether the grass crop will be mowed and disposition of clippings.

B.1 p.6 How will potenital water storage in the root zone be measured so that irrigation applications can be scheduled when 0.5 S is approached?

B.1 p.6 Please confirm previous conversations with EPNG Staff and consultants that approximate volume and concentration of wastewater to be land applied are calculated without inclusion of flow from the Softner Regeneration unit.

B.1 p.12 After 8 years of simulation, the model shows levels of soil water EC to be about 4 mmhos/cm in the top 15 cm of the soil. What EC levels are predicted after 20 years of operation, and will these predicted levels exceed salt tolerance limits for tall fescue?

C.2 p.13 Provide the proposed locations of the additional monitoring wells to be installed.

C.9 As discussed at the April 27 meeting, a vadose zone monitoring plan is necessary to detect a major failure of the system and provide early warning. Information on the type of system, location, proposed monitoring frequency etc. needs to be provided. Would such a system be able to measure or provide information on soil EC in addition to changes in moisture content?

The above items constitute the remaining information OCD needs for review prior to discharge plan approval. Plan approval wil allow EPNG to move ahead with remaining system design and completion of operational maunal preparation. Approval to actually begin effluent application will be deferred unitl OCD reviews and approves the operational manual.

If you or your consultants have any questions, please contact me at (505) 827-5812.

Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

cc: Oil Conservation Division - Aztec
K. Beasley - El Paso Natural Gas: Farmington
H. Van - El Paso Natural Gas: El Paso

FAO IRRIGATION AND DRAINAGE PAPER 24

revised 1977

crop water requirements

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS ROME

FAO IRRIGATION AND DRAINAGE PAPER 24

revised
1977

guidelines for predicting
crop water requirements

by

j. doorenbos
water management specialist
land and water development division
fao

and

w. o. pruitt
fao consultant
irrigation engineer
university of california
davis, california, u.s.a.

in consultation with

a. aboukhaled (lebanon)
j. damagnez (france)
n.g. dastane (india)
c. van den berg (netherlands)
p.e. rijtema (netherlands)
o.m. ashford (wmo)
m. frère (fao)

and

fao field staff

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome 1977

SUMMARY

This publication is intended to provide guidance in determining crop water requirements and their application in planning, design and operation of irrigation projects.

Part I.1 presents suggested methods to derive crop water requirements. The use of four well-known methods for determining such requirements is defined to obtain reference crop evapotranspiration (ETo), which denotes the level of evapotranspiration for different climatic conditions. These methods are the Blaney-Criddle, the Radiation, the Penman and Pan Evaporation methods, each requiring a different set of climatic data. To derive the evapotranspiration for a specific crop, relationships between crop evapotranspiration (ETcrop) and reference crop evapotranspiration (ETo) are given in Part I.2 for different crops, stages of growth, length of growing season and prevailing climatic conditions. The effect of local conditions on crop water requirements is given in Part I.3; this includes local variation in climate, advection, soil water availability and agronomic and irrigation methods and practices. Calculation procedures are presented together with examples. A detailed discussion on selection and calibration of the presented methodologies together with the data sources is given in Appendix II. A computer programme on applying the different methods is given in Appendix III.

Part II discusses the application of crop water requirements data in irrigation project planning, design and operation. Part II.1 deals with deriving the field water balance, which in turn forms the basis for predicting seasonal and peak irrigation supplies for general planning purposes. Attention is given to irrigation efficiency and water requirements for cultural practices and leaching of salts. In Part II.2 methods are presented to arrive at field and scheme supply schedules with emphasis towards the field water balance and field irrigation management. Criteria are given for operating the canal system using different methods of water delivery, and for subsequent design parameters of the system. Suggestions are made in Part II.3 on refinement of field and project supply schedules once the project is in operation.

The presented guidelines are based on measured data and experience obtained covering a wide range of conditions. Local practical, technical, social and economic considerations will, however, affect the planning criteria selected. Therefore caution and a critical attitude should still be taken when applying the presented methodology.

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 1 of
Date: 4/27/88
By: H. Van
File: SJRP

STATE ENGINEER'S OFFICE &

NMOCD/EPNG/KWB MEETING ON THE

NMOCD COMMENTS ON THE LAND APPLICATION

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
72.15	iC_5	13.85
72.15	nC_5	13.71
86.18	iC_6	15.50
86.18	C_6	15.57
100.21	iC_7	17.2
100.21	C_7	17.46
114.23	C_8	19.39
28.05	$C_2^{=}$	9.64
42.08	$C_3^{=}$	9.67

MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

Discussed each response:

- (A.1) Details of system design
  - will be presented in an operational manual
  - The collection system is under construction because regardless of the disposal system EPNG will need this collection system.
  - Spray irrigation will be used

- (A-2). EPNG needs to carefully address the drift off of EPNG property in the final design.
  - OCD agrees that EPNG will

- (A-3) Native Vegetation vs. Tall Fescue
  - Tall fescue is a good choice

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
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72.15	nC_5	13.71
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MISC.

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44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

- EPNG will maintain adequately

• (A.4) Operation of irrigation system during periods of wet weather

- Operational Manual will have criteria for determining threshold values of weather conditions for operating the system.

- w/o moisture equipment how EPNG plans to determine when to apply the wastewater after days of precipitation.

- EPNG will outline the criteria in the operation manual
  1) Several approaches KWB said:
  - Model runs w/ rain & evap. values.
  - Some kind of field testing may be necessary to verify the calculations
  - How often these checks will be required?

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 3 of
Date: 4/27/88
By: H. Van
File: SJRP

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
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44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

- KWB's water balance table 2 includes avg. precipitation.
- The seeding rate needs to be adequate to develop a good root system.

- (A.5) How will the amount of water applied be measured
  - Will be address when the model is presented.

- (A.6)

- (A.7) Does not apply anymore

B. Impacts of Existing and Added Salt

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 4 of
Date: 4/27/88
By: H. Van
File: SJRP

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
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42.08	$C_3^=$	9.67

MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

B.1 More than 10 Ac-Ft needs State Engineer's approval

- Table 1

Column by Column explanation of this ~~[illegible]~~ Table.

STATUS OF CLOSURE PLAN
TO Mr. Nick Black

- 2 wks after we complete review and 2wks to submit the sampling plan.
- Is EPNG willing to purchase the affected land and will indemnify action.

- State Engineer's Concern
  - Salt Treaty w/ Mexico and down valley Colorado
  - Goal is to eliminate salts
  - Demonstrate that the SJRP will not deposit the salts in the systems permanently.

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 5 of
Date: 4/27/88
By: H. Van
File: SJRP

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
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42.08	$C_3^=$	9.67

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44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

- KWB Calculations show that this will not be the case, the goal has been to immobilize the salts. However, this will require management of the site. But the OCD wants assurance that once the plant is not in operation the salts do not leach down to cause deposition of salts.

- KWB has met Boyer's information requirements regarding water balance.

- State Engineer concern of fertilizer addition will be adding salts which have not been taken into consideration, However, he can see that the quantities may not be ~~...~~ substantial based on the fertilizer application rates KWB quoted.

- Needs to address the effects of

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 6 of
Date: 4/27/88
By: H. Van
File: SJRP

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
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MISC.

MW		gals/mol
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64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

of cutting the grass in the operation manual concern the plan use of water.

C. Groundwater & Vadose Zone Monitoring

- (C.1) Agree to install the monitoring wells req'd.
- (C.2) See C.1
- (C.3) Will follow suggestions on the monitoring wells.
- (C.4)
- (C.5) We'll sample as suggested
- (C.6) OK the use of proven statistical package suggested by KWB.
- (C.7) OK
- (C.8) Need to ~~[illegible]~~ analyze halogenated for public concern - by 601 & 602 EPA Tests (Looking for solvents).

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: ___ of ___
Date: 4/27/88
By: [illegible]
File: 5JRP

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
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MISC.

MW		gals/mol
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28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

- (C.9) OCD suggest that the ~~[illegible]~~ lysimeters should be install to detect major failure. These would provide an early warning system in addition to groundwater monitoring. Take a look on two or three lysimeter systems for OCD to approve one.

KWB&A
ENVIRONMENTAL CONSULTANTS

April 25, 1988

David Boyer
Hydrogeologist
New Mexico Oil
Conservation Division
P.O. Box 2088
Santa Fe, NM 87501

Dear Dave,

Enclosed are copies of the responses to the specific comments offered concerning the land application project at the El Paso Natural Gas San Juan River Plant. During our meeting on Wednesday, Ken will bring a cover letter from EPNG which will need to be attached to the comments. We wanted you to have an opportunity to review the responses prior to the meeting, therefore, we did not feel it was warranted to delay mailing the comments just so the cover letter could be attached.

Henry and I will be in Albuquerque on Tuesday night and Ken will be arriving early Wednesday morning. It is my understanding that the meeting will begin at approximately 10:00 on the 27th. People attending the meeting will include Ken, Henry, two other people from K. W. Brown & Associates, Inc.: Bobby Speak (Hydrogeologist) and Dr. James Rehage (Soil Scientist), and me. Also, there is a possibility that Greg Odegard and John Bridges from EPNG will arrive in time to attend the meeting.

If you have any questions concerning the enclosed information prior to our arrival, please feel free to call me before 4:00 (central time) at (409) 690-9280.

Respectfully,

Sid

Sidney H. Johnson
Staff Scientist

SHJ/ljc
Enclosures

cc: Ken Beasley
Henry Van

K.W. BROWN & ASSOCIATES, INC. ∘ 6 GRAHAM ROAD ∘ COLLEGE STATION, TEXAS 77840 ∘ (409) 690-9280

El Paso
Natural Gas Company

DONALD N. BIGBIE VICE PRESIDENT

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-5215

April 22, 1988

Mr. David G. Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504

Subject: Discharge Plan for San Juan River Plant Non-contact Wastewater (GW-39)

Dear Mr. Boyer:

El Paso Natural Gas Company has received your February 22, 1988 comments on the discharge plan submitted to you on December 30, 1987. El Paso appreciated your input and has studied the concerns expressed in that letter.

Attached are responses to your specific comments. It is understood that members of El Paso's compliance and environmental staff as well as representatives of K.W. Brown and Associates, the project consultant, will meet with you on April 27, 1988 for a detailed review of the responses and supporting groundwater modeling.

Thank you again for your assistance in this effort. Please feel free to contact the San Juan Division Compliance Engineer at (505) 325-2841 should you require additional information.

Sincerely yours,

Donald N. Bigbie

Donald N. Bigbie
Vice President,
San Juan and Southern Divisions

DNB:vs

RESPONSES TO SPECIFIC COMMENTS AND INFORMATION REQUESTS CONCERNING THE WASTEWATER LAND APPLICATION PROJECT at the EL PASO NATURAL GAS SAN JUAN RIVER PLANT

prepared for:

State of New Mexico
Oil Conservation Division
Santa Fe, New Mexico

by:

El Paso Natural Gas Company
Farmington, New Mexico

and

K. W. Brown & Associates, Inc.
College Station, Texas

April, 1988

RESPONSES TO
SPECIFIC COMMENTS AND INFORMATION REQUESTS

A. Surface Preparation and Effluent Application

A.1. P. 3, Phase II; p. 9, D.P.: Amounts applied should be controlled to prevent ponding on the plots. This may require surface leveling to prevent drainage to low areas. Will the method of application (sideroll irrigation) prevent ponding and surface drainage, or will site leveling be necessary?

RESPONSE: The wastewater application rate will be adjusted to ensure that surface ponding does not occur. Specific operational and design features for the land application system used to prevent surface ponding will be detailed in an Operational Manual which is currently being prepared.

It is not anticipated that surface leveling will be required since Phase I field investigations determined the soils on the East site have permeabilities which range from 1.3 to 20.0 in/hr. (The primary soil series at the East site is the Sheppard series which exhibits a permeability of 3.1 to 20.0 in/hr.) It is anticipated that the application rate of the irrigation system will be adjusted as not to exceed the soils ability to accept the applied wastewater. If during operation it is noted that ponding is occurring in localized areas, measures will be taken, either in system operation or recontouring, to prevent ponding.

A.2. P. 7, D.P.: To prevent spray drift off property during high winds, El Paso may want to establish a non-irrigated buffer zone next to the country road. If not already in place, fencing along the east boundary of the irrigated area (along the country road) should be installed to prevent public access.

RESPONSE: A buffer zone is not considered a viable option since the full acreage may be desired for the land application project in the future. Rather, EPNG will operate the irrigation system under conditions which prevent drift off of EPNG property. Specific system management techniques to be employed to prevent drift will be presented in the operation manual.

A fence currently surrounds the land application site to prevent public access.

A.3. P. 79, Phase I; P. 7 D.P.: If native vegetation is to be irrigated, the proposed application rates that are shown in Table 4.7, p. 36 (Phase II report) will drown the native plants present on the most heavily irrigated acreage. Different vegetation species (e.g. hay, alfalfa) must be planted if application rates are heavy. If rates are lowered to grow native species, "nuisance" species such as tumbleweeds must be avoided. Notwithstanding the above, salt impacts due to leaching must be considered as discussed below.

RESPONSE: As will be presented in the following responses, the wastewater application rates have been adjusted to meet the needs, both water requirements and salt tolerance, for perennial pasture grasses (i.e., tall fescue). To satisfy the evapotranspiration requirements while maintaining a satisfactory vegetative cover a perennial pasture grass will be used. To this end tall fescue will be planted and the site will be maintained as a grass pasture rather than a native plant community. Tall fescue was selected based on its tolerance to salt, long growing season, and low water requirements.

As for "nuisance" species it is anticipated that they will be present in the pasture setting which will be established. However, the abundance of "nuisance" species is expected to be low and it is anticipated that they will not represent a serious aesthetic problem. In the event "nuisance" species become a problem, EPNG will consider mowing the the site before they mature and become a nuisance.

For further information, see the response to comment B.1.

A.4. Procedures on the operation of the irrigation system during periods of wet weather need to be provided. How does El Paso propose to balance actual irrigation needs with actual rainfall so that excess effluent is not applied during periods of rainfall exceeding the average?

RESPONSE: As stated previously an operational manual is currently being prepared which will address all aspects of land application and site management. Preparation of the manual requires input concerning the actual design of the system and the associated constraints of the system. As the details of the system are defined, operational procedures will be formulated which are tailored to the irrigation system implemented. Text within the operation manual will define protocols concerning operation in wet weather. The objectives of the protocols will be to prevent applying excessive amounts of water during conditions which could lead to uncontrolled leaching.

A.5. Will spraying be done on a 24-hour basis? How will the amount of water applied be measured so that the sideroll system does not distribute too much in one spot? Will the sideroll continually move under its own power, or must it be physically moved from one application location to another?

RESPONSE: Once again, the details of the irrigation system to be used at the site have not been completely defined. Once the system is selected all of the details of system operation will be included in the operational manual. At this time EPNG can offer assurances that the system will be operated in a manner which evenly distributes the wastewater across the site. Also, it is not anticipated that the system will be operated on a 24-hour basis. It is likely that timing of irrigation will be based on the amount of wastewater available, plant needs, soil conditions, and prevailing weather.

A.6. P. 7, D.P.: The minimum acreage required is dependent on both seasonal changes in evapotranspiration and on the type of crop grown. Empirical coefficients have been developed that relate crop water needs to evapotranspiration. For the Farmington area, NM State University operates an agricultural farm that measured actual consumptive use (U) for several crops and Class A Pan evaporation (E). The coefficients (U/E) are used to prepare water budgets for irrigation. K. W. Brown used floating pan evaporation data for calculating water rate applications. This is equivalent to a coefficient of 0.87. Alfalfa (a very water consumptive crop) has a coefficient of 0.64 for the area as was estimated in NM State Engineer Office publication #32 ("Consumptive Use and Water Requirements in New Mexico", by H.F. Blaney and E. G. Hanson, 1965). A two-year study by NMSU in 1974-75 estimated the coefficient at 0.77. Two sources reported in SEO #32 list natural grass and grass and weeds as having coefficients of 0.23 and 0.28, respectively. Calculation of application rates for these coefficients requires use of much of the 26-acres year-round, and considerably more off-season storage. Consultation with EMNDR coal mine reclamation experts has provided information that several salt tolerant species of grass grow quite well in the area with total water applied (from precipitation plus supplemental application) of less than 16 inches. They also believe that extra water for leaching is not necessary for these grasses. OCD can provide suggested native grass species and seed application rates for seeding.

RESPONSE: See response to comment B.1.

A.7. D. 8, D.P.: Irrigation location for October is missing on Figure 4-1.

RESPONSE: Changes in the application rates to a zero-discharge system make this figure obsolete. A new figure will be drafted and supplied in the operation manual.

B. Impacts of Existing and Added Salt.

B.1. P. 45-85, Phase II; EPNG 12/24/87 letter; Phase II used computer modeling to estimate both transport of chloride from surface to the ground water (SUMATRA1 and WORM models), and the geochemical speciation of mineral in the ground water (WATEQF model). While I concur with the results of the model simulations for chloride, and the carbonate salts (p. 85), no similar estimation was performed and/or presented for the other soluble salts, especially sodium and sulfate. Both are extremely prevalent in the subsurface cores and in the existing ground water. Most of the soluble cations and anions shown in both E-1 and W-2 cores (Table D-1, Phase I report) are sodium and sulfate. The total effect of all soluble salts on the existing ground water must be determined.

RESPONSE: The following text is intended to address concerns raised in comment A.3 and A.6 in addition to questions posed under comment B.1. K. W. Brown & Associates, Inc.'s (KWB&A) Phase II report provided for the irrigation of land on a variable-area basis. Since the submission of that document, and after reviewing comments from OCD concerning the water balance, EPNG and KWB&A have collectively made a number of revisions to the original water budget. The most significant alteration is in the method of wastewater application. As a result of KWB&A's recommendation, EPNG has decided to pursue a fixed-area irrigation system. This decision stems from anticipated operational complexities associated with the wastewater application process under a variable-area scenario. This revision significantly impacts the Phase II water budget and, as a result, a new water budget considering fixed-area has been developed, and is submitted as Table 1.

The following fully describes each column in Table 1, and includes any assumptions used in formulating the column.

Column (1): Months in a year; the dormant season lasts from November to February, and the growing season extends from March to October.

Column (2): Mean monthly values of precipitation recorded at the Fruitland 2 E meteorological station for the years 1938-1983 (Reference: Kunkel, undated)

Column (3): Design precipitation is used to compute the size of the storage impoundment required during wet weather periods. Design precipitation is based on the 25-year return period normalized rainfall and is computed using the following formula (Reference: KWB&A Phase II report):

$$P_d = F_s \times P_m \qquad (1)$$

Where: P_d = design precipitation (inches)

F_s = factor of safety (1.75) (dimensionless)

P_m = mean precipitation (inches)

Column (4): Class A Pan evaporation values were provided by David G. Boyer, NMOCD (Reference: Boyer, 1988).

Column (5): Lake evaporation was computed from Class A Pan evaporation data using the following equation:

$$E_L = k_p \times E_p \qquad (2)$$

Where: E_L = lake evaporation (inches)

k_p = Class A Pan coefficient (dimensionless)

E_p = Class A Pan evaporation (inches)

A pan coefficient of 0.70 was taken from published National Climatic Center Data (NOAA, 1979).

Column (6): Due to the varying stages in the growth cycle of a plant, consumptive use varies with time. The method used to estimate crop consumptive use for a perennial grass pasture at the SJRP involves several step-wise calculations and is based on climatic data and empirical constants derived for the Farmington area. This method follows procedures outlined by the Food and Agricultural Organization (Doorenbos and Kassum, 1979) which have been widely accepted and applied to irrigation scheduling projects in the southwestern U. S. (Pettygrove and Asano, 1984). For a given crop, maximum evapotranspiration (ET_{max}) is given as:

$$ET_{max} = k_c \times ET_o \qquad (3)$$

Where: ET_{max} = maximum evapotranspiration (inches)

k_c = crop coefficient for the particular crop (dimensionless)

ET_o = reference evapotranspiration (inches)

As mentioned earlier, actual measurements of Class A Pan evaporation at the Farmington weather station were used to approximate reference evapotranspiration (ET_o). Reference evapotranspiration represents the rate of consumptive water use of a healthy crop, grown in large fields under optimum agronomic and irrigation management.

The crop coefficient is the empirical ratio of ET_{max}/ET_o and is derived from experimental data collected at the San Juan Agricultural Experiment Station located near Farmington, New Mexico. The coefficients vary with time and constitute a unique crop curve. Crop coefficients for alfalfa were used to represent tall fescue in the water balance because no reliable data were available for this species. Crop coefficients for this grass were approximated by multiplying the crop coefficient values for alfalfa by 90 percent (Dr. Ted Sammis, personal communication). Tall fescue is the grass species selected for use at SJRP because of its winter hardiness, long growing season, tolerance of salt or alkaline soil conditions, and ease of establishing and maintaining irrigated pastures. Because tall fescue is considered a cool season grass, the period of winter dormancy is shorter than for alfalfa. This means that the consumptive water use and crop coefficients for tall fescue will be slightly higher compared to alfalfa for several months of the year.

The seasonal distribution of mean crop coefficients for alfalfa was obtained from lysimeter trials. The source of these data is the New Mexico State University Experiment Station (Sammis et al., 1985). From this data, a seasonal distribution of the crop coefficient for tall fescue was estimated (Figure 1).

In keeping with the methodologies employed by Sammis et al. in developing crop coefficients for plants in the San Juan River area, a third-order polynomial was fitted to the experimentally-generated data. This curve was used to generate monthly values of tall fescue crop coefficients (Column (6), Table 1).

Column (7): The actual rate of water uptake by the crop (consumptive use) is determined by whether the available water in the soil is adequate, or whether the crop will suffer from stress induced by a soil water deficit. Actual evapotranspiration (ET_a) equals ET_{max} when soil water available to the crop is adequate. Consider the potential water storage, S, which can be defined as the water storage in the root zone between field capacity and the permanent wilting point of plants. $ET_a = ET_{max}$ when the available water in the root zone is 0.5 S or greater (Abdul-Jabber et al., 1983). In other words, ET_{max} occurs when less than 50 percent of the potential water storage has been depleted. Irrigation applications will be scheduled so that an application event occurs when 0.5 S is approached. Timing irrigation events in this manner ensures optimal plant growth and allows use of ET_{max} values for estimating crop consumptive use in the water balance calculations.

Column (8): The root zone moisture deficit is generally defined to be the lack of moisture in the root zone due to evaporation and transpiration exceeding effective precipitation. The root zone moisture deficit is defined to be (KWB&A Phase II report):

$$RZMD = E_a - P \qquad (4)$$

where RZMD = root zone moisture deficit (inches)

E_a = consumptive use (inches)

P = precipitation (inches)

Column (9): This column simply mirrors column (8) with the exception that there are no crop requirements in the dormant period. As a result, crop requirements during November through February are zero.

Column (10): Wastewater inflow is approximately 27 acre-inches per month (Reference: KWB&A Phase II report).

Column (11): As stated previously, EPNG will be irrigating a fixed-area tract of 12 acres. This value was chosen, after much analysis of the water budget, to minimize growing season moisture deficits.

Column (12): Crop requirements are converted to volume units by multiplying column (9) by column (11).

Column (13): Efficiency-adjusted wastewater requirements are computed by use of the following formula (Pettygrove and Asano, 1984):

$$D = \frac{R}{(E_u/100)} \qquad (5)$$

where D = efficiency-adjusted wastewater requirements (acre-inches) (column (13))

R = crop requirements (acre-inches) (column (12))

E_u = irrigation system efficiency (80 percent)

For a system that is 80 percent efficient, only 80 percent of the applied water will reach the soil and plant surfaces, and the remaining 20 percent will be lost to the atmosphere via evaporation.

Column (14): This column represents the volume of wastewater in the storage reservoir at the beginning of the month. For the present analysis, it is assumed that the impoundment is empty at the beginning of January.

Column (15): Available wastewater is the sum of beginning-of-the-month reservoir volume (column (14) and the inflow from the SJRP (column 10) (i.e., 27 acre-inches). This column is used to compute the maximum storage volume required since it is assumed that all 27 acre-inches of the wastewater flow enters the impoundment prior to irrigating.

Column (16): To prevent downward movement of wastewater during the dormant season, there will be no applications made from November to February.

The method of wastewater storage has been changed from tank storage to a double-lined surface impoundment with leak detection; the impetus for this change is essentially poor economics resulting from excessive storage requirements. Total yearly wastewater requirements, considering plant needs and irrigation system efficiency, are approximately 500 acre-inches (42 acre-feet). The SJRP can only supply 324 acre-inches (27 acre-feet) of water annually. Thus, a moisture deficit exists at the site. To provide adequate water during the hottest part of the growing season (i.e., June through August), only a fraction of the wastewater requirements are applied during the spring. The values in column (16) listed during the growing season were chosen manually to achieve a balance between supplying the grass with water and ensuring that the storage reservoir drains completely prior to entering the dormant season; this precludes unlimited accumulation of water in the impoundment over the years that the system is in operation.

Column (17): Losses and gains in water result in the storage reservoir over the course of the year due to interception of precipitation and evaporation of water from the reservoir surface. Net reservoir gain/loss is computed using the following formula:

$$R_L = (E_L - P)\, A_{Res} \qquad (6)$$

where R_L = reservoir gain/loss (acre-inches)

E_L = lake evaporation (inches)

P = precipitation (inches)

A_{Res} = mean surface area of the storage impoundment (acres)

Column (18): End-of-the-month reservoir volume is column (15) minus column (16) minus column (17). The end-of-the-month reservoir volume then becomes the beginning-of-the-month reservoir volume for the succeeding month.

B.2. Table 4.7 (p. 36) Phase II, p. 3, K. W. Brown attachment to EPNG 12/24/87 letter: The scenario presented in the table estimates more than a foot of water per year being leached to the subsurface on the most heavily irrigated plots. When steady state conditions are attained, that amount will reach the ground water and mound under the site. This will locally change both the direction and magnitude of the local hydraulic gradient causing the poorer quality ground water (with native and added salts) to migrate faster downgradient. The magnitude of these changes (both water movement and concentrations has not been estimated in the reports.

RESPONSE: Initially the land application system was to be designed to maintain the quality of leachate at or above the quality of the local groundwater. However, regulatory questions raised by OCD in the cover letter to these comments in effect limits operation of the system to zero discharge. (Zero discharge is defined as not allowing applied wastewater to reach groundwater during the operation of the land application system.)

As EPNG will be pursuing a no-discharge permit from OCD, the Phase II water balance and computer modeling exercise are no longer appropriate. The following text describes the "re-modeling" of wastewater application based on the updated water balance.

The principal goal of this effort was to show that the majority of salts introduced into the soil system will be retained by the vadose zone. Unlike the Phase II flow/transport model, the updated version focuses on the upper six feet of soil. A root water uptake function has been included to accurately depict extraction of soil moisture from the root zone. This root water uptake model considers plant stresses derived from lack of moisture and from osmotic pressures inhibiting uptake of water by roots. The computation of osmotic pressure requires soil water electrical conductivity (EC). EC is a measure of the total amount of salts present in the soil solution. Thus, unlike the transport of chloride in Phase II, this analysis focused on transport of soil water EC. Since EPNG is striving for a no-discharge situation, it follows that there should be minimal drainage from the root zone; this has, in fact, been demonstrated. For the present analysis, the root zone constitutes the upper 3 feet of soil. Below 3 feet, the soil is very similar to that modeled as Stratum 1 in Phase II (the main difference is that the saturation moisture content has been redefined, conservatively, as 0.40 cm^3/cm^3 instead of 0.45 as in Phase II).

Aside from changing to a fixed-area irrigation system, a significant departure from the Phase II water budget analysis is the omission of a leaching requirement. This approach insures that the applied wastewater will be immobilized (i.e., absorbed) by the 65-foot unsaturated zone underlying the east site. Since there is no longer a leaching requirement, the volume of applied wastewater has been significantly changed from Phase II; this alteration

affects the boundary conditions (with respect to the flow model) that feed WORM. Table 2 shows the revised boundary conditions.

Table 2. Revised Boundary Conditions for WORM.

Year	Month	80 % of Appl. WW (cm)	Net Infil. (cm)	Consump. Use[c] (cm)	Net Infil. (cm/day)	Consump. Use (cm/day)	Final Soil Water EC (mmhos/cm)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Jan	0.00	0.67[a]	0.00	0.0224	0.0000	0.00
	Feb	0.00	0.00[a]	0.00	0.0000	0.0000	0.00
	Mar	1.69	3.27[b]	3.34	0.1089	0.1114	1.30
	Apr	1.69	3.01[b]	8.09	0.1005	0.2698	1.40
	May	3.39	4.53[b]	12.46	0.1510	0.4152	1.87
	Jun	6.77	7.54[b]	19.01	0.2512	0.6336	2.25
	Jul	6.77	8.55[b]	20.18	0.2850	0.6728	1.98
	Aug	5.93	8.42[b]	17.92	0.2805	0.5975	1.76
	Sep	4.57	6.71[b]	11.23	0.2235	0.3743	1.70
	Oct	2.20	4.41[b]	4.52	0.1470	0.1508	1.25
	Nov	0.00	0.00[a]	0.00	0.0000	0.0000	0.00
	Dec	0.00	0.71[a]	0.00	0.0238	0.0000	0.00
2	Jan	0.00	0.67[a]	0.00	0.0224	0.0000	0.00
	Feb	0.00	0.00[a]	0.00	0.0000	0.0000	0.00
	Mar	1.69	3.27[b]	3.34	0.1089	0.1114	1.30
	Apr	2.71	4.03[b]	8.09	0.1343	0.2698	1.68
	May	5.08	6.22[b]	12.46	0.2074	0.4152	2.04
	Jun	8.47	9.23[b]	19.01	0.3076	0.6336	2.29
	Jul	8.47	10.24[b]	20.18	0.3415	0.6728	2.07
	Aug	7.62	10.11[b]	17.92	0.3370	0.5975	1.88
	Sep	5.08	7.21[b]	11.23	0.2405	0.3743	1.76
	Oct	4.57	6.78[b]	4.52	0.2261	0.1508	1.69
	Nov	0.00	0.00[a]	0.00	0.0000	0.0000	0.00
	Dec	0.00	0.71[a]	0.00	0.0238	0.0000	0.00

[a]Net Infiltration = Precipitation - 0.50 * Lake Evaporation (>=0)
[b]Net Infiltration = Precipitation + 0.80 * Applied Wastewater
[c]Column (7) of Table 1

Column (6) feeds into WORM's surface boundary condition for the flow equation, and column (7) is utilized by the root water uptake function.

Since the proposed irrigation system is anticipated to be 80 percent efficient (20% evaporative loss during irrigation), it follows that the fraction of wastewater that actually reaches the soil surface will have undergone a concentration of salts due to the evaporation of 20 percent of the applied wastewater. The following two-step mass-balance procedure was devised to adjust for the build-up of salt concentration upon irrigation, and the dilution of the applied wastewater with precipitation:

$$C_3V_3 = C_1V_1 - C_2V_2 \qquad (7)$$

Where: C_3 = EC of wastewater actually reaching soil surface (mmhos/cm)

V_3 = volume of wastewater actually reaching soil surface (ac-in)

C_1 = EC of applied wastewater (mmhos/cm)

V_1 = volume of wastewater applied (ac-in)

C_2 = EC of wastewater lost to atmosphere (mmhos/cm)

V_2 = volume of wastewater lost to atmosphere (ac-in)

$$V_3 = V_1 - V_2 \qquad (8)$$

Insertion of equation (8) into equation (7) and solving for C_3, yields:

$$C_3 = \frac{C_1V_1 - C_2V_2}{V_1 - V_2} \qquad (9)$$

To illustrate the logic of the procedure, a quick calculation using the numbers for March is given:

C_1 = 2 mmhos/cm C_2 = 0 mmhos/cm
V_1 = 10 ac-in V_2 = 10 ac-in - (0.8)(10 ac-in) = 2 ac-in

$$C_3 = \frac{(2\text{ mmhos/cm})(10\text{ ac-in}) - (0\text{ mmhos/cm})(2\text{ ac-in})}{(10\text{ ac-in} - 2\text{ ac-in})} = \mathbf{2.50\ mmhos/cm}$$

As stated above, the procedure utilized two steps to arrive at the final quality of the applied wastewater. The final step is used to adjust the salt concentration in the wastewater due to dilution by precipitation.

$$C_5V_5 = C_3V_3 + C_4V_4 \qquad (10)$$

Where: C_5 = final EC of water applied to soil surface (mmhos/cm)

V_5 = total volume of water applied to soil surface (ac-in)

C_4 = EC of precipitation (mmhos/cm)

V_4 = volume of precipitation (ac-in)

$$V_5 = V_3 + V_4 \qquad (11)$$

Insertion of equation (11) into equation (10) and solving for C_5, yields:

$$C_5 = \frac{C_3V_3 + C_4V_4}{V_3 + V_4} \qquad (12)$$

To continue with the calculation for March:

C_3 = 2.50 mmhos/cm C_4 = 0 mmhos/cm
V_3 = 8 ac-in V_4 = (0.62 in)(12 ac) = 7.44 ac-in

$$C_5 = \frac{(2.50 \text{ mmhos/cm})(8 \text{ ac-in}) + (0 \text{ mmhos/cm})(7.44 \text{ ac-in})}{(8 \text{ ac-in} + 7.44 \text{ ac-in})} = \mathbf{1.30 \text{ mmhos/cm}}$$

Thus, the electrical conductivity of the wastewater plus precipitation, considering irrigation losses, is approximately 1.30 mmhos/cm for the month of March. Column (8) was used as a boundary condition for the solute transport component of WORM.

The flow/transport model WORM was run for a period of 8 years utilizing boundary conditions defined on a monthly basis. Figure 2 illustrates the predicted moisture content profile for the upper six feet of soil for years 0 through 4. Year 1 indicates that the upper 110 cm (3.61 feet) of soil has been wetted to levels above the initial moisture content of 8.8 percent. Below 110 cm, the model has shown that an insignificant amount of drainage has occurred (0.089 cm of water has drained after 1 year) as the moisture content has fallen below the initial value; this amount of drainage pales in comparison to the total amount of water applied (18.50 cm), and the total amount of water removed via evapotranspiration (18.88 cm).

The convergence of moisture curves for years 2-4 suggests that steady-state conditions are developing within the upper six feet of soil; Figure 3 tends to support this claim. A closer comparison of Figure 3 with Figure 2 indicates that the soil is becoming drier with time. At 180 cm (6 feet), the curves are grouped together at the initial moisture content level of about 9 percent. The curve describing soil moisture conditions after 8 years have passed shows that the soil profile is becoming drier. It should be reiterated at this point that the saturation moisture content is 40 percent. Thus, the highest level of water saturation observed during the 8-year run was about 31 percent (12.5/40 * 100 %).

Figures 4 and 5 are curves of soil water EC versus depth for years 0 through 8. Initially (i.e., t=0), the soil water EC was at 0.18 mmhos/cm (this value was derived from field data obtained during Phase I). The model has predicted that a rather steady rise in soil water EC can be expected during the life of the irrigation project. EC is a measure of total salts present in the soil. To respond to the concern about the movement of sodium and sulfate, the EC values reported on Figures 4 and 5 can be used to indicate the transport of total soluble salts, including sodium and sulfate. Since the values for EC remain below 4 mmhos/cm, plant stresses induced by high osmotic pressures in the soil will probably be minimal. The results of the solute transport component of the model are in complete agreement with the expected results.

Lastly, Figure 6 is a curve of cumulative water drained from the modeled six-foot soil column versus time. It can be expected that about 1 inch of water will drain from the root zone into the underlying vadose zone after 5-6 years of operation. Since the unsaturated zone beneath the east site is about 60-70 feet thick, it can be stated with confidence that the 1-inch of water that drains will not pose any threat whatsoever to the native groundwater in the area. Furthermore, an addition of 1 inch of water will not result in the development of a groundwater mound, and any concerns that movement of the poor-quality groundwater beneath the site toward the San Juan River by such a mound can be dismissed.

After 8 years of simulation, 457.03 cm (179.93 in) of water have been applied to the soil, 444.13 cm (174.85 in) of water have been evapotranspired by the plants, and 3.76 cm (1.48 in) of water have been drained into the vadose zone; the remainder (i.e., 9.13 cm (3.59 in)) has been absorbed by the porous medium and remains suspended there due to capillary forces. These numbers indicate that the soil is effectively acting as a storage medium for wastewater and precipitation while the plants are actively effecting evapotranspiration. The modeling results confirm that EPNG will be in conformance with a no-discharge wastewater irrigation scenario.

C. Ground Water and Vadose Zone Monitoring.

C.1. P. 20, Phase II; p. 9 D.P.: At least quarterly water levels should be obtained to ascertain changes in ground water elevation and direction of flow.

RESPONSE: EPNG agrees to monitor water levels in all wells and piezometers on a quarterly basis. The operation manual will include protocols for gathering and recording depth-to-water measurements quarterly.

C.2. P. 20, Phase II: Both MW-1 and 2 are completed in gravels below 3-4 feet of gray clay/shale. This isolates them from leaching from above and makes them unsuitable for detection of changes due to the land application. MW-2 is also completed 1 to 2 feet below the water table.

RESPONSE: The purpose of the monitoring wells installed at the site was to define the geology and hydrology of the site and if possible use them for detection monitoring during land application. Since the wells had to be installed with a rotary wash rig identification of the location of the top of the water table was not possible. Therefore, the wells were completed based on the texture of the geologic material. EPNG is prepared to install additional monitoring wells for detection monitoring. The new wells will be completed in a manner which allows detection of recharge water and the screens will be sufficiently long as to adequately sample the aquifer under the land application site.

C.3. P. 22 Phase II: Since flow appears to be south to south-easterly, at least one additional monitor well is necessary near piezometer E1B. Although not intended for use as a monitor well, its use as such would be acceptable since it is completed in gravels and water levels are currently within 2 feet of the top of the screen. E-3 should also be considered for monitoring use; at least part of is screen is above the shale that is present in both MW-1 and 2.

RESPONSE: Consideration will be given to designating these piezometers as monitoring wells. If they are not selected, new monitoring wells will be installed to satisfy concerns for having an adequate detection monitoring system in-place.

C.4 Monitor well/piezometers used for monitoring water level and water quality changes should be isolated from the surface sprinkling and runoff. A 20-25 feet buffer zone from the edge of the sprinkler spray would seem appropriate.

Size?

RESPONSE: Rather than designating a buffer zone around each well and piezometer, EPNG will install enlarged pads at the surface of each to prevent a situation from developing where surface applied moisture could migrate to the well screen. Also, as stated earlier, the surface soils are sufficiently permeable to accept applied moisture and the irrigation system will be operated as to prevent surface ponding (and surface runoff) of irrigated wastewater. Furthermore, the construction of the wells is such that the grout seal and the bentonite plug are designed to prevent migration of moisture along the borehole. The construction of enlarged pads at the surface of each well and piezometer will provide sufficient protection to prevent irrigated water from "short circuiting" its way to the well screen.

C.5. P. 25-28, Phase II; P. 11, D.P.: At least two additional background ground water samplings are necessary to establish baseline data. For each sampling (and subsequent monitoring) the wells should be pumped until electrical conductivity (EC), temperature and pH are constant. At least twice the amount of water in the casing and in the surrounding sand pack should be evacuated prior to sampling.

RESPONSE: EPNG is in complete agreement that additional samples should be collected to establish a reliable and representative background data set. To this end EPNG is prepared to sample all appropriate monitoring wells, and perhaps local wells, to determine the variability of the local groundwater. At least three additional samples will be collected within a twelve month period. These samples will be collected at least several months apart to aid in determining season variability. Description of the groundwater sampling protocol is presented in Phase II pages 88-91. In accordance with your request, EPNG is prepared to monitor pH, EC, and temperature at the well head prior to sampling to demonstrate groundwater stability.

C.6. OCD proposes that maximum concentration limits (MCL) for each constituent in each well be set by averaging the three background sampling for each well, taking the standard deviation for each constituent and adding a percentage. At this time we feel that using a set number (e.g. 2 standard deviations) will not provide adequate warning of changes in the system due to leaching, If the MCL is exceeded (or lowered) in excess of the allowable amount you will be required to demonstrate that it is not due to the land application.

RESPONSE: EPNG does not feel that sufficient statistical justification can be offered for selecting a set percentage (i.e., 10%, 50%, 100%). Therefore, EPNG is prepared to use a statistical method which allows determination of significance using a proven procedure such as the one presented in 40 CFR (e.g., hypothesis testing, Student-t Test). With the procedure selected it should be possible to define upper and lower concentration limits for individual constituents.

C.7. P. 11 D.P.: OCD will require quarterly sampling of monitor wells for at least the first three years to evaluate the effect of the land application. At that time we will consider a request to reduce the frequency of sampling.

RESPONSE: EPNG agrees to quarterly sampling for the first three years of operation.

C.8. P. 11, D.P.: In addition the constituent listed in paragraph 2 for sampling, nitrate should be determined. Also, at least once per year the wastewater should be sampled for volatile aromatic and halogenated hydrocarbons.

RESPONSE: Due to the configuration of piping in the wastewater system, hydrocarbons are never expected in the non-contact wastewater system. EPNG agrees to analyze the non-contact wastewater for nitrate and volatile aromatics on an annual basis.

C.9. P. 101, Phase II; p. 12, D.P.: Will the 4 foot and 10 foot lysimeters be installed in the same trench or on differing plot locations? What months are proposed for sampling? Semi-annual sampling for most if not all lysimeters will be necessary if the active growing area is expanded to most of the 26 acres.

RESPONSE: Text presented in Phase II and the discharge plan concerning the type, location, and installation of the lysimeters was based on the proposed operation which allowed for leaching of wastewater at concentrations which would not adversely impact groundwater. Since the design will be changed to zero discharge, the need for lysimeters has been eliminated since it is a foregone conclusion that soil-pore liquid quality at shallow depths will be compromised by the concentration of salts. Since it is not possible to bury glass brick lysimeters at depths greater than ten feet and given the zero discharge design, soil-pore liquid monitoring is not proposed.

Don't want to eliminate

D. Water Storage and Miscellaneous.

D.1. P. 4, D.P.: EPNG must notify OCD in advance of any changes or modifications proposed at the facility (e.g. start-up of the gasoline plant) that will modify the volumes and composition of wastewater discharge.

Response: EPNG will notify OCD in advance of any process changes that will significantly modify the volumes and composition of the wastewater discharged.

D.2. P. 7, D.P.: Plans and specifications for the design of holding pond or storage tanks (whichever is decided upon) must be submitted to OCD for review prior to construction. An unlined pond is unacceptable. If tanks are used, a bermed area one-third larger in volume than the tank capacity must be constructed.

Response: EPNG will submit plans and specifications for design and operation of the wastewater storage and disposal facilities prior to construction.

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Table 1. El Paso Natural Gas Co. SJRP Wastewater Application Calculations.

Class A pan coeff. = 0.70
Irr. system efficiency = 80.00 percent
Reservoir surf. area = 2.00 acres
Reservoir volume = 12.86 acre-feet
Reservoir depth = 6.43 feet

Month	Record Mean Precip. (in)	Design Precip. (in)	Class A Pan Evap. (in)	Lake Evap. (in)	Crop Coeff. (Tall Fescue)	Consumptive Use (in)	Root Zone Moisture Deficit (in)	Crop Requirements (in)	Wastewater Inflow (ac-in)	Irr. Area (acres)	Crop Requirements (ac-in)	Eff.-adj. Wastewater Requirements (ac-in)	BOM Reservoir Volume (ac-in)	BOM Available Wastewater (ac-in)	EOM Applied Wastewater (ac-in)	EOM Net Reservoir Gain/loss (ac-in)	EOM Reservoir Volume (ac-in)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
J	0.65	1.14	1.10	0.77	0.00	0.00	-0.65	0.00	27.00	12.00	0.00	0.00	0.00	27.00	0.00	0.24	26.76
F	0.47	0.82	1.79	1.25	0.00	0.00	-0.47	0.00	27.00	12.00	0.00	0.00	26.76	53.76	0.00	1.57	52.19
M	0.62	1.09	4.35	3.04	0.43	1.32	0.70	0.70	27.00	12.00	8.35	10.43	52.19	79.19	10.00	4.85	64.34
A	0.52	0.91	7.33	5.13	0.62	3.19	2.67	2.67	27.00	12.00	32.00	40.00	64.34	91.34	10.00	9.22	72.12
M	0.45	0.79	8.37	5.86	0.84	4.90	4.45	4.45	27.00	12.00	53.45	66.81	72.12	99.12	20.00	10.82	68.30
J	0.30	0.53	10.42	7.29	1.03	7.48	7.18	7.18	27.00	12.00	86.20	107.75	68.30	95.30	40.00	13.99	41.32
J	0.70	1.22	10.01	7.01	1.13	7.95	7.25	7.25	27.00	12.00	86.95	108.69	41.32	68.32	40.00	12.61	15.70
A	0.98	1.72	8.89	6.22	1.13	7.06	6.08	6.08	27.00	12.00	72.92	91.15	15.70	42.70	35.00	10.49	0.00
S	0.84	1.47	6.62	4.63	0.95	4.42	3.58	3.58	27.00	12.00	42.97	53.71	0.00	27.00	27.00	7.59	0.00
O	0.87	1.52	4.35	3.04	0.59	1.78	0.91	0.91	27.00	12.00	10.94	13.67	0.00	27.00	13.00	4.35	9.65
N	0.53	0.93	2.33	1.63	0.00	0.00	-0.53	0.00	27.00	12.00	0.00	0.00	9.65	36.65	0.00	2.20	34.45
D	0.68	1.19	1.14	0.80	0.00	0.00	-0.68	0.00	27.00	12.00	0.00	0.00	34.45	61.45	0.00	0.24	61.21
J	0.65	1.14	1.10	0.77	0.00	0.00	-0.65	0.00	27.00	12.00	0.00	0.00	61.21	88.21	0.00	0.24	87.97
F	0.47	0.82	1.79	1.25	0.00	0.00	-0.47	0.00	27.00	12.00	0.00	0.00	87.97	114.97	0.00	1.57	113.41
M	0.62	1.09	4.35	3.04	0.43	1.32	0.70	0.70	27.00	12.00	8.35	10.43	113.41	140.41	10.00	4.85	125.56
A	0.52	0.91	7.33	5.13	0.62	3.19	2.67	2.67	27.00	12.00	32.00	40.00	125.56	152.56	16.00	9.22	127.33
M	0.45	0.79	8.37	5.86	0.84	4.90	4.45	4.45	27.00	12.00	53.45	66.81	127.33	154.33	30.00	10.82	113.52
J	0.30	0.53	10.42	7.29	1.03	7.48	7.18	7.18	27.00	12.00	86.20	107.75	113.52	140.52	50.00	13.99	76.53
J	0.70	1.22	10.01	7.01	1.13	7.95	7.25	7.25	27.00	12.00	86.95	108.69	76.53	103.53	50.00	12.61	40.91
A	0.98	1.72	8.89	6.22	1.13	7.06	6.08	6.08	27.00	12.00	72.92	91.15	40.91	67.91	45.00	10.49	12.43
S	0.84	1.47	6.62	4.63	0.95	4.42	3.58	3.58	27.00	12.00	42.97	53.71	12.43	39.43	30.00	7.59	1.8[illegible]
O	0.87	1.52	4.35	3.04	0.59	1.78	0.91	0.91	27.00	12.00	10.94	13.67	1.84	28.84	27.00	4.35	0.0[illegible]
N	0.53	0.93	2.33	1.63	0.00	0.00	-0.53	0.00	27.00	12.00	0.00	0.00	0.00	27.00	0.00	2.20	24.80
D	0.68	1.19	1.14	0.80	0.00	0.00	-0.68	0.00	27.00	12.00	0.00	0.00	24.80	51.80	0.00	0.24	51.56

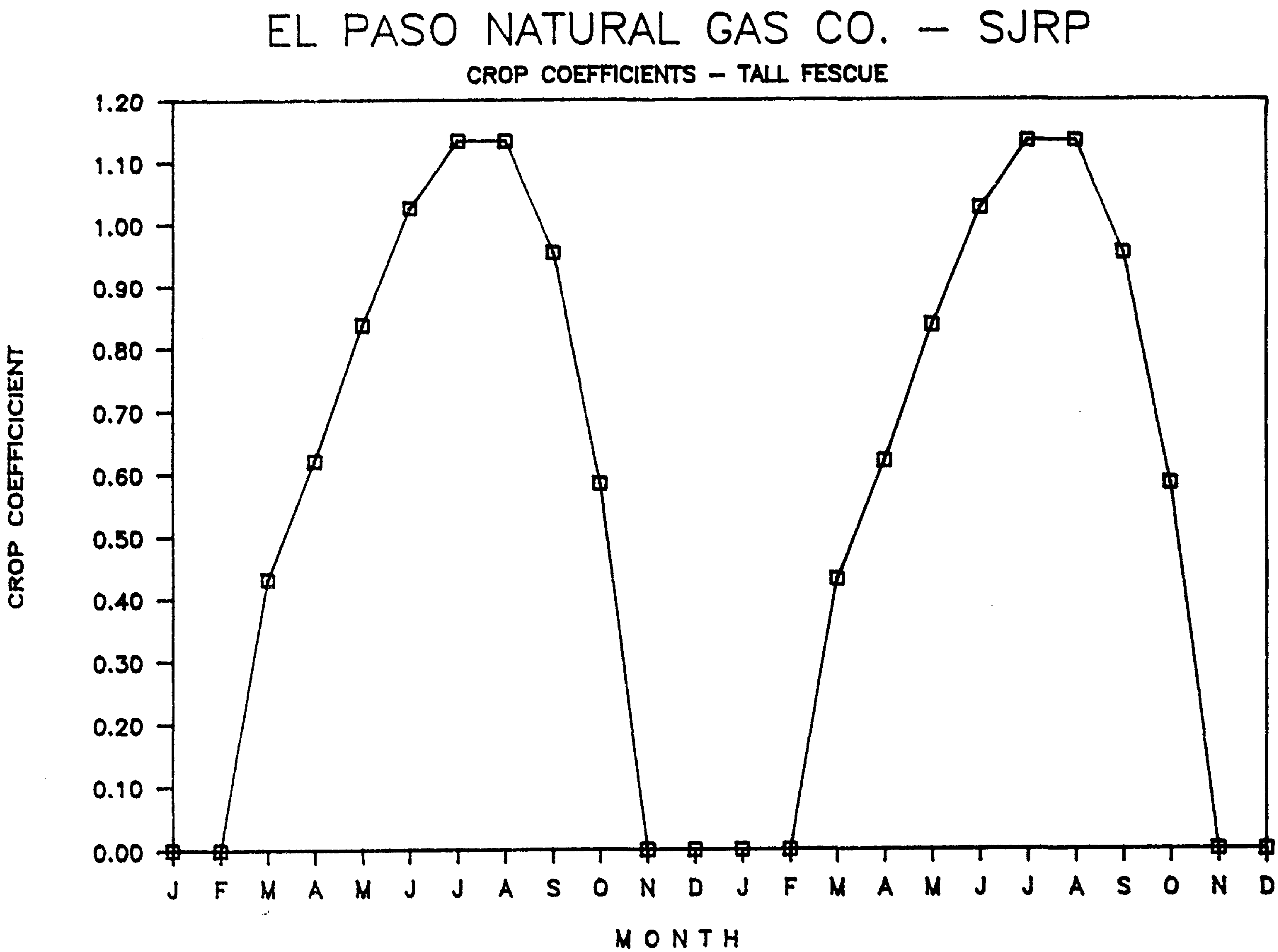


Figure 1. Monthly Distribution of Crop Coefficients for Tall Fescue.

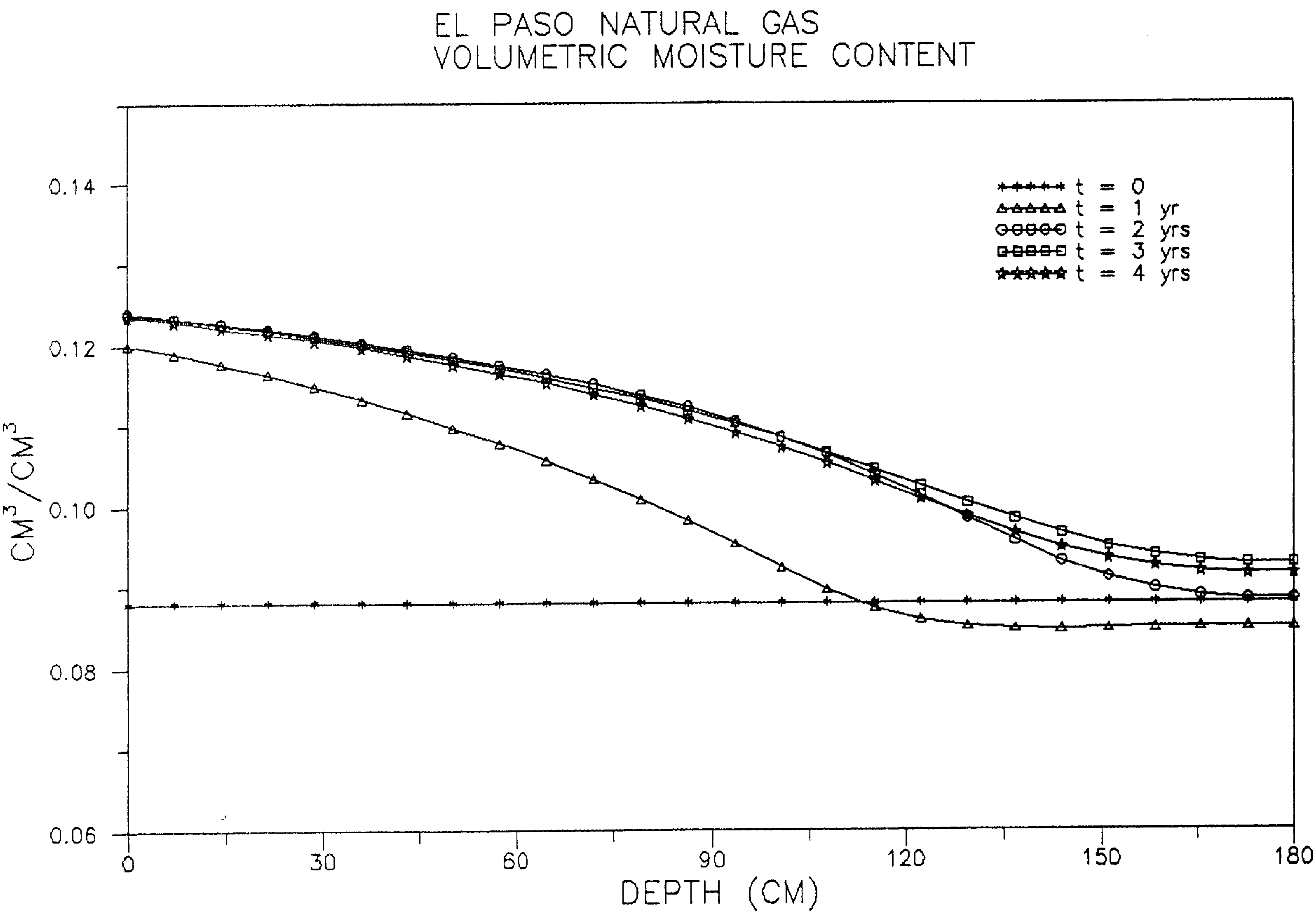


Figure 2. Volumetric Moisture Content Versus Depth for Years 0-4 as Predicted by WORM.

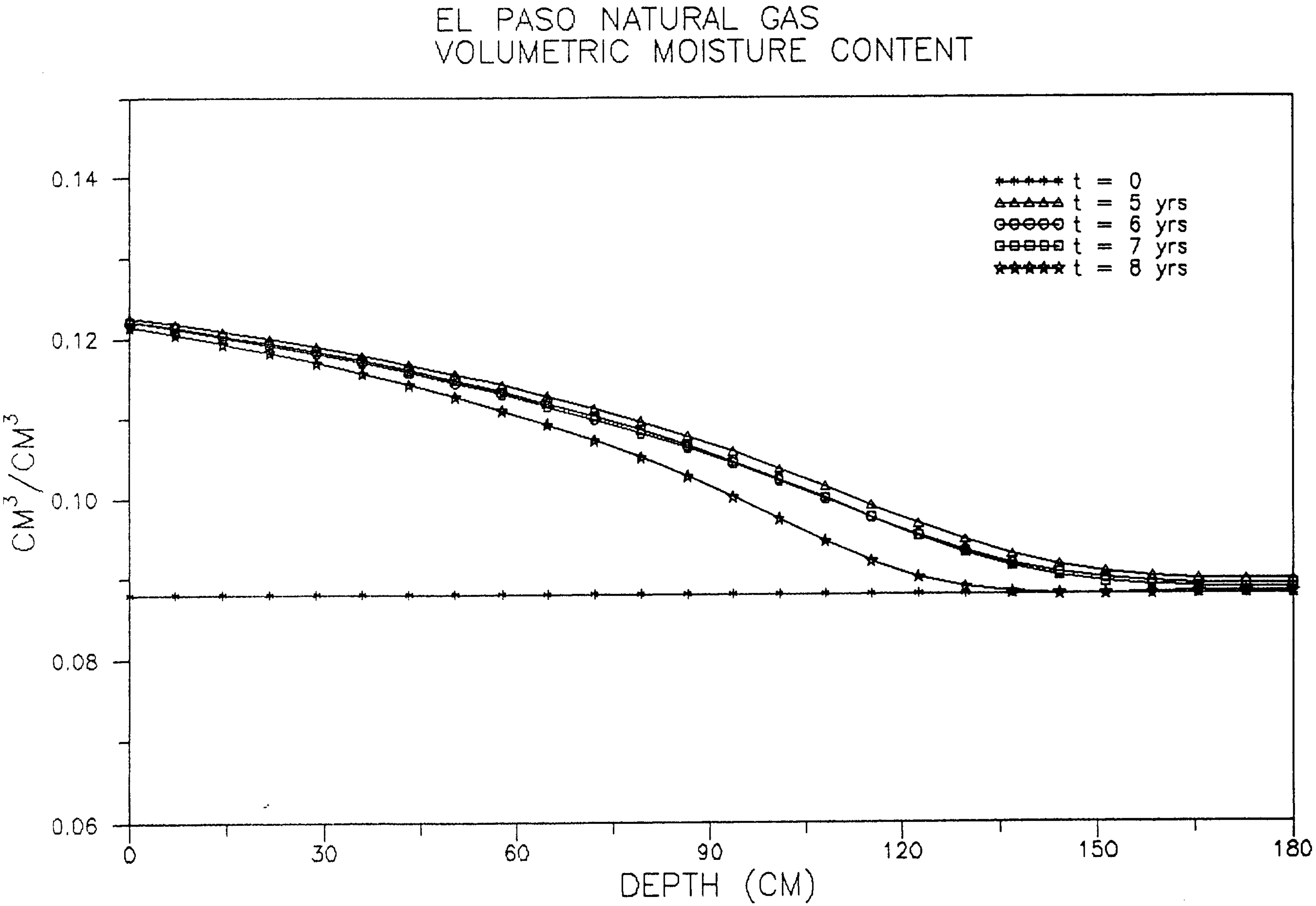


Figure 3. Volumetric Moisture Content Versus Depth for Years 5-8 as Predicted by WORM.

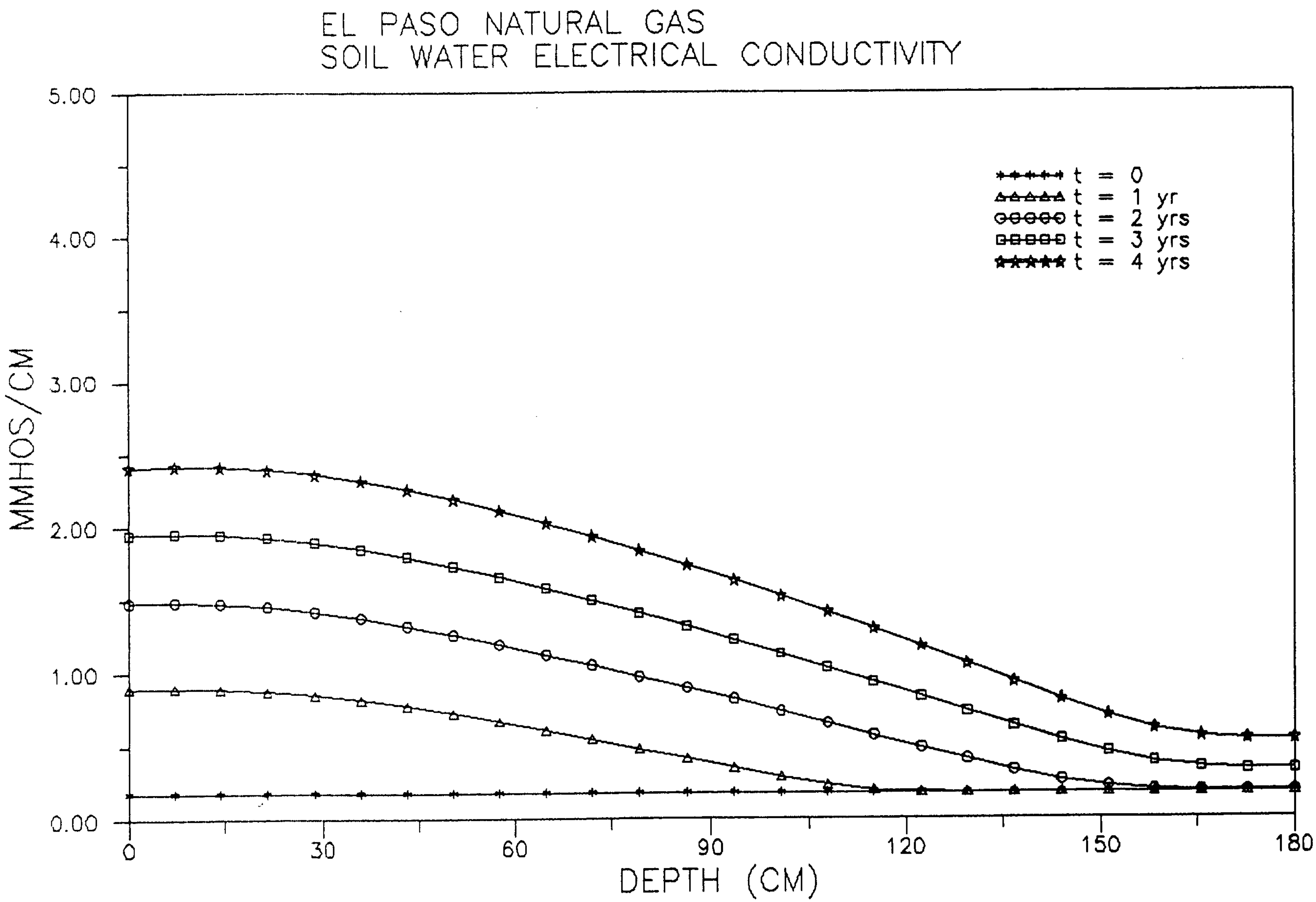


Figure 4. Soil Water EC Versus Depth for Years 0-4 as Predicted by WORM.

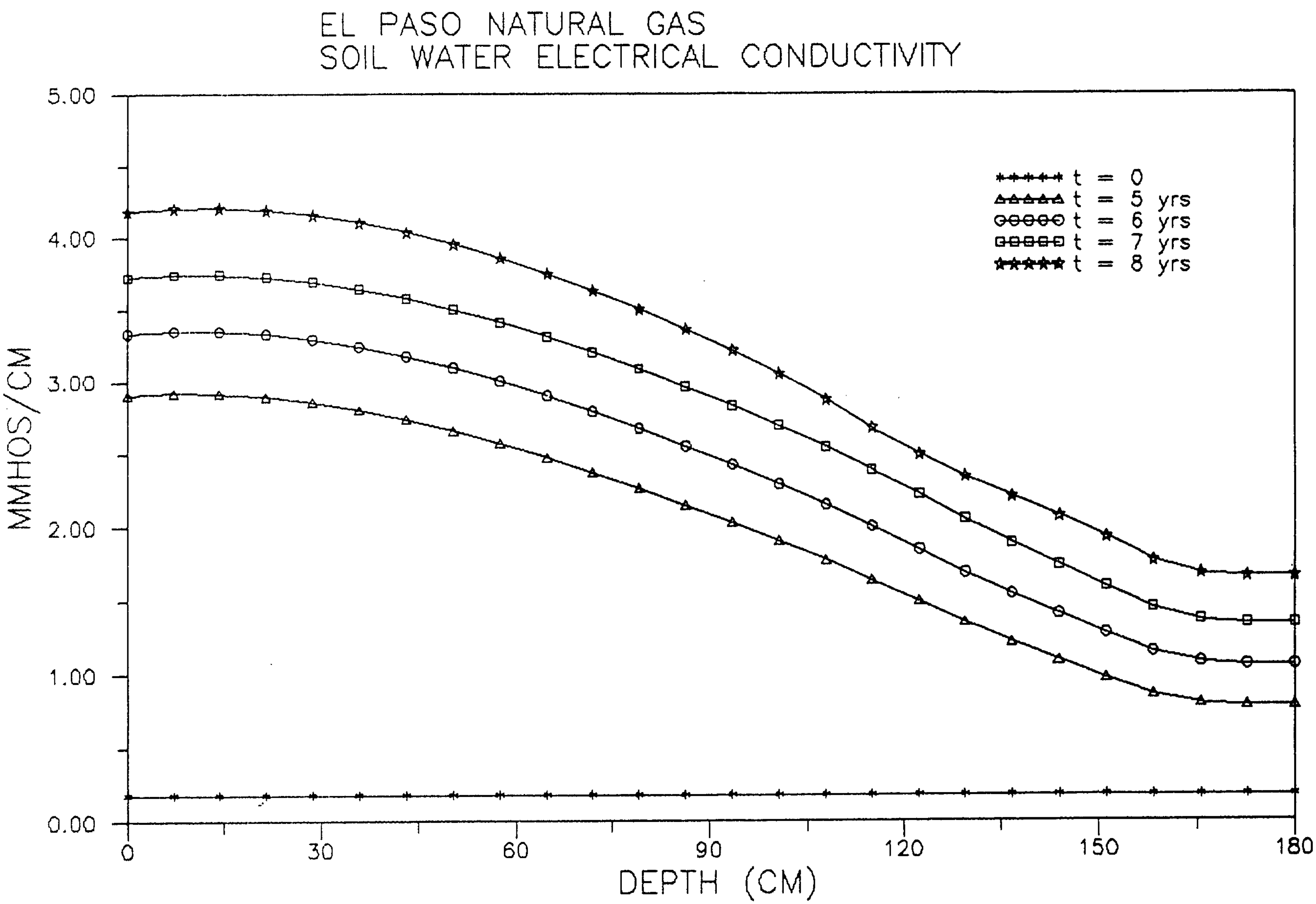


Figure 5. Soil Water EC Versus Depth for Years 5-8 as Predicted by WORM.

For 8 years

180" applied (ppt + ww)
175" Plant ET
1.5" Drained
3.5" Suspended in column

0.03"/yr. regional
going to 0.12"/yr
Adding 0.09"

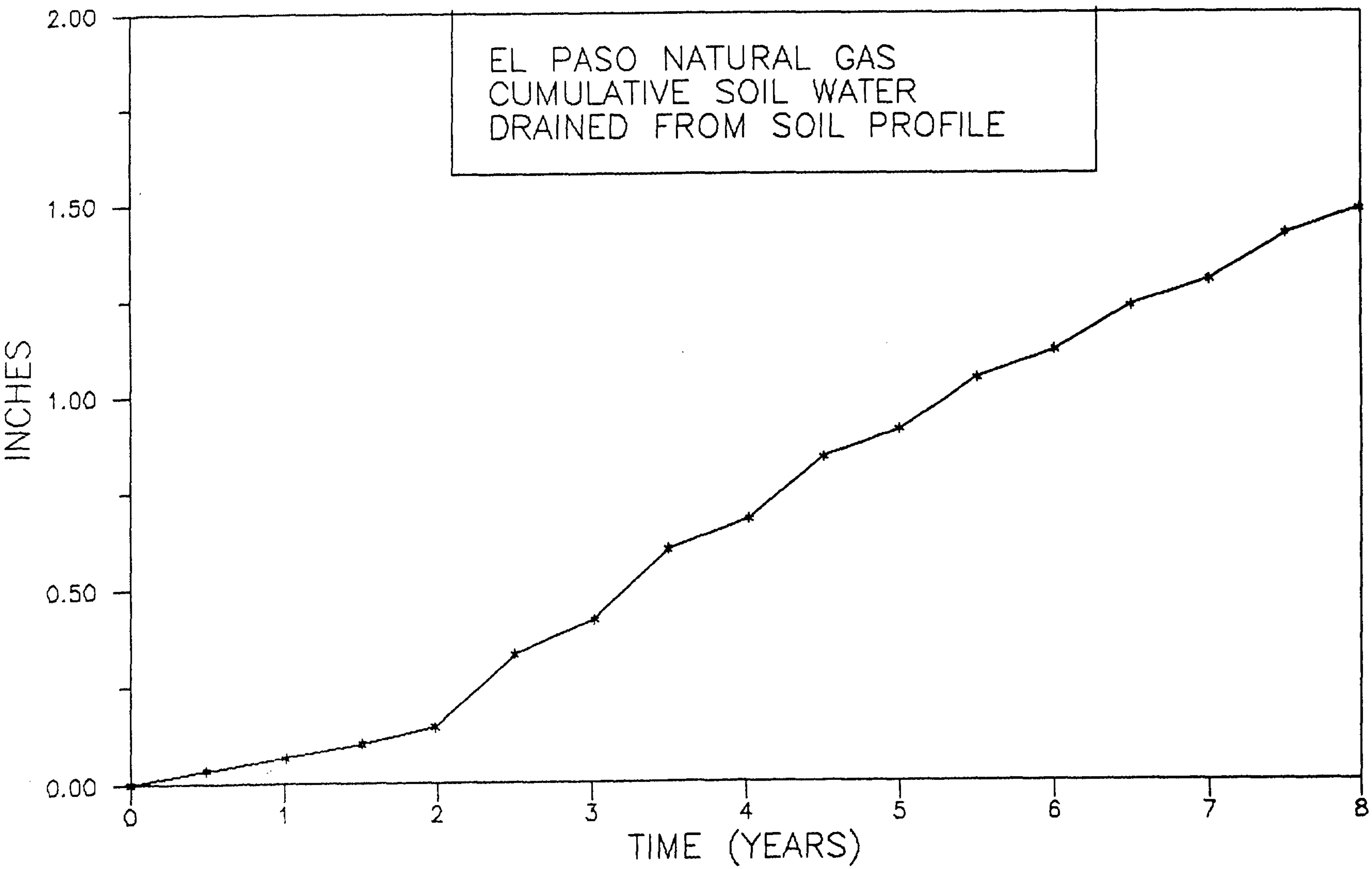
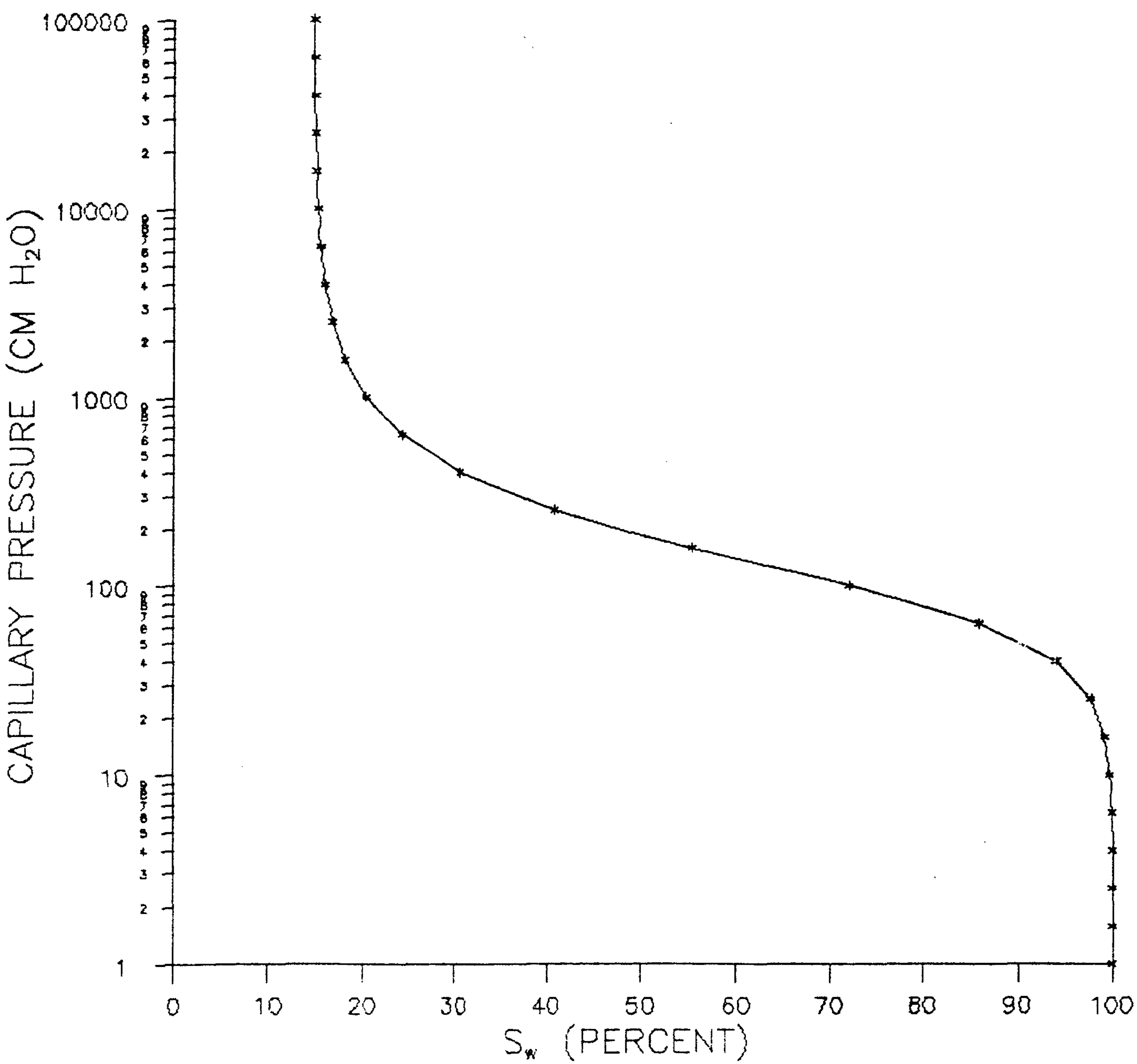
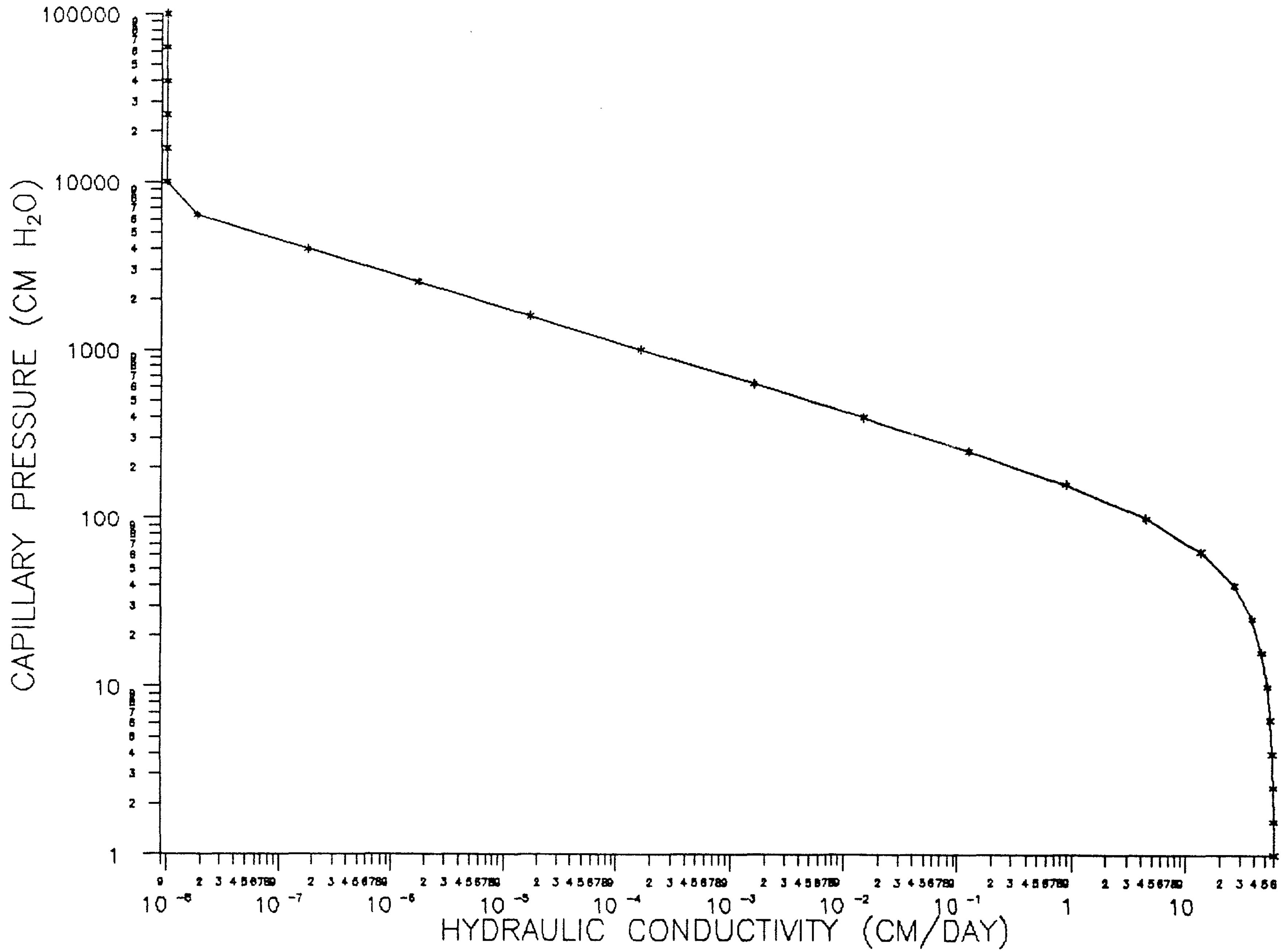
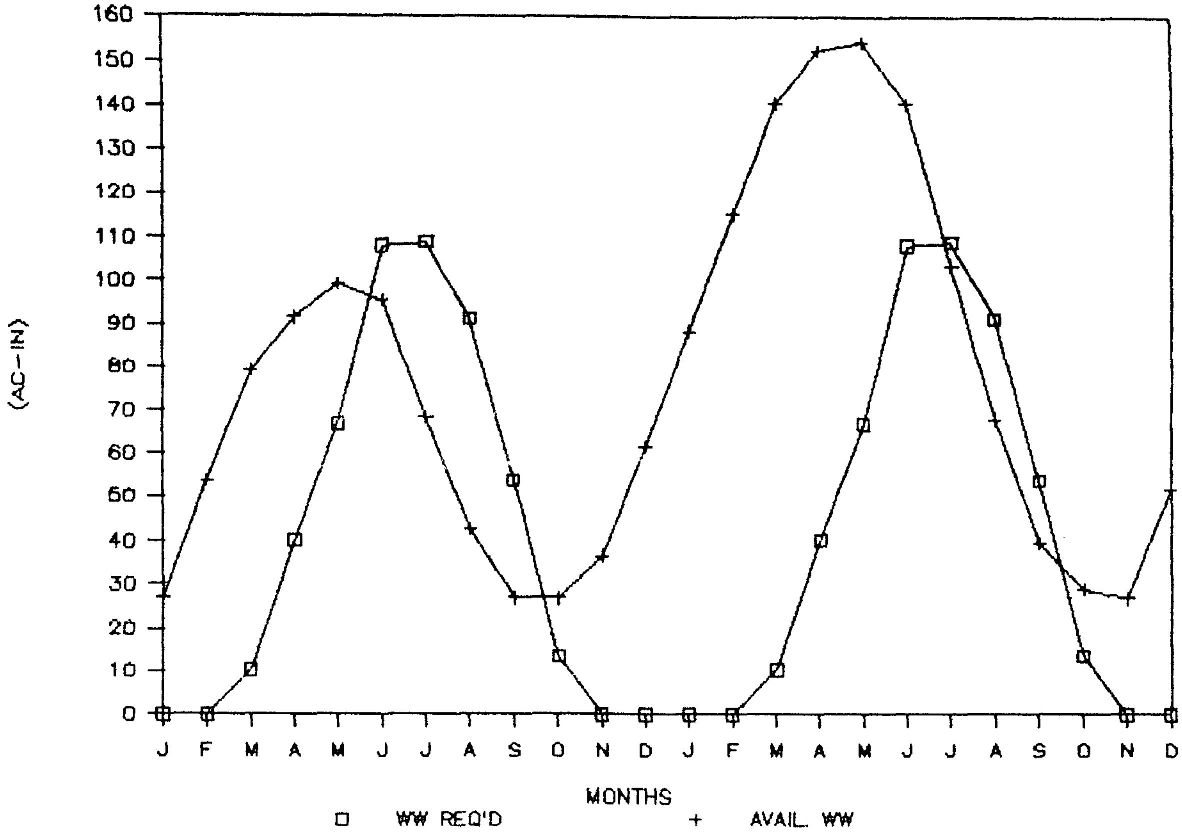
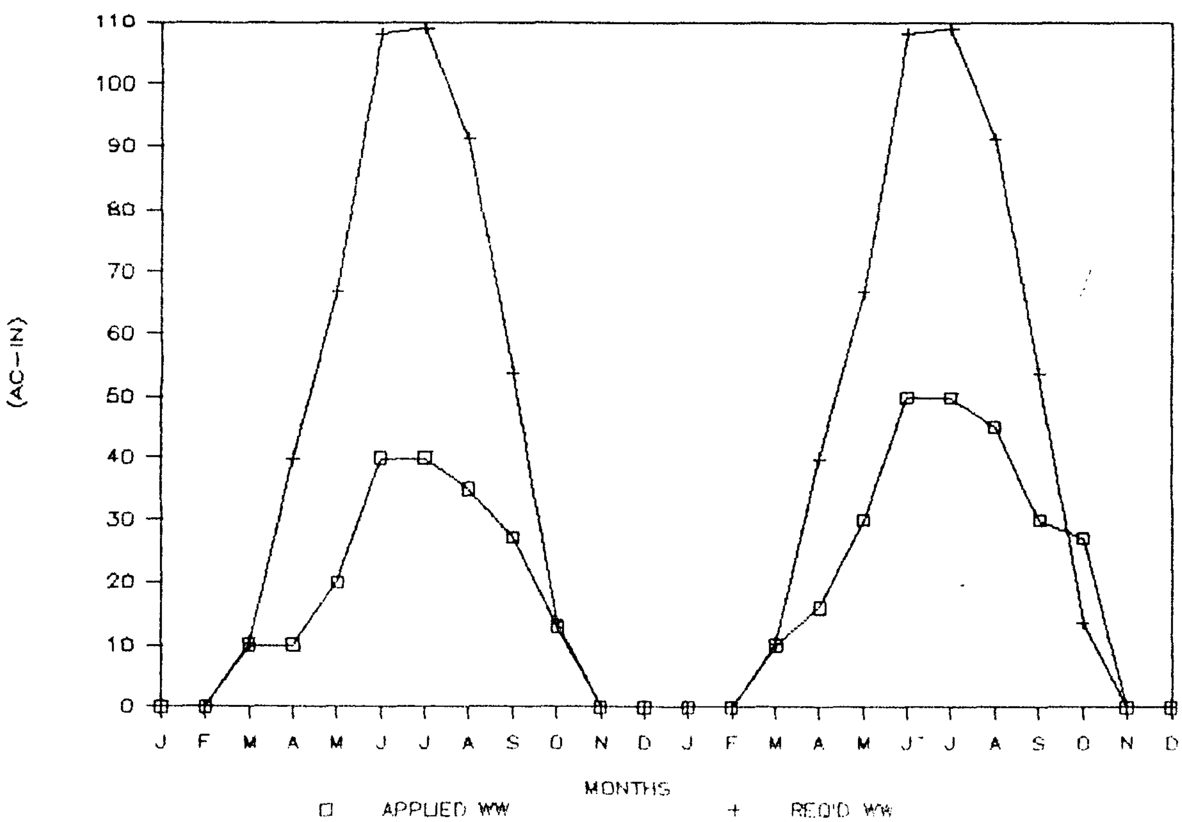


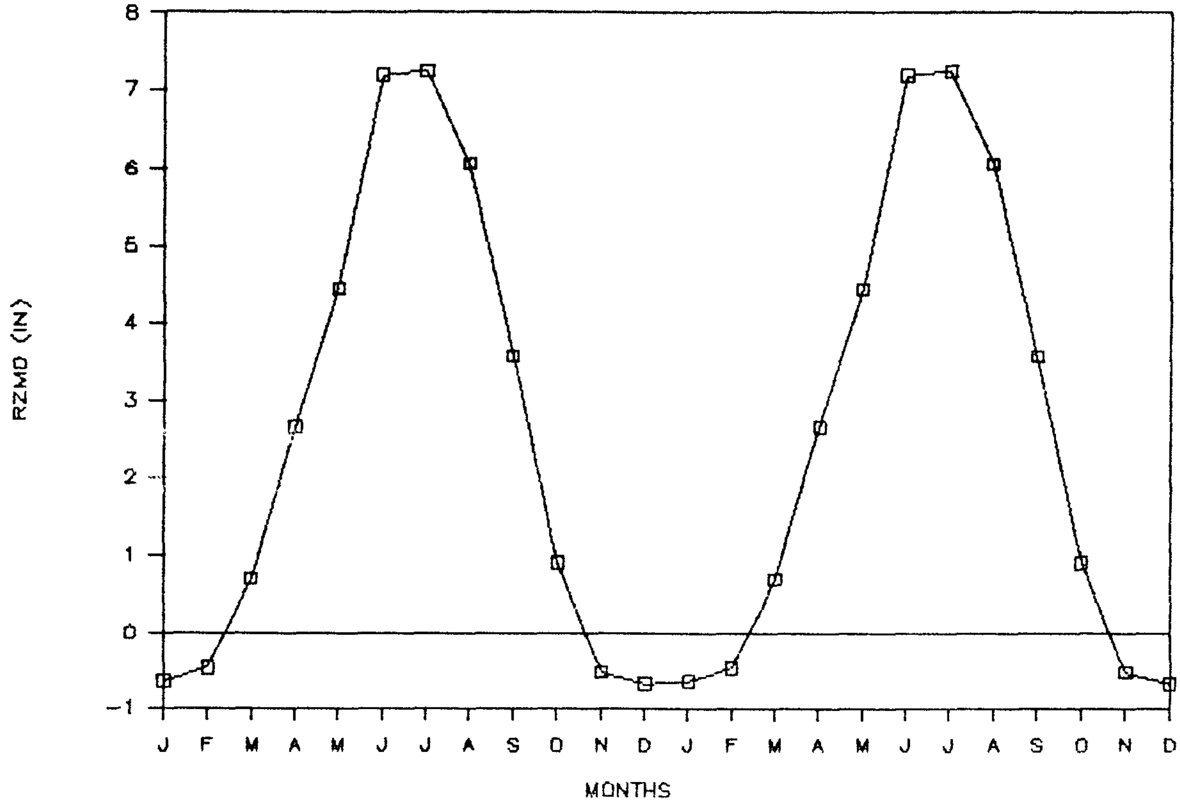
Figure 6. Cumulative Soil Water Drained from 6-foot Soil Profile Versus Time as Predicted by WORM.

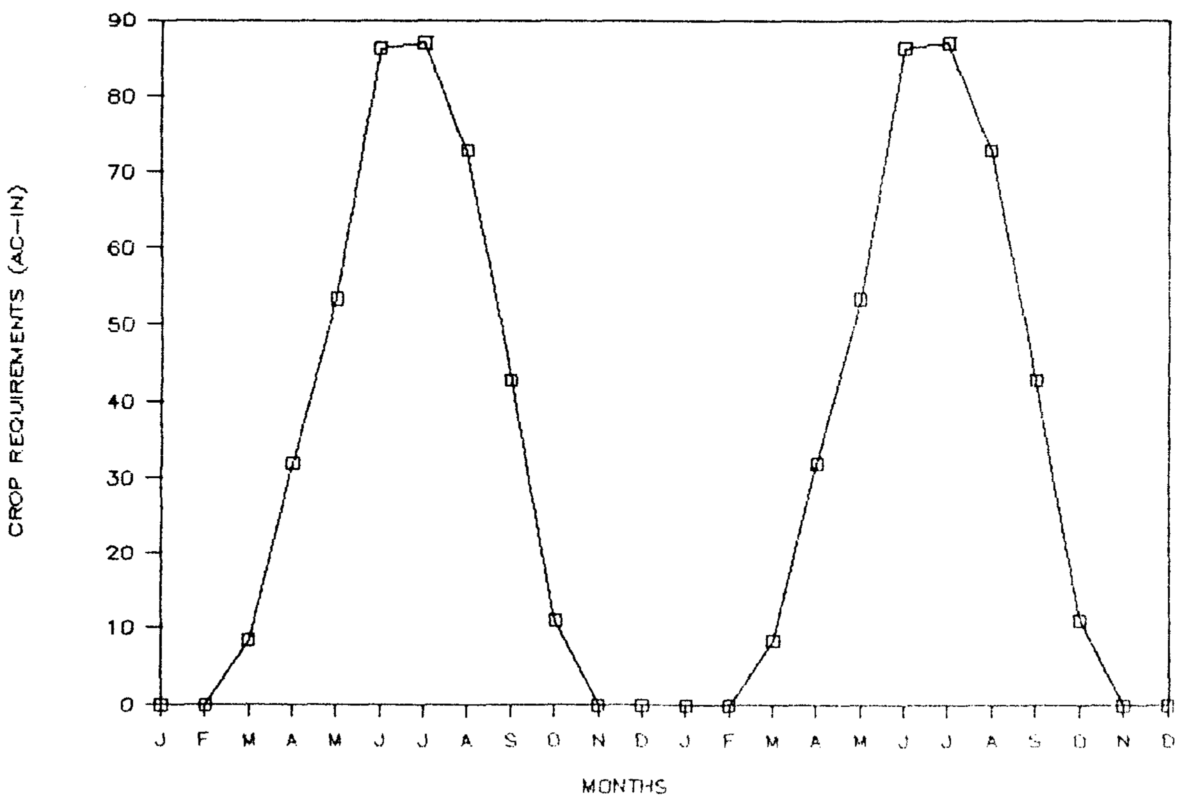

CAPILLARY PRESSURE (CM H2O)
100000
10000
1000
100
10
1
0
10
20
30
40
50
60
70
80
90
100
Sw (PERCENT)

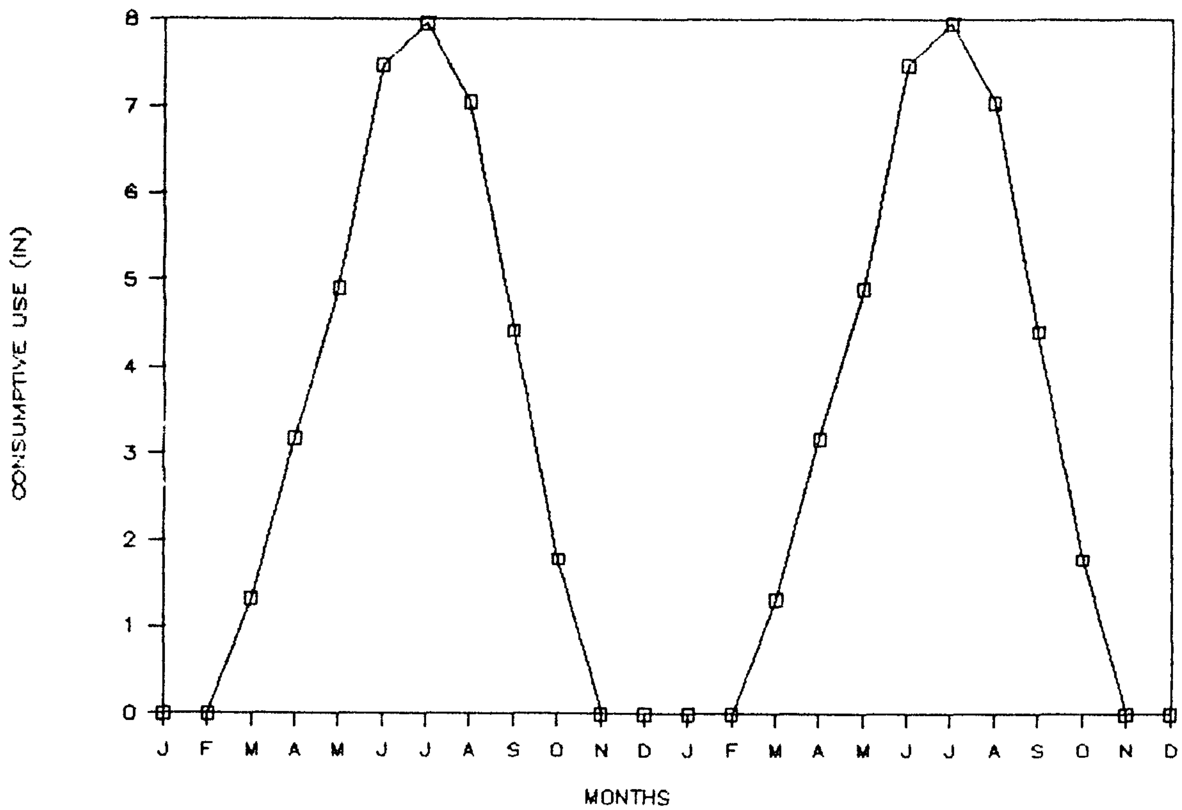

CAPILLARY PRESSURE (CM H2O)
HYDRAULIC CONDUCTIVITY (CM/DAY)
100000
10000
1000
100
10
1


(AC−IN)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
J F M A M J J A S O N D J F M A M J J A S O N D
MONTHS
□ WW REQ'D
+ AVAIL. WW

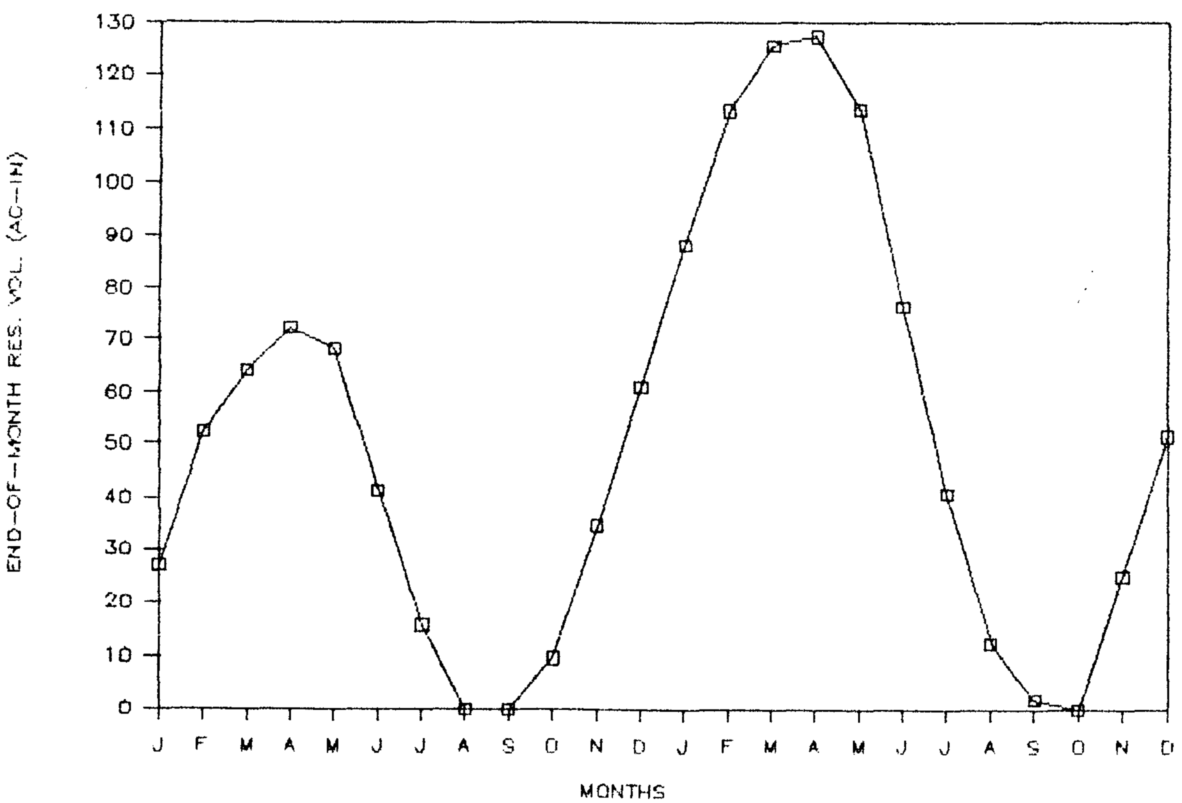

(AC−IN)
110
100
90
80
70
60
50
40
30
20
10
0
J F M A M J J A S O N D J F M A M J J A S O N D
MONTHS
□ APPLIED WW
+ REQ'D WW


RZMD (IN)
8
7
6
5
4
3
2
1
0
-1
J F M A M J J A S O N D J F M A M J J A S O N D
MONTHS


CROP REQUIREMENTS (AC-IN)
90
80
70
60
50
40
30
20
10
0
J F M A M J J A S O N D J F M A M J J A S O N D
MONTHS



CONSUMPTIVE USE (IN)
0
1
2
3
4
5
6
7
8
J F M A M J J A S O N D J F M A M J J A S O N D
MONTHS



END-OF-MONTH RES. VOL. (AC-IN)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
J F M A M J J A S O N D J F M A M J J A S O N D
MONTHS

State of New Mexico

W.R. HUMPHRIES
COMMISSIONER

Commissioner of Public Lands

P.O. BOX 1148
SANTA FE, NEW MEXICO 87504-1148

February 22, 1988

Kenneth E. Beasley
Compliance Engineer
El Paso Natural Gas
P. O. Box 4990
Farmington, N M 87499

RE: EPNG Plant, Kirtland, New Mexico
Section 36, Township 30N, Range 15W

Dear Ken,

We enjoyed meeting you and Henry today and appreciate the opportunity to work with you and Dave Boyer at OCD regarding the closure plan for the water discharge program being used at your plant.

I understand from our discussion that you will send us a copy of the proposed closure plan which will include, among other things, a proposal to remove and replace surface soils in effected areas, including contouring and revegitating.

With regard to contact water testing, I understand you will provide us the background and other test data currently available and proposed new test types and sites on state trust lands.

If you have any further comments or suggestions please let us know.

Very truly yours,

Nicholas J. Black
Associate Counsel

cc: Henry Van
Dave Boyer
Dwain Glidewell
Robert Langsenkamp

Memo

From
DAVID G. BOYER
Hydrogeologist

2/22/88

To Steve Reynolds –

Your letter of February 17 was received today after I had prepared the attached comments. I believe your concerns have been addressed on p. 2 and p. 4 of my letter. In addition to impacts on the rivers, I am concerned about several domestic wells immediately downgradient.

Thanks for your letter; your comments are always appreciated.

Dave

Oil Conservation Division
P.O. Box 2088 Santa Fe, N.M. 87501

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

February 22, 1988

Rec'd 2/22/88
K.E. Beasley

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Donald N. Bigbie
Vice President
San Juan Division
El Paso Natural Gas
P. O. Box 4990
Farmington, New Mexico 87499

RE: Discharge Plan for San Juan River Plant, Non-Contact Wastewater (GW-39)

Dear Mr. Bigbie:

This letter provides comments and requests additional information on the above referenced discharge plan submitted and received at the Oil Conservation Division (OCD) on December 30, 1987. Since the discharge plan references EPNG's November, 1987 Phase II report on the "Land Application Feasibility Study, San Juan River Plant," relevant comments on that report are also provided as are comments from a followup El Paso letter dated December 24, 1987.

The results of the feasibility study, overall, show the land application concept to be a good one, especially now that the softener regeneration unit will be removed from the non-contact wastewater stream. The information and analyses provided by K.W. Brown and Associates in the Phase I and Phase II reports were generally excellent and provided the essential information for us to complete our reviews. Follow-up information, when requested, was quickly provided to us. Our remaining concerns are about specific details of the irrigation application (amounts, type of crop, area) and about ground water and other monitoring required to demonstrate that the plan will work as expected.

The WQCC Regulations (Section 3-103) state that "when an existing pH or concentration of any water contaminant exceeds the standard specified in Subsection A, B, or C, the existing pH or concentration shall be the allowable limit, provided that the discharge at such concentrations will not result in concentrations at any place of withdrawal for present or reasonably foreseeable future use in excess of the standards of this section." (underlined emphasis added). Although the proposed effluent discharge exceeds the numerical standard of this section for several of the constitutents, it is of better quality than the local ground water sampled at four domestic wells south and east of the proposed land application area. If direct comparisons of concentrations were the only consideration, the proposal would be directly approvable. However, two additional factors must be considered that relate to the portion of Section 3-103 emphasized above:

1. In the proposed discharge plan some portion of the volume of effluent land applied will, by design, be leached downward concentrating existing salts in the effluent and dissolving additional native salts in the subsurface. The leaching of native salts such that standards are caused to be exceeded is prohibited by WQCC Section 3-109-D.2b. Both the applied and leached salts can migrate to the existing ground water beneath the site and increase salt concentrations, and add to ground water volumes in storage.

2. The concentrations of contaminants in the existing ground water beneath the proposed site, with the exception of sodium and chloride concentrations, exceed the existing concentrations in the local domestic wells. The apparent ground water flow direction is such that further addition of significant volumes of fluid can cause migration of the existing and added fluids to a place of withdrawal (the local wells or the San Juan River). This would cause a violation of Section 3-103 of the WQCC Regulations.

One solution to this problem is application of wastewater in small enough increments so that essentially all salts are trapped in the subsurface above the water table and only minimal volumetric flux moves to the ground water. The volumes and concentrations so added should be small enough so that impacts to ground water are negligible. This will require tight operational control on the volumes applied so that the water budget will balance as designed. All 26 acres may be required to be used to dispose of the effluent to minimize downward movement. Close monitoring of ground water levels and concentrations will be needed to assure compliance. Additional monitoring wells may be necessary to evaluate land application performance. Some additional modeling, as requested below, will be needed to evaluate several different operational scenarios.

A second solution, which El Paso is encouraged to explore further, involves blending the plant water with raw water for golf course irrigation. If the resultant blend meets WQCC standards, no ground water or other monitoring except of the blended mixture will be required by OCD. Since the golf course has been irrigated for many years with raw water and native salts are assumed to have been mostly leached out (as evidenced by the water quality in downgradient wells), blending would not cause the salt migration that would occur in the proposed land application. If need be, raw water could be used to irrigate the greens, and blended water used for fairways and trees.

SPECIFIC COMMENTS AND INFORMATION REQUESTS

A. Surface Preparation and Effluent Application

1. P. 3, Phase II; p. 9, D.P.: Amounts applied should be controlled to prevent ponding on the plots. This may require surface leveling to prevent drainage to low areas. Will the method of application (sideroll irrigation) prevent ponding and surface drainage, or will site leveling be necessary?

2. P. 7, D.P.: To prevent spray drift off property during high winds, El Paso may want to establish a non-irrigated buffer zone next to the country road. If not already in place, fencing along the east boundary of the irrigated area (along the country road) should be installed to prevent public access.

3. P. 79, Phase I; P. 7 D.P.: If native vegetation is to be irrigated, the proposed application rates that are shown in Table 4.7, p. 36 (Phase II report) will drown the native plants present on the most heavily irrigated acreage. Different vegetation species (e.g. hay, alfalfa) must be planted if application rates are heavy. If rates are lowered to grow native species, "nuisance" species such as tumbleweeds must be avoided. Notwithstanding the above, salt impacts due to leaching must be considered as discussed below.

4. P. 7, D.P.: Procedures on the operation of the irrigation system during periods of wet weather need to be provided. How does El Paso propose to balance actual irrigation needs with actual rainfall so that excess effluent is not applied during periods of rainfall exceeding the average?

5. P. 7, D.P.: Will spraying be done on a 24-hour basis? How will the amount of water applied be measured so that the sideroll system does not distribute too much in one spot? Will the sideroll continually move under its own power, or must it be physically moved from one application location to another?

6. P. 7, D.P.: The minimum acreage required is dependent on both seasonal changes in evapotranspiration <u>and</u> on the type of crop grown. Empirical coefficients have been developed that relate crop water needs to evapotranspiration. For the Farmington area, NM State University operates an agricultural farm that measured actual consumptive use (U) for several crops and Class A Pan evaporation (E). The coefficients (U/E) are used to prepare water budgets for irrigation. K.W. Brown used floating pan evaporation data for calculating water rate applications. This is equivalent to a coefficient of 0.87. Alfalfa (a very water consumptive crop) has a coefficient of 0.64 for the area as was estimated in NM State Engineer Office publication #32 ("Consumptive Use and Water Requirements in New Mexico", by H.F. Blaney and E.G. Hanson, 1965). A two-year study by NMSU in 1974-75 estimated the coefficient at 0.77. Two sources reported in SEO #32 list natural

grass and grass and weeds as having coefficients of 0.23 and 0.28, respectively. Calculation of application rates for these coefficients requires use of much of the 26-acres yearround, and considerably more off-season storage. Consultation with EMNRD coal mine reclamation experts has provided information that several salt tolerant species of grass grow quite well in the area with total water applied (from precipitation plus supplemental application) of less than 16 inches. They also believe that extra water for leaching is not necessary for these grasses. OCD can provide suggested native grass species and seed application rates for seeding.

7. P. 8, D.P.: Irrigation location for October is missing on Figure 4-1.

B. Impacts of Existing and Added Salt.

1. P. 45-85, Phase II; EPNG 12/24/87 letter: Phase II used computer modeling to estimate both transport of chloride from surface to the ground water (SUMATRA1 and WORM models), and the geochemical speciation of minerals in the ground water (WATEQ model). While I concur with the results of the model simulations for chloride, and the carbonate salts (p. 85), no similar estimation was performed and/or presented for the other soluble salts, especially sodium and sulfate. Both are extremely prevalent in the subsurface cores and in the existing ground water. Most of the soluble cations and anions shown in both E-1 and W-2 cores (Table D-1, Phase I report) are sodium and sulfate. The total effect of all soluble salts on the existing ground water must be determined.

2. Table 4.7 (p. 36) Phase II, p. 3, K.W. Brown attachment to EPNG 12/24/87 letter: The scenario presented in the table estimates more than a foot of water per year being leached to the subsurface on the most heavily irrigated plots. When steady state conditions are attained, that amount will reach the ground water and mound under the site. This will locally change both the direction and magnitude of the local hydraulic gradient causing the poorer quality ground water (with native and added salts) to migrate faster downgradient. The magnitude of these changes (both water movement and concentrations) has not been estimated in the reports.

C. Ground Water and Vadose Zone Monitoring.

1. P. 20, Phase II; p. 9 D.P.: At least quarterly water levels should be obtained to ascertain changes in ground water elevation and direction of flow.

2. P. 20, Phase II: Both MW-1 and 2 are completed in gravels below 3-4 feet of gray clay/shale. This isolates them from leaching from above and, makes them unsuitable for detection of changes due to the land application. MW-2 is also completed 1 to 2 feet below the water table.

3. P. 22 Phase II: Since flow appears to be south to south-easterly, at least one additional monitor well is necessary near piezometer EIB. Although not intended for use as a monitor well, its use as such would be acceptable since it is completed in gravels and water levels are currently within 2 feet of the top of the screen. E-3 should also be considered for monitoring use; at least part of its screen is above the shale that is present in both MW-1 and 2.

4. Monitor well/piezometers used for monitoring water level and water quality changes should be isolated from surface sprinkling and runoff. A 20-25 feet buffer zone from the edge of the sprinkler spray would seem appropriate.

5. P. 25-28, Phase II; P. 11, D.P.: At least two additional background ground water samplings are necessary to establish baseline data. For each sampling (and subsequent monitoring) the wells should be pumped until electrical conductivity (EC), temperature and pH are constant. At least twice the amount of water in the casing and in the surrounding sand pack should be evacuated prior to sampling.

6. OCD proposes that maximum concentration limits (MCL) for each constitutent in each well be set by averaging the three background samplings for each well, taking the standard deviation for each constituent and adding a percentage. At this time, we feel that using a set number (eg. 2 standard deviations) will not provide adequate warning of changes in the system due to leaching. If the MCL is exceeded (or lowered) in excess of the allowable amount, you will be required to demonstrate that it is not due to the land application.

7. P. 11 D.P.: OCD will require quarterly sampling of monitor wells for at least the first three years to evaluate the effect of the land application. At that time we will consider a request to reduce the frequency of sampling.

8. P. 11, D.P.: In addition the constituent listed in paragraph 2 for sampling, nitrate (NO_2) should be determined. Also, at least once per year the wastewater stream should be sampled for volatile aromatic and halogenated hydrocarbons.

9. P. 101, Phase II; p. 12, D.P.: Will the 4 foot and 10 foot lysimeters be installed in the same trench or on differing plot locations? What months are proposed for sampling? Semi-annual sampling for most if not all lysimeters will be necessary if the active growing area is expanded to most of the 26 acres.

D. Water Storage and Miscellaneous.

1. P. 4, D.P.: EPNG must notify OCD in advance of any changes or modifications proposed at the facility (e.g. start-up of the gasoline plant) that will modify the volumes and composition of waterwater discharged.

2. P. 7, D.P.: Plans and specifications for the design of holding pond or storage tanks (whichever is decided upon) must be submitted to OCD for review prior to construction. An unlined pond is unacceptable. If tanks are used, a bermed area one-third larger in volume than the tank capacity must be constructed.

If you or your consultants have any questions regarding this letter or the information requested, please contact me at (505) 827-5812.

Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB:sl

cc: OCD - Aztec
EPNG - Farmington, El Paso

NEW MEXICO INTERSTATE STREAM COMMISSION

FEB 22 1988

BATAAN MEMORIAL BUILDING
STATE CAPITOL
SANTA FE, NEW MEXICO 87503

February 17, 1988

Mr. Dave Boyer
Oil Conservation Division
Energy, Minerals and Natural Resources Department
State Land Office Building
Post Office Box 2088
Santa Fe, New Mexico 87504

Dear Mr [illegible]:

Reference is made to the discharge plan application, GW-39, El Paso Natural Gas Company, San Juan Gas Processing Plant. The Notice of Publication indicates that the application is for the discharge of wastewater with a total dissolved solids concentration of approximately 1400 mg/l through an irrigation application and the groundwater likely to be affected is at a depth of about 70 feet with an average total dissolved solids concentration of approximately 4500 mg/l.

The irrigation application will likely cause deep percolation below the root zone which will create a groundwater mound, which in turn will apply additional hydraulic head on the underlying groundwater. The additional head imposed could cause discharge of the groundwater with a total dissolved solid concentration of 4500 mg/l to the San Juan River or its tributaries.

Please let me know if additional information would be helpful.

Sincerely,

Steve

S. E. Reynolds
Secretary

SER: PBM:rav

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
Suite D, 3530 Pan American Highway NE
Albuquerque, New Mexico 87107

February 11, 1988

Mr. William J. Lemay, Director
Oil Conservation Division
State of New Mexico
State Land Office Building
P.O. Box 2088
Santa Fe, New Mexico 87504-2088

Dear Mr. Lemay:

This responds to your public notice in which two proposed groundwater discharge plans were described. We have reviewed the plans and have not identified any resource issues of concern to our agency in the following:

GW-45, Sunterra Gas Processing Company, San Juan County Bloomfield, NM.
GW-39, El Paso Natural Gas Company, San Juan Gas Processing Plant, San Juan County, Farmington, NM.

These comments represent the views of the Fish and Wildlife Service. If you have any questions concerning our comments, please contact Tom O'Brien at FTS 474-7877 or (505) 883-7877.

Sincerely yours,

John C. Peterson
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Regional Administrator, Environmental Protection Agency, Dallas, Texas
Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, Albuquerque, New Mexico

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 3rd day of February.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
s/William J. Lemay, Director

SEAL

Journal, February 11, 1988

FEB 12 1988

STATE OF NEW MEXICO }
County of Bernalillo } ss

....CRAIG E. MEYERS............... being duly sworn declares and says that he is RETAIL ADV. MGR. of the **Albuquerque Journal**, and that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937, and that payment therefore has been made or assessed as court costs; that the notice, a copy of which is hereto attached, was published in said paper in the regular daily edition,

for ....1................. times, the first publication being on the ....11....... day of ....February...................., 198...8...., and the subsequent consecutive publications on ...., 198......

Craig E Meyers

OFFICIAL SEAL
SYLVIA L. NUANES
NOTARY PUBLIC - NEW MEXICO
NOTARY BOND FILED WITH SECRETARY OF STATE
My Commission Expires 11-18-89

Sworn and subscribed to before me, a Notary Public in and for the County of Bernalillo and State of New Mexico, this ....11.... day of ....February..........., 198.8

PRICE ....$30.98.............................

Statement to come at end of month.

EDJ-15 (R-2/86)

ACCOUNT NUMBER ....C80932.................

AFFIDAVIT OF PUBLICATION

No. 21317

STATE OF NEW MEXICO,
County of San Juan:

Betty Shipp being duly sworn, says: That he is the National Ad Manager of THE FARMINGTON DAILY TIMES, a daily newspaper of general circulation published in English at Farmington, said county and state, and that the hereto attached Legal Notice

was published in a regular and entire issue of the said FARMINGTON DAILY TIMES, a daily newspaper duly qualified for the purpose within the meaning of Chapter 167 of the 1937 Session Laws of the State of New Mexico for one ~~consecutive~~ (days) ~~(weeks)~~ on the same day as follows:

First Publication Wednesday February 10, 1988

Second Publication

Third Publication

Fourth Publication

and that payment therefor in the amount of $ 40.35 has been made.

Betty Shipp

Subscribed and sworn to before me this 12th day of February, 1988.

J. Shorter

NOTARY PUBLIC, SAN JUAN COUNTY, NEW MEXICO

My Commission expires: June 23, 1990

Copy of Publication

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 3rd day of February. To be published on or before February 13, 1988.

SEAL

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
WILLIAM J. LE MAY
Director

Legal No. 21317 published in the Farmington Daily Times, Farmington, New Mexico on Wednesday, February 10, 1988.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

February 5, 1988

Mr. Robert C. Speake, Hydrogeologist
K. W. Brown & Associates
6A Graham Road
College Station, Texas 77840

Dear Mr. Speake:

Enclosed is some evaporation, precipitation, and consumptive use data to use in recalculation of the water budgets.

I've also enclosed a table showing various consumptive use coefficients for differing vegetation. I suggest using the precipitation data shown in Column #1 and the Class A evaporation data shown in Column #2. Actual Class A evaporation data is given for April through September, and data for the remaining months was estimated using floating pan data and the actual coefficient (0.871) for the April-September data.

Please rerun the water budgets for at least California grass, NM grass and weeds, hay, and the alfalfa coefficients. These will produce more realistic irrigation requirements given the variety of vegetation that might be grown at the site. Please try several of the runs without a 25% leaching coefficient. I'm more worried about leaching than I am salt building up.

If you have any questions, or need other data, please let me know by calling at (505) 827-5812.

Sincerely,

David G. Boyer by JB

David G. Boyer, Chief
Environmental Bureau

DGB:sl

Encl.

cc: EPNG Farmington, El Paso

AMPAD EFFICIENCY® LINE NO. 6636

Consumptive use coefficients
u/E, where u = inches consumptive use
E = Class A pond Evap

Month	① PPT	Pan ② Class A Evap
Jan	0.65	(1.10)
Feb	0.47	(1.79)
Mar	0.62	(4.35)
Apr	0.57	7.33
May	0.45	8.37
June	0.30	10.42
July	0.70	10.01
Aug	0.98	8.89
Sep	0.84	6.62
Oct	0.87	(4.35)
Nov	0.53	(2.33)
Dec	0.68	(1.14)
Total	7.62	66.70

ⓐ u/E = 0.77 Alfalfa, WRRI #66, p.38

ⓑ u/E = 0.61 Field Corn WRRI #66
= 0.54 Spring Barley p. 16

ⓒ u/E = 0.64 Alfalfa ④ SEO #32, p.62
0.30 Beans " "
0.52 Corn " "
0.56 Hay ③ " "

ⓓ u/E = 0.23 Natural Grass (Calif) SEO #32, p. 52

ⓔ u/E = 0.28 Grass & Weeds NM SEO #32, p. 47

Example for Hay for May:
(8.37)(0.56) = 4.69 = Consumptive use or E.T. (Evap. Trans).

Footnotes

① From p. 79, State Temp & Ppt. Sum.

② Farmington Class A Pan – Six-Months Readings 3/49 - 9/79
( ) - Estimated using floating pan and 0.801 coeff.

③ Ratio u hay to u alf = 0.88.

④ Estimated Class A Pan Evap Farmington growing season 5/13 to 10/9 = 41.46 in
26.49/41.46 = 0.64

Station Dufur Ranch County San Juan Index No. ______

Latitude 36°27' Longitude 107°38' Elevation 6800 ft

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Precip													
Years of record	1	1	1	1	2	2	2	2	2	2	2	1	0
Mean	.70	.24	.40	.80	.19	2.28	2.38	2.18	.25	.47	.91	.85	11.65/
Temp													
Years of record	1	1	1	1	2	2	1	2	1	1	1	1	0
Mean	23.4	35.8	36.1	41.8	56.0	66.7	72.4	67.9	61.2	53.1	37.8	33.5	48.8/
PE	.31	.54	.80	1.50	3.86	6.24	7.57	5.84	3.75	2.27	.69	.44	33.81
Surplus	.39										.22	.41	1.02
Deficit		.30	.40	.70	3.67	3.96	5.19	3.66	3.50	1.80			23.18

Station Farmington 4NE County San Juan Index No. 3134

Latitude 36°45' ~~Longitude~~ 108°10' Elevation 5395 ft

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Precip													
Years of record	57	57	59	58	58	59	61	61	61	61	60	60	54
Mean	.52	.55	.61	.58	.46	.40	.91	1.01	.96	.99	.45	.63	8.12/ 8.07
Temp													
Years of record	22	22	22	22	21	23	23	23	23	23	23	23	19
Mean	27.7	34.5	41.1	49.1	58.9	68.4	74.9	72.5	64.3	52.8	39.6	29.5	51.4/ 51.1
PE	.36	.52	1.18	2.33	4.39	6.64	8.18	6.82	4.26	2.26	.79	.38	38.11
Surplus	.16	.03										.25	.44
Deficit			.57	1.75	3.93	6.24	7.27	5.81	3.30	1.27	.34		30.48
Evap -- floating pan 1914-1948													
Years of record	14	23	36	43	54	56	56	57	59	43	31	22	8
Mean	.96	1.56	3.79	6.34	8.01	8.83	8.73	7.38	5.71	3.79	2.03	.99	51.69/ 58.12
Monthly Class A	(1.10)	(1.79)	(4.35)	7.33	8.37	10.42	10.01	8.89	6.62	(4.35)	(2.33)	(1.14)	
Wind													
Years of record	21	21	22	28	38	40	40	39	40	30	21	20	16
Mean	1485	1577	2234	2151	1566	1150	814	704	680	851	1242	1257	17839/ 15711

12-Month Total Class A Evap. = 66.70 in

Floating/Class A for six months: 45/51.64 = 0.871

( ) - Value calculated using 0.871 coeff.

Values ~~Apr-Sept~~ Apr-Sept from Class A pan at station 3/49-9/79

Class A data from State Climatologist Office, NMDA

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STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

WILLIAM J. LEMAY, Director

S E A L

KWB&A
ENVIRONMENTAL CONSULTANTS

January 6, 1988

David Boyer
Hydrogeologist
New Mexico Oil
Conservation Division
P.O. Box 2088
Santa Fe, NM 87501

Dear Dave,

During our last meeting, you had asked if a paper discussing the land application project at the EPNG San Juan River Plant would be presented at a technical meeting. At that time, no one was planning to present a paper discussing the feasibility study. Early in December, however, Henry was asked if he would present a paper at the International Hydrology Meeting to be held at the University of Juarez. Henry agreed and promptly called me and asked if I would be interested. Of course, I said yes. The end result was that I prepared a talk and a paper which discussed the project on a fairly non-technical level. Enclosed you will find copies of the paper which was submitted for publication in the annual proceedings.

Although you have copies of the reports, I thought you might like to have copies of the paper as a brief summary.

Respectfully,

Sid

Sidney H. Johnson
Staff Scientist

SHJ:ljc
Enclosure

K.W. BROWN & ASSOCIATES, INC. • 6 GRAHAM ROAD • COLLEGE STATION, TEXAS 77840 • (409) 690-9280

LAND APPLICATION OF SALINE WASTEWATER
A FEASIBILITY STUDY

by

Henry Van and Sidney H. Johnson*

Abstract: A feasibility study was conducted to determine if land application of saline wastewater from a natural gas processing plant was a viable, cost-effective disposal option. Two proposed application sites were studied to determine their suitability for wastewater irrigation in respect to soil types present, depth to groundwater, and groundwater quality. Additionally, local vegetation was identified and individual plant species tolerance to saline irrigation was evaluated. Wastewater quality from the facility was improved by segregating wastewater streams and implementing conservation measures to the point that the quality of the wastewater was better than the quality of the local groundwater. As a result of the changes in the wastewater system, and based on the physical setting of the disposal site, it was determined that land application was an acceptable disposal option.

INTRODUCTION

In May of 1987 El Paso Natural Gas Company (EPNG) sought to determine if saline wastewater generated at its San Juan River Plant in Kirtland, New Mexico could safely be disposed using conventional irrigation equipment and a site specific management program (Figure 1). To make the evaluation EPNG set about describing the physical characteristics at two proposed disposal sites and identifying the chemical composition of the wastewater. Physical characterization of the sites included identifying local land use,

Henry Van, Ph.D., Senior Environmental Engineer, El Paso Natural Gas Company, El Paso, TX.
Sidney H. Johnson, Staff Hydrogeologist, K. W. Brown & Associates, Inc., College Station, TX.

Figure 1. Location of Study Site.

groundwater quality, soil types, native vegetation, and the local climatic setting. Characterization of the wastewater focused on quantifying inorganic constituents and comparing species concentrations with native groundwater quality.

The San Juan River Plant processes approximately 52 million cubic feet of natural gas and generates approximately 22,100 gallons of wastewater daily. Sources for the non-contact wastewater include boilers, regeneration units, evaporators, and cooling towers. Of these the regeneration wastewater accounts for the majority of the salt (NaCl) in the wastewater stream. Therefore, wastewater from this unit was removed from the wastewater flow destine for land application.

WASTEWATER

Initially, all wastewater sources were scheduled for land application and totaled 9.67 million gallons per year. During the course of the project the wastewater system was closely examined and modifications to the system were implemented. Changes in the system and water conservation measures lowered the total wastewater flow to 8.07 million gallons per year. Perhaps more important than reducing the total flow was identifying a single source, the regeneration units, which accounted for 7% of the total flow but was contributing 75% of the total salt in the wastewater flow. Based on the chemical composition of the flow volume from the regeneration units it was decided that this stream would be diverted to a lined impoundment for evaporation. Table 1 illustrates the improved water quality as a result of removing this stream from the wastewater for the land application project.

Table 1. Major Changes in Wastewater Quality.

Parameter (mg/l)	Wastewater w/ Regeneration Unit	Wastewater w/o Regeneration Unit
TDS	6,399	1,419
EC (umhos/cm)	10,354	2,047
SAR	69.2	5.3
Chloride	3,183	315
Sodium	2,034	221
Wastewater Flow (MG/yr)	9.67	8.07

SOILS

Soils at both of the proposed land application sites, referred to as the East and West sites, were examined to determine which site was most suitable for the application of wastewater. The objectives of the soils investigation were to define possible limiting conditions and determine the physical and chemical properties of the various soil series.

A total of five soil series were identified: Blackston, Haplargids, Mayqueen, Sheppard and Doak. All of the soils at the site are sandy textured (sandy loam or loamy sand) and contain varying amounts of native salts (carbonates and sulfates). Chemical and physical analysis of samples collected from each of the soils series identify the Sheppard and Doak series as the most desirable and the Blackston and Haplargids series as undesirable. Table 2 illustrates the differences between the East site soils, which are comprised primarily of the Sheppard and Doak series, and West site soils, which contain large portions of the Blackston and Haplargids series. On the basis of this comparison the East site was selected for the land application of wastewater.

In addition to chemical analysis of the soils, the infiltration rates of the various profiles of each soil series was measured. Infiltration rates were determined using double ring infiltrometers and chart recorders. Soils at the selected site exhibited infiltration rates at the surface of 8.9 to 1.33 inches per hour and 3.1 to 1.84 inches per hour for the subsurface. These infiltration rates are sufficiently rapid to allow wastewater to enter the soil, thereby preventing erosion due to surface runoff as well as preventing excessive build-up of salt at the surface and within the root zone.

Table 2. Physical Properties of Soils at EPNG SJRP Wastewater Irrigation Sites.

Soil Series/ Depth (in)	Permea- bility (in/hr)	Erosion Factor (K)	Wind Erodi- bility Group	Slope (%)	Available Water Capacity (in/in)	Surface Texture
Blackston						
0-12	3.18	0.28	5	1-3	0.14-0.17	Sandy loam
12-30	0.62	0.10			0.07-0.10	
30-72	6.0-20.0	0.10			0.03-0.06	
Haplargids						
0-8	1.42	0.24	2	1-3	0.09-0.12	Loamy sand
8-13	1.38	0.24			0.09-0.12	
13-72	6.0-20.0	0.24			0.09-0.12	
Mayqueen						
0-4	6.0-20.0	0.24	2	1-3	0.06-0.10	Loamy sand
4-16	2.0-6.0	0.28			0.10-0.14	
16-72	6.0-20.0	0.24			0.07-0.10	
Sheppard						
0-3	8.9	0.15	2	1-3	0.06-0.08	Loamy sand
7-12	3.14	0.15			0.06-0.08	
12-72	6.0-20.0	0.15			0.06-0.08	
Doak						
0-6	1.33	0.24	5	1-3	0.09-0.12	Sandy loam
6-19	1.84	0.24			0.09-0.12	
19-72						

GEOLOGY AND HYDROLOGY

To determine the potential impact wastewater irrigation would have on local groundwater an investigation of the local geologic and hydrologic setting was performed. The investigation consisted of drilling 11 borings, of which 5 were completed as piezometers, and installing 3 monitoring wells. Logs from the borings and well installation allowed the construction of geologic cross-sections which indicate that the site is situated on approximately 60 to 90 feet of Quaternary alluvium. The alluvium was deposited in an erosional feature on top a marine shale (Kirtland shale). Just above the alluvium/shale interface, coarse-grained channel sediments (gravel) were deposited, and form the local aquifer (Figure 2).

Bail tests and falling head tests conducted in the piezometers and monitoring wells indicate the unsaturated alluvial sediments have hydraulic conductivities of approximately 2×10^{-5} cm/sec and the saturated gravel sediments of the aquifers have hydraulic conductivities of approximately 1×10^{-3} cm/sec. Depth to groundwater at the site was in excess of 60 feet and the hydraulic gradient was determined to be 0.007 ft/ft.

GROUNDWATER QUALITY

In addition to establishing physical properties of the local hydrology, the chemistry of the local groundwater was established. Prior to wastewater application, groundwater samples were collected from local well owners, as well as from the monitoring wells installed at the proposed site. Analysis of the samples indicated the local groundwater is quite variable and typically of poor quality, exhibiting total dissolved solid concentrations of 1,400 to 5,400 mg/l (Table 3).

Computer analysis of the groundwater samples using a geochemical

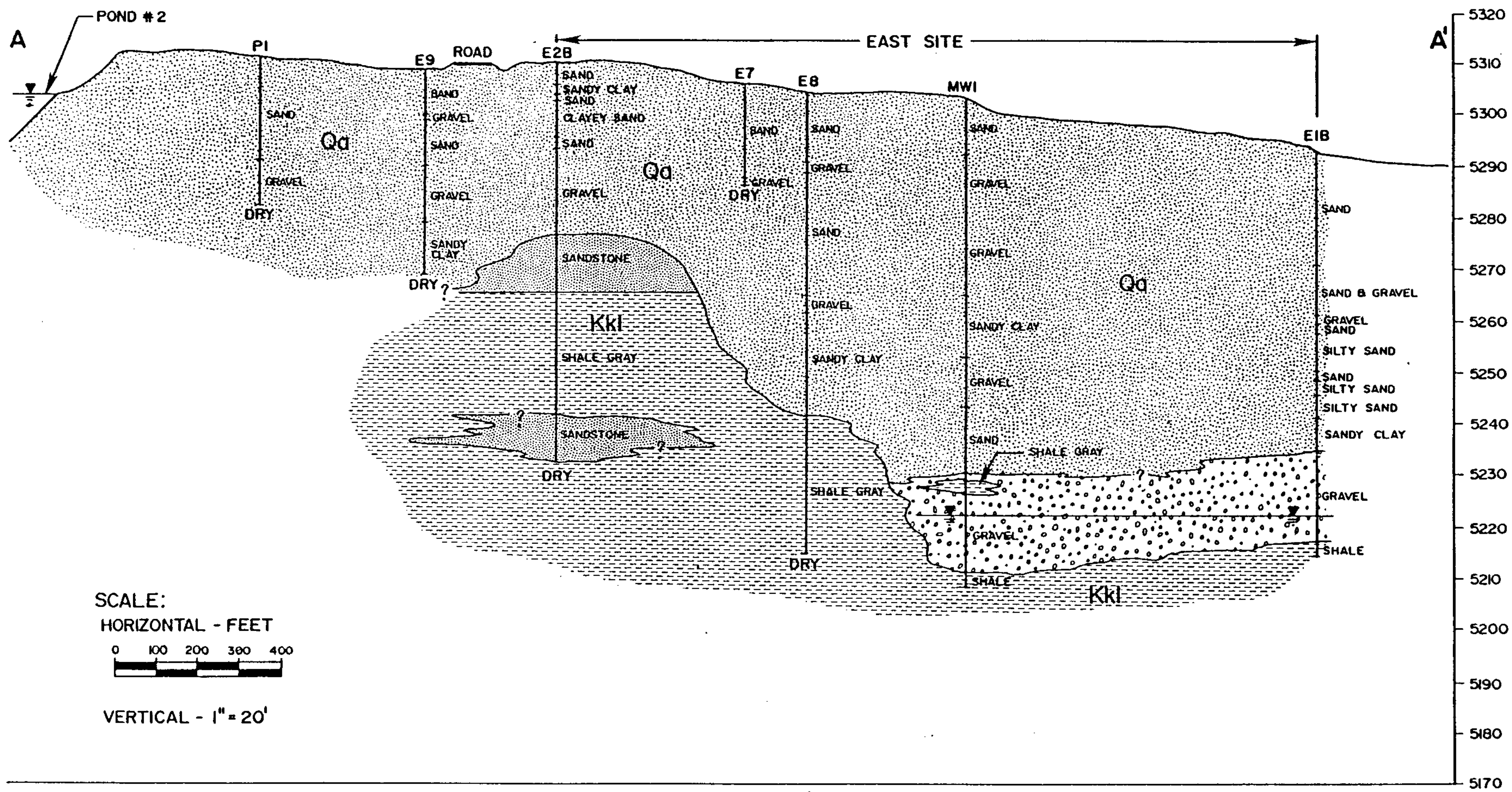

FIGURE 2. GEOLOGIC CROSS-SECTION A-A' OF EAST SITE, EPNG SJRP.

Table 3. Analytical Results for Groundwater Samples.

Parameters (reported in mg/l)	Monitoring Wells: Well # 1	Monitoring Wells: Well # 2	Monitoring Wells: Well # 3	Monitoring Wells: Well Avg.	Local Wells: Lester Well	Local Wells: Hansen Well	Local Wells: Isham Well	Local Wells: Dailey Well	Local Well Avg.	Waste-water
COD	31	33	0.18	21	NA	NA	NA	NA	NA	108.0
TOC	7	9	4	7	NA	NA	NA	NA	NA	23
TDS	4,800	5,400	3,300	4,500	1,400	2,000	3,400	4,300	2,775	1,419
E.C. (umhos/cm)	5,800	6,800	4,200	5,600	3,000	2,950	4,075	4,800	3706	2,047
SAR	8.8	10.3	7.2	8.8	16.7	9.7	13.4	14.0	13	5.3
Oil & Grease	2.00	1.50	NA	NA	NA	NA	NA	NA	NA	2[illegible]
Total K Nitrogen	NA	NA	NA	NA	0.40	< 0.4	5	3.9	2.43	0.40
Nitrate-N	NA	NA	NA	NA	< 0.10	< 0.10	< 0.10	< 0.10	0.10	2.32
Ammonia	< 0.40	< 0.40	< 0.40	0.40	< 0.40	< 0.40	< 0.40	< 0.40	0.40	0.46
O-phosphate	< 0.1	< 0.1	< 0.1	0.1	NA	NA	NA	NA	NA	7.5
Alkalinity (total)	350	610	320	427	320	230	150	91	198	28
Alkalinity (HCO3)	350	610	320	427	320	230	150	91	198	NA
Arsenic	< 0.010	< 0.010	< 0.010	0.010	NA	NA	NA	NA	NA	0.005
Barium	< 0.30	< 0.30	< 0.30	0.30	NA	NA	NA	NA	NA	0.27
Boron	0.77	0.54	< 0.5	0.60	NA	NA	NA	NA	NA	0.5
Cadmium	< 0.01	< 0.01	< 0.01	0.01	NA	NA	NA	NA	NA	0.007
Calcium	320	340	280	313	31	130	190	280	158	91
Chloride	170	320	110	200	110	400	400	450	340	316
Chromium	< 0.02	< 0.02	< 0.02	0.02	NA	NA	NA	NA	NA	0.018
Copper	< 0.01	< 0.01	< 0.01	0.01	NA	NA	NA	NA	NA	0.11
Cobalt	0.011	0.010	< 0.005	0.009	NA	NA	NA	NA	NA	0.05
Cyanide	< 0.01	< 0.01	< 0.01	0.01	NA	NA	NA	NA	NA	0.007
Floride	< 0.1	< 0.1	< 0.1	0.1	NA	NA	NA	NA	NA	0.5
Lead	< 0.05	< 0.05	< 0.05	0.05	NA	NA	NA	NA	NA	0.[illegible]
Magnesium	160	190	78	143	13	44	57	66	45	24[illegible]
Manganese	4.5	0.97	0.24	1.90	NA	NA	NA	NA	NA	0.03
Mercury	< 0.001	< 0.001	< 0.001	0.001	NA	NA	NA	NA	NA	0.001
Molybdenum	0.28	0.022	0.015	0.106	NA	NA	NA	NA	NA	0.02
Nickel	0.1	0.1	0.1	0.1	NA	NA	NA	NA	NA	0.07
Potassium	17.00	8.70	4.90	10.20	3.10	5.6	6.3	3.5	4.6	4.91
Selenium	< 0.01	< 0.01	< 0.01	0.01	NA	NA	NA	NA	NA	0.007
Silver	< 0.01	< 0.01	< 0.01	0.01	NA	NA	NA	NA	NA	0.007
Sodium	770	960	530	753	440	500	820	1,000	690	221
Sulfate	2,800	3,000	1,900	2,567	780	790	1,800	2,470	1,460	543
Zinc	0.06	0.03	0.03	0.04	NA	NA	NA	NA	NA	0.68

* Values reported below detection (<) are averaged at the detection limit.
NA = value not available; NS = No standard

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speciation model (WATEQF) indicated the groundwater is near saturation or is super-saturated in respect to carbonate minerals (calcite, aragonite, and dolomite) and sulfate minerals (gypsum and anhydrite) and is strongly under-saturated in respect to halite. The results of the model correlate well with the chemistry of the local soils which contain abundant carbonate and sulfate minerals.

Based on the analysis of local groundwater samples, and a comparison with the wastewater quality, it was determined the primary constituent of concern was chloride. Wastewater concentration of chloride was 315 mg/l and the groundwater chloride concentration in the area varied from 110 to 450 mg/l (a statistical mean of 417 mg/l was used as background chloride concentration). Based on this assessment, computer models (SUMATRA1 and WORM) were run to assess the impact chloride would have on groundwater quality.

Results of the models, based on the proposed irrigation rates and which take into account concentration of salts by evapotranspiration, indicate that no statistically significant deterioration of groundwater will occur during the first 20 years of operation (Figure 3). The initial drop in groundwater quality is attributed to the movement of relatively good quality soil-pore water draining from the unsaturated profile during the first few years of operation. In subsequent years the groundwater quality begins to approach wastewater quality. Eventually, it is anticipated that the quality of the leaching fraction will equal the quality of the irrigated wastewater.

VEGETATION

One of the concerns of the study was whether or not a vegetative cover could be maintained during the active operation of the site to prevent

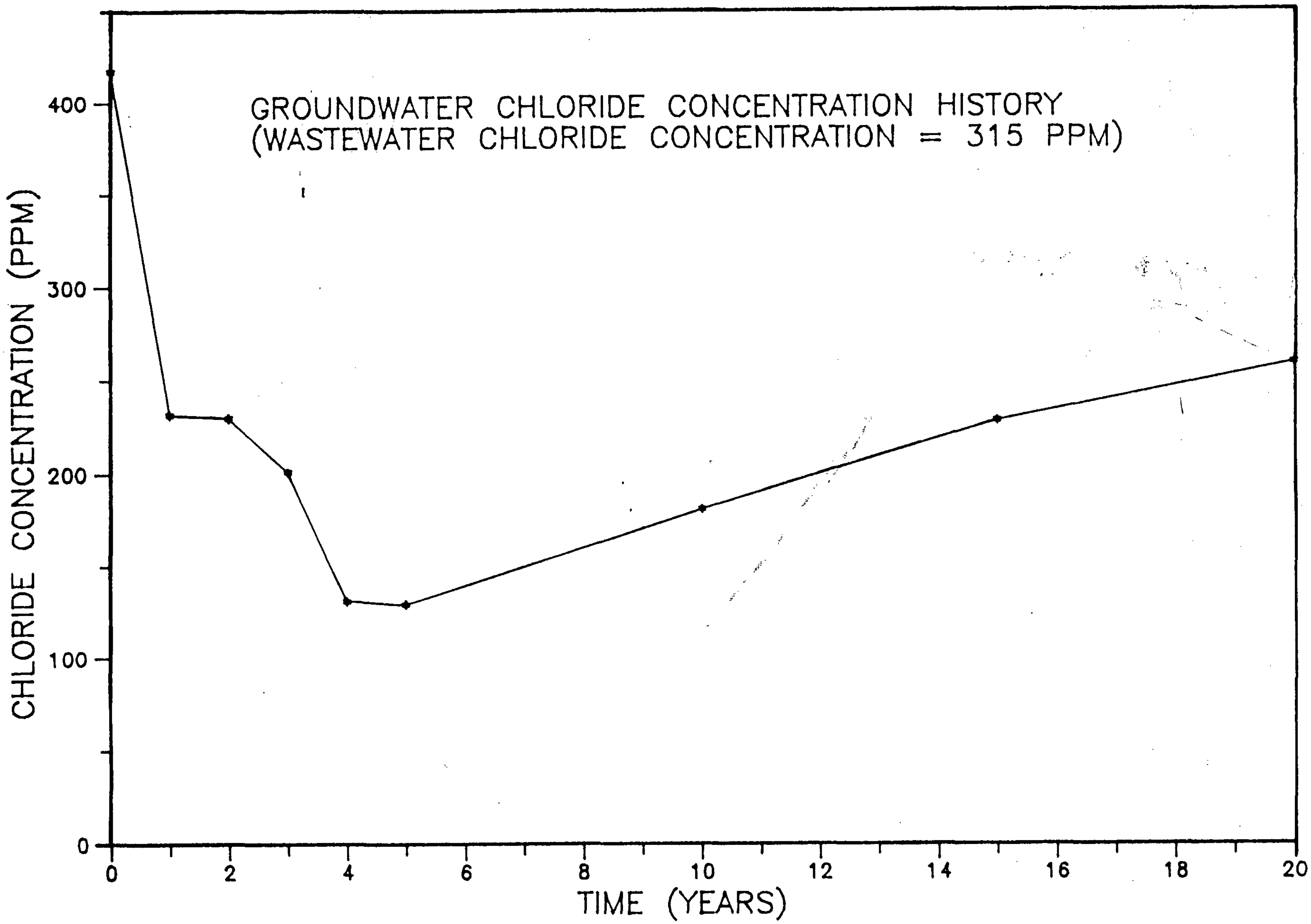

Figure 3. Changes in Chloride Concentration as a Function of Time.

erosion of the soil. To determine if native plant species would be suitable for maintaining a vegetative cover, a survey of the local species was conducted, which consisted of setting up 20 transects with 100 sample points on each. From the 2,000 data points, local species were identified and their relative abundance was calculated. Having identified the species it was possible to determine from published literature their relative tolerance to saline conditions. The assessment indicates that many of the native species (i.e., rice grass - Oryzopsis hymenoids, 4-wing saltbush - Atriplex canescens, and tumble weed - Salsola iberica) are very tolerant to saline conditions and should fare well in the environment created by the wastewater irrigation. Other species which were very abundant at the site and moderately tolerant to saline conditions include brome (Bromus tectorum) and mustard (Descurainia spp.). It is believed that management at the site will permit these species to increase in abundance, thereby forming a suitable vegetative cover.

Based on the assessment of the local vegetation, it was determined that native species rather than cultivated species would be used.

CLIMATIC ASSESSMENT AND SITE MANAGEMENT

To design a wastewater application system which would satisfy leaching requirements and plant moisture needs, it was necessary to evaluate the local water budget. Assessment of the local climatic setting included designing an interactive computer program which accounted for evapotranspiration, precipitation, and wastewater irrigation on a monthly basis. From the assessment it was determined that during the winter months an irrigation area of 26 acres would be required to effectively dispose of the wastewater, whereas only 2 acres would be needed during the summer months. The large discrepancy between winter and summer irrigation area is a function of the extremely negative water balance which exists at the site and is most noticeable during the summer months. Tables 4 and 5 illustrates the format used to calculate the water balance. In addition to calculating irrigation area requirements, the program determined storage requirements for periods when wastewater cannot be irrigated.

SURROUNDING LAND USE

A final consideration of the wastewater project was an assessment of the surrounding land use and the impact land application of wastewater would have. The assessment included determining the distance to local residences and businesses and surveying local groundwater use. Results of the assessment indicate that local use of groundwater is very limited and restricted to non-potable applications. The area near the application area is sparsely populated; therefore, it has been determined that with proper management no adverse impact to local residences will occur.

SITE MANAGEMENT

Once the site begins operation routine monitoring of wastewater quality, soils, soil-pore liquid, and groundwater will be required. Wastewater samples will be collected monthly during the first year of operation and semi-annually thereafter to monitor wastewater quality. Soil samples will be collected annually following the growing season to determine soil variability, the impact of wastewater irrigation, and to evaluate the need to add soil amendment such as gypsum. Soil-pore liquid (leaching fraction) will be monitored throughout the life of the land application project using glass brick lysimeters. The lysimeters are designed to capture water moving through the soil profile under the influence of gravity. Samples from the lysimeters will provide an early indication of the quality of water leaching to groundwater. Soil-pore

Table 4. Hydrologic Budget for Determining Wastewater Storage Requirements.

Month	Design precip. (in)	E.T. (in)	Root zone moisture deficit (in)	Leaching requirement (in)	Irr. requirements (in)	Eff.-adjusted irr. requirements (in)	Wastewater inflow (acre-in)	Req'd irr. area (acres)	Irr. area used (acres)	Beginning of Month: Tank volume (acre-in)	Beginning of Month: Avail. wastewater (acre-in)	End of Month: Wastewater applied (acre-in)	End of Month: Tank volume (acre-in)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Jan	1.58	0.96	0.00	0.00	0.00	0.00	25.28	0.00	0.00	25.28	50.56	0.00	50.56
Feb	1.07	1.56	0.49	0.12	0.61	0.77	22.65	29.58	26.00	50.56	73.21	19.91	53.30
Mar	1.26	3.79	2.53	0.63	3.16	3.95	25.28	6.39	19.88	53.30	78.58	78.58	0.00
Apr	1.33	6.34	5.01	1.25	6.26	7.83	24.41	3.12	3.12	0.00	24.41	24.41	0.00
May	0.70	8.02	7.32	1.83	9.15	11.44	25.28	2.21	2.21	0.00	25.28	25.28	0.00
Jun	0.75	8.83	8.08	2.02	10.10	12.63	24.41	1.93	1.93	0.00	24.41	24.41	0.00
Jul	1.37	8.74	7.37	1.84	9.21	11.52	25.28	2.20	2.20	0.00	25.28	25.28	0.00
Aug	1.91	7.38	5.47	1.37	6.84	8.55	25.28	2.96	2.96	0.00	25.28	25.28	0.00
Sep	1.47	5.72	4.25	1.06	5.31	6.64	24.41	3.68	3.68	0.00	24.41	24.41	0.00
Oct	1.91	3.79	1.88	0.47	2.35	2.94	25.28	8.61	8.61	0.00	25.28	25.28	0.00
Nov	1.02	2.03	1.01	0.25	1.26	1.58	24.41	15.47	15.47	0.00	24.41	24.41	0.00
Dec	1.75	1.00	0.00	0.00	0.00	0.00	25.28	0.00	0.00	0.00	25.28	0.00	25.28
Totals:	16.12	58.16	43.41	10.85	54.26	67.83	297.25					297.25	

Irrigation efficiency = 80 percent
Leaching coefficient = 25 percent

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Table 5. Hydrologic Budget for Determining Wastewater Application Rates.

Month	Record mean precip. (in)	E.T. (in)	Root zone moisture deficit (in)	Leaching requirement (in)	Irr. requirements (in)	Eff.-adjusted irr. requirements (in)	Waste-water inflow (acre-in)	Req'd irr. area (acres)	Irr. area used (acres)	Beginning of Month: Tank volume (acre-in)	Beginning of Month: Avail. waste-water (acre-in)	End of Month: Waste-water applied (acre-in)	End of Month: Tank volume (acre-in)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Jan	0.90	0.96	0.06	0.00	0.00	0.00	25.28	0.00	0.00	25.28	50.56	0.00	50.56
Feb	0.61	1.56	0.95	0.24	1.19	1.48	22.65	15.26	26.00	50.56	73.21	38.59	34.62
Mar	0.72	3.79	3.07	0.77	3.84	4.80	25.28	5.27	12.49	34.62	59.90	59.90	0.00
Apr	0.76	6.34	5.58	1.40	6.98	8.72	24.41	2.80	2.80	0.00	24.41	24.41	0.00
May	0.40	8.02	7.62	1.90	9.52	11,91	25.28	2.12	2.12	0.00	25.28	25.28	0.00
Jun	0.43	8.83	8.40	2.10	10.50	13.13	24.41	1.86	1.86	0.00	24.41	24.41	0.00
Jul	0.78	8.74	7.96	1.99	9.95	12.44	25.28	2.03	2.03	0.00	25.28	25.28	0.00
Aug	1.09	7.38	6.29	1.57	7.86	9.83	25.28	2.57	2.57	0.00	25.28	25.28	-0.00
Sep	0.84	5.72	4.88	1.22	6.10	7.63	24.41	3.20	3.20	-0.00	24.41	24.41	-0.00
Oct	1.09	3.79	2.70	0.68	3.38	4.22	25.28	5.99	5.99	-0.00	25.28	25.28	-0.00
Nov	0.58	2.03	1.45	0.36	1.81	2.27	24.41	10.77	10.77	-0.00	24.41	24.41	-0.00
Dec	1.00	1.00	0.00	0.00	0.00	0.00	25.28	0.00	0.00	0.00	25.28	0.00	25.28
Totals:	9.20	58.16	48.96	12.23	61.13	76.41	297.25					297.25	

Irrigation efficiency = 80 percent
Leaching coefficient = 25 percent

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liquid samples will be collected semi-annually. Groundwater samples will be collected quarterly during the first year to form a statistically data base and annually thereafter to monitor changes in groundwater quality.

All samples collected at the site will be monitored for inorganic constituents only since the wastewater to be irrigated is from non-contact (never in contact with hydrocarbons) sources. The primary parameters which will be monitored include TDS, EC, pH, TKN, SAR, Ca, Mg, Na, Cl, SO_4, NO_3, CO_3, and HCO_3.

SUMMARY AND CONCLUSIONS

Field investigations at the proposed land application site determined that the physical setting was ideal for the irrigation project. The soils at the site were permeable, which would allow rapid infiltration of the irrigated wastewater, and reduce the likelihood that soils structure would not be compromised by salts. The thickness of the unsaturated geologic material was in excess of 60 feet and is composed of material which exhibits hydraulic conductivities of 2×10^{-5} cm/sec, thereby allowing a sufficient buffer between the groundwater and the irrigated wastewater. The chemistry of the surface soils and the geologic material was also determined to be suitable for land application since the chemical species present (primarily salts) in the alluvium were present in the groundwater at their saturation indices. Therefore, leaching water through the profile would not increase the relative concentration of native salts in respect to local groundwater quality.

Comparison of wastewater quality and groundwater quality using solute transport computer programs indicate that groundwater quality will not be adversely impacted by the irrigation of the wastewater. Rather, due to improvements in wastewater quality, which resulted from modifications in the wastewater system and segregation of individual wastewater streams, the quality of the wastewater is better than the native groundwater. Predictions offered by the computer model indicate that groundwater quality will be improved, and over time the groundwater will approach the quality of the wastewater.

At the end of the feasibility study it was determined that, with the improvements and modifications in the wastewater system and provided proper site management is maintained, land application of wastewater at this site is an environmentally sound and economically viable option. In order to insure the success of the operation and to comply with State regulations it is necessary that routine monitoring be performed throughout the active operation of the land application project. Routine monitoring will include sampling wastewater, soil, soil-pore liquid, and groundwater for constituents present in the wastewater which could adversely impact groundwater quality or compromise the condition of the surface soils.

ACKNOWLEDGMENTS

We would like to express our sincerest thanks to Ken Beasley, Compliance Engineer of EPNG San Juan Division, and the employees of the San Juan River Plant for their assistance in conducting the feasibility study. Special thanks also go to Dave Boyer, Jami Bailey, and Bill Olsen of the New Mexico Oil and Gas Conservation Division and Dr. Bill Stone of the New Mexico Bureau of Mines & Minerals Resources for their technical assistance throughout the course of this study.

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-5215

DONALD N. BIGBIE VICE PRESIDENT

December 30, 1987

Mr. William J. LeMay, Director
Energy and Minerals Department
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87501-2088

Re: Discharge Plan for El Paso Natural Gas Company - San Juan River Plant

Dear Mr. LeMay:

Enclosed for your review is the completed Non-contact Wastewater Discharge Plan for the El Paso Natural Gas Company's San Juan River Plant. The plan details proposed disposal methods and techniques to ensure compliance with the New Mexico Water Quality Act and New Mexico Water Quality Control Commission Regulations.

El Paso respectfully requests approval of this plan and will meet with Agency personnel whenever necessary should clarification or further information be required. Information requests should be directed to Kenneth E. Beasley, Compliance Engineer for San Juan Division at (505) 325-2841, Extension 2175.

Thank you for your consideration in this matter.

Very truly yours,

EL PASO NATURAL GAS COMPANY

Donald N. Bigbie
Vice President

DNB:ka

Enclosure

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

December 24, 1987

Mr. David G. Boyer
Hydrogeologist/Environmental Bureau Chief
Energy & Minerals Department
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 87501-2088

Subject: Discharge Plan for El Paso Natural Gas Company
San Juan River Plant

Dear Mr. Boyer:

During our meeting of December 2, 1987, you raised concerns over the predictions offered by the mathematical model in the Land Application Feasibility Study Phase II report and requested Stiff diagrams of the local groundwater quality. K. W. Brown and Associates have addressed the issue raised by using an updated version of the SUMATRA 1 model as well as additional methods for analyzing local groundwater quality. Enclosed is the update of the groundwater model for Phase II Land Application Study and the Stiff diagrams you requested.

If you have questions, please contact K. E. Beasley or myself at 505/325-2841, Ext. 2175 or 915/541-2832, respectively.

Very truly yours,

Henry Van, Ph. D.
Senior Environmental Engineer
Environmental & Safety Affairs Department

HV:gb
Enclosures

c: K. E. Beasley
J. C. Bridges

KWB&A
ENVIRONMENTAL CONSULTANTS

December 22, 1987

Kenneth E. Beasley
Compliance Engineer
El Paso Natural Gas Company
P.O. Box 4990
Farmington, NM 87499

Re: Update of Groundwater Model for Phase II Land Application Study, San Juan River Plant

Dear Ken:

In our meeting at OCD to discuss the Phase II report concerns were raised over the predictions offered by the model concerning impact on groundwater. To address the issues raised, we have used an updated version of the SUMATRA1 model as well as additional methods for analyzing local groundwater quality. Information presented in the following sections should calm all fears concerning the suitability of the land application project.

LOCAL GROUNDWATER QUALITY

A reassessment of the local groundwater quality was conducted to identify upper concentrations for indicator constituents in native groundwater. To illustrate the quality of the local groundwater, Stiff diagrams were constructed which present a 2-dimensional picture of the major anions and cations (attached). The diagrams were constructed using laboratory data presented in the Phase I and Phase II reports. From the diagrams it is apparent that groundwater quality in the area is quite variable; however, it is possible to determine trends within the data. Especially notable is the "bow tie" configuration of the diagrams drafted for the private wells and monitoring wells. One interesting point is the difference in the magnitude of the chloride peaks of the monitoring wells (and the Lester well) as compared to the local wells (Dailey, Hansen, and Isham). The smaller chloride peak along with the **relative** increased concentrations noted for calcium, magnesium, sodium, sulfate, and bicarbonate for the monitoring wells suggests that irrigation with raw water at the golf course may be influencing groundwater quality near the EPNG facility. The increased concentrations of these constituents in the monitoring wells would be consistent with the expected results for leaching raw water, which has low chloride concentrations, through a soil profile which contains carbonate minerals and sodium sulfate. This assessment also supports the explanation presented in the Phase II report that irrigation at the golf course may be causing a slight irregularity in the groundwater flow direction at the East site.

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In addition to assessing local groundwater quality, the Stiff diagrams were used to determine if the monitoring wells have been affected by seepage from the wastewater ponds. Diagrams constructed from water samples collected from the wastewater ponds have strong peaks for chloride. Given chloride is very mobile it would be expected that if the wells were receiving water from the wastewater ponds the chloride peaks in the affected monitoring wells would be exaggerated in respect to the other native salts. However, this is not the case. In fact, a reduced peak for chloride was seen on each of the monitoring well Stiff diagrams. This suggests that local groundwater is being diluted in respect to chloride rather than receiving wastewater from the ponds. Therefore, it has been determined that the monitoring wells have not been affected by seeping water from the ponds.

Two possible explanations could account for the reduced chloride peak on the monitoring well Stiff diagrams. One is the influence of leaching water from irrigating the golf course as discussed above. The other is that the wells could have been affected by fresh water used to perform the slug tests. Despite having purged the wells extensively and monitoring the electrical conductivity of the produced water, it is possible that some fresh water could have remained in the formation, thereby lowering the chloride concentration. To develop a clear data base and establish variability within the monitoring wells, additional pumping and sampling as defined in Phase II is recommended.

Based on the assessment of local groundwater quality it appears that the monitoring wells at the East site have been influenced by activities at the site. Therefore, it is suggested that the upper limits for groundwater quality be based on the results of the local wells (Dailey, Hansen, and Isham). These three wells are located such that they could not have been affected by irrigation activities or recharge from other surface waters. Also, each well is used on a regular basis, and samples were collected following extensive pumping. Therefore, it is believed that water quality, as defined by these wells, is representative of native groundwater quality upgradient of the proposed land application site. Using analytical data from these wells, it has been determined that the primary constituent of concern is chloride. The average chloride concentration for these wells is 417 ppm and the standard deviation of these samples is 29.

COMPUTER MODEL

Following a numerical analysis of the proposed irrigation operations at EPNG-SJRP, some concerns as to the applicability of the model boundary conditions used in Phase II were voiced. Since the submission of the Phase II report, dated November 1987, we have acquired an updated version of the SUMATRA1 model from the author of the code, M. Th. van Genuchten, which allows for the simulation of groundwater quality.* Summarized below are our findings and conclusions concerning the impact of land application of saline wastewater after applying the new code (WORM).

During KWB&A's re-analysis, the following variances from the Phase II analysis were made:

1. An assessment of background groundwater quality;
2. Specification of groundwater chloride concentration was added; and
3. The texture of Strata 1 and 2 was coarsened.

Unlike SUMATRA1, WORM allows for the specification of groundwater concentration at the lower boundary. Based on our analysis of surrounding water wells, a value of 417 ppm was chosen to represent background groundwater chloride concentration.

The revised parameters (the parameters used in Phase II are included in parentheses) used as input to WORM are as follows:

Stratum 1

Initial chloride concentration: 2.40 (2.40) meq/l
Thickness: 36.0 (36.0) feet
Bulk density: 1.65 (1.65) g/cc
Diffusion coefficient: 1.30 (1.30) cm^2/day
Dispersivity: 1000 (1000) cm
Distribution coefficient: 0 (0)
Saturated hydraulic conductivity: 190.0 (190.0) cm/day
Residual moisture content: 0.14 (0.06) cc/cc
Saturation moisture content: 0.44 (0.45) cc/cc
Texture: loamy sand (silty clay)

Does this account for volume applied?

Stratum 2

Initial chloride concentration: 1.05 (1.05) meq/l
Thickness: 29.6 (29.6) feet
Bulk density: 1.55 (1.55) g/cc
Diffusion coefficient: 1.30 (1.30) cm^2/day
Dispersivity: 1000 (1000) cm
Distribution coefficient: 0 (0)
Saturated hydraulic conductivity: 7.3 (7.3) cm/day
Residual moisture content: 0.16 (0.25) cc/cc
Saturation moisture content: 0.46 (0.40) cc/cc
Texture: sandy loam (loamy sand)

Figure 1 predicts the concentration history for chloride in groundwater over a 20-year period. Initially, chloride is at 417 ppm, while the applied wastewater is at 315 ppm. The initial drop in chloride concentration is attributed to downward movement of overlying, good-quality pore water. An impact on groundwater quality is apparent after about 4 years of service. Based on WORM modeling, the maximum attainable groundwater concentration will be that of the wastewater (315 ppm); this can be demonstrated using elementary breakthrough curve analysis.

In fact, since the quality of the applied wastewater, with respect to chloride concentration, is lower than background, it follows that EPNG's proposed irrigation operations will serve to enhance groundwater quality.

The foregoing discussion in no way accounted for dilution and offsite transport of infiltrated salts by the regional groundwater flow system. To address this type of analysis requires the utilization of a multi-dimensional model. Nevertheless, the present (WORM) analysis can be thought of as a worst case situation in that dilution of the infiltrating chloride by the regional groundwater flow system was disregarded (this is unavoidable in a one-dimensional analysis). In reality, the mass of chloride in the groundwater would not accumulate, but would be entrained by the regional flow system.

It is hoped that this follow-up analysis lends clarity to the Phase II modeling effort regarding the predicted impact (or lack thereof) of EPNG's proposed irrigation operations on local groundwater quality. Any questions or comments that you may have regarding this work may be directed at either Sid Johnson or Bobby Speake.

Respectfully,

Sidney H. Johnson
Project Manager/Hydrogeologist

Robert C. Speake
Hydrogeologist

SHJ/cw

Enclosures

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*Genuchten, M. Th. (1987). "A Numerical Model for Water and Solute Movement In and Below the Root Zone." USDA-ARS, U.S. Salinity Laboratory, Riverside, California. 61 pp.

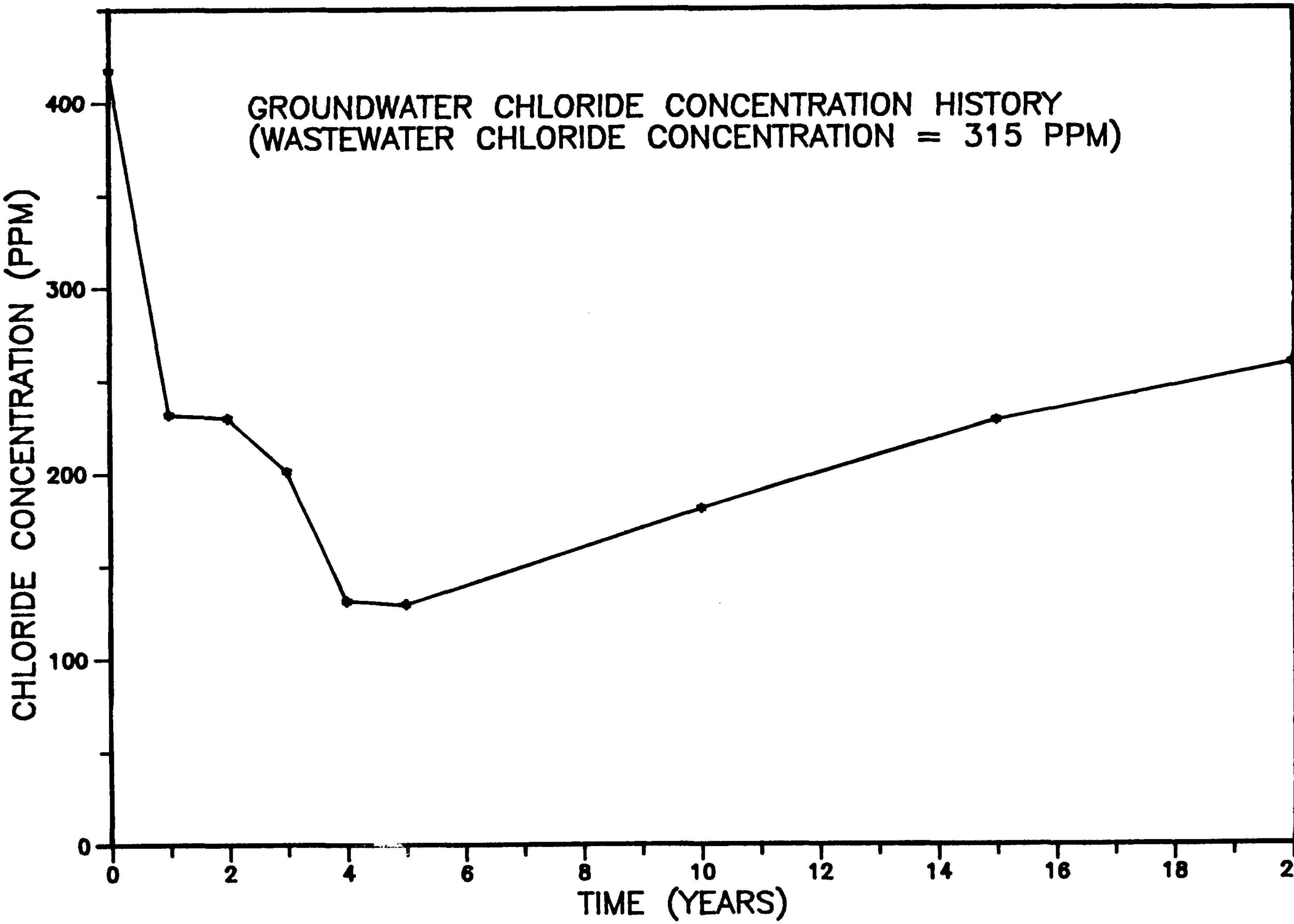

GROUNDWATER CHLORIDE CONCENTRATION HISTORY
(WASTEWATER CHLORIDE CONCENTRATION = 315 PPM)
CHLORIDE CONCENTRATION (PPM)
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
TIME (YEARS)

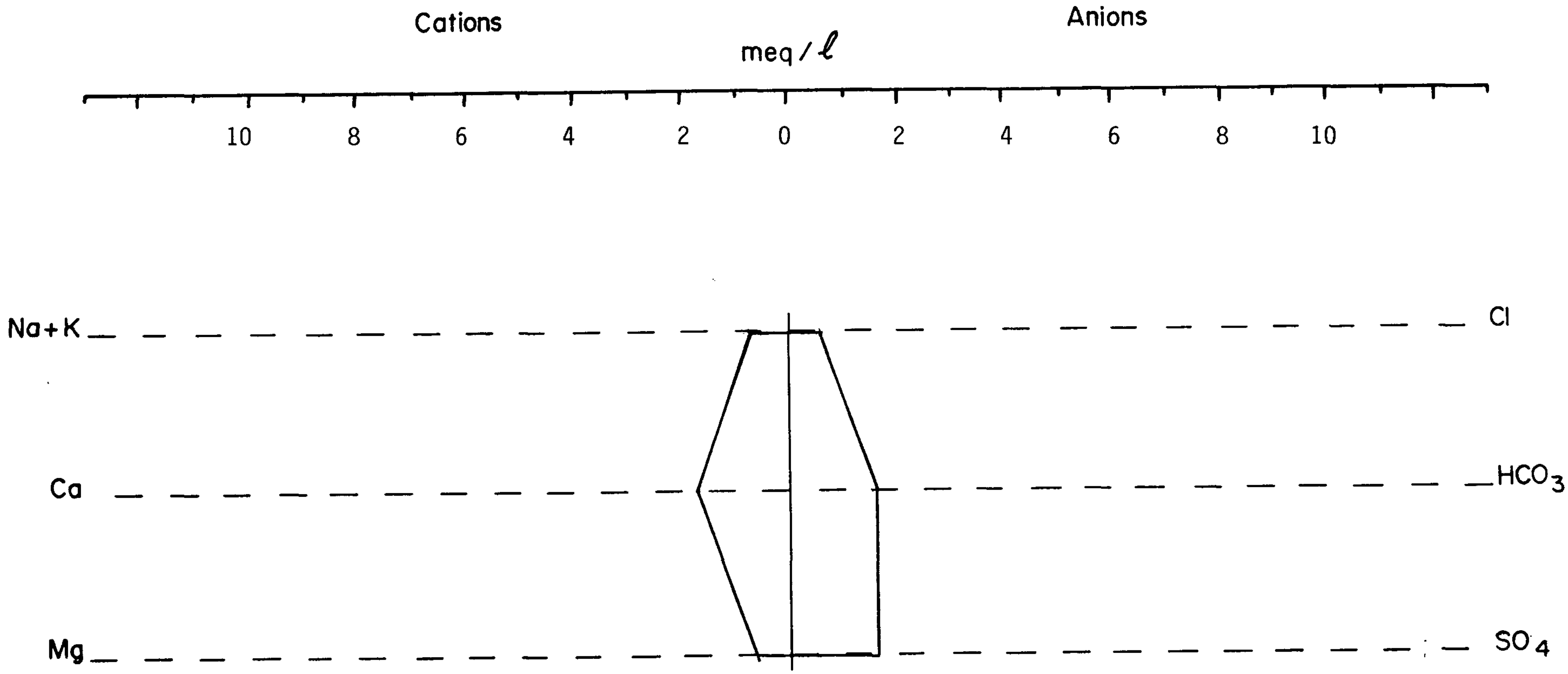
FIGURE 1.

Table 4. Local Water Wells (w/o Lester Well).

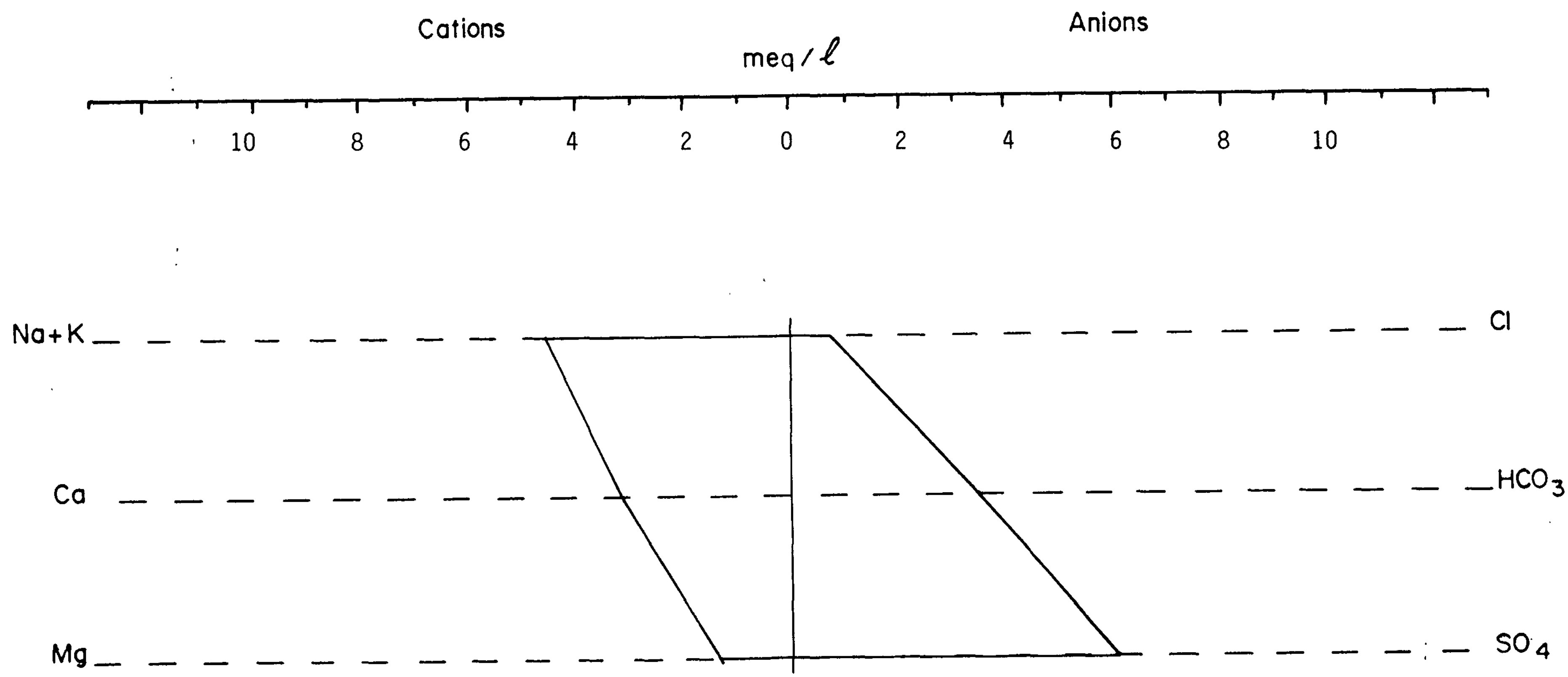
Parameters (reported in mg/l)	Local Wells: Hansen Well	Local Wells: Isham Well	Local Wells: Dailey Well	Overall Statistics: Min. Value	Overall Statistics: Max. Value	Overall Statistics: Avg	Overall Statistics: Std. Dev.	Overall Statistics: Var.	Upper Limit of Mean 95%	Avg. + 3 x Std. Dev.	Upper Limit + 1 std. Dev.
TDS	2,000	3,400	4,300	2,000	4,300	3,233	1,159	1,343,333	5,187	6,710	6,346
E.C. (umhos/cm)	2,950	4,075	4,800	2,950	4,800	3,942	932	868,958	5,513	6,738	6,445
SAR	9.7	13.4	14.0	10	14	12	2	5	16	19	19
Ammonia	0.40	0.40	0.40	0	0	0	0	(0)	0	0	0
Alkalinity (total)	230	150	91	91	230	157	70	4,867	275	366	344
Alkalinity (HCO3)	230	150	91	91	230	157	70	4,867	275	366	344
Calcium	130	190	280	130	280	200	75	5,700	327	426	403
Chloride	400	400	450	400	450	417	29	833	465	503	494
Magnesium	44	57	66	44	66	56	11	122	74	89	85
Potassium	5.6	6.3	3.5	4	6	5	1	2	8	10	9
Sodium	500	820	1,000	500	1,000	773	253	64,133	1,200	1,533	1,454
Sulfate	790	1,800	2,470	790	2,470	1,687	846	715,233	3,112	4,224	3,958

* Values reported below detection (() are averaged at the detection limit.
NA = value not available; NS = No standard

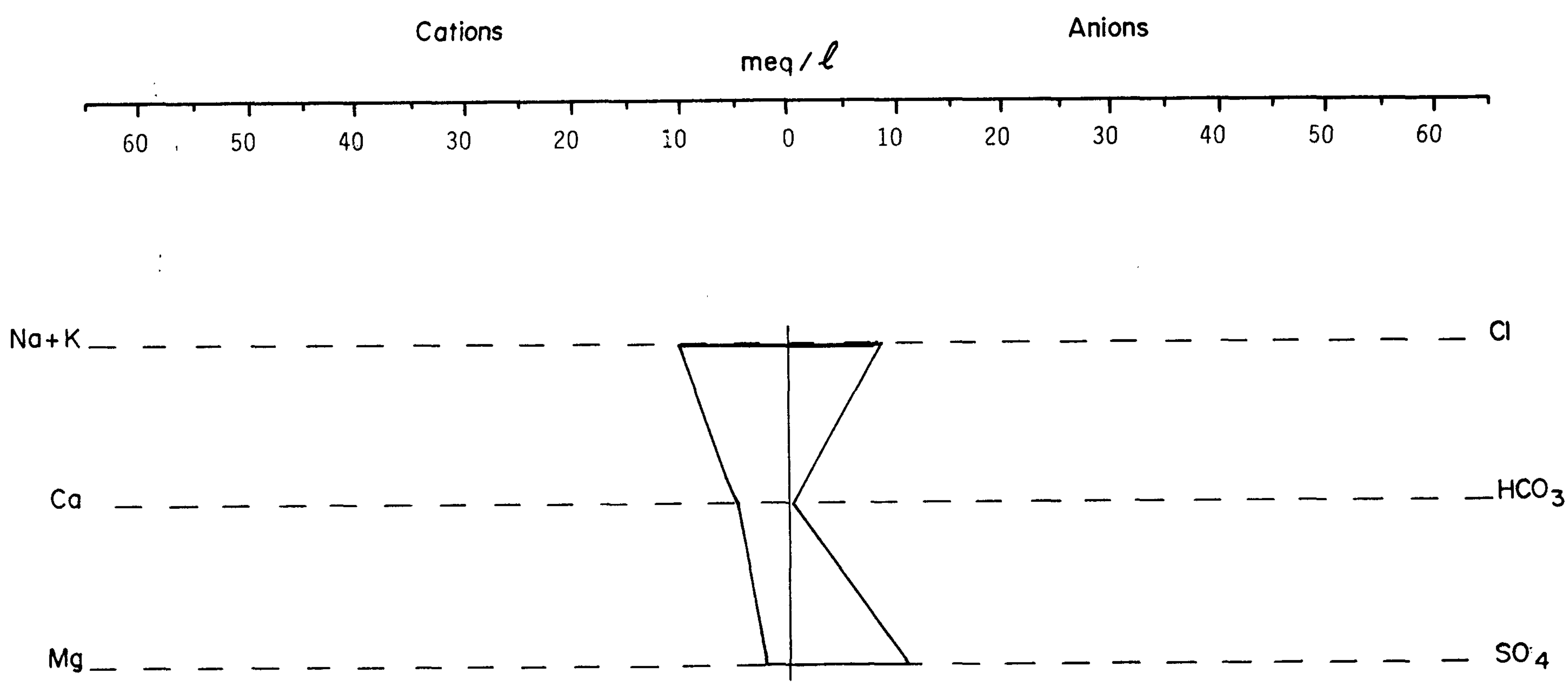
RAW WATER



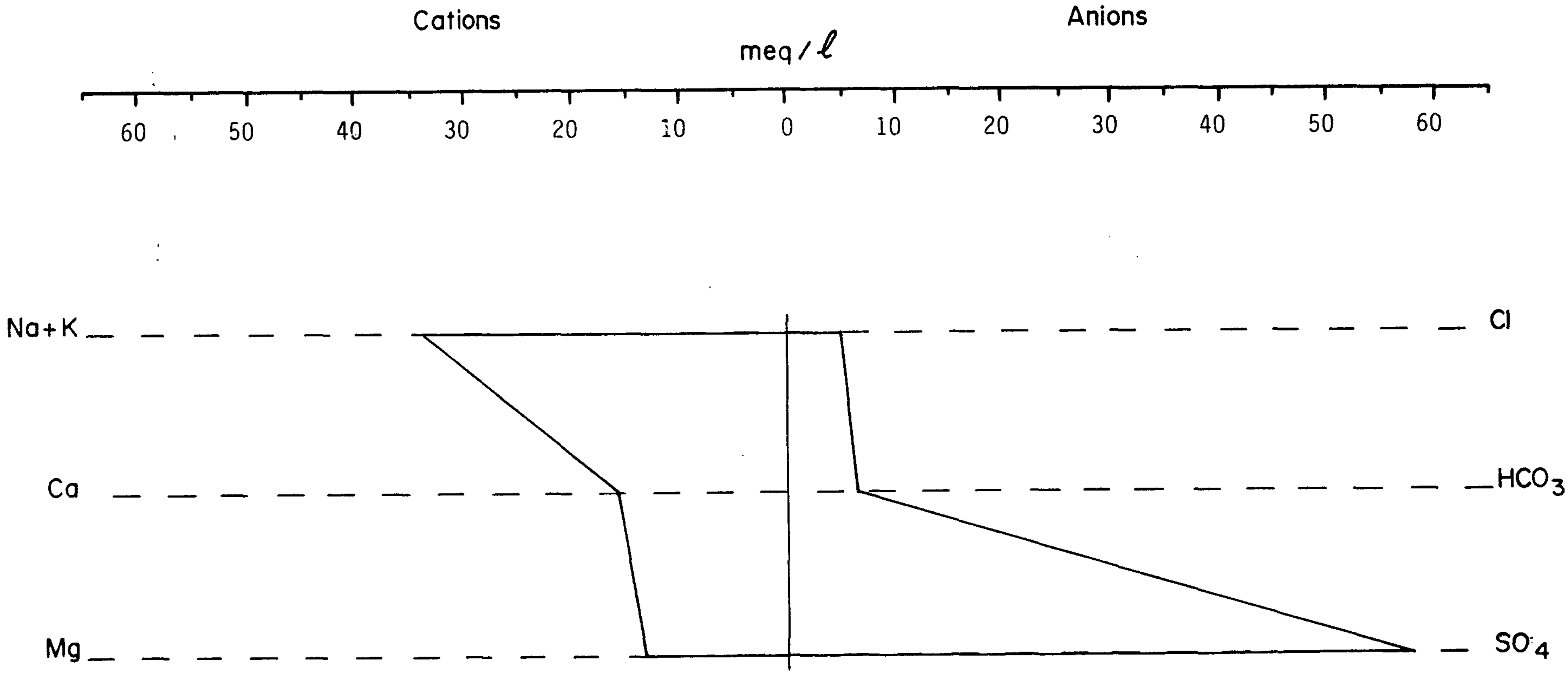
KENNEDY
7/2/87



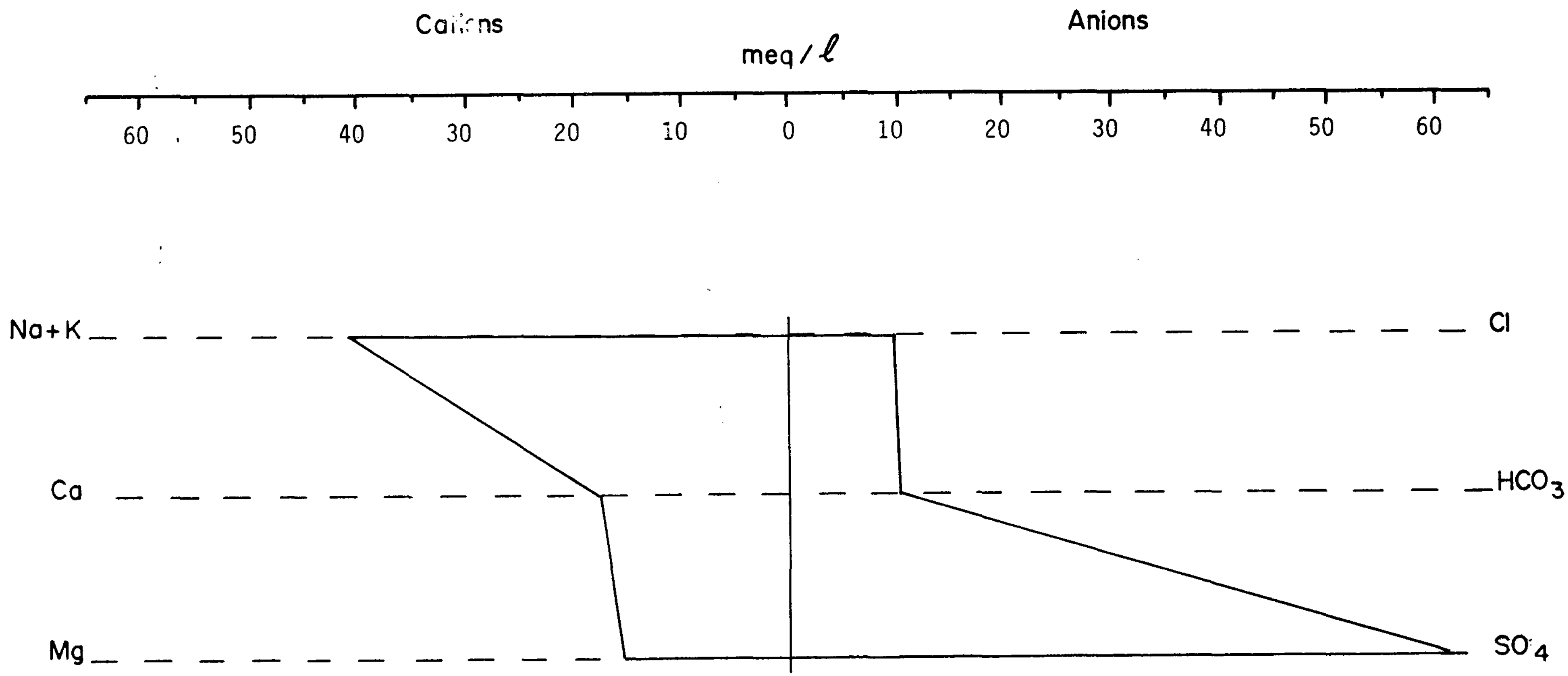
WASTEWATER, PHASE II W/O REG. UNITS.



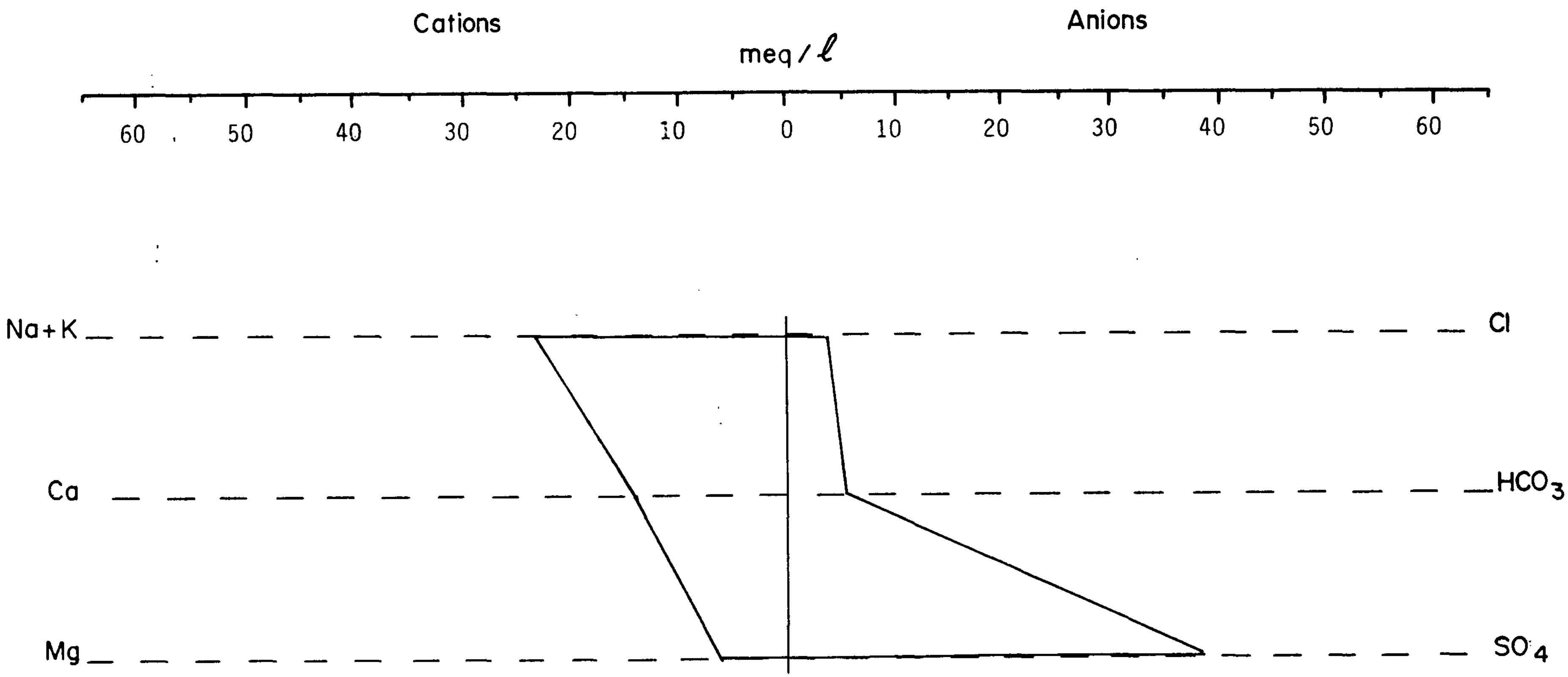
MONITORING WELL #1
10/9/87



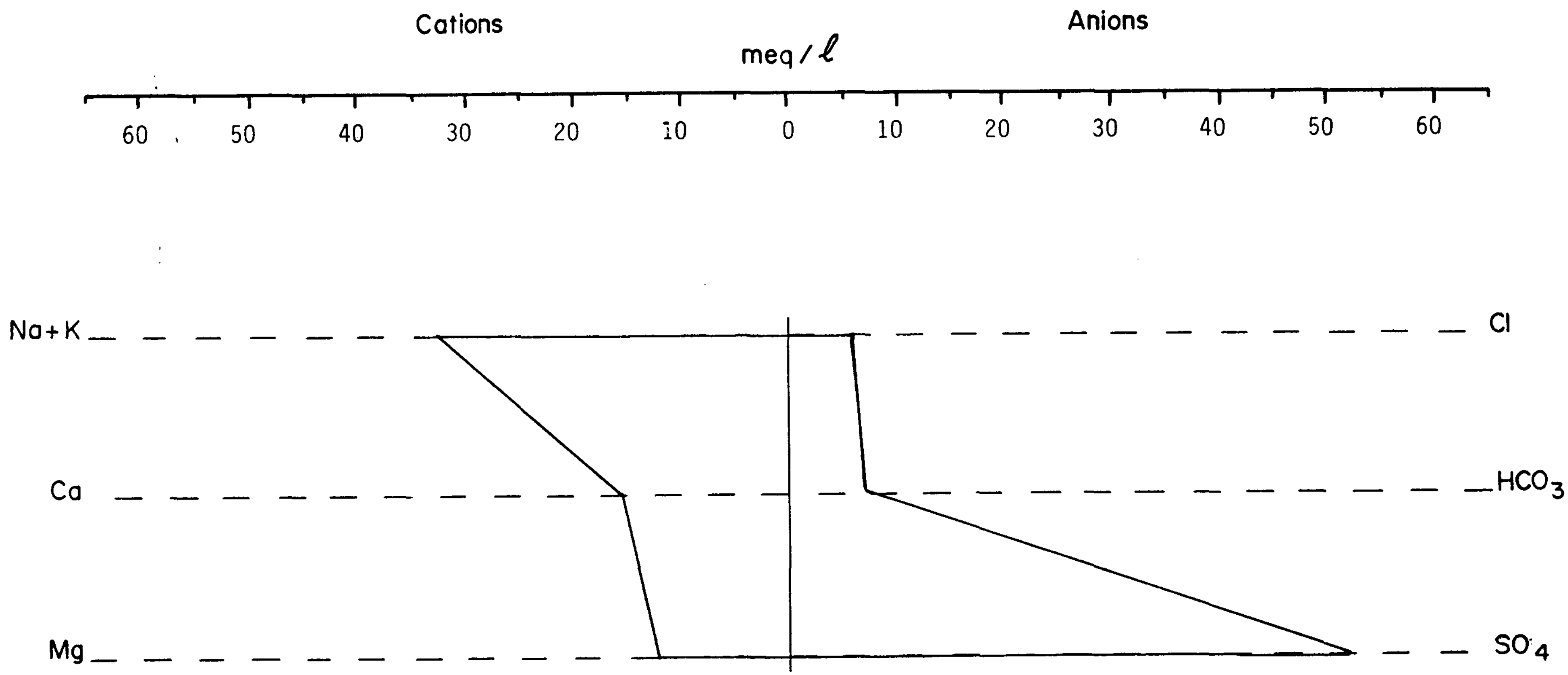
MONITORING WELL #2
10/9/87



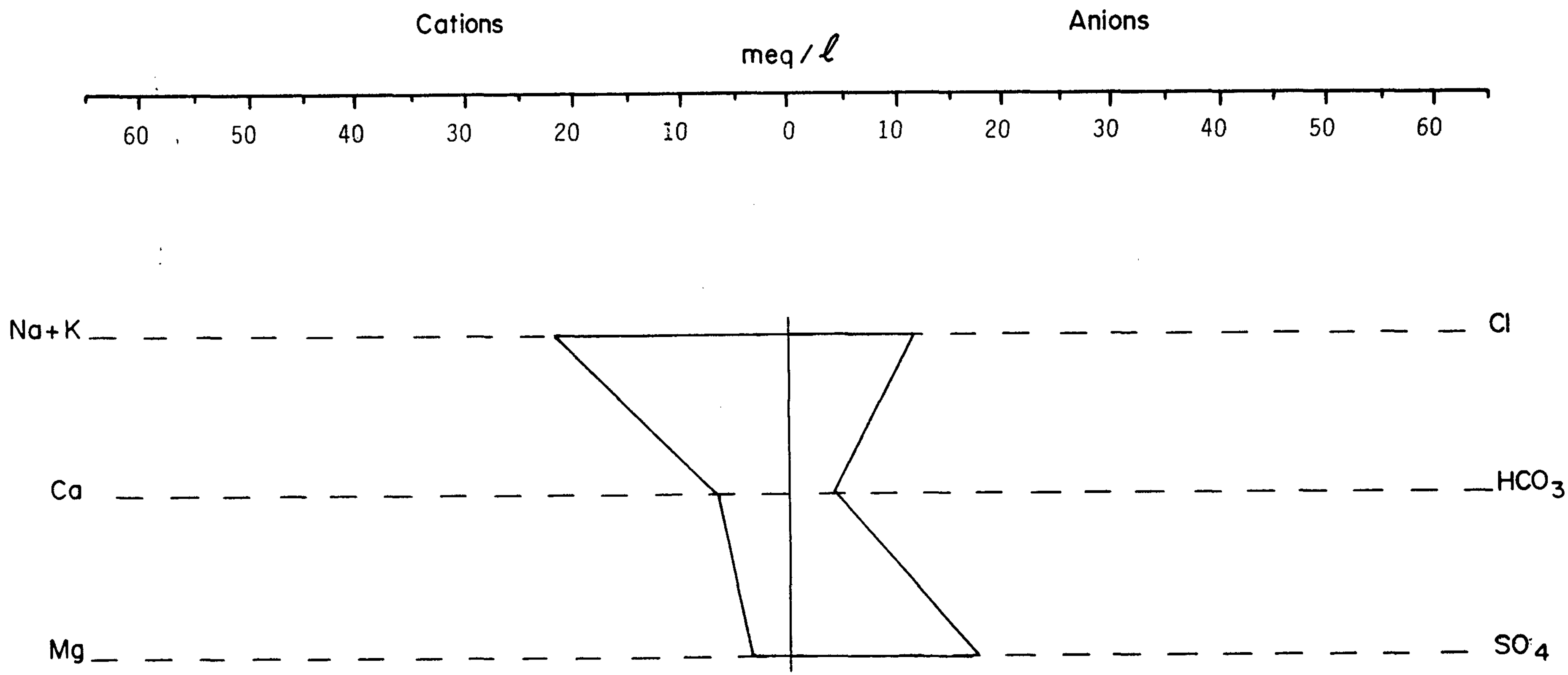
MONITORING WELL # 3
10/9/87



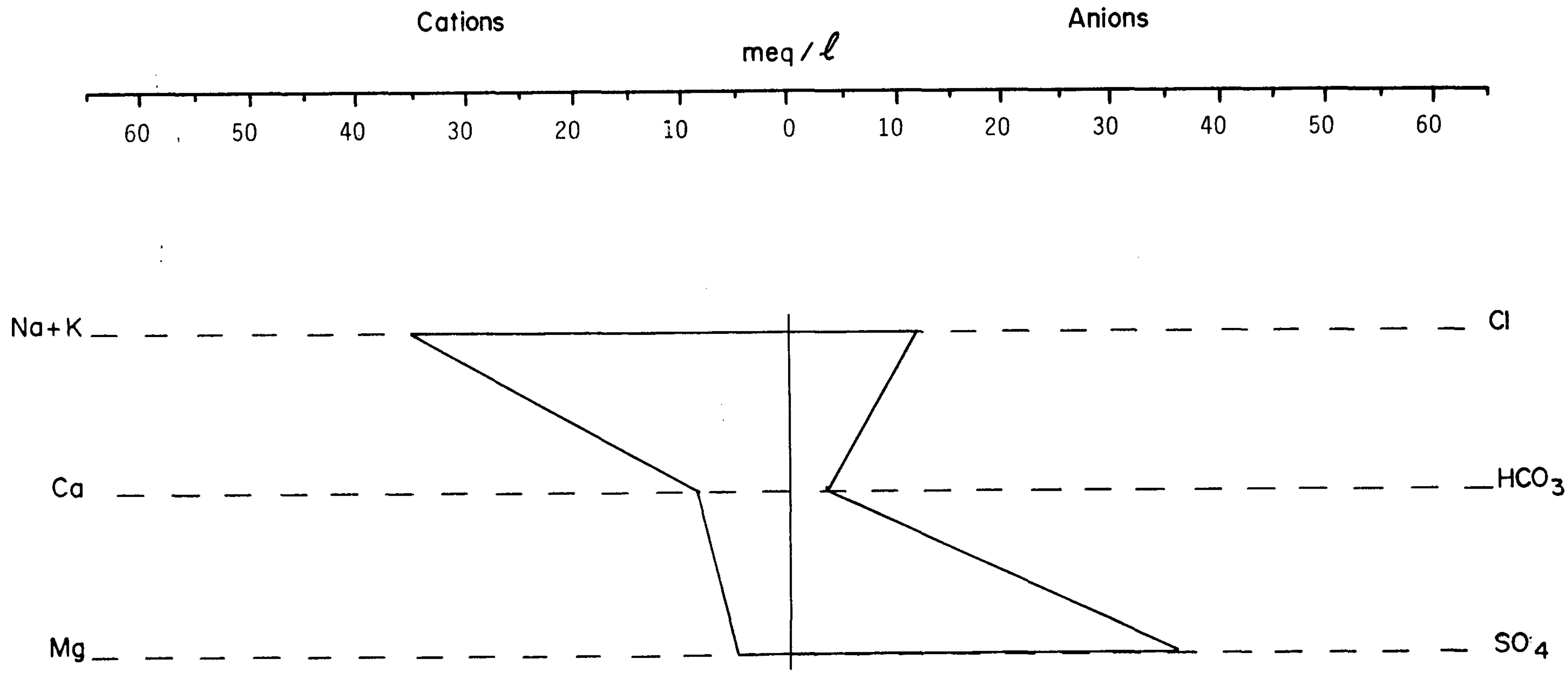
MONITORING WELL AVG.
10/9/87



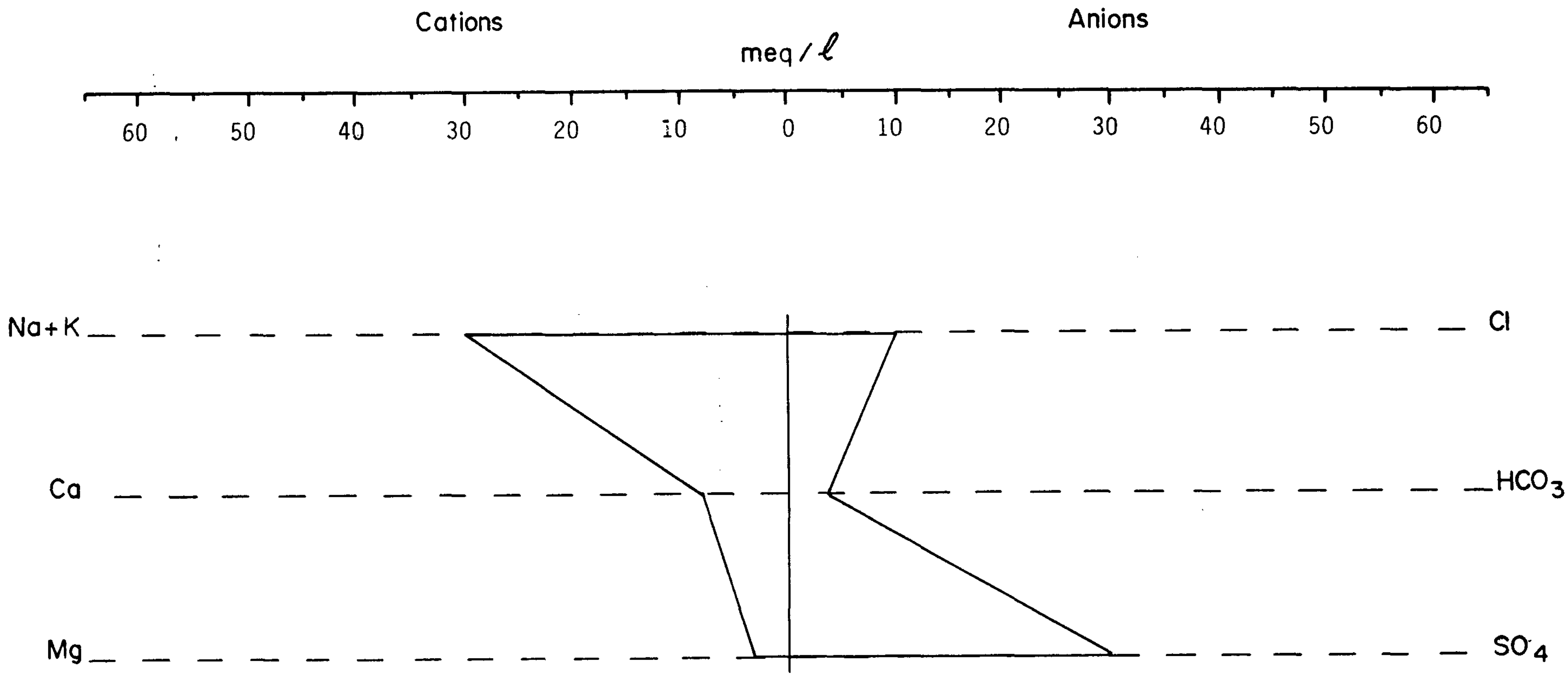
HANSEN WELL
7/2/87



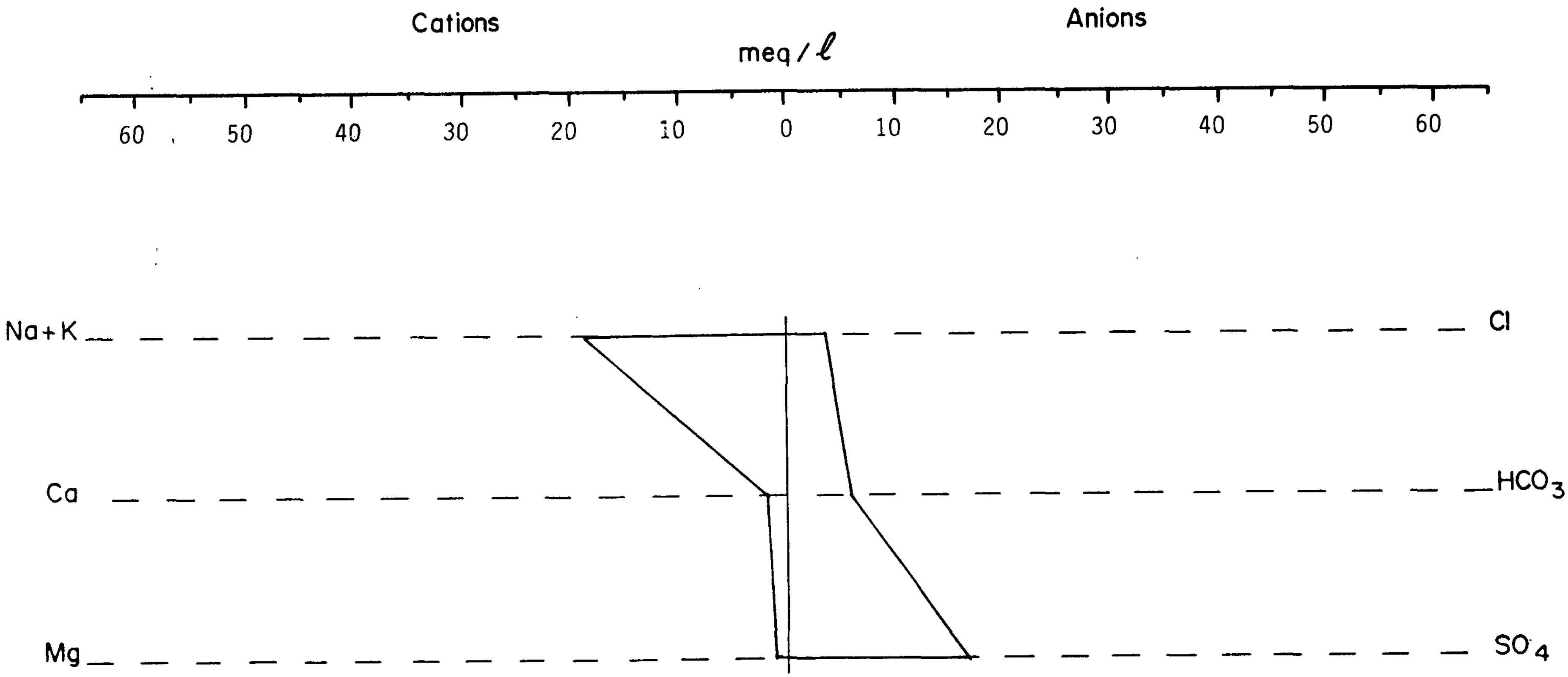
ISHAM WELL
7/2/87



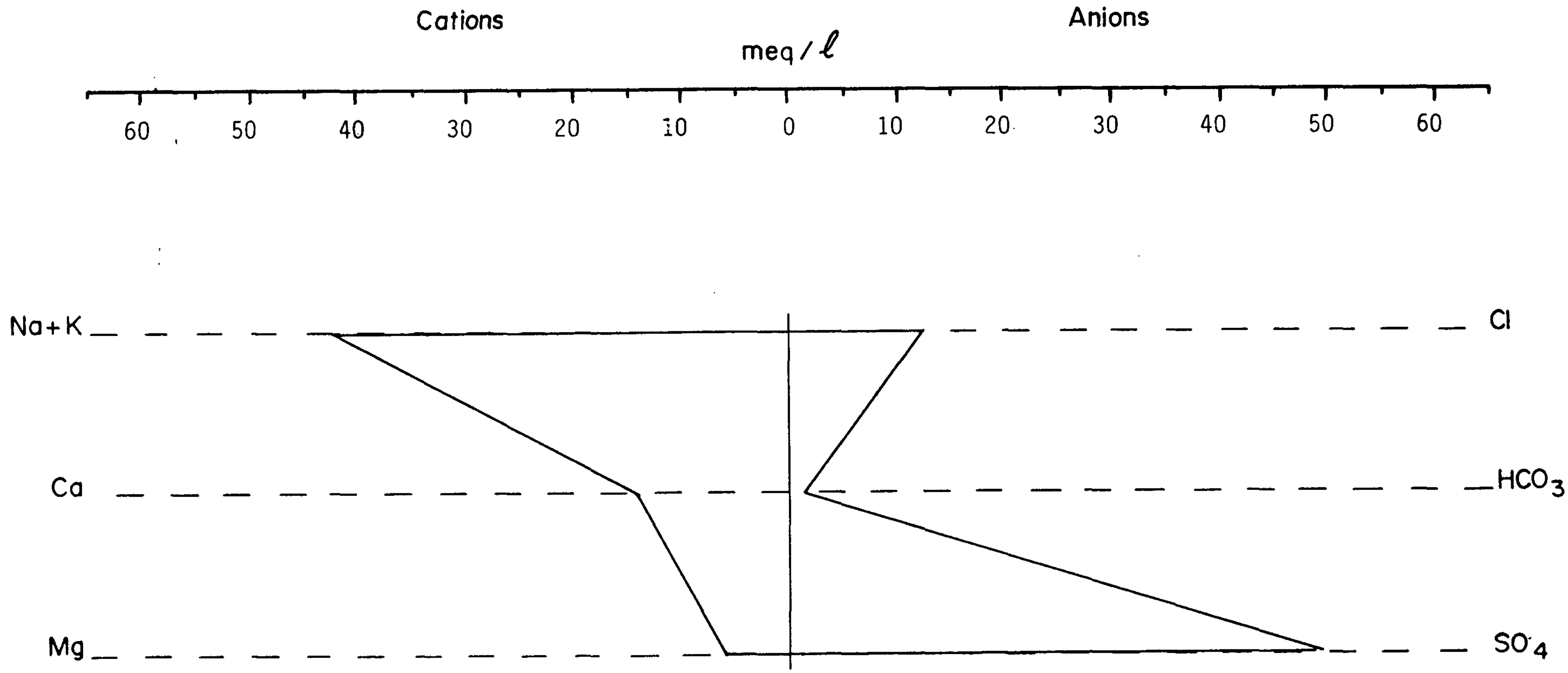
LOCAL WELL AVG.
7/2/87



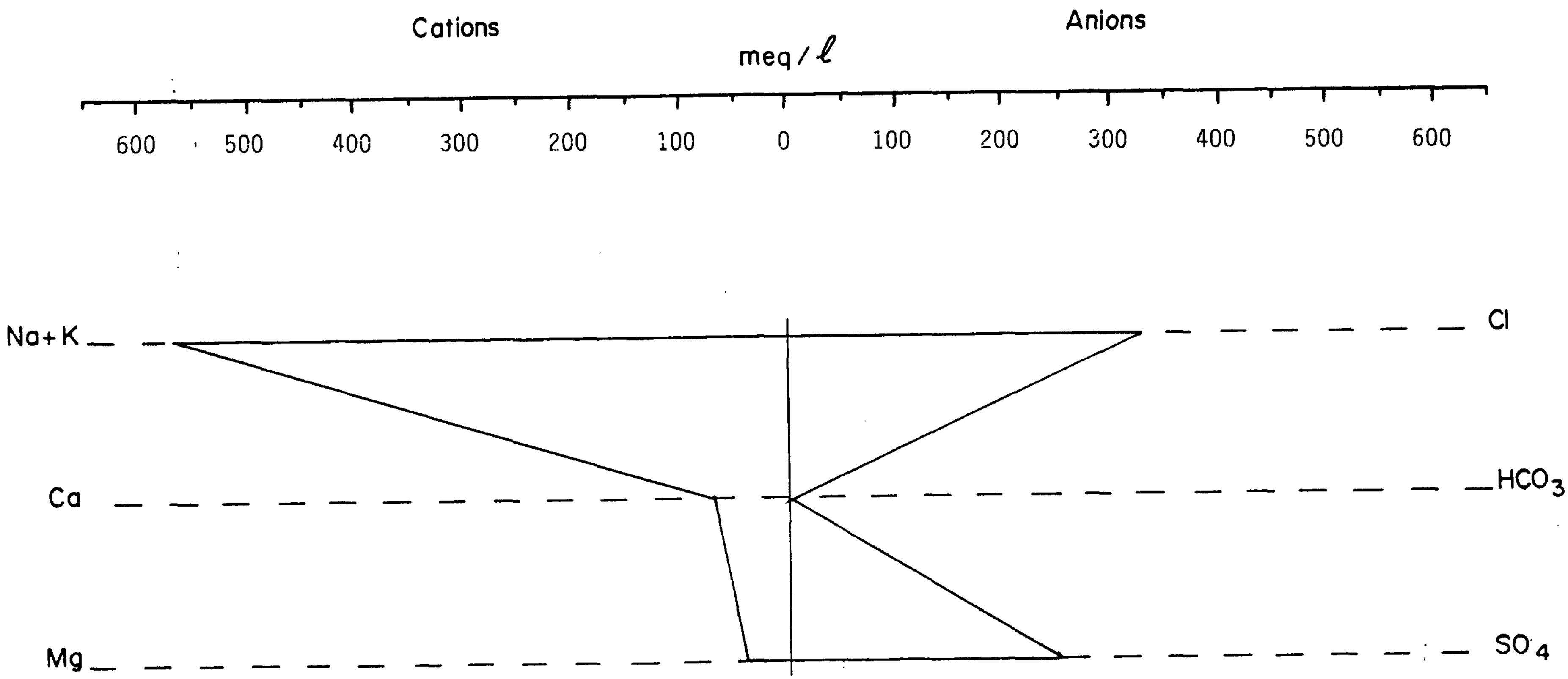
LESTER WELL
7/2/87



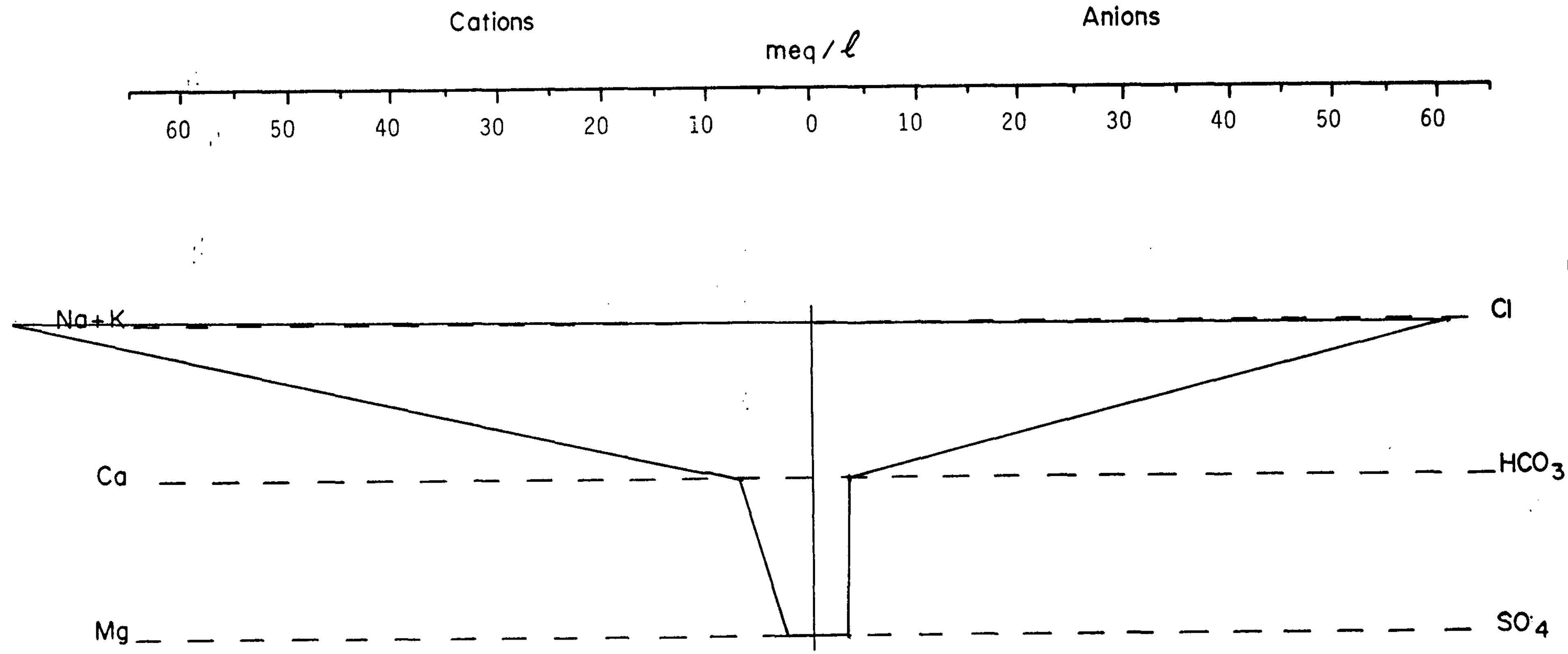
DAILEY WELL
7/2/87



WASTEWATER POND #3
11/4/85



WASTEWATER POND #2
11/4/85



PHASE 2 EL PASO NATURAL GAS GROUNDWATER/GEOCHEMICAL MODELING

The following is a list of models, model input requirements, and model output used during Phase 2:

WATEQF-This is a computerized model (FORTRAN) that, given a complete chemical analysis of a water sample, computes solute activities, predicts the equilibrium distribution of aqueous species, and describes the sample's saturation with respect to a suite of minerals.

Input requirements:

1. Temperature
2. pH
3. Calcium concentration
4. Magnesium concentration
5. Sodium concentration
6. Potassium concentration
7. Chloride concentration
8. Sulfate concentration
9. Bicarbonate concentration

Model output:

1. Ionic strength
2. Activity coefficients
3. Ratios of selected cations and anions
4. Saturation indices with respect to a number of minerals
5. Partial pressure of carbon dioxide and oxygen
6. Total dissolved solids

SUMATRA-1 This is a computerized model (FORTRAN) for simulating simultaneous water and solute transfer in a one-dimensional (vertical), saturated-unsaturated, and non-homogeneous soil profile.

Input requirements:

1. Boundary conditions with respect to solute concentration and moisture content or presuure head
2. Initial conditions with respect to solute concentration and moisture content or pressure head
3. Residual moisture content of each soil in the profile
4. Saturation moisture content of each soil in the profile
5. Saturated hydraulic conductivity of each soil type in the profile
6. Specific storage of each soil type in the profile
7. Bulk density of each soil type in the profile
8. Diffusion coefficient of each soil type in the profile
9. Dispersivity of each soil type in the profile
10. Distribution coefficient of each soil type in the profile
11. Zero-order liquid phase decay constant
12. First-order liquid phase decay constant
13. First-order solid phase decay constant

14. Soil column thickness
15. Simulation time

Model output:

1. Echo of input data
2. Characteristic curves (moisture content and hydraulic conductivity) for each soil type in the profile
3. Vertical distribution of pressure head, moisture content, and solute concentration for a specified period of time
4. Total moisture in soil column
5. Total solute mass in solution

W		gals/mol
.04	C_1	6.4
.07	C_2	10.12
.10	C_3	10.42
.12	iC_4	12.38
.12	nC_4	11.93
.15	iC_5	13.85
.15	nC_5	13.71
.18	iC_6	15.50
.18	C_6	15.57
.21	iC_7	17.2
.21	C_7	17.46
.23	C_8	19.39
.05	$C_2^=$	9.64
.08	$C_3^=$	9.67

MISC.

		gals/mol
0	O_2	3.37
1	CO	4.19
1	CO_2	6.38
6	SO_2	5.50
8	H_2S	5.17
1	N_2	4.16
2	H_2	3.38

TEL. CONFERENCE WITH NMOCD (D. Boyer)
K.F. Beasley and H. Van

Phase II Land Application Study

P. 42 Irrigation Schedule

- If we are to irrigate the entire area we should evaluate the leaching requirements
- The model maybe the wrong model for what we wanted to do. Can not evaluate the flux just the conc. of salts at a definite depth. But Boyer is not bothered if we use higher TDS conc. The use of the Model is ~~[illegible]~~ in appropriate. (P.83 →)
- Water balance looks good
- Specify crops to grow

SAMPLING

- Define the time schedule for the composite samples. Boyer wants to specify whether the samples will be 3 samples over an 8Hr span.

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 2 of
Date: 12/4/87
By: H. Van
File: San Juan PH.

Tel. Conference w/ Bzyan & Staff
Land Application Study

V		gals/mol
.04	C_1	6.4
.07	C_2	10.12
.10	C_3	10.42
.12	iC_4	12.38
.12	nC_4	11.93
15	iC_5	13.85
15	nC_5	13.71
18	iC_6	15.50
18	C_6	15.57
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21	C_7	17.46
23	C_8	19.39
05	$C_2^=$	9.64
08	$C_3^=$	9.67

MISC.

	gals/mol
O_2	3.37
CO	4.19
CO_2	6.38
SO_2	5.50
H_2S	5.17
N_2	4.16
H_2	3.38

- Parameters: add in
  - NO_3 2ml H_2SO_4 (Conc.) P.88
  - TKN also
  - all Nitrite Species.
- Do not let the outflow flow for 10 min. just for 2 min or until the EC or pH are constant.
- P.89 Add HCO_3 H_2CO_3
- Do annual sampling in the last quarter of the year say Nov. P.89
- No Metal Sampling
- Wash Bailer w/ Lab soap and wash w/ distilled H_2O P.90

P.96 Do the
- Soil coring after the active growing season

P.101 Need Sampling Dates preferably after the growing season.

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 3 of
Date: 12/4/87
By: H. Van
File: S.J. Plant

V		gals/mol
.04	C_1	6.4
.07	C_2	10.12
.10	C_3	10.42
.12	iC_4	12.38
.12	nC_4	11.93
.15	iC_5	13.85
.15	nC_5	13.71
.18	iC_6	15.50
.18	C_6	15.57
.21	iC_7	17.2
.21	C_7	17.46
.23	C_8	19.39
.05	$C_2^=$	9.64
.08	$C_3^=$	9.67

MISC.

		gals/mol
)	O_2	3.37
1	CO	4.19
1	CO_2	6.38
5	SO_2	5.50
3	H_2S	5.17
1	N_2	4.16
2	H_2	3.38

Tel. Conference w/ Bayer (Brasley & Van)
Land Application

- Need in the disch plan a contingency plan in case something begins to happen. Need right now additional sampling to establish better data and get a feel for the variability of the G.W. quality.

  Gen. Statement that if changes occur we will do additional sampling.

- Sid to prepare the Diagrams he mentioned in our meeting.
- We should evaluate operating conditions every disch. plan renewal
- If given a schedule for closure we can be given additional time to prepare a closure plan.
- He needs to check to see if we are to include the Seep Pond.
- Bayer concerned that the leased ponds do not leach salts as a result of rain. We will get together

Form 7-T(Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 1 of ____
Date:
By: H. Van
File: San Juan River P.H.

Tel. Conference w/ Boyer (Beasley & Van)
Land Application Study

to discuss the closure plan.

- We will put together an outline of the closure plan, meet w/ Boyer and discuss it. Then prepare the draft closure plan.

V		gals/mol
.04	C_1	6.4
.07	C_2	10.12
.10	C_3	10.42
.12	iC_4	12.38
.12	nC_4	11.93
.15	iC_5	13.85
.15	nC_5	13.71
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.21	C_7	17.46
.23	C_8	19.39
.05	$C_2^=$	9.64
.08	$C_3^=$	9.67

MISC.

		gals/mol
)	O_2	3.37
1	CO	4.19
1	CO_2	6.38
5	SO_2	5.50
3	H_2S	5.17
:	N_2	4.16
2	H_2	3.38

N		gals/mol
.04	C_1	6.4
.07	C_2	10.12
.10	C_3	10.42
.12	iC_4	12.38
.12	nC_4	11.93
.15	iC_5	13.85
.15	nC_5	13.71
.18	iC_6	15.50
.18	C_6	15.57
.21	iC_7	17.2
.21	C_7	17.46
.23	C_8	19.39
.05	$C_2^=$	9.64
.08	$C_3^=$	9.67

MISC.

		gals/mol
0	O_2	3.37
1	CO	4.19
1	CO_2	6.38
5	SO_2	5.50
3	H_2S	5.17
1	N_2	4.16
2	H_2	3.38

MEETING WITH NMOCD TO DISCUSS THE PHASE II FINAL REPORT / SJRP LAND APPLICATION

Meeting in Santa Fe

- The Phase II is an excellent report
- Basic Comments by D. Boyer
  - Is the H_2O quality of the wells in the divide match that of the existing ponds?
  - Would like to compare the two waters to see if they are impacting the groundwater south of the evaporation ponds. This may be additional information to be used in the operation of the land application system.
  - Question on Fig. 3-2
    How the gray shale was found when drilling MW1.
  - Question on the Model (Fig. 6-1)
    Are the considerations conservative regarding Stratum 1 & Stratum 2. Maybe should have used sand rather than silt?
    The logs seem to show sands to be predominantly sands.
  - OCD agrees with the simplification ~~of~~ the two strata approach but maybe if

Phase II Final Report
Meeting in Santa Fe

V		gals/mol
.04	C_1	6.4
.07	C_2	10.12
.10	C_3	10.42
.12	iC_4	12.38
.12	nC_4	11.93
.15	iC_5	13.85
.15	nC_5	13.71
18	iC_6	15.50
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05	$C_2^=$	9.64
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MISC.

		gals/mol
)	O_2	3.37
1	CO	4.19
1	CO_2	6.38
5	SO_2	5.50
3	H_2S	5.17
1	N_2	4.16
?	H_2	3.38

we would have used a more conservative strata the model would have changed.

- No problem with eliminating the Phase III
- We can proceed with the land application
- How can EPNG proceed?
  - First, Boyer wanted to know about the EPNG proposed monitoring program.
  - Sid Johnson provided a brief summary of the soil-pore-water monitoring.
  - Boyer wanted to look at this system in more detail to decide whether we need this type of monitoring or is adequate.
  - Groundwater monitoring was explained by Sid. Boyer thought that the monitoring program is adequate.
  - Will EPNG use the Golf Course? EPNG has not decided yet the use

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 3 of
Date: 12/2/87
By: H. Van
File: 5202 W/W

PHASE II FINAL REPORT
Meeting in Santa Fe

V		gals/mol
.04	C_1	6.4
.07	C_2	10.1:
.10	C_3	10.4:
.12	iC_4	12.38
.12	nC_4	11.93
15	iC_5	13.85
15	nC_5	13.71
18	iC_6	15.50
18	C_6	15.57
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MISC.

	gals/mol
O_2	3.37
CO	4.19
CO_2	6.38
SO_2	5.50
H_2S	5.17
N_2	4.16
H_2	3.38

of the Golf Course.

- Boyer needs to look at the monitoring program before deciding how EPNG should proceed.
- We need closure of existing evap. ponds.
- Contingency plans are needed.
- Dec. 4, 1987 Tel. conference between Boyer/Beasley/Van.
- Reference Phase I & II Reports and as a separate report the ~~decision~~ on monitoring of w/w ~~[illegible]~~ and gw, and the post closure plan.

El Paso
Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

November 20, 1987

Mr. David G. Boyer
Hydrogeologist/Environmental Bureau Chief
Energy and Minerals Department
New Mexico Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87501-2088

Subject: San Juan River Plant Land Application Study
Phase II Report

Dear David:

Enclosed for your review are three copies of the San Juan River Plant Land Application Study Phase II Report. Confirming Henry Van's conversation with you, Sid Johnson of K.W. Brown and Associates, Henry Van, and I are expecting to meet with you on December 2, 1987 at 10 A.M. to discuss the report. Feel free to call me or Henry in the interim if you have any questions.

Sincerely yours,

Kenneth E. Beasley III
Compliance Engineer

KEB:cam

Enclosures

KWB&A
ENVIRONMENTAL CONSULTANTS

October 13, 1987

David Boyer
Hydrogeologist
New Mexico Oil
Conservation Department
P.O. Box 2088
Santa Fe, NM 87501

Dear Dave:

Hopefully, Ken Beasley has forwarded the corrections to the Phase I report to you by this time. I intended to send them to you directly but the copies inadvertently ended up with Ken's copies.

The Phase II report is proceeding, however, it appears that my original estimated time for completion was overly optimistic. Due to changes in the wastewater treatment process at the San Juan Facility, we have had to make several corrections to our original information. All of the changes will be clearly stated in the upcoming report.

During our recent meeting in Santa Fe I stated that I would send you a copy of the the Surface Impoundment Cost Model (SICM). You will find a copy of the report as well as a computer copy of the program. The program is a Lotus spreadsheet which allows you to define site specific parameters in order to estimate the cost of constructing a surface impoundment based on average industry costs.

If you have any questions concerning the model or if I can provide you with additional information, please feel free to call me at (409) 690-9280.

Respectfully,

Sid

Sidney H. Johnson
Staff Scientist

SHJ:ljc
Enclosure

K.W. BROWN & ASSOCIATES, INC. • 6 GRAHAM ROAD • COLLEGE STATION, TEXAS 77840 • (409) 690-9280

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

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OCT 02 1987
AIR QUALITY BUREAU

September 24, 1987

Mr. David Boyer
Hydrogeologist
Energy and Minerals Dept.
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87501-2088

not Air Quality

Re: Discharge Plan for El Paso Natural Gas Co. -
San Juan River Plant, GW-33

Dear Mr. Boyer:

This is to confirm the submittal of the Land Application Feasibility Study Phase I final report to Ms. Jamie Bailey while we were in Farmington on September 1, 1987.

We have proceeded to conduct Phase II, detailed hydrogeologic study, based on the information obtained during Phase I. This information indicates that land application of wastewater is a viable option. Phase II will allow us to conduct predictive modeling to forecast the short and long-term impacts on the groundwater beneath the plant site.

We will keep you informed about the progress of Phase II activities. If you have questions, please contact me or K. E. Beasley at 915/541-2832 and 505/325-2841 Ext. 2175, respectively.

Very truly yours,

Henry Van, Ph.D.
Sr. Environmental Engineer
Environmental and Safety
Affairs Department

RECEIVED
OCT 07 1987
GROUND WATER HAZARDOUS WASTE BUREAU

ka

cc: K. E. Beasley

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OCT - 9 1987
OIL CONSERVATION DIVISION
SANTA FE

 — EPNG Land Application Study — 9/6/87
NMOCD Meeting on Phase I

DISCUSSION OF NMOCD's COMMENTS

- Pointed corrections in Table 2-2 in the original Table 2-2.
- Discussed revised Table 2-2 due to elimination of the Softener Reg. and CCD alk. from the land application system.
- One permeability was performed at the east site due to one soil series (#8).
- Discussed soil amendments to prevent wind erosion.
- * Need to ask William of KWB about his permeability curves.
- * Ask about the use of surface water for leaching - is it beneficial use, we could make a case that the use of nonsodic water is for vegetation benefit. {State Engineer's Office}
- Would there be a need for modifying the surface of the east site? K.W. Brown does not

anticipate that re-surfacing will be needed.

- OCD may require berming for 100-yr. flood storm instead of the 25-yr. as KWB has used.

- Winter Operation
  - Anticipate winter storage
  - This is based on the ability to evaporate and not vegetation growth
  - How the w/w application would be manage during very wet periods.
    - KWBrown will take into consideration the flexibility.

- Fig. 8-2 the DK soil is missing

- What species on the east site are concentrators of chemical species

- EPNG Land Application Study - 9/16/87
NMOCD Meeting on Phase I

- OCD suggested the use of Atriplex because of its high evapotranspiration rate.

- OCD agree on the Phase I report recommendation.

- Deep Well injection - Class II well nearby.

- Need to check Table 10.2 and the figures.

Presentation of Phase II
Proposed Report Outline.

- Computer Modeling
  - examples presented
  - need to document the model and explain the model.
  - purpose of modeling
    - forecast movement of moisture & salts.

- Discussion on the status of Phase II Drilling Program.

- EPNG Land Application Study -
NMOCD Meeting of Phase I

9/16/87

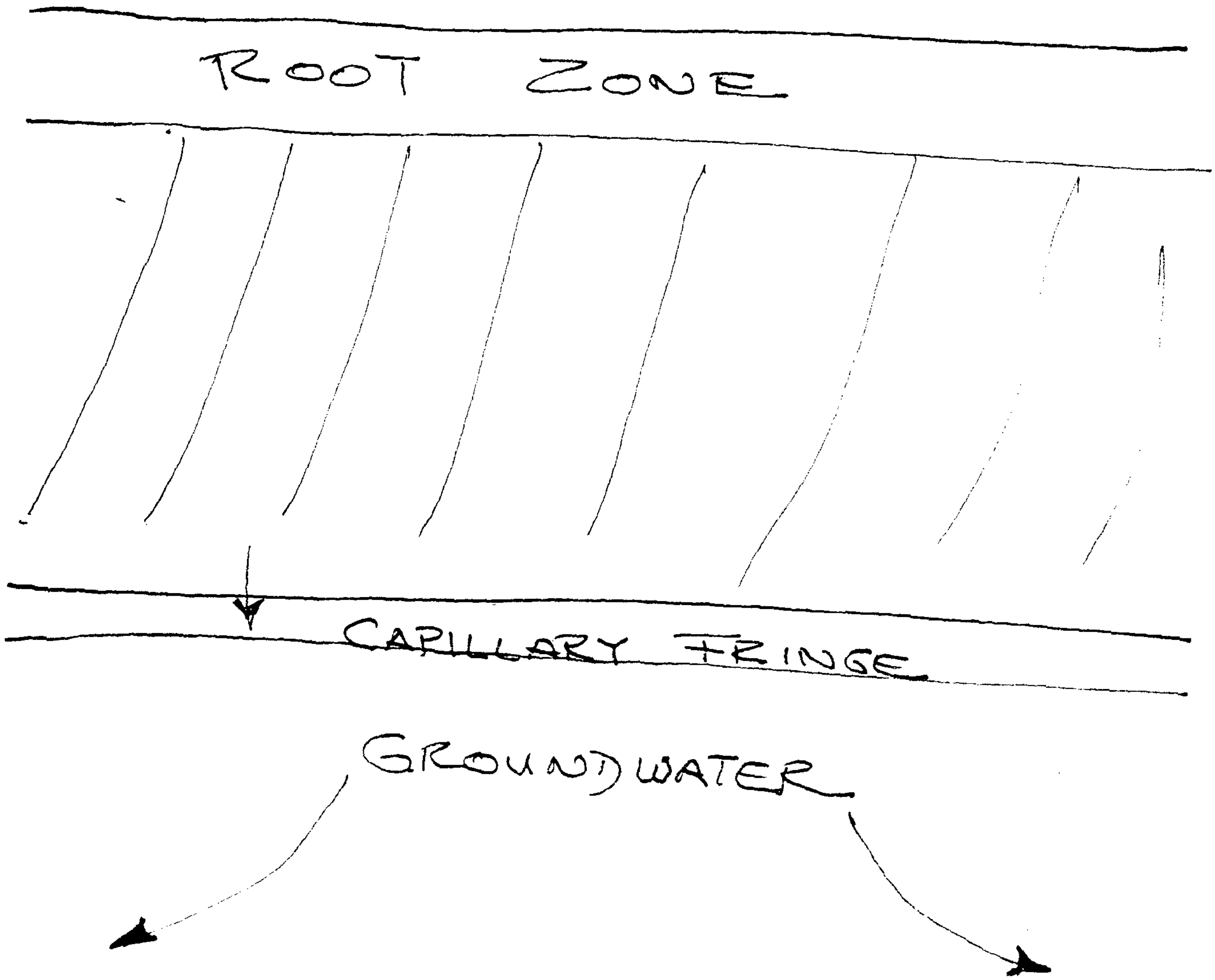
- Show cross-section of the monitoring wells, borings and piezometers in Phase II report.
- OCD encourages to find out the effects of the ~~[illegible]~~ ponds on the
- Future Monitoring During the Operation?

Background
- – natural salts in the soil
  – what tools will we use for monitoring that the land application system is working as designed?
    - Vadose zone monitoring
    - Groundwater

- What will happen to the natural salts due to wastewater application.

Mountain Taylor Desch-Plans
Bruce Galagar. 2399

- Gulf Mineral Resources had done this type of work. Holding capacity of the vadose zone.



- Some monitoring would probably be needed regardless because the zone is not completely homogenous.
- Calculate the amount of moisture that

the vadose zone will take.

* • Can the quality of the w/w be use in the Golf Course? Even if some blending with river water is done. Perhaps with some equalization basin.

Individuals Present

- David Boyer – NMOCD
- Jamie Baily – NMOCD
- K.E. Beasley – EPNG
- H. Van – EPNG.
- S. Johnson – K.W. Brown

Page 1
:.E. Beasley
:.Van

9/16/87

STATUS OF DISCH. PLAN
EPNG
SAN JUAN RIVER PLANT

- Discussion of Modification of the contact wastewater pond.
  - The pond will be enlarged due to the addition of three wastewater streams.
    1. Pigging Liquids
    2. CCD Regeneration
    3. Water Softener
- There is a possibility that the size could be reduced due to some possible process changes.
- A Notice (Public) will be published.

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

December 30, 1986

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501-2088
(505) 827-5800

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Kenneth E. Beasley III
El Paso Natural Gas Company
P. O. Box 4990
Farmington, New Mexico 87499

Re: Proposed Scope of Work, Land Application Feasibility Study - San Juan River Plant, GW-33

Dear Mr. Beasley:

Following the December 8 meeting between the OCD and EPNG on the proposed scope of work referenced above, we have the following comments and suggestions:

A. General Background

1. On page 3, #8 you state "The final result should provide an estimate on the lifetime of the system before NMWQCC ground water standards are exceeded." This section should be reworded to indicate that standards will not be exceeded at a place of present or reasonably foreseeable future use. Suggested wording is shown on the attached sheet.

B. Scope of Work

1. The soil water transmission characteristics (#2, p. 4), and the vertical infiltration rate should be quantified in a later study phase. Some suggested language is attached.

2. Phase I work should indicate the groundwater quality of already existing wells. The OCD will assist EPNG in obtaining samples from private water wells in the area. Some suggested language is attached.

3. Phase III should investigate the types of possible monitoring (ground water and vadose zone) that may need to be considered as part

of the waste management plan. Again, some specific suggested wording is provided.

4. At some point in the study, EPNG might want to look at the economics (capital investment plus O & M costs)of this proposal versus other alternatives (eg. lined pond with sprayers; partial evaporation - partial land application, etc.). A final phase (which would result in the discharge plan application) would be the final design for the land application project and should include proposed operations, maintenance, and a monitoring system schedule.

During the period of EPNG's approval to discharge non-contact waste water without an approved discharge plan at the San Juan River Plant, EPNG has committed to operate a pumpback system from the so-called "seep" pond to Pond #1. The OCD Environmental Engineer and other staff have evaluated the proposed conceptual design for the system and the installation schedule proposed in your December 5, 1986, letter and approve the proposal. Based on your timetable, the project should be completed on or about May 1, 1987. Please notify us when the system is placed in operation, and provide as-built completion information.

The engineering and other responses provided in the December 5 letter are acceptable. As stated at the December 8 meeting, I am not sure what further investigation of the hydrocarbon contamination in wells P-7 and P-10 would accomplish. EPNG has taken reasonable steps to locate the source (including pipeline excavation, replacement and hydrostratic testing). Since the contamination is localized, and in a high TDS seepage area that will be captured by the temporary pumpback system, no further investigative, or remedial, action is being required by OCD at this time. If additional pertinent information becomes available, investigation may need to be resumed.

The OCD requests that EPNG plan to meet with us in mid-March 1987 to discuss and review progress on the scope of work.

Please provide a proposed meeting date by late February. In the meantime if you have any questions, please contact me at the above address, or by phone at 827-5812.

Sincerely,

DAVID G. BOYER
Hydrogeolgist
Environmental Bureau

encl.

cc: Frank Chavez - Aztec
John Craig, EPNG - Farmington
Henry Van, EPNG - El Paso

SUGGESTED OCD CHANGES TO EPNG
SAN JUAN RIVER PLANT SCOPE OF WORK

A. Suggested change to A.8:

If a laboratory experimental demonstration is required, prepare an experimental design to evaluate the most feasible scenarios. The experimental design should address any potential pathways for the discharged constituents and should quantitavely define them. The experimental work should provide appropriate waste loading rates and preliminary information concerning frequency and type of waste application to guarantee the ability of the soil and biota to assimilate constituents. Also, the experimental work should provide information on operational features. The program should comply with pertinent environmental NMOCD regulations. The final results should provide an estimate on the lifetime of the system. ~~before NMWQCC groundwater standards are exceeded.~~ NMWQCC regulations require that ground water standards not be exceeded at a place of present or reasonably foreseeable future use.

B. Phase I, suggested change to #2, paragraph 2:

Evaluation of the water transmission characteristics based on the hydrological classification of the soil series. Actual determination of vertical infiltration rates will occur in other study phases.

Suggested addition to Phase I, new #4:

4. Available information on existing water well locations and use in the nearby area shall be compiled. Information shall include depth, water level and aquifer completion. Water quality data of a type relevant to potential land application imports shall be collected. The OCD has agreed to assist EPNG or the contractor in obtaining water quality information.

Renumber work elements 4 through 6, as 5 through 7.

B. Phase III. Suggested change:

If Phases I and II show that land application may be feasible, an experimental design should be prepared to assess the most feasible scenarios evaluated under Phase II. The experimental design should include site test plats for vegetation likely to be used and laboratory breakthrough columns (undisturbed). This study will be used to establish (a) the feasibility of land application, (b) appropriate waste loading rates, (c) frequency of waste application, (d) type of waste application, (e) criteria for management of the soil and site to guarantee the ability of the soil to assimilate constituents, (f) types of possible monitoring (including ground water and vadose zone) to detect any failure of the system, (g) life of the land application site and (h) definition of the impletion of a final design.

Table 1. Suggested addition:

Sampling for nitrite-nitrogen, ammonia-nitrogen and total Kjeldahl-nitrogen is requested since nitrogen will not be present in nitrate form in an oxygen deficient ground water (eg. P-12 at San Juan River Plant has 0.04 mg/l NO_3 but 449 mg/l ammonia and 1400 mg/l TKN).

H. Van & Beasley

EL PASO NATURAL GAS
SAN JUAN RIVER PLANT
FEASIBILITY STUDY OF LAND APPLICATION

Dec. 8, 86

- Do not spent money on the benzene until OCD notifies the need
- Meeting next week Testimony before Congressional Committee on Lee Acres, Dec. 15, 86
- The economics of L.A. over the life of the plant should be assessed, perhaps in Phase I (O&M). Monitoring will be an important item of O&M. Preliminary economic assessment
- P. 3 #8 reasonably that standards will not be exceeded even at the end of 20 yrs.
- Phase I should indicate G.H_2O of existing wells. Perhaps doing it w/OCD as the public provides
- P. 6. Use Consultant
- Phase IV: should be the Final Design which should include O&M and Monitoring.

  Be careful in the selection of the monitoring methods.
- EPNG should meet with OCD to revise the schedule and determine the next mode of action in terms of time. This could be a progress report.
- OCD will send approval of the scope by the first of the year.

El Paso
Natural Gas Company

P O BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

January 22, 1987

K. W. Brown & Associates
Attention: Dr. Kirk W. Brown
6A Graham Road
College Station, Texas 77848

Re: Invitation to Bid: Land Application Feasibility Study - EPNG's San Juan River Plant

Gentlemen:

El Paso Natural Gas Company invites you to submit your lump sum proposal for a Land Application Feasibility Study for our San Juan River Plant near Farmington, New Mexico, as described in the Scope of Work attached.

Your bid is to be prepared in accordance with the specifications set forth in the Scope of Work attached. For each phase, you should include a brief description of your proposed work plan. A breakdown cost for each of the three phases and a total lump sum is requested. A cost breakdown sheet is attached for your bid. Any applicable taxes are to be included in your bid.

After receiving your proposal, the Company will review the prices and upon review and concurrence, will enter into a contract with the successful bidder, if any.

El Paso Natural Gas Company and the New Mexico Oil Conservation Division will review study results at the end of each phase and based on the results, a decision will be made to continue or terminate the project.

Effective January 1, 1987, El Paso Natural Gas Company has instituted a new safety policy requiring the use of protective clothing by its employees and Contractor employees working in our plant sites. A copy of this policy is enclosed for your use.

Your proposal must be mailed or delivered to ensure its being received by the undersigned no later than 2:30 p.m., local time, on **Wednesday, February 4, 1987.** Proposals not received by that time will not receive consideration.

Please clearly mark the envelopes: "Bid Proposal - Land Application Feasibility Study - San Juan River Plant".

Mail Proposals To: El Paso Natural Gas Company
Attention: Mr. Kenneth L. Steelhammer
Contracting/Materials Management Department
304 Texas Avenue
El Paso, Texas 79901

El Paso Natural Gas Company reserves the right to reject any or all bids.

If you have any questions concerning this Bid Proposal, please feel free to call the undersigned at (915) 541-2692. Questions concerning the "Scope of Work" should be addressed to Mr. Henry Van, Environmental Affairs Department at (915) 541-2832 in El Paso, Texas.

Yours very truly,

Kenneth L. Steelhammer
Specialist, Contracting

KLS:ff
Attachments

cc: Messrs.
K. E. Beasley (w/attachment)
J. C. Bridges (w/attachment)
J. F. George (w/attachment)
W. H. Healy, Jr. (w/attachment)
J. D. Jones
H. Reiquam (w/attachment)
J. W. Somerhalder (w/attachment)
H. Van (w/attachment)

File

S C O P E   O F   W O R K

LAND APPLICATION FEASIBILITY STUDY

FOR EL PASO NATURAL GAS COMPANY

SAN JUAN RIVER PLANT

FARMINGTON, NEW MEXICO

S C O P E   O F   W O R K

LAND APPLICATION FEASIBILITY STUDY

FOR EL PASO NATURAL GAS COMPANY

SAN JUAN RIVER PLANT

FARMINGTON, NEW MEXICO

A. General Background

The New Mexico Oil Conservation Division (OCD) is responsible for ensuring that Oil & Gas operations have no adverse environmental impacts on surface or ground water. OCD requested that El Paso Natural Gas Company (EPNG) prepare a discharge plan for its San Juan River Plant describing in detail the methods or techniques EPNG proposes to use in order to comply with the regulations of the New Mexico Water Quality Control Commission. EPNG submitted a discharge plan in April, 1986. After OCD's review of the plan and based on the Agency's recommendation, EPNG proposed to revise the section of the plan relating to non-contact wastewater (wastewater containing no hydrocarbons) and investigate disposal of this portion of the plant's waste streams using a land application system. To obtain approval for this proposed system OCD has requested that EPNG conduct a feasibility study.

The San Juan River Plant is located in Section 1, T. 29 N., R. 15 W., San Juan County, New Mexico, approximately 8 miles west of Farmington, New Mexico (see attached map). This Plant is engaged in the compression and processing of natural gas and the recovery of natural gas liquid products. Non-contact wastewater produced in the plant has been estimated at approximately 61,690 gallons per day (gpd). Because these volumes are estimates, EPNG is continuing to study and attempting to quantify wastewater flows. Even though wastewater flows may vary there should be no difference in quality that would affect the land application study.

The following information must be gathered and evaluated to demonstrate the feasibility of using land application:

1. The topography of the site(s) and its immediate surroundings and its influence on the operation of a land application system, e.g. runoff patterns, surface flow, etc.

2. The geological stability (faults, fractures, fissures) of the land application site(s).

3. The data necessary to physically and chemically characterize the soils within potential land application site(s).

4. The data necessary to evalulate the hydrologic and hydrogeologic characteristics of the site(s).

5. Range estimates of water and constituents absorption by vegetation likely to be used, or that can naturally invade the area.

6. Appropriate mathematical modeling of the land application site using conservative and non-conservative scenarios and information gathered from Items 1 through 5.

7. A report containing all the information gathered, results of the mathematical modeling and conclusions and recommendations. Determine system effectiveness considering surface and ground water, both within and outside the plant property. If the information gathered shows land application to be feasible, determine the need for an experimental laboratory demonstration.

8. If a laboratory experimental demonstration is required, prepare an experimental design to evaluate the most feasible scenarios. The experimental design should address any potential pathways for the discharged constituents and should quantitatively define them. The experimental work should provide appropriate waste loading rates and preliminary information concerning frequency and type of waste application to guarantee the ability of the soil and biota to assimilate constituents. Also, the experimental work should provide information on operational features. The program should comply with pertinent environmental NMOCD regulations. The final results should provide an estimate on the lifetime of the system. New Mexico Water Quality Control Commission (NMWQCC) regulations require that groundwater standards not be exceeded at a place of present or reasonably foreseeable future use.

B. **Scope of Work**

The feasibility of land application study scope of work is comprised of three phases. Results will be evaluated at the end of each phase. If the results show the project not to be feasible EPNG will stop the study activities.

Determination of the feasibility of land application requires the identification and quantitative measurement of site characteristics that control the stabilization, confinement and potential migration of the wastewater constituents (attached is the project schedule). Contractor will perform the following:

Phase I

1. Reconnaissance of the proposed land application site. Contractor should indicate those tasks which can be achieved by literature search and those requiring field work. Also, contractor should determine if a surface resistivity survey is required.

   If a surface resistivity survey is deemed necessary, prepare a plan for implementing a survey of the area within the property boundary (where appropriate) as well as the area immediately north of the plant property boundary. The plan should include the resistivity method to be used, reasons for using such method and an implementation schedule. The surface resistivity survey should aid in locating groundwater sampling installations.

2. A detailed soil survey in accordance with the standard Soil Conservation Service (SCS) techniques and procedures. The soils found on the site need to be identified and a detailed map of the area prepared. This map will include a description of each soil series. Samples of the soil horizons in the unsaturated zone should be collected and analyzed for the physical and chemical properties required for land application design. Evaluate (a) water holding capacity of the unsaturated zone, (b) soil salinity, and the shrink-swell potential of the soil.

   Evaluation of the water transmission characteristics based on the hydrological classification of the soil series. Actual determination of vertical infiltration rates will be conducted during Phase II.

   Evaluation of (a) land surface slope, (b) susceptibility of soil to erosion (hydraulic or surface flow), (c) vegetation patterns and their potential roles (d) necessary site modification to allow land application evaluation of the potential impact on the short-term and long-term operation of the system.

3. An evaluation of the geologic formations underlying the land application site should be prepared to aid in characterization, design and management of the site . Attention should be given to:

   a) General characterization of the geology:
   b) Depth, stability and water transmission capability of the subsurface soils;
   c) Degree of weathering with depth;

d) Outcrops and types of bedrock, as well as bedrock and/or other underlying strata irregularities such as fissures, faults, fractures, crevices, joints, caves, springs, sinkholes, seeps and limestone cavities.

4. Available information on existing water well locations and use within one-fourth mile shall be compiled. Information shall include depth, water level and aquifer completion. Water quality data of a type relevant to potential land application imports shall be collected. The NMOCD has agreed to assist EPNG in obtaining water quality information.

5. A climatological assessment of the site and its impact on the operation of the land application system. Also, provide minimum monthly determinations of the amount of time during which wastewater must be diverted to holding ponds.

6. A determination of the need for vegetation other than native flora, including a list of possible species or mixtures of species that maximize evapotranspiration and would survive the environment created by wastewater application. Estimate ranges of constituent uptake for vegetation likely to exist at the site.

7. Prepare a report that includes, but is not limited to, all of the information referred to in Steps 1 through 6, as well as any preliminary conclusions and recommendations which may be reached using this information. If results obtained thus far show land application not to be feasible EPNG will stop project activities.

Phase II

1. Consultant will prepare a drilling program for EPNG and NMOCD approval. Using all available information, properly locate and install groundwater sampling locations. Well construction will be to EPNG specifications. Also, contractor will evaluate site hydrological and hydrogeological characteristics such as: (1) depth to bedrock or gravel, (2) depth to groundwater table including seasonal perched water level and (3) physical and chemical characterization of surface and groundwater upgradient, downgradient and within the potential land application site.

   Consultant will prepare a sampling program for EPNG and NMOCD approval. Groundwater samples will be taken by the contractor in accordance with U.S. Environmental Protection Agency methods of groundwater sampling. Samples will be delivered to the EPNG representative for analysis by EPNG or its contractors. The cost of for analysis by EPNG or its contractors. The cost of the analyses should not be part of this bid. Table 1 shows the list of chemical parameters for which the groundwater will be analyzed.

2. Prepare a map of the potential land application site(s) showing runoff patterns, groundwater depths and flow directions. All existing private and/or public wells, springs and other water supplies within one-fourth mile of the site borders should be indicated on the map. Any quarries, landfills, sand and gravel pits, surface mines, or other activities that come into contact with the groundwater table or are located within one-fourth mile of the site boundaries should be included on the map. Any nearby potential sources of groundwater quality deterioration other than the proposed land application site should be identified and their locations shown.

3. Evaluate data obtained in Phases I and II and conduct appropriate mathematical predictive modeling using conservative and non-conservative scenarios.

4. Prepare a report that includes but is not limited to the following:

   a) Hydrological and hydrogeological characteristics of the land application site(s).
   b) All information gathered in Phases I and II.
   c) Map as outlined in Section 2.
   d) Appropriate mathematical models performed under conservative and non-conservative scenarios.
   e) Conclusions and recommendations.
   f) If results obtained thus far show land application not to be feasible EPNG will stop project activities.

Phase III

If Phases I and II show that land application may be feasible, an experimental design should be prepared to assess the most feasible scenarios evaluated under Phase II. The experimental design should include site test plots for vegetation likely to be used and laboratory breakthrough columns (undisturbed). This study will be used to establish (a) the feasibility of land application, (b) appropiate waste loading rates, (c) frequency of waste application, (d) type of waste application, (e) criteria for management of the soil and site to guarantee the ability of the soil to assimilate constituents, (f) types of possible monitoring (including groundwater and vadose zone) to detect any failure of the system, (g) life of the land application site and (h) definition of the implementation of a final design.

TABLE 1

EPNG SAN JUAN RIVER PLANT

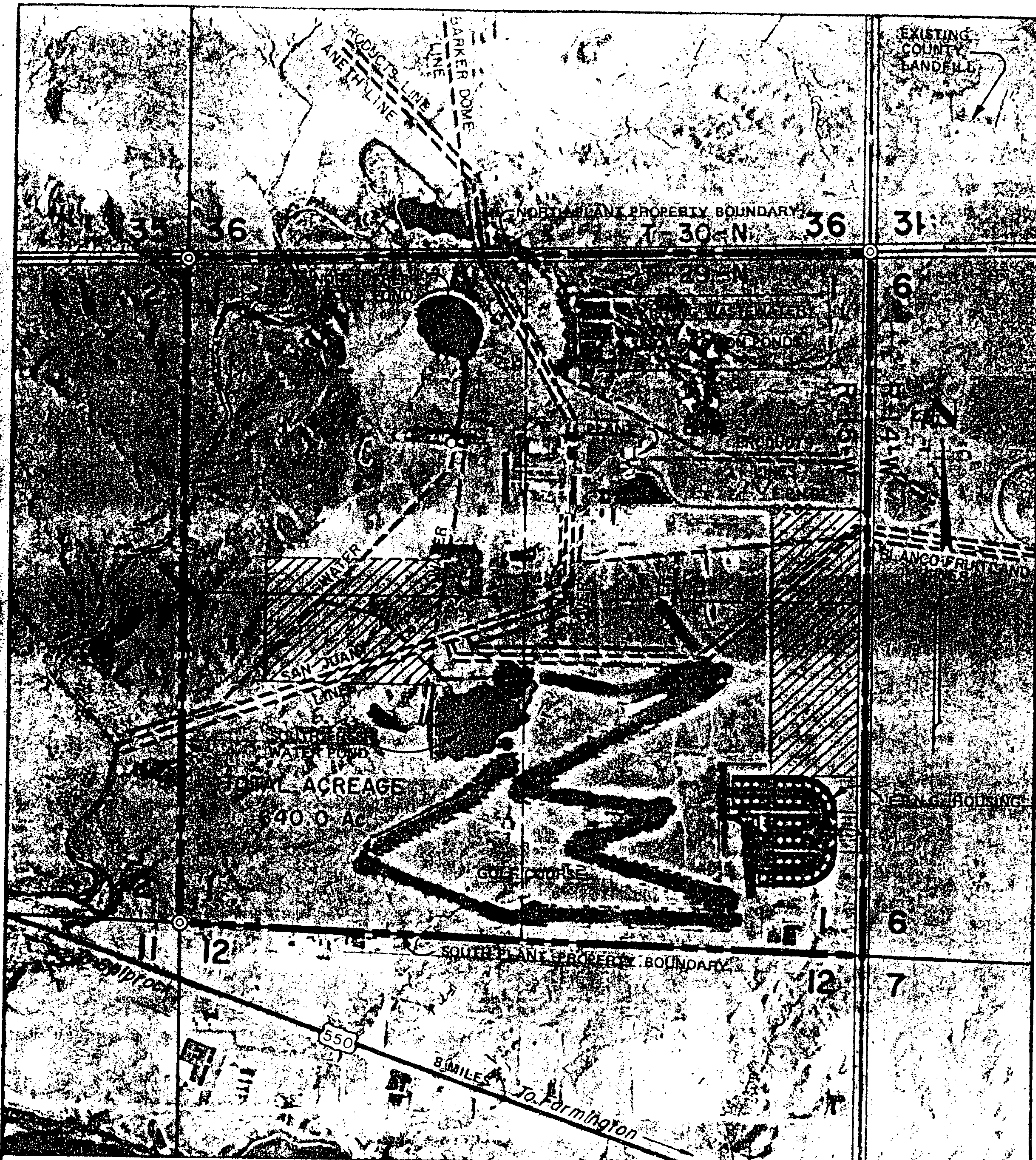
GROUNDWATER CHARACTERIZATION MONITORING PARAMETERS

COD
Ammonia - N
Nitrate - N
Nitrite - N
Total Kjeldahl - N
Oil and Grease
TOC
O - Phosphate
Cyanide (Total)
Phenolics
Arsenic
Barium
Cadmium
Calcium
Chromium (Total)
Copper
Hardness (As CaCO3)
Iron
Lead
Magnesium
Manganese
Mercury
Potassium
Selenium
Silver
Sodium
Zinc
Alkalinity (Total, as CaCO3)
Alkalinity (Bicarbonate as HCO3)
Chloride
Fluoride
TDS
Total Residue
Sulfate
PCB's
pH
Ethylene Dibromide
Naphthalene
Monomethylnaphthalene
Anion/Cation Balance (in meq)
Volatile Organics
(see next page)

TABLE 1 (Cont'd.)

Volatile Organics

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
Trichlorofluoromethane
1,1-Dichloroethane
1,1-Dichloroethene
Trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
Carbon Tetrachloride
Bromodichloromethane
1,2-Dichloropropane
Trans-1,2-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
cis-1,3-Dichloropropene
Benzene
2-Chloroethylvinyl Ether
Bromoform
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
Chlorobenzene
Ethylbenzene
Xylenes



R/W No. 50236 All Sec. 1

PROPOSED LAND APPLICATION SITES

El Paso Natural Gas Company

SAN JUAN RIVER PLANT SITE

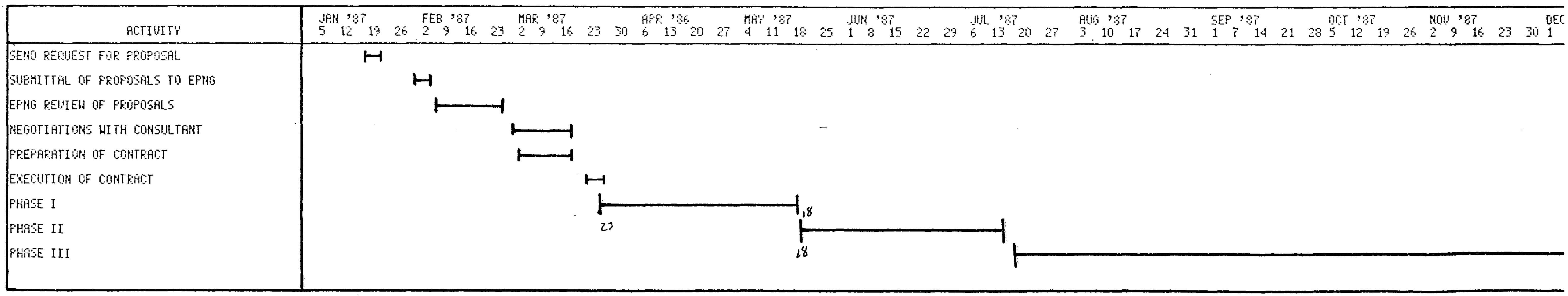
TWS 29-N, RANGE 15-W

SAN JUAN COUNTY, NEW MEXICO

PRINT RECORD

SCALE 1"=1000'	DATE JAN. 15, 1987	NO. 52021-X-
DRAWN BY	R/W NO. 50236	

LAND APPLICATION FEASIBILITY STUDY SCHEDULE
EL PASO NATURAL GAS COMPANY
SAN JUAN RIVER PLANT
FARMINGTON, NEW MEXICO



A PROPOSAL TO PERFORM A LAND APPLICATION FEASIBILITY STUDY FOR THE EL PASO NATURAL GAS COMPANY'S SAN JUAN RIVER PLANT

prepared for

El Paso Natural Gas Company
El Paso, Texas

by

K. W. Brown Associates, Inc.
6A Graham Road
College Station, Texas 77840

February, 1987

(Revised: March 10, 1987)

TABLE OF CONTENTS

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1.0 INTRODUCTION

This proposal has been prepared in response to El Paso Natural Gas Company's (EPNG) invitation to bid on performing a Land Application Feasibility Study for the San Juan River Plant. The proposal format is arranged to include discussions of technical approach, project organization and management, scheduling, cost, and the qualifications and experience of K. W. Brown Associates, Inc. (KWBA) to conduct the project. The technical approach is patterned after the three phases of work requested in the Scope of Work supplied by EPNG with the bid invitation. Likewise, a cost breakdown and lump sum bid have been prepared as requested. In doing so, however, certain assumptions were necessary, such as the number of borings and wells that may be needed to complete the hydrogeologic investigation. Where such assumptions have been made, they are noted in the technical approach and cost estimate sections, and unit costs are provided should the assumptions prove to be inaccurate.

As will be stated in greater detail in subsequent sections of this proposal, KWBA is uniquely qualified to perform this work. Our extensive experience in land application facility design and permitting, including all aspects of site investigations, will serve EPNG's interests. KWBA will provide effective and economical studies and recommendations, and ultimately can aid in permitting, construction, and implementation of the land application program, if it is determined to be feasible.

2.0 TECHNICAL APPROACH FOR EVALUATION

The following discussion is organized in phases according to the Scope of Work provided by EPNG with the bid invitation, and describes the approach to be taken by KWBA in performing the feasibility study.

Based on the limited information provided by EPNG or obtained from local sources in preparing this proposal (e.g., general geology and climate, waste flow rate, land area available, and general nature of the waste), it appears that the site is favorable for a zero discharge land application facility. Therefore, much of the feasibility work described will focus on providing adequate data for facility design and permitting. The major concerns regarding feasibility and long term management of the facility will probably relate to the quality of the wastewater itself, and how application of this water to the land will impact soil productivity and possibly groundwater quality in the long term. In particular, salts, chromium, and phosphorus are typical contaminants in this type of non-contact wastewater, and these along with anionic metals (e.g., B, Mo, Se) are likely to be the limiting constituents with regard to buildup in the soil or potential groundwater impacts. On the other hand, neither organics nor most of the heavy metals should affect facility operations or environmental safety. Emphasis in design will therefore focus on developing a water management program to control constituent buildup and migration. The need for and sizing of a wastewater pond for bad weather storage will also be carefully considered due to its potentially high cost and impact on the cost effectiveness of the land application option.

This study will address land application as one option for disposing of this wastewater, but other alternatives exist, such as underground injection or a reverse osmosis/water recycling system. All possible alternatives should be evaluated and compared based on their technical feasibility, regulatory acceptability, cost effectiveness, and potential liabilities. It is recognized that EPNG has probably already considered such options, but a final recommendation on the feasibility of land application should also address relative costs. Although not a part of this proposed level of effort, the evaluation of alternatives and their costs is well within the capabilities and experience of KWBA, and we will provide these services if needed.

2.1 PHASE I - PRELIMINARY SITE ASSESSMENT

Phase I of the feasibility study will develop a basic understanding of the site and of the feasibility of land applying the wastewater to economically achieve EPNG's disposal objectives without presenting undue environmental concerns.

2.1.1 Reconnaissance of Site

The reconnaissance step of the feasibility study will involve a data gathering and interpretation effort prior to the beginning of field investigations. The data gathering effort will encompass KWBA's in-house resources, published literature, and EPNG's file information. Before proceeding to the next step of Phase I, the gathered information will then be evaluated as a basis for subsequent field work and site characterization including the identification of potentially limiting parameters or conditions. The findings and recommendations of this step will provide a preliminary picture of land application feasibility and be useful in refining work plans for subsequent steps.

Literature - KWBA already possesses an extensive in-house library of land application research literature and technical design information, much of which was prepared by KWBA for government and industry clients.

Especially of value are references on the environmental fate and behavior of waste constituents in land application systems, and design guidance for sizing zero discharge wastewater land application facilities and storage basins. In addition, published reference materials will be obtained describing site soils and vegetation (e.g., SCS soil survey), geology and topography (e.g., USGS quadrangle and geologic reports, Bureau of Mines reports, drill logs from local oil and gas wells), local groundwater occurrence and uses, and climate (e.g., data from nearby reporting stations). If available, aerial photographs of the site will also be obtained. All information in EPNG's possession which is pertinent to the project will be requested for inclusion in the assessment. Such information will include geotechnical bore logs from facility construction, facility topographic survey, pertinent maps and diagrams, any previous descriptive work done for the facility, and data on wastewater quality and quantity.

The reconnaissance data gathering effort will be an entirely in-house effort, and will not incorporate any field investigations, such as resistivity surveys. A brief justification for foregoing any geophysical testing follows. A major portion of the entire facility is located on alluvium, and near-surface (15 to 30 feet below ground surface) saturated conditions which are hydraulically linked to the adjacent river and tributaries are likely to exist. To the agency, this aquifer and/or perched water table is the main zone of interest for groundwater monitoring purposes. For complex hydrogeologic situations and where significant contamination potential exists, the use of geophysical methods to obtain an overview of the site geology and hydrology would be useful in that large scale features can be identified and the number of exploratory borings required for characterization can be reduced. However, in order to identify subsurface lithologic boundaries and saturated zones, it is necessary to conduct a seismic refraction survey and limited verification drilling in addition to a resistivity survey. Such a program is both time consuming and costly, and it is judged unnecessary for implementing the program at the EPNG site. Instead, KWBA proposes a practical yet cost effective means of obtaining subsurface information for this site, as described in Section 2.1.3 of this proposal.

Interpretation - In order to characterize land application feasibility and to guide subsequent field investigations, it is essential that the information gathered about the site be interpreted before proceeding further. The compiled data should shed light on the land treatability of the wastewater, and general surface and subsurface conditions such as general soils and geology, lithologic and textural properties, hydraulic conductivities of the uppermost layers, and depth to shallow aquifers/perched water tables. Suitability of the waste and site for land application will be summarized and discussed with EPNG, and general recommendations will be made before proceeding with field work. This reconnaissance interpretation step will also entail finalization of field investigation plans based on the evidence gathered. The remaining steps of this chapter describe field and in-house investigations and interpretations needed to complete Phase I of the land application feasibility study.

2.1.2 Soil Survey

A detailed soil survey will be conducted to determine which soils occur in the survey area, where they are and how they relate to soils outside the area. In order to meet these requirements, this survey will be conducted utilizing standard procedures, identification methods and classification systems currently employed by the Soil Conservation Service (SCS). Observations of note will include steepness, length, and shape of slopes; size of streams; general pattern of drainage; the types of native plants; susceptibility of soils to erode; and types of rock. Many soil cores (hand auger) and several pits will be dug to study the soil profiles within the area. A profile is the sequence of natural layers (horizons) which make up the soil. These layers extend from the surface down to the parent material (geology), which has undergone little alteration by the interactions caused by the soil formation processes.

Detailed descriptions of the profiles will be made and compared with data collected from similar adjacent areas. The soils will be classified and named according to standard soil survey procedures. A detailed soil map will be prepared on aerial photographs which illustrate the soil boundaries, trees, buildings, fields, roads and miscellaneous details. These various details enable accurate placement of soil boundaries onto the aerial photographs. The survey will meet standards for a medium intensity study as defined by the National Cooperative Soil Survey.

The acreage shown on the soil map will consist of many small areas called "map units." Most of the map units are comprised of one major soil series with small portions of inclusions which are soils that are frequently associated with the mapped units. The mapping units in this survey will be described in detail by horizon.

The soils will be sampled and analyzed to characterize the physical and chemical properties of each map unit that may affect land treatment operations. It is anticipated that a total of 50 samples will be collected for analysis. Chemical properties will include, at a minimum, the following: cation exchange capacity, soluble cations, soluble anions, pH, electrical conductivity, soil organic matter, and sodium absorption ratio. Physical properties will include, but not be limited, to the following: infiltration rates (field determinations), water retention capacity, and texture. Of particular importance to this investigation, water holding capacity, soil salinity, and shrink-swell potential will be determined for each map unit since these parameters could significantly affect the proposed land treatment operation.

In the event that site-specific conditions and/or agency requirements call for a soil moisture content study over a period of time, a program will be designed and a soil moisture system installed. The system will consist of a network of moisture sensitive instruments placed throughout the soil profile at different locations, all connected to a central control meter. The network would be monitored on a weekly basis for approximately six months.

The soil survey findings will be evaluated to assess the potential use of the selected areas for land treatment operations. Emphasis will be placed on site modifications that may be required to improve short-term and long-term potential for land application of the non-process wastewaters.

2.1.3 Geology and Hydrology

The subsurface hydrogeologic and surface geologic characterizations of the site are discussed separately below. Both will entail field work in conjunction with in-house data and literature evaluations.

Subsurface Hydrogeology - In order to characterize hydrogeologic properties of the subsurface materials, it is essential that all available existing information from previous site and area studies be evaluated. These materials will be collected in the site reconnaissance step (Section 2.1.1) and will include review of USGS geologic and hydrologic reports, Bureau of Mines' reports, drill logs from local oil and gas wells, SCS infiltration studies, and agricultural reports. The compiled data and interpretation should shed light on general subsurface conditions such as general geology, lithologic and textural properties, hydraulic conductivities of the uppermost layers, and depth to shallow aquifers or perched water tables. However, as is often the case, this information is not truly representative of the site-specific conditions; therefore, initial assessment of the site's feasibility for land application may not be convincing.

It is therefore proposed that the Phase I hydrogeologic site characterization include a brief drilling program. This program will not only provide an overview of site-specific conditions, but will also accomplish several objectives of Phase II. The drilling program will consist of approximately five (5) to seven (7) exploratory borings across the entire facility. One core sample per each three (3) feet of borehole will be collected for particle size, density, and moisture analysis. During the drilling of each boring, formation permeability measurements (open hole method) will be taken (approximately two measurements per stratigraphic layer). Additional core samples will be collected for laboratory measurement of permeability, and will be compared with the field measurements. Detailed descriptions of lithology, structure, and morphology will be made of each layer encountered during drilling. All borings will be drilled to a total depth to be decided in the field (to bedrock). In those borings that encounter groundwater, a piezometer may be installed for purposes of observing and mapping the potentiometric surface. All field activities and data evaluation will be conducted by a KWBA hydrogeologist.

Including a drilling program in Phase I of the project will enable EPNG to enter Phase II with the more complete understanding of the subsurface conditions necessary to properly locate and install a groundwater monitoring system. The drilling program for Phase II will thus be minimized to installation of monitoring wells, establishing depth to bedrock and collecting samples for physical properties analysis.

Surface Geology - While conducting the subsurface investigations, the hydrogeologist will also evaluate surface features of the site and the surrounding areas. The key features will include surface geomorphology, formation outcrops, fault and fracture zones, and surface seeps and/or springs. Notation of the surface geology and hydrogeology will aid in the subsurface interpretations.

2.1.4 Water Well Survey/Water Quality Assessment

KWBA, with the aid of NMOCD and other state and government agencies, will compile all relevant information pertaining to local aquifers, groundwater usage, and groundwater quality. The information will be from all water wells within one-fourth mile of the facility. Additional information on water wells further from the facility will be compiled in the event documentation is needed. Each water resource will be investigated for its quality and usability.

2.1.5 Climatological Assessment/Water Balance

Two important parameters required in determining the feasibility of land application of wastewater are losses through evaporation and gains from precipitation. For "zero discharge" land application, the quantity of wastewater applied cannot exceed the value of net water loss; therefore, evapotranspiration is the primary means of water disposal.

The initial step in constructing a site specific water balance will be collection of background data. Monthly precipitation and class A pan evaporation data for a 20 to 30 year period will be gathered from records of the nearest weather station in the area. The monthly class A pan evaporation values will be multiplied by a pan coefficient to estimate the reference evapotranspiration. The reference evapotranspiration is then multiplied by a crop coefficient appropriate for the chosen cover crop, resulting in the monthly evapotranspiration. The crop coefficient is developed through a literature search based upon the type of vegetation and its ability to intercept and transpire the applied wastewater, and percent cover. In addition, a list will be made of the most effective crops for evapotranspiration of the wastewater under these conditions (see Section 2.1.6). Information on the various soil series present at the site (Section 2.1.2) will provide values for soil physical properties, which will be used in the water balance calculations to provide estimates of percolation and runoff rates for various design storms.

The monthly water budget is then calculated to give an estimate of the depth of water which can be applied. The annual rate is then taken as the sum of the monthly rates. Based upon monthly climatic data and the water balance, an estimate will be made of the amount of time that wastewater must be diverted to holding, and the necessary size of the holding pond, if needed.

2.1.6 Vegetation Survey

Initial determination of vegetation type will be conducted with the aid of aerial photographs and range site assessments given in the SCS Soil Survey for San Juan County. The site investigation will then provide detailed information as to dominant vegetation and percent cover. Determination of vegetation types present at the wastewater irrigation site will be made at the time of the soil survey. Ten line transacts, each consisting of 10 observation points, will be conducted at random locations to obtain total ground cover and to determine dominant plant species present.

In addition, a literature search will be made to compile a list of possible species to use which maximize evapotranspiration, will be tolerant of the environment that will be created by the irrigation with EPNG wastewater (i.e., salt tolerance) and will be adaptable to the climate of the area. Estimates of constituent uptake by the cover crop that is chosen for the site will also be determined. Recommendations will be made as to best vegetation for use at the facility.

2.1.7 Phase I Report

EPNG will receive a report from KWBA summarizing the findings of the Tasks listed under Phase I as well as conclusions and recommendations based on the information. In addition to recommendations as to the feasibility of the facility, general cost estimates will be prepared to enable EPNG to compare the economic feasibility of land application relative to other alternatives. Initially, five copies of the Phase I draft report will be submitted for review and comment. Once comments are addressed, ten copies of the final report will be submitted in a format suitable for presentation to the agency.

In addition, EPNG will receive weekly and monthly progress reports during implementation of Phase I. Weekly reports will consist of telephone conversations, whereas monthly reports will be in a letter format. Each report will summarize activities that are planned, completed and in progress for the period. Observed problems and possible solutions being considered will also be noted. Project costs by month will be provided in the monthly report.

2.2 PHASE II - SITE INVESTIGATION

2.2.1 Site Hydrological and Hydrogeological Investigation

Once the strategy is approved by EPNG and NMOCD, KWBA will proceed with the well installation and sampling plan.

2.2.1.1 Drilling Program --

KWBA will prepare a monitoring well installation plan for the approval of EPNG and NMOCD. This plan will most likely call for a minimum of one upgradient well and three downgradient wells for each application plot. An additional background well may be needed in order to establish background water quality. The choice of well materials and well design will be discussed with EPNG before the wells are installed. During the well installation activity, all encountered layers will be described and sampled, and permeability tests conducted. The piezometric surface will be observed for several days to monitor the degree of water table fluctuation.

2.2.1.2 Sampling Plan --

Part of the plan will also consist of surface and groundwater quality evaluation. A sampling and analysis program will be outlined for EPNG to follow during Phase III and subsequent years. Initial sampling will take place once the wells are fully developed and have had a chance to stabilize.

2.2.2 Site Map

A map of the potential land application site will be developed based upon data gathered during the site investigation, existing topographic maps, and pertinent information concerning surrounding land use. From the site investigation, information will be supplied on surface runoff patterns, groundwater characteristics, soil types, and surrounding land use. The map will be a scaled representation giving location and characteristics of the site including depth to groundwater, direction of groundwater flow, surface runoff patterns, relevant surface structures, and existing public and private wells. In addition, surrounding activities which may affect groundwater (e.g., landfills, quarries, etc.) will be identified and located on the map.

2.2.3 Mathematical Modeling

Appropriate mathematical modeling will be conducted under both conservative and nonconservative scenarios. Modeling will include investigation of several aspects of the land application of wastewater. For example, surface water hydrology and its effect on the system can be studied utilizing SCS and other watershed computer model simulation. Groundwater will be examined with respect to flow rates and direction, transport of waste constituents, and attenuation of constituents. In addition, soils will be investigated with respect to their ability to immobilize and attenuate the waste.

2.2.4 Phase II Report

EPNG will receive a report from KWBA summarizing the findings of the above tasks and making conclusions and recommendations based on the information compiled under Phases I and II. Five copies of the Phase II draft report will be submitted for review and comment. This draft report will include discussions on site geology, hydrology, and hydrogeologic characteristics, site maps, modeling results for nonconservative and conservative constituents, and a summary of findings from Phase I that are pertinent for this assessment. Conclusions and recommendations will be provided based on the compiled information from Phases I and II. Once comments are addressed, 10 copies of the final report will be submitted in a format suitable for submittal to the agency.

In addition, EPNG will receive weekly and monthly progress reports during the implementation of Phase II, as described in Section 2.1.7.

2.3 PHASE III - LABORATORY/BENCH STUDY

Following the determination that land treatment of wastewater at the EPNG site is feasible, field tests will be designed to demonstrate the effectiveness of land application and to guide the final design and management of the facility. The results of the study will confirm the following: 1) waste loading rates (both hydraulic loading and waste constituent loading); 2) frequency of application; 3) method of waste application; 4) proper soil management techniques to assure continued renovation of applied waste; 5) recommended vegetation; 6) recommended site monitoring equipment and procedures; 7) facility life; and 8) final design specifications for the wastewater disposal facility. KWBA's approach for the Phase III design follows.

Laboratory bench-scale studies will not be needed for the EPNG feasibility and design program due to the site climate and the nature of the wastewater to be applied. Salts will be one major class of wastewater constituents, and these are certainly mobile in soil. However, a short-term column study cannot readily predict leachate concentrations. Column studies can provide an indication of the sorptive capacity of the soils for anionic wastewater metals, and the mobility of these metals would be emphasized in any lab study. The negative water budget of the site and facility management should, however, preclude any significant percolation of water through the soil to groundwater, thus preventing the mobilization of such constituents. Emphasis in Phase III should therefore be on field testing to demonstrate the effectiveness of land application and to provide final design and management guidance. However, in the event that a laboratory study is necessary, one will be conducted during Phase III.

2.3.1 <u>Field Plot Studies</u>

A replicated field plot study will be designed and implemented to evaluate land application effectiveness. The field plots would be designed to be instrumented with soil-pore liquid samplers to evaluate leachate quality, and tensiometers to measure soil moisture content with depth and soil moisture flux. Soil cores will be planned to determine to what extent waste constituents are degraded, immobilized or transformed in the soil. The number of field plots will be determined by the number of treatments recommended for evaluation by the model(s) developed in Phase II. Each treatment will be replicated three times. Field plots can be used to evaluate vegetation, wastewater application systems, application rates, application frequencies, soil amendments (e.g., limestone or sulfur for control of soil pH), and the potential effects of wastewater constituents on soil and groundwater.

2.3.2 Phase III Report

The report for Phase III will consist of the design described in the above discussion. In addition, EPNG will receive weekly and monthly progress reports during implementation of Phase III, as described in Section 2.1.7.

3.0 TASK FLOW DIAGRAM

The task flow diagram that will be utilized will be the timeline provided in the RFP from EPNG. The time schedule will be adjusted based on the project requirements and discussions with EPNG.

4.0 PROJECT ORGANIZATION

KWBA personnel along with their respective involvements with the tasks are listed in Table 4-1. Gordon Evans will be the EPNG Technical Monitor. Duties will include technical overview, project strategy and direct involvement with selected tasks. David Zabcik will be the EPNG Fiscal Project Manager. Duties will include project strategy, personnel coordination, client interaction, budget management and project overall status along with direct involvement on selected tasks. Brief vitae of these key personnel follow:

Gordon B. Evans

Mr. Evans has extensive project management experience in the assessment, design, management, monitoring, and permitting of land treatment units. As Technical Director of KWBA, he has coordinated the review of policy documents, permits, agency research programs and industry waste disposal operations. He has coauthored and technically reviewed guidance documents for site assessments, land treatment, surface impoundments and landfills. In the area of land application, he has designed facilities for the treatment and disposal of municipal wastewaters, oilfield waste, and hazardous and nonhazardous industrial wastes. Mr. Evans' experience and skills will help EPNG to assess, develop and permit an economical and sound long-term waste management operation. A more detailed discussion of Mr. Evans' experience is presented in Appendix A.

J. David Zabcik

Mr. Zabcik has been actively involved with permitting activities for land treatment facilities and site assessment programs for waste management operations. As a project manager for KWBA, he has coordinated site assessment programs, permitting strategies, and permit preparation. He has

Table 4.1 Key Personnel and Project Responsibilities.

Name	Title	Area of Involvement
J. David Zabcik	Senior Associate	Project manager: project coordination; fiscal management, technical input to all project sections
Gordon Evans	Senior Associate Technical Director	Technical Monitor: technical advisory and monitor of all sections; Quality assurance; Reconnaissance assessment
Mike Trojan	Staff Hydrogeologist	Geologic and groundwater tasks Water well survey/water quality assessment; Site mapping
James Rehage	Staff Soil Scientist	Reconnaissance assessment; Soil and vegetation surveys; Site mapping; Climate and water budget
Janic Artiola	Staff Soil Scientist	Modeling; Design of Phase III study

in-depth understanding of the essential elements for designing and permitting waste management units, and has managed the design of land application systems for numerous industrial clients. Mr. Zabcik has the organizational skills essential in meeting the tight time constraints associated with feasibility studies, facility designs, permitting and response to comments. His experience in working with industrial clients and in acting as liaison to regulatory agencies will be an added asset to the EPNG project. A more detailed discussion of Mr. Zabcik's experience is provided in Appendix A.

<u>Vitae of Key Personnel Assigned to the Project</u>

Brief vitae for the assigned staff and all other staff directly involved with the project are included in Appendix A.

5.0 KWBA CORPORATE PROFILE: RELATED LAND TREATMENT EXPERIENCE

Since its founding seven years ago, KWBA has become a world leader in advancing the land treatment technology and in serving the land treatment needs of industry and government. Committed to the increasing use of the technology for industrial waste treatment and to expanding its use for wastes not previously land treated, KWBA believes that the careful application of land treatment will benefit industry as a cost-effective, environmentally safe method to treat and dispose of wastes. Treatment is a significant advantage since it will result in the reduction or elimination of potential long-term cleanup or environmental damage liabilities.

Our Corporate experience spans the full range of activities in land treatment. Working in the industrial sector, KWBA has assessed, designed, permitted, supervised construction, managed, monitored, and helped close facilities land treating both hazardous and nonhazardous wastes. Most recently, as the RCRA permitting program has begun to gather momentum, KWBA has been active in preparing and assisting in the preparation of numerous Part B permit applications. Working in the government sector, we have actively injected a seasoned, realistic approach to the regulatory agencies' problems of assessing and permitting land treatment units.

The following profile specifically describes the broad and in-depth resources and expertise that KWBA will bring to bear on a successful, cost-effective feasibility study and design effort for the El Paso Natural Gas Company's San Juan River Plant.

5.1 INDUSTRIAL EXPERIENCE

Arco Petroleum Products land treatment unit (Houston, Texas) - KWBA authored the treatment demonstration plan, unsaturated zone monitoring plan, and the treatment program for the Arco Part B permit application. The work included regular meetings with the client and representation of their position before the Texas Water Commission. Once the permit application was submitted, field work was carried out in establishing the field plots for the treatment demonstration and installing unsaturated zone monitoring equipment.

American Petrofina Company of Texas land treatment unit (Port Arthur, Texas) - KWBA prepared and submitted to the client a complete Part B permit application covering all aspects of the regulatory requirements. During the progress of the project, KWBA met with officials from Fina and the Texas Department of Water Resources to develop strategy and help resolve technical and regulatory issues.

U.S. Pollution Control, Inc. commercial land treatment unit, landfill and treatment units (Salt Lake City, Utah) - The client retained KWBA to completely review and rewrite the land treatment section of their Part B permit application. The original application had been prepared by the client and submitted to the State of Utah and was reviewed extensively there and at EPA headquarters in Washington. Numerous and severe deficiencies had been noted. Therefore, KWBA completely reorganized the permit application, changed the format to more clearly present the information, and proceeded to rewrite all sections that were pertinent to land treatment. KWBA also succeeded, during meetings with the state and EPA, to obtain a more favorable compliance schedule for addressing the deficiencies. In 1985, KWBA performed a detailed soil survey and site characterization and constructed and instrumented field plots for the treatment demonstration study. Subsequently, the State of Utah granted a permit to the client for performance of the demonstration study.

Coastal Corporation hazardous waste land treatment unit (Corpus Christi, Texas) - KWBA prepared closure and post-closure plans and a groundwater monitoring plan for inclusion in the Part B application for this refinery oily waste land treatment unit. In addition, KWBA prepared conceptual designs to be used in construction of the facility and performed soil survey and background soil quality investigations.

Exxon Company, USA land treatment unit (Baytown, Texas) - Through subcontracts with Exxon's prime contractors, KWBA participated in strategic planning, unit design, and soil selection for the advanced "perched bed" design. Since soil chosen for construction was critical for unit success in the wet Gulf Coast environment, KWBA performed field sampling, testing, and selection services for inclusion in the Part B application. Finally, KWBA provided the literature review for inclusion in the Part B.

Exxon Company, USA land treatment unit (Baton Rouge, Louisiana) - Included in the refinery's Part B were sections prepared by KWBA on unsaturated zone monitoring and the treatment zone description. Field services related to these portions of the Part B included borings and analysis of samples to characterize the site stratigraphy and material quality down to 30 feet. In addition, KWBA personnel installed the soil-pore liquid sampling equipment for the unit.

Arco Petroleum Products, land treatment unit (Ferndale, Washington) - KWBA provided complete environmental services for the Arco plant, particularly addressing the permitting needs for the on-site land treatment unit. Services rendered included hydrogeologic investigations, installation of vadose zone and groundwater monitoring systems, chemical and physical characterization of soil, geology and wastes, collection of regularly scheduled soil and groundwater monitoring samples, preparation of a complete Part B permit application for the unit, and successful completion of the required treatment demonstration study for the site.

Mobil Oil Corporation, land treatment unit (Ferndale, Washington) - KWBA completed the final Part B permit application for the unit after thorough field investigations of the site (including hydrogeologic and soils investigations), and successfully demonstrated that the unit was performing as designed. In the course of the work, KWBA conducted a soil survey, collected numerous soil samples for characterization, installed a shallow zone monitoring well system, and designed a drain system to remove the perched water table beneath the site. Plans were prepared for monitoring soils and groundwater at the facility, managing the waste application and treatment process, and ultimate closure of the unit.

Municipal Wastewater Land Application Projects for several clients (In or near Austin, Texas) - Wastewater disposal in the Texas Hill Country near Austin is a major concern due to the possible effects to the vulnerable Edwards Aquifer. Developers in the area must therefore design zero discharge land application systems for sewage effluent. KWBA has carried out soil and vegetation surveys, calculated water budgets and water storage requirements, and subsequently designed several such land application systems for cities and developers in the area.

Nonhazardous Oilfield Waste Land Application Projects for industrial clients (West Texas, Louisiana, and Alabama) - KWBA has designed land application facilities for nonhazardous oilfield waste disposal in Texas, Louisiana, and Alabama. The work included all aspects of site characterization (e.g., soils, vegetation, geology, hydrology, water budgets, and groundwater), and lead to the design and permitting of these units. In addition, KWBA has continued to be active with these facilities in on-going monitoring and management. The major concerns at these facilities are salt control, water management, buildup of metals, and degradation of the minor amounts of organics present in the wastes.

5.2 LAND TREATMENT ACTIVITIES FOR EPA UNDER THE RCRA PROGRAM

Relevant land treatment work is listed below:

KWBA authored:

- Hazardous Waste Land Treatment (EPA SW-874, 1983)
- Hazardous Waste Land Treatment Demonstrations (EPA draft January 1985)
- Land treatment section of the Permit Writers Guidance Manual for Land Treatment, Storage, and Disposal Facilities (EPA 530 SW-84-004, May 1984)

KWBA edited:

- Land treatment section of the Permit Writers Guidance Manual (EPA, 1984)
- Unsaturated Zone Monitoring for Hazardous Waste Land Treatment Units (EPA Draft, January 1985)

KWBA presented:

- Permit Writers Training Program: Land Treatment Units at all ten EPA regional offices (1981 and 1983)
- State permit writers training under EPA sponsorship at the University of Wisconsin, Madison (January, 1985)

KWBA strives to provide reasonable and realistic approaches to land treatment design and permitting that meet RCRA mandates while stressing practicality and economy. Contacts within the EPA allow KWBA to obtain accurate and up-to-date information on policy decisions affecting land treatment permitting, resulting in cost and time savings to our industrial clients.

6.0 COST

The estimate of cost for the project has been itemized according to phase, task, and cost category (i.e., labor, direct costs), as shown in Table 6.1. The cost breakdown summary sheet provided by EPNG is then given to summarize the costs shown in the table. It should be noted that there are two optional tasks for which costs are itemized. Conducting these tasks (Phase I - Task D; Phase III - Task A) will be necessary only if determined so by EPNG, the agency, and KWBA. Also, the ranges in costs which appear in Table 6.1 are the result of a breakdown of drilling and well installation footage (e.g., the low end of the range represents drilling to 30 feet and the high end drilling to 75 feet). The cost estimates do not include cost of a topographic survey, nor do they include costs associated with soil-pore water and groundwater analysis.

Table 6.1 Proposed Costs for the EPNG Land Application Feasibility Study.*

Phase	Task	Labor ($)	Direct Cost ($)	Total ($)
I	A. Reconnaissance	3,300	750	4,050
	B. Soil survey, geology, hydrology, vegetation, and water well survey#	9,500-10,000	14,000-20,500	23,500-30,500
	C. Soil analyses	300	8,050	8,350
	D. Soil moisture monitoring (design and equipment installation) - optional	1,500	7,500	9,000
	E. Climate/water budget	1,200	250	1,450
	F. Interpretation/report	6,000	1,500	7,500
	PHASE I SUBTOTALS	21,800-22,300	32,050-38,550	53,850-60,850
II	A. Well drilling, testing and initial sampling (assuming 10 wells)	6,500-7,250	15,500-18,750	22,000-26,000
	B. Monitoring plan	2,000	500	2,500
	C. Site map preparation	800	400	1,200
	D. Modeling	4,000	500	4,500
	E. Phase II report	2,500	1,000	3,500
	PHASE II SUBTOTALS	15,800-16,550	17,900-21,150	33,700-37,700
III	A. Laboratory leaching study - optional	9,800	5,725	15,525
	B. Field study			
	1. design	4,000	1,000	5,000
	2. materials (reusable)+	--	10,000	10,000
	3. construction and equipment installation	10,000	5,000	15,000
	C. Management/monitoring	7,700	6,500	14,200
	D. Phase III report	6,500	1,000	7,500
	PHASE III SUBTOTALS	38,200	29,225	67,225
			TOTAL COST	$154,775 - $165,775

* Costs do not include analytical costs for groundwater monitoring samples or for samples collected during the Phase III field feasibility test.

\# These tasks are considered as one for the purpose of cost estimating since they will be performed together in the field during one trip.

\+ Most of the equipment used in the Phase III study will be reusable in the full-scale operation. Therefore, these costs may be amortized over a period beyond that of the field study phase.

Land Application Feasibility Study
El Paso Natural Gas Company
San Juan River Plant

COST BREAKDOWN

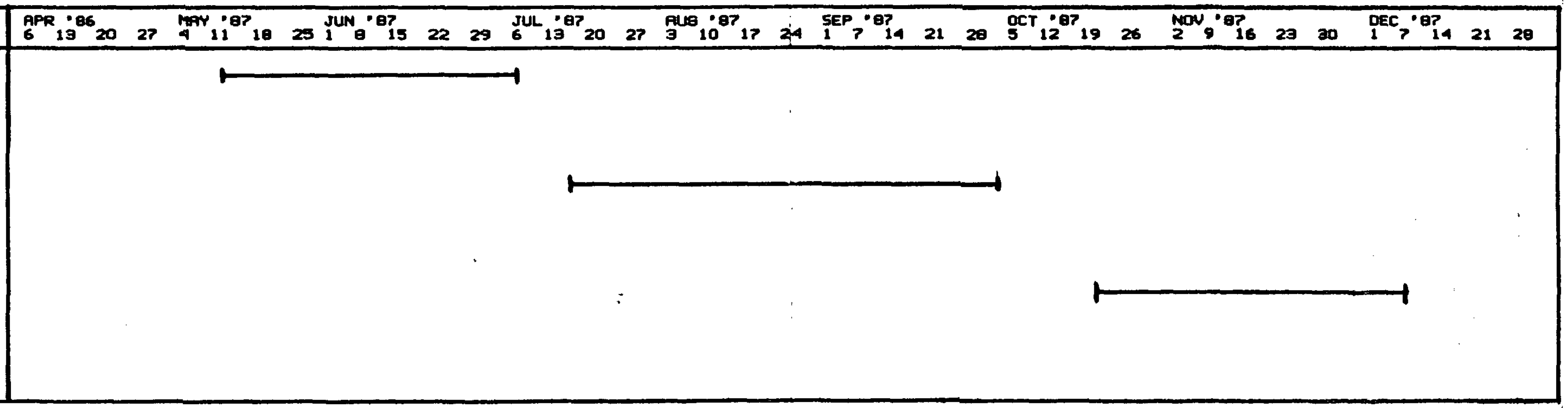
PHASE I	$ 53,850 - 60,850
PHASE II	$ 33,700 - 37,700
PHASE III	$ 67,225
TOTAL COST	$ 154,775 - 165,775

APPENDIX A

EXHIBIT D

LAND APPLICATION FEASIBILITY STUDY SCHEDULE
EL PASO NATURAL GAS COMPANY
SAN JUAN RIVER PLANT
FARMINGTON, NEW MEXICO

ACTIVITY



PHASE I

BEGIN : MAY 11, 1987
COMPLETE : JULY 6,1987

PHASE II

BEGIN: JULY 15, 1987
COMPLETE : SEPTEMBER 30, 1987

PHASE III

BEGIN : OCTOBER 19, 1987
COMPLETE : DECEMBER 7, 1987

CONSULTANT BID SUMMARY
LAND APLICATION FEASIBILITY STUDY
SAN JUAN RIVER PLANT
EL PASO NATURAL GAS COMPANY

FEBRUARY 1987

CONSULTANTS BID SUMMARY
LAND APPLICATION FEASIBILITY STUDY
SAN JUAN RIVER PLANT
FEBRUARY 1987

CONSULTANT: WOODWARD-CLYDE CONSULTANTS

PHASE I	PHASE II	PHASE III
• WILL CONDUCT ALL ACTIVITIES PROVIDED IN PHASE I OF THE EPNG RFP. • WILL PREPARE A WORK PLAN FOR PHASE I FOR EPNG'S APPROVAL. • WILL CONDUCT THE FOLLOWING: - RESISTIVITY SURVEY, IF REQUIRED, USING THE EM-31 METHOD - SOIL SURVEY - HYDRAULIC PROPERTIES OF SOILS - PHYSICAL CHARACTERISTICS OF THE LAND SURFACE - GEOLOGIC EVALUATION - LOCATE EXISTING WATER WELLS - CLIMATOLOGICAL DATA - VEGETATION SURVEY - SOIL PHYSICAL AND CHEMICAL ANALYSIS - EVALUATION OF SOIL EROSION POTENTIAL AND PROVIDE MODIFICATIONS TO THE SITE TOPOGRAPHY TO MINIMIZE IMPACT FROM SHORT AND LONG TERM USE OF THE LAND - LOCATE WATER WELL LOCATIONS WITHIN A TWO MILE RADIUS • CLIMATOLOGICAL ASSESSMENT WILL BE CONDUCTED AS WELL AS AN EVALUATION OF THE CLIMATE ON THE OPERATION OF THE LAND APPLICATION FACILITY. • A VEGETATION ASSESSMENT WILL BE CONDUCTED USING PRIOR KNOWLEDGE AND LITERATURE SURVEY TO SUGGEST APPROPRIATE TYPES OF VEGETATION TO BE USED IN THE LAND APPLICATION SYSTEM. BECAUSE THIS WOULD BE A LITERATURE SEARCH, ONLY ESTIMATES WOULD BE AVAILABLE FOR SUCH THINGS AS EVAPOTRANSPIRATION, UPDATE OF INORGANIC CONSTITUENTS AND SUITABILITY OF SPECIFIC FLORA. • THE SOIL SAMPLING WILL BE DONE BASED ON A STATISTICAL BASIS TO OBTAIN MORE EFFICIENT RESULTS AT LOWER COST. • A PHASE I REPORT WILL BE PREPARED WITH CONCLUSIONS AND RECOMMENDATIONS. EPNG NOTES: - SATISFIES ALL THE RFP REQUIREMENTS - DOES NOT PROPOSE A DIFFERENT APPROACH	• WILL CONDUCT A DRILLING PROGRAM TO INCLUDE FOUR WATER WELLS, COLLECTION OF SAMPLES AND EVALUATION OF DATA. • WILL PREPARE A MAP SHOWING THE SOIL AND HYDROLOGICAL CHARACTERISTICS WHICH WOULD IMPACT LAND APPLICATION. • WILL CONDUCT MATHEMATICAL PREDICTIVE MODELING USING THE RITZ MODEL OR OTHER MODELS. • A PHASE II REPORT WILL BE PREPARED INCLUDING THE ITEMS LISTED IN THE EPNG SCOPE OF WORK. ALSO, CONCLUSIONS AND RECOMMENDATIONS WILL BE MADE THAT WOULD IMPACT THE CONTINUATION OF THE PROJECT. EPNG NOTES: - SATISFIES ALL THE RFP REQUIREMENTS - DOES NOT PROPOSE A DIFFERENT APPROACH	• PROPOSE TO DESIGN A PROGRAM SIMILAR TO THE ONE OUTLINED IN TABLE 2-1 AND TABLE 2-2 (SEE WCC PROPOSAL). EPNG NOTES: - SATISFIES ALL THE RFP REQUIREMENTS - THIS COST INCLUDES DESIGN & IMPLEMENTATION OF THIS PHASE - CONSULTANT WOULD NEED TO EXPLAIN HOW THEY WOULD IMPLEMENT THIS PHASE

CONSULTANTS BID SUMMARY
LAND APPLICATION FEASIBILITY STUDY
SAN JUAN RIVER PLANT
FEBRUARY 1987

CONSULTANT: K. W. BROWN & ASSOCIATES

PHASE I

- WILL CONDUCT DATA GATHERING AND INTERPRETATION EFFORT BEFORE CONDUCTING THE FIELD SURVEY.
- PROPOSE NOT TO CONDUCT ANY GEOPHYSICAL TESTING BECAUSE THE EPNG SITES ARE SMALL AND WOULD NOT BE COST EFFECTIVE.
- WILL CONDUCT A DETAIL SOIL SURVEY BY THE SCS METHOD. SOIL CORING WILL BE USED. A DETAILED SOIL MAP WILL BE PREPARED ON AERIAL PHOTOGRAPHS.
- THE SOILS WILL BE SAMPLED AND ANALYZED TO CHARACTERIZE THE PHYSICAL AND CHEMICAL PROPERTIES OF EACH MAP UNIT ON THE PROPOSED SITES.
- WILL CONDUCT GEOLOGIC AND HYDROGEOLOGIC CHARACTERIZATION OF THE SITES. THIS WILL ENTAIL FIELD WORK, IN-HOUSE DATA, AND LITERATURE EVALUATIONS.
- WILL CONDUCT A BRIEF DRILLING PROGRAM DURING PHASE I TO CONFIRM THE INITIAL ASSESSMENT OF THE SITE'S FEASIBILITY FOR LAND APPLICATION. THIS PROGRAM WILL CONSIT OF THE FOLLOWING:
  - FIVE EXPLORATORY BORINGS ACCROSS THE ENTIRE FACILITY.
  - ONE CORE SAMPLE PER EACH THREE FEET OF BOREHOLE WILL BE COLLECTED FOR PARTICLE SIZE, DENSITY AND MOISTURE ANALYSIS.
  - PERMEABILITY MEASUREMENTS (OPEN HOLE METHOD) WILL BE TAKEN, APPROXIMATELY TWO MEASUREMENTS PER STRATIGRAPHIC LAYER.
  - ADDITIONAL CORE SAMPLES WILL BE COLLECTED FOR LABORATORY MEASUREMENT OF PERMEABILITY AND COMPARED TO FIELD MEASUREMENTS.
  - DETAILED DESCRIPTIONS OF LITHOLOGY, STRUCTURE AND MORPHOLOGY WILL BE MADE FOR EACH LAYER ENCOUNTERED DURING DRILLING.
- BY INCLUDING A DRILLING PROGRAM IN PHASE I WILL ENABLE EPNG TO ENTER PHASE II WITH A MORE COMPLETE UNDERSTANDING OF THE SUBSURFACE CONDITIONS NECESSARY TO PROPERLY LOCATE AND INSTALL A GROUNDWATER MONITORING SYSTEM. THE DRILLING PROGRAM FOR PHASE II WILL THUS BE MINIMIZED TO INSTALLATION OF MONITORING WELLS, ESTABLISHING DEPTH TO BEDROCK AND COLLECTING SAMPLES FOR PHYSICAL PROPERTIES ANALYSIS.
- WHILE CONDUCTING THE SUBSURFACF INVESTIGATIONS, THE HYDROGEOLOGIST WILL ALSO EVALUATE SURFACE FEATURES OF THE SITES.
- WILL CONDUCT A WATER WELL SURVEY AND WATER QUALITY ASSESSMENT.
- A CLIMATOLOGICAL ASSESSMENT/WATER BALANCE WILL BE CONDUCTED.
- A VEGETATION SURVEY WILL BE CONDUCTED TO ASSESS DOMINANT VEGETATION AND PERCENT COVER. A LITERATURE SEARCH WILL BE MADE TO COMPILE A LIST OF POSSIBLE SPECIES TO USE WHICH MAXIMIZE EVAPOTRANSPIRATION AND STILL BE TOLERANT TO THE WASTEWATER.
- WILL PREPARE A PHASE I REPORT WITH FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. IN ADDITION TO RECOMMENDATIONS, GENERAL COST ESTIMATES WILL BE PREPARED TO ENABLE EPNG TO COMPARE THE ECONOMIC FEASIBILITY OF LAND APPLICATION RELATIVE TO OTHER ALTERNATIVES.

EPNG NOTES:
- SATISFIES ALL THE RFP REQUIREMENTS
- DOES NOT RECOMMEND A GEOPHYSICAL SURVEY
- THEY RECOMMEND TO BEGIN DRILLING IN PHASE I TO GATHER BETTER AND DETERMINE THE FEASIBILITY SOONER
- THEY RECOMMEND CONDUCTING PERMEABILITY TESTS IN THE FIELD DURING THIS PHASE

PHASE II

- WILL PREPARE A MONITORING WELL INSTALLATION PLAN. THE PLAN MOST LIKELY CALL FOR A MINIMUM ONE UPGRADIENT WELL AND THREE DOWNGRADIENT WELLS FOR EACH PROPOSED SITE. AN ADDITIONAL BACKGROUND WELL MAY BE NEEDED IN ORDER TO ESTABLISH BACKGROUND WATER QUALITY.
- DURING DRILLING, LITHOLOGY, STRATIGRAPHY, AND PERMEABILITY TESTS WILL BE CONDUCTED.
- THE PIEZOMETRIC SURFACE WILL BE OBSERVED FOR SEVERAL DAYS TO MONITOR THE WATER LEVEL FLUCTUATION.
- WILL SAMPLE SURFACE AND GROUND WATER.
- A MONITORING PROGRAM WILL BE OUTLINED FOR THE LAND APPLICATION SYSTEM.
- A MAP OF THE POTENTIAL LAND APPLICATION SITE WILL BE PREPARED AND WILL INCLUDE LOCATION AND CHARACTERISTICS OF THE SITE INCLUDING DEPTH TO GROUNDWATER, DIRECTION OF GROUNDWATER FLOW, SURFACE RUNOFF PATTERNES, SURFACE STRUCTURES AND EXISTING PUBLIC AND PRIVATE WELLS.
- APPROPRIATE MATHEMATICAL MODELING WILL BE CONDUCTED UNDER BOTH CONSERVATIVE AND NON-CONSERVATIVE SCENARIOS. MODELING WILL INCLUDE INVESTIGATIONS OF SEVERAL ASPECTS OF LAND APPLICATION OF WASTEWATER.
- A REPORT FOR PHASE II WILL BE PREPARED SUMMARIZING THE FINDINGS OF THE ABOVE TASKS MAKING CONCLUSIONS AND RECOMMENDATIONS BASED ON PHASE I AND II DATA. THE REPORT WILL INCLUDE (A) SITE GEOLOGY, (B) HYDROLOGY, HYDROGEOLOGIC CHARACTERISTICS, (C) SITE MAP AND (D) MODELING RESULTS.

EPNG NOTES:
- SATISFIES ALL THE RFP REQUIREMENTS
- THEY RECOMMEND ONE UPGRADIENT WELL
- THEY RECOMMEND THREE DOWNGRADIENT WELLS
- THEY RECOMMEND ONE BACKGROUND WELL
- THEY WILL PREPARE A LAND APPLICATION GROUNDWATER MONITORING PROGRAM
- THEY FEEL THAT THERE MAY BE A GOOD POSSIBILITY THAT WITH THEIR APPROACH PHASE III WILL NOT BE NEEDED

PHASE III

- DO NOT RECOMMEND LABORATORY BENCH-SCALE (SEE PROPOSAL PP.13-14).
- WILL CONDUCT FIELD TESTING TO DEMONSTRATE THE EFFECTIVENESS OF LAND APPLICATION AND TO PROVIDE FINAL DESIGN AND MANAGEMENT GUIDENCE.
- WILL DESIGN A FIELD PLOT STUDY WITH REPLICATES TO EVALUATE LAND APPLICATION EFFECTIVENESS. THIS DESIGN WILL INCLUDE:
  - PLOTS EQUIPPED WITH SOIL-PORE LIQUID SAMPLERS TO EVALUATE LEACHATE QUALITY AND TENSIOMETERS TO MEASURE SOIL MOISTURE CONTENT WITH DEPTH AND SOIL MOISTURE FLUX.
  - SOIL CORES WILL BE ANALYZIED TO DETERMINE FATE OF WASTE CONSTITUENTS.
- A REPORT FOR PHASE III WILL BE PREPARED. THIS REPORT WILL DESCRIBE THE ABOVE PROGRAM AND PROVIDE CONCLUSIONS AND RECOMMENDATIONS

EPNG NOTES
- SATISFIES ALL THE RFP REQUIREMENTS
- THEY DO NOT RECOMMEND A LABORATORY BENCH-SCALE STUDY
- THEY RECOMMEND CONDUCTING A FIELD TESTING TO DEMONSTRATE THE FEASIBILITY OF THE SYSTEM, IF THE DATA GATHERED IN PHASES I AND II WAS NOT CONCLUSIVE
- THEY WILL USE SOIL-PORE SAMPLERS TO EVALUATE LEACHATE

CONSULTANTS BID SUMMARY
LAND APPLICATION FEASIBILITY STUDY
SAN JUAN RIVER PLANT
FEBRUARY 1987

CONSULTANT: ROBERTS/SCHORNICK & ASSOC.

PHASE I

- WILL DEVELOP A PROJECT QUALITY ASSURANCE/QUALITY CONTROL PLAN.
- WILL CONTROL A SOIL SERIES INVESTIGATION TO CHARACTERIZE THE SOIL PROPERTIES RELEVANT TO LAND APPLICATION.
- WILL REVIEW POTENTIAL VEGETATION SPECIES AND MAKE RECOMMENDATIONS. TWELVE SITES WILL BE RANDOMLY SAMPLED.
- THE FOLLOWING SAMPLES WILL BE COLLECTED:
  - 36 SAMPLES FOR SCS PARAMETERS
  - 24 SAMPLES FOR LAF PARAMETERS
  - 4 UNDISTURBED HYDRAULIC CONDUCTIVITY TESTS
- WILL CONDUCT A PRELIMINARY GEOHYDROLOGIC INVESTIGATION. FIRST THROUGH LITERATURE REVIEW AND LATER BY CONDUCTING A FIELD SURVEY.
- WILL NOT CONDUCT A RESISTIVITY SURVEY DURING PHASE I. RSA CONSIDERS THIS TO BE PREMATURE. INSTEAD PROPOSES TO CONDUCT A SITE VISIT AND REVIEW RECORDS OF PREVIOUS SUBSURFACE EXPLORATION ACTIVITIES.
- A PHASE I REPORT WILL BE PREPARED IN ACCORDANCE WITH EPNG REQUEST FOR PROPOSAL. STATISTICAL ANALYSIS WILL BE PERFORMED AS APPROPRIATE.
- IF LAND APPLICATION IS FEASIBLE, A CONCEPTUAL DESIGN WILL BE PRESENTED. PRELIMINARY SITE SELECTION AND LAND APPLICATIONS CALCULATIONS WILL BE PRESENTED.
- IF LAND APPLICATION APPEARS TO BE FEASIBLE PRELIMINARY CONCEPTUAL OPERATIONAL SYSTEMS WILL BE IDENTIFIED.
- DETAILED COST ESTIMATES FOR THE OPERATIONAL SYSTEMS WILL NOT BE PRESENTED IN THE PHASE I REPORT.

EPNG NOTES:
- SATISFIES ALL RFP REQUIREMENTS

PHASE II

- WILL DRILL 10 BORINGS TO DEPTHS RANGING BETWEEN 50 - 100 FEET DEEP.
- BORINGS WILL BE SAMPLED TO PROVIDE DATA ON THE STRATIGRAPHIC SEQUENCE BENEATH EACH POTENTIAL LAND APPLICATION SITE AND ALSO IN APPROPRIATE UP AND DOWNGRADIENT LOCATIONS.
- IF GEOPHYSICAL TECHNIQUES APPEAR TO BE REQUIRED THESE WILL BE SELECTED AND IMPLEMENTED.
- IT IS ESTIMATED THAT 8 WELLS WILL BE INSTALLED AT TWO UPGRADIENT AND SIX DOWNGRADIENT LOCATIONS. THESE WELLS WILL BE CONSTRUCTED OFF 2 INCH DIAMETER PVC CASING AND SCREEN.
- IF SUBSURFACE EXPLORATION DISCLOSES THE PRESENCE OF UNEXPECTED CONDITIONS, ADDITIONAL EXPLORATORY AND MONITORING WELLS MIGHT BE REQUIRED.
- WILL PERFORMED FIELD TESTING TO DETERMINE THE HYDRAULIC PROPERTIES OF THE WATER-BEARING STRATA. PIEZOMETRIC LEVEL MEASUREMENTS AND SLUG TESTS WILL BE ALSO INCLUDED.
- A MAP SHOWING PIEZOMETRIC LEVELS WILL BE PREPARED. THIS AND DATA FROM PHASE I WILL BE USED TO ESTIMATE SEASONAL CHANGES IN THE WATER-BEARING STRATA.
- IF DATA COLLECTED DURING PHASE II INDICATE THAT ON OR MORE SHORT DURATION PUMPING TESTS WOULD BE VALUABLE THESE WILL BE CONDUCTED ACCORDINGLY. HOWEVER, THE PERFORMANCE OF PUMPING TESTS IN NOT PLANNED
- WILL COLLECT GROUNDWATER SAMPLES (SURFACE WATER, IF NEEDED). TWO SETS OF WATER SAMPLES ARE RECOMMENDED TO BETTER CHARACTERIZE THE GROUNDWATER(SEE P.22 OF PROPOSAL).
- MATHEMATICAL MODELING WILL BE CONDUCTED TO ESTIMATE THE AVERAGE SOIL RETENTION AND TREATMENT EFFICIENCY.
- BREAKTHROUGH CONCENTRATIONS AT THE BOTTOM OF THE TREATMENT ZONE BOUNDARY WILL BE PREDICTED.
- THE CONSTITUENT'S "LIFE HISTORY" WILL BE DETERMINED AT DEFINITIVE TIME INTERVALS IN THE TREATMENT ZONE SOIL MATRIX. THE OUPUT FROM THIS MODEL WILL BE UTILIZED IN MODELING IMPACTS TO THE GROUNDWATER AQUIFER SYSTEM.
- MATHEMATICAL MODELING WILL BE CONDUCTED TO ESTIMATE THE MANNER BY WHICH WATER AND CHEMICAL COMPOUNDS ORIGINATING IN THE TREATMENT ZONE COULD MOVE FROM THE GROUND SURFACE THROUGH THE LAND TREATMENT ZONE.
- A PHASE II REPORT WILL BE PREPARED IN ACCORDANCE WITH THE RFP.
- IF LAND APPLICATION CONTINUES TO APPEAR FEASIBLE, THE CONCEPTUAL PHASE I OPERATION SYSTEM WILL BE UPDATED. PLANNING LEVEL COST ESTIMATES WILL BE GENERATED.
- RSA RECOMMENDS THAT BASED ON THE INFORMATION GATHERED, EPNG CONSIDER EARLY ESTABLISHMENT OF VEGETATIONAL PLOTS SO THAT SUFFICIENT GROWTH

EPNG NOTES:
- SATISFIES ALL THE RFP REQUIREMENTS

PHASE III

- RSA FEELS THERE IS A GOOD POTENTIAL THAT THIS PHASE MAY NOT BE NECESSARY.
  - CHARACTERIZE EFFECTS OF WASTESTREAM AAPPLICATIONS ON SELECTED VEGETATION GROWTH.
  - TWO TEST PLOTS & TWO DIFFERENT WASTEWATER FLOW RATES WILL BE USED.
  - TWO CONTROL PLOTS WILL BE USED WITH NON-WATEWATER IRRIGATION.
  - ONLY ONE UNIT AREA WILL BE USED.
  - CHARACTERIZE LAND APPLICATION PARAMETER DISTRIBUTION IN THE TREATMENT ZONE.
  - LEACHING COLUMNS WILL BE CONSTRUCTED OF PREFERABLY UNDISTURBED SOIL. "BARREL" LYSIMETERS WILL BE USED FOR THE LEACH COLUMNS.
  - THE EXPERIMENTAL STUDY WILL BE CARRIED OUT AT THE PLANT. RSA WILL PARTICIPATE IN THE START UP OF THE FIELD STUDY AND TRAIN EPNG STAFF IN RAGARDS TO WASTEWATER APPLICATION AND MAINTENANCE PROCEDURAL REQUIREMENTS.
- A PHASE III REPORT WILL BE PREPARED AND WILL INCLUDE THE FOLLOWING:
  - MODELING CALCULATIONS BASED ON THE EXPERIMENTAL RESULTS.
  - EXPERIMENTAL DESIGN STUDY WORK WITH RESULTS
  - UPDATED CONCEPTUAL DESIGN OF THE LAND APPLICATION SYSTEM PRESENTED IN PHASE II.

EPNG NOTES:
- SATISFIES ALL THE RFP REQUIREMENTS

CONSULTANTS BID SUMMARY
LAND APPLICATION FEASIBILITY STUDY
SAN JUAN RIVER PLANT
FEBRUARY 1987

CONSULTANT: METRIC CORPORATION

PHASE I

- WILL REVIEW ALL AVAILABLE SECONDARY GEOLOGIC AND HYDROGEOLOGIC DATA.
- WILL CONDUCT FOUR SETS OF FOUR BORINGS FOR GATHERIG SUBSURFACE DATA RATHER THAN A RESISTIVITY SURVEY.
- WILL CONDUCT POSSIBLE SEISMIC SURVEY.
- WILL CONDUCT A DETAILED (ORDER ONE) SURVEY OF THE SOILS AT EACH PROPOSED LAND APPLICATION SITE.
- WILL GATHER PHYSICAL AND CHEMICAL SOIL CHARACTERISTICS .
- ANALYSIS AND MITIGATION DESIGN WILL BE PERFORMED OF THE SURFACE FEATURES AFFECTING LAND APPLICATION OPERATION.
- WILL PERFORM EXHAUSTIVE LITERATURE REVIEW TO COMPLETELY DESCRIBE EXISTING GEOLOGICAL CHARACTERISTICS OF LAND APPLICATION AREAS AND DOCUMENT IN A REPORT.
- WILL REVIEW STATE ENGINEER OFFICE RECORDS ON EXISTING WATER WELLS.
- WILL PERFORM LITERATURE SEARCH OF CLIMATOLOGICAL DATA AND PERIOD OF WASTEWATER STORAGE.
- WILL PERFORM LITERATURE REVIEW OF VEGETATION AND POSSIBLE SPECIES TO BE USED. WILL TALK WITH GOV. RESEARCH GROUPS ABOUT ADAPTED OR ITRODUCED VEGETATION INSTRUMENTAL IN HIGH CONSUMPTIVE USE RATES.WILL RECOMMEND SEEDING RATES AND SPECIES FOR MAXIMUM EVAPORATION RATES.
- WILL PREPARE A PHASE I REPORT AS REQUESTED BY EPNG.

EPNG NOTES:
- SATISFIES ALL THE RFP REQUIREMENTS
- THEY WILL CONDUCT 4 SETS OF 4 BORINGS RATHER THAN RESISTIVIY
- THEY WILL CONDUCT POSSIBLE SEISMIC SURVEY

PHASE II

- O WILL INSTALL FOUR 2-INCH PVC MONITORING WELLS TO AN AVERAGE OF 20 FEET USING THEIR OWN CME-55 HOLLOW STEM AUGER EQUIPPED DRILLING RIG.
- O THEIR GROUNDWATER MONITORING PROGRAM WILL BE BASED ON PHASE I INVESTIGATIONS. IT WILL INCLUDE SAMPLING AND SAMPLE PRESERVATION. ONE SAMPLING WILL BE PERFORMED BY METRIC.
- WILL CONDUCT NINE RING INFILTROMETER TESTS AT THE SITES TO DETERMINE VERTICAL INFILTRATION RATES.
- WILL PREPARE A MAP SHOWING ALL RELEVANT HYDROLOGIC AND MAN MADE FEATURES WITHIN 1/4 MILE OF THE PROPOSED LAND APPLICATION SITES.
- APPROPRIATE MATHEMATICAL MODELING WILL BE PERFORMED OF THE VADOSE AND SATURATED ZONES THAT ARE HYDRAULICALLY CONNECTED WITH THE "RECEIVING WATERS".
- A REPORT WILL BE PREPARED CONTAINIG THE DATA, ANALYSES AND RECOMMEMDATIONS DEVELOPED IN PHASE II AND II.

EPNG NOTES:
- SATISFIES ALL THE RPF REQUIREMENTS
- THEY WILL DRILL FOUR 2-INCH WELLS @ AVG. 20 FT.
- THEY WILL SAMPLE ONLY ONE TIME
- THEY WILL CONDUCT 9 RING INFILTROMETER TESTS TO DETERMINE INFILTRATION RATES

PHASE III

- WILL PREPARE AN EXPERIMENTAL DESIGN (PLAN) ADDRESSING ADDITIONAL PRIMARY DATA COLLECTION REQUIRED FOR FINAL DESIGN.
- WILL ADDRESS THE NEED FOR VEGETATION.
- WILL ADDRESS THE NEED FOR VEGETATION TEST PLOTS, LABORATORY BREAKTHROUGH COLUMNS AND ANY OTHER RECOMMENDED TESTING OR RESEACH REQUIRED TO DETERMINE DESIGN PARAMETERS.
- THE EXPERIMENTAL DESIGN WILL INCLUDE A VADOSE ZONE MONITORING PLAN.

EPNG NOTES:
- SATISFIES ALL THE RFP REQUIREMENTS
- BASED ON PHASES I & II RESULTS THEY WILL ADDRESS THE NEED FOR VEGETATION TEST PLOTS, LABORATORY BENCH-SCALE AND/OR OTHER TESTING
- THEY WILL INCLUDE A VADOSE ZONE MONITORING PLAN

P R O P O S E D   S C O P E   O F   W O R K

LAND APPLICATION FEASIBILITY STUDY

FOR EL PASO NATURAL GAS COMPANY

SAN JUAN RIVER PLANT

FARMINGTON, NEW MEXICO

P R O P O S E D   S C O P E   O F   W O R K

LAND APPLICATION FEASIBILITY STUDY

FOR EL PASO NATURAL GAS COMPANY

SAN JUAN RIVER PLANT

FARMINGTON, NEW MEXICO

A. General Background

The New Mexico Oil Conservation Division (OCD) is responsible for ensuring that Oil & Gas operations have no adverse environmental impacts on surface or ground water. OCD requested that El Paso Natural Gas Company (EPNG) prepare a discharge plan for its San Juan River Plant describing in detail the methods or techniques EPNG proposes to use in order to comply with the regulations of the New Mexico Water Quality Control Commission. EPNG submitted a discharge plan in April, 1986. After OCD's review of the plan and based on the Agency's recommendation, EPNG proposed to revise the section of the plan relating to non-contact wastewater (wastewater containing no hydrocarbons) and investigate disposal of this portion of the plant's waste streams using a land application system. To obtain approval for this proposed system OCD has requested that EPNG conduct a feasibility study.

The San Juan River Plant is located in Section 1, T. 20 N., R. 15 W., San Juan County, New Mexico, approximately 8 miles west of Farmington, New Mexico. This Plant is engaged in the compression and processing of natural gas and the recovery of natural gas liquid products. Non-contact wastewater produced in the plant has been estimated at approximately 61,690 gallons per day (gpd). The following information must be gathered and evaluated to demonstrate the feasibility of using land application:

1. The topography of the site(s) and its immediate surroundings and its influence on the operation of a land application system, e.g. runoff patterns, surface flow, etc.

2. The geological stability (faults, fractures, fissures) of the land application site(s).

3. The data necessary to physically and chemically characterize the soils within potential land application site(s).

4. The data necessary to evaulate the hydrologic and hydrogeologic characteristics of the site(s).

5. Range estimates of water and constituents absorption by vegetation likely to be used, or that can naturally invade the area.

6. Appropriate mathematical modeling of the land application site using conservative and non-conservative scenarios and information gathered from Items 1 through 5.

7. A report containing all the information gathered, results of the mathematical modeling and conclusions and recommendations. Determine system effectiveness considering surface and ground water, both within and outside the plant property. If the information gathered shows land application feasible, determine the need for an experimental laboratory demonstration.

8. If a laboratory experimental demonstration is required, prepare an experimental design to evaluate the most feasible scenarios. The experimental design should address any potential pathways for the discharged constituents and should quantitatively define them. The experimental work should provide appropriate waste loading rates and preliminary information concerning frequency and type of waste application to guarantee the ability of the soil and biota to assimilate constituents. Also, the experimental work should provide information on operational features. The program should comply with pertinent environmental NMOCD regulations. The final results should provide an estimate on the lifetime of the system before NMWQCC groundwater standards are exceeded.

B. Scope of Work

Determination of the feasibility of land application requires the identification and quantitative measurement of site characteristics that control the stabilization, confinement and potential migration of the wastewater constituents. Contractor will perform the following:

Phase I

1. Reconnaissance of the proposed land application site. Contractor should indicate those tasks which can be achieved by literature search and those requiring field work. Also, contractor should determine if a surface resistivity survey is required.

   If a surface resistivity survey is deemed necessary, prepare a plan for implementing a survey of the area within the property boundary (where appropriate) as well as the area immediately north of the plant property boundary. The plan should include the resistivity method to be used, reasons for using such method and an implementation schedule. The surface resistivity survey should aid in locating groundwater sampling installations.

2. A detailed soil survey in accordance with the standard Soil Conservation Service (SCS) techniques and procedures. The soils found on the site need to be identified and a detailed map of the area prepared. This map will include a description of each soil series. Samples of the soil horizons in the unsaturated zone should be collected and analyzed for the physical and chemical properties required for land application design. Evaluate (a) water holding capacity of the unsaturated zone, (b) soil salinity, and the shrink-swell potential of the soil.

   Evaluation of the water transmission characteristics based on the hydrological classification of the soil series.

   Evaluation of (a) land surface slope, (b) susceptibility of soil erosion (hydraulic or surface flow), (c) vegetation patterns and their potential roles (d) necessary site modification to allow land application to be undertaken, with an evaluation of the potential impact on the short-term and long-term operation of the system.

3. An evaluation of the geologic formations underlying the land application site should be prepared to aid in characterization, design and management of the site . Attention should be given to:

   a) General characterization of the geology;
   b) Depth, stability and water transmission capability of the subsurface soils;
   c) Degree of weathering with depth;
   d) Outcrops and types of bedrock, as well as bedrock and/or other underlying strata irregularities such as fissures, faults, fractures, crevices, joints, caves, springs, sinkholes, seeps and limestone cavities.

4. A climatological assessment of the site and its impact on the operation of the land application system. Also, provide minimum monthly determinations of the amount of time during which wastewater must be diverted to holding ponds.

5. A determination of the need for vegetation other than native flora, including a list of possible species or mixtures of species that maximize evapotranspiration and survive the environment created by wastewater application. Estimate ranges of constituent uptake for vegetation likely to exist at the site.

6. Prepare a report that includes, but is not limited to, all of the information referred to in Steps 1 through 5, as well as any preliminary conclusions which may be reached using this information.

Phase II

1. Using all available information, properly locate and install groundwater sampling locations. Well construction will be to EPNG specifications. Also, contractor will evaluate site hydrological and hydrogeological characteristics such as: (1) depth to bedrock or gravel, (2) depth to groundwater table including seasonal perched water level and (3) physical and chemical characterization of surface and groundwater upgradient, downgradient and within the potential land application site.

   Groundwater samples will be taken by the contractor in accordance with U.S. Environmental Protection Agency methods of groundwater sampling. Samples will be delivered to the EPNG representative for analysis by EPNG or its contractors.

2. Prepare a map of the potential land application site(s) showing runoff patterns, groundwater depths and flow directions. All existing private and/or public wells, springs and other water supplies within one-fourth mile of the site borders should be indicated on the map. Any quarries, landfills, sand and gravel pits, surface mines, or other activities that come into contact with or come close to the groundwater table within one-fourth mile of the site boundaries should be included on the map. Any nearby potential sources of groundwater quality deterioration other than the proposed land application site should be identified and their locations shown.

3. Evaluate data obtained in **Phases I** and **II** and conduct appropriate mathematical predictive modeling using conservative and non-conservative scenarios.

4. Prepare a report that includes but is not limited to the following:

   a) Hydrological and hydrogeological characteristics of the land application site(s).

b) All information gathered in Phases I and II.

c) Map as outlined in Section 2.

d) Appropriate mathematical models performed under conservative and non-conservative scenarios.

Phase III

If **Phases I** and **II** show that land application may be feasible, an experimental design should be prepared to assess the most feasible scenarios evaluated under **Phase II.** The experimental design should include site test plats for vegetation likely to be used and laboratory breakthrough columns (undisturbed). This study will be used to establish (a) the feasibility of land application, (b) appropiate waste loading rates, (c) frequency of waste application, (d) type of waste application, (e) criteria for management of the soil and site to guarantee the ability of the soil to assimilate constituents , (f) life of the land application site and (G) definition of the implementation of a final design.

TABLE 1

EPNG SAN JUAN RIVER PLANT

GROUNDWATER CHARACTERIZATION MONITORING PARAMETERS

COD
Nitrate - N
Oil and Grease
TOC
O - Phosphate
Cyanide (Total)
Phenolics
Arsenic
Barium
Cadmium
Calcium
Chromium (Total)
Copper
Hardness (As $CaCO_3$)
Iron
Lead
Magnesium
Manganese
Mercury
Potassium
Selenium
Silver
Sodium
Zinc
Alkalinity (Total, as $CaCO_3$)
Alkalinity (Bicarbonate as HCO_3)
Chloride
Fluoride
TDS
Total Residue
Sulfate
PCB's
pH
Ethylene Dibromide
Naphthalene
Monomethylnaphthalene
Anion/Cation Balance (in meq)
Volatile Organics
(see next page)

TABLE 1 (Cont'd.)

Volatile Organics

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
Trichlorofluoromethane
1,1-Dichloroethane
1,1-Dichloroethene
Trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
Carbon Tetrachloride
Bromodichloromethane
1,2-Dichloropropane
Trans-1,2-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
cis-1,3-Dichloropropene
Benzene
2-Chloroethylvinyl Ether
Bromoform
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
Chlorobenzene
Ethylbenzene
Xylenes

P R O P O S E D   S C H E D U L E

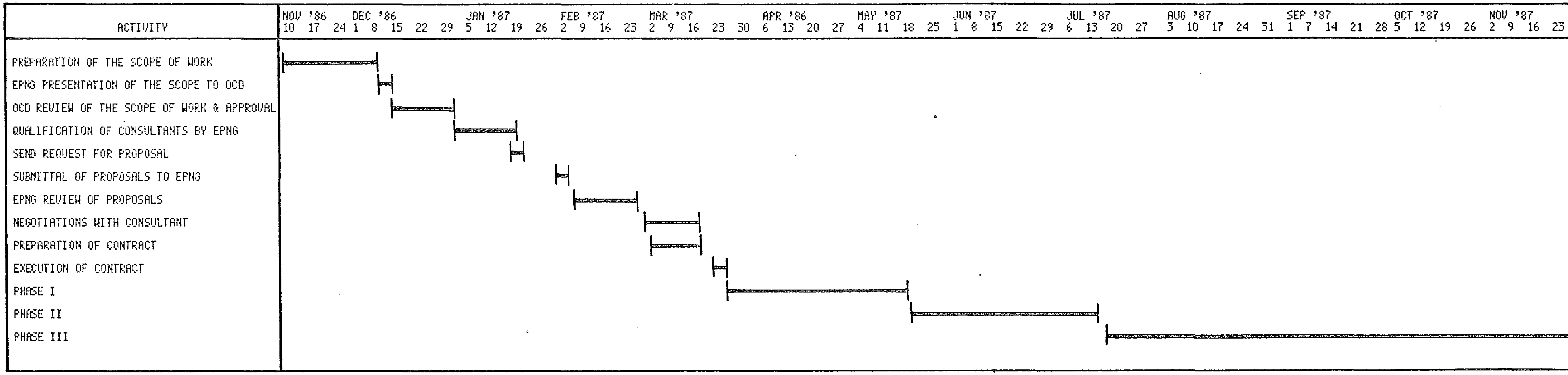
LAND APPLICATION FESIBILITY STUDY

FOR EL PASO NATURAL GAS COMPANY

SAN JUAN RIVER PLANT

FARMINGTON, NEW MEXICO

LAND APPLICATION FEASIBILITY STUDY PROPOSED SCHEDULE
EL PASO NATURAL GAS COMPANY
SAN JUAN RIVER PLANT
FARMINGTON, NEW MEXICO



STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

November 12, 1986

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501-2088
(505) 827-5800

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. John M. Craig
Vice President
El Paso Natural Gas Co.
P. O. Box 4990
Farmington, N.M. 87499

RE: GROUND WATER DISCHARGE PLANS FOR EL PASO NATURAL GAS COMPANY, SAN JUAN RIVER PLANT; GW-33, GW-39

Dear Mr. Craig:

Your letters of October 22 and October 31, 1986, requesting an extension of time to operate the existing waste management system at the San Juan River Plant have been received by this Division. As discussed by OCD staff in the November 8, OCD-EPNG meeting in Santa Fe, the discharge plan will be divided into two separate plans so that work on modifying the contact wastewater system can proceed independently of the feasibility study for the land application system. Therefore, Discharge Plan GW-33 will address the contact wastewater streams and plant operations (spills, storm runoff, housekeeping, etc.) and public notice will be issued immediately. Discharges of non-contact wastewater will be assigned discharge plan number GW-39.

As a result of the division of wastewater disposal review into two separate discharge plans, the following extensions of time are authorized for operation of the existing waste management system without an approved discharge plan:

(1) GW-33, Contact wastewater and plant operations - from November 1, 1986, until February 1, 1987, provided final conceptual design information, a proposed schedule for pond construction, and a response to OCD's June 27, 1986 letter are received by December 5, 1986.

(2) GW-39, Non-contact wastewater from November 1, 1986, until October 31, 1987, provided that a land application investigation schedule (including anticipated dates for selection of a contractor, beginning of investigation, progress discussions with OCD, etc.) are received by December 5, 1986.

The EPNG-OCD discussions held November 8 on land application feasibility and methods were useful in developing general guidelines for further work on the concept. The key to agency approval of the disposal method is complete hydrogeological characterization of the proposed site and immediately surrounding area, and an operational plan that provides for accurate effluent application and monitoring. If the economics of land treatment are unfavorable, EPNG might want to consider changes in some wastewater streams to decrease salt loads, or investigate enhanced spray evaporation systems similar to those currently used by both Amoco and Basin Disposal in the Farmington area.

If you have any questions regarding this letter, or the discharge plan requirements, please contact David Boyer of my staff at 827-5812.

Sincerely,

R. L. STAMETS
Director

RLS:DGB:dp

cc: David Boyer
Frank Chavez, OCD-Aztec

EPNG
SAN JUAN RIVER PLT.

Meeting w/ NMOCD

11/7/86
Notes of H. Van

- CONTACT VS NON-CONTACT WASTEWATER

Ken pointed out what lines were contact and which ones were non-contact.

TDS of NON-CONTACT ≈ 2500 mg/l

- Salinity Limitations

NPDES limits would apply for surface. (Major Cannon?)
GW - WQCC standards apply to the groundwater.

Not too concern about salinity loading if LA is to be used.

- Hydrogeological Data

1. G.W. Quality data of the area where the land application
2. South of the gulf would req'd more hydrogeological data because is closer to the domestic systems

(Blending is appealing. to ~ 1,500 rather than 2500 - 3,000 mg/l.

3. Characterize the GW Qual. West of H_2O Pond,
4. " " surface runoff from the land application.

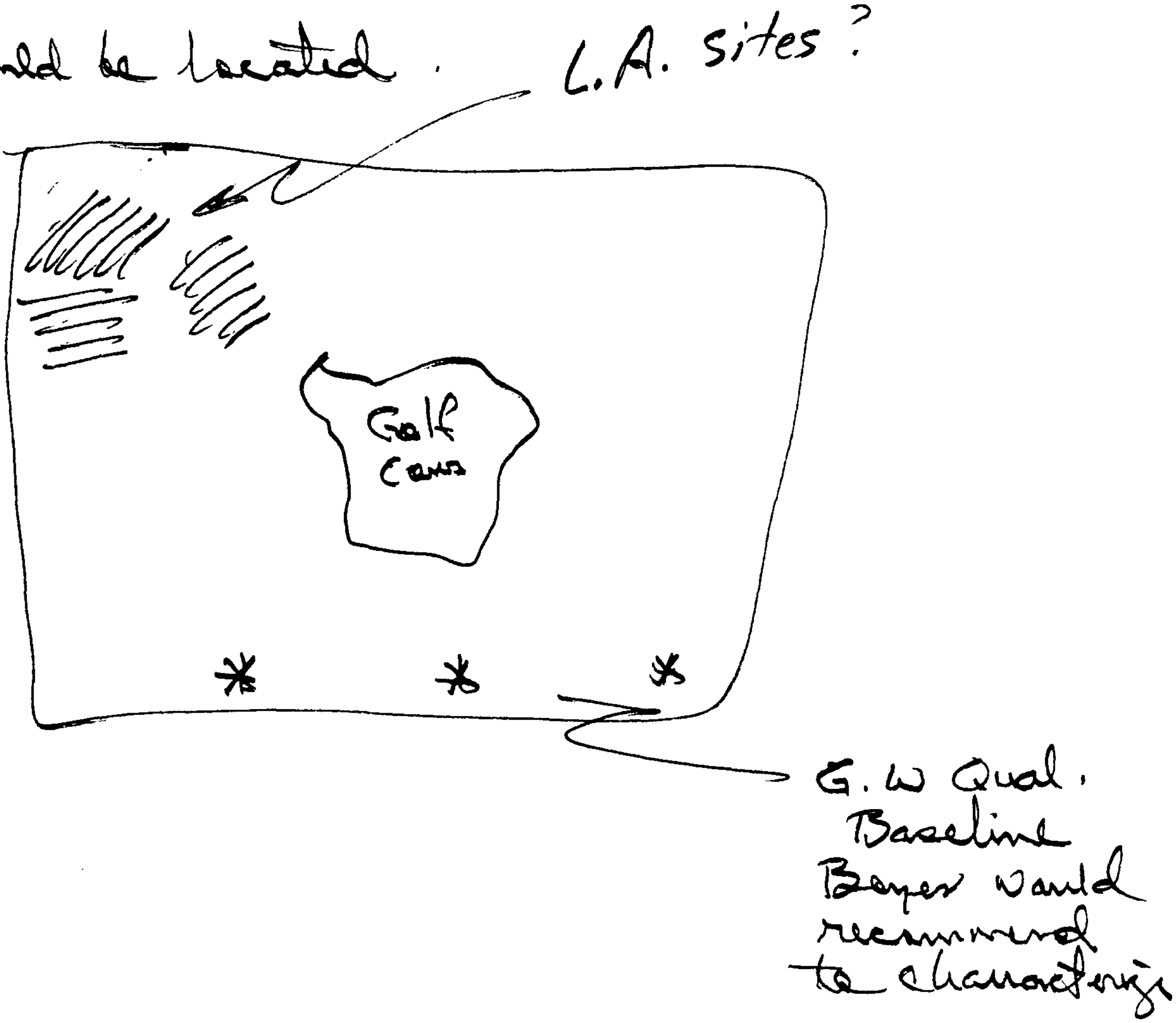
Any domestic wells in the area that could be impacted

G.W. Flow Characteristics (Movement & Direction)

Surface resistivity would help where the

L.A. = Land Application

wells could be located.



- Keep a balance to immobilize the salts. This is a function of soil characteristics.
- Beyer favors sprinklers
- Monitor Vadose Zone moisture content w/ Neutron monitor. during the LA project. This may be costly but not sure.

  Soil - Moisture distribution is important
  What is a good method for monitor soil moisture movement.
- Without ~~[illegible]~~ blending

{Handbook 64
{US Dept. of Agriculture.

- salt movement is very important
- How critical is to keep the salt in the vadose zone
- The idea is to keep the salts in the Vadose zone.
- Monitoring evaporation and precipitation

(Monitoring System — what instrumentation.)

<u>Strategy</u>

- Sample the existing domestic wells first to get an idea of G.W.
- Water levels — are important with respect to getting data about flow.
- Get G.W. quality and soil data first and then get together with NMOCD to plan the next phase
- Leach of the cores ~~which~~ we obtain in the area to see what
- What and how much is the [illegible] H2O ~~[illegible]~~ leaching? Bayer is interested.

REPORTING REQUIREMENTS

- Set up a schedule on how we propose to proceed for Boyer. A meeting after phase 1.
- Meeting to discuss the scope of work for Phase I → Proceed → Meeting after Phase I.

[what about enhanced evaporation] : Alternative?

- During the characterization of the G.W. include a monitoring well by the south flare pit.
- Be careful about surface resistivity method, Lee Acres used a good practical method:
- Contractor: Tracer Research Corp. of Tucson - Benzene Problem Orbital Gas Chromatography which analyzes the soil gas.

[In 2-3 weeks the schedule is due include the investigation of P-12 with the proposal & schedule for C.A.]

Boyer just wants to know about P-12 but most likely no aquifer restoration.

Keep work to N so subsurface movement to SW
Need hydro work in area E of golf course
What effect f.w. pond has on hydrology
Prob WT not bleaching cuz of salt movement

1. Characterize WQ E of golf course + W of raw water pond
See if subsurface drainage to WSW Charac.
gw flow
Impact of golf course - up + down gradient
WQ at property boundary

Com:
Monitor vadose zone moisture content
Keep salts in vadose zone - See how critical this is + if movement
What impact?

If gw < 1000, can't degrade up to 1000
> 1000, can't degrade further

Sample domestic wells in area + DTW

MW by P12

Notes of J. Bailey

For EPNG:	For OCD
H. Van	Boyer
K. Beasley	Bailey
J. Bridges	Anderson

El Paso
Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

October 31, 1986

Mr. David G. Boyer
Hydrogeologist/Environmental Bureau Chief
Energy and Minerals Department
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87501-2088

Subject: Discharge Plan for El Paso Natural Gas Company - San Juan River Plant, GW-33

Dear Mr. Boyer:

El Paso Natural Gas is in the process of evaluating land application of non-contact waste water at the San Juan River Plant as an alternative to existing disposal practices. However, preliminary research has revealed that an extensive study of site conditions and the long-term effects of the system will be required in order to ensure that both NMOCD and El Paso are satisfied with the proposed modifications. El Paso personnel will be meeting with you on Friday, November 7 to discuss the details of information requirements and the study plan.

It is expected that approximately nine months will be required to complete the feasibility study and an additional three months to assess the study results and complete a conceptual design. Therefore, El Paso Natural Gas respectfully requests permission to continue to operate the existing waste management system at the San Juan River Plant for a twelve-month period beginning November 1, 1986. As requested by you on October 31 in a conversation with El Paso personnel, and upon concurrence of the New Mexico State Land Commission, a pump-back system for the leachate collection area northwest of the plant to the existing disposal pond will be implemented as an interim control measure.

Very truly yours,

John M. Craig
Vice President

JMC:KEB:cm

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☒ Telephone ☐ Personal	Time 10:30	Date 10/31/86

Originating Party	Other Parties
Henry Van, Ken Beasley, EPNG (915) 541-2832, 325-2841	David Boyer OCD

Subject: San Juan River Plant - Discharge Plan revisions & Schedule

Discussion: Van and Beasley called to discuss extension of time to operate without an approved plan. They want to do thorough feasibility study on land application and request a year to complete the study, decide best option and submit design. After some discussion the following were decided: ① Contact ponds (and probably main plant separation) would be separate DP. EPNG requested to submit answers to June 27 letter and anticipated date of pond completed. OCD to issue public notice and review. ② Non-contact ponds can continue to be operated provided pump-back

Conclusions or Agreements: system operated to keep pond levels low. ③ EPNG needs to address 1400 mg/l TKN in area of flare pit — where going & how long & how bad. ③ Benzene at pipeline crossing to be addressed after talking to State Land Office. Not worried about more GW contamination since salts have already damaged, but have crossed to State land. EPNG will bring in an extension request on Friday. OCD will discuss land application criteria. [illegible] (11/7)

Distribution: EPNG File, San Juan River

Signed: D. G. Boyer

El Paso
Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

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OCT 24 1986
OIL CONSERVATION DIVISION
SANTA FE

October 22, 1986

Mr. David G. Boyer
Hydrogeologist/Environmental Bureau Chief
Energy and Minerals Department
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87501-2088

Subject: Discharge Plan for El Paso Natural Gas Company - San Juan River Plant, GW-33

Dear Mr. Boyer:

Because of the technical and regulatory concerns which were expressed in your evaluation of the San Juan River Plant Discharge Plan, El Paso has re-examined the disposal methods for non-contact wastewater outlined in that document and assessed the alternatives offered in your letter. As stated in the Plan itself, El Paso is dedicated to operating its facilities in a manner that insures environmental protection and compliance with all applicable regulations and has carefully considered various waste management systems in an effort to achieve this.

Based upon your recommendations, El Paso has evaluated land application of non-contact waste water and it appears to be the one which most completely satisfies mutual concerns. However, preliminary background work indicates that the opinions on the viability of this alternative are varied. In order to ascertain that all concerned are in accord on the objectives to be achieved by the proposed modifications, it would be beneficial to schedule a meeting at a time convenient to you to discuss your recommendations. El Paso personnel will arrange to be available at any time amenable to the Agency. Further study will be required later to assess system requirements and site conditions. For this reason, El Paso Natural Gas respectfully requests permission to continue to operate the existing waste management system at the San Juan River Plant. Once the uncertainties relating to the alternatives have been resolved, a concrete schedule for Plan revision and implementation can be established.

In closing, let me again express that El Paso Natural Gas wishes to cooperate with NMOCD in every way possible in this effort. We have a mutual objective in implementing these changes, the protection of the environment.

Very truly yours,

John M. Craig
Vice President

JMC:KEB:cm

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☒ Telephone ☐ Personal	Time 3 PM	Date 10/20/86

Originating Party	Other Parties
EPNG HENRY VAN + TEN	JAMI BAILEY

Subject

USE OF NON-CONTACT WATER FOR IRRIGATION AT SAN JUAN PLANT

Discussion

EPNG is checking into eliminating all unlined pits, retaining one lined pit for surge capacity, and using all non contact waste water (60,000 gal/day) for irrigation of 30-40 acres between the access road and the golf course. DTW is 25'. Their main concerns are that they cannot guarantee zero leachate, and they do not know if there would be minimal impact on groundwater, even with the dilution factors. In Dave Boyer's 6/27/86 letter to John Craig use of the waste water for irrigation was suggested as a means of disposal. They would like assurance that such a disposal would be approved.

Conclusions or Agreements

Distribution D. Boyer

Signed Jami Bailey

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☒ Telephone ☐ Personal	Time 11 AM	Date August 11, 1986

Originating Party	Other Parties
Henry Van, EPNG El Paso	D. Boyer OCD Ken Beasley, EPNG Farmington

Subject: EPNG San Juan River Plant - Land Application options

Discussion: Van and Beasley called to ask about criteria for land application. The major consideration, I told them, was that leachate not reach ground water, or cause existing salts to leach. The major points to concentrate on are the balance between application and evaporation uptake to tie up salts in vadose zone. Rainfall is not sufficient to leach downward. If cropping, have to have salt tolerant crop. Need off-season storage. Limited GW monitoring to characterize existing conditions and insure plan is working.

Conclusions or Agreements: Said that properly engineered and operated system is approvable, and referred them to US DA Handbook #60, "Soil Chemistry" text, and Profs at NMSU.

Distribution: San Juan River Plant File

Signed: D G Boyer

EL PASO NATURAL GAS COMPANY

ENVIRONMENTAL AUDIT DATA

(Use Additional Sheets Where Necessary)

(Answers such as; not known, not to our knowledge, don't know, etc. are acceptable. No answer is better than a wrong answer.)

I. General Information

A. Date : August 3, 1982

B. Facility : San Juan River Plant

C. Division : San Juan

D. Facility Personnel

1. Name of person responsible for environmental matters Buck Manley
   a. Amount of time spent on environmental matters 25% or as needed
   b. Other responsibilities Staff Engineer

2. Name of alternate W. B. Shropshire
   a. Amount of time spent on environmental matters 50% or as needed
   b. Other responsibilities Other Federal Regulations (MES, MMS, DOT)

E. Contact Between Plant and Regulatory Authority

where's list?

1. Has plant been visited by a regulatory agency(ies)? Yes
   a. What agency(ies)? See attached list
   b. When? ____
   c. Why? Water and air quality walk-through inspections; odor and smoke complaint investigations.

2. Has plant received notifications or other communications from regulatory agencies regarding actual or suspected noncompliance situations? No
   a. What agency(ies)? ____
   b. When? ____
   c. Why? ____
   d. Outcome? ____

3. Has plant been involved in any civil litigation? No
   a. With whom? ____
   b. When? ____
   c. Specifics? ____
   d. Outcome? ____

4. Have procedures for properly dealing with an agency inspection been reviewed at this plant? Yes; an established (7-8 year) policy procedu

F. On the attached topographic map of the facility and adjacent areas indicate the following by name commonly used at plant:

1. Buildings
2. Turbines
3. IC engines
4. Gas treating facilities
5. Gas extraction facilities
6. Gas dehydration facilities
7. Sulfur recovery unit
8. Incinerators, flares
9. Boilers
10. Heaters
11. Water Storage Tanks
12. Liquid fuel storage
13. Oil storage tanks
14. Loading racks (train and truck)
15. Chemical storage
16. Cooling towers
17. Water wells
18. Water treatment facilities
19. Cess pools and septic tanks/ drain fields
20. Disposal ponds
21. Lagoons (Reservoirs)
22. Pits
23. Injection wells
24. Brine Ponds and Handling Systems (Surge tank, pipes and pumphouse)
25. Waste discharge pipes
26. Current solid waste storage and disposal (dumps, landfills, containers, etc.)
27. Past solid waste storage disposal (dumps, landfills, containers, etc.)
28. Water bodies
29. Streams, rivers
30. Springs
31. Arroyos & gullies
32. Scrap storage
33. Drum storage
34. Transformers
35. Drip Condensate Tank
36. Sulfur Storage
37. Product Storage
38. API Separator (Not in use)
39. Fin Fans

II. Air Emissions

A. Internal Combustion Engines (compressors, auxiliaries, etc.)

Type (Cooper-Bessemer, GMV-10TF, etc.) *	:	(1)
Rated Horsepower: Sea level/site	:	/ / / 1/
Number of Similar Horsepower Units	:	
Hours of Operation/year, each*/	:	
Fuel Consumption/year, each	:	
Exhaust Stack Parameters:		

1/ How determined:
A) Emissions factors (whose)
B) Engineering Design
C) Calculated/Field Measured
D) Other (specify)

*/ If more than one, list on separate sheet

(1) See separate sheet

Stack height (ft.) [from ground]	:	______
Stack I.D. (ft.)	:	______
Temperature (°F)	:	______ / / 1/
Velocity (ft./sec.)	:	______ / /
NO_x Emissions (#/hr) ea. 2/	:	______ / /
SO_x Emissions (#/hr) ea. 2/	:	______ / /

B. Gas Fueled Turbines

Type (GE Frame 5, etc.)	:	(1) 1/
Rated Horsepower: Sea level/site/nameplate	:	/ / /
Number of Similar Horsepower Units	:	______
Hours of Operation/year, ea.	:	______
Fuel Consumption/year, ea.	:	______
Exhaust Stack Parameters:		
Stack height (ft.)	:	______
Stack outlet I.D. (ft.)	:	______
Temperature (°F)	:	______ / / 1/
Velocity (ft./sec.)	:	______ / /
NO_x Emissions (Wgt/time) ea. 2/	:	______ / /
SO_x Emissions (Wgt/time) ea. 2/	:	______ / /

C. Gas Fueled Heaters

Type (Feed heaters, reboilers, etc.)	:	(1)
Duty (BTU's/hr)	:	______
Number of similar duty units	:	______
Fuel gas consumption/year ea.	:	______
Stack Parameters:		
Stack height (ft.) [from ground]	:	______
Stack I.D. (ft.)	:	______
Flue Gas: Temperature (°F)	:	______ / / 1/
Velocity (ft./sec.)	:	______ / /
NO_x Emissions (wgt/time) ea. 2/	:	______ / /
SO_x Emissions (wgt/time) ea. 2/	:	______ / /

D. Boilers

Type (Direct Fired, waste heat, etc.)	:	(1)
Size (#/hr rating)	:	______
Number of similar size units	:	______
Fuel gas consumption/year ea.	:	______
Stack Parameters:		
Stack height (ft.) [from ground]	:	______
Stack I.D. (ft.)	:	______
Flue Gas: Temperature (°F)	:	______ / / 1/
Velocity (ft/sec)	:	______ / /
NO_x Emissions (wgt/time) ea. 2/	:	______ / /
SO_x Emissions (wgt/time) ea. 2/	:	______ / /

1/ Ibid
2/ If available
(1) See separate sheet

E. Other Pollutant Emitting Facilities (flares, incinerators 3/, burn pits, sulphur plants, etc.; visible and nonvisible emissions; fugitive dust)

Type: (Describe Fully) Sulfur Pit Acid Gas Incinerator
Size : ______
Number of similar size units : ______
If burn pit:

What is burned? "B" Treating Plant Acid Gas; Sulfur Plant Tail gas
How often? Continuous
Permitted or approved? Yes
By whom? ______
In writing? (attach copy) ______

Fuel gas consumption/year ea. Basis June-Dec. 1981 : 74560 MCF/Yr
Stack Parameters: Avg. : 7.26 MCF/HR

Stack height (ft.) [from ground]	:	195'
Stack I.D. (ft.)	:	3.5'
Stack Gas: Temperature (°F)	:	1100 / / 1/
Velocity (ft./sec.)	:	41.5 / /
NO_x Emissions (wgt/time) ea. 2/	:	7.13 T/Yr. / /
SO_x Emissions (wgt/time) ea. 2/	:	17.10 T/Yr. / /
Visible Emissions (smoke, etc)	:	None
Continuous	:	
Intermittent	:	

Odors (description) ______

F. Comments ______

G. List each air permit held by the facility and attach a copy. ______

H. What is the frequency of monitoring of emissions for each of the above sources? Sulfur in tail gas logged each hr. Additional sulfur from "B" Treating Plant daily by lab.
1. Who monitors? Operators and lab technicians
2. What method is used? DuPont analyzer - Tutwiler
3. Where is monitoring data maintained? Plant and Division Office
4. Is monitoring required by a State Agency or EPA? Direct monitoring of the stack has not been required.

I. Are modifications planned for the facility? If so, what are they? Quarterly report to State shows sulfur recovery as % of inlet Sulfur and confirms conformance to New Mexico Regulations.

1/ Ibid
2/ Ibid
3/ If with SRU's, SRU sulfur throughput, tail gas composition or sulfur concentration in tail gas (on separate sheet if necessary).

E. Other Pollutant Emitting Facilities (flares, incinerators 3/, burn pits, sulphur plants, etc.; visible and nonvisible emissions; fugitive dust)

Type: (Describe Fully) North Burn Pit
Size :
Number of similar size units :
If burn pit:

What is burned? Hydrocarbon - Barker Dome & Aneth Inlet Scrubber Dump, Gas, Some liquid from pigging Aneth Line.
How often?
Permitted or approved?
By whom?
In writing? (attach copy)

Fuel gas consumption/year ea. Avg. 1.71 MCF/Hr 14871 MCF
Stack Parameters:

Stack height (ft.) [from ground] :	
Stack I.D. (ft.) :	
Stack Gas: Temperature (°F) :	/ / 1/
Velocity (ft./sec.) :	/ /
NO_x Emissions (wgt/time) ea. 2/ :	/ /
SO_x Emissions (wgt/time) ea. 2/ :	/ /
Visible Emissions (smoke, etc):	
Continuous :	
Intermittent :	Smoke

Odors (description)

F. Comments

G. List each air permit held by the facility and attach a copy.

H. What is the frequency of monitoring of emissions for each of the above sources?

1. Who monitors? Operators monitor and report
2. What method is used? Dispatcher
3. Where is monitoring data maintained? Dispatcher and Plant Logs
4. Is monitoring required by a State Agency or EPA?

I. Are modifications planned for the facility? If so, what are they?
None Planned

1/ Ibid
2/ Ibid
3/ If with SRU's, SRU sulfur throughput, tail gas composition or sulfur concentration in tail gas (on separate sheet if necessary)

E. Other Pollutant Emitting Facilities (flares, incinerators 3/, burn pits, sulphur plants, etc.; visible and nonvisible emissions; fugitive dust)

Type: (Describe Fully) Emergency Acid Gas Flare
Size : 24" J. Zink Burner
Number of similar size units : 1
If burn pit:

What is burned? ______
How often? ______
Permitted or approved? ______
By whom? ______
In writing? (attach copy) ______

Fuel gas consumption/year ea. : A. G. Flare fuel is metered in common with the sulfur plant tail gas incinerator fuel.

Stack Parameters:

Stack height (ft.) [from ground] : 132 + 160*
Stack I.D. (ft.) : 2'
Stack Gas: Temperature (°F) : Unknown/ / / 1
Velocity (ft./sec.) : Unknown / /
NO_x Emissions (wgt/time) ea. 2/ : / /
SO_x Emissions (wgt/time) ea. 2/ : / /
Visible Emissions (smoke, etc): None
Continuous : ______
Intermittent : ______

Odors (description) ______

F. Comments Flare used if sulfur plant emergency outage occurs. Infrequent use occurs.

G. List each air permit held by the facility and attach a copy. ______

H. What is the frequency of monitoring of emissions for each of the above sources? Operator log and written report is submitted each occurrence.

1. Who monitors? ______
2. What method is used? S_2 content of acid gas determined daily w/ Tutwiler
3. Where is monitoring data maintained? Plant and Division Office
4. Is monitoring required by a State Agency or EPA? Yes, of S_2 bearing plant inlet stream

I. Are modifications planned for the facility? If so, what are they? None planned

1/ Ibid
2/ Ibid
3/ If with SRU's, SRU sulfur throughput, tail gas composition or sulfur concentration in tail gas (on separate sheet if necessary).
* Located on hill 160' above surrounding terrain.

E. Other Pollutant Emitting Facilities (flares, incinerators 3/, burn pits, sulphur plants, etc.; visible and nonvisible emissions; fugitive dust)

Type: (Describe Fully) South burn pit
Size : ____
Number of similar size units : ____
If burn pit:

What is burned? Hydrocarbons
How often? Depends on operating conditions
Permitted or approved? ____
By whom? ____
In writing? (attach copy) ____

Fuel gas consumption/year ea. (1981) : 19567 MCF, Avg 2.23 MCF/Hr.
Stack Parameters:

Stack height (ft.) [from ground] : ____
Stack I.D. (ft.) : ____
Stack Gas: Temperature (°F) : ____ / / 1/
Velocity (ft./sec.) : ____ / /
NO_x Emissions (wgt/time) ea. 2/ : ____ / /
SO_x Emissions (wgt/time) ea. 2/ : ____ / /
Visible Emissions (smoke, etc): ____
Continuous : ____
Intermittent : (Smoke)

Odors (description) None

F. Comments ____

G. List each air permit held by the facility and attach a copy. ____

H. What is the frequency of monitoring of emissions for each of the above sources? ____

1. Who monitors? Operator reports to dispatcher
2. What method is used? ____
3. Where is monitoring data maintained? Dispatcher and Plant Log
4. Is monitoring required by a State Agency or EPA? ____

I. Are modifications planned for the facility? If so, what are they?
None planned

1/ Ibid
2/ Ibid
3/ If with SRU's, SRU sulfur throughput, tail gas composition or sulfur concentration in tail gas (on separate sheet if necessary.)

III. Wastewater Effluent

A. Types of Wastewater

Checklist		Yes	No	Quantity/Unit Time	
1. Cooling Tower Blowdown	:	X		35,500 GPD	/ A/ 4/
2. Boiler Blowdown	:	X		29,300 GPD	/ A/
3. Water Treater Backwash & Rinse	:	X		29,900 GPD	/ /
4. API Pit (not in Use)	:	X			/ /
5. Domestic Waste	:	X		12,300 GPD	/B /
6. Graywater	:				/ /
7. Hydrotest	:				/ /
8. Other (describe) ________	:				/ /

B. How stored or disposed of (pond, etc.; if pond indicate whether lined or not; on-site or off-site)

1. Cooling Tower Blowdown		:	Industrial Pond - Unlined
2. Boiler Blowdown	24.23A	:	Industrial Pond - Unlined
3. Water Treater Backwash & Rinse		:	Industrial Pond - Unlined
4. API Pit		:	Not operating
5. Domestic Waste	.661 Acres Plant	:	Leachfield & Ponds -Unlined
6. Graywater	Wash Rack	:	To industrial Pond
7. Hydrotest		:	
8. Other (describe) ________		:	

C. Have Waste Flows Been Characterized? (pH, temperature, etc.) If yes, circle number corresponding to flow in Section III A and attach analysis.

Individual Pollutants (in mg/l, ppm. #day, etc.)

1. pH ________ 1/ 2/ 3/ 4/ 5/ 6/ 7/ 8
2. Temperature (°F) ________ 1/ 2/ 3/ 4/ 5/ 6/ 7/ 8
3. BOD ________ 1/ 2/ 3/ 4/ 5/ 6/ 7/ 8
4. COD ________ 1/ 2/ 3/ 4/ 5/ 6/ 7/ 8
5. Disposal System schematics available ________ 1/ 2/ 3/ 4/ 5/ 6/ 7/ 8
6. Who does sampling? Plant Laboratory Attendant
   a. Method? Grab samples/ pH meter
   b. Frequency? Daily
7. Who does analysis? What methods are used? Plant Lab Attendants
   a. Nature of reporting? Daily water test: FM-23-0329
   b. Where are records kept? At plant and lab. All wastewaters checked annually for trace metals.
8. Attach results of any extraction procedure toxicity tests.
   N/A (only at Aneth) M. A. Manley has toxicity data

D. Any Other Special Method for Disposing of Water? No
If so, describe fully: ________

4/ How Determined:
A) Measured
B) Estimated
C) Engineering Design
D) Other

E. Does Disposal Method(s) have a Permit(s) and from what Agency(ies)? (Attach copy).
Don't believe permit is required because of annual NMEID survey.

F. Any NPDES point sources (discharge pipes, etc.) not identified above?
No; Plant is approximately two miles from the river

1. Identify ______
2. Permit available or applied for? ______
   (If yes, attach copy)

G. Storage/Disposal

1. Type (pits, ponds, tanks, etc.) : Ponds - Industrial/Domestic
2. Capacity : 24.23 AC/0.661 AC
   Surface Volume : 116.2 AC.FT/ 2.64 AC. FT.
3. Retention Time (Other than unlined ponds) : Unlined/Unlined
4. Construction Material : Dirt/Dirt
5. Odors : None/slight
6. Visible Hydrocarbons : None/None
7. Condition of Berms and Liners : /Needs dirt work on dike of southeast pond

H. Active or Inactive Wells on Property? : ______
If so, describe: No disposal wells

I. Overall Plant Wastewater Knowledge

1. Number of plant employees involved: Key personnel in each area plus Technical Services
2. Are they trained? Yes
   a. By whom? On the job training
   b. Subject matter of training? Operation of equipment
   c. How frequent is the training? As needed
3. Any employees with State certification? 1 in Division
   If so, list: John L. Allison, NMEID Wastewater III Certificate, Water Chemist

J. Comments: No scheduled training; Allison, water chemist and certified wastewater plant operator, helps plant personnel troubleshoot and correct wastewater problems.

K. List all points at the facility where waste water is discharged into a surface body of water, if any, including intermittent streams. 5/
N/A

1. Locate each such body of water on the topographic map of the facility.

L. Provide a copy of all wastewater information (monitoring), if any, for the last year.

5/ An intermittent stream is one that flows at least part of each year.

M. Is any of the waste water treated prior to being stored, or treated while being stored? Describe. Hexavalent chromium is reduced in the bottoms of the industrial ponds by H_2S in septic bottom action

N. Are the waste water streams mixed with other substances? No
Describe ____________

O. Is the facility near a lake, natural pond, river, stream, or intermittent stream? Two miles from the San Juan River

IV. Solid Wastes 6/ (other than waste water)

A. Potential Wastes and Discharges

1. Potentially Hazardous Substances Check List

		Yes	No	
	a	X		Transformers/Capacitors
	b	X		Pesticide/Herbicide Storage and Use
	c	X		Gasoline, Diesel, or Aviation Fuel
	d	X		Oil Storage (used or new)
	e	X		Distillates, Other Hydrocarbon or Bulk Products (blowdowns, drips, pigging, etc.)
	f	X		Heat Transfer Fluids (heater-treaters, etc.) PCBs, Ambitrol, Dowtherm
	g		X	Hydraulic Fluids Stored
	h	X		Dehydration Material (spent beads, etc.)
	i		X	Pickling Operations
	j		X	Tank bottoms and Sludges
	k		X	Tank Washings
	l	X		Insulation and Fireproofing Materials (asbestos, etc.)
	m	X		Corrosion Inhibitors
	n	X		Filter Mediums/Filters
	o		X	Drilling Muds with Heavy Metals or Other Toxic Additives
	p	X		Solvents and Other Chemicals (i/e/. degreasers, acids, water treatment, cleaning chemicals, emulsifiers, etc.)
	q		X	Spills or Leaks of Hazardous Materials
	r		X	Chemical Landfills on Property
	s	X		Other Potentially Hazardous Substances (odorants)
	t	X		Existing Hazardous Waste Permits (generator number, manifest, etc.)

2. Solid Waste 6/

		Yes	No	
	a	X*		Discarded Drums, Drum Liners, Paint Cans, and Other Containers
	b		X	Paper and Plastic Waste

6/ Solid, Liquid, Semi-solid or Contained Gaseous Material Which:
1) Is discarded,
2) Has served its intended purpose, or
3) Is a processing by-product.

* Rinsed three times and returned to Division Warehouse

____	c	____	X	Garbage or other Solid Waste (on and offshore)
____	d	____	X	Active Solid Waste Landfills or Garbage Dumps on Property
____	e	____	X	Inactive Solid Waste Landfills or Garbage Dumps on Property
____	f	____	X*	Existing Solid Waste Permits

B. Identify All Wastes Accumulated or Generated. (On and Off-site)

1. Characterize as to domestic, spent catalyst (identify), catalyst beds, empty drums, used oil, etc. (Indicate amounts if known). 1) Domestic 2) Refer back to A1 and A2
2. Location(s). 1) Active landfill
3. Volume. 1) Unknown 2) Unknown
4. Is the waste mixed with other wastes? ____
5. Is the waste treated? No
6. Are any of the wastes reused or recycled? Used oil made into kerosene at Blanco. Drums reused for alcohol in the field.

C. Storage or Disposal Method For those listed in "B" above.

1. 1) Picked up semi-weekly 2) To county landfill
2. Spent catalyst, non-toxic aluminum oxide, spread on road and in plant area.
3. ____
4. Is there any open burning of these wastes? No
5. If so, give specifics: ____

D. If Stored or Disposed On Company Property:

1. Where? Drums temporarily stored
2. Has a permit been obtained from a regulatory agency? N/A
   Which Agency? ____
   Attach a copy.
3. Have any tests been conducted to determine what chemicals would leach from the wastes as a result of rainfall? N/A
4. Where would the leachate go? (into the ground, into a ditch, etc.)
   N/A
5. Disposal Schedule: (Daily, weekly, etc.) ____

E. If Disposed of Off Company Property:

1. Where? County landfill located approximately 1/2 mile NE of plant
2. Schedule: (Daily, weekly, etc.) Twice weekly
3. By whom? (Plant personnel, contractor) Plant personnel
4. If by Contractor, does Contract Exist? N/A
   Attach a copy.
5. Type of Disposal Facility: (Municipal, County, etc.) County
6. Permit Status of Facility: unknown (Believed to be permitted)
7. Permit Status of Hauler: None
8. Does plant have procedure for issuance of manifests for transport of hazardous waste? Yes
9. Are records retained on wastes transported off site? No, but because plant supervision has interest in the landfill they try to keep close watch/control as to what is actually put into it.

Kirtland

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* None required

F. Overall Plant Solid Waste Knowledge:

1. Number of plant persons involved: Key personnel plus Tech Ops
2. Are they trained? Yes
   a. By whom? On the job training
   b. Subject matter of training? Disposal area locations
   c. How frequent is the training? As needed
3. Any employees with State certification? No
   If so, list: ______

G. Has the site been inventoried for hazardous wastes? Yes

H. Comments: ______

I. Hazardous Substances Storage*

1. Transformers/Capacitors (PCB's)

   a. Company Owned Yes Company Serviced Yes
   b. Number 5 locations Age 20+ years
   c. Capacity ______
   d. Tested for PCB's Yes When 1982 Spills or Leaks Yes
   e. Comments ______

2. Pesticide/Herbicide Storage and Use*

   a. Herbicides 1) Pesticides 2) Rodenticides No
   b. Trade Name 1) Urebor 2) ML 57
   c. Storage 1)Garden Shack 2)On oil dock Volumes 1) Two 20 lb. containers 2) One 55 gallon drum
      Use 1) Weed Killer 2) Insects
      Active Ingredient 1) ? 2) Malathion
   d. Comments Handled by three plant personnel; none certified.

3. Gasoline, Diesel, or Other Fuel*

   a. Material Gasoline Number of Tanks 1
   b. Capacity Each Tank 500 gallon tank
   c. Above/Below Ground Above
   d. Dike Capacity (drain?) No
   e. Vented ______ SPCC Plan No 1/
   f. Comments Used for welding machines, etc.

* If more than one, list on separate sheet using same format

1/ Not applicable to this plant. Audited by EPA five years ago.

4. Oil Storage* See attachment

a. New ______ Number of Tanks ______
b. Manufacturer ______
c. Capacity Each Tank ______
d. Above/Below Ground ______ Dike Capacity (drain?) ______

______
e. Disposition ______
f. SPCC Plan ______
g. Comments ______

a. Used ______ Number of Tanks ______
b. Manufacturer ______
c. Capacity Each Tank ______
d. Above/Below Ground ______ Dike Capacity (drain?) ______
e. Disposition ______
f. Comments ______

5. Distillates, Other Hydrocarbon, (i.e., LPG) or Bulk Products* See Attachment

a. Material ______ Storage(in line?) ______
b. Storage Capacity ______
c. Above/Below Ground ______ Dike Capacity (Drain?) ______
d. Disposition ______
e. Origin ______ SPCC Plan ______
f. Brine Pond capacity ______

6. Heat Transfer Fluids Stored*

a. Brand Name Ambitrol
b. Use Antifreeze Quantity ______
c. Storage 15b on aerial photo
d. Manufacturer Union Carbide
e. Tested for PCB's (When?) N/A Results ______
f. Spills or Leaks Closed system
g. Disposition Not disposed of

7. Hydraulic Fluids*

a. Brand Name None Quantity ______
b. Storage ______ Disposition ______

8. Dehydration Material*

a. Type Dry Bed 1) Silica Gel; 2) Mol Sieve
b. Quantity 1) 25,000 lbs 2)? Disposition 1) Will have 70,000 # for dumping on plant dirt roads.

* If more than one, list on separate page using same format.

9. Pickling Operations*

a. Type of Pickling None
b. Process Chemicals
c. Quantity Disposition

10. Tank Bottoms and Sludges*

a. Type Material None
b. Quantity Disposition
c. Frequency

11. Tank and Truck Washing*

a. Type None
b. Cleaner Used
c. Quantity (est). Disposition
d. Comments

12. Insulation and Fireproofing Materials*

a. Type Material Boiler mud & pipe covering
b. Quantity Disposition Insulators carry it off
c. Comments Stored in water treater building

13. Corrosion Inhibitors*

a. Brand Name 1) Chromine T 2) Corless 130
b. Use 1) CT 2) Steam Quantity 1) 1500 gal 2)
c. Storage Manufacturer Continental Products
d. Active Ingredient 1) Sodium Bi Chromate 40% 2) Filming Amine
e. Disposal Method 1) 2) Industrial waste pond
f. Comments

14. Filter Mediums*

a. Type Paper cartridge Number ?
b. Changeout Frequency Based on analysis
c. Disposition Burned at county landfill by plant personnel.

15. Drilling Muds with Heavy Metals or Other Toxic Additives

a. Type N/A
b. Additive Package
c. Disposition
d. Permit Date

* If more than one, list on separate page using same format.

16. Solvents and Other Cleaning Chemicals*

a. Type Varsol Brand Name Exxon
b. Use Parts Cleaning Quantity 500 gal. storage
c. Storage 15g on aerial photo
d. Manufacturer Exxon
e. Active Ingredient Kerosene
f. Disposition Wear it out

17. Spills or Leaks of Hazardous Materials*

a. Substance No Quantity
b. Where Date
c. By Whom Action
d. Notification

18. Chemical Landfills on Property*

a. Type Usage No
b. Chemicals Type
c. Duration Permitted? Yes No
d. Location
e. Comments

19. Other Potentially Hazardous Substances*

a. Type Algaecide Brand Name Toxene 35
b. Use In cooling towers Quantity 260 gal/yr.
c. Storage In water treater building chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient See attachment
e. Disposition Used up in cooling towers on recommended feed schedule; drums to be rinsed three times with water and returned to Division Warehouse. EPA Reg. No. 9386-4-12471.

19. Other Potentially Hazardous Substances*

a. Type Bactericide Brand Name Toxsene 37
b. Use In cooling towers Quantity 250 gal/yr.
c. Storage In water treater building chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient Methylene bis (thyocyenate) 10%
Disposition Used up in cooling towers on recommended feed schedule; drums to be rinsed 3 times with water and returned to Division Warehouse. EPA Reg. No. 9386-4-12471

* If more than one, list on separate sheet using same format.

19. Other Potentially Hazardous Substances*

a. Type Microbiocide Brand Name Toxsene 39
b. Use In cooling towers Quantity 260 gal/yr.
c. Storage In water treater building chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient See attachment
e. Disposition Used up in cooling tower on recommended feed schedule; drums to be rinsed 3 times with water and returned to division Warehouse

19. Other Potentially Hazardous Substances*

a. Type 66° B' H_2SO_4 Name Concentrated Sulfuric Acid
b. Use To neutralize alkalinity in cooling tower water
Quantity 2930 gal. in 1981
c. Storage In three steel acid tanks near "B" Cooling Tower Pump House
Manufacturer
d. Active Ingredient H_2SO_4 93% approx.
e. Disposition Fed into cooling towers' basins by metering pumps controlled by UNILOC pH meters.

19. Other Potentially Hazardous Substances*

a. Type $AL_2(SO_4)_3$ Brand Name Alum.
b. Use water treatment, coagulant Quantity 2600# in 1981
c. Storage In water treater building chemical storeroom
Manufacturer
d. Active Ingredient $AL_2(SO_4)_3$, Aluminum Sulfate
e. Disposition Mixed with water; solution fed by metering pump into Accelerator.

19. Other Potentially Hazardous Substances*

a. Type Caustic Name Caustic soda
b. Use To raise pH of boiler water Quantity 8050 # in 1981
c. Storage Water Treater Building - chemical storeroom
Manufacturer
d. Active Ingredient Sodium Hydroxide, No OH
e. Disposition Mixed with water; solution fed into boiler water by metering pump, manually controlled

19. Other Potentially Hazardous Substances*

a. Type Amine - Piperazine Brand Name Corless 130
b. Use To protect steam & Condensate Lines Quantity 825 gal. in 1981
c. Storage Water Treater Building - chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient Amino Ethyl Piperazine, $NH\ C_2\ H_4\ C_6\ H_8$
e. Disposition Mixed with water; solution fed into boiler feed water by metering pump; manually controlled.

* If more than one, list on separate sheet using same format.

19. Other Potentially Hazardous Substances*

a. Type Reducer Brand Name DEOX-21
b. Use Scavenge oxygen from boiler water Quantity 2800# in 1981
c. Storage Water Treater Building - chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient Sodium Sulfite Na_2SO_3
e. Disposition Mixed with water; solution fed into boiler feed water by metering pump, manually controlled.

19. Other Potentially Hazardous Substances*

a. Type Phosphate Brand Name Hymol - 82
b. Use Precipitate hardness from boiler water Quantity 1100 gal. in 1981
c. Storage Water Treater Building - chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient Sodium Phosphate, $Na_x(PO_3)x$
e. Disposition Mixed with water; solution fed into boiler feed water by metering pump, manually controlled

19. Other Potentially Hazardous Substances*

a. Type Amine, neutralizing Brand Name Corless 202
b. Use To protect condensate lines Quantity 550 gal. in 1981
c. Storage Water Treater Building - chemical storeroom
Manufacturer Continental Prod. of Texas
d. Active Ingredient Morpholine, O C, H_9 N
e. Disposition Mixed with water; solution fed into condensate lines by metering pump, manually controlled

19. Other Potentially Hazardous Substances*

a. Type Oxidizer Chemical Name Chlorine
b. Use To sterilize potable water Quantity 180# in 1981
c. Storage North side of water treater building near gas chlorinator
Manufacturer
d. Active Ingredient Chlorine Gas
e. Disposition Fed thru gas chlorinator into domestic booster pump section for pre chlorination before filtration

* If more than one, list on separate sheet using same format.

19. Other Potentially Hazardous Substances*

a. Type Acrylic Polymer Chemical Name Hydrochem D-100
b. Use To disperse suspended solids Quantity 825 gallons in 1981
c. Storage Water Treater Building - chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient Sodium Acrylamide
e. Disposition Batch fed into cooling tower basins as antifoulant for improving heat exchange in coolers.

19. Other Potentially Hazardous Substances*

a. Type Amine Brand Name Quest 40
b. Use To sequester hardness Quantity 60 gal. in 1981
c. Storage Water treater building - chemical storeroom
Manufacturer Continental Products of Texas
d. Active Ingredient Sodium salt of Nitrilo Tri Acetic Acid
e. Disposition Mixed with water and lubricated into closed system to prevent scaling should hardness get into cooling system.

19. Other Potentially Hazardous Substances*

a. Type Anodic inhibitor Brand Name Chromine-T
b. Use Open & closed cooling systems Quantity 1540 gal. in 1981
c. Storage Dock south of shop
Manufacturer Continental Products of Texas
d. Active Ingredient Sodium BiChromate, $Na_2Cr_2O_7$, 40%
e. Disposition Fed by metering pump (Uniloc controlled) into cooling tower basins; lubricated into closed cooling water systems.

V. Potable Water

A. Source of Supply

1. Company or other: Animas River and SanJuan River
2. If wells, how many, how deep, (bottom hole) when drilled, static /pumping) etc. N/A. Quality
3. If other, are contracts available? N/A
4. Any special provisions? (Describe) N/A
5. System metered? Yes Quantity 49,192,000 Gal. in 1981

B. Quality

1. Analyzed to meet State/Federal requirements? State/ Federal
2. Chemical Analysis:
   a. Date of most recent test: June 8, 1982
   b. Copy of analysis available? (Please attach) See attachment
      1. Routine chemical analyses daily by Plant Lab attendant and a minimum of once per year by San Juan Division Lab and a minimum of twice per year by Continental Products of Texas. See sheets attached.

      2. Annual trace metals, nitrates and fluorides analyzed by EAD labs in Albuquerque, New Mexico.

3. Annual radio activity analysis by Eberline of Albuquerque, New Mexico.

4. Annual pesticides analysis by Anachem of Albuquerque, New Mexico.

5. See sheets attached for copies of analyses.

3. Bacteriological Analysis:
   a. Sampling schedule: On the Wednesday following the second Tuesday of each month
      1) By whom? Plant lab attendant
      2) Where analyzed? NTUA Lab in Ft. Defiance, Arizona
      3) Latest copy available? (Please attach) See attachments

4. Radiological:
   a. Date of most recent test: June 19, 1982 (See attachment)
   b. Copy of analysis available? Not available

5. Compliance violations? None
   a. What agency? ______
   b. When? ______
   c. Specifics? ______
   d. Outcome? ______

6. Complaints (odors, taste, other): No

C. Treatment (Potable Water Only)

1. What types of treatment? Filtration and Chlorination
2. Equipment working/verification method? Turbidity & chlorine analysis
3. Is drinking water analyzed? Yes Frequency: Daily
4. Who analyzes? Plant Lab Attendant What method? *
5. Is there analyses documentation? Yes Where? Division Lab

* Turbidity, nephelo-metric method; chlorine, DPD free chlorine, colorometric method.

D. Drinking Water System Certified? N/A, NMEID Community Water System Survey Attached

1. Copy of certification available (Please attach) ______
2. Water system operator's title: N/A

E. Number of Service Connections / persons served: 49 / 135 to 145

1. Company
   a. Drawings of system available? Included in environmental survey
   b. System metered Yes Quantity 49,192,000 gallons in 1981
2. Non-Company
   a. Drawings of system available? N/A
   b. System metered ______ Quantity ______

F. Overall Drinking Water System Knowledge:

1. Number of plant employees involved: 2 lab attendants
2. Are they trained? Yes
   a. By whom? Division Lab
   b. Subject matter of training? Water analysis
   c. How frequent is the training? Annually if cross check shows variance

3. Any employees with State certification? One in Division
If so, list: John L. Allison, Water Chemist, NMEID Water IV Certificate
See attachments.

G. Provide a summary of all potable water monitoring reports, for the past year.

VI. Oil Spill Contingency

A. Does the facility have oil storage tanks? Yes

B. Could the facility, due to its location, discharge oil into or upon the navigable waters of the United States? 7/ No

1. If yes:
   a. Does the facility have an oil spill contingency plan? Not required
   b. Where located? Division Office
   c. When was plan last updated? 1981, then every 3 years
   d. Are plant employees knowledgeable of the plan? ____
   e. Have there been any spills where the plan was activited? ____

2. Are the storage tanks diked? Condensate tanks outside of plant are dyked.
   a. Does the diked containment area provide for the capacity of the largest single tank plus sufficient allowance for precipitation? ____

3. Do diked areas have drains with valves? No
   a. What type valves? ____
   b. Are valves normally left open or closed? ____

4. What provisions are made to control an oil spill once it occurs? Operations is trained and equipped for immediate response
5. What kind of training has been undertaken to implement the plan? N/A
6. What equipment is available to implement the plan? All available on hand
7. What are the reporting procedures in the event of an oil spill? To dispatcher, to main office where standard procedure is established. Failure report follow-up

C. Are there other storage tanks on the site? Yes

1. Where located? See aerial photo
2. Types of liquids stored in the tanks? ____
3. Are these tanks contained within a diked area? ____

VII. Superfund Reporting Requirements

A. Has the plant been inventoried for hazardous substances? Yes

B. Which, if any, of the substances on the attached Superfund list are present at the plant? None

1. If so:
   a. How much? ____
   b. How are they stored? ____

7/ Navigable waters include all tributaries, which flow at least part of each year, to all streams and rivers.

c. How are they disposed of? Industrial Pond

d. Is plant management aware of reporting requirements for hazardous substances spills? ______

e. Identify reporting requirements in effect at the facility.

______

______

C. List all spills of any hazardous substance on the Superfund list of a reportable quantity within the past year. None

1. Were they reported? ______
2. What are the reporting procedures for spills? ______

______

3. What are the clean up procedures for spills? ______

D. List all closed waste storage and/or disposal facilities on the facility premises, near the facility premises, or used by the facility in the past. No

1. Surface impoundments and ponds. ______
2. Cess pools and septic tanks. ______
3. Dumps and landfills. ______

VIII. Other

A. Housekeeping

Housekeeping	Poor 8/	Good	Excellent
1. Water Treater		X	
2. Boiler Room		X	
3. Cooling Towers		X	
4. Pump Rooms		X	
5. Storage Area			
6. Disposal Area			
7. Other (specify) ______			

B. Are there fences and/or signs at the following?

	Fence Yes	Fence No	Signs Yes	Signs No
1. Ponds Domestic:	X		X	
Industrial:		X		X
2. Pits :		X		X
3. Chemical Drum Storage :		X		X
4. Disposal Areas :		X		X

8/ Describe on a separate page.

C. Has plant been monitored for noise? Yes

1. By whom? Safety Department and Main Office Engineering
2. When? Late 1981
3. Specifics? Plant monitored for new additions
4. Have there been any complaints? No
5. If known, what is the highest decibel level at:
   a. the facility? ______
   b. the perimeter of the facility? ______
   c. the nearest public road? ______
   d. each building within 1/2 mile of the facility? ______

D. Underground Injection N/A

1. List all active and inactive underground injection wells and test holes:
   a. on the facility premises: ______
   b. used by the facility: ______
   c. within one mile of the facility premises or used by others: ______
2. Locate each on the topographic map.
3. Is a state permit in existence for each? ______ (Attach a copy)
4. Have any applications been disapproved? ______
5. Have any permits been revoked? ______
6. Have any variances been obtained? ______
7. Provide a copy of each quarterly report on each well for the past year.

E. Does the facility discharge any effluent into a Publicly Owned Treatment Works ("POTW")9/ or are there any plans to do so? N/A

1. Is waste oil disposed of through the POTW? ______
   a. Reused? ______
   b. Other? ______
2. Are "slug" discharges avoided? ______
3. Are there local or state rules for the POTW? ______
   Are they being complied with? ______

F. Is there any evidence of any groundwater contamination at or from the facility? No, no known water wells in area.

1. List all known water wells within one mile of the facility and show approximate location on the topographic map. None known or aware of in area

9/ POTW: State or city owned sewage treatment works involved in the storage, treatment, recycling, and reclamation of municipal sewage or liquid industrial waste.

Questionnaire completed by: E. F. Smythe

T. M. Sawyer

San Juan Div. Tech. Ops.