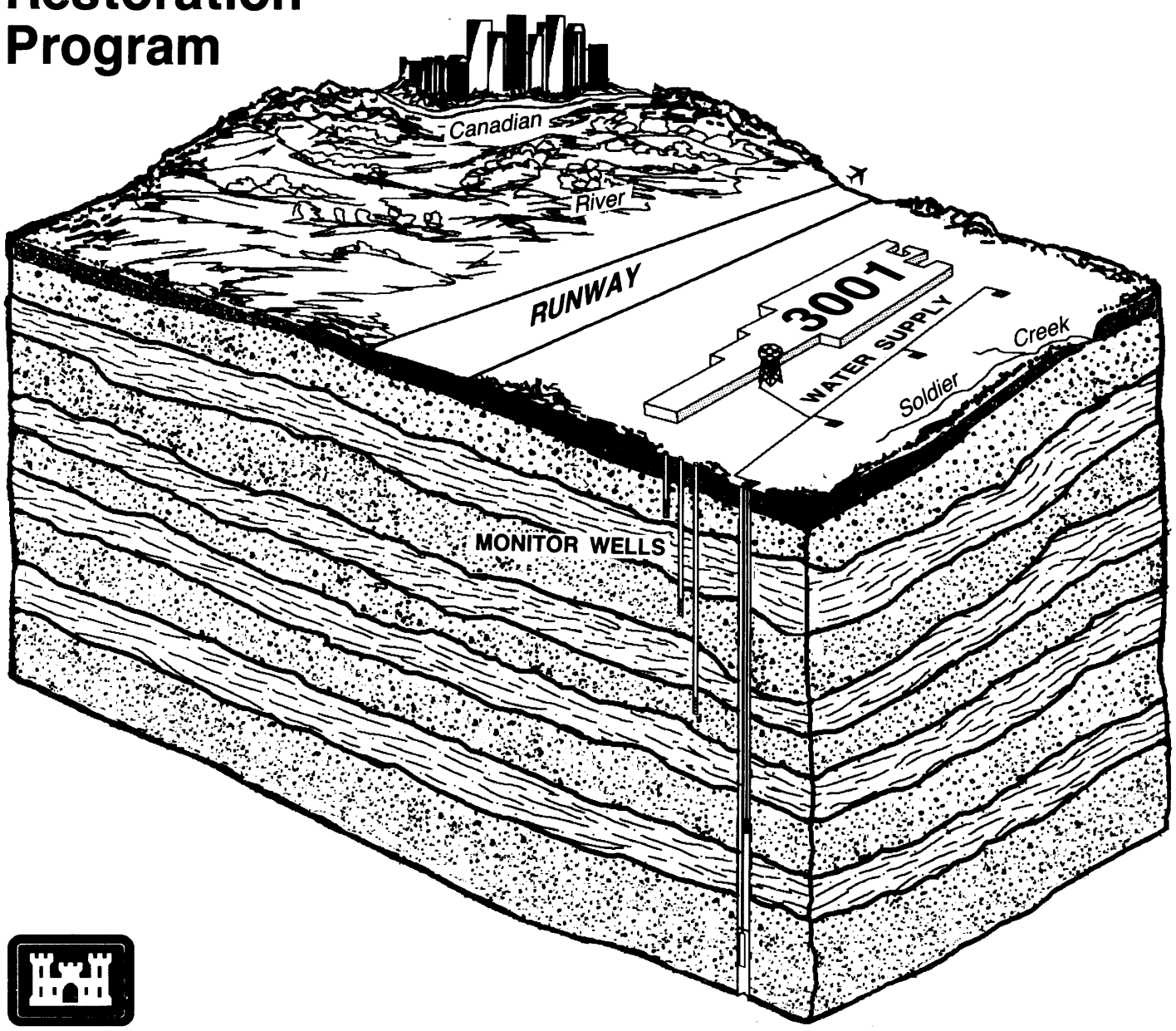
Building 3001
Remedial Investigations
Volume II - Appendices

TINKER AIR FORCE BASE
Installation
Restoration
Program



US Army Corps of Engineers
Tulsa District

JANUARY 1988

BUILDING 3001
REMEDIAL INVESTIGATIONS

VOLUME II - APPENDICES

TINKER AIR FORCE BASE
INSTALLATION RESTORATION PROGRAM
PROJECT NO. WWYK86-311
SITE NO. TINKER 01

PREPARED FOR:
ENVIRONMENTAL MANAGEMENT DIRECTORATE
DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER

PREPARED BY:
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT

JANUARY 1988

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APPENDIX A

MINUTES OF TRC AND TWG MEETING

DE OFFICIAL FILE

CC

28 AUG 1985

Minutes of Technical Review Committee (TRC) - 20 August 1985

EPA State of Oklahoma

1. Place: DE Conference Room, Building 417

2. Chairman: Colonel Ray Reaves

3. Members present:

Mr Robert Hannesschlager	EPA
Mr Mark Coleman	State of Oklahoma

4. Others present:

Col Shelton Birch	USAFH/SGB
Lt Col Rich Baldwin	OC-ALC/SE
Capt Richard Ashworth	Hq AFESC/RDVW
Capt Darrel Cornell	USAFH/SGB
Mr Howard Bain	OC-ALC/JA
Mr David Burris	2854 CES/DEE
Ms Anne Copeland	OC-ALC/MAQ
Mr Jim Day	2854 CES/DEEX
Mr Jenkins Dunbar	Okla State Dept Health
Mr Fred Heitman	Okla Water Resources Bd
Mr Don Hensch	Okla State Dept Health
Dr Ken Johnson	Okla Geological Survey
Mr Warren Jones	2854 CES/DEEX
Mr Gene Leiterman	2854 CES/DE
Mr Odell Morgan	ACOG/GWA
Mr Gene Pickett	2854 ABG/PA
Mr Marvin Piwoni	EPA R.S. Kerr Laboratory
Mr Drew Puffer	EPA, Region VI
Mr Robert Ramsey	Corp of Engineers
Dr Dee Ann Sanders	USAF OEHL
Ms Cathy Taylor	2854 CES/DEEX
Ms Ramona Wagner	Corp of Engineers
Mr Greg Wallace	ACOG/GWA
Mr John Wilson	EPA R.S. Kerr Laboratory
Mr Terry Yonkers	AFRCE-CR

4. Introduction: Colonel Reaves welcomed the members and visitors, and he asked everyone to introduce themselves and state the organization they were representing. Colonel Reaves reiterated the purpose of the TRC was to have a single point of contact for communications, coordination and action. We are all interested and diligently working in solving the problems that were created in the past and developing procedures to insure those problems do not occur again. We believe the mode of communication we have now is working very well. We would like to propose, however, expanding the charter of the TRC to include other environmental issues along with the Installation Restoration Program (IRP).

5. Charter Modification: Colonel Reaves cited the statement in the GAO Report, Hazardous Waste Management at Tinker AFB --- Problems Noted, Improvements Needed:

> "State regulatory authorities have expressed their concern that no single group or person has direct authority to correct or eliminate practices causing environmental problems at Tinker. This results from several automous activities on base that generate the waste. Some are commanded by officers that have a higher rank than the base commander and they have usually are also under different chains of command to get the other activities through their chains of command to take corrective action. This often results in slow responses to the regulatory agencies."

Colonel Reaves further stated his office is now the single point of contact for all environmental issues at Tinker AFB. We are asking the other agencies involved in the TRC do the same. At this time there was a lengthy discussion on the proposed charter. Mr Coleman expressed his concerns of the changes, i.e., state laws, organization structures, the definition of "all environmental matters", and the lack of authority on some matters. Mr Coleman citing specific state laws as the major hinderance further recommended the charter stay the way it is - IRP matters only. If at a later date and some changes occur, then possibly the proposed changes could be adopted. Since there was a consensus of the committee to leave the charter the way it is written now, IRP matters only, this agenda item was tabled for now.

6. Meeting Frequency: Colonel Reaves proposed the TRC be conducted on a quarterly basis, the middle month of the quarter, the third Tuesday of that month (November, February, May, August). The suggestion was also proposed to form a technical work group (TWG) chaired by the Base Civil Engineer to meet a month before the TRC. At the time of the TWG, final notification would be made on the exact date/time of the TRC. The agenda items would be composed at the TWG and at least two weeks before the TRC, the agenda would be sent to the members for their information. Mr Coleman and Mr Hannesschlager agreed with all of the proposals. This agenda item is closed.

7. IRP Update:

a. Corp of Engineers Report of Investigation: Ms Ramona Wagner briefed the work and findings performed within the fire damaged portion of building 3001. Pits were located during the renovation and they were sampled and tested. Discussions were held with the regulatory agencies on proper disposal methods. There were 148 holes drilled and 64 pits sampled. Out of those 64 pits, only one had a high enough concentration of the chlorinated solvents for concern. The pit was near column row E105 and the TCE found was in the soil adjacent to it, approximately five feet away from the pit. There were two other pits that had minor concentrations of other substances and all were disposed of in the proper manner. The second phase of the program was the drilling of 12 holes in the interior of the building. The holes were drilled approximately 80-90 feet deep. They were drilled to the first water level (approximately 30-40 feet). The hole was bailed and the recharged water sampled and tested for purgeable organics. The hole was cased and then deepened to the next water zone that was about 75 feet. The hole was then bailed and the recharged water was sampled. The results indicated the upper water zone had a gradient that

a gradient that was towards the southeast, and the direction of the lower water zone was to the southwest. The highest concentration of TCE was in the northeast corner of the lower water zone. As a result of the tests, the locations for additional monitoring wells, in the non-fire damaged portion of building 3001, were established and located basically in a grid pattern with the goal of getting them down gradient. Three of these well clusters are already in and one more cluster is left to be put in. These wells have not been sampled yet, just installed. We are just now to a point were the information collected can be really evaluated. We have not been able to prepare a geological log, but we will on every well.

Question: How did you manage to isolate the contamination in the upper water zone and lower water zone?

Answer: The hole was cased down to 40-45 feet then the lower water zone was measured to insure no leakage was occuring down the casing. This allowed us to get a static water level down about 75 feet. Once this was determined to be the static water level and there was not any influence from the upper water zone, the lower water zone was bailed out and the recharge sampled. All 12 holes were back filled with special cement so there would not be any conduit for the contaminates to go from one water zone to another.

Question: Any reason why the bottom corner is higher in concentration?

Answer: We do not have enough data yet to make any determination.

Question: Could well 19 be a conduit?

Answer: If if was a conduit, wouldn't there be a higher concentration in well 19 than well 18? All indications show that well 19 has not been near as high as well 18. Trace amounts only. Although it is very suspicious.

b. Civil Engineering:

(1) Wells 18 & 19: Mr Jim Day, environmental engineer, presented a quick background of the two wells and the previous work that has been conducted to date. There has been sampling and testing performed on the wells. We did have some equipment removed from the wells before pumping efficiency tests were conducted. We also conducted some TV tests where we found debris in both wells. Well 18 had a pump shaft at the 591 feet level (1017 feet deep). Well 19 had an airline at the 609 feet level which blocked the TV camera from progressing further down the well (1100 feet deep). The efficiency report stated the wells were not efficient nor was the equipment in good shape. From these studies it was determined well 18 had a significant increase in TCE. The Statement of Work (SOW), which was previously approved by the TRC, has been sent to Procurement and we are anticipating awarding the contract by 23 August 1985. Mr Day went into further explanation of the seven different phases of the work. The main key is to get the debris removed from the wells. The final phase will be setting a temporary plug. If it can be determined where the TCE is entering the well, a temporary plug below that spot will be installed until a conclusion is made on the exact fix.

(2) Landfill 6: Ms Cathy Taylor, environmental engineer, briefed the up-to-date status on landfill 6. Monitoring wells have been placed and we are looking at placing three more; exact locations have not been determined yet. We had our contractor recommend an interim fix for the landfill until

a long term action could be decided. The interim fix is designing a clay cap of 18" with a 16" topsoil cover and then revegetated. This should be completed within 90 days. We were able to use the clay from another location on base.

Question: How much clay is there now?

Answer: Ms Taylor did not have that information.

Question: How deep would the additional monitoring wells be?

Answer: That has not been determined yet, but when the exact locations of the wells are decided upon, the depths will also.

Question: What is the thickness and permability of the clay?

Answer: Ms Taylor did not have the answer off-hand, but would provide the information before everyone left.

c. Bio-Environmental Engineering (Bldg 3001): Capt Cornell presented an analysis of the information that has been collected to date and what it might mean. He further stated the pits appear to be the source of the TCE; however, he also presented a mathematical argument that indicated slow leaks from pipes could also result in the TCE contamination presently being found.

8. Future IRP Work Projection: Capt Cornell gave an overview of the future work Tinker is striving toward. They are:

a. The south portion of building 3001 - basically performing similar types of tests and studies that have been performed on the north portion.

b. Placing some monitoring wells west of building 3001.

c. Determine if we need some recovery wells.

d. Start looking at the landfills and fire training pits.

9. Unanswered Regulatory Agency Concerns: Colonel Reaves asked if there were any other questions referencing the agenda items that have been discussed:

a. Question: Have all the underground storage tanks been eliminated?

Answer: The underground tanks at the north end of building 3001 were either removed or filled in. The lines now are above ground and the remaining tanks are in a basement type room that do allow you to go underneath the tanks to have a look see.

b. Question: Why doesn't Tinker conduct a geological topography study before conducting any more work?

Answer: We are heading in that direction now.

c. Question: Why have we (State and EPA) not had any word on written responses we have provided to Tinker?

Answer: The responses were sent to Hq AFLC to be incorporated into the appropriate documents (i.e., Phase II Stage 2 report; Phase II Stage 3 Statement of Work). We hope by having the TWG this will eliminate the appearance of untimely response.

d. Question: Was the suggestion on the coring of the landfills considered?

Answer: Yes, it was considered but placing of monitoring wells were elected as the way to go.

e. Question: Was the dike fixed at waste pit number 2?

Answer: Yes, that was fixed quite some time ago.

f. Question: Has well 18 been sampled yet?

Answer: No, that is one of the things the contractor will be doing.

g. Question: What temporary fix has been accomplished on the landfills that are seeping?

Answer: We have not looked at that yet and we will put it in for future IRP work.

h. Question: Have you drained the pond that is over one of the landfills?

Answer: No. The pond is not over a landfill but a low level radioactive site. For that matter, we are not even for sure if there was a radioactive site, it was brought to our attention by someone stating they think they remember one being there. We are planning on investigating further to see what is actually there. (Mr Coleman stated they had some equipment that could help us with the investigation.)

10. There being no further questions, Colonel Reaves thanked everyone again for coming and making this committee work the way it should. Notification letters will be forthcoming on the TWG and next TRC. Also, we will be getting with the State on a conference call to possibly expedite some of the answers to their responses.

SIGNED

RAY D.
Base

cc: USAFH/SGB
OC-ALC/SE
Hq AFESC/RDVW
OC-ALC/JA/MA
2854 ABG/PA
USAF OEHL
AFRCE-CR

EM (Capt Cornell)

Technical Working Group Meeting

All Members

1. LOCATION, DATE, TIME: TAFB Bldg 417, 22 Oct 85, 1300Hrs

2. ATTENDEES:

Shelton Birch, Colonel (Chairman)	OC-ALC/EM	734-7844
Penny Arnold	OC-ALC/MAQCE	736-2135
Judy Bittick	OC-ALC/EM	734-3201
Arthur Burkart	Corps Engin Tulsa	745-6168
Bob Coleman	OC-ALC/EM	734-3201
Anne E. Copeland	OC-ALC/MAQCE	736-2525
Darrel Cornell, Capt	OC-ALC/EM	734-7844
Jim Day	OC-ALC/EM	734-3201
Jenkins Dunbar	Ok St Dept Health	271-5338
Geri Hart	OC-ALC/EM	734-3201
J Fred Heitman	Ok Wat Res Board	271-2541
Gene Leiterman	2854 CES/DE	734-3451
Tom Maiello	Ok Wat Res Board	271-2541
Odell Morgan	ACOG/Garber Well	848-8961
Drew Puffer	EPA Dallas,TX	214-767-9088
Cathy Lee Taylor	OC-ALC/EM	734-3201
Greg Wallace	ACOG/Garber Well	848-8961
Ramona E Wagner	Corps Engin Tulsa	745-6116

3. The meeting began at 1308Hrs with introduction by Colonel Reaves, OC-ALC/EM Environmental Directorate, who expressed urgency in correcting Tinker's problems. He stated everyone must help and that turnaround decision may be less than three days. He noted that although no specific date to correct Tinkers problems has been published, all efforts must be directed to immediate corrections.

4. The TWG agreed to continue meetings at 1300Hrs one month prior to the TRC. Everyone was reminded the next TRC would convene 19 Nov 85, 1300Hrs, in the TAFB Civil Engineering Conference room, Bldg 417. Inputs for that meeting's agenda should be provided by members to Capt Cornell no later than 12 Nov 85 (mailed before 8 Nov 85).

5. The Corps of Engineers presented a "shopping list" of proposed activities; including their cleanup at Pine Bluff Arsenal. Cleanup consisted of topsoil removal, site coring to determine geology and inplace closure construction. For TAFB they proposed to: 1) study geohydrology of base, 2) develop closure plans at 6 sites, and 3) resample all onbase wells. Exact options will be reviewed by Tinker officials and recommendation will be presented at next TRC.

6. An update of Tinker activities was presented. Dansbury Assoc of Norman, OK began onsite work 23 Oct 85 to cleanout and remove debris at wells 18 and 19. An environmental assessment to recommend cleanup alternatives is subcontracted to Dr Larry Canter, Univ of Okla/CEES. Projected completion time is 120 days; working two work shift daily. Work also had begun at landfill six with 56 days needed to complete installing the cover cap. Resoding wouldn't be completed until spring 86. Three boreholes around landfill should be installed before the TRC meeting to establish criteria for three downgradient wells. Venting of the landfill will occur by extending the preexisting plastic stacks.

7. Stream sediment and tree removal work was briefed. A stack of data was given Mr Dunbar, Mr Puffer and Mr Wallace. Tinker officers requested as rapid evaluation of this data as possible to determine whether the material had to be disposed at a hazardous waste permitted landfill.

8. Tinker Public Affairs officer, Mr Gene Pickett, briefed attendees of his Community Action Plan. It outlines the base IRP history, significance of findings and reviews groups and committees established to handle environmental problems. He promised that a draft copy of the Plan would be provided members the week of 28 Oct 85 and requested that input should be returned along with the TRC Agenda input on 12 Nov 85.

9. Modification to Stage 3 IRP work was presented (included with agenda at the meeting). The work included additions to the Stage 3 work and items which TAFB would conduct inhouse or through contractors.

10. Specific assignments imposed by this meeting were:
    a. Immediate turnaround regarding significance of sediment analysis by state officials.
    b. Review of Community Action Plan by regulatory agencies due 12 Nov.
    c. Agenda Items for TRC due by 12 Nov 85.

11. Meeting was adjourned at 1445 Hrs.

SHELTON R. BIRCH, Col, USAF, BSC
Staff Bioenvironmental Engineer

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

REPLY TO ATTN OF: EM

4 DEC 1985

SUBJECT: Minutes of Technical Review Committee (TRC) - 19 Nov 85

TO: Attendees

1. Place: DE Conference Room, Bldg 417

2. Chairman: Colonel Ray Reaves

3. Members present:

Mr Robert Hannesschlager	EPA
Mr Mark Coleman	State of Oklahoma

4. Others present:

Col Shelton R. Birch	USAFH/SGB
Mr. Howard Bain	OC-ALC/JA
Maj Jody Bukacek	OC-ALC/MAQC
Ms. Anne Copeland	OC-ALC/MAQ
Capt Darrel Cornell	OC-ALC/EM
Mr. Jim Day	2854 CES/DEEX
Mr. Jenkins Dunbar	Okla State Dept Health
Mr. J. Hilton Frey	EPA, Region VI
Ms. Mary Ninman-Glover	Okla State Dept Health
Mr. Don Hensch	Okla State Dept Health
Dr. Ron Jarman	Okla Water Resources Bd
Mr. Gene Leiterman	2854 CES/DE
Mr. Odell Morgan	ACOG/GWA
Mr. Tom Maiello	Okla Water Resources Bd
Mr. Gene Pickett	2854 ABG/PA
Mr. Drew Puffer	EPA, Region VI
Mr. Robert Ramsey	Corps of Engineers
Mr. John Roberts	Corps of Engineers
Mr. Tony Robledo	AFRCE-CR(Dallas,TX)
Mr. Greg Wallace	ACOG/GWA

5. Tinker Representative Changes to TRC. Colonel Reaves briefed the TRC that a reorganization had occurred which placed all environmental matter directly under the control of the Environmental Management Directorate. Responsibility for all environmental matters have now been transferred from the base commander's office to Colonel Reaves who now has the title of Director, Environmental Management (OC-ALC/EM). Mr Bain noted that this change freed Col Reaves to concentrate his resources specifically on the environment. It was emphasized that all correspondence should now be directed to OC-ALC/EM rather than the previous 2854 ABG/CC address. Mr Mark Coleman expressed the opinion that the change seemed appropriate and a good idea.

Mr Hannesschlager asked whether this change was an enhancement to the previous responsibilities. Col Reaves stated that it was, and pointed out that Gen Burbee has said the environment is his number one priority.

6. Update of IRP Program: An update of the current status of Installation Restoration Program (IRP), Phase II work was presented by Capt Cornell. He briefly outlined what Radian Corporation investigations were accomplished and what recommendations were presented. A summary of these investigations and recommendations were given to attendees and, based upon conclusions reached by Radian, the Air Force recommended that nothing further be done (except long term sampling of monitor wells) at the following five sites: Radioactive Waste Disposal Sites 1022E and 62598, the base drinking water wells and Industrial Waste Pits 1 and 2. Mr Mark Coleman stated he wanted to have his staff review the Radian recommendations before giving his approval to delete the two Industrial Pits and the two radioactive disposal sites. Col Birch pointed out that the status of these four sites should be determined as rapidly as possible so work can begin by the Corps of Engineers.

7. Update of Wells 18 and 19 Project: An update of the work at wells 18 and 19 was presented by Mr Day. He noted that cleaning and televising of both wells has almost been completed. Analysis of waters was the next item scheduled. Before any long-term test pumping would begin, the regulatory agencies would be briefed.

8. Status of Landfill Six: Capt Cornell presented a status report on the landfill six clay covering activities. He noted that the cover was quickly being placed and that additional boring adjacent to the landfill indicated appropriate placement of long term monitor wells in both the perched and lower zones. A copy of the contractors cross-sectional views was given attendees along with a rationale of the locations of the monitor wells.

9. Corps of Engineers Proposal for IRP Program: Mr Roberts presented the Corps of Engineers proposal to deal with unresolved problems regarding the IRP sites. He showed slides illustrating previous Corps investigations plus removal and closure action accomplished at Pine Bluff Arsenal, Arkansas. He presented a plan for Tinker AFB, which prioritized the sites as follows: hydrogeologic study of base, investigation of TCE contamination of the upper soils around Bldg 3001, evaluation of landfills 1- 5, fire training areas 1 and 2 and radioactive waste disposal sites 201W and 1030W. The plan extends 18 months and includes plans to remedy any adverse findings discovered by the Corps. Col Birch noted that the 18 months could begin as soon as Congress approves the 1986 budget and funds are received by Tinker. Mr Hannesschlager wanted to know if cluster wells would be installed in the southern portion of Bldg 3001 as occurred in the northern half. He was assured that the Corps plans included that option. Mr Hannesschlager also requested that a some form of formalized agreement be established between the Corps, Air Force and EPA similar to their Yellow Book Federal Facilities Agreement since he favored the Corps' plan. One problem noted with such an agreement would be that if, for some

reason, the 18 month time period were exceeded or funds were not completely approved, Tinker would be out of compliance. Col Birch said that a more detailed Statement of Work would require another three weeks to complete and that a letter would be sent to EPA which would include those plans. Everyone expressed a desire to begin the proposal before 1985 ended.

10. Community Action Plan: Mr Pickett briefed the members on Tinker's Public Affair Community Action Plan. He noted that due to the dynamic nature of Tinker IRP work, the plan which members had was already out-of-date. Mr Coleman stated he would rather not be designated the Community Coordinator. Members agreed to provide Mr Pickett written comments as quickly as possible so the Plan could be published as soon as possible.

11. No additional items were discussed. Colonel Reaves again thanked everyone for taking time from their busy schedules to attend. The meeting was adjourned until the next Technical Working Group meeting on January 21, 1986 and the next TRC meeting on February 18, 1986.

RAY D. REAVES, Colonel, USAF
Director, Environmental Management

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

18 FEB 1986

REPLY TO ATTN OF: EM (Col Birch)

SUBJECT: Technical Working (TWG) Meeting Minutes - 21 January 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417; 21 January 1986, 1300 hours.

2. Chairman: Col Birch, OC-ALC/EM

3. Attendees:

Mr. Carpenter	Oklahoma City Water Department
Mr. Hearn	Oklahoma City Water Department
Ms. Moore	ACOG/GWA
Ms. Fairchild	OU, Environmental Ground Water Instructor
Mr. Ramsey	Corps of Engineers, Tulsa District
Mr. Johnson	Oklahoma Geological Survey
Mr. Puffer	EPA Superfund
Mr. Schuessler	PRC Engineering
Ms. Wagner	Corps of Engineers, Tulsa District
Mr. Roberts	Corps of Engineers, Tulsa District
Mr. Heitman	Oklahoma Water Resources Board
Mr. Nichols	Oklahoma State Department of Health
Capt Hoelscher	HQ AFLC/DEPV
Mr. Weaver	Corps of Engineers, Tulsa District
Ms. Taylor	OC-ALC/EM
Capt Jeter	OC-ALC/EM
Mr. Day	OC-ALC/EM
Mr. Luza	Oklahoma Geological Survey

4. The meeting began at 1300 hours.

5. Agenda Items:

a. Installation Restoration Program Update:

(1) Well 18 and 19 Work: Mr. Day, OC-ALC/EM, gave an update on this project. All of the analytical field work is completed. The contractor is reviewing the data and will have a draft report to OC-ALC/EM tomorrow, 22 Jan 86. There will also be an Environmental Assessment (EA) prepared on the remedial action. It was found that Well 18 had the highest amount of contamination. The contractor is going to look at the well to determine the source of the contamination, as well as some means of mitigating the contamination. We will try to provide a copy of that report in advance of next month's TRC meeting. We are granting them a two-week extension due to some time delays and weather delays.

(2) Landfill 6: Ms. Taylor, OC-ALC/EM, gave an update on the Landfill 6 project. The construction of the clay cap is completed. There was an 18 inch clay cap constructed as well as a 10 inch top soil cover. The monitoring wells

are now being installed. There will four (4) monitoring wells instead of the original five (5) wells. Additional monitoring wells are requested by the Oklahoma State Department of Health, as part of their comments on the IRP report. This is an interim measure. Complete evaluation of the site will be done as part of the Corps of Engineers project.

(3) Underground Storage Tanks: Mr. Day, OC-ALC/EM, briefed that the project started three months ago to identify abandoned tanks only. The contractor has found an additional 36 tanks above and beyond the 72 originally contracted. We are in the process of getting an additional contract to cover these 36 tanks. The contract is 70 percent complete, waiting on some lab results. We will have a draft report in OC-ALC/EM in middle to late February. Mr. Heitman, OWRB, stated that they are charged with investigating pollution incidents from leaking tanks. The OWRB has a requirement to give that information to the state by 8 May 1986.

(4) Soldier Creek Cleanout: Col Birch, OC-ALC/EM, stated that we have basically reached a point where we have exhausted the amount of the contract we had originally been budgeted for. We have requested and received assurances that more money is forthcoming for that project. We need some documentation of the decision process that lead up to the decision to remove the sediment. We are not sure when the money will be here. To date, 2800 cubic yards have been removed. We have determined that we need to remove 7000 cubic yards. The contract was to remove all visible contamination. Once they removed the visible contamination, the contract called for them to come in and assess the remaining sediments to see if there was any need for further removal. We have reached the point where they have removed about 1/3 of the contaminated soil from Soldier Creek. The price for cleanout was $223 per cubic yard. Mr. Heitman, OWRB, was concerned that the TWG had not been notified earlier of the fact that the contract was running low on money. It had been earlier decided that the contractor was to stop when he reached the point of expendign 2/3 of the total contract money. It does not appear that this has been done. Additional sampling was to be done in the other streams to determine how much sediment needed to be removed. Ms. Taylor noted that no sediment removal has been done in other streams. Sampling of these sediments is now planned as part of the second phase of the project which is awaiting additional funds from headquarters. Mr. Heitman, OWRB, would like to see the sampling because there is concern that perhaps we can take a different approach on the other creeks. Mr. Heitman, OWRBS, agreed to meet with Ms. Taylor next week to discuss what has been done.

b. Corps of Engineers Project: Col Birch, OC-ALC/EM, stated that a copy of the Corps of Engineers Scope of Work was sent out prior to the meeting. The group will go over the Scope of Work after Mr. Roberts, Corps of Engineers, Tulsa District, makes his presentation of the methods the Corps will be using. Mr. Roberts, Corps of Engineers, Tulsa District, gave a slide presentation showing the concepts and methods they will be using in their project. Mr. Roberts stressed that the remedial methods shown in the slides may or may not be the methods used at Tinker. Once the decision is made, they will proceed with plans and specifications. The methods to be used will be agreen upon based on review of the variables. Mr. Ramsey, Corps of Engineers, Tulsa District, stated that a report will be prepared that will discuss what was found and why we picked a particular plan of closure. There will be an on going flow of information, the data for each site will be discussed as it is found. The following changes to the Scope of Work were discussed.

(1) Mr. Heitman, OWRB, stated that they could only accept results from laboratories that are certified with the OWRB. Mr. Heitman checked and found the Corps of Engineers' laboratory is not certified with the OWRB. Therefore, they are to go ahead and begin sampling, but they must submit an application for certification and pass the certification test which will be coming up in May 1986. Passing this test will give them certification until 31 December 1986.

(2) Col Birch, OC-ALC/EM, briefed the group that one of the changes to be made to the SOW would be to specify the priority in which we are going to conduct the work. We will change to specify clearly the first priority will be the groundwater geohydrology. Second priority will be assessment of Bldg 3001, and third priority will be Landfill 6. The remaining priorities will be as listed on the page.

(3) There will be a work plan prepared for each particular site. This work plan will be prepared before any work actually starts and will describe what type of work will be done.

(4) Col Birch asked if there was a State or EPA requirement to split the samples. Mr. Nichols, Oklahoma State Department of Health; and Mr. Drew Puffer, EPA Superfund, will check on this requirement and get back with the Corps of Engineers within the next couple of days.

(5) Col Birch, OC-ALC/EM, also asked Mr. Nichols, Oklahoma State Department of Health, whether the state could assist in collecting samples from private wells off base. Mr. Nichols said he would check into this matter and get back with Col Birch.

(6) Col Birch, OC-ALC/EM, stated that they will be inserting some wording in paragraph 5.2(a), to make sure it is clear that the wells will be within the perimeter of the base as opposed to off base. These wells will be temporary and will be used on a one-time basis for this project. The EPA and State had no objection to use PVC for construction of the wells, but cautioned that permanent wells should be stainless steel.

(7) Page 4, para 5.2(g): The "surveys" referenced in this paragraph refers to geometrology surveys.

(8) Page 4, para 6.1: A sentence will be added to the end of the paragraph to state that drilling in and around Building 3001 requires advance planning and coordination with the using organization and other base agencies.

(9) Page 5, para 6.2(f): Col Birch questioned whether the State or EPA would be interested in observing the pump tests on the wells. It was agreed that the agencies would be notified before the tests and an invitation offered at that time.

(10) Page 6: A concern was raised about precautions to be taken before drilling into landfills. The Corps agrees to conduct appropriate geophysical investigations (e.g., ground penetrating radar) to minimize drilling into a container of toxic waste.

(11) Page 9, para 11: Modify to reflect the Corps will submit their laboratory's QA/QC plan prior to starting work.

(12) Page 6, para 8.0: Mr. Hearn, Oklahoma City Water Department, expressed concern for the lack of surface water sampling at Landfill 6. The south part of the landfill drains toward Draper Reservoir which serves as a back-up source of drinking water for the area. It was agreed that the sediment samples would be collected from the run-off channels to determine if pollutants were leaving the landfill.

(13) Mr. Hearn, Oklahoma City Water Department, expressed concern that the Corps of Engineers planned to place monitoring wells only to the depth of 120 feet when the Garber-Wellington Aquifer is 500 feet deep. .Mr. Roberts, Corps of Engineers, Tulsa District, stated that the depth of 120 feet would be sufficient to determine contamination. Mr. Hearn gave Mr. Roberts a copy of a map showing the sites of three wells that are the property of the Water Department that have not been used in 10 years. These wells might possibly be used in the sampling of the Corps of Engineers.

(14) Col Birch thanked the participants for the detailed review of the Scope of Work and indicated that the base wants to have the final draft to the TRC representatives as soon as possible so that the study can begin.

c. Mr. Hearn, Oklahoma City Water Department, expressed a concern for the land that Landfill 6 is on - this land is leased to Tinker AFB until 30 September 1989. He indicated that the city might possibly sell this land to Tinker AFB. Col Birch will ask the base legal office to pursue this issue.

d. Col Birch called for other issues to be discussed. There were none.

6. The meeting adjourned at 1530 hours.

SHELTON R. BIRCH, Col, USAF, BSC
Staff Bioenvironmental Engineer

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

8 APR 1986

REPLY TO ATTN OF: EM

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 18 February 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 3001; 18 February 1986, 1300 hours.

2. Chairman: Col Reaves, OC-ALC/EM

3. Attendees:

Brig Gen Searock	OC-ALC/CV
Mr. Mark Coleman	Oklahoma State Health Department (State of Oklahoma Representative to TRC)
Mr. Bob Hannesschlager	EPA Superfund Branch (EPA Representative to TRC)
Mr. Gene Leiterman	2854 CES/DE
Col Carr	OC-ALC/MAQ
Col Birch	OC-ALC/EM
Mr. John Roberts	Corps of Engineers, Tulsa District
Mr. Ken Johnson	Oklahoma Geological Survey
Mr. Bob Ramsey	Corps of Engineers, Tulsa District
Mr. Drew Puffer	EPA Superfund Branch
Mr. Greg McCabe	EPA Superfund Branch
Ms. Anne Copeland	OC-ALC/MAQCE
Mr. Danny Arnold	OC-ALC/MAQCE
Mr. J. W. Dansby	Dansby & Associates
Capt Jeter	OC-ALC/EME
Ms. Cathy Taylor	OC-ALC/EME
Dr. Ron Jarman	Oklahoma Water Resources Board
Ms. Suzanne Moore	Association of Central OK Governments
Mr. Odell Morgan	Association of Central OK Governments
Mr. Howard Bain	OC-ALC/JA
LTC Baldwin	OC-ALC/SE

4. The meeting began at 1300 hours.

5. Agenda Items:

a. Brig Gen Searock, OC-ALC/CV, gave a brief talk on his trip with the Corps of Engineers to Washington D.C. and IRP plans for Tinker AFB. These plans include the Corps of Engineers' project which is estimated to take 18 months.

b. Col Reaves, OC-ALC/EM, briefed the group on the review process we will be utilizing for the Installation Restoration Program. The Technical Working Group and Technical Review Committee will be reviewing the project step by step. This will save time in starting and stopping the project for review processes. Members of these committees should be authorized to provide lead review and tentative approval for their respective organizations, given the limitations

that much committee work will be based on verbal response. This process is expected to result in "no surprises" to either Tinker AFB or the reviewing agencies as required written documents are submitted for formal approval. We hope to use the TRC and TWG as a public debate forum. We will check to see if this will suffice as a public hearings requirement.

c. Col Reaves, OC-ALC/EM, briefed that we have received a great deal of positive feedback on our program. Tinker's program has gone from reactive to proactive. We got a handshake agreement from Col Kane (AF/LEEV) to provide the funding. The funds will be made available as we ask for them.

d. Installation Restoration Program:

(1) Landfill 6: Capt Jeter, OC-ALC/EME, briefed that a clay cap has been placed over Landfill 6 in an attempt to prevent migration of contamination from this landfill. This clay cover is 18 inches in depth. A 10 inch top soil layer has been placed on top of the clay cap. This top soil material came from on base. Basically, it is a clay soil which provides added protection. Four additional monitoring wells with casings of stainless steel will be drilled. Trees may not be appropriate to grow in the area because the roots may extend too deep into the landfill. Grasses are more favorable to grow in the area because of their shallow root system. Mr. Roberts, Corps of Engineers, Tulsa District, suggested a mowing plan be developed to keep trees off the landfill. Capt Jeter, OC-ALC/EME, briefed that this initial remedial action for Landfill 6 has been completed.

(2) Water Wells 18 and 19: Capt Jeter, OC-ALC/EME, briefed the group that the project is at a completion stage. A draft report has been received and reviewed. This report recommends plugging the wells permanently. The wells are corroded beyond feasible usage. They would not be effective as drinking wells or as a recovery system. A final report will be distributed within the next few days. The method of plugging will be through pressurized concrete both on interior and exterior of casing. Wells 18 and 19 will be one of the first areas that the Corps of Engineers will be looking at in their study.

(3) East Soldier Creek Cleanup: Capt Jeter, OC-ALC/EME, briefed that the soil is being excavated to down below a layer of black soil. This excavating goes down to as much as 48 inches. The Oklahoma State Department of Health and Oklahoma Water Resources Board recommended the excavation be to background levels. For expediency, this was assumed to be a visible clean point. All sampling was done at the top level of 5 inches. All the sediments will be taken to a RCRA disposal site. Additional sampling will be performed at the point of visibly clean. We currently are out of money for this project, but arrangements are being made for further funding. The topic of sampling was discussed with Mr. Mark Coleman, Oklahoma State Department of Health, voicing a concern for sampling a bulk load instead of specific samples being made. It was decided that a meeting will be held with concerned parties on Friday, 21 February 1986, to discuss the sampling issue further. An alternate kind of direct recovery will be explored. The entire subject will be explored to determine the most cost effective way of dealing with this matter.

5. The meeting adjourned at 1400 hours.

RAY D. REAVES, Col, USAF
Chairman, Technical Review Committee

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145

1 MAY 1986

REPLY TO ATTN OF: EM (Col Birch)

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 15 April 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417; 15 April 1986, 1300 hours.

2. Chairman: Col Birch, OC-ALC/EM

3. Attendees:

Capt Jeter	OC-ALC/EME
2Lt Boyce	HQ AFLC/DEVX
Ms. Taylor	OC-ALC/EME
Mr. Dunbar	Oklahoma State Department of Health
Mr. Nichols	Oklahoma State Department of Health
Mr. Roberts	Corps of Engineers, Tulsa District
Mr. Obrochta	Corps of Engineers, Tulsa District
Mr. Burkart	Corps of Engineers, Tulsa District
Mr. Warren	Corps of Engineers, Tulsa District
Ms. McConnell	Corps of Engineers, Tulsa District
Ms. Wagner	Corps of Engineers, Tulsa District
Mr. Phillips	OC-ALC/DSM
Mr. Black	OC-ALC/DSME
Mr. Leiterman	2854 CES/DDE
Mr. Robledo	AFRCE/CR
Mr. Morgan	ACOG/GWA
Ms. Moore	ACOG/GWA
Mr. Taylor	ACOG/GWA
Mr. Carpenter	Oklahoma City Water Department
Mr. Williams	OC-ALC/XRX
Mr. Heitman	Oklahoma Water Resources Board
Mr. McCabe	EPA Region VI/Superfund Branch
Mr. Bain	OC-ALC/JA

4. The meeting began at 1300 hours.

5. Agenda Items:

a. Installation Restoration Program Update:

(1) Underground Storage Tank Report: Capt Jeter, OC-ALC/EME, briefed that the report on the tanks had been distributed to members of the TWG. A contract was awarded a few months ago to gather information for reporting underground storage tanks in May. In the process, the contractor identified abandoned tanks and active tanks. Several areas on base were identified as having leaks or spills from these tanks. One sample well in the fuel yard was identified as having 12 feet of fuel. A relatively short distance away

no fuel was found. This seems inconsistent. The fuel is confined by a clay lens. We are dealing with 25 tanks in the fuel yard, one is already abandoned. Therefore, a total of 24 active tanks are involved. An FY 86 MCP project to install above ground fuel storage tanks may be impacted by the fuel cleanup requirements. We have a statement of work prepared for a precision leak test on the active tanks to determine how many and which tanks are a problem. We will immediately abandon all leaking tanks. We will be working with the Corps of Engineers who will do a more thorough investigation of the contaminated area. This project has been moved up in priority in the COE schedule. When we have identified where the fuel is standing, we will pump it out. The Corps will prepare a remedial action plan to identify alternatives for dealing with the fuel yard contamination. Hopefully, we can work all remedial actions with the MCP project in progress. Testing was done July 85 on the tanks utilizing the stand pipe method with no leaks identified. The MCP project is 35% design complete. Mr. Heitman, Oklahoma Water Resources Board, recommended we check with the Fire Marshall on any requirements of above ground tanks. This has been presented to Brig Gen Searock and he is aware of the problem and is supporting our approach.

(2) Water Wells 18 and 19: The final report on this topic was distributed to members. Capt Jeter, OC-ALC/EME, briefed that the final report recommended plugging of the wells. HQ AFLC concurs with this recommendation. The COE will prepare specifications for plugging the wells and our contractor, who performed the study, will take the Corps specs and plug the wells with technical assistance from the Corps of Engineers. Funding for the project has been requested. Congressman Synar is suggesting plugging the wells as soon as possible. The time frame of this entire project would put the completion of the project in mid-June. The Corps of Engineers will be conducting their investigation of Bldg 3001 in conjunction with the plugging of the wells.

(3) Soldier Creek Cleanout: Capt Jeter, OC-ALC/EME, briefed that we have a contract to remove the contaminated sediment from Soldier Creek. This project is 65% complete. The contractor is to remove the sediment to a visibly clean point. We have conducted post-cleanup samples where the contractor has finished the digging, and are awaiting results which should be back this week. We have removed approximately 5100 cubic yard to date. The creek will be regraded, sloped, and sodded after the excavation is complete. We have prepared a record of decision outlining the decision steps on the cleanout method and the approach. We have sent this record of decision to HQ AFLC and expect it back in a few days with their comments. We will be requesting that the TRC members sign off on this decision document at the TRC meeting in May.

(4) Landfill 6: Capt Jeter, OC-ALC/EME, briefed that the contractor should begin mulching operations either today or tomorrow to promote grass growth in this area.

b. Corps of Engineers Project: Mr. Roberts, Corps of Engineers, Tulsa District, made a slide presentation to the group concerning the methods the Corps will be using in their various investigations. The Corps officially began on 1 March 86. Currently, two rigs are on site working. One is digging

monitoring wells around the perimeter of the base, the other is doing explorations around Bldg 3001. The Corps also has a sampling truck on base. Mr. Roberts presented the sites on base which are under investigation in their order of priority. Mr. Roberts also presented a slide depicting the time frame for the various investigations on base. A total of 24 months is scheduled for the completion of all sites. The fuel yard will most likely be placed high on the priority list to come right after the investigations of Bldg 3001. Ms. Wagner, Mr. Obrochta, Mr. Burkart, and Mr. Warner each presented a portion of the projects on-going on base and the exact methods used [illegible].

c. Cooperative Research Efforts: Capt Jeter, OC-ALC/EME, briefed on research that Tinker AFB will be participating in with the AFESC and Louisiana State University. The research efforts will be looking at Elm Creek, an ephemeral stream. This research will involve metals migration in soils. Another cooperative project will be done with AFESC and the USEPA/RSKERL lab in Ada, Oklahoma. This project is to investigate aerobic degradation of trichloroethylene in groundwater. The last project briefed involves aquifer material collection for various laboratory studies conducted by AFESC and USEPA.

6. Regulatory Concerns:

a. Water Wells 18 and 19: ACOG/GWA voiced some concerns regarding the pumping of Wells 18 and 19 before permanently plugging the wells. This will not be done because it is believed that the contamination would only be drawn deeper if we utilized the wells to pump the contamination out. The potential is present to do more harm if the wells are pumped. The work the Corps is doing in Bldg 3001 will eventually result in recommendations for remedial action to cleanup the contamination in the area of Wells 18 and 19.

SHELTON R. BIRCH, Col, USAF, BSC
Chairman

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145

1 MAY 1986

REPLY TO ATTN OF: EM (Col Birch)

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 15 April 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417; 15 April 1986, 1300 hours.

2. Chairman: Col Birch, OC-ALC/EM

3. Attendees:

Capt Jeter	OC-ALC/EME
2Lt Boyce	HQ AFLC/DEVX
Ms. Taylor	OC-ALC/EME
Mr. Dunbar	Oklahoma State Department of Health
Mr. Nichols	Oklahoma State Department of Health
Mr. Roberts	Corps of Engineers, Tulsa District
Mr. Obrochta	Corps of Engineers, Tulsa District
Mr. Burkart	Corps of Engineers, Tulsa District
Mr. Warren	Corps of Engineers, Tulsa District
Ms. McConnell	Corps of Engineers, Tulsa District
Ms. Wagner	Corps of Engineers, Tulsa District
Mr. Phillips	OC-ALC/DSM
Mr. Black	OC-ALC/DSME
Mr. Leiterman	2854 CES/DDE
Mr. Robledo	AFRCE/CR
Mr. Morgan	ACOG/GWA
Ms. Moore	ACOG/GWA
Mr. Taylor	ACOG/GWA
Mr. Carpenter	Oklahoma City Water Department
Mr. Williams	OC-ALC/XRX
Mr. Heitman	Oklahoma Water Resources Board
Mr. McCabe	EPA Region VI/Superfund Branch
Mr. Bain	OC-ALC/JA

4. The meeting began at 1300 hours.

5. Agenda Items:

a. Installation Restoration Program Update:

(1) Underground Storage Tank Report: Capt Jeter, OC-ALC/EME, briefed that the report on the tanks had been distributed to members of the TWG. A contract was awarded a few months ago to gather information for reporting underground storage tanks in May. In the process, the contractor identified abandoned tanks and active tanks. Several areas on base were identified as having leaks or spills from these tanks. One sample well in the fuel yard was identified as having 12 feet of fuel. A relatively short distance away

no fuel was found. This seems inconsistent. The fuel is confined by a clay lens. We are dealing with 25 tanks in the fuel yard, one is already abandoned. Therefore, a total of 24 active tanks are involved. An FY 86 MCP project to install above ground fuel storage tanks may be impacted by the fuel cleanup requirements. We have a statement of work prepared for a precision leak test on the active tanks to determine how many and which tanks are a problem. We will immediately abandon all leaking tanks. We will be working with the Corps of Engineers who will do a more thorough investigation of the contaminated area. This project has been moved up in priority in the COE schedule. When we have identified where the fuel is standing, we will pump it out. The Corps will prepare a remedial action plan to identify alternatives for dealing with the fuel yard contamination. Hopefully, we can work all remedial actions with the MCP project in progress. Testing was done July 85 on the tanks utilizing the stand pipe method with no leaks identified. The MCP project is 30% design complete. Mr. Heitman, Oklahoma Water Resources Board, recommended we check with the Fire Marshall on any requirements of above ground tanks. This has been presented to Brig Gen Searock and he is aware of the problem and is supporting our approach.

(2) Water Wells 18 and 19: The final report on this topic was distributed to members. Capt Jeter, OC-ALC/EME, briefed that the final report recommended plugging of the wells. HQ AFLC concurs with this recommendation. The COE will prepare specifications for plugging the wells and our contractor, who performed the study, will take the Corps specs and plug the wells with technical assistance from the Corps of Engineers. Funding for the project has been requested. Congressman Synar is suggesting plugging the wells as soon as possible. The time frame of this entire project would put the completion of the project in mid-June. The Corps of Engineers will be conducting their investigation of Bldg 3001 in conjunction with the plugging of the wells.

(3) Soldier Creek Cleanout: Capt Jeter, OC-ALC/EME, briefed that we have a contract to remove the contaminated sediment from Soldier Creek. This project is 65% complete. The contractor is to remove the sediment to a visibly clean point. We have conducted post-cleanup samples where the contractor has finished the digging, and are awaiting results which should be back this week. We have removed approximately 5100 cubic yard to date. The creek will be regraded, sloped, and sodded after the excavation is complete. We have prepared a record of decision outlining the decision steps on the cleanout method and the approach. We have sent this record of decision to HQ AFLC and expect it back in a few days with their comments. We will be requesting that the TRC members sign off on this decision document at the TRC meeting in May.

(4) Landfill 6: Capt Jeter, OC-ALC/EME, briefed that the contractor will begin mulching operations either today or tomorrow to promote grass growth in this area.

b. Corps of Engineers Project: Mr. Roberts, Corps of Engineers, Tulsa District, made a slide presentation to the group concerning the methods the Corps will be using in their various investigations. The Corps officially began on 1 March 86. Currently, two rigs are on site working. One is digging

monitoring wells around the perimeter of the base, the other is doing explorations around Bldg 3001. The Corps also has a sampling truck on base. Mr. Roberts presented the sites on base which are under investigation in their order of priority. Mr. Roberts also presented a slide depicting the time frame for the various investigations on base. A total of 24 months is scheduled for the completion of all sites. The fuel yard will most likely be placed high on the priority list to come right after the investigations of Bldg 3001. Ms. Wagner, Mr. Obrochta, Mr. Burkart, and Mr. Warrer each presented a portion of the projects on-going on base and the exact methods used in each case.

c. Cooperative Research Efforts: Capt Jeter, OC-ALC/EME, briefed on research that Tinker AFB will be participating in with the AFESC and Louisiana State University. The research efforts will be looking at Elm Creek, an ephemeral stream. This research will involve metals migration in soils. Another cooperative project will be done with AFESC and the USEPA/RSKERL lab in Ada, Oklahoma. This project is to investigate aerobic degradation of trichloroethylene in groundwater. The last project briefed involves aquifer material collection for various laboratory studies conducted by AFESC and USEPA.

6. Regulatory Concerns:

a. Water Wells 18 and 19: ACOG/GWA voiced some concerns regarding the pumping of Wells 18 and 19 before permanently plugging the wells. This will not be done because it is believed that the contamination would only be drawn deeper if we utilized the wells to pump the contamination out. The potential is present to do more harm if the wells are pumped. The work the Corps is doing in Bldg 3001 will eventually result in recommendations for remedial action to cleanup the contamination in the area of Wells 18 and 19.

SHELTON R. BIRCH, Col, USAF, BSC
Chairman

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

11 JUL 1986

REPLY TO
ATTN OF: EM

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 20 May 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 3001; 20 May 1986, 1300 hours.

2. Members:

	Col Ray Reaves	OC-ALC/EM, Chairman
	Mr. Mark Coleman	Oklahoma State Department of Health (State of Oklahoma Representative to TRC)
	Mr. Robert Hannesschlager	EPA Superfund Branch (EPA Representative to TRC)

3. Attendees:

Brig Gen Searock	OC-ALC/CV
Col Shelton Birch	OC-ALC/EM
Capt Jack Jeter	OC-ALC/EME
Mr. Joe Phillips	OC-ALC/DSM
Mr. Warren Jones	2854 CES/DEEX
Mr. Danny Arnold	OC-ALC/MA
Ms. Sharon Moore	OC-ALC/EME
Mr. Howard Bain	OC-ALC/JA
Mr. Robert Ramsey	Corps of Engineers, Tulsa District
Mr. John Roberts	Corps of Engineers, Tulsa District
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Mr. Ken Johnson	Oklahoma Geological Survey
Mr. Fred Heitman	Oklahoma Water Resources Board
Dr. Ron Jarman	Oklahoma Water Resources Board
Mr. Tony Robledo	AFRCE-CR
Mr. William Green	AFRCE-CR
Mr. Odell Morgan	Association of Central Oklahoma Governments/ Garber-Wellington Association
Ms. Suzanne Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr. Don Hensch	Oklahoma State Department of Health
Ms. Valeria Collier-Vick	Oklahoma State Department of Health
Mr. John Nichols	Oklahoma State Department of Health
Mr. Greg McCabe	EPA Superfund Branch
Mr. Bob Hammons	General Accounting Office, OKC
Mr. John Rohrbacker	General Accounting Office, OKC
Ms. Julie Cline	General Accounting Office, OKC

4. The meeting opened at 1300 hours, Brig Gen Searock welcomed members and visitors.

a. Base Projects:

(1) Underground Storage Tank Project: Capt Jeter, OC-ALC/EM, briefed the group on the underground storage tank project. We had a contractor come on base to investigate all abandoned and active storage tanks to gather information

for a May 1986 report to the Oklahoma Corporation Commission. We have reported 190 tanks, of which about 100 are abandoned. In the process of investigation, three areas on base indicated leaks or spills around tanks. A report of these findings has been distributed to the Technical Review Committee members. The area of prime concern is the fuel yard, which appears to have some standing free product. This area is of immediate concern because of an FY 86 Military Construction Project (MCP) to replace the underground tanks in the area with above ground tanks. Our interest is to keep the MCP schedule and to get the environmental concerns handled so that they can be worked together. Capt Jeter, OC-ALC/EME, briefed the action plan for addressing the fuel yard contamination.

a) The first step will be to construct a new fuel fill station to permit abandoning the existing underground tanks. A work order has been submitted for this work. We anticipate completion of the work within six months.

b) We have recently completed a leak test of tanks using a standpipe method and also a pressure test of all piping. Although not as sensitive as the proposed EPA procedures, the tests did not identify any leaking tanks or piping.

c) We are expanding the Corps of Engineers' project to include a complete investigation of this site to quantify the extent of contamination and to determine the specific remedial measures that will be required. If substantial free product is confirmed, we will remove it for reclamation/reuse.

d) The MCP plans, currently specify the method of permanently abandoning the existing tanks to be removing the tops off the tanks, pumping any free fuel in the tanks, and then backfilling the tanks with sand. The tanks would be left in place.

e) Cleanup actions for this kind of contamination has historically involved some combination of pumping and treatment of shallow groundwater. If these remedial measures are required, they should not interfere with the construction of the MCP and may be able to be implemented simultaneously.

DISCUSSION: Mr. Coleman, OSDH, emphasized the importance of removing the free standing fuel promptly after discovery since the fuel will be transported with groundwater movement. He noted that because of this, the absence of free standing fuel upon follow-up investigation does not mean the fuel was never present. Dr. Jarman, OWRB, noted that the use of microorganisms to treat the in-ground fuel might be appropriate. This method would be acceptable to the OWRB and would work well in conjunction with the proposed construction. Capt Jeter, OC-ALC/EM, asked the group if there were any concerns associated with the proposed actions. Mr. Hannesschlager US EPA, and Mr. Coleman, OSDH, stated there were none.

(2) Water Wells 18 and 19: Capt Jeter, OC-ALC/EME, briefed the status of these wells. Three investigations have been conducted of the wells. The most recent one was conducted by J.W. Dansby & Associates. All of the studies have identified these wells as potential routes for contaminants beneath B3001 to enter the lower levels of the Garber-Wellington aquifer. The Dansby study indicated that both wells had numerous corrosion holes in the casings and also that the well casings were poorly bonded to the surrounding geologic strata. The report recommended that both wells be sealed and grouted to preclude further migration of contamination. We have requested approval from our Headquarters for this action. The Corps of Engineers has prepared detailed specifications for plugging the wells and will provide technical oversight on the project. The actual plugging will take two weeks after approval to proceed is reviewed from our Headquarters.

(3) Soldier Creek: Capt Jeter briefed that we have completed the removal of visibly contaminated soils. We have completed sampling to confirm that the clean up is complete. We have removed all organics, but some heavy metals remain in the creek sediments above recommended levels. The creek has been graded, sodded, and sod is being maintained. We have done additional sampling on the creek bed at sites agreed upon with the OWRB. We are going to analyze the first 6 inches for cadmium, chromium, and lead. We have collected these samples and expect the results in the next few days. We will then discuss what additional work is needed in Soldier Creek. We have prepared a Record of Decision for Headquarters that details steps taken. This was done in coordination with the OWRB and OSDH. We are expecting comments on this back from Headquarters within the next couple of weeks. We will make corrections they request and provide copies to the TRC members. Mr. Hannesschlager, EPA Superfund Branch, asked what the current schedule was for looking at the other creeks around the base. Capt Jeter replied that the COE has prepared a Statement of Work for looking at the other creeks, and we have requested approval and FY 87 funding for this project from our Headquarters. Kuhlman, Crutcho, and Elm Creeks are included in the sampling proposed for FY 87. Dr. Jarman, OWRB, complimented the Air Force and Tinker Air Force Base for dealing with this difficult problem in a professional mannor.

(4) Landfill 6: Capt Jeter briefed that a clay cap has been placed on the landfill and we are currently sprigging this area with grass. This item is closed out.

(5) Corps of Engineers Project: Mr. John Roberts, COE, Tulsa District, briefed the group on the COE progress made on the Installation Restoration Program (IRP). Attachment 1 goes into more detail explaining the status of the IRP.

(6) Cooperative Research Efforts: Capt Jeter briefed the group on the upcoming cooperative research projects that will be conducted on base. One project will be to look at metals, one will collect soil samples for laboratory studies on transport of Air Force chemicals, and one will pilot test an aerobic biodegradation system for TCE treatment. Mr. Coleman, OSDH, stressed that we will want to look at the pilot program to make sure they have applied for appropriate permits before they begin testing.

b. Regulatory Concerns:

No separate issues were raised by State or EPA officials.

6. The meeting was adjourned at 1400 hours.

RAY D. REAVES, Col, USAF
Chairman, Technical Review Committee

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

1 Atch
COE Status of IRP

INSTALLATION RESTORATION PROGRAM

AGENDA

TECHNICAL REVIEW COMMITTEE (TRC) - 20 MAY 1986

1. Introduction
2. Review of Scope of Work
3. Submittals to Tinker Air Force Base
4. Status Report:
   a. Groundwater Assessment
   b. Building 3001
   c. Fuel Farm Area
   d. Landfills 1-6
   e. FTA's 1 and 2
   f. EWDS's 1030W and 201S
5. Discussion

INSTALLATION RESTORATION PROGRAM

COE SUBMITTALS TO TINKER AIR FORCE BASE

THRU 20 MAY 1986

1. Site Safety Plan
2. Sampling & Analysis Quality Assurance/Quality Control Plan
3. Work Plan for Groundwater Assessment
4. Work Plan for Building 3001
5. Work Plan for Landfill 6
6. Specifications for Plugging Wells 18 and 19

TECHNICAL WORKING GROUP

SUMMARY OF MEETING CONCERNING IRP BY CORPS OF ENGINEERS

1. Installation Restoration Program. Captain Jeter, Tinker Air Force Base, reported on the following projects:

a. Underground Storage Tanks. Plans are to replace existing tanks with above ground tanks. Tops will be cut off the tanks, and the tanks will be cleaned and filled with sand. Remedial action plan for the site will be done by the Corps of Engineers, Tulsa District.

b. Water Wells 18 and 19. The recommendation was made by Dansby and the Corps of Engineers to plug wells 18 and 19. Headquarters, Air Force Logistics Center (HQ AFLC) has agreed with this recommendation. The Corps of Engineers are preparing the specifications and will provide quality assurance, however, Dansby will be doing the actual plugging of these two wells. Wells could be plugged by mid June 1986. Funding has been requested from HQ AFLC.

2. Corps of Engineers Presentation.

a. John Roberts reported that the Corps of Engineers officially began work 1 March 1986. Currently the Corps of Engineers are installing monitoring wells around the base and doing some explorations around Building 3001. With the use of slides, Mr. Roberts discussed the time frame for completion of projects on base. Results of investigations were not available for this meeting. Detailed information on procedures used by Corps of Engineers investigations including drilling procedures, disposal of drill water and mud, well installation and sampling procedures, and methods to be used to plug wells 18 and 19 was presented at the TWG. The work plan for the groundwater assessment and Building 3001 investigations were also discussed. Procedural details were presented by the Geotechnical staff, Tulsa District. The Corps of Engineers also included sampling for salt water intrusion as part of the groundwater assessment to resolve concerns by the Garber/Wellington Association.

4. Concerns/Questions.

a. Garber Wellington expressed concern over the plugging of wells 18 and 19. They proposed that the wells be pumped prior to plugging. The Corps of Engineers disagreed with the proposal for the following reasons:

(1) The Building 3001 hydrogeologic investigation is not complete.

(2) Premature pumping of wells 18 and 19 could result in a significant spread of any contaminants.

(3) A pump and test plan for any subsurface contamination will be a long term project.

STATUS REPORT
on
INSTALLATION RESTORATION PROGRAM
at
TINKER AIR FORCE BASE, OKLAHOMA
(as of 23 May 1986)

Groundwater Assessment:

Ten of twelve deep perimeter wells and eight of twelve shallow perimeter wells have been installed. Drill crews from St. Louis and Omaha Districts of the Corps of Engineers have been assisting Tulsa District on this effort.

Sampling of existing base wells is proceeding. Summer engineering students will double our water sampling work force to accomplish this sampling as soon as possible.

Data is being evaluated from the Garber/Wellington Aquifer Association and the Oklahoma State Department of Health to selected off-base wells for sampling in the groundwater assessment. Stationing for all on-base wells is being developed as the first step in inputting all data on to STORET.

Building 3001:

Eleven two-well clusters have been installed around the building. All Corps of Engineers wells are being painted black and white for easy identification. About half of the well clusters have been sampled. Six shallow wells were installed as companions to the previously installed wells by Radian.

The initial round of results has been received from the laboratory. All results are received on a diskette in a format ready to transmit to STORET.

The visual inspection and mapping of the floor slab in the south 83 columns of the building have been completed. Thirty-nine pits or sumps have been located and will be drilled into within the next 30 days. The ground-penetrating radar survey will also be performed in this time frame. As pits (or sumps) are periodically cleaned out, they are being inspected for soundness or evidence of leakage.

The specifications and Government estimate for the plugging of base water supply wells 18 and 19 have been prepared and submitted to Tinker for negotiation of a contract modification with J. W. Dansby, the Contractor who will actually plug the wells.

Landfill 6

The work plan for Landfill 6 has been prepared and submitted.

Sampling of the sediments in the drainages leading south from the

landfill area into Stanley Draper Lake will begin this week.

Drilling through the landfill will begin when weather permits. Undisturbed samples will be taken of the cap; one sample will be composited from the landfill waste in each trench, and any water (leachate) encountered will be sampled.

Old aerial photos have been ordered from the ASCS Office in Salt Lake City, Utah, to aid in trench locations.

Water samples have been collected from all but the wells across 59th Street.

Fuel Farm Area:

The work plan has not been submitted. The wells installed by A. L. Burke will be used, if possible; however, many have been contaminated with surface runoff. The A. L. Burke wells were an average of 30 feet in depth, and the Corps investigation of this site will be directed at this water-bearing zone, as well as at the top of the regional groundwater table, some 80 feet in depth.

Work must proceed here rapidly because of the upcoming MCP project in the same vicinity.

Landfills 1-4 and 5:

Reconnaissance has begun, and wells have been sampled. The trenches are well defined here because of subsidence in the landfill.

FTA's:

A meeting has been scheduled with a long-time member of the fire department and Tulsa District Corps of Engineers to establish exact locations of the FTA's. Visual evidence of them is no longer present.

RWDS:

The two radiological waste disposal sites have not been investigated. It is expected that the ground-penetrating radar will be useful in locating the "pigs" so that samples can be taken from nearby and evaluated.

Tinker file

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

14 AUG 1986

REPLY TO ATTN OF: EM

SUBJECT: Additional Information for TWG Minutes

TO: All TWG Members

1. Minutes of the Technical Working Group (TWG) meeting on 15 July 1986 are attached. Since that meeting, we have obtained additional information on several items discussed at the meeting. This information is summarized below.

a. Wells 18 and 19: Funds for plugging these wells have been received and we are negotiating with the contractor. We anticipate completion of this project within three weeks.

b. Fuel Farm Project: Investigation of current RCRA rules indicate the soil will not have to be disposed of as a hazardous waste. Additional samples of the soil will be analyzed by the method described in the proposed changes to the RCRA rules.

c. Bldg 3001: The conclusions concerning the extent of contamination beneath Bldg 3001 were reached from a preliminary analysis of the data. A thorough analysis indicates preliminary data did not fully identify the total area of contamination. Additional investigations have been started to determine the extent of contamination.

2. The TRC meeting will be held on Monday, 18 August 1986, at 1:00 p.m. in the MA Conference Room, Bldg 3001.

for SHELTON R. BIRCH, Col, USAF, BSC
Staff Bioenvironmental Engineer

1 Atch
TWG Minutes

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

14 AUG 1986

REPLY TO ATTN OF: EM (Col Birch)

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 15 July 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 414, 15 July 1986, 1300 hours.

2. Chairman: Col Birch, OC-ALC/EM

3. Attendees:

Capt Jeter	OC-ALC/EME
Ms. Taylor	OC-ALC/EME
Mr. Leiterman	2854 CES/DE
Mr. Black	OC-ALC/DSME
Mr. Farley	Oklahoma State Department of Health
Dr. Jarman	Oklahoma Water Resources Board
Mr. Heitman	Oklahoma Water Resources Board
Mr. Luza	Oklahoma Geological Survey
Mr. Horak	U.S. Geological Survey, OKC
Mr. Frey	U.S. Environmental Protection Agency
Ms. Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr. Ramsey	Corps of Engineers, Tulsa District
Mr. Roberts	Corps of Engineers, Tulsa District
Mr. Warren	Corps of Engineers, Tulsa District
Mr. Burkart	Corps of Engineers, Tulsa District
Ms. Wagner	Corps of Engineers, Tulsa District
Ms. McConnell	Corps of Engineers, Tulsa District
Mr. Obrochta	Corps of Engineers, Tulsa District
Mr. Clark	Corps of Engineers, Tulsa District
Mr. Tye	Southwestern Division Laboratory
Mr. Hammons	General Accounting Office
Ms. Cline	General Accounting Office

4. The meeting began at 1300 hours.

5. Agenda Items:

a. Installation Restoration Program Update:

(1) Water Wells 18 and 19: Capt Jeter, OC-ALC/EME, briefed the group on the status of the plugging of the wells 18 and 19. At the present time, the wells are still not plugged. Plans and specifications, as well as an environmental assessment have been completed. We are currently awaiting funding to plug these wells. The cost will be approximately $150,000. We hope funding will be forthcoming shortly.

(2) Soldier Creek Cleanout: Capt Jeter, OC-ALC/EME, briefed the group on the findings of the post-cleanup sampling. The results indicate some residual contamination. The topic was discussed at length, and it was decided to form an ad hoc committee to discuss the matter in depth prior to the TRC meeting on 19 August 1986. This committee will convene after results of water samples are received.

b. Corps of Engineers Project: Mr. Roberts, Corps of Engineers, Tulsa District, briefed the group on the progress the Corps had been making with the various projects. The Corps is 4 1/2 months into the overall project and are already two months ahead of the anticipated schedule.

(1) Fuel Farm Investigations: Ms. Wagner, Corps of Engineers, Tulsa District, reported on the findings of the Corps' investigation of the extent of fuel contamination in the fuel farm area. Slides were presented showing the details of the area with the fuel being present in the immediate vicinity of the underground storage tanks. Sampling and analysis of the soil that must be excavated for the above ground tank foundations indicate the presence of hydrocarbon fuel residue. This residue contains traces of benzene in concentrations that may be considered hazardous under recently proposed changes to RCRA rules. Concern was expressed about the amount of dirt that might have to be disposed of as hazardous waste. Additional investigation will be done on this item.

(2) Bldg 3001: Mr. Warren, Corps of Engineers, Tulsa District, reported on the investigation of the pits being done in Bldg 3001. Slides were shown depicting the areas of contamination. The contamination seemed to be confined to beneath the building itself. Recommendations were given to clean up the TCE contamination in the area.

(3) Groundwater Assessment: Mr. Roberts, Corps of Engineers, Tulsa District, gave a brief update of the overall Tinker AFB groundwater assessment project. Access to wells on lands off base was discussed. Mr. Roberts will get with Dr. Jarman, OWRB, to identify the areas that the Corps needs to gain access to for sampling purposes.

for SHELTON R. BIRCH, Col, USAF, BSC
Chairman

CCE
Ms McConnell

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

30 OCT 1986

REPLY TO
ATTN OF: EM

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 18 August 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 3001, 18 August 1986, 1300 hours.

2. Members:

	Col Ray Reaves	OC-ALC/EM, Chairman
	Mr. Mark Coleman	Oklahoma State Department of Health (State of Oklahoma Representative to TRC)
	Mr. Robert Hannesschlager	EPA Superfund Branch (EPA Representative to TRC)

3. Attendees:

Brig Gen Searock	OC-ALC/CV
Col Maxie W. Allen	OC-ALC/DS
Col G. M. Blackburn	OC-ALC/SE
Col Dave Nicola	OC-ALC/MAQ
Capt Deven Volk	28 AD/DE
Capt Jack Jeter	OC-ALC/EME
Mr. Howard Bain	OC-ALC/JA
Mr. Joe Phillips	OC-ALC/DSM
Mr. Don Black	OC-ALC/DSME
Mr. Gene Leiterman	2854 CES/DE
Ms. Anne Copeland	OC-ALC/MAQCE
Mr. Danny Arnold	OC-ALC/MAQCE
Ms. Geri Hart	OC-ALC/EME
Mr. Jeff Bradley	OC-ALC/EME
Mr. Gary Baker	HQ AFLC/DEVW
Mr. Greg McCabe	EPA Superfund Branch
Mr. Don Hensch	Oklahoma State Department of Health
Mr. Tony Robledo	AFRCE-CR
Ms. Suzanne Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
Dr. Ron Jarman	Oklahoma Water Resources Board
Dr. Ken Johnson	Oklahoma Geological Survey
Ms. Julie Cline	General Accounting Office
Mr. Bob Hammons	General Accounting Office
Mr. Bob Ramsey	Corps of Engineers, Tulsa District
Mr. John Roberts	Corps of Engineers, Tulsa District
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Ms. Carol McConnell	Corps of Engineers, Tulsa District
Mr. Charles Lock	Corps of Engineers, Tulsa District

4. The meeting opened at 1300 hours, Brig Gen Searock welcomed members and visitors. Brig Gen Searock updated the group on activities since the last TRC meeting. A briefing had been given at HQ AFLC by Mr. Ramsey and Mr. Roberts of the Corps of Engineers. The briefing was well received. A letter was sent to Lt Gen Heiberg, Commander, Corps of Engineers, expressing our appreciation for the Corps' work here at Tinker AFB.

a. Base Projects:

(1) Soldier Creek Cleanup: Capt Jeter, OC-ALC/EME, briefed the group on the Soldier Creek Cleanup project. The visible contaminants have been removed from the area and disposed. We have analyzed samples of water as it comes over Soldier Creek through Price's Pond for one month. The results show no effect on the water quality. A proposal was made in the Technical Working Group to continue to do monitoring on Price's Pond. The sediment analysis showed heavy metals, but show no impact on the water. We will continue sampling Soldier Creek and will begin evaluations of other creeks and will meet again to discuss what else should be done.

(2) Water Wells 18 and 19: Capt Jeter, OC-ALC/EME, briefed the status of these wells. We have started plugging of the wells. The contractor will be on site next week and will begin the plugging process. This week the contractor will be breaking out concrete and will proceed with plugging next week. Well 19 should be completed by the second week of September. We have completed the Environmental Assessment and have issued a Finding of No Significant Impact for the plugging.

(3) Underground Storage Tanks: Capt Jeter, OC-ALC/EME, briefed that a revised copy of the draft report will be sent for review next week. This report is still in draft form pending further changes.

(4) Corps of Engineers Project: Mr. John Roberts, COE, Tulsa District, briefed the group on the COE progress made on the Installation Restoration Program (IRP).

(a) Building 3001: Slides were shown depicting the spread of contamination under and around Building 3001. The primary contaminants are chromium and trichloroethylene (TCE). The extent of contamination has not been fully defined west of the building or vertically beneath the building. Future investigations were presented which are designed to fully establish these limits. Contamination in the regional aquifer was found to be present northeast of Building 3001, near the Industrial Waste Treatment Plant. Since this location is upgradient of Building 3001 and contaminants are different from those being detected beneath the building, there appears to be another source of contamination in that area, either on or off Tinker Air Force Base. The Corps will be performing quality assurance for the plugging of Wells 18 and 19. Mark Coleman, State Department of Health, expressed concern that base water supply wells in the vicinity of Building 3001 could become contaminated, although no contamination has been detected as of yet. A 5 ppb detection limit was used in the first round of sampling and Mr. Coleman felt that a detection limit of .5 ppb should be used in any subsequent sampling. Mr. Coleman also recommended that precautionary measures be developed for the drinking water wells in the vicinity of Building 3001. The Corps of Engineers will present a proposal for addressing this matter at the October TWG meeting.

(b) Fuel Farm: Ms. Wagner briefed the group on the Fuel Farm project. She discussed the upcoming Military Construction Project to replace the underground tanks with above ground tanks. Ms. Wagner stated that based on discussions between Tulsa District, TAFB, EPA, and the State of Oklahoma, and the definition of hazardous waste in 40 CFR 261.33, soil coming from required excavations at the Alter POL Facility project is not considered a hazardous waste based on benzene and toluene content. Those constituents originated from

fuel spills at the site and not from spills of benzene or toluene. The soil is not considered to be hazardous waste based on ignitability based on input from EPA and the definition in 40 CFR 261.21 (a)(2). Mr. Hannesschlager, EPA, recommended that soil samples be tested using the Toxicity Characteristic Leaching Procedure test. The testing would be only for background information and would not affect the disposal requirements for the soil. The recovery of the fuel product has not been as fast as anticipated due to slow recharge of a well drilled for this purpose. Another well will be installed to speed up the recovery of the fuel product. Groundwater samples have been taken and results are pending. The actions taken to date at the site are interim actions and a remedial action plan will incorporate all results and reocmmendations into a final report.

(c) Groundwater Assessment: Mr. Roberts, COE, Tulsa District, briefed the group on the groundwater assessment. The purpose of this assessment is to determine the effects that Tinker AFB is having on the groundwater aquifer. A map showing the wells on and off Tinker Air Force Base that will be used in the Groundwater Assessment was shown. The results of the Groundwater Assessment will be discussed at October's TWG.

b. Regulatory Concerns:

No separate issues were raised by State or EPA officials.

5. The meeting was adjourned at 1400 hours.

RAY D. REAVES, Col, USAF
Chairman, Technical Review Committee

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

Ms. McConnell
COE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

06 NOV 1986

REPLY TO ATTN OF: EM

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 21 October 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417, 21 October 1986, 1300 hours.

2. Chairman: Col Birch, OC-ALC/EM

3. Attendees:

	Ms. Taylor	OC-ALC/EME
	Mr. Bradley	OC-ALC/EME
	Mr. Quaider	HQ AFLC/DEV
	Mr. Jones	2854 ABG/DE
	Mr. Black	OC-ALC/DSME
	Mr. Phillips	OC-ALC/DSM
	Ms. Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
	Mr. Morgan	Association of Central Oklahoma Governments/ Garber-Wellington Association
	Ms. Turner	U.S. Environmental Protection Agency
	Mr. Frey	U.S. Environmental Protection Agency
	Mr. Hensch	Oklahoma State Department of Health
	Mr. Obrochta	Corps of Engineers, Tulsa District
	Mr. Roberts	Corps of Engineers, Tulsa District
	Mr. Ramsey	Corps of Engineers, Tulsa District
	Mr. Warren	Corps of Engineers, Tulsa District
	Ms. McConnell	Corps of Engineers, Tulsa District
	Ms. Wagner	Corps of Engineers, Tulsa District
	Mr. Burkart	Corps of Engineers, Tulsa District

4. The meeting began at 1300 hours.

5. Agenda Items:

a. Installation Restoration Program Update:

(1) Underground Storage Tanks: Col Birch, OC-ALC/EM, briefed that a final draft report had been distributed and comments received. These comments were incorporated into a response sent to the contractor. We are currently awaiting the final report from the contractor. We anticipate additional studies to be done based upon the final report. We will brief the final report to the TWG before it goes to the TRC.

(2) Water Wells 18 and 19: Col Birch, OC-ALC/EM, briefed that these wells have been permanently plugged. This item is being closed out and will be taken off future agendas.

b. Corps of Engineers Project: Mr. Roberts, COE, gave a summary of the individual briefings to follow. Mr. Roberts stated that a smooth transition had occurred during the change in fiscal years. No delays were caused.

(1) Groundwater Assessment: Mr. Obrochta, COE, presented the results from the groundwater assessment. The results show that the water levels follow the topography by flowing towards the creeks. No meaningful amounts of contamination were found. There was one well cluster (#40) in the northwest portion of the base that did show some heavy metals. This seems to be isolated to this area. We hope to install some additional wells to complete the background analysis of certain wells on base. Some elevated levels of gross alpha and beta were found in the group of wells located in the southwest portion of the base. This area does have a radiologic disposal site which could explain the higher levels of these values. The off-base wells samples were extremely clean. No other organics showed up in the off-base wells. We intend to re-sample a few wells to confirm the findings. Ms. Moore, ACOG, presented a proposal by the Garber-Wellington Association to provide a long term monitoring plan for the natural effects on groundwater. This plan could be incorporated into the Corps of Engineers Groundwater Assessment. It was agreed upon to include the Garber-Wellington Association's plan as a chapter of the Corps of Engineers' monitoring plan. It is hoped to have the final monitoring plan together by the next TWG meeting.

(2) Building 3001 Investigations: Mr. Burkart, COE, briefed on the plugging of wells 18 and 19. This plugging was completed as of 26 September 1986. The pit sampling was done on 23 pits in Bldg 3001. Four of the pits were found to contain contaminants that are recommended for removal. The western extent of the plume of TCE under Bldg 3001 was better defined with additional wells and sampling. The plume appears to be reaching towards the runway from the north end of Bldg 3001. The water supply wells on base are a concern in the protection of the drinking water. Action plans were proposed and a view of the area of contamination was shown after 100 years of no action. We are in the process of screening all the alternatives. We will be looking into these alternatives in greater detail.

(3) Fuel Farm: Ms. Wagner, COE, briefed the group on the fuel farm area and the recommended actions for dealing with the contamination in the area. The original estimate of 100,000 gallons of JP-4 has now been determined to be incorrect. The adjusted estimate is 40,000. The fuel layer is approximately 4 feet in the most concentrated area instead of the original 12 feet. A discussion was opened concerning the disposal of the water and fuel that will be pumped from the fuel farm area. Col Birch, OC-ALC/EM, stated we had talked with 4 vendors, 3 of which wanted to be paid to haul the fuel away. The fourth vendor wanted to pay ten cents a gallon for the JP-4. Alternatives on base are to use the JP-4 in some boilers. The real issue is the method of disposal of the groundwater retrieved from the wells. One alternative is to put it into a tank and then take it to the IWTP for treatment. Another alternative would be to pump to grade through the storm sewer. We anticipate 650 gallons of fuel/water per day. Of this amount, 500 gallons will be water with some dissolved hydrocarbons. Another alternative would be to put it through the domestic sewage system which would require application to the city for a permit. If the water goes through the storm sewer line, it will pass through an oil separator before it goes off base. It was decided that Environmental Management will speak with the Oklahoma Water Resources Board and a proposal will be presented at the Technical Review Committee meeting.

(4) Landfill 6: Ms. Wagner, COE, briefed the group on the Landfill 6 project. It was originally an "L" shaped area that was covered with a clay cap. Through the use of aerial photos, historical data, etc., it has been determined to have been a rectangular shape. Trenches have been found in the remaining portion of the landfill. We are currently sampling these trenches and will report the findings at the next TWG meeting.

(5) Landfill 5: Ms. Wagner, COE, briefed the group that work has begun on investigating Landfill 5. A status report will be given at the next TWG meeting.

6. New Business:

a. ACOG Proposals: Ms. Moore, Garber-Wellington Association, presented two proposals by the Association of Central Oklahoma Governments. The first proposal was for a long-term groundwater monitoring plan and the other for a well field management plan. The long-term groundwater monitoring plan will look at water quality changes and the effect on production activities at Tinker. This plan would look at the types of monitoring that would be needed, parameters, frequency, and well head configuration. This plan would monitor changes in the natural water quality, idnetify salt water levels accurately, and monitor salt water intrusion up through the wells. We would be looking at water supply wells primarily. This could be incorporated with the Corps of Engineers Groundwater Assessment to make one monitoring plan. The other proposal dealt with the preparation of a long-term well management plan. Looking back through the records, it is apparent that most wells on base were installed in the 1940's. A rehabilitation was performed in the 1950's and no more signs of rehabilitation are shown recently. Different sizes of casings were used and indicate that a poor quality steel was used. The poor quality steel could be attributed to the fact that they were installed during war time. We want to be able to present a plan to look at the individual wells to see what condition they are in now, to see what type of things needs to be done. This will also assist in identifying the performance efficiency of the wells. A discussion ensued and it was decided that Environmental Management would contact HQ AFLC and ask for an amendment to the scope of work that the Corps of Engineers is using.

7. The Technical Review Committee will be held 18 November 1986, 1000 hours, in the CC Conference Room.

SHELTON R. BIRCH, Col, USAF, BSC
Staff Bioenvironmental Engineer

Ms. McConnell
COE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

06 NOV 1986

REPLY TO ATTN OF: EM

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 21 October 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417, 21 October 1986, 1300 hours.

2. Chairman: Col Birch, OC-ALC/EM

3. Attendees:

	Ms. Taylor	OC-ALC/EME
	Mr. Bradley	OC-ALC/EME
	Mr. Quaider	HQ AFLC/DEV
	Mr. Jones	2854 ABG/DE
	Mr. Black	OC-ALC/DSME
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	Ms. McConnell	Corps of Engineers, Tulsa District
	Ms. Wagner	Corps of Engineers, Tulsa District
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4. The meeting began at 1300 hours.

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for SHELTON R. BIRCH, Col, USAF, BSC
Staff Bioenvironmental Engineer

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145

06 MAR 1987

REPLY TO ATTN OF: EM

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 28 January 1987

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417, 28 January 1987, 1300 hours.

2. Chairman: Col Birch, OC-ALC/EM

3. Attendees:

Maj Jorgensen	OC-ALC/EME
Capt Jeter	OC-ALC/EME
Ms. Taylor	OC-ALC/EME
Mr. Bain	OC-ALC/JA
Mr. Phillips	OC-ALC/DSM
Mr. Black	OC-ALC/DSME
Mr. Burris	2854 CES/DEE
Mr. Ramsey	Corps of Engineers, Tulsa District
Mr. Roberts	Corps of Engineers, Tulsa District
Mr. Hammons	General Accounting Office
Ms. Cline	General Accounting Office
Mr. Hensch	Oklahoma State Department of Health
Mr. Yonkers	AFRCE-CR/ROV
Ms. Turner	U.S. Environmental Protection Agency
Mr. McCabe	U.S. Environmental Protection Agency
Ms. Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
Dr. Johnson	Oklahoma Geological Survey
Mr. Thomas	Oklahoma Water Resources Board
Mr. Maiello	Oklahoma Water Resources Board

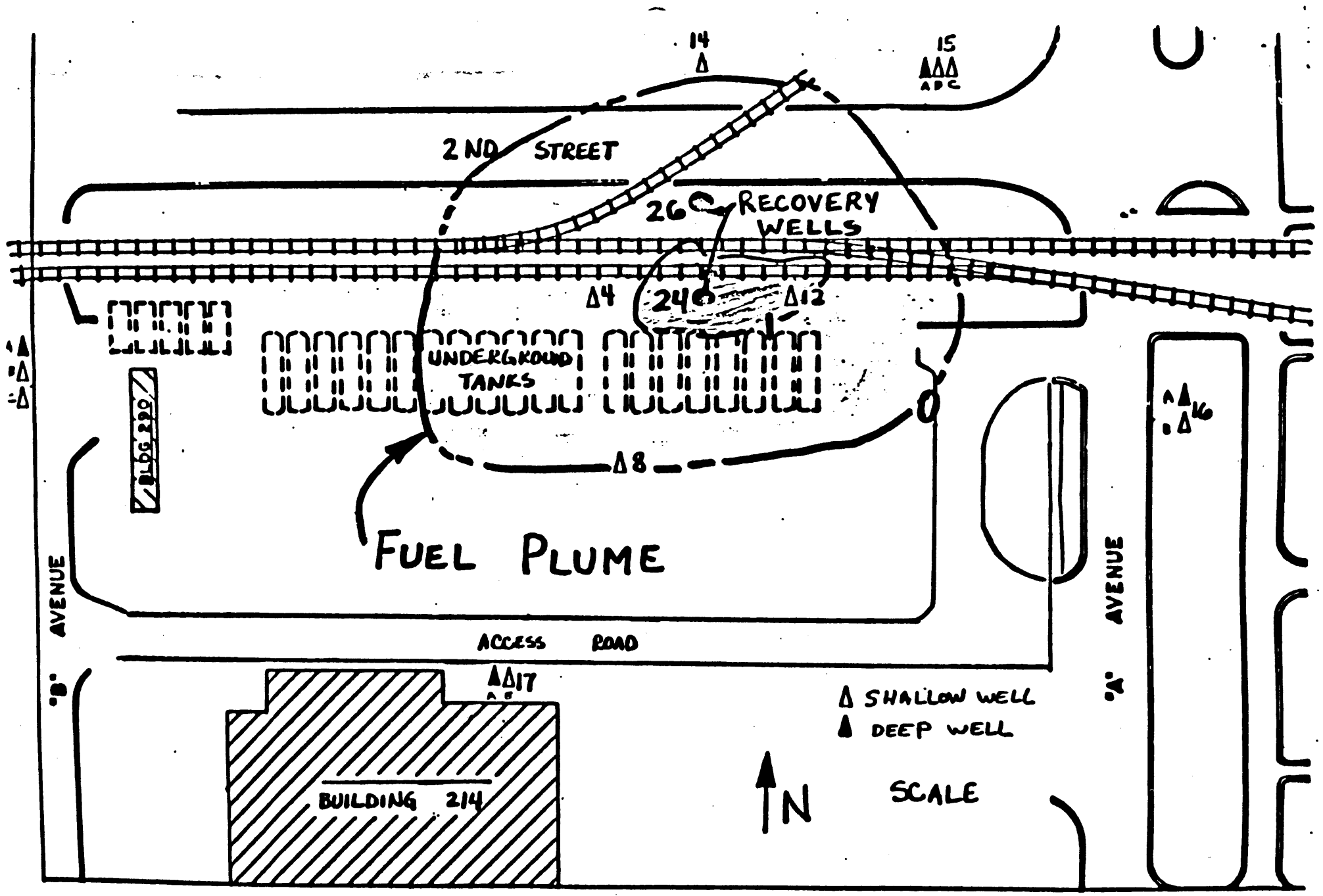
4. The meeting began at 1310 hours. Mr. Roberts, COE, asked that a correction be made to the TWG minutes of 21 October 1986. Paragrph 5b(2), eighth sentence stating "Action plans were proposed and a view of the area of contamination was shown after 100 years of no action." should be stricken from the minutes. No other changes were noted.

5. Col Birch, OC-ALC/EM, thanked everyone for agreeing to delay the meeting a week to allow for the snow and ice.

6. Agenda Items:

a. Installation Restoration Program Update:

(1) Overall Groundwater Assessment: Mr. Roberts, COE, briefed the group that a preliminary assessment was given to the Technical Review Committee at the previous meeting. Mr. Coleman, OSDH, had expressed concern over the values of heavy metals. The Corps has resampled selected wells and utilized OSDH recommended analytical techniques to identify the metals present. This concern has been resolved. At the next TWG meeting, we will have the results



FUEL FARM AREA

WELLS TO BE MONITORED

FIGURE 1

8. Mr. Taylor, ACOG, extended an invitation to those present to attend a field trip to be conducted by the Association of Central Oklahoma Governments on Friday, 21 November 1986. The hours of the field trip will be 0900 - 1700 hours. The field trip is designed to answer the question of just what entails the Garber-Wellington aquifer. This provides the opportunity to observe some of the land use practices. Please contact one of the ACOG members after this meeting to reserve a lot for this tour.

9. Brig Gen Searock extended an invitation for a guided tour of the Maintenance operations within Bldg 3001. Several attendees expressed a desire to attend this tour to be conducted immediately after the meeting.

10. The meeting was adjourned at 1100 hours.

RAY D. REAVES, Col, USAF
Director, Environmental Management

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

(b) Groundwater Investigation: Results have been received from 15 new wells installed for the purpose of defining the western and vertical extent of TCE contamination. The vertical extent of contamination has been established and is limited to 220 feet beneath the ground surface. The western extent of TCE is still undefined in the perched and top of regional aquifer. New wells to define the western extent of contamination are being installed this week.

(2) Fuel Farm:

(a) Results: Construction at the POL Facility has begun thanks to the coooperation of the regulatory agencies. The fuel plume is a maximum of four feet thick and 40,000 to 50,000 gallons of fuel are present in the plume. A plume of groundwater contaminated with benzene, toluene, and xylene, surrounds the fuel plume. The contaminants are confined to the perched aquifer.

(b) Interim Control Measures: Because of the presence of fuel in the subsurface, immediate measures are being taken to remove it. The removal plan consists of 2 recovery wells, a french drain and sump, pumps for the wells and sump that will separate fuel from water at the source, and grouting of MF-3. Water and fuel will be pumped continuously and separately to above-ground holding tanks at the site. Approximately 150 gallons of fuel and 500 gallons of water will be pumped daily and approximately one year will be required to clean up the fuel at the site. Water will be hauled to IWTP and fuel will either be sold or used on base. The recovery wells are in and MF-3 has been grouted. The tanks, pumps and supplies for the french drain are in the procurement process. It is estimated that the system will be complete by 15 Feb 1987.

(c) Post-Closure Groundwater Monitoring Plan:

1. Purpose: A groundwater monitoring plan was proposed that is intended to monitor the effectiveness of the cleanup actions on the perched groundwater quality at the site.

2. Recovery Wells: Groundwater from each of the recovery wells will be sampled every two weeks and tested for benzene, toluene and xylene. Once results stabilize, sampling will be done monthly until recovery is complete. Total volumes of fuel and groundwater removed from the site will be recorded.

3. Monitoring Wells: Nearby monitoring wells 4, 8, 12, and 14, as shown in Attachment 1, will be sampled monthly for trhe first 6 months and quarterly for the next year. The perimeter wells, 1a, 1b, 1c, 15a, 15b, 15c, 16a, 16b, 17a, and 17b wil be sampled semiannually. All monitoring well samples will be tested for benzene, tolune, and xylene and static water level measurements will be made in all monitoring wells when samples are obtained.

4. Duration: Results of the pumping and monitoring will be presented to the TRC and that group will make the decision on when to stop recovery. If results of the monitoring indicate that the system is working, the interim measures will constitute the final measures taken at the site.

(3) Landfill 6: Records search indicates six trenches are present in an area at Landfill 6 that was not covered with the clay cap. Field investigations confirm this. All trenches have been sampled for waste characterization and engineering properties of both the cap and base and all wells except the 55 cluster are in. No results are available.

since most of the work has been completed. He stated that the Environmental Management Directorate was undergoing some changes, but things were to operate as usual. Gen Searock briefed that the Sage Institute's Dr. Kent Stevens was working on a failure avoidance program. Dr. Stevens will be visiting Tinker AFB this week to take a look at the IWTP. The program is designed to look at new and better ways to solve our problems. We may choose to contract with the Sage Institute to do a study on the IWTP. Everyone is welcome to attend the briefing that Dr. Stevens will present on Friday. You may obtain more information by contacting Col Reaves, OC-ALC/EM.

6. Previous Minutes:

a. Fuel Farm: Capt Jeter, OC-ALC/EME, briefed the concerns expressed during the past TRC meeting by Mr. Hannesschlager, EPA. Mr. Hannesschlager suggested using the new Toxicity Characteristic Leaching Procedure test on soil samples from the fuel farm. We had these samples analyzed by the contractor that developed the test and the results will be sent to the EPA.

b. Drinking Water Supply: Capt Jeter, OC-ALC/EME, briefed that the concern had been expressed during the last TRC meeting to go back and test several wells around Bldg 3001 using lower detection limits. This sampling has been completed and the results will be discussed with the Health Department. This item does not directly relate to Tinker's IRP and will therefore be deleted from the TRC and worked with OSDH.

7. Status Update:

a. Underground Storage Tanks: Capt Jeter, OC-ALC/EME, briefed that the draft final report had been distributed for comments. We have received comments back from the EPA. We have sent all the coordinated comments to the contractor. A final report should be distributed within a few months. One item in the draft final report involved several areas of fuel contamination that require further investigation. The Corps of Engineers has provided addendums to their Statement of Work for these investigations. An update will be provided to the Technical Working Group.

b. Water Wells 18 & 19: Capt Jeter, OC-ALC/EME, briefed that the wells had been plugged on 26 Sept 86. This item will be closed out and deleted from the TRC agenda.

c. Long Term Monitoring and Well Field Management (ACOG) Proposals: Capt Jeter, OC-ALC/EME, briefed that the Association of Central Oklahoma Governments had proposed a long term monitoring plan to monitor the water well supply system for naturally occurring constituents. We will have the Corps of Engineers work with ACOG to get the plan incorpoated into the groundwater assessment monitoring plan. The other proposal from ACOG is for a well field management plan to optimize Tinker's water supply system. This particular subject will be deferred to Civil Engineering for them to work directly with ACOG to develop this plan.

d. Corps of Engineers: Ms. Wagner, COE, briefed the group that the intent of the briefing was to give a brief update on new results and present those items to the TRC for which approval is needed. Items discussed were Bldg 3001 pit and groundwater investigation results and status, the fuel farm plan for remedial action and post-closure monitoring, and the status of investigations at Landfill 6.

(1) Bldg 3001:

(a) Pits: The investigation in the southern portion of the building is complete and a report has been submitted to EM. Contents of four pits are recommended for removal.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

26 JAN 1987

REPLY TO ATTN OF: EM

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 18 November 1986

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 3001, 18 November 1986, 1000 hours.

2. Members Present:

Col Ray Reaves	OC-ALC/EM, Chairman
Dr. Ron Jarman	Oklahoma Water Resources Board, Representing Oklahoma State Department of Health (State of Oklahoma Representative to TRC)

3. Members Absent:

Mr. Robert Hannesschlager	EPA Superfund Branch (EPA Representative to TRC)

4. Attendees:

Brig Gen Charles Searock	OC-ALC/CV
Col Shelton Birch	OC-ALC/EM
Capt Jack Jeter	OC-ALC/EME
Mr. Jeff Bradley	OC-ALC/EME
Ms. Geri Hart	OC-ALC/EME
Mr. Howard Bain	OC-ALC/JA
Mr. Fritz Nolting	OC-ALC/JA
Mr. Tom Brewer	OC-ALC/HO
Mr. William Hall	OC-ALC/PA
Mr. Joe Phillips	OC-ALC/DSM
Ms. Anne Copeland	OC-ALC/MAQCE
Mr. Allen Lawrence	2854 CES/DE
Mr. Tony Robledo	AFRCE-CR
Dr. Ken Johnson	Oklahoma Geological Survey
Mr. Ken Luza	Oklahoma Geological Survey
Ms. Suzanne Moore	Association of Central Oklahoma Governments Garber-Wellington Association
Mr. Odell Morgan	Association of Central Oklahoma Governments Garber-Wellington Association
Mr. Zach D. Taylor	Association of Central Oklahoma Governments Garber-Wellington Association
Mr. Don Schreiber	Oklahoma Water Resources Board
Ms. Julie Cline	General Accounting Office
Mr. Bob Hammons	General Accounting Office
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Mr. John Roberts	Corps of Engineers, Tulsa District
Ms. Wendy Lanier	Corps of Engineers, Tulsa District
Ms. Carol McConnell	Corps of Engineers, Tulsa District

5. The meeting opened at 1000 hours, Brig Gen Searock welcomed members and visitors. He mentioned that it was apparent that interest was still high and invited everyone to visit Tinker AFB anytime. He advised everyone to beware of becoming complacent

of off-base well sampling to hand out. As an additional measure of quality control, the Corps is sending ten percent of their samples to the OSDH. A contract has been developed with the Garber-Wellington Association for an assessment of the salt water intrusion. The groundwater assessment will evaluate the effects of Tinker AFB on the overall regional groundwater, both from man-made and natural contaminants. It will also provide a long-term monitoring plan for Tinker AFB and will be presented at the April 1987 TWG meeting.

(2) Building 3001 Investigations: Mr. Roberts, COE, briefed that the Corps had been tasked with defining the extent of contamination around Building 3001. Investigations are complete to the north, south, and east of the building. Two additional well clusters have been installed to the west to better define the contamination. Two fuel contaminated areas in the vicinity of Building 3001 have been added to the scope of work. Monitoring wells have been installed at those two sites. They have been sampled but results are not back as yet. The Corps of Engineers has contracted a specialty firm in geohydrology to review the Corps' interpretation of the contaminant plume and the hydrogeologic conditions around Building 3001.

(3) Fuel Farm: Mr. Roberts, COE, briefed that the interim action plan for the fuel farm was presented at the last Technical Review Committee. A description of the plan was attached to these minutes. The plan consisted of two recovery wells at the site. The fuel will be pumped to two holding tanks, one for water and one for fuel. The water will be trucked to the IWTP and the fuel will be used by Tinker or disposed of in a proper manner. The interim action plan will be completed in February 1987.

(4) Landfill 6: Mr. Roberts, COE, briefed that all trenches have been investigated. The Corps is currently awaiting analytical results.

(5) Landfill 5: Mr. Roberts, COE, briefed that the Corps is still awaiting analytical results. The Corps will present these results at the next TWG meeting.

(6) Landfills 1 - 4: Mr. Roberts, COE, briefed that inclement weather had delayed the investigations.

(7) Fire Training Areas: Mr. Roberts, COE, briefed the Corps is in the process of obtaining drilling clearance for this area.

7. New Business:

a. Off-Base Well Samples: Col Birch, OC-ALC/EM, briefed that the results of the samples taken from the off-base wells will be presented to the owners and members of the TWG before the next meeting.

b. Fuel Farm TCLP Test: Mr. Hensch, OSDH, stated that at the last Technical Review Committee, a concern was expressed over the fuel farm. The EPA requested the TCLP testing method be used on the samples. The results of the TCLP analysis will be provided for the OSDH.

c. Introduction: Mr. Maiello, OWRB, introduced Mr. Bob Thomas, a new section head at the OWRB. Mr. Thomas wil be attending the meetings with Dr. Ron Jarman.

8. The Technical Review Committee will be held 17 February 1987, 1300 hours, in the Commander's Conference Room, Bldg 3001.

SHELTON R. BIRCH, Col, USAF, BSC
Staff Bioenvironmental Engineer

1 Atch
Work Plan for Fire Training Area #2

WORK PLAN

FIRE TRAINING AREA NO. 2
Installation Restoration Program
Tinker Air Force Base

1. General: Field investigations conducted by the Tulsa District will provide information to properly assess the geology, geohydrology, and the extent (if any) of contamination of the soils and groundwater in the fire training area. This information will be used to design remedial cleanup plans, if required, for the groundwater and soils of the site. Investigations will include determining the exact location of the site and collection and analysis of soil and groundwater samples. If long-term monitoring is required, permanent groundwater wells will be installed. All work will be conducted in accordance with the previously furnished Quality Assurance/Quality Control, and Safety Plans.

2. Investigations: Information to reveal the exact locations of the FTA is needed. Other investigations will be conducted to gain information on the extent, if any, of site contamination.

a. Location: Methods to determine exact location of the FTA will include visual site inspections, TAFB personnel interviews, Base records research, acquisition and inspection of old aerial photos, various geophysical techniques, and borings.

b. Sampling:

PHASE I

Soil Sampling: Three auger borings will be made in FTA #2 inside the anticipated perimeter of the burn area. Soil samples will be taken from 0 - 1 foot, and in three foot intervals to 20 feet or auger refusal.

Water Sampling: Grab groundwater samples will be taken from each of the three borings made for soil samples. Two permanent groundwater monitoring wells will be installed at the site, one in an anticipated upgradient direction in the perched aquifer, north of the FTA, the second, in an anticipated downgradient direction from the site, between the FTA and Crutcho Creek, also in the perched aquifer. Water samples will be obtained from these wells.

Phase II - If contaminants are found in significant concentrations during the Phase I investigations, additional exploration will be performed to define the extent of soil and groundwater contamination. These explorations will also provide information on the engineering properties of the soil or rock at the site necessary to design the remedial measures.

c. Sample Analysis: The following parameters are to be evaluated on the Phase 1 samples:

arsenic	Ph*
barium	conductivity*
cadmium	cyanide
chromium	chloride
lead	sulfate
mercury	volatile organics
silver	semi-volatile organics
selenium	pesticides
nickel	PCB's
zinc	oil and grease
	Total Organic Carbon

* these parameters will be evaluated in the field using approved sampling techniques.

Only contaminants detected during Phase 1 sampling will be tested for during Phase 2 sampling.

d. Remedial Action: If contaminants prove to be a potential problem, a design will be developed to remedy surface and subsurface contamination.

Mrs McConnell
CCE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

REPLY TO ATTN OF: OC-ALC/EM

14 MAY 1987

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 27 March 1987

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 3001; 27 March 1987, 1300 hours.

2. Members:

	Col Ray Reaves	OC-ALC/EM, Chairman
	Mr. Mark Coleman	Oklahoma State Department of Health (State of Oklahoma Representative to TRC)
	Mr. Robert Hannesschlager	EPA Superfund Branch (EPA Representative to TRC)

3. Attendees:

Col Shelton Birch	OC-ALC/EM
Maj Jeffrey Jorgensen	OC-ALC/EME
Capt Jack Jeter	OC-ALC/EME
Ms. Lou Terry	OC-ALC/PA
Mr. Jeff Bradley	OC-ALC/EME
Mr. Joe Phillips	OC-ALC/DSM
Mr. Fritz Nolting	OC-ALC/JAM
Mr. Howard Bain	OC-ALC/JAM
Mr. Danny Arnold	OC-ALC/MAQV
Ms. Anne Copeland	OC-ALC/MAQV
Mr. Dave Burris	2854 CES/DEE
Mr. Bob Ramsey	Corps of Engineers, Tulsa District
Mr. John Roberts	Corps of Engineers, Tulsa District
Mr. Cliff Warren	Corps of Engineers, Tulsa District
Ms. Carol McConnell	Corps of Engineers, Tulsa District
Mr. Don Hensch	Oklahoma State Department of Health
Dr. Ron Jarman	Oklahoma Water Resources Board
Mr. Bob Thomas	Oklahoma Water Resources Board
Dr. Ken Johnson	Oklahoma Geological Survey
Ms. Suzanne Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr. Hilton Frey	EPA Superfund Branch
Mr. Tony Robledo	AFRCE-CR
Mr. Green	AFRCE-CR

4. The meeting opened at 1300 hours, Col Reaves welcomed members and visitors. Brig Gen Searock is unable to attend this meeting because he is on leave. Col Reaves mentioned to the group that he, himself, had taken a trip to Washington on 2 Feb 87, with representatives from the Corps of Engineers. The purpose of this trip was to brief the Secretary of the Air Force office and House Environmental Subcommittee on environmental matters. Both briefings were well received. It was mentioned that they see we have a program that is working well.

Installation Restoration Program
Tinker Air Force Base

Four Fuel-Contaminated Sites
Work Plan

1. Site Desciption. The locations of the fuel areas are near buildings 201 and 214. Building 214 lies between A and B Avenue and south of 2nd Street. Building 201 lies between C and D Avenues and north of 1st Street. There are three seperate areas affected around Building 201. They are identified as area "BB" on the west, area "BR" on the south and area "BC" on the northeast. Area "BB" has an abanded diesel tank and has minor amounts of hydrocarbon contamination in the soil at a depth of 8 feet. Area "BR" has an abandoned tank of unknown contents and has both hydrocarbon and halocarbon contamination (3880 ppm hydrocarbons and 0.3 ppm halocarbons). Area "BC" had minor amounts of halocarbon contamination with a high of 5.2 ppm halocarbons and is the site of an abandoned waste solvent tank. Trichloroethylene and chloroform have been identified as two of the contaminants.

The area west of the south end of Building 214 is the site of an abandoned tank of unknown contents. Benzene, toluene, xylenes, vinyl chloride, 1,1-dichloroethene 1, 1,1 trichloroethane, trichloroethene, and ethylbenzene were detected in a groundwater sample. The concentration of Trans-1,2 Dichloroethene was 175910 ppb. An oily film was noted on the groundwater.

2. General. Field investigations at the four locations will provide information to properly assess the geology, geohydrology and extent of contamination at the sites. From this information, a remedial action plan for the site, if necessary, will be developed. The work will consist of evaluating existing data (soil and groundwater analyses) and installing and sampling additional groundwater monitoring wells. All work will be performed in accordance with the Corps of Engineers Quality Assurance/Quality Control Plan, previously furnished.

3. Groundwater Investigations. There are two existing wells west of building 214, both approximately 30 feet deep. These wells will be evaluated and additional wells installed. Data will be collected and analyzed to locate any water-bearing zones, define the permeability of the surrounding soils, establish gradients and direction of groundwater flow. Water samples will be collected and analyzed in order to determine the extent of contamination. One deeper well (approximately 70 feet) will be installed at each site to monitor the regional aquifer. All water samples will be tested for the following parameters:

arsenic	pH
barium	chloride
cadmium	sulfate
chromium	volatile organics
lead	specific conductance
mercury	total organic carbon
nickel	gross alpha
selenium	gross beta
silver	radium 226

a. Installation Restoration Program (Corps of Engineers Project):

(1) Building 3001: Mr. John Roberts, Corps of Engineers, briefed on the new SARA requirements which pertain to the investigations at Bldg 3001, since this is a National Priority List (NPL) site. He stated that we will be completing our remedial investigations and making our interpretations of the geology for inclusion into a Remedial Investigation (RI) report. A health assessment will be made based on the RI by the Center of Disease Control to determine what health risks are involved at the surface, or in the groundwater supply. Based on that, a risk assessment will be made by the Corps of Engineers to determine what clean up levels need to be attained to meet the requirements of the health assessment. Then a feasibility study will be conducted to look at the different alternatives. This study will be very detailed. All preliminary design, including bench models and pilot pumping and treatment facilities necessary to provide technical feasibility and develop a recommended plan, should be performed during the feasibility study. At the conclusion of the feasibility study, this and the remedial investigation report will be made public. Then there will be a public meeting. After the public meeting, there will be a selection of the final plan by the Environmental Protection Agency (EPA) based on the report and comments from the public. After selection of the plan, there is a requirement of 15 months that the construction has to be initiated. Mr. Coleman, OSDH, asked if there was something we could do about pulling the most contaminated portion out from under Bldg 3001 while this process is being done. Mr. hannesschlager, EPA, stated that it would have to be addressed in the same manner as the fuel farm area, under an Expedited Response Plan. Major Jorgensen, OC-ALC/EME, stated that the pilot plan could be made a part of the overall permanent collection scheme. The EPA is still looking at the other sites. Presently, the other sites will not have to go through the same process as is necessary for Bldg 3001, since they are not NPL sites.

(2) Groundwater Assessment: Mr. John Roberts, COE, briefed that the groundwater assessment is to show the effects of Tinker Air Force Base on the Garber-Wellington aquifer. A draft of this assessment will be given to Tinker Air Force Base by 10 April 1987. We will be discussing it at the April Technical Working Group meeting.

(3) Fuel Farm: Mr. John Roberts, COE, briefed that a contractor will be installing pumps, necessary piping, valves and control boxes at the site starting Monday. As soon as the base has electricity at the site, pumping will be initiated. We will be able to discuss how the pumping is going and how much is being pumped at the April Technical Working Group meeting. Installation of a french drain was originally recommended as part of the final action plan. It has now been determined that this would be an unnecessary expense. When recovery wells were drilled there was some fuel seepage in the upper three feet. During the backfilling of the underground storage tanks, there were a number of pits about six feet deep made to the south of where the french drain was to be installed. All pits were dry and there was no fuel coming into any pits. We now recommend that the french drain be eliminated from the plan. It was agreed upon by Mr. Coleman and Mr. Hannesschlager to eliminate this french drain from the plan.

(4) Industrial Waste Pit (IWP) #2: This site is located one mile south of Building 3001, east of the runway near where the transient munitions facility is being constructed. There was some concern that a ditch was in

the near vicinity of the IWP that could cause problems. The Corps has drilled eight holes along the edge of the proposed excavation (twelve foot deep ditch). Undisturbed materials have been observed. Samples have been sent to the lab to be tested. All heavy metals came back within normal limits. Methylene chloride showed up in low quantity. It has been concluded this construction will have no impact on the industrial waste pit.

b. Agenda Items for TWG: Col Reaves, OC-ALC/EM, stated that there will be a great deal of data to be covered at the next Technical Working Group meeting, so it may take longer than the usual meetings. The Technical Working Group will be 21 April 1987, at 1000 hours in the DE Conference Room, Bldg 417.

5. Mr. Hannesschlager, EPA, stated that the EPA has been presenting an update on the new requirements for SARA. He offered to come to Tinker AFB and give this presentation in the future. Col Birch, OC-ALC/EM, asked Mr. Hannesschlager to give this presentation for the June meeting of the Environmental Protection Committee.

6. The meeting was adjourned at 1430 hours.

RAY D. REAVES, Col, USAF
Chairman, Technical Review Committee

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

COE
To Carol McConnell

14 MAY 1987

REPLY TO ATTN OF: EM

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 21 April 1987

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417; 21 April 1987, 1000 hours.

2. Chairman: Col Shelton Birch, OC-ALC/EM

3. Attendees:

Maj Jeff Jorgensen	OC-ALC/EME
Capt Jack Jeter	OC-ALC/EME
Ms. Lou Terry	OC-ALC/PA
Mr. Fritz Nolting	OC-ALC/JAM
Ms. Cathy Taylor	OC-ALC/EME
Mr. Jeff Bradley	OC-ALC/EME
Mr. Don Black	OC-ALC/DSME
Mr. Allen Lawrence	2854 ABG/DE
Mr. John Roberts	Corps of Engineers, Tulsa District
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Mr. Andy Obrochta	Corps of Engineers, Tulsa District
Mr. Clif Warren	Corps of Engineers, Tulsa District
Mr. Charles Lock	Corps of Engineers, Tulsa District
Ms. Carol McConnell	Corps of Engineers, Tulsa District
Mr. Dean Loftin	Corps of Engineers, Tulsa District
Mr. Bob Thomas	Oklahoma Water Resources Board
Mr. Don Hensch	Oklahoma State Department of Health
Mr. Larry Pinkston	Association of Central Oklahoma Governments
Ms. Suzanne Moore	Association of Central Oklahoma Governments
Mr. Jim Madat	Association of Central Oklahoma Governments
Mr. Ken Luza	Oklahoma Geological Survey
Dr. Ken Johnson	Oklahoma Geological Survey
Mr. Greg McCabe	U.S. Environmental Protection Agency
Ms. Suzette Turner	U.S. Environmental Protection Agency
Mr. Bob Hammons	General Accounting Office
Ms. Glenda Thomas	AFRCE-CR

4. The meeting began at 1015 hours. The minutes of 28 January 1987 were approved as written.

5. Agenda Items:

a. EPA Update: Mr. Greg McCabe, EPA, gave a briefing to the group on the new EPA amendments to SARA and how they will affect the Installation Restoration Program at Tinker AFB (See Atchs 1 thru 7). In this region, we have a wide variety of different types of facilities. We currently have 83 federal facilities, but expect this number to grow to about 150 by the end of the fiscal year. At present, we have four facilities on the National Priorities List, but expect this figure to double. Mr. McCabe stated that he was a member of

the National Working Group if anyone would like to give input or has questions. Mr. McCabe stated that the EPA had two facilities in this region that utilize a TRC and have found the TRC at Tinker to be so helpful that they recommend establishment at all NPL sites. Mr. Roberts, COE, asked if the new SARA requirement would apply to all sites on Tinker AFB as a whole, or the individual sites such as Bldg 3001. Mr. McCabe stated that the new SARA requirements will apply to the groundwater contamination under Bldg 3001, and not the other sites on base. the other sites will continue to be addressed through the TRC as in the past as Expedited Removal Actions (ERAs).

b. Installation Restoration Program:

(1) Groundwater Assessment: Mr. Andy Obrochta, COE, briefed the group on the groundwater assessment. The draft final report of the groundwater assessment was distributed at the meeting. The purpose of the assessment was to assess the effect that Tinker AFB is having on the Garber-WellingtOn aquifer and submit recommendations for a long-term monitoring program. The results are that no off-base wells are contaminated from operations on Tinker AFB, minor contamination is present (from no explainable source) in three of the twenty-five perimeter wells, and minor contamination is present in two base water supply wells from base operations and one base water supply well from overpumpage. Recommendations for the long-term monitoring plan are as follows:

Delete the off-base wells from the monitoring network. Sample all perimeter wells and base water supply wells quarterly for one year and annually thereafter (with the exception of water supply wells 13, 14, 15, 16, and 17).

Alter the parameter list in the testing to reflect what may be expected to be found. Obtain monthly water levels and quantitites of water pumped from base water supply wells. Determine static water levels from selected base water supply wells biannually. Perform annual assessments.

(2) Bldg 3001: Mr. Clif Warren, COE, briefed the group on the findings at Bldg 3001. The major contaminants found were chromium and TCE. The TCE plume is moving at the approximate rate of 30 feet per year. Other contaminants have been identified in the plume of contaminated groundwater and the most pervasive are 1,2 dichloroethene, barium, lead, and high pH. Ongoing groundwater model evaluations as well as results from the adjacent north and southwest fuel areas were discussed. The impact of the SARA amendments were discussed. The Remedial Investigation report on Bldg 3001 will be completed by the end of May of this year.

(3) Landfill 6: Mr. Charles Lock, COE, briefed the group on Landfill 6. The landfill was operated from 1970 to 1979. Materials disposed in the landfill include general refuse and some industrial waste treatment sludge. A clay cap has been placed over a portion of the landfill. Results of groundwater sampling at the site were discussed. Generally, the top of the regional aquifer is much cleaner than the perched aquifer. Alternatives being considered were discussed. The objective of the alternatives is to prevent future groundwater contamination, rather than to clean up the groundwater already contaminated.

Mr. Don Hensch, OSDH, asked if there were plans to define the apparent plume of contaminated groundwater leaving the south and west portion of the landfill. The COE response was that no more investigations were planned in

that area since the objective of the remedial actions being considered was not to clean up contaminated groundwater.

(4) Fuel Farm: Ms. Ramona Wagner presented the final remedial action plans for the site as well as the status of the interim control measures at this site.

Final Actions: A draft (Expedited Response Action Summary) has been sent to Tinker. The recommended remedial action for the site is a limited continued groundwater pumping at the site, past the point of fuel recovery. Results of groundwater monitoring will be presented to the TRC and that group will decide when to discontinue groundwater pumping.

Interim Actions: The recovery wells have been installed and the separate fuel and water pumps have been installed in each well. The water pumps have been clogged by silt, but the wells are being re-developed by COE personnel and the pumps will be re-installed by the contractor shortly. The holding tanks are in place ready to receive fuel and water. The french drain was deleted from the plan as approved by the March TRC. The electricity necessary to run the pumps will be brought to the fuel yard shortly by Tinker Base Civil Engineering.

(5) Landfill 5: Ms. Ramona Wagner reported there may be a need to call a special TWG meeting. The new naval facility taxiway runs across Landfill 5 and; therefore, there may be a need to prioritize that particular site so that construction of the naval facility can begin next Spring.

(6) Fire Training #1: Ms. Ramona Wagner, COE, briefed that the Corps has completed Phase I of their investigations which is simply to sample and characterize the wastes. No further information is available at this time.

(7) Transient Munitions Facility/Industrial Waste Pit No. 2: Ramona Wagner reported that there had been some soil sampling in an area of required excavation for the construction of the Transient Munitions Facility because of the proximity of a deep ditch to the reported location of old Industrial Waste Pit No. 2. A no-action plan was proposed for the old IWP No. 2 in the final Radian report, Phase II, Stage I. The soil sampling was performed to insure that no excavation of the materials placed in the pit would occur when the ditch was dug, and the no-action plan would still be applicable. Results of the soil testing indicated that the soil in the area of excavation is uncontaminated.

6. Col Birch, OC-ALC/EM, stated that the TRC agenda will consist of brief summaries of the Corps' topics that they have presented at this meeting. Copies of the report on the fuel farm project will be distributed very shortly. We will be giving some minor comments back to the Corps, which will be distributing the final copy to the people involved. Mr. McCabe, EPA, requested a hard copy of the slides presented by the Corps today.

7. The Technical Review Committee meeting will be held on 19 May 1987, at 1300 hours, in the CC Conference Room, Bldg 3001.

SHELTON R. BIRCH, Col, USAF, BSC
Staff Bioenvironmental Engineer

7 Atchs
EPA Update Slides

CDE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

REPLY TO ATTN OF: OC-ALC/EM

14 JUL 1987

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 19 May 1987

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 3001; 19 May 1987, 1300 hours.

2. Members:

	Col Ray Reaves	OC-ALC/EM, Chairman
	Mr. Mark Coleman	Oklahoma State Department of Health (State of Oklahoma Representative to TRC)
	Mr. Robert Hannesschlager	EPA Superfund Branch (EPA Representative to TRC)

3. Attendees:

Brig Gen Charles Searock	OC-ALC/CV
Maj Jeffrey Jorgensen	OC-ALC/EME
Maj Darrell Cornell	OC-ALC/EME
Ms. Lou Terry	OC-ALC/PA
Mr. Jeff Bradley	OC-ALC/EME
Ms. Geri Hart	OC-ALC/EME
Ms. Cathy Taylor	OC-ALC/EME
Mr. Fritz Nolting	OC-ALC/JAM
Mr. Joe Phillips	OC-ALC/DSM
Ms. Anne Copeland	OC-ALC/MAQV
Mr. Dave Burris	2854 CES/DEE
Mr. John Roberts	Corps of Engineers, Tulsa District
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Ms. Carol McConnell	Corps of Engineers, Tulsa District
Mr. Don Hensch	Oklahoma State Department of Health
Dr. Ron Jarman	Oklahoma Water Resources Board
Ms. Suzette Turner	EPA Superfund Branch
Dr. Ken Johnson	Oklahoma Geological Survey
Ms. Suzanne Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr. Tony Robledo	AFRCE-CR

4. The meeting opened at 1300 hours, introductions were made throughout the room. The meeting minutes of 27 March 1987 were approved as written.

5. Agenda Items:

a. Installation Restoration Program:

(a) Groundwater Assessment: Ms. Ramona Wagner, COE, briefed the group on the status of the groundwater assessment. The purpose of the assessment was to assess the effect that Tinker AFB is having on the Garber-Wellington

aquifer and submit recommendations for a long-term monitoring program. The results are that no off-base wells are contaminated from operations on Tinker AFB, minor contamination is present (from no explainable source) in three of the twenty-five perimeter wells, and minor contamination is present in base water supply wells 15 and 16 from base operations, and in base water supply well 14 from overpumpage. Recommandations for long-term monitoring plan are as follows:

Off-base wells will be deleted from the monitoring network. All perimeter wells and base water supply wells will be sampled quarterly for one year. Based on the recommendation of Bob Hannesschlager, the frequency of sampling second year of monitoring will not be determined until the quarterly results of the first year's sampling have been evaluated.

The parameter list in the testing will be altered to reflect what may be expected to be found. Monthly water levels and quantities of water pumped from base water supply wells will be obtained. Static water levels from selected base water supply wells will be determined biannually. Annual assessments will be performed.

(2) Building 3001: Ms. Ramona Wagner, COE, briefed that the COE is currently writing the remedial investigation report. A draft of that report will be available to Tinker AFB by 30 June 1987. The health assessment will be performed by EPA when the remedial investigation report is complete. The risk assessment will be performed by the Corps of Engineers prior to the feasibility study. The status of the feasibility study is that the screening of control or treatment technologies is currently being performed. The Corps of Engineers will perform any design of a groundwater withdrawal system. An A/E contractor is being selected to perform feasibility studies on various treatment alternatives for the groundwater.

Results from adjacent north and southwest fuel contaminated areas were discussed.

(3) Fuel Farm: The fuel and water pumps have been installed with all discharge lines going to the holding tanks. When the system was turned on silt clogged the pumps. The pumps will be removed and cleaned out tomorrow, 20 May 1987. Sandbag dikes are not yet installed around the tanks.

(4) Landfill 6: Ms. Wagner, COE, briefed that the explorations in this area have been completed and all data has been received. A series of groundwater monitoring wells were installed, and a series of trench samples taken. Both soil samples and rock samples were taken from the trenches as well as water samples. Site conditions are as follows:

The landfill trenches are bottomed in sandstone and are not saturated. The perched groundwater table is right at or slightly below the base of the trenches. The occurrence of contaminants is sporadic and less severe in the top of the regional aquifer than in the perched aquifer.

The proposal made was to complete the clay cap on Landfill 6 and regrade the area to promote drainage and reduce leachate generation. A groundwater control system is required to lower perched groundwater below the bottom of trenches. The issue of what to do with contaminated groundwater already present is unresolved. The completion of the cap, regrading the area for surface drainage

and groundwater control system were approved by TRC members as being necessary at Landfill 6.

(5) Landfill 5: Ms. Wagner, COE, briefed the group on the urgency of resolving the remedial action of this landfill as soon as possible due to the fact that the Naval facility will be built at Tinker. Construction on this facility will begin next Spring. The taxiway will be placed across the landfill which would make this site inaccessible for any type of remedial work once it is in place. Site conditions are as follows:

The landfill trenches are bottomed in shale and have higher water levels in the trenches than in the adjacent stream or perched groundwater. The group of contaminants found in the groundwater monitoring wells are different from the group of contaminants found in samples of water and waste taken from the trenches. Both the geologic conditions and the occurrence of contaminants at the site suggest that Landfill 5 is not contributing significantly to groundwater contamination.

The proposal made was to place a clay cap over Landfill 5 prior to construction of the Navy taxiway. No type of construction that would require disturbance to the taxiway will be required at some later date. Groundwater withdrawal or monitoring wells can be installed outside the paved "shoulders" of the taxiway.

6. Mr. Coleman, OSDH, expressed pleasure with the direction of things with the Technical Review Committee. A good solid communication has been taking place.

7. The meeting adjourned at 1430 hours.

RAY D. REAVES, Col, USAF
Chairman, Technical Review Committee

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

WE
Mr. Clif
Warren

27 AUG 1987

REPLY TO
ATTN OF: EM

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 4 August 1987

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 417; 4 August 1978, 1000 hours.

2. Chairman: Maj Jeffrey M. Jorgensen, OC-ALC/EME

3. Attendees:

Capt Jack Jeter	OC-ALC/EME
Ms. Cathy Taylor	OC-ALC/EME
Mr. Fritz Nolting	OC-ALC/JAM
Mr. Don Black	OC-ALC/DSME
Mr. Joe Phillips	OC-ALC/DSM
Mr. Randy Gilreath	OC-ALC/DSSG
Mr. Warren Jones	2854 ABG/DE
Mr. Don Hensch	Oklahoma State Department of Health
Dr. Ron Jarman	Oklahoma Water Resources Board
Mr. Larry Pinkston	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr. Bob Thomas	Oklahoma Water Resources Board
Ms. Suzette Turner	U.S. Environmental Protection Agency
Ms. Ellen Greeney	U.S. Environmental Protection Agency
Mr. John Roberts	Corps of Engineers, Tulsa District
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Mr. Dean Loftin	Corps of Engineers, Tulsa District
Mr. Clif Warren	Corps of Engineers, Tulsa District
Ms. Carol McConnell	Corps of Engineers, Tulsa District

4. The meeting began at 1000 hours. The minutes of 21 April 1987 were approved as written. Maj Jorgensen, OC-ALC/EME, introduced himself and said he would be filling in for Col Birch since he had recently PCS'd.

5. Agenda Items: Status Update - Corps of Engineers

a. Meeting Overview: Ramona Wagner, COE, gave an overview of the meeting. She advised that the Remedial Investigation report on Building 3001 had been completed in draft form and would be distributed at the end of the meeting. Results and recommendations concerning Fire Training Area #2 will be discussed. There will also be a brief discussion on the groundwater assessment, fuel farm, landfills 5 & 6, and the status of remaining sites of the Tinker Installation Restoration Program.

b. Building 3001: Mr. Clif Warren gave a status report of Building 3001 and provided an overview of remedial investigations.

(1) Status Report: Remedial Investigations (RI) have been completed and a draft report will be handed out for review and comment. Under the direction of the Environmental Protection Agency (EPA) a Health Assessment will be performed.

The COE will be doing a baseline Risk Assessment (RA) to evaluate the public health effects of the existing conditions and the long term effects of a no action plan. The Risk Assessment will also serve as a basis for comparing the risks of remedial alternatives evaluated. The Feasibility Study (FS) is underway. The initial screening portion of the FS of alternatives has been completed and an A-E (Black and Veatch of Kansas City, MO) has been selected to perform the FS. Once selection of the recommended alternative is made there will be a public comment period. Then, final design and award will be made.

(2) Overview of Remedial Investigations: The extent of groundwater contamination was defined by monitoring well clusters. There were approximately 75 monitoring wells installed in clusters of 2, 3, or 4. Two underground tank storage areas were also investigated (one north tank are and one southwest tank area). The major contaminants are TCE and chromium. Other organics and metals are present in smaller plumes and lower concentration ranges. Some contaminants entered the aquifer system by vertical migration into the perched aquifer and the contaminants are contained mainly in the upper 175 feet. There are four sources of contamination to the perched aquifer. They are: subsurface pits, underground fuel tanks, storm drain lines, and West Soldier Creek. The subsurface pits are located inside the building and contained solvents in the past. Results of these pit investigations were discussed in the OctOber 1986 TWG meeting. A summary report is contained in the RI report. The underground fuel tanks are located north and southwest of the site. Two active tanks are located at the north site and are possibly leaking. Abandoned tanks are located southwest of the site in an area where benzene, tolune, and xylene are present in storm drain lines which allowed leakage to the perched aquifer and discharges to West Soldier Creek. West Soldier Creek is a source of recharge to the perched aquifer. The perched aquifer served as a source of vertical migration to the top of the regional aquifer. A summary of the contaminants in the nearby water supply wells are presented. Water supply wells 15 and 16 showed traces of TCE, dichloroethane and tetrachloroethylene, but levels are far below standards.

After investigations were complete, the TCE and chromium plumes were computer modeled in order to establish the conditions under a no action plan and establish a baseline for evaluating groundwater withdrawal plans. The TCE plume migration is both to the east and west in the perched zone. The plume decreases in concentration beneath the building but gets larger as it migrates. Migration rates vary due to the varying gradient. The plume is moving approximately 25 feet per year ~~due~~ towards the west and 20 feet per year to the east until it nears East Soldier Creek. There the rate increases to about 60 feet per year due to the steep gradient toward the creek. Top of regional TCE plume movement is towards the west in the direction of the hydraulic gradient. The zone also has a westward migration with a rate of about 10 feet per year. All of the plumes remain within the base property boundaries over the entire 50 year period modeled, except where the perched TCE plume discharges into East Soldier Creek, allowing contaminants to be carried with streamflow.

(3) Feasibility Study: The Feasibility Study is underway. Interim recommendations as the FS continues are to monitor water supply wells 13 - 17 quarterly and the remaining groundwater monitoring wells yearly. Two active underground tanks in the southwest area should be inspected to assure they are empty or filled with inert materials. Northeast of the site there should be investigations near the base boundary and around the Industrial Waste

Treatment Plant (IWTP), since this area has groundwater hydraulically upgradient and high concentrations of organics are apparently migrating from this direction. A baseline Risk Assessment will be made to help establish clean-up limits, calculate public health risks, and serve as a basis for comparing risks. The screening of remedial alternatives concluded that the most feasible plan for remedial action will involve a system of groundwater collection, treatment and disposal of treated water. Black and Veatch has been selected as the A-E to evaluate treatment alternatives for the Feasibility Study.

Capt Jeter asked about the modeling of the perched aquifer over the next 50 years, "What concentrations of TCE contamination would migrate through the stream?" Mr. Warren, COE, answered, "After 10 years, approximately 100 micrograms per year will have reached the stream". A member of the Garber-Wellington Association asked, "What kind of model was used?" Mr. Warren answered, "Discreet Random Walk, written by Thomas Prickett."

In response to the question, "What type of time schedule for Feasibility Study and Assessment are we looking at?". Mr. Warren answered, "We are preparing a scope of work now. The Feasibility Study is estimated to take approximately one year, depending on the alternatives that are most favorable."

Capt Jeter asked for a two week turn-around to review draft RI report and return comments. EPA suggested 30 days be allowed. A 30-day review and comment period was agreed to.

c. Fire Training Area No. 2: Mr. Dean Loftin, COE, briefed the group on Fire Training Area No. 2 which is located in the South Central area of the base.

(1) History: Aerial photographs taken in 1970 were viewed. During the operation of this site, fuels, waste oils and waste solvents were used to ignite an airplane carcass. The fires were put out with water and fire fighting foam. This site was operated between 1962 and 1966 and was diked but unlined. At the present time there are no visible signs that this was ever used as a Fire Training Area.

(2) Site Conditions: During site explorations, no dark and odorous soil was found that would be indicative of fuel contaminated soils. No groundwater was encountered during explorations and shale was encountered at approximately four feet. Analysis of samples revealed organic compound in three classes. First, very low concentrations of acetone (27 ppb) and methylene chloride (153 ppb) were attributed to labatory and sampling error. Second, tetrahydro furan hexane, 2-hexanone and heptane were found in both blanks and soil samples from the site in maximum concentrations of 4 ppm, and are considered to be within background concentrations. Third, 2-pentanol and octane were present in the soil in concentrations less than 70 ppm and are possibly residual from the fuel. They are not listed on the hazardous substance list. In addition, bis (2 ethylhexyl) phthalate, a common plasticizer, was found in concentrations less than 7 ppm and is not considered to be toxic at those concentrations.

The conclusion is that there is no significant contamination at FTA-2 and it is recommended no further investigations or remedial action be performed at this site. A report will be prepared to document findings at the site and submitted.

d. Ms. Wagner, COE, briefly reported on several other sites.

(1) Groundwater Assessment: The draft report of the groundwater assessment has been completed and comments resolved or incorporated. There will be one difference between the final report and the draft report. An additional 5 or 6 wells will be located to provide down-gradient monitoring points to historic base operations or to fill in gaps in the monitoring network, pending AFLC approval. Final report will be completed as soon as comments from AFLC are resolved. Well installation and resampling for groundwater assessment will be initiated 1 October 1987, pending funding from AFLC.

(2) POL Facility (Fuel Farm): Pumping began operation on 1 June 1987. There have been some difficulties with the system. Some electrical problems were encountered. Tulsa, Tinker AFB personnel, and the well contractor have been working with the system to get it working all the time. Three things are proposed as parameters to evaluate system, (1) cumulative quantities of liquids and fuel pumped at the site, (2) water levels in adjacent wells and, (3) BTX in adjacent wells. Approximately 25,000 gallons of water and 500 gallons of fuel had been collected as of 25 July. Pumps have been raised in an effort to collect less water and more fuel.

(3) Landfill 6: In review, three issues regarding Landfill 6 were discussed at the previous TRC: (1) construction of the clay cap over the remainder of the landfill (2) construction of a groundwater control system to lower the perched water table below the bottom of the cells and, (3) groundwater contamination present at the site.

A construction contract to complete the clay cap will be advertised 17 August and awarded before 30 September. The clay cap will tie into the existing cap and consists of the same design, 18" of clay overlain by 12" of topsoil. A laboratory testing program to insure that field densities will meet a permeability of 10^{-7} cm/sec is underway.

The groundwater control system will be installed as a part of the final remedial action at the site.

The issue of what to do about existing groundwater contamination cannot be resolved until the limits are known. A proposal to install 10 additional wells (5 clusters of two) south and west of the landfill was made. They will be locted 600 - 700 feet from the landfill boundaries. Seepage velocities and time of landfill operation were used to select well locations.

(4) Landfill 5: This is the site where the proposed Naval Facility (E6A) will be located. The taxiway will cross the south portion of the landfill. Due to the urgency of project, data was presented at the TRC meeting.

(a) Site Conditions: Landfill 5 borders on Crutcho Creek. The landfill trenches are higher than in the perched aquifer. Both the perched and regional aquifer flow southwest from the landfill. Contaminants detected in the groundwater monitoring wells are not the same as those detected in the grab samples (both waste and water) from the trenches. Both geologic conditions and distribution of contaminants indicate that the trenches at Landfill 5 are not contributing to groundwater contamination at the site.

(b) Recommendations: The members of the TRC previously approved the capping of the landfill (since a portion of the site would soon be inaccessible) to reduce the potential of leachate generation in the landfill.

6. New Items:

a. Abandoned Tanks at IWTP: Capt Jeter, OC-ALC/EME, introduced a new site that we will be talking about more in the future. There are some abandoned tanks at the IWTP. Several years ago, these were approved for removal by HQ AFLC. We will be collecting samples to determine if there is any contamination outside the tanks and determine appropriate disposal for the soil.

b. Sludge Drying Beds at Old STP: Capt Jeter, OC-ALC/EME, briefed that this is another topic that we will be discussing in the future. The same situation for the IWTP applies to these beds. These beds were used for anaerobic digester sludge. We want to close them out so we will be doing the same procedure to determine if there is contamination and what to do with the soil. Borings have been completed at the IWTP and some borings completed at the drying beds. We should have some results to discuss at the next TWG.

7. The Technical Review Committee meeting will be held on 25 August 1987, at the CC Conference Room in Bldg 3001, at 1330 hours.

JEFFREY M. JORGENSEN, MAj, USAF
Chief, Environmental Planning Division

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

REPLY TO
ATTN OF: EM

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 25 August 1987

TO: All Members

1. Location, Date, Time: Bldg 3001, CC Conference Room, 25 August 1987, 1330 hours

2. Members:

Col Ray Reaves	OC-ALC/EM, Chairman
Mr Mark Coleman	Oklahoma State Department of Health (State of Oklahoma Rep to TRC)
Mr Robert Hannesschlager	EPA Superfund Branch (EPA Rep to TRC)

3. Attendees:

Maj Jeff Jorgensen	OC-ALC/EME
Maj Darrel Cornell	OC-ALC/EME
Capt Jack Jeter	OC-ALC/EME
Ms Cathy Taylor	OC-ALC/EME
Mr Jeff Bradley	OC-ALC/EME
Mr Fritz Nolting	OC-ALC/JAM
Mr Howard Bain	OC-ALC/JAM
Mr Joe Phillips	OC-ALC/DSM
Mr Hilton Frey	EPA Superfund Branch
Mr Don Hensch	Oklahoma State Department of Health
Dr Ron Jarman	Oklahoma Water Resources Board
Mr Odell Morgan	Association of Central Oklahoma Governments/ Garber-Wellington Association
Ms Suzanne Moore	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr John Roberts	Corps of Engineers, Tulsa District
Mr Robert Ramsey	Corps of Engineers, Tulsa District
Mr Andy Obrochta	Corps of Engineers, Tulsa District
Ms Ramona Wagner	Corps of Engineers, Tulsa District
Ms Carol McConnell	Corps of Engineers, Tulsa District
Mr Terrence Lyons	HQ AFLC/DEVW
Mr Jerry Robbins	Dynamac, HQ AFLC/DEVW

4. The meeting opened at 1330 hours. Introductions were made throughout the room. The TRC minutes of 19 May 1987 meeting were approved as written. Col Reaves, OC-ALC/EM, stated that Gen Bowden and Gen Walsh had been unable to attend this meeting. Gen Bowden wanted to attend to reiterate the fact that he is very pleased with what is occurring. He is aware the congressional delegation is aware of these proceedings and of the recent GAO report which was quite favorable. He wants the excellent communication to remain and will do everything from his side to make sure it does. Gen Bowden and others have said "it is the program to get the job done".

5. Agenda Items:

a. Installation Restoration Program

(1) Building 3001: Mr. John Roberts, COE, stated that the GAO had published a report in July of this year entitled "Tinker AFB is Making Progress in Cleaning Up Abandoned Sites". We have a very efficient method of accelerating the IRP. Everyone should continue to offer suggestions. For Building 3001, the Air Force completed the report, presented it to the TWG on 4 Aug 87, and agreed on a 30-day review time for everyone's comments. The Health Assessment will be perfomed by the EPA, the Risk Assessment by the Corps, and the Feasibility Study will be performed by contract. Black and Veatch has been selected to assist in the Feasibility Study. They will provide assistance in the treatment process selection. The Remedial Investigation report presents the conclusions of all investigations performed at the site. A total of 240 acres were investigated.

The aquifer is separated into different zones. The perched water table is from the depths of 20-25 feet. The top of the regional aquifer is from 80-110 feet, and the regional zone, which is a non-producing zone, is up to 175 feet deep. Finally, the producing zone of the aquifer is below that point. The top three zones were modeled for movement of TCE and chromium, and the results depicting conditions at 10-25-50 years. With the exception of the perched water plume, which would reach Soldier Crek at 10 years, all of the pollutants would stay within the vicinity of Bldg 3001 for the time modeled. The perched groundwater is moving approximately 25 feet per year to the west, 20 feet per year to the east, and 80 feet per year when it reaches Soldier Creek. The regional aquifer moves approximately 20 feet per year to the southwest and 15 feet per year to the east. It was recommended that groundwater monitoring be done quarterly for base water supply wells and quarterly for one year on a selected group of Bldg 3001 monitoring wells. A proposal will be made to the TWG regarding selection of the Bldg 3001 wells for inclusion.

Also recommend inspecting fuel tanks north and southwest of the building for leakage. A contractor will look at the tanks. Tinker does not have on-base capabilities to perform these tasks and will have to go off-base. One large concrete tank is no longer required; proposing abandonment. The other tank is a smaller tank, holding approximately 20,000 gallons of diesel fuel. Mr. Roberts, COE, stated that most of the pits inside Bldg 3001 were removed during the renovation of the building after the fire. There are still four pits in the south end of the building that contain organics and heavy metals. Recommend removal of these four pits as an interim action. Finally, the contamination just northeast of the building has different contaminants from that directly around Bldg 3001. Recommend that investigations begin to determine where these contaminants originate.

Performed a screening of alternatives and came up with technically feasible alternatives for Bldg 3001. Groundwater collection, treatment and disposal is a favorable alternative. The State Health Department was asked to give us appropriate standards for different disposal methods. Mr. Coleman, OSDH, stated that if only talking about TCE, answers can be provided, but more information on other specific compounds and magnitudes are required. Mr. Roberts, COE, stated that they are specifically showing the possible disposal methods for a dozen different contaminants under Bldg 3001. In order to do a Feasibility Study, the standards for various methods of disposal will be needed. The question was asked if it is necessary to show the standard the water would have to meet to discharge to the IWTP. The OSDH and OWRB concurred that the ultimate standard for this disposal is concentration discharged to the creek and that bioassay

monitoring will be the probable means to assess discharge acceptability. This is one topic that must be resolved before the Feasibility Study can proceed. The topic of recharging the aquifer was discussed, but again, the subject of standards was brought up. The wells utilized for this purpose would have to be classified as some sort of injection wells. This concept was rejected by the Oklahoma State Department of Health representative.

(2) Fire Training Area #2: Mr. Roberts, COE, presented conclusions and recommendations on the Fire Training Area #2. This area is near Crutcho Creek. A 1970 aerial photo was shown. The COE located the site; however, no visual evidence exists for the site. Seven borings were drilled in the general area; one in the general area, one in the center and six around the borings, but none were found. The COE reached auger refusal at about 7 feet. No groundwater was located. Compounds found were fuel-related, but most are not listed as hazardous wastes. One plasticizer compound found is the only listed hazardous waste at the site. Conclusions are that there is no significant contamination at fire training area #2. A final report on this item will be complete in a couple of weeks for review.

(3) Landfill #5: Mr. Roberts, COE, briefed this is the site of the proposed Navy taxiway and that this topic was discussed at the 4 Aug 87 TWG. This landfill's trenches are located so they are bottomed in a shale. The site has water perched in the trenches themselves. Analysis of the Garber-Wellington aquifer is showing one group of contaminants and the trenches are showing a separate group of contaminants. It is the conclusion of the COE that Landfill #5 is not contributing to the groundwater contamination, but the landfill trenches do contain contaminants, that if left alone could become a potential source for groundwater contamination. This recommendation in the final report will be to place a clay cap on the landfill to reduce water penetrating to the waste. The feasibility of any groundwater remedial action will be addressed when the Crutcho Creek investigations are discussed.

(4) Landfill #6: Mr. Roberts stated it was agreed at the last TRC to extend the clay cap to cover the rest of the trenches. Groundwater control to prevent perched water from flowing through the landfill waste and methods to handle the contaminated groundwater that pre-exists at the site was also discussed. The extention of the clay cap was advertised 17 Aug 87, bid opening scheduled for 15 Sep 87, and construction to start in Oct 87. The groundwater control system will be part of the follow-on remedial actions at the site.

(5) Groundwater Assessment: Mr. Roberts briefed that the groundwater assessment draft report was distributed for comment in Apr 87. The only significant change to the final report is additional well locations used to monitor Tinker's effect on surrounding areas. There will now be an additional six wells (a total of nine) to fill in gaps where monitoring is not performed currently. Primarily, these will be down gradient from Tinker's operations. This will provide a better assessment of if/how Tinker affects any off-base wells. These comments will be incorporated in the final report.

(6) Fuel Farm: Mr. Roberts said pumping fuel and groundwater started from the area on 1 Jul 87. The total amounts of fuel and water collected from this site thus far are 733 gallons of fuel and about 39,000 gallons of water. Efforts have been made in readjusting pumping levels to pump more fuel and less

water, and continually calibrating the system to work more effectively. There have been approximately 100 gallons of fuel each week within the past few weeks. At future TRC meetings, levels of fuel and groundwater pumped will be presented to determine effectiveness of the system.

6. The meeting adjourned at 1500 hours.

RAY D. REAVES, Col, USAF
Chairman Technical Review Committee

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

cc Mr. Clif Warren

19 NOV 1987

REPLY TO ATTN OF: EM

SUBJECT: Technical Working Group (TWG) Meeting Minutes - 20 October 1987

TO: All Members

1. Location, Date, Time: Tinker AFB, Bldg 3333; 20 October 1987, 1000 hours.

2. Chairman: Maj Jeffrey M. Jorgensen, OC-ALC/EME

3. Attendees:

Maj Darrel Cornell	OC-ALC/EME
Capt Jack Jeter	OC-ALC/EME
Mr. William Hall	OC-ALC/PA
Ms. Cathy Taylor	OC-ALC/EME
Ms. Geri Hart	OC-ALC/EME
Mr. Howard Bain	OC-ALC/JAM
Mr. Joe Phillips	OC-ALC/DSM
Mr. Danny Arnold	OC-ALC/MAQV
Mr. Don Black	OC-ALC/DSME
Mr. Warren Jones	2854 ABG/DE
Mr. Don Hensch	Oklahoma State Department of Health
Dr. Ken Johnson	Oklahoma Geological Survey
Ms. Suzanne Moore	Association of Central Oklahoma Governments/Garber-Wellington Association
Ms. Suzette Turner	U.S. Environmental Protection Agenc
Mr. Thomas Maiello	Oklahoma Water Resources Board
Mr. Bob Thomas	Oklahoma Water Resources Board
Mr. Robert Ramsey	Corps of Engineers, Tulsa District
Mr. John Roberts	Corps of Engineers, Tulsa District
Mr. Clif Warren	Corps of Engineers, Tulsa District
Mr. Dean Loftin	Corps of Engineers, Tulsa District
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Ms. Wendy Lanier	Corps of Engineers, Tulsa District
Ms. Susan Price	HQ AFLC/DEVW

4. The meeting began at 1000 hours. The minutes of 4 August 1987 were approved as written.

5. Agenda Items - Corps of Engineers

a. Groundwater Assessment: The final report on the Groundwater Assessment has been published and copies have been distributed by the Tinker AFB office of Environmental Management. The major difference between the draft and final report is that in the final report, nine additional monitoring wells are recommended

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for monitoring the perched aquifer in lieu of the three wells recommended in the draft report. The installation of additional wells will begin this week. Two wells will be installed in the top of regional aquifer in addition to the nine in the perched aquifer. The quarterly sampling of all perimeter wells and water supply wells is scheduled to begin in mid to late November. The question was asked if screens were being installed at 50 feet? Ms. Wagner, COE, stated that based on the elevation, holes were being drilled and screened at 35 - 50 feet. The question was asked if the filter pack goes all the way up? It is the Corps' intention to install wells to provide a network around the perimeter without installing a well in every sandstone lens. Tinker has clusters of 2 to 3 wells in every location instead of putting one well. They will receive water from all locations. If contaminants are detected, the COE will go back in and isolate the contaminant. The seal on the deeper well is below the water bearing zone on the perched aquifer. The depths vary on the base because of differences in surface elevation. Work plans call for drilling separate wells instead of grouping them in one well.

b. Building 3001: Clif Warren, COE, provided an update of the work at the Building 3001 site.

(1) At the last TWG meeting in July 1987, a draft report of the Remedial Investigations (RI) was handed out. All review comments from the TWG and TRC members have been received with the exception of OWRB comments. The OWRB comments are expected by 30 October 1987. Tulsa District is in the process of resolving the other comments now. A question was raised by HQ AFLC as to whether the final RI can be published before the FS is completed, since the two processes are integrated when discussed in section 300.68 of the NCP. Ms. Suzette Turner of the EPA, Region VI, responded that the RI should be finalized and stand as a separate document from the FS. Ms. Suzette Turner, EPA, stated that she will bring an answer back on this item to the next TRC. (OPR: EPA)

(2) Based on the review comments of the draft RI, the significant changes were discussed before finalizing the report.

a. Additional data concerning the background air quality and air monitoring at the base will be included in the air investigations section of the report. The additional data will include identifying the current emissions, monitoring points, and air quality monitoring zone. This information will provide useful background data for conducting the risk assessment and analyzing feasibility study alternatives.

b. Additional groundwater quality results will be added to Appendix G of the report. These results, which were discovered to be missing from the draft report, include benzene, toluene, xylene, and acetone results for all the wells, all the results of water supply wells 13 - 16, and the results of the quality control blanks.

c. The groundwater flow and contaminant transport modeling of the no-action plan has been revised to include a continuous vertical migration of contaminants into and out of the aquifer zones as plume movements are simulated. The previous modeling results showed the plume behavior in a two dimensional closed system where no additional vertical contamination was added.

d. The estimated amount of fuel product above the perched aquifer in the north tank area will be revised. The original estimate of 10,000 gallons may have been too high due to apparent product thickening in the wells. Also, more recent fuel and water levels taken in the wells indicate that the plume may be spreading. This may be due to tank 3404 still containing approximately 200,000 gallons of fuel oil. An additional round of fuel and water levels will be taken and a revised fuel estimate will be made.

(3) The revised groundwater modeling plume (discussed in paragraph 5.b.(2)c) for TCE were shown along with the previously presented plumes. The TCE plume in the perched aquifer accounts for continuing migration of contaminants from the vadose zone in areas of recharge. It also allows for contaminants leaving the aquifer due to leaking out of the zone. The plume covers a similar area as the closed system; however, the concentrations are lower. The plume in the top of regional zone was simulated over time with continued contaminant migration from the perched zone above it. The plume migrates towards the west approximately 20 feet per year and is spread over a similar area as the closed system with similar concentrations. The plume in the regional zone is affected by the top of regional zone above it. The plume migrates west about 10 feet per year and is spread over a larger area with higher concentrations than the plume shown previously in the closed system. This modeling, which accounts for continuing vertical migration of contaminants should be more realistic than the closed system.

(4) In the draft RI report several interim recommendations were made. It was recommended to sample all monitoring wells at the site annually and the water supply wells quarterly. A comment to previous TRC minutes has been made indicating that quarterly sampling of monitoring wells may be more appropriate. All of the wells are being sampled this quarter and results will be available for review approximately two weeks prior to the next TWG meeting in January. The results will be discussed at that time and the decision made as to whether sampling of selected wells for specific parameters on a quarterly basis is necessary. A recommendation was made in the draft report to inspect the fuel tanks at the north and southwest tank areas. The Corps of Engineers will be inspecting the southwest tanks, leak testing or replacing tanks 3401 (steel diesel tank) properly abandoning tank 3404 (concrete fuel oil tank), and recovering the fuel product in the north tank areas this FY. The RI draft report also recommended removing the contents of four abandoned pits inside Building 3001 and investigating the groundwater in the area northeast of the site. Tinker EM is going to have the pit contents removed. Preliminary groundwater investigations will be initiated northeast of the site of the industrial waste treatment plant by installing four or five well clusters around the plant.

(5) The feasibility study is underway. Tinker EM has sent the screening of feasible alternatives report to the EPA and OSDH for their review and approval. A reply has been received from OSDH and we are waiting on a reply from EPA. Proposed standards for emissions of organics to the air and discharges of treated groundwater to receiving waters will be submitted to OSDH and OWRB for approval. Approved standards are needed to evaluate groundwater treatment alternatives during the feasibility study. The A-E contract with Black and Veatch should be awarded within the next two to four weeks. Black and Veatch will complete several items of work beginning with selection of four or five appropriate alternatives to develop and evaluate. This item will be presented at a TRC meeting by Black and Veatch. The final selected alternative will also be presented at a TRC meeting by Black and Veatch.

c. Fuel Farm: Ms. Ramona Wagner, COE, presented the status of the ERA report and results of the fuel recovery and groundwater monitoring program to date.

(1) Report Status: The report comments have been received from all agencies with the exception of OWRB. Their comments will be available by 30 October 1987. Upon resolution of all comments, the final report will be published. Tom Maiello, OWRB, commented that enhanced vapor recovery (a vacuum system placed on wells screened in the unsaturated zone) should be considered in the ERA report as a treatment technology. Mr. Maiello felt that enhanced vapor recovery would also speed up site remediation. Major Jorgensen commented that upon completion of the new POL Facility (estimated to be 30 January 1988) the site appearance would become important, and anything to speed up fuel collection and removal of the black collection tanks should be investigated.

(2) Results of Fuel Recovery and Groundwater Monitoring:

a. Monitoring Program: The groundwater monitoring program consists of monitoring cumulative quantitites of fuel and groundwater pumped from the site, monthly monitoring fuel and water levels in nearby monitoring wells, and monthly monitoring of BTX results in groundwater from nearby wells and recovery wells. Perimeter wells (2 clusters of two and 2 clusters of three) outside the product plume are monitored for water levels and BTX results every six months.

b. Results: Recovery began in June of 1987. Since that time 987 gallons of fuel and 73,200 gallons of water have been pumped from the site. Fuel recovery is progressing at a more or less steady rate. Water levels in MF-4 and MF-12 are declining, although it is impossible to tell whether the decline is a seasonal trend or result of groundwater pumping. The fuel product thickness in MF-12 has decreased to approximately two feet and the top of liquid level is declining as well. BTX (Benzene, toluene, and xylenes) results were presented for MF-4, 12, 13, 24, and 26. All three parameters were declining in MF-4. In MF-12, toluene was decreasing, however benzene and xylenes were increasing. BTX were not detected in MF-14 and this represents a decline. BTX remained essentially unchanged in MF-24 and MF-26, the two recovery wells. All BTX data were evaluated using a least squares line best fit for B, T, or X versus time. Positve slope lines were interpreted to be increasing trends. Negative slope lines were interpreted to be decreasing trends.

c. Conclusions and Recommendations: Conclusions reached were that:

1. The original estimate of quantity of fuel present (50,000 gallons) was high and a figure of 5,000 to 10,000 gallons is more accurate.

2. Water levels in MF-4, 12, and 14 are declining.

3. BTX concentrations in MF-4, 12, and 14 are declining.

4. The north well, MF-26, is producing little to no fuel.

The recommendation made was to continue the pumping of fuel and groundwater for at least three more months and then reevaluate the situation.

d. Landfills 1 - 4:

(1) Site Conditions: Ms. Wendy Lanier, presented preliminary results from Landfills 1 - 4. The landfills are located in the southwest corner of the Base and are more or less contiguous. Landfill (LF) 1 was in operation from 1942 to 1945 and covers approximately 2.5 acres. LF-2 covers approximately 25 acres and was in operation from 1945 to 1952, LF-3 covers approximately 9 acres and was in operation from 1952 to 1961, and LF-4 covers approximately 12 acres and it was in operation from 1961 to 1968. Several photographs of the landfills were shown and an aerial map of the landfills in 1970 was displayed to show the location of monitoring wells and trench borings was shown and the sampling and testing of the groundwater, waste and soil from the site was discussed. Two geologic sections of the site were displayed and showed a perched water table and the top of regional aquifer potentiometric surface (both of which agreed with Base-wide maps of the same aquifers shown in the Groundwater Assessment). A poorly defined intermediate water table was also encountered in a portion of the landfill. The trenches in Landfills 2, 3, and 4 are predominantly bottomed in shale and the trenches in Landfill 1 are bottomed in a silty sandstone. The site perched water contours display a mounding over the trenches with radial flow.

A listing of detected contaminants (25 volatile, 26 semi-volatiles, 9 metals and 4 miscellaneous) at the site was displayed and a spreadsheet of significant contaminants and the concentrations in each boring or monitoring well at the site was given to all attendees. Contaminant plumes were displayed in the perched aquifer for TOC, TCE, MEK and Chromium. The main points discussed about the plumes were that they are not completely defined, and that the oil sludge dump areas on Landfills 3 and 4 show the highest concentrations for many of the plumes. Contaminant plumes were shown for TOC and Chromium in the top of regional aquifer.

(2) Conclusions and Recommendations: Conclusions reached were as follows: The groundwater beneath the site has been contaminated by the landfills. The extent of the contamination has not been completely defined. Recommendations are to perform additional explorations in order to define the extent of contamination and to regrade the landfill surfaces and place a cap over landfills. As an interim remedial action, the TWG agreed with these recommendations.

(3) Discussion: Major Jorgensen asked if in view of the high concentrations in landfills if there was a possibility that they would become an NPL site. Ms. Suzette Turner from the EPA replied that she would discuss the site with her superiors, but at this time it was an Expedited Response Action site.

e. Landfill #6: Ms. Wagner, COE, briefed that the clay cap is going to be placed over the portion that was not originally covered by the clay cap. The construction will begin around 1 Nov 87. Installation of monitoring wells around the landfill will begin possibly around 1 Jan 88.

6. TRC Minutes: Ms. Susan Price, AFLC, questioned whether signed TRC minutes constituted EPA and State of Oklahoma approval of issues presented for approval in the TRC meeting. Don Hensch, Oklahoma State Department of Health, replied that yes, Mark Coleman's signature to meeting minutes constituted approval of those minutes. Ms. Suzette Turner, EPA, Region VI, also replied that Bob Hannesschlager's signature on the TRC minutes constituted EPA's approval of

the minutes. Howard Bain, Tinker JA office, replied that this issue had been discussed and resolved during the initial TRC meetings and with the TRC Charter (Attachment 1).

7. Barium: Ms. Susan Price, AFLC, stated that barite was a mineral present in the Garber-Wellington formation and AFLC would not support cleanup of a site with only barium contamination present.

Ms. Wagner of the Corps of Engineers stated that background concentrations of barium had been calculated for the perched, top of regional, and producing zone of the Garber-Wellington aquifer. Many of the sites at Tinker had barium concentrations well above the background concentrations that appeared to be due to site contamination.

Capt Jeter, Tinker EM, stated that barium should be identified in any remedial investigation, as much as iron and manganese are identified, because of its potential to foul cleanup systems. Barium is a primary drinking water quality parameter as well, and this must be considered.

Ms. Suzanne Moore, Garber-Wellington Association (ACOG), stated that the barium concentrations at Tinker had not given them any concern.

8. The Technical Review Committee meeting will be held on 17 November at 1300 hours, in the CC Conference Room of Bldg 3001.

JEFFREY M. JORGENSEN, Maj, USAF
Chairman

1 Atch
TRC Charter

CHARTER
TINKER AFB TECHNICAL REVIEW COMMITTEE (TRC)

PURPOSE: To facilitate communication and coordination among the AF, Federal EPA, and the State of Oklahoma in response actions undertaken under the Installation Restoration Program (IRP) at Tinker AFB. The IRP is DoD's presidentially delegated response to the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) to conduct a comprehensive identification of hazardous waste disposal sites, assess the nature and magnitude of contamination, and take corrective action to protect the public health and environment.

STRUCTURE: Membership shall consist of a designated representative from the AF (Chair), EPA and the State of Oklahoma. Each member may provide technical support personnel as required. Meetings will be called by the chair on a regular basis or at the request of individual members as needed. Meetings will be held in the Oklahoma City vicinity. The chair will be responsible for writing minutes of the meetings and for dissemination to committee members of minutes and other data requiring committee review and comments.

FUNCTION: The primary function of the TRC is to provide coordinated direction to IRP activities at Tinker AFB. The committee members will be required to review and comment on various IRP technical documents and related plans and data. They shall consider and recommend necessary changes based on continuing review of response actions in the Tinker IRP. Individual committee members are responsible for insuring that inputs reflect a total state, EPA or AF position. If a concurrence cannot be reached, the matter will be referred to respective member's higher authority for resolution.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-

COE
Mr. Robert Ramsey

13 JAN 1988

REPLY TO
ATTN OF: EM

SUBJECT: Technical Review Committee (TRC) Meeting Minutes - 19 November 1987

TO: All Members

1. Location, Date, Time: Bldg 3001, CC Conference Room; 19 November 1987, 1500 hours.

2. Members	Col Ray Reaves	OC-ALC/EM, Chairman
	Mr. Mark Coleman	Oklahoma State Department of Health (State of Oklahoma Representative to TRC)
	Mr. Robert Hannesschlager	EPA Superfund Branch (EPA Representative to TRC)
3. Attendees:	Maj William Fodor	OC-ALC/EMI
	Maj Jeffrey Jorgensen	OC-ALC/EME
	Maj Darrel Cornell	OC-ALC/EME
	Capt Jack Jeter	OC-ALC/EME
	Ms. Cathy Taylor	OC-ALC/EME
	Mr. Fritz Nolting	OC-ALC/JAM
	Mr. Joe Phillips	OC-ALC/DSM
	Mr. Don Black	OC-ALC/DSME
	Mr. Danny Arnold	OC-ALC/MAQV
	Ms. Anne Copeland	OC-ALC/MAQV
	Mr. David Burris	2854 CES/DEE
	Mr. Dave Dillon	Oklahoma Water Resources Board
	Mr. Bob Thomas	Oklahoma Water Resources Board
	Mr. Don Hensch	Oklahoma State Department of Health
	Mr. Hal Cantwell	Oklahoma State Department of Health
	Ms. Glenda Thomas	AFRCE-CR/ROVE
	Mr. Robert Ramsey	Corps of Engineers, Tulsa District
	Mr. John Roberts	Corps of Engineers, Tulsa District
	Ms. Carol McConnell	Corps of Engineers, Tulsa District

4. The meeting opened at 1500 hours. Colonel Reaves, OC-ALC/EM, began the meeting by introducing Brigadier General Walsh, the new Vice Commander. Other introductions were made throughout the room.

5. Previous Minutes: There was some discussion concerning the minutes of the August TRC meeting. However, everyone was in agreement with the minutes as written. Both the State and EPA have approved the minutes and Tinker EM should be receiving a signed copy soon.

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6. Status Update - Corps of Engineers:

a. Building 3001: John Roberts, COE, stated that the draft Remedial Investigation (RI) Report had been submitted at the August TRC meeting. All agencies have completed their review and comments have been resolved. The final RI will be submitted to the Tinker Environmental Management (EM) office in mid-January. Based on the review comments, some changes were made to the RI Report. Additional data concerning background air quality and air monitoring at the Base will be included in the report Additional groundwater quality as well as QA/QC results will be added to the report. Also, the Corps is revising the groundwater modeling to include continuous vertical migration of contaminants from the vadose zone in areas of recharge. Slides were viewed which depicted the prediction modeling for TCE contaminated groundwater for a no-action plan. There is a revision to the estimated amount of fuel product floating on the perched aquifer at the north tank area. The original estimate of 10,000 gallons of fuel may have been too high. After an additional round of fuel and water levels have been taken, a revised estimated fuel estimate will be made.

(1) Interim Recommendations for Building 3001:

(a) The draft RI report recommends one more annual round of monitoring of all wells at the site. Based on discussion with OSDH and AFLC, quarterly monitoring will be performed in FY88. Parameters to be tested in the first round will be as recommended in the draft RI. Based on the results of this sampling round, a new monitoring plan including selected wells and a modified parameter list will be presented at the January TWG.

(b) Fuel tanks north and southwest of the building will be checked for leaks, if active, or inspected to determine if the tank was abandoned properly, if inactive. The large fuel oil tank is to be abandoned some time in the near future. A plan is being developed to clean and properly abandon the tank. The diesel tank will be leak tested or replaced. Estimates have been provided to Tinker EM. Free product present in the north fuel area will be removed as an interim action. An addendum to the Scope of Work to perform this work is being prepared. There are four subsurface pits in Building 3001 that still contain solvents and heavy metals. Contents of pits will be removed. Groundwater investigations will be performed northeast of the site.

(2) Health Assessment/Risk Assessment: The health assessment is underway under the direction of EPA. Representatives from ATSDR will be arriving Tinker AFB on 8 December to do field work. The risk assessment is being done by Tulsa District Corps of Engineers. Draft has been completed and will be given to Tinker EM in December. It will show potential health affects with a no action plan on the Building 3001 site.

(3) Feasibility Study: The feasibility study screening of alternatives report has been reviewed and comments mailed to Tinker. Black and Veatch contract to assist Tulsa District feasibility study has been awarded. Black and Veatch will select 4 - 5 best alternatives and present these plans to the TWG.

b. Landfills 1 - 4: These landfills are located in the southwest corner of the Base. Preliminary data was presented. Landfills 1, 2, 3 and 4 are contiguous; therefore, they are considered as one site. Landfill 1 covers 2.5 acres and was operational between 1942 to 1945. Landfill 2 covers 25 acres and was operational between 1945 to 1952. Landfill 3 covers 9 acres and was operational between 1952 to 1961. Landfill 4 covers 12 acres and was operational between 1961 to 1968. An aerial photograph taken in 1970 was viewed. It shows

a good definition of the trench locations. Major Cornell asked if there was visual evidence that this was as far as this landfill went. Mr. Roberts, COE, answered, "yes". Two cross sections were shown. Landfills 2, 3 and 4 are underlain by shale. Landfill 1 is underlain with silty sandstone. There were several occurrences of groundwater at the site; the first being near the ground surface. An intermediate perched water table which intersects some of the landfill trenches and the top of the Garber-Wellington aquifer were also shown. Perched groundwater flow is towards Crutcho Creek. Regional groundwater flow is generally to the southwest. TOC contours were shown in the perched and regional groundwater. TCE and MEK contours were shown for the perched groundwater, and chromium was shown for both the perched and regional zones. Contamination is undefined to the west and south. TOC contamination in the top of the regional aquifer was very much lower than in the perched aquifer. Old sludge dump areas at landfills 2 and 3 show the highest concentrations for many of the plumes The sludge dump area in Landfill 3 contained 120,000 ppb of TCE in the perched water with one foot of fuel on the top of the water. One soil sample in this area had 3 million ppb TCE. Wells 5 and 42 had less than 100 ppm TCE in the regional groundwater. Preliminary conclusions are that the landfills have contaminated groundwater in and around the site. The extent of contamination has not been completely defined.

(1) Recommendations: It was recommended that the landfill surface be regraded and a cap be placed over it. Additional groundwater investigations in the areas of undefined plumes as well as additional sampling to determine the extent of the highly contaminated sludge dumps were recommended. TRC members concurred with these recommendations. Mark Coleman recommended removal of the free fuel product from Landfill 3 as an interim action. Mr. Coleman stated that the fuel can be disposed of as non-hazardous waste. Mr. Coleman also recommended that a system, such as a french drain, be considered to prevent groundwater from coming into contact with contaminated trench materials. TRC members also concurred with these recommendations. In response to Major Jorgensen's question concerning the method by which these sites should be handled considering the contaminants discovered at the site, Bob Hannesschlager, EPA, replied that the site should continue to be handled as an Expedited Response Action (ERA).

c. Fuel Farm: Comments have been received on the draft report for Expedited Response Action. Final report will be out soon. Results of fuel recovery from wells 24 and 26 are that 1,027 gallons of fuel and 88,000 gallons of groundwater have been removed from the site. Wells 4, 12, and 14 monitor the thickness of fuel and quality of groundwater beneath the fuel. There is not as much fuel as originally calculated. BTX concentrations are generally declining in all wells. The north well is no longer producing any measurable fuel and the south well is producing very little fuel In March or April, the POL facility will be completed. Wells will remain with the exception of well #4 and that well is questionable due to the fact it is in the way of construction. The Construction Office is looking to see if it s more economical to modify the construction or replace the well.

(1) Recommendations: Continue pumping fuel and groundwater another three months. Reevaluate the site and make recommendations to TWG and TRC. Additional measures that could speed up fuel recovery will be investigated. TRC members concurred with these recommendations.

d. Groundwater Assessment: Nine additional wells were recommended in the final Groundwater Assessment Report to be installed to better monitor the perched groundwater quality. Two additional wells were recommended for the

top of the regional aquifer. All but one of these 11 wells have been installed. Results of quarterly sampling will continue to be reported to the TRC.

e. Landfill 6: This landfill is located southeast of the Base. The recommendation to extend the clay cap to cover the remainder of Landfill 6 has been implemented. A construction contract was awarded 19 October 1987. Construction is underway. Design of a groundwater collection trench will be completed to prevent perched water from flowing through the landfill trenches. The issue of what to do with the groundwater that is already contaminated is still unresolved, pending the installation of additional monitoring wells to define the extent of groundwater contamination to the southwest. A right-of-entry permit for well installation is being prepared.

f. Landfill 5: Intermediate remedial action is to provide a clay cap over the landfill. The Navy project which includes a taxiway over a portion of this landfill is pending Congressional approval. The taxiway and clay cap are to be designed concurrently. This is temporarily on hold until further information concerning the Navy project is received.

g. FTA 2: The draft FTA 2 ERA report was distributed. The report recommends no additional investigations and a no-action plan. Mr. Roberts, COE, asked everyone to review the report as soon as possible so it can be finalized.

7. The meeting was adjourned at 1600 hours.

RAY D. REAVES, Col, USAF
Chairman, Technical Review Committee

MARK COLEMAN
State Representative, Technical Review Committee

ROBERT HANNESSCHLAGER
EPA Representative, Technical Review Committee

COE

Mr. Clif Warren

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR LOGISTICS CENTER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145

26 JAN 1988

REPLY TO
ATTN OF: EM

SUBJECT: Revised Technical Working Group (TWG) Meeting Minutes - 21 December 1987

TO: All Members

1. Location, Date and Time: Tinker AFB, Bldg 3333, 21 December 1987, 1000 hours.

2. Chairman: Maj Jeffrey M. Jorgensen, OC-ALC/EME

3. Attendees:

Maj Darrel Cornell	OC-ALC/EME
Maj Michael Cook	2854 CES/DEM
MSgt Robert Martin	2854 CES/DEMS
Mr. Fritz Nolting	OC-ALC/JAM
Mr. Joe Phillips	OC-ALC/DSM
Mr. Danny Arnold	OC-ALC/MAQV
Mr. Jim Payne	OC-ALC/MAQV
Mr. Bob Thomas	Oklahoma Water Resources Board
Ms. Suzette Turner	U.S. EPA, Region VI, Superfund Branch
Mr. Don Hensch	Oklahoma State Department of Health
Mr. Odell Morgan	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr. Zack Taylor	Association of Central Oklahoma Governments/ Garber-Wellington Association
Mr. John Roberts	Corps of Engineers, Tulsa District
Mr. Robert Ramsey	Corps of Engineers, Tulsa District
Mr. Clif Warren	Corps of Engineers, Tulsa District
Ms. Ramona Wagner	Corps of Engineers, Tulsa District
Ms. Carol McConnell	Corps of Engineers, Tulsa District
Mr. Don Cooley	Black and Veatch
Mr. Vernon Reid	Black and Veatch

4. The meeting began at 1000 hours. Mr. Roberts, COE, stated that this is a special TWG meeting called to discuss the report of Black and Veatch concerning the alternatives of remedial action for Bldg 3001.

5. Agenda Items - Black and Veatch

a. Introductions: Mr. Roberts, COE, introduced Mr. Cooley as the Project Engineer for the Black and Veatch contract. Mr. Reid, Project Manager, was also introduced to the group.

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b. Black and Veatch Organization: Mr. Cooley briefed the group on the Black and Veatch organization. This organization consists of 3,000 people divided into several different divisions. Within the Hazardous Waste Division, there are about 100 environmental engineers and environmental scientists. Copies of their proposed draft report were passed around the room and the history of the project was discussed.

c. Building 3001 Summary:

(1) History: In 1985, the Radian Corporation issued a report which was part of the Installation Restoration Program (IRP). Radian identified trichloroethylene (TCE) in two water wells in Bldg 3001, and recommended further studies be done. Later, the Corps of Engineers published their remedial investigation, reporting that solvents and metals were found beneath the building in addition to adjacent soils. They also found fuel in soil beneath both the north and south end of the building. Thirty-two different contaminants were identified in the soil and groundwater. The TCE plume affects 220 acres and is believed to originate from Bldg 3001. Since then, this site was added to the National Priority List. Fortunately, the pollution will not travel off base within the next 50 years unless it intercepts Soldier Creek before that period. In the Black and Veatch report, the site is referred as the Building 3001 site; however, their report refers not only to the building itself, but also the two fuel areas near the building. Another report, completed by P.E. La Moreaux (PELA report) reviewed potential technologies that might be used to treat the wastes. In Nov 87, Black and Veatch was engaged to do a Feasibility Study of the PELA alternatives. They were asked to identify and evaluate the alternatives in terms of treating and disposing of the groundwater. The PELA report was supposed to screen alternatives; it actually screened technologies. Black and Veatch has reviewed those technologies and is suggesting alternatives. Some of the alternatives have options within them. The Black and Veatch study is based upon a Corps of Engineers Statement of Work.

(2) Remedial Action Categories: The National Oil and Hazardous Substance Contingency Plan lists five categories of remedial action. They are:

(a) Alternatives that specify off-base storage, destruction, and treatment of disposed hazardous substances at a facility approved under RCRA. Such a facility must also comply with all other applicable EPA standards.

(b) Alternatives that attain all applicable or relevant federal public health or environmental standards, guidance, or advisories.

(c) Alternatives that exceed all applicable or relevant federal public health and environmental standards, guidance, or advisories.

(d) Alternatives that meet the CERCLA goals of preventing or minimizing present or future migration of hazardous substances and protecting human health and the environment, but do not attain the applicable or relevant standards.

(e) No action.

The National Contingency Plan has asked that all alternatives be considered.

(3) Alternative:

Based on this information B&V developed a logic chart to show what potential alternatives are available. Six alternatives were selected for development. They include:

(a) No action at site.

(b) Off-site treatment or disposal of collected groundwater.

(c) No treatment and industrial reuse of collected groundwater.

(d) Treatment of collected groundwater through modified existing industrial waste treatment plant (IWTP) and disposal or reuse of treated water.

(e) Treatment of collected groundwater through new treatment facility and industrial reuse or irrigation of treated water.

(f) Treatment of collected groundwater through new treatment facility and discharge of treated water.

Mr. Cooley concluded by asking for questions or comments.

(4) Comments & Questions.

(a) If it is decided to treat the groundwater on site, will it be done with the existing IWTP? If so, existing plant is loaded to capacity and would have to be modified. The necessary changes to the plant to increase hydraulic capacity must be identified. A method to pretreat the TCE (either air stripping or carbon absorption) must be added.

(b) Mr. Roberts stated that the selection of feasibility study alternatives is a very important decision point for the TWG. Advise if this is the right track or if TWG members would like to see something else. Don Hensch, OSDH, stated, "Those alternatives are the ones we would like to see. We would like to see some reuse following treatment, if economically feasible." Ms. Suzette Turner, Environmental Protection Agency, remarked, "Alternatives presented seem reasonable as long as contaminants are low enough that it will not cause another problem, but we need to look at the report further."

(c) Mr. Roberts stated, "The subject came up concerning the injection of treated water back into the aquifer." Mr. Hensch emphasized, "Mr. Coleman says no."

(d) Mr. Reid stated, "Water quality limits for on-base industrial reuse must be identified." Danny Arnold, Maintenance Division (MA), indicated he would provide assistance and support to arrive at these limits.

(e) Mr. Odell Morgan, an ACOG representative, suggested the alternative of off-site removal to an oil well for secondary recovery may be feasible. The water could be pipelined rather than hauled. Three miles from Tinker is an oil well project which may be able to accept that type of water.

Mr. Hensch, OSDH, stated that the water classifies as an industrial waste water, class 1; where oil wells are class 2 wells. Ms. Turner stated, "EPA would like to stay away from this all the way around."

(f) Tinker requested a short suspense (6 Jan 88) for comments on their draft report to be returned to the Corps. In addition, Tinker requested the regulatory agencies evaluate whether different permits would be needed if water is diverted to the IWTP. This water might be a hazardous waste. The EPA said they would check whether a different permit is needed.

6. The meeting was adjourned at 1050 hours.

JEFFREY M. JORGENSEN, Maj, USAF
Chairman

APPENDIX B

BUILDING 3001 FIRE DAMAGED AREA SUMMARY REPORT

INSTALLATION RESTORATION PROGRAM
TINKER AIR FORCE BASE, OKLAHOMA
BUILDING 3001 FIRE DAMAGED AREA INVESTIGATIONS

1. Introduction. During the period of May through August 1985, the Tulsa District Corps of Engineers conducted Installation Restoration Program (IRP) investigations within the fire-damaged portion of Building 3001. The purpose of the work was to investigate subsurface contamination within this area as reconstruction was in progress. The work consisted of the following tasks:

a. Investigating abandoned solvent pits including a geophysical survey and drilling and sampling program.

b. Groundwater investigations and monitoring well installations.

Plate 1 shows the project location. The principal findings of the investigation are discussed in paragraph 2 below, and the recommendations for further action are discussed in paragraph 3. The methods of investigations and complete findings are discussed in paragraphs 4 through 9.

2. Principal Findings. Only one abandoned solvent pit contained TCE pollution (located near column row E105), and two others contained high metal concentrations (near column rows V85 and LM107). The contents of these three pits were taken to a hazardous waste landfill.

The groundwater beneath the building occurs as an upper perched aquifer (encountered at approximately 20 feet deep, elevation 1256 feet) of variable thickness overlying the regional Garber/ Wellington Aquifer (encountered at approximately 75 feet deep, elevation 1201 feet). Groundwater within the perched zone appears to have a gradient towards the southeast as it migrates within the sandstone layers and is confined on the bottom by shales. TCE contamination levels ranged from 135 to 6170 ppb in this zone.

The regional aquifer appears to be confined and has a gradient towards the southwest. TCE concentrations were variable with one sample having a concentration as high as 28,000 ppb.

Monitoring well clusters were installed within the two groundwater aquifers to continue monitoring contamination levels. Each cluster consisted of three wells. The well locations were selected based on groundwater flow directions and contaminant concentrations.

3. Recommendations. Based on the findings within the fire damaged area, it is recommended that the IRP investigations be continued throughout the Building 3001 site. The work should include continued monitoring of existing groundwater wells, installation of additional monitoring wells, sampling of abandoned solvent pits within the remainder of the building, defining the groundwater quality and extent of contamination around the building, and conducting aquifer tests to define hydrogeologic parameters. The information gained from these

investigations should be used to evaluate the complex subsurface conditions and design remedial actions for the site.

4. Background Information. Trichloroethylene (TCE) and tetrachloroethylene were discovered in base water supply wells 18 and 19 during an Air Force monitoring program. Both wells, which are located within Building 3001, were taken out of service. Previous IRP work conducted at this site consisted of Phase I, Phase II - Stage 1, and Phase II - Stage 2 investigations. During the Phase II - Stage 1 investigations, Well 18 was pumped (for 16 hours) with samples periodically collected for analysis. TCE concentrations ranged from 4600 to 1800 ppb during the pumping period and tetrachloroethylene remained below detection limits. Monitoring wells were installed at seven locations around the building during Phase II - Stage 2 investigations. The wells were set in the upper regional aquifer zone. Water level elevations varied from 1194 to 1223 feet. The locations and water level elevations for the seven wells (well numbers 19A through 25A) are shown on plate 2. Water samples were collected and analyzed for the presence of organic solvents. TCE concentrations of 642 and 102 ppb were found in wells 19A and 20A, respectively. Other substances such as chlorobenzene and trans-1-2-Dichloroethene were detected in relatively high concentrations at some locations. Plate 3 summarizes the test results. Conclusions drawn from the previous IRP reports were as follows:

a. Abandoned pits and tanks beneath Building 3001 should be sampled and analyzed for the presence of chlorinated solvents.

b. The complete area of contamination is not defined.

c. Additional monitoring wells should be installed in the area to fill in the gaps concerning the extent of contamination.

d. Remedial actions should be initiated to remove industrial organics from the upper zones of the aquifer.

5. Corps of Engineers Involvement. Phase IV IRP investigations were initiated when an abandoned pit was discovered while excavating for an industrial waste line within the fire-damaged area of Building 3001 (Restoration Building 3001 Project). The Tulsa District then conducted IRP investigations while reconstruction of the fire damaged area was taking place. All field work occurred between May and August 1985.

6. Abandoned Pit Investigations. An investigation was initiated during May 1985 to determine the location and contents of any pits or trenches within the building that may be contamination sources. The investigation consisted of a records search, visual floor inspection, geophysical survey, drilling and sampling program, and laboratory testing program. As-built drawings and past engineering reports were reviewed, and some base personnel were interviewed during the records search. Also, pit locations were determined by visually examining the floor slabs. Areas identified as pits were marked for drilling and sampling.

a. Geophysical Survey. The geophysical survey was made within the building, using a subsurface penetrating radar system. The survey was conducted by Geophysical Survey Systems, Inc. (GSSI). The radar equipment used was a Subsurface Interface Radar (SIR) System consisting of a GSSI Model 4800 Control Unit, a Model SR-8004H Graphic Recorder, and Model 3102 Transducer. The control unit and graphic recorder were mounted in a vehicle and the transducer, connected by a cable, was hand-towed over the concrete floor in parallel east-west lines at 15-feet spacings. A total of 17,345 linear feet of radar data was acquired in the 3-day survey. Based on reflective features observed on the recorder, 82 possible pits were identified.

b. Drilling and Sampling. Areas identified as potential pits were cored into using a 4-inch diameter concrete coring machine. Samples of pit contents were collected with either push tubes or drive samplers. The samples were placed in containers, packed in ice, and shipped to laboratories for testing. Care was taken to prevent cross-contamination by cleaning the sampling equipment after each location. Sixty-four pits were located within the fire damaged portion of the building. All of the pits contained sand backfill except one (in the area of V85), which contained a small amount of fluid. The pits that were located and investigated are shown on plate 4. Soil samples were taken from beneath the building at some locations adjacent to pits and in areas of required excavations for the reconstruction project. These samples were analyzed for the same parameters as pit contents. Eight locations (borings E105, R85, A87, K107, W83, W88, D99, and PQ78) were sampled and the locations are shown on plate 4.

c. Laboratory Testing. Samples of pit contents were tested for the following parameters:

- total organic carbon
- volatile organics
- acid etractable organics
- base/neutral extractable organics
- reactivity
- ignitability
- corrosivity
- arsenic
- barium
- cadium
- chromium
- lead
- mercury
- selenium
- silver

Both EP toxicity and total extraction tests were performed on the metals. As results began to come back from the laboratories, the testing program was pared down to the following parameters:

total organic carbon	chromium
volatile organics	lead
arsenic	mercury
barium	selenium
cadmium	silver

with both EP toxicity and total extraction tests on the metals.

Out of the 64 pits investigated, only one contained a high concentration of organic solvents. This pit was located near column-row E105 and contained 120,000 ppb of TCE. A soil sample taken approximately 5 feet away from the pit also contained TCE. Two other pits (near column rows V85 and LM107) showed high concentrations of metals. The contents of all three pits were taken to a hazardous waste landfill. Table 1 gives a summary of pit contents, sample depths, and laboratory test results. The table lists all compounds and metals detected and their concentrations. Laboratory results from the soil sampling are included in Table 2. The table includes a description of the soil and the depth where sampled.

7. Subsurface Investigations. Twelve borings were made within the building to investigate the stratigraphy and groundwater (see plate 4 for boring locations). A Failing 1500 drill rig was used, and the holes were advanced with either auger or rock bits. The investigation methods typically consisted of the following steps:

a. Drill the holes approximately 15 feet below the first groundwater occurrence (35 feet).

b. Bail the holes, allow recharge, measure groundwater levels, and collect groundwater samples.

c. Then, advance the holes to approximately 100 feet and set casing to effectively seal off the upper groundwater zone.

d. Bail the holes, allow recharge, measure groundwater levels, and collect a groundwater sample from this lower zone.

e. Record the hole with gamma and electrical resistivity logs. Plug the hole from bottom to top with bentonite-cement grout.

Groundwater samples were shipped to laboratories for testing. Geologic logs were prepared based on examination of drill cuttings and gamma and electrical resistivity. The logs are included as Attachment 1. Typical cross sections, which illustrate the subsurface conditions, are shown on plates 5 and 6.

As a result of the investigations, an upper perched water zone was identified above the regional aquifer. The perched zone is located within sandstone zones overlying a shale. The static water level of this zone is at approximately 20 feet deep. The gradient generally slopes to the southeast, reflecting the surface topography. Groundwater contours are shown on plate 7.

TABLE 1 PIT SAMPLE RESULTS

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
L91	5-10-85	Sand	3.6-4.6	
J107	5-10-85	Sand	0.6-5.9	.0017 Bis (2-ethylhexyl) phthalate, .0031 Diethyl phthalate, .027 Trichloroethene, .047 Methylene chloride, .0026 Toluene, 53 Barium (EP Tox),.20 Selenium (EP Tox), .002 Benzene,.012 Methyl ethyl ketone.
K107	5-10-85	Sand	1.6-2.2	.646 Methylene chloride, .608 1,1-Dichloroethane, .157 1,1-Dichlororthane, .095 trans-1,2-Dichloroethane, 2.27 Tetrachloroethene, 305.5 1,1,1-Trichloroethane, .48 Trichloroethene, 1.21 Aceton
K107	5-10-85	Sand	0.5-7.4	.73 Barium (EP Tox) .0027 Mercury (EP Tox) .30 Selenium (EP Tox), .06 Cadmium (EP Tox), .046 Methylene chloride, .386 Tetrachloroethene, .031 Trichloroethene, .0037 trans-1,2-Dichloroethene, .007 Acetone, .0015 para-Dichlorobenzene, .0042 meta-Dichlorobenzene, .0015 Diethyl phthalate, .0011 N-Nitrosodiphenylamine

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
G107	5-10-85	Sand	0.7-2.5	.55 Barium (EP Tox), .12 Selenium (EP Tox), .073 Methylene Chloride, .109 Tetrachloroethene, .049 Trichloroethene, .020 Acetone, .033 Methylethyl Ketone, .013 meta-Dichlorobenzene,.014 Di-n-butylphthalate
BC107	5-13-85	Gravel	0.5-0.7	.80 Ba (EP Tox) .15 Cd (EP Tox), .40 Pb (EP Tox), .38 Se (EP Tox), .0055 Methylene Chloride, .0016 Tetrachloroethene, .035 Trichloroethene, .0086 Methyl ethyl Ketone, .0021 Toluene
FG105	5-13-85	Sand	0.5-4.0	115 Ba, .90 Ba (EP Tox) .01 Cd (EP Tox), .02 Cr (EP Tox), .034 Methylene Chloride, .016 1,2 1,2-Dichloroethane, .016 trans-1,2-Dichloroethene, .143 Trichloroethene, .0088 Toluene, .0013 Ethyl benzene, .0035 meta-Xylene and Chlorobenzene, .0011 para-Dichlorobenzene.
LM 107	5-13-85	Sand	0.5-5.6	93 Ba, 61 Cd, 27 Cr, 33 Cu, 106 Pb, .057 Methylene Chloride, .0034 trans-1,2 Dichloroethene, .314 Tetrachloroethene, .037 Trichloroethene, .006 Methyl ethyl ketone, .0013 Bis (2-ethylhexyl)phthalate, .0017 Toluene

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
NO 107	5-13-85	Sand	0.5-5.6	93 Ba, 61 cd, 27 Cr, 33 Cu, 106, Pb, .057 Methylene chloride, .0034 trans 1,2-Dichloroethene, .314 Tetrachloroethene, .037 Trichloroethene, .006 Methyl ethyl Ketone, .0013 Bis (2-ethylhexyl)phthalate, .0017 Toluene
NO 107	5-13-85	Sand	0.5-2.1	47 Ba, .0075 Tetrachloroethene, .021 Acetone.
JK 105	5-13-85	Sand	0.4-2.2	61Ba, .015 Acetone, .0044 Benzene
AB87-1	5-14-85	Sand	6.0-7.0	.022 Methylene chloride, .006 1,4-Dichlorobenzene, .300 trans-1,2-Dichloroethene, .053 Tetrachloroethene, .572 Trichloroethene, .011 Acetone, .023 Benzene, .512 meta Xylene and Chlorobenzene
AB87-3	5-14-85	Sand	5.0-7.7	.032 Methyl ethyl Ketone, .0019 Bis(2-ethylhexyl) phthalate
R85	5-15-85	Sand	0.6-4.1	77 Ba, 3 Cd, 16 Cr, .100 Methylene Chloride, .032 Tetrachloroethene, .016 1,1,1-Trichloroethane, .475 Trichloroethene, .002 Benzene

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
LM85	5-15-85	Sand	0.7-4.1	107 Ba, 9 Cr, 11 Pb, 85 Zn, .025 Methylene Chloride, .155 1,4 Dichlorobenzene, .068 Tetrachloroethene, .008 Trichloroethene, .024 Acetone.
J88	5-15-85	Sand	0.5-3.3	64 Ba, 5 Cr, 2 Cu, 50 Zn, 037 Methylene Chloride, .015 Trichloroethene, .023 Acetone.
F88	5-15-85	Sand	0.6-4.5	72 Ba, 4 Cr, 3 Cu, 25 Zn, .041 Methylene Chloride, .003 1,1,2-Trichloroethane, .008 Trichloroethene, .019 Acetone
DE86	5-15-85	Sand	0.5-2.6	48 Ba, 1, Cr, 3 Ni, 11 Zn, .117 Methylene Chloride, .091 1,4-Dichlorobenzene, .133 Carbon tetrachloride, .122 1,1-Dichloroethane, .092 1,2-Dichloroethane, .102 trans-1,2-Dichloroethene, .122 1,2-Dichloropropane, .107 Tetrachloroethene, .088 1,1,1-Trichloroethane, .119 1,1,2-Trichloroethane, .130 Trichloroethene, .128 Trichlorofluoromethane, .100 Chloroform, .115 Bromodichloromethane, .119 Chlorodibromomethane, .027 Acetone.

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
T90	5-15-85	Sand	0.6-4.3	77 Ba, 7 Cr, 4 Cu, 141 Zn, .099 Methylene chloride, .031 Trichloroethene, .015 Benzene
T87	5-15-85	Sand	0.5-1.0	80 Ba, 4 Cr, 3 Cu, 5 Ni, 26 Zn, .041 Methylene Chloride, .013 Trichloroethene
E85	5-15-85	Sand	0.5-7.4	51 Ba, 5 Cr, 3 Cu, 5 Ni, 29 Zn
D83	5-16-85	Sand	0.5-3.0	.., 1 Cd, 1 Cu, 2 Cr, 12 Zn
Q85	5-16-85	Sand	0.5-1.0	90 Ba, 1 Cd, 7 Cr, 2 Cu, 6 Ni, 29 Zn, .083 Methylene Chloride, .026 Trichloroethene, .021 Benzene
Q82	5-16-85	Gravel	0.5-7.4	59 Ba, 1 Cd, 20 Cr, 8 Cu, 217 Ni, 32 Zn, .0018 Benzene, .031 Methyl ethyl Ketone
No 109	5-16-85	Sand	0.5-3.5	231 Ba, 2 Cr, 2 Cu, 3 Ni, 21 Zn, .040 Methylene Chloride, .001 1,1,1-Trichloroethane, .010 Trichloroethane, .011 Acetone, .018 Methyl ethyl icetone.
N110	5-16-85	Sand	0.5-4.2	111 Ba, 4 Cr, 2 Cu, 4 Ni, 29 Zn, .059 Methylene Chloride, .024 Trichloroethene, .002 Benzene
L109	5-16-85	Sand	7.5-8.5	165 Ba, 4 Cr, 18 Pb, 5Ni, 52 Zn, .018 Methylene Chloride, .005 Trichloroethene, .003 Benzene, .016 Acetone

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
H110	5-16-85	Sand	0.9-4.9	45 Ba, 2 Cr, 2 Ni, 19 Zn, .002 Benzene
J95	5-16-85	Sand	0.4-0.8	91 Ba, 8 Cr, 5 Cu, 12 Ni, 29 Zn, .101 Methylene Chloride, .279 Trichloroethene
L108	5-17-85	Sand	0.5-4.8	540 Ba, 10 Pb, .125 Acetone
L107	5-17-85	Sand	0.5-1.3	82 Ba, 5 Cr, 23 Zn
V85	5-17-85	Gravel	0.5-3.2	50 As, 71 Ba, 5 Cd, 25,6000 Cr, 44 Cu, 152,000 Pb, .18 Hg, 11 Ni, 27 Zn, 59.8 Pb (EP Tox), .093 Methylene Chloride, .219 Trichloroethene
T81	5-17-85	Sand	0.5-9.8	66 Ba, 3 Cr, 3 Ni, 18 Zn
U82	5-20-85	Gravel	0.5-2.0	291 Ba, 2 Cd, 62 Cr, 9 Cu, 265 Pb, 204 Zn, .004 Methylene Chloride, .001 1,1 Dichloroethane, .155 Tetrachloroethene, .003 1,1,1 Trichloroethane, .038 Trichloroethene
R89	5-20-85	Sand	0.5-3.9	59 Ba, 1 Cd, 8 Cr, 4 Cu, 27 Ni, 28 Zn, .073 Methylene Chloride, .168 Tetrachloroethene, .210 Trichloroethene
P91	5-20-85	Sand	0.5-4.9	19 Ba, 2 Cd, 5 Cr, 5 Ni, 15 Zn, .003 Methylene Chloride, .002 Tetrachloroethene, .130 Trichloroethene

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
P92	5-20-85	Sand	0.5-2.2	204 Ba, 3 Cr, 20 Zn
J100	5-20-85	Sand	0.5-1.2	36 Ba, 3 Cr
G101	5-20-85	Sand	0.3-1.3	
H101	5-20-85	Sand	0.3-1.6	59 Ba, 3 Cr, 26 Zn, .001 Toluene
K101	5-20-85	Sand	0.7-6.3	64 Ba, 82 Cd, 4 Cr, 12 Zn
A98	5-21-85	Sand	7.0-9.8	58 Ba, 1 Cd, 4 Cr, 16 Zn, .002 Benzene
A92	5-21-85	Sand	0.5-4.2	35 Ba, 2 Cr, 12 Pb, 20 Zn, .0053 Benzene, .0032 Toluene
B94	5-21-85	Sand	0.5-3.2	38 Ba, 3 Cr
A93	5-21-85	Sand	0.5-4.2	
A95	5-21-85	Sand	0.5-4.1	
K111	5-22-85	Sand	0.7-1.8	
L111	5-22-85	Sand	0.8-2.9	
N111	5-22-85	Sand	0.8-3.0	
M111	5-22-85	Sand	0.8-3.0	.006 Methylene Chloride
G108	5-22-85	Sand	0.5-7.3	

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
F107	5-23-85	Sand	0.5-6.6	491 Ba, 3 Cd, 16 Cr, 6 Cu, 20 Pb, .07Hg, 14 Ni, 31 Zn, .015 Methylene Chloride, .046 trans-1,2-Dichloroethane, .173 Tetrachloroethene, .226 Trichloroethene
D105	5-23-86	Limestone chips	0.5-2.0	24 Ba, 4 Cr, 4 Cu, 2 Ni, 18 Zn, .002 1,4-Dichlorobenzene, .005 Tetrachloroethene, .012 Trichloroethene
P88	5-23-85	Gravel	0.7-6.2	29 Ba, 2 Cd, 8 Cr, 3 Cu, 12 Ni, 21 Zn, .045 Methylene Chloride, .104 Tetrachloroethene, .092 Trichloroethene
R88	5-23-85	Limestone Chips	0.5-1.7	
U85	5-23-85	Limestone Chips	0.5-1.6	31 Ba, 2 Cd, 69 Cr, 4 Cu, 20 Ni, 20 Zn, .002 Methylene Chloride, .010 Tetrachloroethene, .002 Benzene

TABLE 1 PIT SAMPLE RESULTS (CONT)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds and Metals (ppm)
K107	5-28-85	Clay	4.0-7.5	101 Ba, 38 Cd, 206 Cr, 706 Cu, 65 Pb, .19 Pb, 183 Ni, 26 Se, 10 Zn, .023 1,2-Dichlorobenzene, .005 1,4-Dichlorobenzene, .042 Bis(2-ethylhexyl) phthalate, .004 Phenol, .274 Toluene, 6.09 paraDichlorobenzene, 2.35 meta-Dichlorobenzene, 15.3 ortho-Dichlorobenzene, .646 Methylene chloride, .608 1,1-Dichloroethane, .157 1,2-Dichloroethane, .095 trans 1,2-Dichloroethene, 2.27 Tetrachloroethene, 3.06 1,1,1-Trichloroethane, .480 Trichloroethene

TABLE 2
SOIL SAMPLE RESULTS

Boring No.	Date Sampled	Soil Type	Sample Depth(ft)	Summary of Compounds and Metals (ppm)	Remarks
W-83	19 May 85	Clay	5-6	0.76 Ba (EP Tox), 0.47 Cr (EP Tox) 0.0052 1,1,1-Trichloroethane, 0.00015 Trichloroethene	Required Excavation
		Shale	14-15	1.06 Ba (EP Tox), 5.62 Cr (EP Tox), 0.0077 Methylene Chloride, .0021 1,1 Dichloroethane, .0092 Trans-1,2-dichloroethene, 4.21 Tetrachloroethene, .0015 1,1,1-Trichloroethane, 1.92 1,1,2-Trichloroethane, 10.57 Trichloroethene, .102 Trichlorofl~~orom~~ethane, .0057 Chloroform	
		Shale	15-16	.15 Ba (EP Tox), 5.89 Cr (EP Tox), .0034 Hg (EP Tox), .18 Se (EP Tox), .0075 Methylene chloride, .0023 Tetrachloroethene, .0037 1,1,1-Trichloroethane, .033 Trichloroethene	
W-88	20 May 85	Clay	10-20	.0011 Trichloroethene, .0073 Methyl ethyl Ketone, .041 Acetone	Required Excavation
A87	28 May 85	Clay	9-10	.022 Methylene chloride, .007 1,4-Dichlorobenzene,.300 trans -1,2-Dichloroethene, .053 Tetrachloroethene, .572 Trichloroethene	Required Excavation
K107	24 July 85	Clay	1.0-5.0	.27 Ba (EP Tox), .02 Methylene chloride, .0036 1,4-Dichlorobenzene, .0045 Trans 1,2-Dichloroethene, .027 Trichloroethene, .313 Acetone, .049 Methyl ethyl Ketone, .0043 Benzene, .002 Chlorobenzen and meta-Sylene, .0065 para-Dichlorobenzene, .0024 meta-Dichlorobenzene, .0024 ortho-Dichlorobenzene	Adjacent to Pit

TABLE 2
SOIL SAMPLE RESULTS

Boring No.	Date Sampled	Soil Type	Sample Depth(ft)	Summary of Compounds and Metals (ppm)	Remarks
K107	24 July 85	Clay	7.0-7.5	.25 Ba (EP Tox), .0089 Methylene Chloride, .0046 Trichloroethene, .0022 Benzene, .0046 pi-n-butylphthalate, .0052 Bis(2-ethylhexyl)-phthalate	
R85	24 May 85	Clay	9.0-10.0	1138 Ba, 7Cd, 153Cr, 29 Cu, 14 Pb, 35 Ni, 66 Zn, 5.0 Cr (EP Tox), .005 Methylene Chloride, .015 Tetrachloroethene, .003 Trichloroethene	Suspected Pit location
D99	24 Jun 85	Clay	14-15	1.2 Ba (EP Tox), .0026 Hg (EP Tox), .0049 1,1,1-Trichloroethane, .0035 Trichloroethene	Suspected Pit location
PQ78	10 May 85	Sand	9-10		Required Excavation
E105	8 Jun 85	Clay	5.0-6.0	120 Trichloroethene, 2.11 Methylene Chloride, 1.08 Carbon tetrachloride, 73.5 Benzene, 0.96 2-Chloroethylvinyl Ether, 45.4 1,1,2,2-Tetrachloroethane, 45.1 Toluene, ~~D.73~~ 0.73 Chlorobenzene, 33.6 Ethylbenzene, 6.80 Cd (EP Tox)	Adjacent to Pit

The top of the regional aquifer was found at approximately 75 feet deep. The gradient slopes to the southwest, generally following the dip of the formations. Groundwater contours for this region are plotted on plate 8 (these contours include information from wells 19A through 25A, installed during Phase II - Stage 2 investigations.

8. Groundwater Quality. Groundwater samples were tested for purgeable organics. Concentrations of TCE ranged from 135 to 6170 ppb in the upper water zone. TCE concentrations were more sporadic in the lower zone with an exceptionally high concentration of 28,000 ppb near column row E105, where the pit containing 120,000 ppb was located. A summary of the laboratory results is shown in Table 3.

9. Monitoring Well Clusters. Four monitoring well clusters, well numbers 31A,B,C through 34A,B,C, were installed within the building (see plate 4 for well locations). Boreholes for wells were advanced with 9.5 inch rockbits, using water for circulation. No drilling mud was used. The holes were recorded with gamma and electrical resistivity logs. Geologic logs were prepared based on examination of drill cuttings and gamma and electrical resistivity logs. The geologic logs are included in Appendix C of the Remedial Investigations Report. Each cluster consisted of three wells--one located in the upper perched aquifer, one in the top of the regional aquifer, and one approximately 75 feet into the regional aquifer. The wells are constructed of 4-inch diameter stainless steel casings and screens. As-built well logs are included in Appendix D of the Remedial Investigations Report. Ground-Samples from the monitoring wells will be collected and analyzed for groundwater quality during the Corps of Engineers' IRP Remedial Investigations.

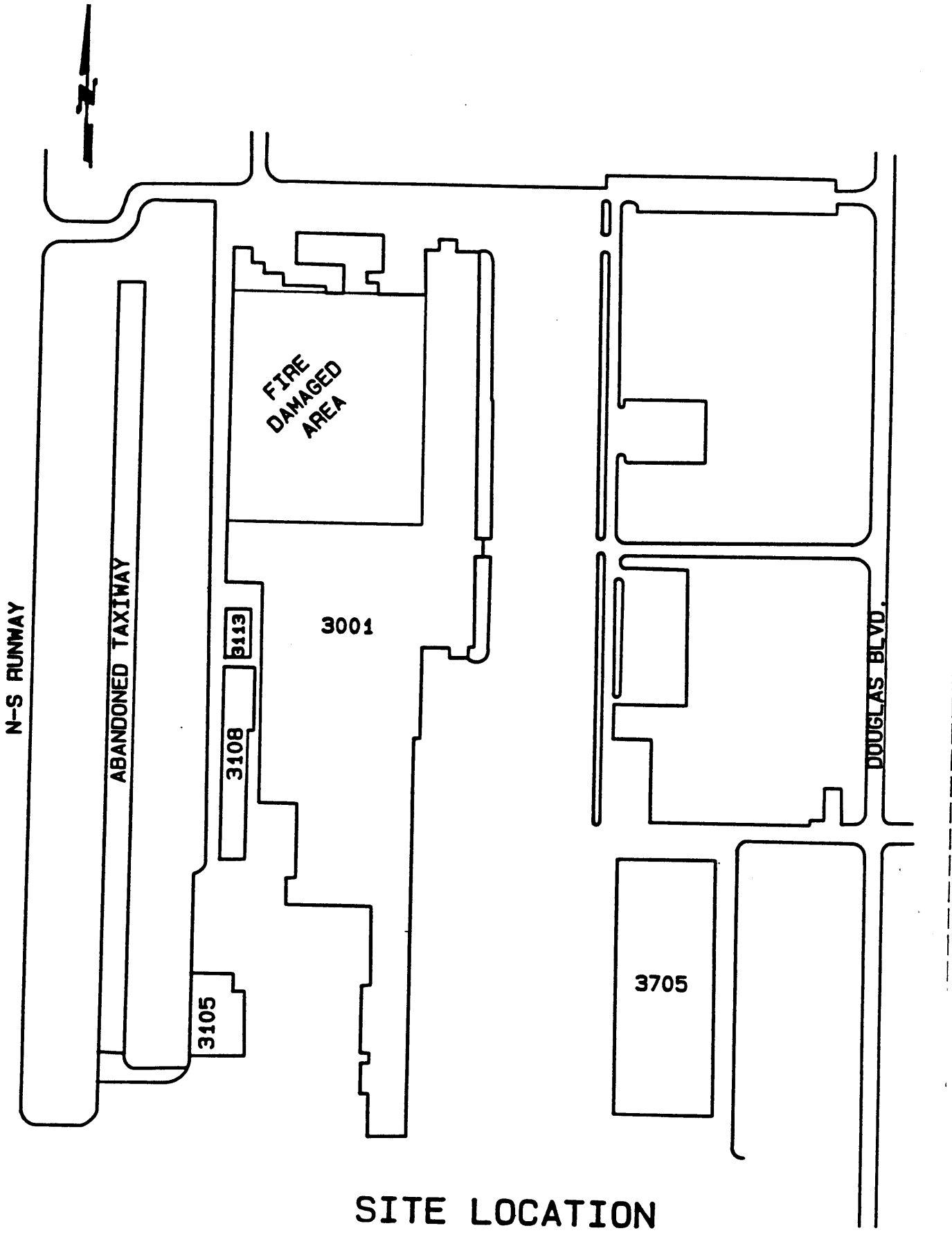
TABLE 3
GROUNDWATER TESTING SUMMARY (ppb)

Boring No	Aquifer Zone	Tri-Chloroethylene	Tetra Chloroethylene	Methylene Chloride	1,2-Di-Chloroethane	Benzene	Chloroform
D91	upper	716	ND	3.2	1.6	0.8	21
	lower	915	5.1	1.3	1.9	0.7	30
D99	upper	2000(1)	2.5(1)	12	63	338	19
	lower	-	-	1.5	85	656	25
E105	upper	820	240	400	1510	10	10
	lower	28000	ND	85	-	13	44
F83	upper	1607	-	-	-	-	-
	lower	297	-	-	-	-	-
N99	upper	921	9	1.3	1.9	0.7	2.6
	lower	7	11	1.3	1.9	0.7	1.2
O-105	upper	362	2.1	3.6	1.9	0.7	3.6
	lower	33	2.4	2.7	1.9	0.9	1.6
P91	upper	3100	ND	<10	<10	<10	<10
	lower	1800	ND	<10	83	<10	<10
Q83	upper	121	-	-	-	-	-
	lower	12	-	-	-	-	-
X83	upper	135	ND	80	340	ND	70
	lower	1830	ND	30	120	ND	12
X91	upper	882	ND	46	ND	10	7
	lower	1800	ND	3.4	3.2	0.8	1.1
X99	upper	278	11.2	6.9	1.7	0.8	2.5
	lower	3.3	13.1	6.3	1.7	0.8	1.0

TABLE 3 (CONT)
GROUNDWATER TESTING SUMMARY (ppb)

Boring No	Aquifer Zone	Tri-Chloroethylene	Tetra Chloroethylene	Methylene Chloride	1,2-Di-Chloroethane	Benzene	Chloroform
X105	upper	6710(1)	ND	ND	ND	ND	ND
	lower	ND	ND	ND	ND	ND	ND

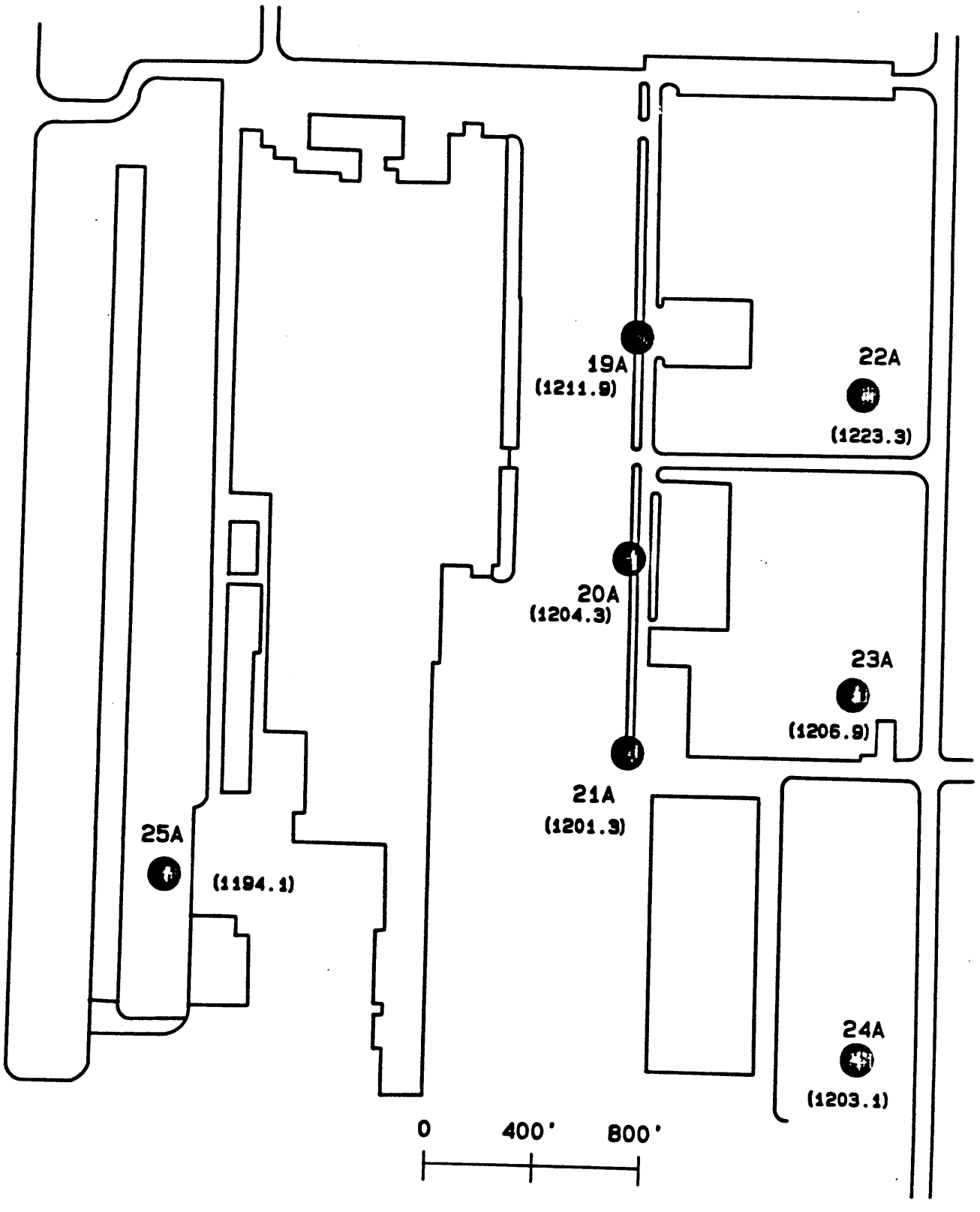
(1) Mixed water sample between upper and lower zones
(2) Also had 21,400 ppb 1,1-Dichloroethylene
ND - Non detected



SITE LOCATION

0 400' 800'

PLATE 1



MONITOR WELLS (INSTALLED BY RADIAN CORP.)
(1211.9) GROUND WATER ELEVATION

PHASE II-STAGE 2 IRP MONITORING WELLS

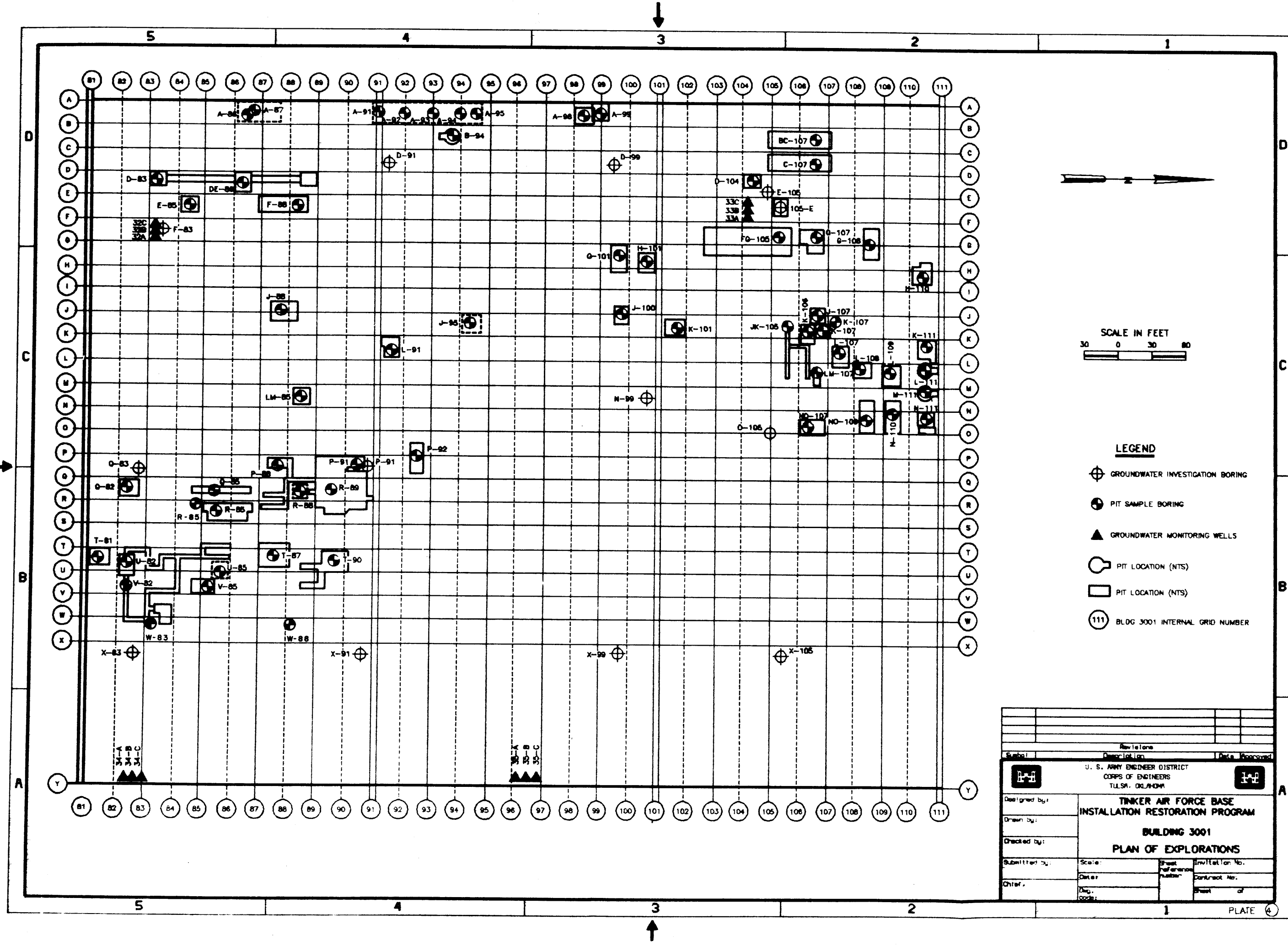
PLATE 2

Installation Restoration Program Phase II - Stage 2
Building 3001 Groundwater Sampling Results

Parameter (ppb)	19A		20A		21A		22A		23A		24A		25A	
	7/17	8/1	7/18	8/1	7/18	7/31	7/30	8/14	7/30	8/14	7/30	8/14	7/16	8/1
Chloroethene													1.1	0.6
Methylene Chloride		1.4	0.9				2.0						1.9	0.6
Trichlorofluoromethane	1.2		2.7		3.9	0.4	1.8	22.0			0.5		7.6	1.7
1,1-Dichloroethene	1.7	0.8						2.0						
1,1-Dichloroethane	1.4	1.3	1.4		0.3	0.2	1.7	1.8						
trans-1,2-Dichloroethene	18.1		33.2											
Chloroform		9.9		19.6	0.7	1.6		0.8					4.6	3.8
1,2-Dichloroethane	2.6	2.0				0.3							4.9	
1,1,1-Trichloroethane	4.2	2.5	0.2											
1,2-Dichloropropane	0.3	0.2												
Trichloroethylene	642.0	444.0	102.0	52.8	4.9	3.1	0.6	0.5			0.1		1.3	0.9
1,1,2,2,-Trichloroethane		2.7												
Tetrachloroethylene	4.7	1.7	0.7	0.2										
Chlorobenzene		1.3					20.5	21.8						
1,2-Dichlorobenzene		1.1					8.4	11.0						
bis(2-ethylhexyl)phthalate (EPA 625)							13						12	
di-n-octyl phthalate (EPA 625)					44								12	
benzene (EPA 624)													47	39
chlorobenzene (EPA 624)							21	30						
trans-1,2-dichloroethene (EPA 624)	48												21	
methylene chloride (EPA 624)														
toluene (EPA 624)									61				670	1886

(NOTE: Testing performed by Radian Corporation in 1984. EPA Method 621 was used unless otherwise noted).

PLATE 3



SCALE IN FEET
30 0 30 60
LEGEND
GROUNDWATER INVESTIGATION BORING
PIT SAMPLE BORING
GROUNDWATER MONITORING WELLS
PIT LOCATION (NTS)
PIT LOCATION (NTS)
111 BLDG 3001 INTERNAL GRID NUMBER
Revisions
Symbol
Description
Date
Approved
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA
Designed by:
Drawn by:
Checked by:
Submitted by:
Chief,
TINKER AIR FORCE BASE
INSTALLATION RESTORATION PROGRAM
BUILDING 3001
PLAN OF EXPLORATIONS
Scale:
Date:
Dwg. code:
Sheet reference number
Invitation No.
Contract No.
Sheet of
PLATE 4

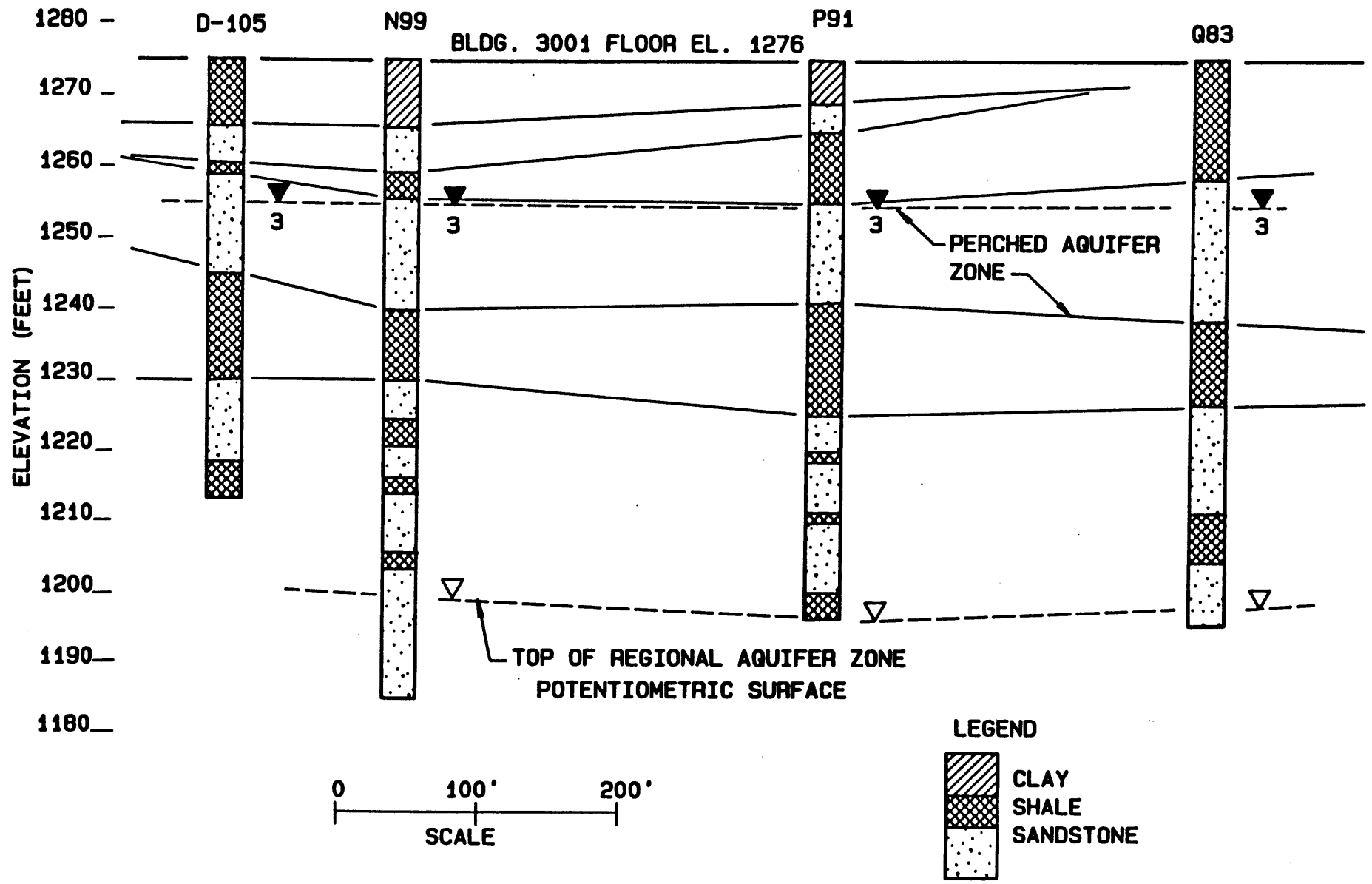

1280
1270
1260
1250
1240
1230
1220
1210
1200
1190
1180
ELEVATION (FEET)
D-105
N99
P91
Q83
BLDG. 3001 FLOOR EL. 1276
3
PERCHED AQUIFER ZONE
TOP OF REGIONAL AQUIFER ZONE
POTENTIOMETRIC SURFACE
0
100'
200'
SCALE
LEGEND
CLAY
SHALE
SANDSTONE

PLATE 5

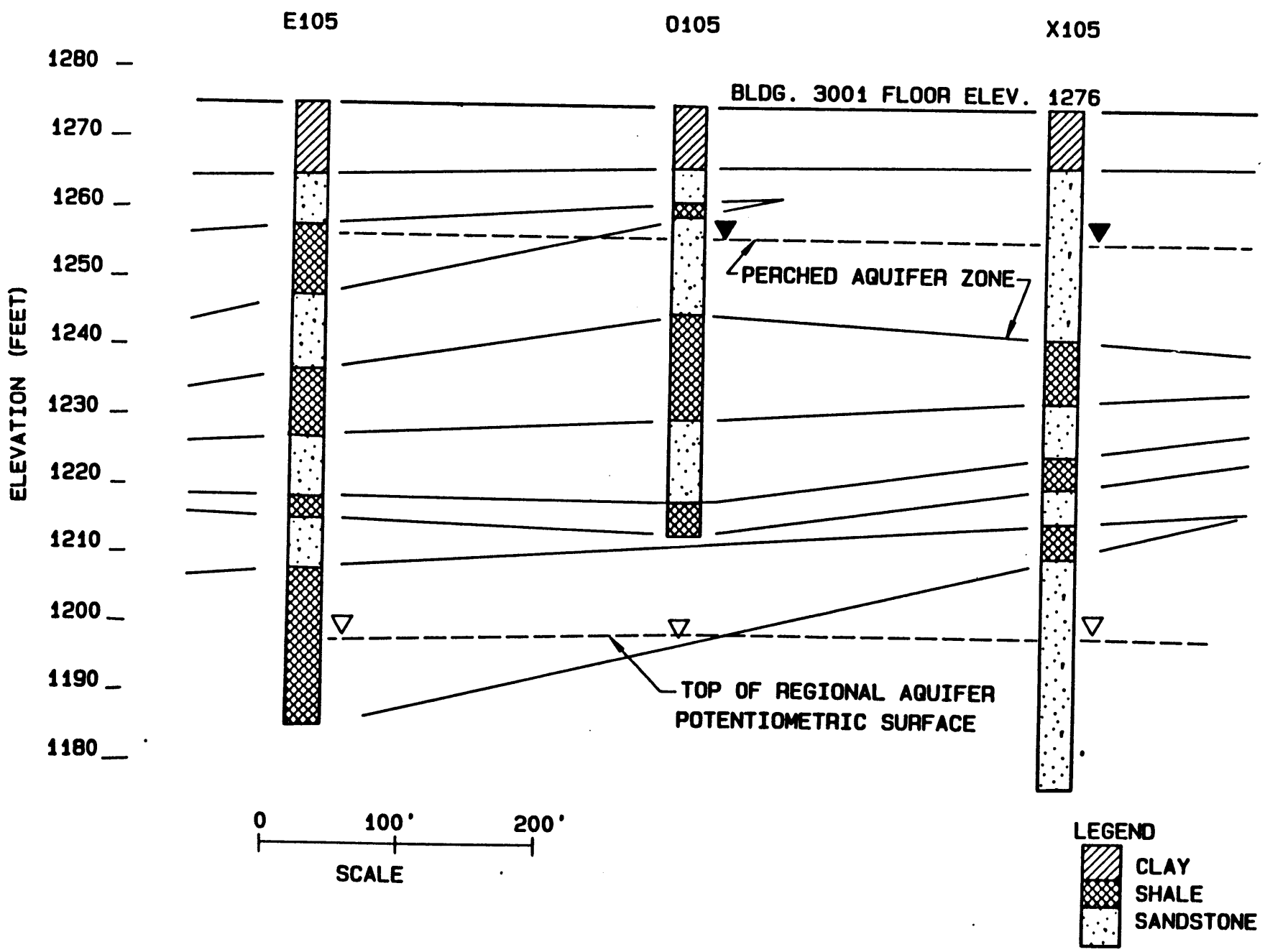
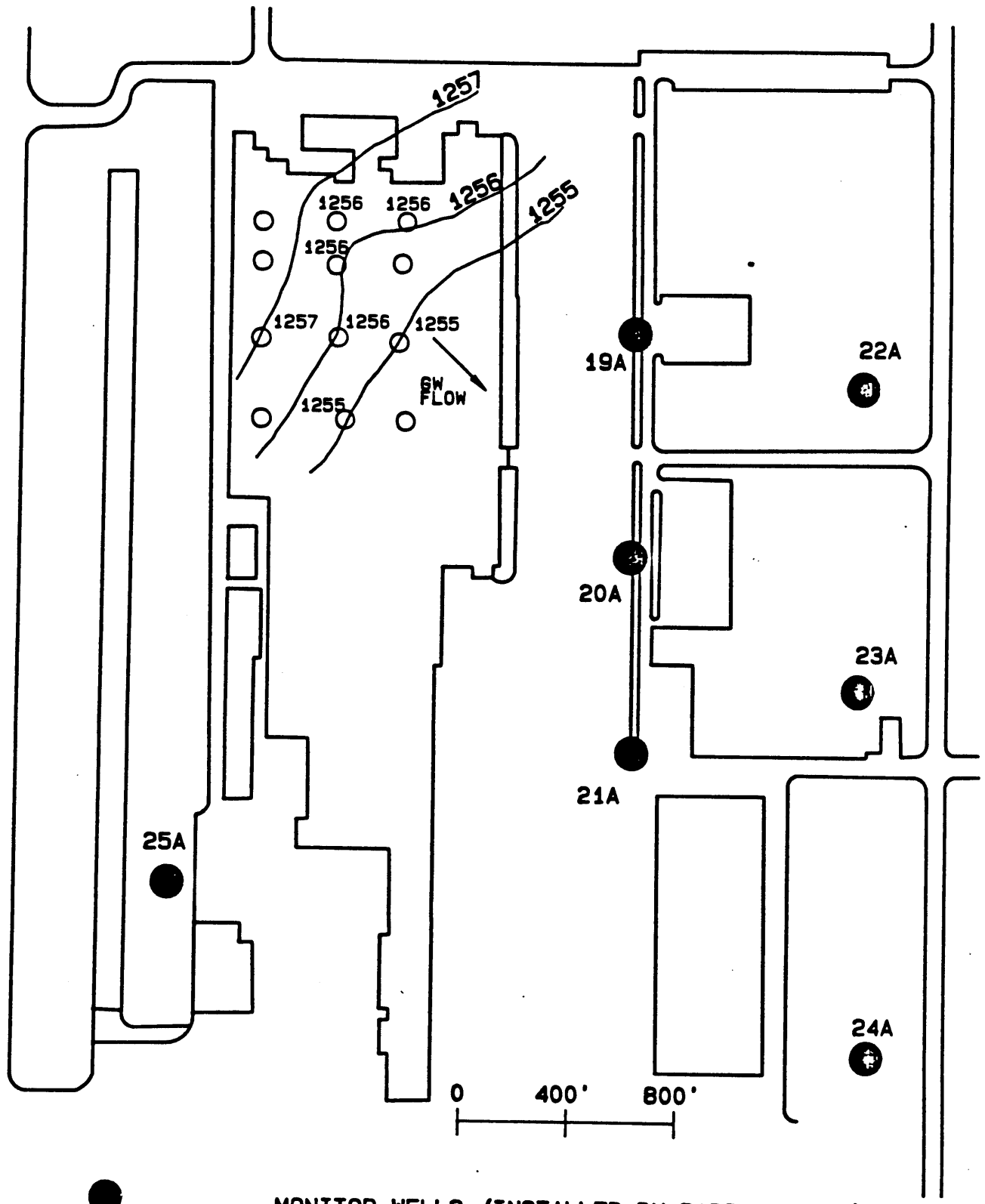

E105
0105
X105
1280
1270
1260
1250
1240
1230
1220
1210
1200
1190
1180
ELEVATION (FEET)
BLDG. 3001 FLOOR ELEV. 1276
PERCHED AQUIFER ZONE
TOP OF REGIONAL AQUIFER
POTENTIOMETRIC SURFACE
0
100'
200'
SCALE
LEGEND
CLAY
SHALE
SANDSTONE

PLATE 6



● MONITOR WELLS (INSTALLED BY RADIAN CORP.)

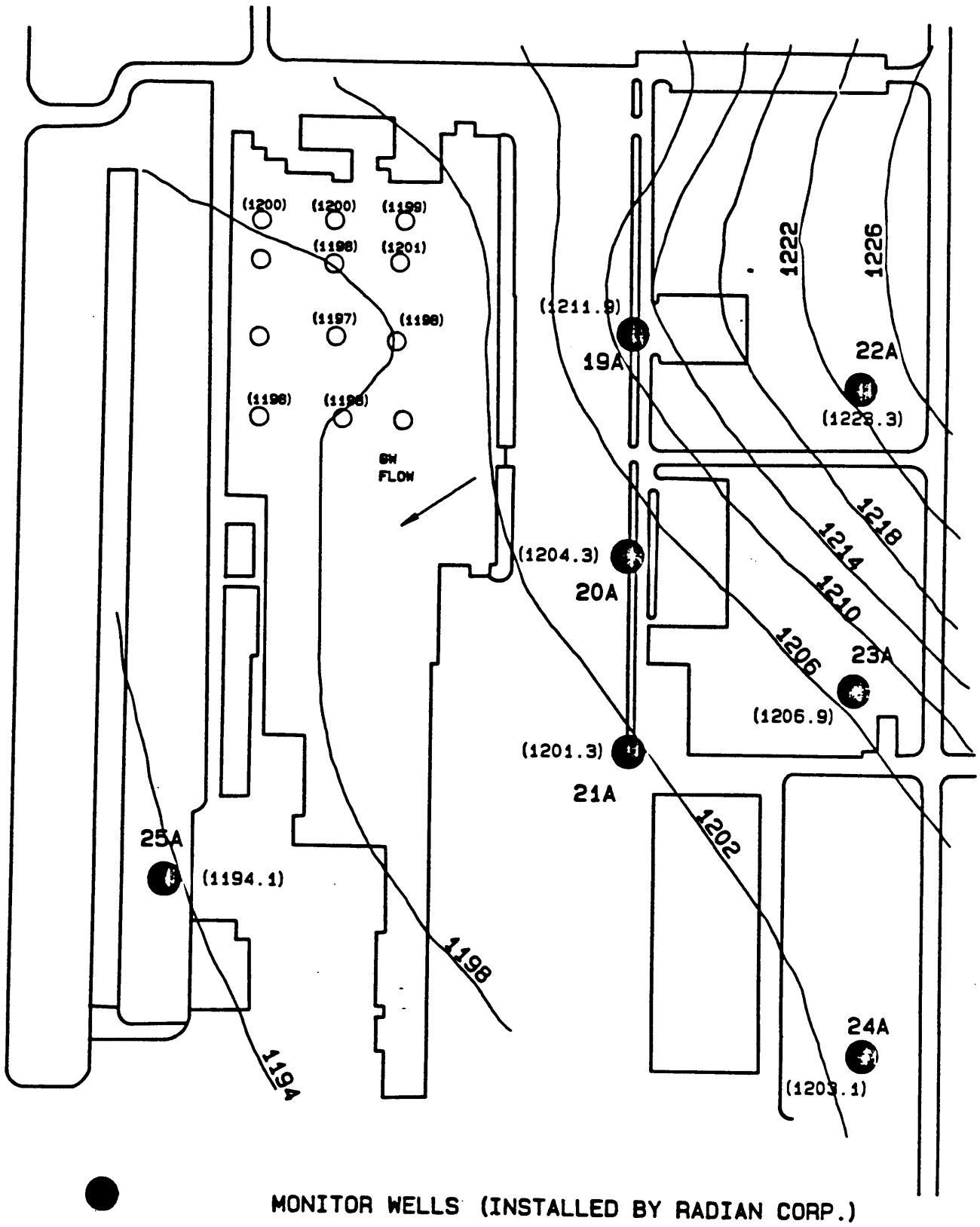
(1211.9) GROUND WATER ELEVATION

○ BORING LOCATION

GROUNDWATER CONTOUR

PERCHED AQUIFER ZONE GROUNDWATER CONTOURS

PLATE 7



TOP OF REGIONAL AQUIFER POTENTIOMETRIC CONTOURS

PLATE 8

ATTACHMENT 1

GEOLOGIC LOGS

Hole No. 0-105

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TULSA DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT	TINKER AFB Bldg 3001
2. LOCATION (Coordinates or Station)	2' West and 1' South of 0-105
3. DRILLING AGENCY	Tulsa District
4. HOLE NO (As shown on drawing title and file number)	0-105
5. NAME OF DRILLER	RAINS
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	---
8. DEPTH DRILLED INTO ROCK	98.0
9. TOTAL DEPTH OF HOLE	98.0
10. SIZE AND TYPE OF BIT	5¼" Rock Bit
11. DATUM FOR ELEVATION SHOWN (MSL or MLL)	Floor level Elev. 1276
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED --- UNDISTURBED ---
14. TOTAL NUMBER CORE BOXES	---
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED 10 July 1985 COMPLETED 11 July 1985
17. ELEVATION TOP OF HOLE	1276
18. TOTAL CORE RECOVERY FOR BORING	--- %
19. SIGNATURE OF INSPECTOR	GILBERT

DEPTH RECOVERY a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.5			0.0-05 CONCRETE			5¼" Rock bit 0.5-38'
9.0			0.0-9.0 SHALE, soft, red brown.			Bailed Hole W.L. Time 26.3' 1016 24.0 1017 23.2 1018 22.5 1019 22.0 1020 21.5 1021 21.2 1022 21.1 1023 20.7 1025 20.4 1027 20.2 1030 20.0 1035 19.8 1040 19.7 1045 19.7 1050 19.6 1132
14.0	10		9.0-14.0 SANDSTONE, soft, red brown.			
16.0			14.0-16.0 SHALE,			
30.0	20		16.0-30.0 SANDSTONE, soft, red brown.			
45.0	30 40		30.0-45.0 SHALE, soft, red brown			COLLECT TOP WATER SAMPLE Set 40' of casing 3¼" Fish tail To 98.0'.
57.0	50		45.0-57.0 SANDSTONE, soft, red brown.			Bailed Hole W.L. Time 78.3 1505 78.0 1506 77.8 1507 77.6 1508 77.5 1509 77.2 1512 77.1 1515 76.8 1520 76.6 1525 76.5 1530 76.5 1535
62.0	60		57.0-62.0 SHALE, soft, red brown.			
	70 80 90		62.0-98.0 Caved. Not Gamma logged.			COLLECT BOTTOM WATER SAMPLE
98.0			WATER SAMPLES COLLECTED Top water sample @ 19.6, no casing. Bottom water sample @ 76.5, 38' casing. Rock described from Gamma Log.			
			Bottom of Hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT Tinker AFB Bldg 3001 HOLE NO. 0-105

DRILLING LOG | DIVISION: SOUTHWEST | INSTALLATION: TULSA DISTRICT | SHEET 1 OF 1 SHEETS

1. PROJECT	TINKER AFB - BLDG 3001
2. LOCATION (Coordinates or Station)	12' W. and 9.5' S. of E105
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	E105
5. NAME OF DRILLER	NOAH RAINS
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	10.0
8. DEPTH DRILLED INTO ROCK	80.0
9. TOTAL DEPTH OF HOLE	90.0
10. SIZE AND TYPE OF BIT	5½" Rock Bit
11. DATUM FOR ELEVATION SHOWN (MSL or USC&GS)	FLOOR LEVEL Elevation 1276
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED - UNDISTURBED -
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	-
16. DATE HOLE	STARTED 19 Jun 85 COMPLETED 19 Jun 85
17. ELEVATION TOP OF HOLE	-
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	EUGENE GILBERT

DEPTH (a)	(b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
0.5			0.0-0.5 CONCRETE			5½" Rock Bit 0.0-25.0' Bailed hole Took top of water sample 4" fishtail bit to 29.0' Set 30' of casing. Water still entering hole. Drilled and reset casing to 39'. Fishtail to 63' Bailed hole - making no water. Fishtail to 90'. Bailed Hole W.L. Time 76.0 0700 79.3 0741 78.3 0742 78.0 0743 77.5 0745 77.3 0750 77.3 0802
			0.5-10.0 CLAY (CL)			
10.0	10					
			10.0-17.5 SANDSTONE soft, red brown.			
17.5						
			17.5-27.5 SHALE soft, red brown.			
27.5						
	30		27.5-38.0 SANDSTONE soft, red brown.			
38.0						
	40		38.0-48.0 SHALE soft, red brown.			
48.0						
	50		48.0-57.0 SANDSTONE soft, red brown.			
57.0						
60.0			57.0-60.0 SHALE			
	60		60.0-67.0 SANDSTONE soft, red brown.			
67.0						
	70		67.0-90.0 SHALE soft, red brown.			
	80		WATER SAMPLES COLLECTED Top sample 18.4, BOH @ 24', no casing. Bottom Sample 76.0, BOH @ 90', 39' casing.			
90	90		BOTTOM OF HOLE Rock Description from Gamma Log			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: TINKER AFB - BLDG 3001 | HOLE NO: E-105

Hole No. X-105

DRILLING LOG | DIVISION: SOUTHWEST | INSTALLATION: TULSA DISTRICT | SHEET 1 OF 1 SHEETS

1. PROJECT: TINKER AFB Bldg 3001
2. LOCATION (Coordinates or Station): 7' East and 12' North of X-105
3. DRILLING AGENCY: Tulsa District
4. HOLE NO. (As shown on drawing title and file number): X-105
5. NAME OF DRILLER: RAINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 8.0
8. DEPTH DRILLED INTO ROCK: 90.0
9. TOTAL DEPTH OF HOLE: 98.0
10. SIZE AND TYPE OF BIT: 5½" Rock bit.
11. DATUM FOR ELEVATION SHOWN (GS or MSL): Floor Level Elev. 1276
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ---; UNDISTURBED ---
14. TOTAL NUMBER CORE BOXES: ---
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 8 July 85; COMPLETED 9 July 85
17. ELEVATION TOP OF HOLE: 1276
18. TOTAL CORE RECOVERY FOR BORING: --- %
19. SIGNATURE OF INSPECTOR: GILBERT

ELEVATION Depth a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.5			0.0-05 CONCRETE			5½" Rock bit 0.0-38'
			0.5-8.0 CLAY (CL)			
8.0						Bail Test
	10		8.0-33.0 SANDSTONE, Mod Soft, red brown.			W.L. / Time: 28.1 1408; 22.0 1409; 21.3 1410; 20.9 1412; 20.5 1413; 20.4 1414; 20.3 1416; 20.0 1420; 20.0 1425; 20.0 1430
	20					Collect top sample @ 20'. Set 40' casing 3¾" rock bit to 98'.
	30					
33.0			33.0-42.0 SHALE soft, red brown.			Bail Test
	40					W.L. / Time: 81.3 0832; 80.9 0834; 80.5 0835; 80.5 0836; 80.3 0837; 80.2 0838; 79.8 0840; 79.2 0845; 78.8 0850; 78.3 0855; 78.1 0900; 77.8 0905; 77.5 0910; 77.4 0915; 77.1 0920; 77.0 0925; 76.9 0930; 76.8 0935; 76.7 0940; 76.7 0945; 76.7 0950
42.0			42.0-50.0 SANDSTONE, soft, red brown.			
50.0	50		50.0-55.0 SHALE, soft, red brown.			Collect Bottom Water Sample.
55.0			55.0-60.0 SANDSTONE, soft, red brown.			
60.0	60		60.0-65.0 SHALE, soft, red brown.			
65.0			65.0-98.0 SANDSTONE, soft red brown, with shaly zones.			
	70					
	80					
	90		WATER SAMPLES COLLECTED Top water @ 20.0', BOH @ 38' - No Casing. Bottom water @ 76.7, BOH @ 98' - 80' casing. Rock descriptions from Gamma Log.			
98.0			Bottom of Hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: Tinker AFB Bldg. 3001 | HOLE NO.: X-105

DRILLING LOG

DIVISION: SOUTHWESTERN

INSTALLATION: Tulsa District

SHEET 1 OF 1 SHEETS

1. PROJECT: Tinker Air Force Base
2. LOCATION (Coordinates or Station): 4.5' north and 5' west of D91
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO (As shown on drawing title and file number): D91
5. NAME OF DRILLER: Rains
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 7.0
8. DEPTH DRILLED INTO ROCK: 91.0
9. TOTAL DEPTH OF HOLE: 98.0
10. SIGNATURE OF INSPECTOR: GILBERT
11. DATUM FOR ELEVATION SHOWN (MSL or MLW): Floor Bldg. 3001
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: See below
16. DATE HOLE: STARTED 2 July 85; COMPLETED 2 July 85
17. ELEVATION TOP OF HOLE: 1276
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIZE AND TYPE OF BIT: 5½" Rock Bit

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	7.0		CONCRETE 0.5-7.0, CLAY- Soft, red brown.			5½" Rockbit 0.0-38.0'
	10.0		7.0-18.0, SANDSTONE- soft, red brown			W.L. / Time 25.3 / 9:53 22.5 / 9:54 20.8 / 9:56 20.4 / 9:58 20.0 / 10:00 19.8 / 10:02 19.7 / 10:07 19.5 / 10:10 19.5 / 10:14 19.5 / 10:30
	18.0					
	21.0		18.0-21.0, SHALE- Sandy soft, red brown			
	32.0					4" Fishtail - 98' Set 40' of casing Bailed hole, could not bail below 30'. Reset casing to 50'
			32.0-35.0, SHALE- Sandy soft, red brown			
	41.0		35.0-41.0, SANDSTONE- mod hard, red brown			Bailed hole easily lowered to 78.9'.
			41.0-60.0, SHALE- soft red brown, sandy 51-56			Hole caved in at 82'.
	50.0					W.L. / Time 78.9 / 16:38 78.9 / 16:50
	60.0					OVERNIGHT LEVEL 79.0 / 07:00 2 July 85
			60.0-71.0, SANDSTONE- soft-mod. hard, red brown			
	70.0					Water Samples
			71.0-77.0, SHALE- soft red brown			Top-19.5'-BOH at 38' w/no casing.
	77.0					Bottom-79.0-BOH at 98' with 50' casing.
	80.0		Hole caved below 77'. Not logged.			All rock described from interpretation of Gamma log.
	90.0					
	98.0		BOTTOM OF HOLE			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: Tinker 3001 Bldg.

HOLE NO: D-91

Hole No. F-83

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TULSA DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT: TINKER AFB - BLDG 3001		10. SIZE AND TYPE OF BIT: 5½" Rock Bit	
2. LOCATION (Coordinates or Station): 6' E. and 9' No. of F-83		11. DATUM FOR ELEVATION SHOWN (GS or MSL): FLOOR ELEVATION 1276	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO (As shown on drawing title and file number): F-83		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED – ; UNDISTURBED –	
5. NAME OF DRILLER: NOAH RAINS		14. TOTAL NUMBER CORE BOXES: –	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: –	
7. THICKNESS OF OVERBURDEN: 5.0		16. DATE HOLE: STARTED 11 July 85; COMPLETED 12 July 85	
8. DEPTH DRILLED INTO ROCK: 93.0		17. ELEVATION TOP OF HOLE: 1276	
9. TOTAL DEPTH OF HOLE: 98.0		18. TOTAL CORE RECOVERY FOR BORING: – %	
		19. SIGNATURE OF INSPECTOR: EUGENE GILBERT	

DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
0.5		0.0-0.5 CONCRETE			5½" Rock Bit to 38.0'
5.0		0.5-5.0 SANDY CLAY			BAIL TEST
20.0		5.0-20.0 SHALE - soft, red brown			W.L. - Time 23.2 - 12:10 22.3 - 12:11 20.8 - 12:12 20.6 - 12:13 20.3 - 12:14 20.2 - 12:15 19.9 - 12:20 19.8 - 12:25 19.7 - 12:30 19.7 - 12:35
31.0		20.0-31.0 SANDSTONE - soft, red brown.			TOP SAMPLE COLLECTED
35.0		31.0-35.0 SHALE - soft, red brown.			Set 40' of 4" Casing w 1.2 S.U. 3½" fishtail bit to 98'
38.0		35.0-38.0 SANDSTONE			BAILED HOLE
45.0		38.0-45.0 SHALE, soft, red brown.			Casing not sealing out upper water. Casing pulled and lowered to 48'.
50.0					BAILED HOLE
52.0		50.0-52.0 SHALE			W.L. Time 80.9 - 10:32 80.7 - 10:33 80.6 - 10:35 80.3 - 10:40 80.2 - 10:45 80.1 - 10:50 80.0 - 10:55 79.9 - 11:30 79.9 - 11:35 Bottom of Sample Collected.
54.0		52.0-54.0 SANDSTONE			
56.0		54.0-56.0 SHALE			
59.0		56.0-59.0 SANDSTONE			
61.0		59.0-61.0 SHALE			
71.0		61.0-71.0 SANDSTONE soft, red brown.			
74.0		71.0-74.0 SHALE			
80.0		74.0-80.0 SANDSTONE soft, red brown			Rock described from Gamma Log.
82.0		80.0-82.0 SHALE			
84.0		82.0-84.0 SANDSTONE			
98.0		84.0-98.0 NOT LOGGED			
		BOTTOM OF HOLE			

Hole No. Q-83

DRILLING LOG	DIVISION: SOUTHWESTERN	INSTALLATION: TULSA DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT: TINKER AFB - Bldg. 3001	10. SIZE AND TYPE OF BIT: 5½" Rock Bit
2. LOCATION (Coordinates or Station): 12 West and 9' South of Q-83.	11. DATUM FOR ELEVATION SHOWN (MSL or USC&GS): Floor level 1276
3. DRILLING AGENCY: Tulsa District	12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
4. HOLE NO. (As shown on drawing title and file number): Q-83	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED --- UNDISTURBED ---
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES: ---
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: See Below
	16. DATE HOLE: STARTED 11 July 85 COMPLETED 11 July 85
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE: 1276
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING: --- %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR: GILBERT

ELEVATION / DEPTH (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
0.6			0.0-0.6 CONCRETE			5½" ROCK BIT TO 38'.
	10		0.6-17.0 CLAY-SHALE soft, red-brown.			BAIL TEST W.L. Time 22.7 1319 22.0 1320 21.4 1322 21.2 1324 20.9 1329 20.8 1331 20.8 1339
17.0	20		17.0-37.0 - SANDSTONE, soft, red brown.			COLLECT SAMPLE @ 20.8'.
	30					SET 40' of casing with 1.2 stick up.
37.0	40		37.0-48.0 - SHALE, soft, red brown.			3¼" Fishtail to 98'.
48.0	50		48.0-64.0 SANDSTONE, soft, red brown.			BAILED HOLE W.L. Time 78.8 0720 78.6 0721 78.4 0722 78.3 0723 77.9 0724 77.7 0729 77.6 0734 77.5 0739 77.4 0744 77.4 0749 76.9 0754 76.7 0759 76.7 0804
	60		WATER LOSS @ 60.0'			
64.0	70		64.0-72.0 SHALE soft, red brown.			
72.0	80		72.0-80.0 SANDSTONE, soft, red brown.			
80.0	90		Not logged below 80.0'. Caved.			
			WATER SAMPLES COLLECTED			
			Top sample @ 20.8' BOH @ 38' No casing.			
			Bottom sample @ 79.9' BOH @ 98' 38' casing.			
98.0			Rock Identified from Gamma Log.			
			Bottom of Hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: Tinker AFB Bldg 3001 HOLE NO. Q-83

Hole No. X-83

DRILLING LOG | DIVISION: SOUTHWEST | INSTALLATION: TULSA DISTRICT | SHEET 1 OF 1 SHEETS

1. PROJECT: Tinker AFB Bldg. 3001
2. LOCATION (Coordinates or Station): 6.5' South and 8.0' East of X-83.
3. DRILLING AGENCY: Tulsa District
4. HOLE NO. (As shown on drawing title and file number): X-83
5. NAME OF DRILLER: RAINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: ---
8. DEPTH DRILLED INTO ROCK: 98.0
9. TOTAL DEPTH OF HOLE: 98.0
10. SIZE AND TYPE OF BIT: 5½" Rock Bit
11. DATUM FOR ELEVATION SHOWN (MSL or MLL): Floor Level 1276
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ---; UNDISTURBED ---
14. TOTAL NUMBER CORE BOXES: ---
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 26 June 85; COMPLETED 26 June 85
17. ELEVATION TOP OF HOLE: 1276
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: GILBERT

DEPTH (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
0.5			10.0-0.5 CONCRETE			5½" Rockbit 0.5-39.0.
	10		0.5-15.0 SHALE soft, red brown			Bailed Hole
15.0						Top Water Sample June 26
	20		15.0-32.0 - SANDSTONE, soft, red brown.			W.L. / Time: 26.7 1255; 23.1 1256; 21.9 1259; 21.5 1300; 21.3 1302; 21.1 1305; 20.9 1310; 20.8 1316; 20.7 1320; 20.7 1330
32.0						Set 4" Casing to 39'. Fishtail to 98'.
	30		32.0-42.0 SHALE soft, red brown.			Bailed Hole BOTTOM SAMPLE
42.0	40					W.L. / TIME: 77.4 16.26; 77.5 1640; 77.4 1648; 77.3 1700
	50		42.0-62.0 SANDSTONE, soft, red brown.			OVER NIGHT 27 June 85 77.6 @ 0700
62.0	60					
69.0			62.0-69.0 SHALE, soft, red brown.			
71.0	70		69.0-71.0 SANDSTONE			
74.0			71.0-74.0 SHALE			
	80		74.0-84.0 SANDSTONE, soft, red brown.			
84.0						
	90		CAVED BELOW 84'			
			WATER SAMPLES COLLECTED			
			Top Sample 20.7, BOH @ 39.0' No Casing. Bottom Sample 77.6, BOH @ 98.0' 39' Casing.			
98.0			Description of Rock from Gamma Log.			
	100		Bottom of Hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: TINKER AFB BLDG 3001 | HOLE NO.: X-83

Hole No. X-91

DRILLING LOG	DIVISION: SOUTHWESTERN	INSTALLATION: TULSA DISTRICT	SHEET: OF SHEETS

1. PROJECT: TINKER AFB BLDG 3001
2. LOCATION (Coordinates or Station): 7.5 S and 55 E of X-91.
3. DRILLING AGENCY: TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number): X-91
5. NAME OF DRILLER: RAINS
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 5.0
8. DEPTH DRILLED INTO ROCK: 93.0
9. TOTAL DEPTH OF HOLE: 98.0
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (MSL or USC&GS): Floor Level El. 1276
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ---; UNDISTURBED ---
14. TOTAL NUMBER CORE BOXES: ---
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 21 June 85; COMPLETED 24 June 85
17. ELEVATION TOP OF HOLE: 1276
18. TOTAL CORE RECOVERY FOR BORING: --- %
19. SIGNATURE OF INSPECTOR: GILBERT

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.5			0.0-0.5 CONCRETE			5½" Rock bit 0.0-39.0' No casing. Took top water sample after bailing to 24.7' and water had recovered to 20.6'.
5.0			0.5-5.0 CLAY (Cl)			
	10		5.0-16.0 SHALE, soft, red brown.			
16.0						W.L. - Time 23.4 - 1618 21.4 - 1620 21.0 - 1623 20.8 - 1625 20.6 - 1630 20.6 - 1635
	20		16.0-35.0 SANDSTONE, soft, red brown.			
	30					Installed 39' of casing. 3½" Fish tail to 98.0'. Bottom water bailed to 81.7'. Recovered to 77.6'.
35.0						W. L. - Time 78.6 - 1327 78.2 - 1328 78.3 - 1329 77.4 - 1330 77.6 - 1350 77.5 - 1400 77.4 - 1405 77.4 - 1430
	40		35.0-42.0 SHALE, soft, red brown.			
42.0						
	50		42.0-56.0 SANDSTONE, soft, red brown.			Collect bottom water sample 24 June 85.
56.0						
	60		56.0-62.0 SHALE, soft, red brown.			
62.0						
	70		62.0-70.0 SANDSONE, soft, red brown.			
70.0						
	80		70.0-80.0 SANDSTONE AND SHALE interbeds.			
80.0						
			80.0-95.0 SANDSTONE, soft, red brown.			WATER SAMPLE COLLECTED Top sample WL 20.6 w no casing. Bottom sample WL 77.6 w 39' casing.
94.0						
98.0			95.0-98.0 Not Gamma logged.			
			Bottom of Hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: TINKER AFB BLDG. 3001 HOLE NO. X-91

Hole No. P-91

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TULSA DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT: Tinker AFB Bldg 3001		10. SIZE AND TYPE OF BIT: 5¼" Rock bit.	
2. LOCATION (Coordinates or Station): 10.5 East and 5' South of P-91		11. DATUM FOR ELEVATION SHOWN (GS or MSL): Floor Level El. 1276	
3. DRILLING AGENCY: Tulsa District		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): P-91		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED --- UNDISTURBED ---	
5. NAME OF DRILLER: RAINS		14. TOTAL NUMBER CORE BOXES: ---	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: See Below	
		16. DATE HOLE: STARTED --- COMPLETED ---	
7. THICKNESS OF OVERBURDEN: 6.0		17. ELEVATION TOP OF HOLE: 1276	
8. DEPTH DRILLED INTO ROCK: 92.0		18. TOTAL CORE RECOVERY FOR BORING: --- %	
9. TOTAL DEPTH OF HOLE: 98.0		19. SIGNATURE OF INSPECTOR: GILBERT	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.5			0.0-0.5 CONCRETE			5¼" Rock bit 0.0-39'
6.0			0.5-6.0 CLAY			
10.0	10		6.0-10.0 SANDSTONE, soft, red brown.			Bailed Hole W.L. - Time 26.2 - 1236 22.4 - 1240 22.3 - 1242 21.7 - 1245 21.3 - 1250 20.2 - 1255 20.2 - 1300
20.0	20		10.0-20.0 SHALE, soft, red brown.			
34.0	30		20.0-34.0 SANDSTONE, soft, red brown.			Installed 4" casing to 39' 3" Fishtail to 98'.
50.0	40		34.0-50.0 SHALE, soft, red brown.			Bailed Hole W.L. - Time 79.3 - 1550 79.1 - 1555 79.0 - 1600 78.8 - 1605 78.8 - 1625 78.8 - 1630
55.0	50		50.0-55.0 SANDSTONE, soft, red brown.			OVERNIGHT READING W.L. - Time 78.3 - 0700
57.0			55.0-57.0 SHALE			
63.0	60		57.0-63.0 SANDSTONE, soft, red brown.			
65.0			63.0-65.0 SHALE			
75.0	70		65.0-75.0 SANDSTONE, soft, red brown.			
78.0			75.0-78.0 SHALE			
98.0	80 90		78.0-98.0 CAVED Not Logged.			WATER SAMPLES COLLECTED Top water sample @ 20.2', BOH @ 39' No casing. Bottom water sample @ 78.8', BOH @ 98' 39' casing.
			Bottom of Hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: TINKER AFB BLDG. 3001 HOLE NO. P-91

Hole No. X-99

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TULSA DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT: TINKER AFB
2. LOCATION (Coordinates or Station): 17.5' N and 6.5' E of X-99
3. DRILLING AGENCY: TULSA DISTRICT
4. HOLE NO (As shown on drawing title and file number): X-99
5. NAME OF DRILLER: RAINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: -
8. DEPTH DRILLED INTO ROCK: 98.0
9. TOTAL DEPTH OF HOLE: 98.0
10. SIZE AND TYPE OF BIT: 5½ inch rock bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Floor level El. 1256
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED -; UNDISTURBED -
14. TOTAL NUMBER CORE BOXES: -
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 25 Jun 85; COMPLETED 25 Jun 85
17. ELEVATION TOP OF HOLE: 1256
18. TOTAL CORE RECOVERY FOR BORING: - %
19. SIGNATURE OF INSPECTOR: GILBERT

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.5			0.0-0.5 CONCRETE			5½" Rock bit to 38.4'
	10		0.5-16.5 SHALE, soft, red brown.			Bailed Hole W.L. Time 23.1 1029 21.7 1030 20.7 1035 20.5 1040 20.4 1052 20.4 1100
16.5			16.5-35.0 SANDSTONE, soft, red brown.			Water sampled.
	20					Set casing to 38.4' Depth.
	30					3½" Fishtail to 98'
35.0			35.0 - 44.0 SHALE, soft red brown			Bailed Hole WL Time 85.3 1545 84.5 1546 84.2 1547 83.6 1550 82.2 1555 81.1 1600 79.6 1608 78.5 1615 78.1 1619 77.4 1624 76.5 1636 76.0 1645 75.5 1655 75.3 1700 75.0 1708 75.0 1715
44.0	40					
52.5	50		44.0-52.0 SANDSTONE, soft red brown.			
54.0			52.0-54.0 SHALE			
59.0			54.0-59.0 SANDSTONE soft, red brown.			
67.0	60		59.0-67.0 SHALE, soft, red brown			
79.0	70		67.0-79.0 SANDSTONE soft, red brown w shale zones 70.0'72.0			Sampled Bottom water at 75.0 Overnight WL 74.7 0700 26 Jun 85.
98.0	80		79.0-BOH SHALE, soft, red brown, sandy.			Rock descriptions from Gamma 109.

WATER SAMPLES COLLECTED

Top sample at 20.4, BOH at 39' w no casing.
Bottom sample at 75.0, BOH at 98' w 38' casing.

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)

PROJECT: Tinker AFB Bldg 3001 HOLE NO: X-99

DRILLING LOG

DIVISION: SOUTHWEST
INSTALLATION: TULSA DISTRICT
SHEET 1 OF 1 SHEETS

1. PROJECT: TINKER AFB BLDG 3001
2. LOCATION (Coordinates or Station): 12'N and 6' W of D-99.
3. DRILLING AGENCY: Tulsa District
4. HOLE NO (As shown on drawing title and file number): D-99
5. NAME OF DRILLER: RAINS
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 8.0
8. DEPTH DRILLED INTO ROCK: 67.0
9. TOTAL DEPTH OF HOLE: 75.0
10. SIZE AND TYPE OF BIT: 4" AUGER - 3¼ Fishtail
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Floor of Bldg
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ---; UNDISTURBED ---
14. TOTAL NUMBER CORE BOXES: ---
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 29 May 85; COMPLETED 29 May 85
17. ELEVATION TOP OF HOLE: 1276 ±
18. TOTAL CORE RECOVERY FOR BORING: --- %
19. SIGNATURE OF INSPECTOR:

Elevation / Depth (a)	Depth (b)	Legend (c)	Classification of Materials (Description) (d)	% Core Recovery (e)	Box or Sample No. (f)	Remarks (Drilling time, water loss, depth of weathering, etc., if significant) (g)
0.6			0.0-0.6 CONCRETE			4" Auger 0.6-16.9 3¼" Fishtail bit 16.9-75.0'
8.0			0.6-8.0 CLAY (CL-CH) red brown, moist, stiff.			
16.9	10		8.0-16.9 Redbed Sandstone and Shale silty, clayey. Moist cuttings @ 14'.			Pulled augers at 16.9 and observed water in hole. W.L. @ 1330 = 15.2 Angered to 19.0' and set 20.3 casing with 1.8' s.u. Drilled hole to 75'. water blown from hole with compressed air. Recovery test W.L. - Time 32.0' - 0945 25.7 - 0950 23.7 - 1000 23.1 - 1030 23.0 - 1045 22.95 - 1100 22.95 - 1230
	20					
	30		No Electrical Logs run on this hole.			
	40					
	50					
	60					
	70		CONCLUSION:			
75.0			UPPER WATER ZONE @ 15.2' (Probably lower) LEVEL OF LOWER ZONE NOT CONCLUSIVE AS INSUFFICIENT CASING SET TO SEAL OFF TOP ZONE.			
	80		Bottom of Hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

Hole No. N-99

DRILLING LOG | DIVISION: SOUTHWEST | INSTALLATION: TULSA DISTRICT | SHEET 1 OF 1 SHEETS

1. PROJECT: TINKER AFB Bldg 3001
2. LOCATION (Coordinates or Station): 12' West and 55' North of N-99
3. DRILLING AGENCY: Tulsa District
4. HOLE NO (As shown on drawing title and file number): N-99
5. NAME OF DRILLER: RAINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 9.0
8. DEPTH DRILLED INTO ROCK: 89.0
9. TOTAL DEPTH OF HOLE: 98.0
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (MSL or MLW): Floor level 1276
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ---; UNDISTURBED ---
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 2 June 85; COMPLETED 3 June 85
17. ELEVATION TOP OF HOLE: 1276
18. TOTAL CORE RECOVERY FOR BORING: --- %
19. SIGNATURE OF INSPECTOR: GILBERT

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f
0.5			0.0-0.5 CONCRETE		
			0.5-9.0 CLAY (CL)		
9.0					
	10		9.0-16.0 SANDSTONE, soft, red brown.		
16.0					
			16.0-19.0 SHALE, soft, red brown		
19.0					
20.0	20		19.0-20.0 SANDSTONE		
21.0			20.0-21.0 SHALE		
			21.0-35.0 SANDSTONE, soft, red brown.		
	30				
35.0					
			35.0-45.0 SHALE, soft, red brown.		
	40				
45.0					
			45.0-51.0 SANDSTONE, soft, red brown.		
51.0	50		51.0-54.0 SHALE		
54.0					
			54.0-58.0 SANDSTONE, soft, red brown		
58.0					
	60		58.0-62.0 SHALE, soft, red brown.		
62.0					
			62.0-69.0 SANDSTONE, soft, red brown.		
69.0					
72.0	70		69.0-72.0 SHALE		
			72.0-90.0 SANDSTONE, soft, red brown.		
	80				
90.0	90				
			90.0-98.0 CAVED. No Gamma Log.		
			Bottom of Hole		

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

5¼" Rock bit to 39'.

Bail Test
No Casing

W.L.	Time
24.9 -	1640
21.8 -	1641
21.2 -	1642
20.8 -	1643
20.7 -	1644
20.5 -	1645
20.3 -	1650
20.2 -	1700
20.1 -	1710
20.1 -	1715

Collect top sample.

Set 40' of 4" casing
3" Rockbit to 98.0'.

Bail Test
40-98'

W.L.	Time
84.0 -	0957
82.1 -	0958
80.7 -	1000
79.6 -	1001
79.1 -	1004
78.7 -	1005
78.2 -	1010
77.8 -	1020
77.7 -	1035

WATER SAMPLES COLLECTED

Top sample @ 20.1 BOH 39'.
Bottom sample @ 77.7 BOH 98'.

Rock Descriptions from Gamma log.

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: TINKER AFB BLDG 3001 | HOLE NO. N-99

APPENDIX C

PLUGGING OF WATER SUPPLY WELLS 18 AND 19

Ransby &
Associates, inc.
CIVIL • ENVIRONMENTAL ENGINEERS
316 South Peters • Suite 230 • Norman, OK 73069
405-321-4049

REPORT OF PLUGGING PROCEDURES
WATER WELLS 18 AND 19

PROJECT: MODIFY WATER WELLS 18 AND 19
F34650-85-C-0404

SEPTEMBER, 1986

PREPARED FOR:

Department of the Air Force
Directorate of Contracting and Manufacturing
Oklahoma City Air Logistics Center/PM
Tinker Air Force Base, OK 73145-5320

Dansby &
Associates, inc.
CIVIL • ENVIRONMENTAL ENGINEERS
316 South Peters • Suite 230
Norman, OK 73069 • 405-321-4049

Mr. Van Wylie
OC-ALC/PMKFS
Tinker Air Force Base
OK 73145-5320

9/30/86

Re: Report on Plugging Procedures
Modification of Water Wells 18 and 19
Contract No. F3650-85 C-0404

Dear Mr. Wylie,

Enclosed are ten copies of the "Report of Plugging Procedures" for Water Wells 18 and 19 as required by the specifications for the project. If you have any questions or need more information, please call.

Yours Truly,

J. W. Dansby

J.W. Dansby, P.E.
President

JWD/kc

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APPENDIX C - CEMENT BOND LOGS ABOVE STATIC WATER LEVEL FOR WELLS 18 AND 19 . . . . GREEN

1.0 INTRODUCTION

Dansby and Associates, Incorporated (DAI) was retained under contract number F34650-85-C-0404 by Tinker Air Force Base to conduct investigations and propose modifications for wells 18 and 19. The proposed modifications were to permanently plug both wells since they were contaminated with volatile organic compounds. DAI was contracted under modification No. P00007 dated August 26, 1986, to plug the wells. Plugging of both wells is complete. This report summarizes the plugging procedures for each well.

2.0 PLUGGING PROCEDURES

2.1 GENERAL

The general procedure for plugging both wells was to start at the lower perforated intervals in each well, set a packer above those intervals, and fill the casing and annular space with cement. After each interval was cemented the packer was to be set at the next perforated interval up hole until the highest perforated interval in the well was cemented. All packers were retrieved from both wells.

2.2 TAIL PIPE

A PVC tail pipe was attached to the bottom of the packers to allow the casing to be filled from the bottom to the top of the interval to be cemented. This procedure allowed more control in placement of the cement and resulted in a more uniform

cement quality since the possibility of the cement being diluted by falling through the water is reduced. The PVC tail pipe was not retrievable and is cemented into the well.

2.3 CEMENT MIX

Class A cement with a density of 15.5 lbs. per cubic foot was used in both wells with a mixture of 2% calcium chloride added to the mix to accelerate the setup time. The only zone where Class A was not used was from 548' to 645' in Well 19. This zone was accepting large quantities of water based on the noise and spinner logs which were completed in 1985. A thixotropic cement with a density of 18.2 lbs per cubic foot was used in this zone due to its very short setup time. The cementing service log for each well, which was provided by Dowell, is included in Appendix B.

2.4 CEMENT BOND LOGS

A cement bond log had not been completed on either well above the static water level. A cement bond log was completed on both wells after the perforated intervals were cemented and the casing was filled with water. Both logs indicated a good bond to the casing from 60 feet and 210 feet to the surface on wells 18 and 19, respectively. Cement Bond logs for each well are included in Appendix C.

2.5 PERFORATIONS

Perforations were to be placed in the wells to allow those areas to be filled behind the casing where a cement bond was not indicated by the cement bond log and a connection to a perforated interval was not apparent. Well 18 was perforated with four shots at 195 feet. Well 19 was not perforated since the cement bond logs indicated a good log from 210 feet to the surface.

2.6 CEMENTING PROCEDURES

Due to the porosity of the Garber Wellington Formation and the construction of the wells, criteria was developed to determine if each zone was cemented adequately. Without these criteria, vast quantities of cement may have been wasted by pumping into the formation or cement may have been pumped on top of the packer which could cement the packer and string of pipe into the hole. The cement job is considered satisfactory if the casing and annular space was filled with cement.

Three basic criteria were used as a guide to determine if a zone was cemented satisfactorily. These criteria are the pump pressure, the water level in the well casing, and the volume of cement pumped.

A pressure of one psi per foot was used as a maximum cementing pressure so the formation would not be damaged. The zone was adequately cemented, if pressure was sustained at low pumping rates or during stage cementing for several minutes.

The water level in the casing was monitored above the packer to indicate circulation of water and/or cement through perforations above the packer. Fluid movement through the annular space was indicated if the water level increased during cementing. Generally, cement was pumped to fill the casing and annular space in this situation. However, care was taken to not pump cement on top of the packer, which could result in the string of tubing and packer being cemented into the well.

The volume of cement pumped is another indication of sufficient cement being pumped into the well. Stage pumping was initiated in each zone after the casing volume plus 110% of the estimated annular volume had been pumped without an increase in pressure. Generally, the cement was allowed to set 20 minutes, 30 minutes, and 30 minutes for the first, second, and third stages respectively. At least an additional 10% of the casing and annular volume was pumped during each stage unless the zone started holding pressure.

3.0 DETAILED PLUGGING RECORD

3.1 General

This section summarizes the actual field activities during plugging of Wells 18 and 19. Tables and Figures are also included for each well to summarize the field activities. The Work Summary for each well is included in Appendix A.

3.2 Well 18

Well 18 was cemented in five stages. This work is summarized in the "Work Summary for Well 18" in Appendix A and Figure 1. " Information Summary for Well 18".

The volume of cement pumped is compared to the estimated volume of casing and annular space in Table 1, "Cementing Schedule for Well 18". Estimating the casing volume is complicated since the wall thickness of the casing varies thoughout the depth of the well as indicated by the casing caliper and inspection log that was completed in 1985. Also, since the casing is corroded, the inside diameter varies from the original I.D. of the pipe when it was manufactured. The I.D. assumed to estimate casing volumes is the largest manufactured for each particular pipe size.

The volume of annular space was estimated by assuming an original borehole diameter and using the cement bond log to indicate the length of unbonded casing. This should be conservative since some sloughing of the borehole wall should have occurred over the past 40 years since the well was constructed. Adequate cement was pumped to fill the casing and estimated annular space in each cementing stage for well 18. The total volume of slurry pumped into Well 18 is 139.6 Barrels which is 22% greater than the estimated volume of the casing and annular space of 114.6 Barrels.

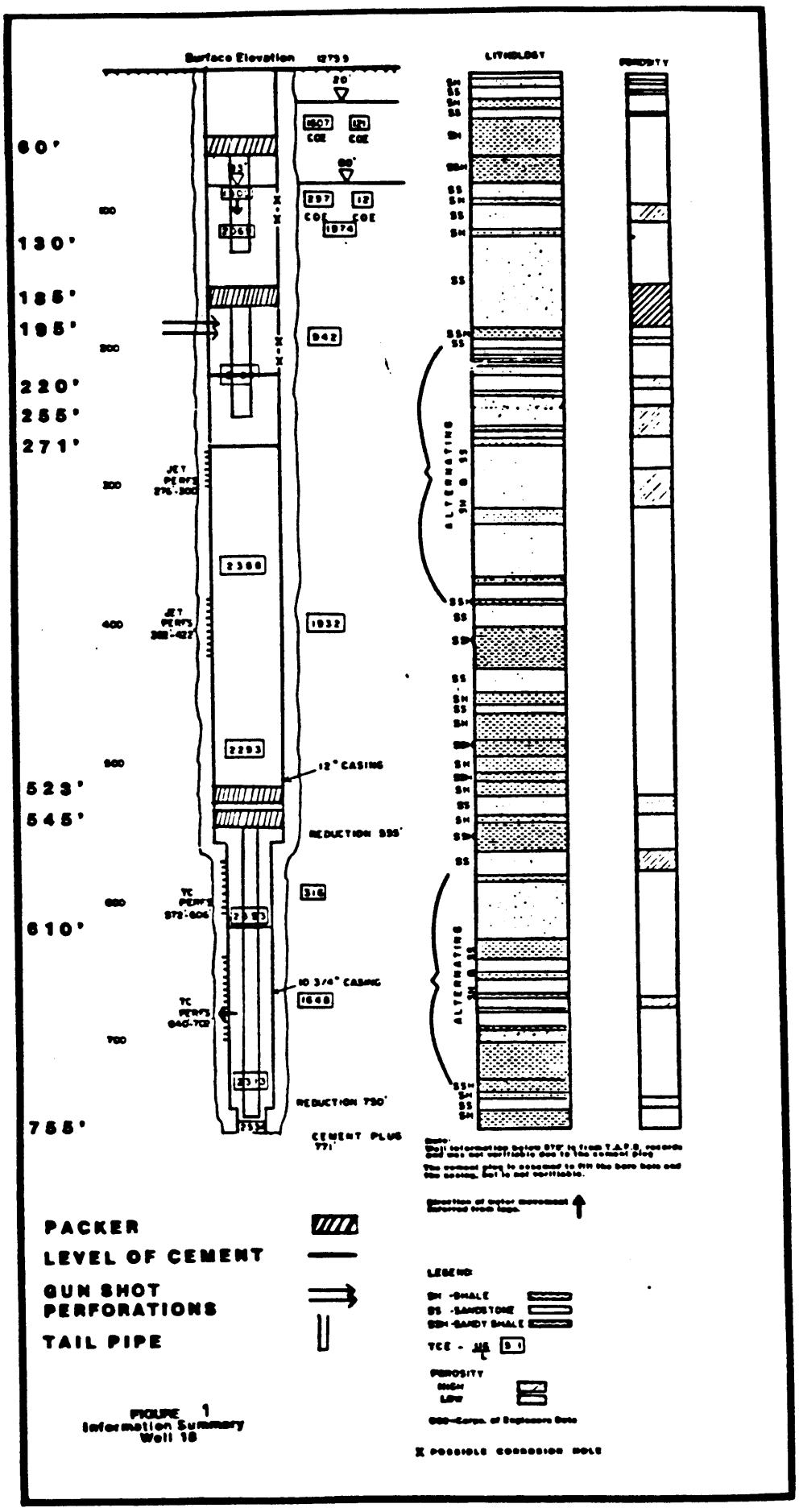


FIGURE 1
Information Summary
Well 18

TABLE 1
CEMENTING SCHEDULE
WELL 18 - TAFB
9/30/86

Stage	Interval bottom (ft)	Interval top (ft)	Estimated Casing Diameter I.D. (in.)	Casing Length (ft)	Estimated Casing Volume (cu. ft.)	Estimated Original Bore Diameter (in.)	Bore Length (ft)	Pipe O.D. (in.)	Estimated Length of unbonded casing (ft)	Estimated Volume of annular space (ft.3)	Volume casing + est. annular space (ft.3.)(barrels)		Volume Concrete Pumped (ft.3) (barrels)	
1	771	750	6.5	21	5	9	21	7	0	0				
	750	610	10.2	140	79	13	140	10.75	81	24				
				...	..		...		...	..	...	....		
				161	84		161		81	24	108	19.2	111	19.6
2	610	555	10.2	55	31	13	55	10.75	14	4				
	555	271	12.3	284	234	15	284	13	6	2				
				...	...		...		..	...				
				339	265		339		20	6	271	48	27*	48*
3	271	220	12.3	51	42	15	51	13	0	0	42	7.5	48	7.1
4	220	60	12.3	160	132	15	160	13	140	42	174	31	315	56
5	60	0	12.3	60	50	15	60	13	0	0	50	8.9	50	8.9
				...	..		...		...	..	..	..	..	..
	Total			771	573		771		241	72	645	114.6	787	139.6

* This volume includes 4 barrels of water that was displaced into the cement during staging.

3.3 Well 19

Well 19 was cemented in 9 stages. This work is summarized in the Work Summary for well 19 in Appendix A and Figure 2 "Information Summary for Well 19".

The volume of cement pumped is compared to the estimated volume of casing and annular space in Table 2 "Cementing Schedule for Well 19". An adequate volume was pumped to fill the casing and annular space in each cementing stage for Well 19. The total barrels of cement slurry pumped into Well 19 is 191.6 barrels which is 29% greater than the estimated volume of the casing and annular space of 149.1 barrels.

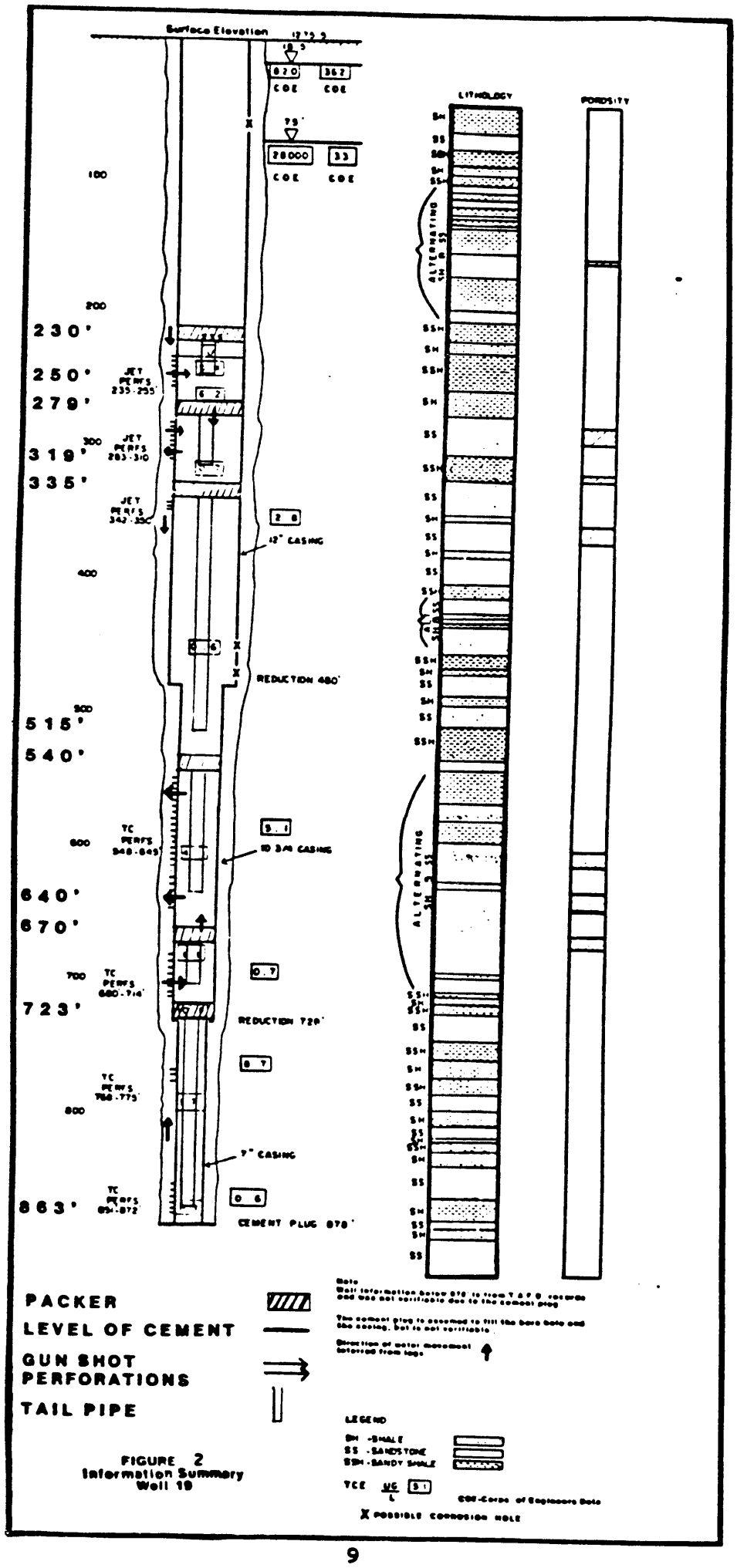


FIGURE 2
Information Summary
Well 19

TABLE 2
CEMENTING SCHEDULE
WELL 19 - TAFB
9/30/86

Stage	Interval bottom (ft)	Interval top (ft)	Estimated Casing Diameter (in.) I.d.	Casing Length (ft)	Estimated Casing Volume (cu. ft.)	Estimated Original Bore Diameter (in.)	Estimated Pipe O.D. (in.)	Estimated Length of unbonded casing	Estimated Volume of annular space (ft.3)	Estimated Volume casing + annular space (ft.3.)	(barrels)	Volume Concrete Pumped (ft.3)	(barrels)
1	878	723	6.5	155	36	9	7	135	24	60	10.7	88	15.7
2	723	670	10.2	53	30	13	10.75	30	9	39	6.9	101	18
3	670	540	10.2	130	74	13	10.75	96	28	102	18.2	159	28.
4	540	480	10.2	60	34	13	10.75	49	14	48	8.5		
	480	335	12.3	145	120	15	13	23	7	127	22.6		
				205	154				21	175	31.1	213	38
5	335	279	12.3	56	46	15	13	30	9	55	9.8	131	23.3
6	279	230	12.3	49	40	15	13	5	2	42	7.5	51	9
7	230	100	12.3	130	107	15	13	0	0	107	19	121	21.6
8 & 9	100	0	12.3	100	82.5	15	13	0	0	83	14.8	213	38
				878				368	93	663	149.1	1077	191.6

APPENDIX A
WORK SUMMARY
FOR
WELLS 18 AND 19

DETAILED WORK SUMMARY
WELL 18 PLUGGING PROGRAM
9/30/86

Item	Work Task	Date	Comments
1.	Removed floor and dug pit to expose well head.	8/27 - 8/29	Cement was not around pipe and annular space was open for several feet below bottom of pit.
2.	Rig and Setup.	9/15	
3.	Ran gauge ring.	9/15	Gauge Ring would not clear welds @ 5' from TOC.
4.	Ran Scrapper.	9/16	Hung up on welds at 5 feet.
5.	Drove Scrapper with 300 # Weight.	9/16	Still did not clear welds.
6.	Jacked Scrapper out of hole.	9/16	Weld at 5' almost removed by scrapper. Several more welds could be seen from the surface. Decided to use inflatable packers.
7.	Ran 210 feet of PVC tailpipe.	9/16	
8.	<u>Stage 1:</u> Ran tubing and set packer at 545 feet.	9/16	
9.	Set packer and pumped 19.6 barrels of Class A cement.	9/17	The packer moved uphole at 300 to 350 psi. Water level increased above packer at this pressure. Since there was a possibility of cement being pumped around packer, and packer and tubing being cemented into hole, packer was removed after pumping this volume.
10.	Released packer and removed tubing and packer.	9/17	
11.	Ran depthometer and sinker bar to tag cement.	9/17	Sinker bar went to 717 feet. Cement had not set up.
12.	Ran Junk basket to tag cement.	9/18	Hit the PVC tailpipe at 533 feet.
13.	Ran sinker bar to tag cement.	9/18	Tagged cement at 610 feet.
14.	<u>Stage 2:</u> Ran tubing and set packer at 523 feet.	9/18	Injection rate established at 0.3 BPM at 470 psi for 5 1/2 minutes. Zone effectively plugged.
15.	Released packer and pumped 17.8 barrels of cement. Displaced cement in tubing with 2 barrels of water.	9/18	Tubing was under a vacuum. Dowell Supervisor stated that, if tubing is on a vacuum then cement was not above the packer at 523 feet.

DETAILED WORK SUMMARY
WELL 19 PLUGGING PROGRAM
9/30/86

Item	Work Task	Date	Comments
1.	Remove cement from around well head	8/25 - 8/29	Cement was evident around the casing. The annular space appeared to be well cemented.
2.	Rig up.	9/22	
3.	Stage 1: Set packer at 723 feet with 140 feet of tail pipe.	9/22	
4.	Pumped 15.7 barrels cement. Well squeezed at 700 psi.	9/22	
5.	Stage 2: Set packer at 670' with 40 feet of tail pipe.	9/22	
6.	Pumped 13BBLS cement and let set 10 minutes.	9/23	
7.	Pumped additional 4 barrels cement.	9/23	Shut down at 600 psi due to pressure limit.
8.	Staged for 1 hr. Squeezed at 690 psi. Total pumped was 18 barrels.	9/23	
9.	Stage 3: Set packer at 540 feet with 100 feet of tail pipe.	9/23	
10.	Pumped 20 BBL of RFC thixotropic followed with 8 barrels of Class A cement.	9/23	Squeezed at 500 psi. Total cement pumped was 28 barrels.
11.	Stage 4: Packer Set at 335 feet with 180 feet of tail pipe.	9/23	
12.	Pumped 38 barrels and squeezed at 310 psi.	9/24	
13.	Stage 5: Packer set at 279 with 40 feet of tail pipe.	9/24	Water level stabilized at 201 feet after packer set. Was at 231 feet.
14.	Pumped 23.3barrels of Class A cement.	9/24	Built pressure to 250 psi during staging. Water level rose to 175' during cementing.
15.	Stage 6: Set packer at 230 feet with 20 feet of tail pipe.	9/24	
16.	Pumped 9 BBLS of cement and squeezed at 200 psi.	9/24	Water level rose to 120 feet.
17.	Filled casing with water. Ran cement bond log from 230 feet to the surface.	9/24	Good bond from 230 feet to the surface. Water level stabilized at 80 feet which indicates a hole in the casing at that elevation.
18.	Stage 7: Ran 220 feet of tubing.	9/25	
19.	Pumped 21.6 barrels to fill casing to 100 feet.	9/25	

DETAILED WORK SUMMARY
WELL 18 PLUGGING PROGRAM
9/30/86
CONTINUED

Item	Work Task	Date	Comments
16.	Pumped 14.6 barrels of cement. Displaced cement in tubing with 2 barrels of water.	9/18	Tubing still on a vacuum.
17.	Pumped 11.6 barrels of cement. Displaced cement in tubing with 2 barrels of water.	9/18	Tubing pressure was equalized which indicated cement was near the bottom of the packer according to the Dowell Supervisor.
18.	Removed tubing and packer.	9/18	
19.	Ran Junk basket and tagged cement at 271 feet.	9/18	The perforated intervals below 555 feet had at least 200 psi induced by the cement above that zone prior to set up of the cement. A good bond was shown by the existing bond logs from 230 feet to 555 feet except at the perforations. Volumes of slurry pumped is more than estimated to fill casing and estimated annular space.
20.	Perforated the casing at 195 feet with 4 shots.	9/18	
21.	Stage 3: Set packer at 185 feet with 70 feet of PVC tail pipe.	9/18	
22.	Established injection rate at 4 1/2 BPM at 140 psi.	9/18	Water level increased above packer which indicated a connection with corrosion holes at 80 feet through the annular space.
23.	Pumped 7.1 BBL of cement. Tagged cement with junk basket at 220 ft.	9/18	Did not place cement above perforations so could pressure cement entire zone.
24.	Stage 4: Set packer at 60 feet with 70 feet of PVC tail pipe.	9/19	Static water level and corrosion holes were at approximately 80 feet.
25.	Pumped 43.4 barrels.	9/19	Shutdown due to psi limit.
26.	Stage pumped an additional 12.6 barrels at approximately 100 psi over a 45 minute period.	9/19	The pressure did not drop below 80 psi over this 45 minute period. Total barrels pumped during this packer set was 56 barrels.
27.	Filled casing with water and ran cement bond log.	9/19	A good bond was indicated by the log from 56 feet to the surface.
28.	Stage 5: Ran 40 feet of tubing into hole and pumped 28 barrels of cement.	9/19	Approximately 8.9 barrels filled the casing. The additional 19.1 barrels was used to fill the pit that had been dug to expose the well head. Some cement ran down the annular space that had been exposed, then stopped.
29.	Repair floor.	9/26 - 9/27	

DETAILED WORK SUMMARY
WELL 19 PLUGGING PROGRAM
9/30/86
CONTINUED

Item	Work Task	Date	Comments
20.	Placed packer at 15 feet.	9/25	Casing failed and packer exploded.
21.	Stage 8: Placed packer at surface and pumped 30 barrels.	9/25	Staged but did not develop pressure.
22.	Stage 9: Removed packer and placed cement line in hole.	9/25	
23.	Pumped approximately 8 barrels into casing and 15.3 barrels into pit.	9/25	Casing started filling, then level dropped and well took cement for a short period. Then casing was filled and cement level stabilized.
24.	Repaired floor.	9/27 - 9/28	

APPENDIX B
DOWELL CEMENTING SERVICE REPORTS
FOR
WELLS 18 AND 19

CEMENTING SERVICE REPORT

DS-496 PRINTED IN U.S.A.

DOWELL SCHLUMBERGER INCORPORATED

TREATMENT NUMBER 1668 | DATE 9-17-86

STAGE | DS DISTRICT SEMINOLE, OKLA.

WELL NAME AND NO. TINKER AFB WATER WELL #18 | LOCATION (LEGAL) SEC

FIELD-POOL TINKER AFB | FORMATION SURFACE

COUNTY/PARISH OKLAHOMA | STATE OKLAHOMA | API. NO.

NAME DANSBY & ASSOCIATES

AND

ADDRESS NORMAN, OKLA. ZIP CODE

SPECIAL INSTRUCTIONS

RIG NAME: CAPITAL WELL SERVICE

WELL DATA:		BOTTOM			TOP
BIT SIZE	CSG/Liner Size				
TOTAL DEPTH	WEIGHT				
☐ROT ☐CABLE	FOOTAGE				
MUD TYPE	GRADE				
☐BHST ☐BHCT	THREAD				
MUD DENSITY	LESS FOOTAGE SHOE JOINT(S)				TOTAL
MUD VISC.	Disp. Capacity				

NOTE: Include Footage From Ground Level To Head In Disp. Capacity

Float	TYPE		Stage Tool	TYPE	
	DEPTH			DEPTH	
SHOE	TYPE			TYPE	
	DEPTH			DEPTH	

Head & Plugs	☒TBG ☐D.P.	SQUEEZE JOB	
☐Double	SIZE 2 3/8	TOOL TYPE	BAKER PACKER
☐Single	☒WEIGHT 4.7	DEPTH	545'
☐Swage	☐GRADE	TAIL PIPE: SIZE 3"	DEPTH 780'
☐Knockoff	☐THREAD 8RD	TUBING VOLUME	2.2 Bbls
TOP ☐R ☐W	☐NEW ☒USED	CASING VOL. BELOW TOOL	0 Bbls
BOT ☐R ☐W	DEPTH 545'	TOTAL	2.2 Bbls
		ANNUAL VOLUME	Bbls

PRESSURE LIMIT 545 PSI | BUMP PLUG TO — PSI

ROTATE X RPM | RECIPROCATE X FT | No. of Centralizers X

JOB SCHEDULED FOR TIME: 0800 DATE: 9-17 | ARRIVE ON LOCATION TIME: 0800 DATE: 9-17 | LEFT LOCATION TIME: DATE:

TIME 0001 to 2400	PRESSURE TBG OR D.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
1500								PRE-JOB SAFETY MEETING
0800	0				0			ARRIVE LOC & RIG UP
1000	0				0			STANDBY WHILE RUNNING TBG & PACKER
1516	0			0	2	H2O	8.3	START WATER
1519	250			2	1	"	"	TBG LOADED - INCREASE PRESSURE
1519	600			2 1/4	1/2	"	"	PACKER INFLATED & SET
1521	250			4	2	"	"	ESTABLISH INJECTION RATE
1532	80		19.6	0	2	CMT	15.6	START CEMENT
1540	350			16 1/2	2	"	"	SHUT DOWN - PACKER & TBG CAME UP HOLE
1545	—			16 1/2	0	"	"	PULL UP ON TBG TO RESET PACKER
1605	100			16 1/2	1	"	"	START CEMENT
1608	150			19 1/2	1	"	"	END CEMENT - STOP PUMP 94 SKS
1608	—		-	—	0			WASH OUT LINES
1612	150					H2O	8.3	START DISPLACEMENT
1620	150		2.2	0		"	"	DISPLACEMENT IN - STOP PUMP
1625	0			2.2				RIG OFF TBG & WASH UP.
1730								PULL TBG & PACKER & RETURN 9-18-86

REMARKS

SYSTEM CODE	NO. OF SACKS	YIELD CU. FT/SK	COMPOSITION OF CEMENTING SYSTEMS	SLURRY MIXED BBLS	SLURRY MIXED DENSITY
1.	94	1.18	STANDARD + 2% CAL. MIXED ON 1ST PLUG 9-17-86	19.6	15.8
2.					
3.					
4.					
5.					
6.					

BREAKDOWN FLUID TYPE | VOLUME | DENSITY

☐ HESITATION SQ. ☒ RUNNING SQ. | CIRCULATION LOST ☐YES ☐NO

BREAKDOWN PSI | FINAL 150 PSI | DISPLACEMENT VOL. Bbls

Washed Thru Perfs ☐YES ☒NO | TO FT | MEASURED DISPLACEMENT ☐ ☐WIRELINE

PERFORATIONS TO TO TO TO

CUSTOMER REPRESENTATIVE BUZZ SAWYER

DS SUPERVISOR JOE NORTH

PRESSURE MAX. MIN:

Cement Circulated To Surf. ☐YES ☐NO Bbls.

TYPE OF WELL ☐OIL ☐GAS ☐STORAGE ☐INJECTION ☐BRINE WATER ☐WILDCAT

CEMENTING SERVICE REPORT
SUPPLEMENT LOG

XWL-496-1 PRINTED IN U.S.A

DATE 9-18-86

CUSTOMER WELL NAME AND NUMBER Tinker AFB Water Well #18 | LOCATION (LEGAL) Sec 15-11N-2W | DOWELL LOCATION Seminole, OK | TREATMENT NUMBER 16627 | PAGE 2 OF 3 PAGES

TIME (0001 to 2400)	PRESSURE TBG OR D.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
								Arrive on Loc & Rig up
								Hold Safety Mtg
1241	0			0	1	H2O	8.3	Start Pumping Water
1243	600			1.8	1	"	"	Set Packer
1243	180			1.8	2	"	"	Establish Injection Rate
1245	110			4.5	2	"	"	Stop Pump
1326 *	0			0	1¾	Cmt	15.6	Start Cement
1327	0			17.2	"	"	"	End Cement 85 sx
1328	20			0	2	H2O	8.3	Start Disp
1340	0			2	"	"	"	End Disp
1343	0			0	"	Cmt	15.6	Start Cement
1356	30			14.6	"	"	"	End Cement 70 sx
1356	0			0	"	H2O	8.3	Start Disp
1359	40			2	"	"	1'	End Disp
1401	0			0	"	Cmt	15.6	Start Cement
1485	40			11.6	"	"	"	End Cement 55 sx
1415	0			0	"	H2O	8.3	Start Disp
1419	0			2	"	"	"	End Disp
								Rig off well & Standby
								Circ Mud Cement
								Rig To 76b
2204	20			0	1	H2O	8.3	Start Pumping Water
2204	350			1.7	1	"	"	Set Packer
2206	140			24.2	4½	"	"	Establish Injection Rate
2231	40			0	2½	Cmt	15.6	Start Cement
2237	80			7.1	"	"	"	End Cement 34 sx
2239	20			0	"	H2O	8.3	Start Disp
2240	10			.8	"	"	"	End Disp
								Pull Packer
								Rig To 7b "9-19-86"
0103	30			0	½	H2O	8.3	Start Water
0105	900			1.4	½	"	"	Packer Set
0107	60			3.1	2½	"	"	Establish Injection Rate
				0	2½	Cmt	15.6	Start Cement

* 12:42 thru 12:54 Water was pumped at 430 psi at a rate of 0.3 BPM.

EMENTING SERVICE REPORT
UPPLEMENT LOG

WL-486-1 PRINTED IN U.S.A

DATE 9-19-86

USTOMER WELL NAME AND NUMBER TINKER AFB WATER WELL #18 | LOCATION (LEGAL) SEC 15-11N-2W | DOWELL LOCATION SEMINOLE, OK. | TREATMENT NUMBER KGF | PAGE 3 OF 3 PAGES

TIME 2001 to 2400	PRESSURE TBG OR D.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
0130	100			33.8	2½	CMT	156	SHUTDOWN - PULLED DOWNSPOUT
0136	80			33.8	1½	"	"	START CMT.
0142	120			43.4	½	"	"	SHUTDOWN PSI LIMIT
0147	80			43.4	½	"	"	START CEMENT
0152	120			47.5	"	"	"	SHUTDOWN PSI LIMIT
0205	90			47.5	"	"	"	START CMT.
0215	120			51.7	"	"	"	SHUTDOWN PSI LIMIT
0216	90			51.7	"	"	"	START CEMENT - SHUTDOWN FROM 0215
0240	120			56	"	"		0240 UNTIL 56 BBL CMT IS PUMPED
0240	90			0	"	H2O	8.3	START DISP
0240	130			.5	"	H2O	8.3	END DISP.
0250	0							PUMPED 267 SKS ON THIS STAGE
0330	0							RIG DOWN & WASH UP TRUCK & GO HOME
1800	0							RETURN TO BASE WITH MORE CMT.
1900	0							RUN 2 JOINTS TBG.
2057	0			0	2½	CMT	156	START CEMENT
2109	0			28				CEMENT MIXED 133 SKS
2111	0			0				START DISPLACEMENT
2112	0			1				DISP. IN SHUT DOWN
2200								RIG DOWN TRUCKS
2230								JOB COMPLETED.

CEMENTING SERVICE REPORT

DS-496 PRINTED IN U.S.A.

DOWELL SCHLUMBERGER INCORPORATED

STAGE | DS DISTRICT

WELL NAME AND NO. Tinker AFB Water Well "A" | LOCATION (LEGAL) Sec 15-11N-2W

FIELD-POOL Tinker AFB | FORMATION Surface

COUNTY/PARISH Oklahoma | STATE Oklahoma | API. NO.

NAME Dansby & Associates

AND

ADDRESS

ZIP CODE

SPECIAL INSTRUCTIONS

RIG NAME:

WELL DATA:

		BOTTOM			TOP
BIT SIZE	CSG/Liner Size				
TOTAL DEPTH	WEIGHT				
☐ROT ☐CABLE	FOOTAGE				
MUD TYPE	GRADE				
☐BHST ☐BHCT	THREAD				
MUD DENSITY	LESS FOOTAGE SHOE JOINT(S)				TOTAL
MUD VISC.	Disp. Capacity				

NOTE: Include Footage From Ground Level To Head In Disp. Capacity

SHOE Float	TYPE		Stage Tool	TYPE	
	DEPTH			DEPTH	
SHOE	TYPE			TYPE	
	DEPTH			DEPTH	

Head & Plugs	☑TBG ☐D.P.	SQUEEZE JOB	
☐Double	SIZE 2 3/8	TOOL TYPE Baker Inflatable	
☐Single	☐WEIGHT 4.7	DEPTH 723'	
☐Swage	☐GRADE	TAIL PIPE: SIZE ? "	DEPTH
☐Knockoff	☐THREAD 8 RD	TUBING VOLUME 3	Bbls
TOP ☐R ☐W	☐NEW ☑USED	CASING VOL. BELOW TOOL —	Bbls
BOT ☐R ☐W	DEPTH 723'	TOTAL 3	Bbls
		ANNUAL VOLUME —	Bbls

PRESSURE LIMIT X PSI | BUMP PLUG TO X PSI

ROTATE X RPM | RECIPROCATE X FT | No. of Centralizers X

JOB SCHEDULED FOR TIME: 9-22 DATE: 86 | ARRIVE ON LOCATION TIME: 9-22 DATE: 86 | LEFT LOCATION TIME: DATE:

TIME 0001 to 2400	PRESSURE TBG OR D.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
								PRE-JOB SAFETY MEETING
0800								Arrive on Loc & Rig up
1224	0			0	1/2	H2O	8.3	Start Pumping H2O To Set Packer
1226	300			1.2	1/2	"	"	Hole Loaded
1226	980			1.2	1/2	"	"	Set Packer @ 723'
1226	0			1.2	2	"	"	Establish Injection Rate
1227	0			2.8	2	"	"	Stop Pump
1251	0		132	0	3.2 1/4	Cmt	15.6	Start Cement
1310	0			1.32	"	"	"	Shut Down - & Start Stage Cement
1323	0			1.32	1/2	"	"	Stage From 1309 To 1311
1324	0			0	2	H2O	8.3	Start Displacement (Mixed 63 Sks)
1315	0			2	"	"	"	End Disp.
1343			42	0	1 1/4	Cmt.	15.6	Start Cement (Mix 12 Sks)
1351				2	"	"	"	End Cement / Stage Cmt & Disp From
1353				0		H2O	8.3	Start Disp. / 1351 To 1440
1427				2		"	"	Shut Down - Well Squeeze Off To 200 PSI
1430								Pull TBG & Run New Packer Back In

REMARKS

SYSTEM CODE	NO. OF SACKS	YIELD CU. FT/SK	COMPOSITION OF CEMENTING SYSTEMS	SLURRY MIXED BBLS	SLURRY MIXED DENSITY
1.		1.18	Standard + 2% CaCl2		15.6
2.		1.63	RFC 10.2		~~1.92~~
3.					
4.					
5.					
6.					

BREAKDOWN FLUID TYPE | VOLUME | DENSITY

☑HESITATION SQ. ☐RUNNING SQ. | CIRCULATION LOST ☐YES ☑NO

BREAKDOWN PSI | FINAL PSI | DISPLACEMENT VOL. Bbls

Washed Thru Perfs ☐YES ☐NO | TO FT | MEASURED DISPLACEMENT ☑ ☐WIRELINE

PERFORATIONS TO TO | TO TO

CUSTOMER REPRESENTATIVE Buzz Sawyer

PRESSURE MAX. MIN:

Cement Circulated To Surf. ☑YES ☐NO Bbls.

TYPE OF WELL ☐OIL ☐GAS ☐STORAGE ☐INJECTION ☐BRINE WATER ☐WILDCAT

DS SUPERVISOR Joe North

CEMENTING SERVICE REPORT
SUPPLEMENT LOG

WL-406-1 PRINTED IN U.S.A

DATE 9-22-23

CUSTOMER WELL NAME AND NUMBER Tinker Water Well #19 | LOCATION (LEGAL) Sec 15-11N-2W | DOWELL LOCATION Seminole, Ok. | TREATMENT NUMBER 1680 | PAGE 2 OF PAGES

TIME (2001 to 2400)	PRESSURE TBG OR D.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
1706								Rig To 786. 9-22-86
1716	0			0	1/2	H2O	8.3	Start H2O
1716	300			2	1/2	"	"	Hole Loaded
1717	1000			2	1/2	"	"	Set Packer @ 670'
1717	90			6	2	"	"	Establish Injection Rate
1718	80			6	2	"	"	Stop Pump & Return 9-23-86
								9-23-86
0516	0			0	1			Start H2O
0817	0			1	1	Cmt	15.6	Start Cement
0830	30			13	0	"	"	Shut Down Let Set
0851	20			13	1	"	"	Start Cement
0858	540			17	1/4	"	"	Stop Pump - Let Set
0858	240			17	"	"	"	Start Cement
0858	350			18	"	"	"	Stop Pump 85 Sks Cement
0935	400			0	"	H2O	8.3	Start Disp
0942	650			1/2	"	"	"	Disp In
0945								Pull Tbg & Packer & Run Another Packer
								Rig To Tbg
1251					1	H2O	8.3	Start H2O
1252	1120				1/2	"	"	Packer Set
1252	0				1	"	"	Establish Injection Rate
1253	0			0	1/2	Cmt	14.2	Start Cement Rec
1255	0				0	"	"	Pulled Drillpipe - Unpacked
1300	0			0	1	"	"	Start Cement Rec 70 Sks Rec
1310	20			20	1	"	15.6	Start Regular + 2% CC Cement
1310	440			27	0	"	"	Stop Pump
1320	80			27	1/2	"	"	Start Cement
1320	450			27 1/4	0	"	"	Stop Pump
1334	90			27 1/2	1/4	"	"	Start Cement
1334	550			28	0	"	"	Stop Pump 38 Sks Cmt
1337	80			28	1/4	H2O	8.3	Start Displacement
1338	500			30	"	"	"	Disp In
1358				30				Shut Down
1430								Pull Tbg & Packer & Run New Packer

CEMENTING SERVICE REPORT
SUPPLEMENT LOG

DWL-486-1 PRINTED IN U.S.A.

DATE 9.23 & 24 -86

CUSTOMER WELL NAME AND NUMBER	LOCATION (LEGAL)	DOWELL LOCATION	TREATMENT NUMBER
Tinker AFB Water Well #4	1/9 Sec 15-11N-2W	Seminole	1680

PAGE 3 OF PAGES

TIME (0001 to 2400)	PRESSURE TBG OR C.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
								Rig To Tbg.
1710	0			0	1	H2O	8.3	Start H2O
1710	1270			1	1/2	"	"	Set Packer
1710	40			1	2	"	"	Establish Injection Rate
1711	40			3	2	"	"	Stop Pump
								9-24-86
0822				0				Start H2O
0822	0			0	1/3	Cmt	15.6	Start Cement
0936	0			33	1/3	"	"	Shutdown Let Set
0943	20			21	1/3	"	"	Start Cement
0945	240			34	0	"	"	Shutdown Let Set
0946	70			34	1/3	"	"	Start Cement
0959	310			38	1/3	"	"	Stop Pump - End Cement 181 SKS Mixed
1006	40			0	1/3			Start Displacement
1007	330			1/2	0			Stop Pump - Rig Down
1029	0							Unseat Packer & Clear Tbg.
								Pull Tbg. & Packer & Run New Packer
								Rig To Tbg.
1152	0			0	1/2	H2O	8.3	Start H2O
1154	1220			1.2	1/2	"	"	Set Packer
1154	0			1.3	2	"	"	Establish Injection Rate
1156	0			0	1 1/2	Cmt.	15.6	Start Cement
1204	0			14	0	"	"	Stop Pump - Let Set
1215	0			14	1 1/2	"	"	Start Cement
1220	0			17	0	"	"	Stop Pump - Let-Set
1221	0			17	1/2	"	"	Start Cement
1222	20			19	0	"	"	Stop Pump " "
1234	0			19	1/2	"	"	Start Cement
1241				23	0	"	"	End Cement 111 SKS
1242	30			0	1/2	H2O	8.3	Start Displacement
1300	260			1	0	"	"	End Disp.
1310						"	"	Rig Off Tbg.
1310						"	"	Pull Tbg & Packer & Run New Packer
1400								Rig To Tbg.

CEMENTING SERVICE REPORT
SUPPLEMENT LOG

XXL-486-1 PRINTED IN U.S.A

DATE 9.24 & 25 - 86

CUSTOMER WELL NAME AND NUMBER: Tinker AFB Water Well #19 | LOCATION (LEGAL): Sec 15-11N-2W | DOWELL LOCATION: Seminole | TREATMENT NUMBER: 4650 | PAGE 4 OF 4 PAGES

TIME (2400 hr)	PRESSURE TBG OR D.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
1411	0			0	1	H2O	8.3	START H2O
1412	1170			1	1/4	"	"	SET PACKER
1412	0			1	2	"	"	ESTABLISH INJECTION RATE
1428	0			0	2	CMT	15.6	START CEMENT
1530	0			2	2	"	"	LOST PRIME
1542	220			9	1/2	"	"	END CEMENT MIXED 43 SKS 152
1547				0	1/4	H2O	8.3	START DISP
1548				1	0	"	"	DISP IN - RIG DOWN
1550								PULL TBG & PACKER & LOAD CSG WITH H2O
								9-25-86
								RUN TBG IN HOLE W/ PACKER @ 230'
0853	40			0	2 1/2	CMT	15.6	START CEMENT
0901	70			21.6	"	"	"	SHUT CEMENT DOWN MIXED 103 SKS
0901	70			0	"	H2O	8.3	START DISP
0902	40			1	"	"	"	DISP IN
				0				PULL TBG
								RUN TBG & PACKER
0927	0			0	1/2			START H2O
0928	920			1	1/2			SET PACKER
0935	0			0	0			PULL PACKER BUSTED CSG
0930	0			0	0			RUN PACKER
1040	0			0	1/2			START H2O
1041	540			1	1/2			SET PACKER
1045	0			0	1 1/2			START CEMENT / MIX & SHUT DOWN - PUMP 5 SKS
1230	0			30				END CEMENT / FOR 1 STAGE
1245								PULL PACKER & SPOT CEMENT MIXED 142 SKS
1436	0			0	1 1/2	CMT	15.6	START CEMENT
1456	0			23 1/2	"	"	"	END CEMENT MIXED 111 SKS
1500								WASH TRUCK UP
1630								RIG DOWN
1710								LEAVE LOC.
								TOTAL CEMENT = 890 SKS
								OR 1050 CU FT.

APPENDIX C
CEMENT BOND LOGS
ABOVE STATIC WATER LEVEL
FOR
WELLS 18 AND 19

McCullough

BOND CEMENT (AND) OR SONIC SEISMOGRAM LOG

4 GAMMA RAY

FILING NO.

FIELD COPY

COMPANY J.W. DANSBY

WELL WATER WELL #18

FIELD TINKER AIR FORCE BASE

COUNTY OKLAHOMA STATE OKLAHOMA

LOCATION

SEC. TWP. RGE.

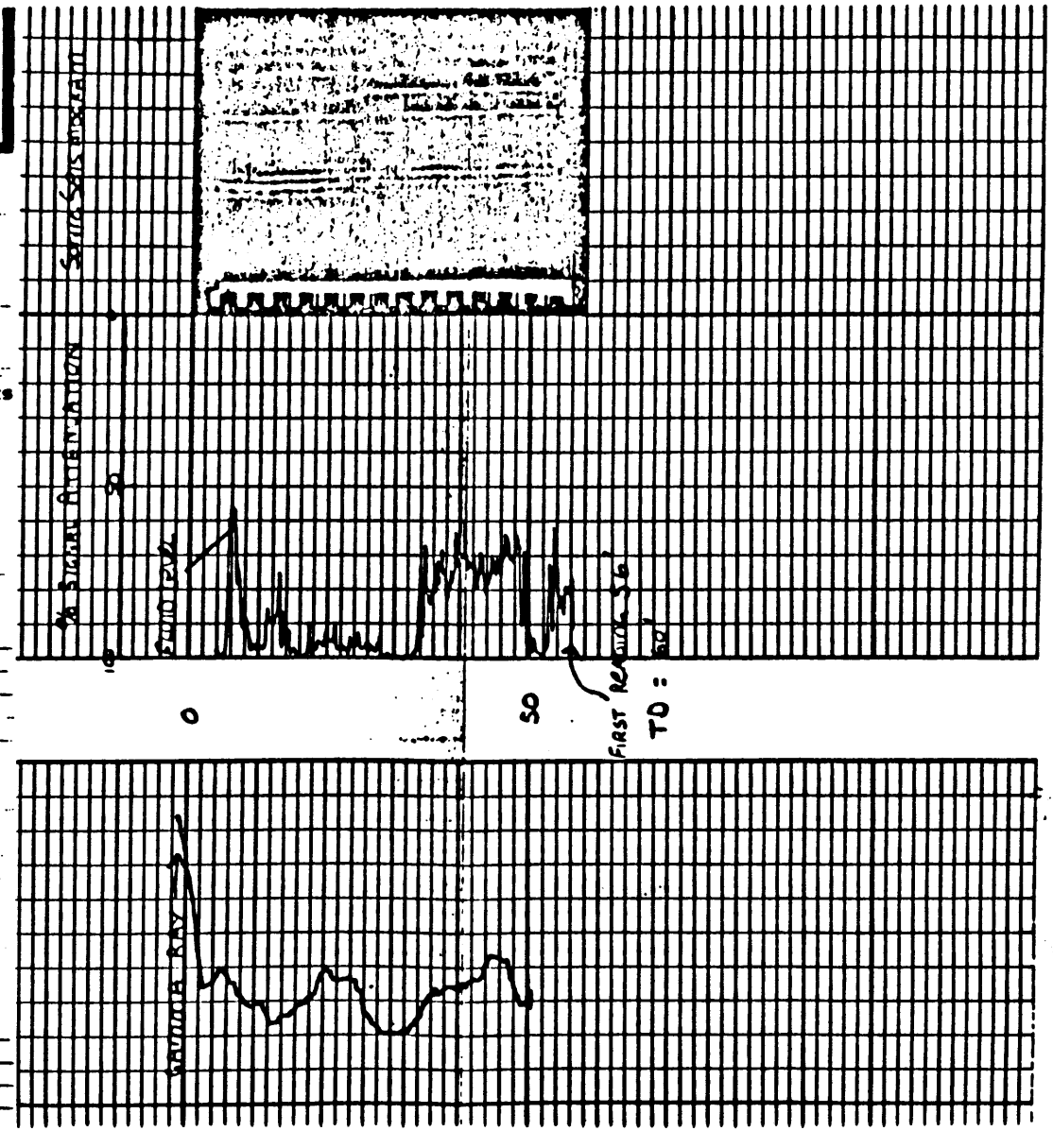
OTHER SERVICES

ELEVATIONS:
KB. 66
DF.
GL.

PERMANENT DATUM ELEV.
LOG MEASURED FROM TOP OF CASING
DRILLING MEASURED FROM

DATE	9-19-86
RUN NO.	one
TYPE LOG	GR-CBL
DEPTH – DRILLER	
DEPTH – LOGGER	
BOTTOM LOGGED INTERVAL	56'
TOP LOGGED INTERVAL	0
TYPE FLUID IN HOLE	TAP WATER
SALINITY PPM CL.	
DENSITY LB./GAL.	
LEVEL	FULL
MAX. REC. TEMP. DEG. F.	
OPR. RIG TIME	
RECORDED BY	BUFFINGTON
WITNESSED BY	DANSBY

RUN NO.	BORE HOLE RECORD BIT	FROM	TO	CASING RECORD SIZE	WGT.	FROM	TO



Star Jet Services

Seismic Display Bond Log

FILING NO.

COMPANY TINKER AIR FORCE BASE

WELL WELL #19

FIELD ---

COUNTY OKLAHOMA STATE OKLAHOMA

LOCATION:

SEC 14 TWP 11N RGE 2W

OTHER SERVICES:

PERMANENT DATUM: GL ELEV. ---

LOG MEASURED FROM GL FT. ABOVE PERM. DATUM

DRILLING MEASURED FROM GL

ELEV.: K.B. ---

D.F. ---

G.L. ---

DATE	9-25-86
RUN NO.	ONE
TYPE LOG	CBL-SSD
DEPTH-DRILLER	---
DEPTH-STAR JET	230
LOGGED INTERVAL	230 TO SURF. TO
OPERATING RIGTIME	CRANE
TYPE FLUID IN HOLE	WATER
SALINITY, PPM CL.	---
DENSITY-VISCOSITY	---
LEVEL	FULL
MAX. REC. TEMP. DEG. F.	---
EQUIPMENT-LOCATION	960 OKC
RECORDED BY	BROWN
WITNESSED BY -	MR. DANSBY

DATE & TIME CEMENTING

AMOUNT & TYPE CEMENT

AMOUNT & TYPE ADMIX

FOLD HERE

THIS HEADING AND LOG CONFORMS TO API RP 33

RE-HOLE RECORD

SIZE	FROM	TO

CASING RECORD

CSG SIZE	WT	FROM	TO
13 7/8	-	SURF.	

CENTRALIZED INTERVAL

SCRATCHED INTERVAL

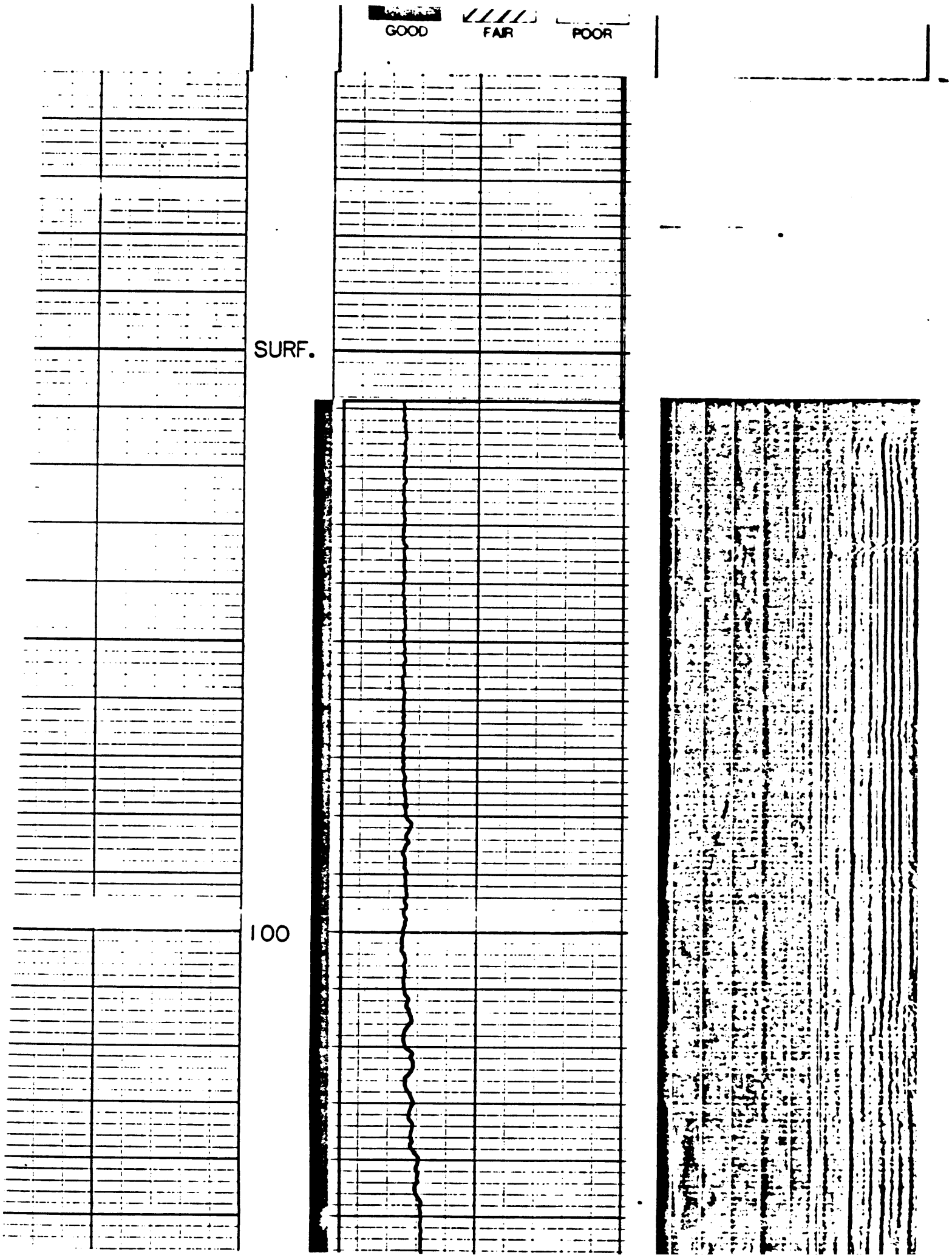
OPEN PERFORATIONS

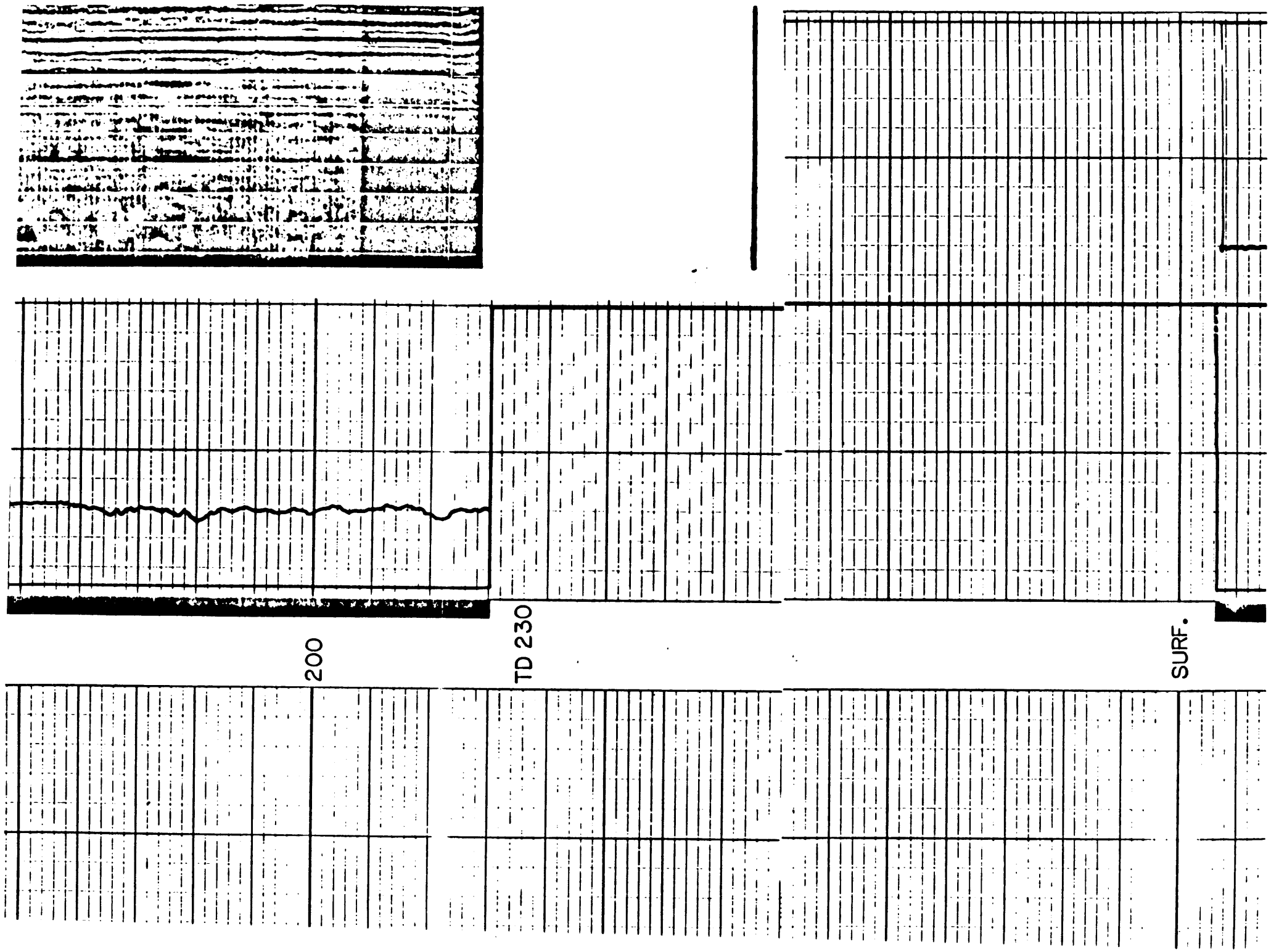
SERVICE TICKET NO

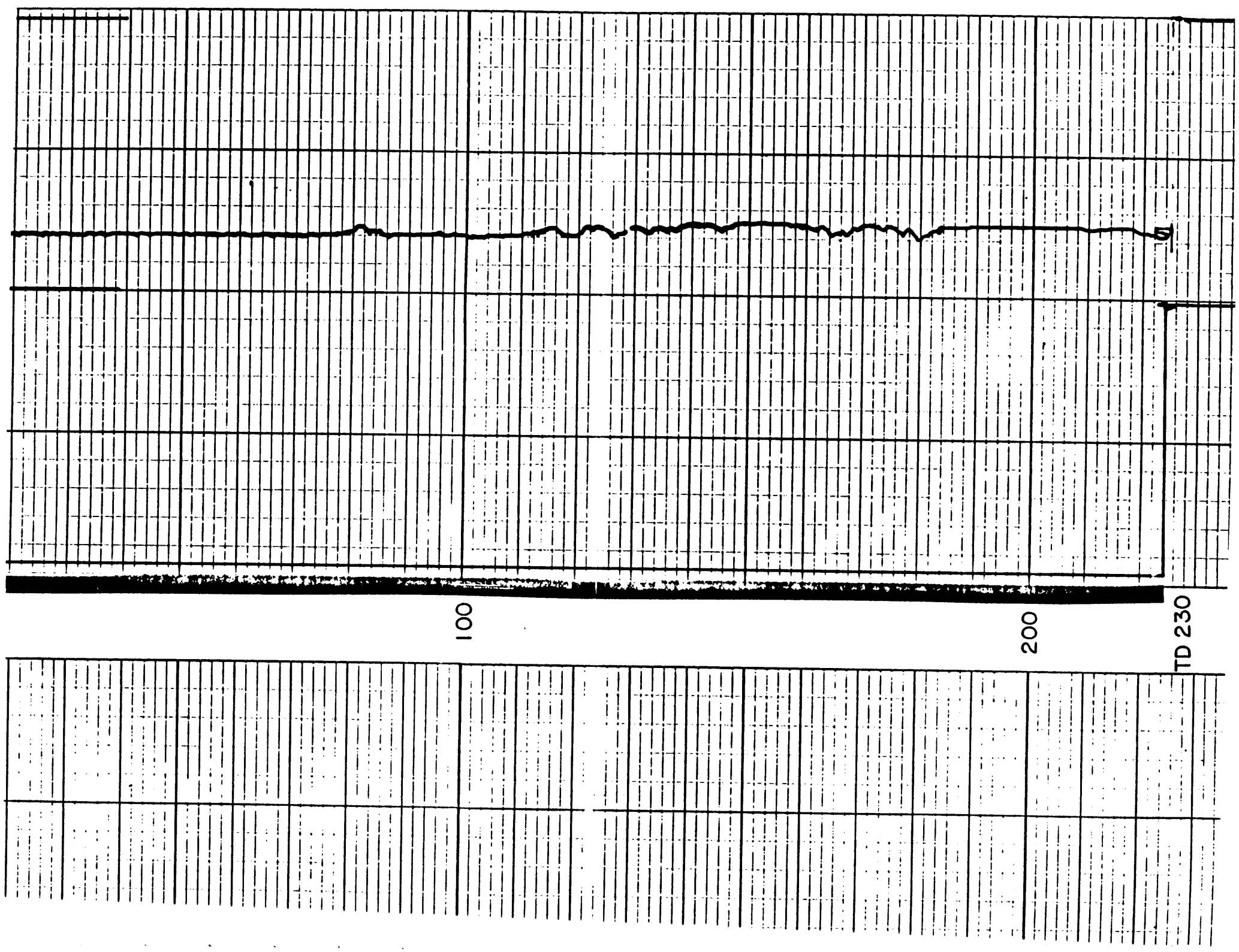
REMARKS

STAR JET does not guarantee the accuracy of any interpretation of log data conversion of log data to physical rock parameters or recommendations which may be given by Star Jet personnel or which may appear on the log or in any other form. Any user of such data interpretations conversions or recommendations agree that Star Jet is not responsible except where due to gross negligence or willful misconduct for any loss damages or expenses resulting from the use thereof.

GAMMA API GAMMA RAY UNITS	DEPTH	AMPLITUDE	SEISMIC SPECTRUM DISPLAY
		PIPE CURVE	MICROSECONDS
		FORMATION CURVE	
		DEGREE OF BONDING	


GOOD
FAIR
POOR
SURF.
100


200
TD 230
SURF.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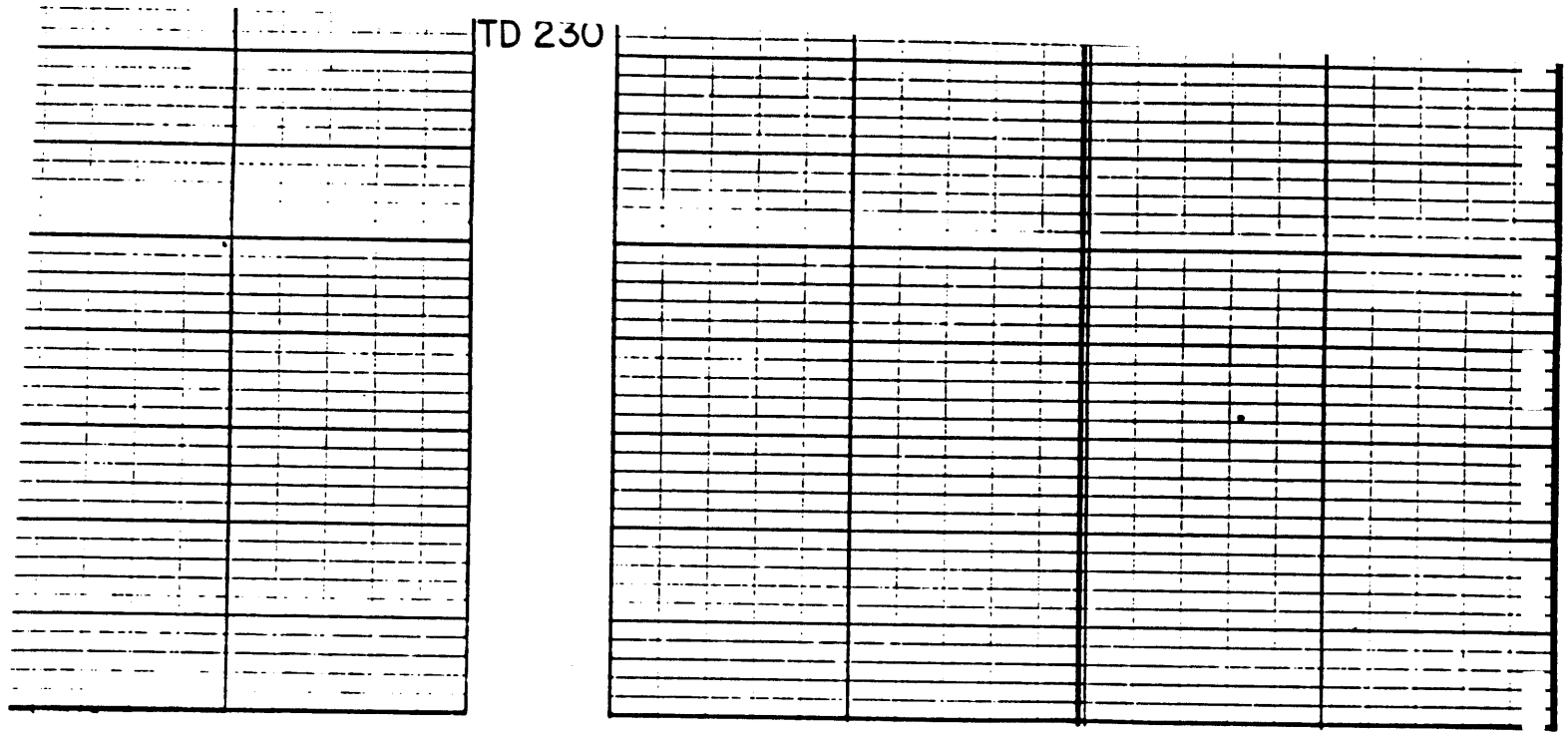
TD 230



Company TINKER AIR FORCE BASE — SJS PD ---

Well WELL # 19 — SJS TD 230

Location ___ SEC 14 TWP 11N RGE 2W — PB TD 230

Field ___ County OKLAHOMA State OKLAHOMA — DRLR TD ---

Equipment Data

GAMMA-RAY: Diameter --- Detector Type ---

Panel Type --- Logging Speed ---

COLLAR LOCATOR: Diameter --- Type ---

CENTRALIZER: Type BOWSPRING O.D min/max 15 1/2 - 4 1/2 # Used TWO

CEMENT BOND: Type Tool SJS Diameter 2" Type Gate FIXED

Transmitter Frequency 30 kh Pulse Rate 20PPS

Tool Spacing 3' Type Receiver SJS Log Speed 30 ft/min

General Data

Date 9-25-85 Casing Size 13-7/8 Casing Weight ---

Centralizers and Scratchers ___

APPENDIX D

ABANDONED PIT INVESTIGATIONS SUMMARY REPORT

INSTALLATION RESTORATION PROGRAM
TINKER AIR FORCE BASE
BUILDING 3001 ABANDONED PIT INVESTIGATION

1. Introduction. A portion of the Installation Restoration Program (IRP) work being conducted by the Tulsa District Corps of Engineers includes an investigation of abandoned solvent pits within Building 3001, south of column-line 81. The purpose of the investigation is to identify any remaining areas which are potentially contaminating the underlying groundwater. The investigation is complete and this report presents the results, recommendations, and investigation procedures.

2. Principal Findings. Twenty-three pits were sampled and tested. The pit locations are shown on plates 1 and 2 of Appendix B. Three pits contained trichloroethene (TCE) contamination (pit numbers MN36, Q51, and U51) and one pit contained a high concentration of 1,1,1-trichloroethane (pit number P75). Several pits contained detectable concentrations of other volatile organics and total metals. A summary of test results and recommended actions is shown in Table 1.

3. Recommendations. It is recommended that the contents from four pits be removed (pit number MN36,P75,Q51, and U51) due to high concentrations of organics and metals which may contribute to groundwater contamination. Other abandoned pits should be left in place since concentration levels of organics and metals are low. Pits MN36, and P75 contain approximately 8 and 4 cubic yards of sand respectively, while pit numbers Q51 and U51 contain approximately 45 and 60 gallons of liquid respectively. These contents should be containerized and disposed of as hazardous waste. Prior to disposal, a sample from each pit should be tested for hazardous waste characteristics.

4. Background Information. Building 3001, is a large industrial-type complex in the eastern portion of Tinker Air Force Base. The building houses numerous maintenance and repair activities for aircraft engines and accessories. Trichloroethene (TCE) and tetrachloroethene were discovered in base water supply wells 18 and 19 during an Air Force monitoring program. The wells, which are located within Building 3001, were taken out of service and have since been plugged. Previous IRP work conducted at the site consisted of Phase I, Phase II-Stage 1, and Phase II-Stage 2 investigations. Several abandoned pits were identified during the Phase II-Stage 2 investigations. During the period of May through August 1985, the Corps of Engineers conducted pit investigations within the area of the building (column-lines 81 and north) that was being restored from fire damage. Within this portion of the building, sixty-four pits were identified and investigated. Of the sixty-four pits, one contained TCE contamination (located near column-line E105) and two others contained high metal concentrations (near column-lines V85 and LM107). The contents of these three pits were taken to a hazardous waste landfill.

5. Field Investigations. Field investigations were initiated during May 1986 to determine the location and contents of any pits within the

building south of column line 81 that may be contamination sources. The investigation consisted of a records search, visual floor inspection, geophysical survey and drilling and sampling program. As-built drawings and past engineering reports were reviewed, and some base personnel were interviewed during the records search. Also, pit locations were determined by visually examining the floor slabs. Areas identified as pits were marked for drilling and sampling.

a. Geophysical Survey. The geophysical survey was made within the building, using a subsurface penetrating radar system. The radar equipment used was a Subsurface Interface Radar (SIR) System consisting of a GSSI Model 4800 Control Unit, a Model SR-8004H Graphic Recorder, and Model 3102 Transducer. Based on reflective features observed on the recorder, possible pits were identified.

b. Drilling and Sampling. Areas identified as potential pits contained either concrete, wood, or metal covers. Wood and metal covers were removed so samples could be collected. Concrete covers were cored into using a 4-inch diameter concrete coring machine. Pit contents consisted of either sand or fluids. Sand samples were collected with either push tubes or drive samplers. Fluids were collected with teflon bailers. Twenty-three pits were sampled. Nineteen pits contained sand and four pits contained fluids. The locations of the pits are shown on plates 1 and 2.

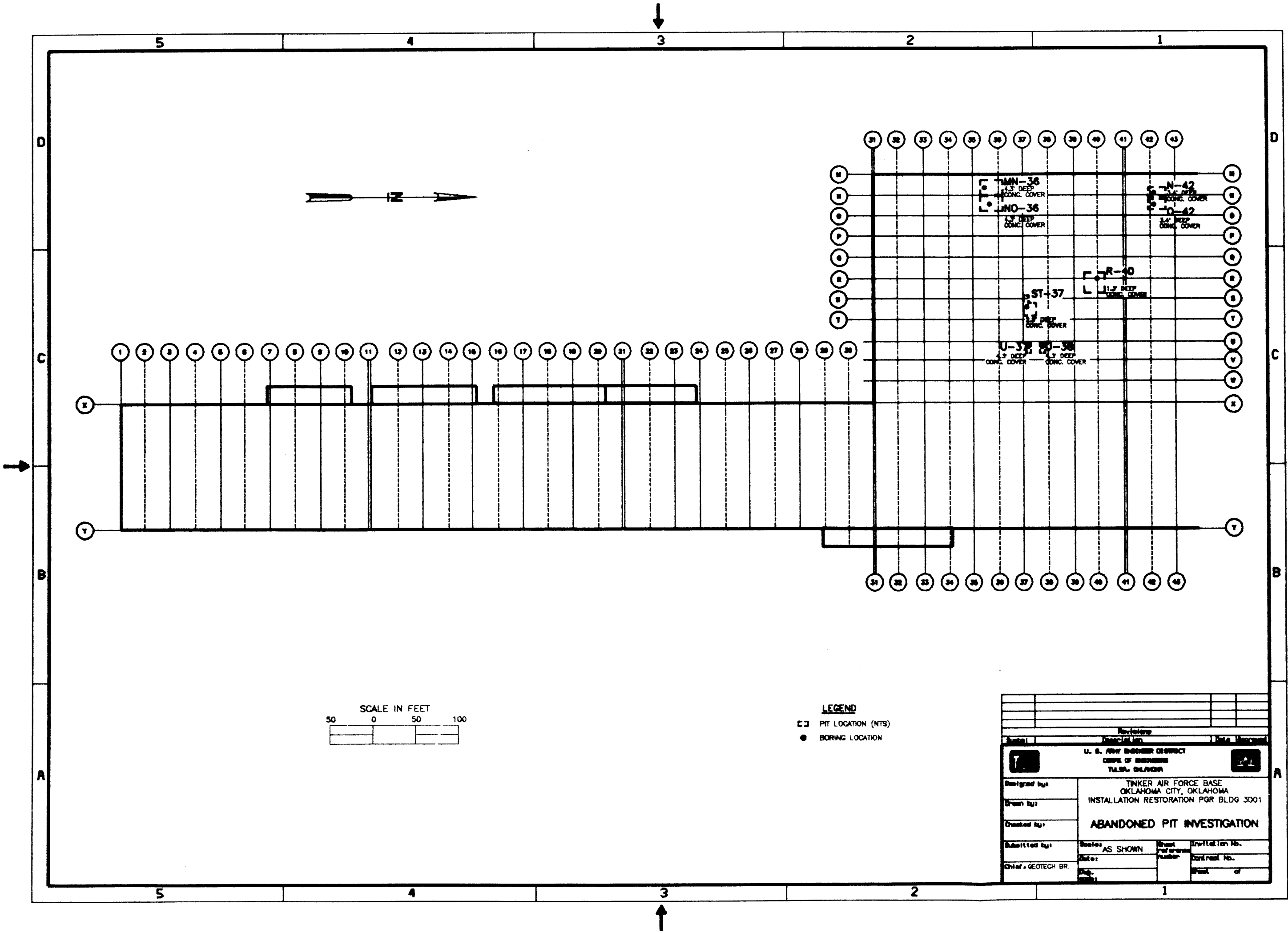
c. Laboratory Testing. Samples of pit contents were tested for volatile organics, total organic carbon, and total metals. A summary of the test results is shown in Table 1. This table lists all volatile organics detected and their concentrations. The metals listed are those which have total concentrations higher than EP Toxicity limits (for soil samples) and those with concentrations exceeding drinking water standards (for liquid samples). The test results and recommendations are discussed in paragraphs 2 and 3 of this report.

TINKER AFB - INSTALLATION RESTORATION PROGRAM
BLDG 3001 PIT INVESTIGATION SUMMARY
TABLE 1

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds & Total Metals Present(ppm)	Recommended Action
N42	5-29-86	Sand	0.5-3.2	.03 Acetone,.007 Methylene Chloride, 6.1 Cr, 18Pb	No Action
042	5-29-86	Sand	0.5-3.4		No Action
J72	5-29-86	Sand	0.6-3.3	.43 Methylene Chloride, 5.6 Cr, 8.3 Pb	No Action
L71	5-29-86	Sand	0.6-2.0	.073 Methylene Chloride	No Action
MN36	6-02-86	Sand	0.6-4.1	1.4 Trichloroethene, 8.4 Cd, 7.9 Pb.	Remove Contents (8CY sand)
NO36	6-02-86	Sand	0.6-4.3	0.16 Methylene Chloride	No Action
ST37	6-02-86	Sand	0.6-2.6	.008 Methylene Chloride	No Action
R40	6-02-86	Sand	0.6-1.3		No Action
R59	6-02-86	Sand	0.6-2.2		No Action
P62	6-02-86	Sand	0.5-0.9	.042 Acetone,.064 Methylene Chloride	No Action
U37	6-02-86	Sand	0.5-4.3	.022 Acetone,.032 Methylene Chloride, 5.6 Pb	No Action
U38	6-02-86	Sand	0.5-4.3	.017 Acetone,.087 Methylene Chloride,	No Action
V59	6-02-86	Sand	0.6-1.7	.039 Acetone,.033 Methylene Chloride,.030 trans -1.2-Dichloroethene	No Action
T61	6-03-86	Sand	0.5-3.2	.042 Acetone,.021 Methylene Chloride, 8Pb	No Action
U62	6-03-86	Sand	0.5-3.5	.031 Acetone,.039 Methylene Chloride	No Action
P75	6-03-86	Sand	0.7-5.4	16, 1,1,1,-Trichloroethane, 24 Xylenes	Remove Contents

TABLE 1 (CONTINUED)

Pit No.	Date Sampled	Pit Contents	Sample Depth (ft)	Summary of Compounds & Total Metals Present(ppm)	Recommended Action
P77	6-03-86	Sand	0.6-2.5	.024 Acetone,.15 Methylene Chloride	No Action
Q77	6-03-86	Sand	0.6-1.8	.08 Methylene Chloride, 280 Ba, 5.5 Cr, 8.9 Pb	No Action
V80	6-03-86	Sand	0.5-5.0	.055 Acetone,.190 Methylene Chloride	No Action
Q51	6-02-86	Liquid	10.0-12.0	42 Trichloroethene, 3.0 Cd, .4 Cr, 22 Pb	Remove Contents (45 gal liquid)
T53W	6-04-86	Liquid	2.0-3.0	.013,1,1,1,-Trichloroethane .029 Tetrachloroethene	No Action (active tank)
T53E	6-04-86	Liquid	2.0-3.0	.17 Cd, 1.5 Cr	No Action (active tank)
U51	6-04-86	Liquid	10.0-12.0	.76 Trichloroethene, .63 Cr, .16 Pb	Remove Contents (60 gal. liquid)



Revisions			
Symbol	Description	Date	Approved

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA

Designed by:	TINKER AIR FORCE BASE OKLAHOMA CITY, OKLAHOMA INSTALLATION RESTORATION PGR BLDG 3001
Drawn by:	
Checked by:	ABANDONED PIT INVESTIGATION
Submitted by:	Scale: AS SHOWN; Sheet reference number; Invitation No.
Chief, GEOTECH BR.	Date: ; Contract No.
	Proj. (code): ; Sheet of

5 4 3 2 1

D C B A

Q-51
12' DEEP IN SUMP
CONC. COVER

P-62
0.9' DEEP
CONC. COVER

R-59
2.2' DEEP
CONC. COVER

T-53-E,T-53-W
3.0' DEEP
METAL COVER

T-61
3.1' DEEP
CONC. COVER

U-51
12' DEEP
WOOD COVER

V-59
1.7' DEEP
CONC. COVER

U-62
3.5' DEEP
CONC. COVER

J-72
1.7' DEEP
CONC. COVER

L-71
2.0' DEEP
CONC. COVER

P-75
3.4' DEEP
CONC. COVER

P-77
5.4' DEEP
CONC. COVER

Q-77
1.8' DEEP
CONC. COVER

V-80
3' DEEP
CONC. COVER

SCALE IN FEET
50 0 50 100

LEGEND

[ ] PIT LOCATION (NTS)

● BORING LOCATION

Revisions		
Symbol	Description	Date Approved

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA

Designed by:	TINKER AIR FORCE BASE OKLAHOMA CITY, OKLAHOMA INSTALLATION RESTORATION PRG BLDG 3001
Drawn by:	
Checked by:	ABANDONED PIT INVESTIGATION
Submitted by:	Scale: AS SHOWN; Sheet reference Number; Invitation No.; Date:; Contract No.; Dwg. code:; Sheet of
Chief, GEOTECH BR	

APPENDIX E

GEOLOGIC LOGS

HOLE NO. 1-1A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 5.5" AG,RB	
2. LOCATION (Coordinates or Station) 155964.50	2186012.40	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-1A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 7 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1204.5	
7. THICKNESS OF OVERBURDEN 8.0		16. DATE HOLE STARTED 03/26/1986	COMPLETED 03/28/1986
8. DEPTH DRILLED INTO ROCK 92.9		17. ELEVATION TOP OF HOLE 1273.3	
9. TOTAL DEPTH OF HOLE 100.9		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR BOWEN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1271.3			SAND (SM) (0.0 – 2.0) MED. TO C. GRAINED, SILTY LOOSE, DAMP, BROWN 0.0–0.5, RED & BLACK WITH GRAVEL 0.5–2.0 (FILL MATERIAL)			AUGERED 0.0–16.0. CLEANED OUT HOLE AND RB TO 100.9. LOGGED HOLE WITH GEO-PHYSICAL TOOLS. ROCK DESCRIPTION BELOW 16.0 BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" WELL. MEASURED WATER LEVEL IN WELL AT 70.9 ON 07/29/86. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE NORMALLY WELL CEMENTED WITH CARBONATE.
1265.3			SILT (ML) (2.0 – 8.0) CLAYEY, LOOSE, DAMP, DARK GREY 2.0–6.0, RED–BROWN 6.0–8.0			
	10		SANDSTONE (SS) (8.0 – 27.0) VERY FINE GRAINED, VERY SOFT, POORLY CEMENTED, RED–BROWN			
	20					
1246.3			SHALE (SH) (27.0 – 34.0) BLOCKY, SOFT, SILTY			
	30					
1239.3			SILTSTONE (SI) (34.0 – 43.0) SOFT, POORLY CEMENTED			
	40					
1230.3			SANDSTONE (SS) (43.0 – 73.0) VERY FINE TO FINE GRAINED, SILTY, VERY SOFT, TO MOD. SOFT POORLY CEMENTED, VERY SILTY OR SHALY ZONES 49.0–55.0, 60.0–62.0, 70.0–71.0			
	50					
	60					
	70					
1200.3			SHALE (SH) (73.0 – 76.0) VERY SILTY, MOD. SOFT			
1197.3			SANDSTONE (SS) (76.0 – 82.0) VERY FINE TO FINE GRAINED, VERY SILTY			
	80					
1191.3			SANDSTONE (SS) (82.0 – 90.0) SHALE INTERBEDED, SOFT TO MOD. SOFT			
1183.3	90		SANDSTONE (SS) (90.0 – 97.0) VERY FINE, SILTY, POORLY CEMENTED, SOFT TO VERY SOFT			
1176.3			SHALE (SH) (97.0 – 100.9) VERY SILTY, MOD. SOFT			
1172.4	100		Bottom of hole 100.9'			

HOLE NO. 1-2A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 6AG,91/2RB	
2. LOCATION (Coordinates or Station) 154048.80 2185798.60		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-2A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4	UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1200.2	
		16. DATE HOLE STARTED 04/16/1986	COMPLETED 04/17/1986
7. THICKNESS OF OVERBURDEN 10.0		17. ELEVATION TOP OF HOLE 1275.7	
8. DEPTH DRILLED INTO ROCK 92.5		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 102.5		19. SIGNATURE OF INSPECTOR BOWEN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1265.7	10		CLAY (CL) (0.0 – 10.0) SILTY, GRAVELLY, MODERATELY STIFF, MOIST, DARK BROWN TO RED BROWN 0.0 TO 4.5'. STIFF, DAMP, RED-BROWN MOTTLED GRAY TO 7.0'. MODERATELY STIFF, DARK GRAY-BROWN TO 10.0			AUGERED 0.0–10.0', ROCK-BIT 10.0–102.5'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. ROCK DESCRIPTION IS BASED ON INTERPRETATION OF GEOPHYSICAL LOGS.
1258.7			SANDSTONE (SS) (10.0 – 17.0) VERY SOFT, SILTY, WEAKLY CEMENTED.			SET 4" PVC WELL. MEASURED WATER LEVEL IN HOLE AT 78.2' ON 29 JULY 1986.
	20		SILTSTONE (ST) (17.0 – 41.0) WITH SANDSTONE INTERBEDS, SOFT WEAKLY CEMENTED, SHALY. VERY SHALY 27.0–29.0'.			NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
	30					
1234.7	40					
1227.7			SHALE (SH) (41.0 – 48.0) SOFT, SILTY, BLOCKY.			
	50		SILTSTONE (ST) (48.0 – 54.0) SOFT, POORLY CEMENTED.			
1221.7						
	60		SANDSTONE (SS) (54.0 – 71.0) FINE GRAINED, SOFT TO VERY SOFT, VERY POORLY CEMENTED TO UNCEMENTED.			
1204.7	70					
1198.7			SHALE (SH) (71.0 – 77.0) SOFT, SILTY, BLOCKY.			
	80		SANDSTONE (SS) (77.0 – 102.5) VERY SILTY, WEAKLY CEMENTED, SOFT TO VERY SOFT. THIN SILTSTONE LENS AT 89.0–90.0'.			
	90					
1173.2	100		BOTTOM OF HOLE AT 102.5'			

HOLE NO. 1-3A

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 51/2AG,RB	
2. LOCATION (Coordinates or Station): 153226.90	2185812.60	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-3A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4	UNDISTURBED 0
5. NAME OF DRILLER: CARROLL		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1198.9	
7. THICKNESS OF OVERBURDEN: 4.1		16. DATE HOLE: STARTED 04/18/1986	COMPLETED 04/22/1986
8. DEPTH DRILLED INTO ROCK: 115.9		17. ELEVATION TOP OF HOLE: 1276.2	
9. TOTAL DEPTH OF HOLE: 120.0		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: BOWEN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1274.7			SILT (ML) (0.0 – 1.5) LOOSE, DAMP, DARK BROWN, ORGANIC MATERIAL.			AUGERED 0.0–10.0', ROCK-BIT 10.0–120.0'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. ROCK DESCRIPTION BELOW 10.0' IS BASED ON INTERPRETATION OF GEO-PHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 79.7 ON 29 JULY 1986. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1272.1			CLAY (CL) (1.5 – 4.1) MEDIUM STIFF, DAMP, RED BROWN MOTTLED WITH WHITE(CALICHE) 3.0–4.1'.			
	10		SANDSTONE (SS) (4.1 – 33.0) VERY FINE GRAINED, SOFT, CLAYEY, WEATHERED, LIGHT RED-BROWN. SILTY 4.0–9.0'; 17.0–20.0'.			
	20					
	30					
1243.2			SHALE (SH) (33.0 – 42.0) VERY SILTY, MODERATELY HARD, THIN SILTSTONE AT 39.0'.			
1234.2	40		SILTSTONE (SI) (42.0 – 53.0) SOFT TO MODERATELY SOFT, POORLY CEMENTED.			
1223.2	50		SANDSTONE (SS) (53.0 – 64.0) FINE GRAINED, SOFT TO MODERATE SOFT, POORLY CEMENTED, VERY SILTY 53.0–60.0'.			
1212.2	60		SILTSTONE (SI) (64.0 – 67.0) SOFT, POORLY CEMENTED.			
1209.2			SANDSTONE (SS) (67.0 – 82.0) FINE TO VERY FINE, SOFT TO VERY SOFT, POORLY CEMENTED.			
	70					
1194.2	80		SHALE (SH) (82.0 – 85.0) BLOCKY, SOFT, SILTY.			
1191.2			SILTSTONE (SI) (85.0 – 88.0) SOFT, POORLY CEMENTED, SHALEY 87.0–88.0'.			
1188.2	90		SANDSTONE (SS) (88.0 – 105.0) FINE GRAINED, SOFT TO VERY SOFT, POORLY CEMENTED.			
1176.2	100					

HOLE NO. 1-3A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 51/2AG,RB	
2. LOCATION (Coordinates or Station) 153226.90 2185812.60		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-3A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 4 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1198.9	
		16. DATE HOLE STARTED 04/18/1986 COMPLETED 04/22/1986	
7. THICKNESS OF OVERBURDEN 4.1		17. ELEVATION TOP OF HOLE 1276.2	
8. DEPTH DRILLED INTO ROCK 115.9		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 120.0		19. SIGNATURE OF INSPECTOR BOWEN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1171.2			SANDSTONE (SS) (88.0 - 105.0) FINE GRAINED, SOFT TO VERY SOFT, POORLY CEMENTED.			
1166.2	110		SILTSTONE (SI) (105.0 - 110.0) SOFT, POORLY CEMENTED.			
1161.2			SHALE (SH) (110.0 - 115.0) WITH SILTY INTERBEDS, SOFT.			
1156.2	120		SILTSTONE (SI) (115.0 - 120.0) SOFT, SANDY, POORLY CEMENTED. BOTTOM OF HOLE			

130
140
150
160
170
180
190
200

HOLE NO. 1-4A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 9 1/2 RB	
2. LOCATION (Coordinates or Station) 152598.80 2185815.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-4A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 9	UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1194.8	
7. THICKNESS OF OVERBURDEN 10.5		16. DATE HOLE STARTED 04/23/1986	COMPLETED 04/25/1986
8. DEPTH DRILLED INTO ROCK 109.5		17. ELEVATION TOP OF HOLE 1275.5	
9. TOTAL DEPTH OF HOLE 120.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1275.5			SILT (ML) (0.0 – 0.7) TOPSOIL, SANDY, LOOSE, DAMP ORGANIC MATERIAL, DK BROWN			AUGERED 0.0–13.0, RB 13.0 TO 12.0. LOGGED HOLE WITH GEOPHYSICAL TOOLS. ROCK DESCRIPTION BELOW 13.0 BASED ON INTERPRETATION OF GEOPHYSICAL LOGS.
1267.5			CLAY (CL) (0.7 – 8.0) STIFF, DAMP, MOTTLED RED–BROWN GRAVELLY – 0.7–1.0			
1265.0	10		SILT (ML) (8.0 – 10.5) CLAYEY, MED. STIFF, DAMP MOTTLED, YELLOW–BROWN, AND LT. GRAY			SET 4"PVC WELL MEASURED WATER LEVEL IN WELL ● 84.1 ON 07/29/86.
1261.5			SHALE (SH) (10.5 – 14.0) SILTY, SOFT, BLOCKY, PARTIALLY WEATHERED, RED–BROWN			
1257.5			SILTSTONE (ST) (14.0 – 18.0) SHALY, SOFT, POORLY CEMENTED			NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
	20		SANDSTONE (SS) (18.0 – 32.0) FINE, TO V. FINE GRAINED, SILTY, POORLY CEMENTED			
	30					
1243.5			SHALE (SH) (32.0 – 37.0) V. SILTY, SOFT			
1238.5			SANDSTONE (SS) (37.0 – 45.0) FINE TO V. FINE, V. SILTY, SOFT, POORLY CEMENTED			
	40					
1230.5			SILTSTONE (ST) (45.0 – 50.0) SHALY INTERBEDS, SOFT, POORLY CEMENTED, FINE GRAINED			
1225.5	50		SANDSTONE (SS) (50.0 – 76.0) SOFT, OCCASIONAL SILTY ZONES			
	60					
	70					
1199.5			SILTSTONE (ST) (76.0 – 79.0) SOFT, SHALY			
1196.5	80		SANDSTONE (SS) (79.0 – 92.0) FINE GRAINED, SOFT, V. SILTY, 87.0–92.0, POORLY CEMENTED			
	90		SILTSTONE (ST) (92.0 – 94.0) SOFT, SHALY, POORLY CEMENTED			
1183.5						
1181.5			SANDSTONE (SS) (94.0 – 98.0) FINE GRAINED, SOFT, WELL CEMENTED			
1177.5			SHALE (SH) (98.0 – 105.0) SILTY, SOFT			
1175.5	100					

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2 RB	
2. LOCATION (Coordinates or Station) 152598.80 2185815.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-4A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 9 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1194.8	
7. THICKNESS OF OVERBURDEN 10.5		16. DATE HOLE STARTED 04/23/1986	COMPLETED 04/25/1986
8. DEPTH DRILLED INTO ROCK 109.5		17. ELEVATION TOP OF HOLE 1275.5	
9. TOTAL DEPTH OF HOLE 120.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1170.5			SHALE (SH) (98.0 - 105.0) SILTY, SOFT			
	110		SANDSTONE (SS) (105.0 - 120.0) FINE TO MED. GRAINED, SOFT POORLY CEMENTED			
1155.5	120		BOTTOM OF HOLE			

HOLE NO. 1-5A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2 RB	
2. LOCATION (Coordinates or Station) 153436.40 2185609.90		11. DATUM FOR ELEVATION SHOWN (GS or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-5A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN DISTURBED 0	UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1197.7	
7. THICKNESS OF OVERBURDEN 5.0		16. DATE HOLE STARTED 04/30/1986	COMPLETED 05/01/1986
8. DEPTH DRILLED INTO ROCK 125.0		17. ELEVATION TOP OF HOLE 1276.1	
9. TOTAL DEPTH OF HOLE 130.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1274.1			CONCRETE			RB 0.0–2.0 THRU CEMENT. AUGERED 2.0–10.0, CLEARED OUT HOLE AND RB 10.0 – 130.0. LOGGED HOLE WITH GEOPHYSICAL TOOLS. SOIL AND ROCK DESCRIPTION BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 82.0 ON 07/29/86. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1271.1			CLAY (CL) (2.0 – 5.0) STIFF, SILTY, SOFT			
1269.1			SHALE (SH) (5.0 – 7.0) SOFT, WEATHERED			
1265.1	10		SILTSTONE (SI) (7.0 – 11.0) SOFT, POORLY CEMENTED			
1251.1	20		SANDSTONE (SS) (11.0 – 25.0) FINE TO V. FINE GRAINED, SOFT TO V. SOFT, POORLY CEMENTED, V. SILTY 21.0–25.0			
1239.1	30		SILTSTONE (SI) (25.0 – 38.0) V. SANDY, SOFT, POORLY CEMENTED			
1228.1	40		SHALE (SH) (38.0 – 46.0) SOFT, SILTY INTERBEDS 43.0 – 46.0.			
1216.1	50		SILTSTONE (SI) (46.0 – 60.0) V. SANDY, SOFT TO V. SOFT			
1209.1	60		SANDSTONE (SS) (60.0 – 67.0) FINE TO V. FINE, SOFT TO V. SOFT, POORLY CEMENTED			
1206.1	70		SILTSTONE (SI) (67.0 – 70.0) V. SHALY, SOFT			
1188.1	80		SANDSTONE (SS) (70.0 – 88.0) FINE TO V. FINE, SOFT TO V. SOFT, POORLY CEMENTED			
1183.1	90		SILTSTONE (SI) (88.0 – 93.0) V. SANDY, SOFT			
1176.1	100		SANDSTONE (SS) (93.0 – 101.0) SOME INTERBEDDED SILTSTONE, SOFT			

DRILLING LOG

DIVISION: SOUTHWEST

INSTALLATION: TINKER

SHEET 2 OF 2 SHEETS

1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	153436.40 2185609.90
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	1-5A
5. NAME OF DRILLER	CARROLL
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	5.0
8. DEPTH DRILLED INTO ROCK	125.0
9. TOTAL DEPTH OF HOLE	130.0
10. SIZE AND TYPE OF BIT	9 1/2 RB
11. DATUM FOR ELEVATION SHOWN (GS or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	1197.7
16. DATE HOLE	STARTED 04/30/1986 COMPLETED 05/01/1986
17. ELEVATION TOP OF HOLE	1276.1
18. TOTAL CORE RECOVERY FOR BORING	0.0 %
19. SIGNATURE OF INSPECTOR	NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1175.1			SANDSTONE (SS) (93.0 - 101.0) SOME INTERBEDDED SILTSTONE,SOFT			
1170.1			SILTSTONE (SI) (101.0 - 106.0) SOFT, SHALY			
1164.1	110		SHALE (SH) (106.0 - 112.0) INTERBEDDED WITH SILTSTONE, SOFT			
1156.1	120		SILTSTONE (SI) (112.0 - 120.0) SOFT, POORLY CEMENTED			
1146.1	130		SANDSTONE (SS) (120.0 - 130.0) FINE, SOFT, POORLY CEMENTED			
			BOTTOM OF HOLE			

HOLE NO. 1-6A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2RB,AG	
2. LOCATION (Coordinates or Station) 152777.10	2185399.20	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-6A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2	UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1195.4	
7. THICKNESS OF OVERBURDEN 2.8		16. DATE HOLE STARTED 04/25/1986	COMPLETED 04/28/1986
8. DEPTH DRILLED INTO ROCK 117.2		17. ELEVATION TOP OF HOLE 1274.7	
9. TOTAL DEPTH OF HOLE 120.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1272.4			CONCRETE			RB 0.0-2.3 THRU CONCRETE. AUGERED 2.3-10.0 AND RB 10.0 TO 120.0. LOGGED HOLE WITH GEOPHYSICAL TOOLS. ROCK DESCRIPTIONS BELOW 5.2 BASED ON GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL ● 83.0 ON 07/29/86. NOTE: SANDSTONES IMMEDIATLEY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1270.1			CLAY (CL) (2.3 - 4.6) GRAVELLY, SLIGHTLY STIFF, LOW PLASTICITY, DAMP, RED-BROWN WITH THIN GRAY LAYERS			
1267.7						
1263.7	10		SHALE (SH) (4.6 - 7.0) SOFT, BLOCKY, WEATHERED, RED-BROWN			
			SILTSTONE (SI) (7.0 - 11.0) SHALY, SOFT			
1257.7			SANDSTONE (SS) (11.0 - 17.0) FINE, SOFT, POORLY CEMENTED			
1253.7	20		SHALE (SH) (17.0 - 21.0) SILTY, SOFT			
1245.7			SILTSTONE (SI) (21.0 - 29.0) SOFT, POORLY CEMENTED, V.SANDY 21.0-23.0			
	30		SANDSTONE (SS) (29.0 - 39.0) FINE GRAINED, SOFT, POORLY CEMENTED, SILTY 29.0-33.0			
1235.7						
	40		SILTSTONE (SI) (39.0 - 52.0) WITH INTERBEDDED SHALE, SOFT.			
	50					
1222.7						
1220.7			SHALE (SH) (52.0 - 54.0) SOFT, SILTY			
			SILTSTONE (SI) (54.0 - 60.0) SHALY, SOFT			
1214.7	60		SANDSTONE (SS) (60.0 - 81.0) FINE GRAINED, SOFT, OCCASIONAL SILTY LAYERS			
	70					
	80					
1193.7						
1189.7			SILTSTONE (SI) (81.0 - 85.0) SHALY, SOFT			
	90		SANDSTONE (SS) (85.0 - 106.0) FINE TO MED., SOFT, POORLY CEMENTED			
1174.7	100					

HOLE NO. 1-6A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS

1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2RB,AG	
2. LOCATION (Coordinates or Station) 152777.10	2185399.20	11. DATUM FOR ELEVATION SHOWN (GS or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-6A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1195.4	
		16. DATE HOLE STARTED 04/25/1986	COMPLETED 04/28/1986
7. THICKNESS OF OVERBURDEN 2.8		17. ELEVATION TOP OF HOLE 1274.7	
8. DEPTH DRILLED INTO ROCK 117.2		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 120.0		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1188.7			SANDSTONE (SS) (85.0 – 106.0) FINE TO MED., SOFT, POORLY CEMENTED			
1156.7	110		SHALE (SH) (106.0 – 118.0) SOFT, V. SILTY, 111.0–116.0			
1154.7	120		SILTSTONE (SI) (118.0 – 120.0) SOFT			
			BOTTOM OF HOLE			

130 140 150 160 170 180 190 200

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT BUILDING 3001 IRP

HOLE NO. 1-6A

HOLE NO. 1-7C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 4 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 154603.00	2184913.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-7C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 10
5. NAME OF DRILLER L. MITCHELL		14. TOTAL NUMBER CORE BOXES 16	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NOT DETERMINED	
7. THICKNESS OF OVERBURDEN 4.0		16. DATE HOLE STARTED 04/10/1987	COMPLETED 04/16/1987
8. DEPTH DRILLED INTO ROCK 146.6		17. ELEVATION TOP OF HOLE 1272.6	
9. TOTAL DEPTH OF HOLE 150.6		18. TOTAL CORE RECOVERY FOR BORING 88.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1268.6	4		SAND (SM) (0.0 – 3.0) GRAVELLY, MEDIUM DENSE, DRY, RED-BROWN.		J-1	ROCKBIT 0.0-20.4'. CORED WITH 4" CORE BARREL 20.4-150.6'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. COMPARED GEOPHYSICAL LOGS WITH CORE TO ESTABLISH GEOPHYSICAL BASE.
1268.6			CLAY (CL) (3.0 – 4.0) STIFF, MEDIUM TO LOW PLASTICITY, DRY, RED-BROWN. GRAVELLY 3.0-3.5'.		J-2	
	8		SANDSTONE (SS) (4.0 – 16.0) FINE, SOFT, HIGHLY WEATHERED, UNCEMENTED, RED-BROWN MOTTLED WITH LIGHT GRAY MATERIAL.		J-3	DID NOT ESTABLISH WATER LEVELS IN HOLE.
	12					DESCRIPTION OF MATERIAL FROM 0.0-10.0' IS FROM HOLE 1-7A.
1256.6	16					CORE LOSSES PULL LENGTH INTERVAL 2 0.2' 30.8-40.0' 5 0.7' 56.5-67.1' 6 2.4' 67.1-76.9' 8 2.7' 85.4-95.6' 9 1.5' 95.6-105.6' 10 1.4' 108.6-112.6' 11 2.3' 115.6-125.6' 12 0.4' 125.6-135.8' 13 2.8' 135.8-145.9' 14 1.2' 145.9-148.0'
			SHALE (SH) (16.0 – 20.4) SOFT, BLOCKY, MINOR SILT.			
1252.2	20		SILTSTONE (SI) (20.4 – 22.3) MODERATE SOFT TO SOFT, POORLY CEMENTED, OCCASIONAL CARBONATE NODULES, RED-BROWN WITH SOME GREEN-GRAY SPOTS. NODULES AT 21.0'.	PULL 1 100%		CORE BOXES 1. 20.4-28.3' 2. 28.3-36.0' 3. 36.0-43.2' 4. 43.2-50.6' 5. 50.6-57.9' 6. 57.9-65.6' 7. 65.6-74.0' 8. 74.0-81.7' 9. 81.7-89.0' 10. 89.0-98.0' 11. 98.0-108.6' 12 108.6-120.0' 13 120.0-128.9' 14 128.9-135.8' 15 135.8-145.9' 16 145.9-150.6'
1250.3			SHALE (SH) (22.3 – 24.3) SOFT, VERY SILTY, RED-BROWN. SILTSTONE 22.9 – 23.6'.			
1248.3	24		SILTSTONE (SI) (24.3 – 25.8) SOFT, POORLY CEMENTED, VERY SHALY, RED-BROWN		CS-1	SAMPLE DEPTH J-1 0.0- 3.0 J-2 3.0- 4.0 J-3 4.0- 5.0 CS-1 24.3- 25.0 CS-2 31.8- 32.6 CS-3 40.6- 41.3 CS-4 41.3- 42.3 CS-5 62.7- 63.6 CS-6 107.4-108.3 CS-7 111.0-111.8 CS-8 126.1-126.9 CS-9 144.8-145.4 CS-10 146.4-147.1
1246.8			SANDSTONE (SS) (25.8 – 32.8) VERY FINE, SOFT, POORLY CEMENTED, SILTY, RED-BROWN. GRADES TO SHALY 27.7 -28.7'. MODERATELY CEMENTED, MODERATE SOFT, 30.5 -32.8'. DIAGONAL FRACTURE AT 31.4'.	RQD= 88.0		
	28			PULL 2 97 %	CS-2	
	32					
1239.8			SILTSTONE (SI) (32.8 – 35.0) MODERATE SOFT, MODERATELY CEMENTED, SOME CARBONATE NODULE CEMENT, AND GREEN-GRAY SPOTS. COARSER NEAR BOTTOM.			
1237.6	36		SANDSTONE (SS) (35.0 – 41.3) SOFT, VERY FINE, SHALY, SOME B BEDDING EVIDENT, RED-BROWN WITH SOME GREEN-GRAY STREAKS FOLLOWING BEDDING.	RQD= 96.0		
1232.6	40			PULL 3		

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 4 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 154603.00 2184913.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-7C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN — DISTURBED 0	UNDISTURBED 10
5. NAME OF DRILLER L. MITCHELL		14. TOTAL NUMBER CORE BOXES 16	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NOT DETERMINED	
		16. DATE HOLE STARTED 04/10/1987	COMPLETED 04/16/1987
7. THICKNESS OF OVERBURDEN 4.0		17. ELEVATION TOP OF HOLE 1272.6	
8. DEPTH DRILLED INTO ROCK 146.6		18. TOTAL CORE RECOVERY FOR BORING 88.0 %	
9. TOTAL DEPTH OF HOLE 150.6		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1231.3			SANDSTONE (SS) (35.0 – 41.3)	PULL 3 100 %	CS-3	
					CS-4	
	44		SHALE (SH) (41.3 – 50.9) SOFT, SILTY, POORLY CEMENTED, INTERBEDDED WITH SILTSTONE 41.3–42.9'. ZONE OF FRACTURES 42.9–43.5'. NODULES AT 45.9' AND 50.5'.	RQD= 95.0		
	48		VERY SILTY 48.2 –50.6'.	PULL 4 100 %		
1221.7						
1219.0	52		SILTSTONE (SI) (50.9 – 53.6) SHALY, SOFT, POORLY CEMENTED, BEDDING EVIDENT, RED–BROWN WITH MINOR GREEN FOLLOWING BEDDING, SOME NODULES.			
	56		SANDSTONE (SS) (53.6 – 67.5) FINE, VERY SOFT, POORLY TO UNCEMENTED, OCCASIONAL SILTY ZONES, RED–BROWN. SOFT BELOW 57.0', FINE TO MEDIUM GRAINED, MINOR CEMENTING, OCCASIONAL FRACTURES.	RQD= 87.0		
				PULL 5 93 %		
	60					
	64		SOME YELLOW SAND IN RED–BROWN AT 65.0'. MEDIUM GRAINED 65.0–67.5'. COARSELY CEMENTED 65.0–67.5'.		CS-5	
				RQD= 56.0		
1205.1						
	68		SILTSTONE (SI) (67.5 – 69.6) MODERATE SOFT, VERY SHALY, WELL COMPACTED, RED–BROWN.	PULL 6 75 %		
1203.0						
	72		SANDSTONE (SS) (69.6 – 107.4) FINE, VERY SOFT TO SOFT, POORLY CEMENTED, YELLOW TO RED–BROWN, NODULAR ZONE 77.8–78.2'.			
	76			RQD= 36.0		
			BECOMES VERY FINE, SILTY, MASSIVE AT 80.0'.	PULL 7 100 %		
1192.6	80			RQD= 87.0		

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 3 OF 4 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 154603.00	2184913.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-7C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN DISTURBED 0	UNDISTURBED 10
5. NAME OF DRILLER L. MITCHELL		14. TOTAL NUMBER CORE BOXES 16	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NOT DETERMINED	
7. THICKNESS OF OVERBURDEN 4.0		16. DATE HOLE STARTED 04/10/1987	COMPLETED 04/16/1987
8. DEPTH DRILLED INTO ROCK 146.6		17. ELEVATION TOP OF HOLE 1272.6	
9. TOTAL DEPTH OF HOLE 150.6		18. TOTAL CORE RECOVERY FOR BORING 88.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SANDSTONE (SS) (69.6 - 107.4) VERY FINE, MODERATE SOFT, SILTY, MASSIVE, RED-BROWN.	PULL 7 100 %		
	84			RQD= 87.0		
			GRADES TO FINE GRAINED AT 86.5'.	PULL 8 73 %		
	88					
	92					
			VERY FINE, MODERATE SOFT, UNCEMENTED, WITH SOME THIN SHALY LAMINA 93.9 -97.6'.	RQD= 57.0		
	96					
			VERY FINE GRAINED 97.6 - 107.4'. CEMENTED, MODERATE HARD 99.9 - 100.2'; 101.4 - 103.4'; 105.6-107.4'.	PULL 9 85 %		
	100					
	104			RQD= 56.0		
1165.2			SHALE (SH) (107.4 - 108.6) VERY SANDY, MODERATE SOFT, APPEARS REWORKED, MOTTLED RED-BROWN, YELLOW AND PURPLE.	PULL 10 86 %	CS-6	
1164.0	108					
			SANDSTONE (SS) (108.6 - 125.9) FINE, MINOR SILT, MODERATE SOFT TO VERY SOFT, POORLY CEMENTED TO UNCEMENTED, RED-BROWN TO YELLOW MOTTLED WITH MINOR GREEN-GRAY. YELLOW 111.0 - 111.8'.		CS-7	
	112					
				RQD= 45.0		
	116			PULL 11 77 %		
			SOME PURPLE AND GREEN-GRAY ZONES 118.0 - 118.8'; 119.4 - 119.6'. VERY FINE GRAINED 118.0 - 120.0'.	RQD= 63.0		
1152.6	120					

DRILLING LOG

DIVISION: SOUTHWEST	INSTALLATION: TINKER	SHEET 4 OF 4 SHEETS	
1. PROJECT: BUILDING 3001 IRP	10. SIZE AND TYPE OF BIT: 4" DIA CB		
2. LOCATION (Coordinates or Station): 154603.00 2184913.00	11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL		
3. DRILLING AGENCY: TULSA DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500		
4. HOLE NO. (As shown on drawing title and file number): 1-7C	13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0	UNDISTURBED 10	
5. NAME OF DRILLER: L. MITCHELL	14. TOTAL NUMBER CORE BOXES: 16		
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: NOT DETERMINED		
7. THICKNESS OF OVERBURDEN: 4.0	16. DATE HOLE: STARTED 04/10/1987	COMPLETED 04/16/1987	
8. DEPTH DRILLED INTO ROCK: 146.6	17. ELEVATION TOP OF HOLE: 1272.6		
9. TOTAL DEPTH OF HOLE: 150.6	18. TOTAL CORE RECOVERY FOR BORING: 88.0 %		
	19. SIGNATURE OF INSPECTOR: C. NARDIN		

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	124		SANDSTONE (SS) (108.6 – 125.9) FINE, MINOR SILT, MODERATE SOFT TO VERY SOFT, POORLY CEMENTED TO UNCEMENTED, RED-BROWN TO YELLOW MOTTLED WITH MINOR GREEN-GRAY. YELLOW 111.0 – 111.8'.	PULL 11 77 % RQD= 83.0		
1146.7						
1143.9	128		SANDSTONE (SS) (125.9 – 128.7) VERY FINE, VERY SHALY, MODERATE SOFT, POORLY CEMENTED, MOTTLED RED-BROWN, PURPLE AND GRAY.	PULL 12 96 %	CS-8	
	132		SANDSTONE (SS) (128.7 – 146.4) FINE, MODERATE SOFT, MINOR CEMENT, SILTY, MASSIVE, RED-BROWN. MOTTLED WITH PURPLE 133.0-133.3'.	RQD= 50.0		
	136		YELLOW 136.6-137.4,139.0-139.1	PULL 13 72 %		
	140		PEBBLY CARBONATE 139.3 -146.4'	RQD= 34.0	CS-9	
1128.2	144		SANDSTONE (SS) (146.4 – 149.6) SOFT, VERY SHALY, MOTTLED PURPLE, RED-BROWN AND GRAY.	PULL 14 74 %	CS-10	
1123.0	148		SANDSTONE (SS) (149.6 – 150.6) FINE, MODERATE SOFT TO SOFT, RED-BROWN.	RQD= 74.0		
1122.0	152		BOTTOM OF HOLE			
	156					
	160					

HOLE NO. 1-BC

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 4 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 155060.10	2184963.80	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-BC		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0	UNDISTURBED 9
5. NAME OF DRILLER L. MITCHELL		14. TOTAL NUMBER CORE BOXES 13	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NOT DETERMINED	
7. THICKNESS OF OVERBURDEN 10.8		16. DATE HOLE STARTED 03/17/1987	COMPLETED 03/19/1987
8. DEPTH DRILLED INTO ROCK 140.2		17. ELEVATION TOP OF HOLE 1273.6	
9. TOTAL DEPTH OF HOLE 151.0		18. TOTAL CORE RECOVERY FOR BORING 67.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1272.1			GRAVEL (GC) (0.0 – 1.5) SANDY, MEDIUM DENSE, MOIST, GRAY TO WHITE (FILL)			AUGERED 0.0–10.8'. CORED WITH 4" DIAMOND 10.8–151.0. LOGGED HOLE WITH GEOPHYSICAL TOOLS. COMPARED GEOPHYSICAL LOGS WITH THE CORE TO ESTABLISH GEOPHYSICAL BASE. DID NOT GET WATER LEVELS IN OPEN HOLE. CORE LOSSES PULL LENGTH INTERVAL 1 3.0' 10.8–17.2' 2 2.8' 17.2–21.0' 3 4.8' 28.8–38.0' 4 3.2' 38.0–48.8' 5 5.9' 48.8–59.9' 6 5.0' 59.9–69.0' 7 1.4' 69.0–71.0' 8 5.3' 72.1–80.1' 9 0.6' 80.1–90.4' 10 0.3' 90.4–99.9' 11 3.0' 99.9–109.9' 12 3.4' 109.9–119.6' 13 1.8' 119.6–129.3' 14 2.2' 129.3–139.0' 15 3.1' 139.0–151.0' SAMPLES CORE BOXES 1. 10.8–23.4' 2. 23.4–33.0' 3. 33.0–45.0' 4. 45.0–57.0' 5. 57.0–72.0' 6. 72.0–84.8' 7. 84.8–92.4' 8. 92.4–99.9' 9. 99.9–109.9' 10. 109.9–121.0' 11. 121.0–129.3' 12. 129.3–139.0' 13. 139.0–149.0' 149.0–151.0' PHOTOGRAPHED BUT NOT BOXED. SAMPLE DEPTH CS-1 14.2– 14.8 CS-2 20.8– 21.7 CS-3 24.6– 25.5 CS-4 37.3– 38.0 CS-5 45.0– 46.0 CS-6 66.3– 67.0 CS-7 71.0– 72.0 CS-8 98.2– 99.0 CS-9 133.9–134.5
	4		SAND (SC) (1.5 – 10.8) VERY FINE, CLAYEY TO SILTY, MEDIUM DENSE, SLIGHTLY MOIST, RED-BROWN.			
1262.8	8					
1259.6	12		SANDSTONE (SS) (10.8 – 14.0) FINE, SOFT, POORLY TO UNCEMENTED, RED-BROWN, POORLY DEFINED CROSSBEDDING.	PULL 1 53 %		
1258.8			SHALE (SH) (14.0 – 14.8) SANDY, SOFT, RED-BROWN, SOME CARBONATE NODULES.		CS-1	
	16		SANDSTONE (SS) (14.8 – 20.8) FINE TO MEDIUM, SOFT, POORLY CEMENTED, RED-BROWN. MINOR CEMENT, MODERATE SOFT 19.9 – 20.8'.	RQD= 1.0		
1252.8	20			PULL 2 75 %		
1249.0	24		SHALE (SH) (20.8 – 24.6) SOFT, BLOCKY, RED-BROWN. DARK RED-BROWN WITH THIN WHITE VEINS, MODERATE SOFT 20.8 – 22.0'. SILTY 22.9 – 23.4'.		CS-2	
	28		SANDSTONE (SS) (24.6 – 36.9) FINE, SOFT TO MODERATE SOFT, POORLY CEMENTED TO MINOR CEMENT, RED-BROWN. SHALE 31.0 – 31.3'. HARD CEMENTED CALICHE ZONE 36.6 – 36.9'.		CS-3	
	32			RQD= 82.0		
				PULL 3 47 %		
1236.7	36		SANDSTONE (SS) (36.9 – 38.0) VERY SHALY, MODERATE HARD, MODERATELY CEMENTED, NODULES, MOTTLED RED-BROWN, GRAY, AND MINOR YELLOW.	RQD= 24.0		
1235.6					CS-4	
1233.6	40		SHALE (SH) (38.0 – 45.0) SOFT, BLOCKY, SOME INTERBEDDED SILTY LAMINA, RED-BROWN WITH MINOR GREEN-GRAY SOME SLICKENSIDES	PULL 4		

DRILLING LOG

DIVISION: SOUTHWEST

INSTALLATION: TINKER

SHEET 2 OF 4 SHEETS

1. PROJECT: BUILDING 3001 IRP
2. LOCATION (Coordinates or Station): 155060.10 2184963.80
3. DRILLING AGENCY: TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number): 1-BC
5. NAME OF DRILLER: L. MITCHELL
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 10.8
8. DEPTH DRILLED INTO ROCK: 140.2
9. TOTAL DEPTH OF HOLE: 151.0
10. SIZE AND TYPE OF BIT: 4" DIA CB
11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0 UNDISTURBED 9
14. TOTAL NUMBER CORE BOXES: 13
15. ELEVATION GROUND WATER: NOT DETERMINED
16. DATE HOLE: STARTED 03/17/1987 COMPLETED 03/19/1987
17. ELEVATION TOP OF HOLE: 1273.6
18. TOTAL CORE RECOVERY FOR BORING: 87.0 %
19. SIGNATURE OF INSPECTOR: C. NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SHALE (SH) (38.0 - 45.0) SOFT, BLOCKY, SOME INTERBEDDED SILTY LAMINA, RED-BROWN WITH MINOR GREEN-GRAY, SOME SLICK-ENSIDES.	PULL 4 70 %		
1228.6	44					
			SILTSTONE (SI) (45.0 - 48.8) VERY SHALY, SOFT, RED-BROWN, SOME SMALL SCALE CROSS BEDDING		CS-5	
1224.8	48			RQD= 68.0		
			SANDSTONE (SS) (48.8 - 69.0) FINE, SILTY, SOFT TO MODERATE SOFT, VERY MINOR CEMENT, RED-BROWN. GRADES FINE TO MEDIUM AT 51.2' WITH SOME SOFT YELLOW ZONES.	PULL 5 46 %		
	52					
	56					
			HARD NODULAR CEMENT 59.6-59.9'	RQD= 1.0		
	60			PULL 6 45 %		
	64					
					CS-6	
	68			RQD= 19.0		
1204.6			SHALE (SH) (69.0 - 73.7) SOFT, BLOCKY, RED-BROWN, APPEARS REWORKED. OLD FRACTURE FILLED WITH SOFT WHITE SILT, HARD, RED IRONSTONE ON FRACTURE EDGE 69.0-72.0'. SLICKENSIDES 72.0-73.7'. MOTTLED YELLOW 73.2 \ 73.7'.	PULL 7 54 %		
	72			RQD= 33.0	CS-7	
1199.9				PULL 8 33 %		
			SANDSTONE (SS) (73.7 - 100.0) FINE, SHALY TO SILTY, SOFT, VERY POORLY CEMENTED, RED-BROWN WITH THIN PARALLEL CEMENTED LAYERS.			
	76					
				RQD= 25.0		
1193.6	80					

DRILLING LOG

DIVISION: SOUTHWEST

INSTALLATION: TINKER

SHEET 3 OF 4 SHEETS

1. PROJECT: BUILDING 3001 IRP
2. LOCATION (Coordinates or Station): 155060.10 2184963.80
3. DRILLING AGENCY: TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number): 1-BC
5. NAME OF DRILLER: L. MITCHELL
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 10.8
8. DEPTH DRILLED INTO ROCK: 140.2
9. TOTAL DEPTH OF HOLE: 151.0
10. SIZE AND TYPE OF BIT: 4" DIA CB
11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0 UNDISTURBED 9
14. TOTAL NUMBER CORE BOXES: 13
15. ELEVATION GROUND WATER: NOT DETERMINED
16. DATE HOLE: STARTED 03/17/1987 COMPLETED 03/19/1987
17. ELEVATION TOP OF HOLE: 1273.6
18. TOTAL CORE RECOVERY FOR BORING: 87.0 %
19. SIGNATURE OF INSPECTOR: C. NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	84		SANDSTONE (SS) (73.7 – 100.0) FINE, SHALY TO SILTY, SOFT, VERY POORLY CEMENTED, RED-BROWN WITH THIN PARALLEL CEMENTED LAYERS.	80.1' PULL 9 94 %		
	88		VERY SHALY 91.7 –92.4'.	RQD= 83.0		
	92		HARD NODULAR CEMENT 96.5–96.8'	PULL 10 96 %		
	96		VERY SHALY IRREGULARLY CEMENTED MOTTLED DARK RED–BROWN, GRAY, AND PURPLE 97.6 – 100.0'.	RQD= 84.0	CS-8	
1173.6	100		SANDSTONE (SS) (100.0 – 151.0) FINE, SILTY, NODULAR CEMENT, MODERATE SOFT, RED–BROWN WITH SOME SOFT UNCEMENTED ZONES.	PULL 11 70 %		
	104					
	108		PARALLEL CEMENTED LAYERS 111.0 – 113.0'. POORLY CEMENTED 113.0–117.7'; 118.1–119.6'.	RQD= 54.0		
	112			PULL 12 64 %		
	116		NODULAR CEMENT 117.7 – 118.1'.			
1153.6	120		MOTTLED YELLOW, DARK RED–BROWN AND RED–BROWN 119.6 – 122.2'.	RQD= 14.0 PULL 13		

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 4 of 4 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 185060.10	2184963.80	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-BC		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0	UNDISTURBED 9
5. NAME OF DRILLER L. MITCHELL		14. TOTAL NUMBER CORE BOXES 13	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NOT DETERMINED	
7. THICKNESS OF OVERBURDEN 10.8		16. DATE HOLE STARTED 03/17/1987	COMPLETED 03/19/1987
8. DEPTH DRILLED INTO ROCK 140.2		17. ELEVATION TOP OF HOLE 1273.6	
9. TOTAL DEPTH OF HOLE 151.0		18. TOTAL CORE RECOVERY FOR BORING 87.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	124		SANDSTONE (SS) (100.0 – 151.0) FINE, SILTY, NODULAR CEMENT, MODERATE SOFT, RED-BROWN WITH SOME SOFT UNCEMENTED ZONES.	119.6'		
				PULL 13 81 %		
			MOTTLED YELLOW, DARK RED-BROWN, AND RED-BROWN 119.6 – 122.2'.			
			SOFT SOME CROSS-BEDDING AND SMALL NODULAR CEMENT. 122.2 – 125.0'.			
	128			RQD= 37.0		
			GRADES TO YELLOW-TAN 129.3–133.0'.			
				PULL 14 77 %		
	132					
			CROSS-BEDDED ZONE OF FINE SILTY YELLOW-TAN CLAY IN DARKER RED-BROWN FINE SANDSTONE 133.0 – 134.5'. MOTTLED GREEN-GRAY AND YELLOW-TAN 134.5 – 135.0'.		CS-9	
	136			RQD= 20.0		
	140		FINE TO MEDIUM GRAINED, ROSE RED SLIGHTLY CEMENTED MODERATELY SOFT 139.0 – 151.0'.	PULL 15 74 %		
	144					
	148					
1122.8			BOTTOM OF HOLE	RQD= 48.0		
	152					
	156					
	160					

HOLE NO. 1-9A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 51/2AG,RB	
2. LOCATION (Coordinates or Station) 155978.20 2184947.20		11. DATUM FOR ELEVATION SHOWN (GS or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-9A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0; UNDISTURBED 0	
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1197.8	
7. THICKNESS OF OVERBURDEN 7.0		16. DATE HOLE STARTED 01/15/1986 COMPLETED 01/05/1986	
8. DEPTH DRILLED INTO ROCK 115.0		17. ELEVATION TOP OF HOLE 1271.2	
9. TOTAL DEPTH OF HOLE 122.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR BOWEN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1264.2			CLAY (CL) (0.0 – 7.0) SOFT, LOW PLASTICITY, SILTY, GRAVELLY 0.0–2.0			AUGERED 0.0–10.0, RB 10.0–122.0. LOGGED HOLE WITH GEOPHYSICAL TOOLS. ROCK & SOIL DESCRIPTIONS BASED ON GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL ● 77.5 ON 07/29/86. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1254.2	10		SANDSTONE (SS) (7.0 – 17.0) FINE, SOFT, POORLY CEMENTED			
1248.2	20		SHALE (SH) (17.0 – 23.0) SOFT, SILTY, V. SILTY 18.0 – 19.0			
1225.2	30 40		SANDSTONE (SS) (23.0 – 46.0) FINE, SOFT TO V. SOFT, POORLY CEMENTED, V. SILTY ZONES 39.0–46.0			
1218.2	50		SILTSTONE (ST) (46.0 – 53.0) SOFT, SOME INTERBEDDED SHALE LAYERS			
1205.2	60		SANDSTONE (SS) (53.0 – 66.0) SOFT, POORLY CEMENTED, SHALY SILTSTONES 57.0–59.0			
1200.2	70		SILTSTONE (ST) (66.0 – 71.0) SOFT, SANDY			
1188.2	80		SANDSTONE (SS) (71.0 – 83.0) FINE, POORLY CEMENTED, SOFT TO V. SOFT, V. SILTY 77.0–83.0			
1182.2			SHALE (SH) (83.0 – 89.0) SOFT, SILTY			
1175.2	90		SANDSTONE (SS) (89.0 – 96.0) FINE, V. SILTY			
1171.2	100		SHALE (SH) (96.0 – 113.0) SOFT, V. SILTY WITH INTER-BEDDED SILTSTONE LAMINAE			

HOLE NO. 1-9A

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER	SHEET 2 of 2 SHEETS
1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 51/2AG,RB	
2. LOCATION (Coordinates or Station): 155978.20 / 2184947.20		11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-9A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0 / UNDISTURBED 0	
5. NAME OF DRILLER: CARROLL		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1197.8	
7. THICKNESS OF OVERBURDEN: 7.0		16. DATE HOLE: STARTED 01/15/1986 / COMPLETED 01/05/1986	
8. DEPTH DRILLED INTO ROCK: 115.0		17. ELEVATION TOP OF HOLE: 1271.2	
9. TOTAL DEPTH OF HOLE: 122.0		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: BOWEN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1158.2	110		SHALE (SH) (96.0 - 113.0) SOFT, V. SILTY WITH INTER-BEDDED SILTSTONE LAMINAE			
1149.2	120		SANDSTONE (SS) (113.0 - 122.0) FINE TO MED., SOFT, POORLY CEMENTED			
	130		BOTTOM OF HOLE			
	140					
	150					
	160					
	170					
	180					
	190					
	200					

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PROJECT: BUILDING 3001 IRP

HOLE NO.: 1-9A

HOLE NO. 1-10C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 6AG,91/2RB	
2. LOCATION (Coordinates or Station) 156324.40 2185389.10		11. DATUM FOR ELEVATION SHOWN (GS or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-10C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0; UNDISTURBED 0	
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1199.5	
7. THICKNESS OF OVERBURDEN 6.0		16. DATE HOLE STARTED 08/07/1986 COMPLETED 08/12/1986	
8. DEPTH DRILLED INTO ROCK 145.3		17. ELEVATION TOP OF HOLE 1268.9	
9. TOTAL DEPTH OF HOLE 151.3		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR FLAMING	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1262.9			SAND (SM) (0.0 – 6.0) FINE TO MEDIUM, BORDERLINE (SC), VERY CLAYEY, LOOSE, MOIST, RED-BROWN, MOTTLED WITH YELLOW 2.0–6.0'.			AUGERED 0.0–10.0, RB TO 10.0–147.0. LOGGED HOLE WITH GEOPHYSICAL TOOLS. ROCK DESCRIPTION BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. DESCRIPTION OF MATERIAL 0.0 – 10.0' IS FROM HOLE 1-10A.
1257.9	10		SANDSTONE (SS) (6.0 – 11.0) FINE TO MED, SILTY, CLAYEY, WEATHERED, RED-BROWN			
1249.9			SILTSTONE (SI) (11.0 – 19.0) SOFT, SANDY, INCREASING SAND FRACTION 13.0–19.0'.			SET 4" PVC WELL. MEASURED WATER LEVEL AT 72.4 ON 1 OCT 1986.
1237.9	20 30		SANDSTONE (SS) (19.0 – 31.0) FINE TO V. FINE, SILTY, SOFT			NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1230.9			SILTSTONE (SI) (31.0 – 38.0) VERY SANDY, SOFT, SOME SANDSTONE INTERBEDS.			
1225.9	40		SHALE (SH) (38.0 – 43.0) VERY SILTY, MODERATE SOFT.			
1219.9			SANDSTONE (SS) (43.0 – 49.0) FINE, SOFT, SILTY			
1214.9	50		SILTSTONE (SI) (49.0 – 54.0) VERY SHALY, MODERATE SOFT, SOME SANDSTONE INTERBEDS.			
1210.9			SANDSTONE (SS) (54.0 – 58.0) FINE, SOFT, SILTY			
1207.9	60		SHALE (SH) (58.0 – 61.0) SILTY, MOD. SOFT			
	70 80 90		SANDSTONE (SS) (61.0 – 94.0) FINE TO MED, SOFT, POORLY CEMENTED, SILTY 68.0–75.0, 81.0–84.0; V. SILTY, MINOR SHALE 90.0–92.0			
1174.9			SILTSTONE (SI) (94.0 – 98.0) VERY SHALY, MODERATE SOFT.			
1170.9			SANDSTONE (SS) (98.0 – 132.0) FINE TO MED., SOFT TO MOD. SOFT.			
1168.9	100					

HOLE NO. 1-10C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS

1. PROJECT	BUILDING 3001 IRP	10. SIZE AND TYPE OF BIT	6AG,91/2RB
2. LOCATION (Coordinates or Station)	156324.40 2185389.10	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
3. DRILLING AGENCY	TULSA DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
4. HOLE NO. (As shown on drawing title and file number)	1-10C	13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER	CARROLL	14. TOTAL NUMBER CORE BOXES	0
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER	1199.5
7. THICKNESS OF OVERBURDEN	6.0	16. DATE HOLE	STARTED 08/07/1986 COMPLETED 08/12/1986
8. DEPTH DRILLED INTO ROCK	145.3	17. ELEVATION TOP OF HOLE	1268.9
9. TOTAL DEPTH OF HOLE	151.3	18. TOTAL CORE RECOVERY FOR BORING	0.0 %
		19. SIGNATURE OF INSPECTOR	FLAMING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SANDSTONE (SS) (98.0 - 132.0) FINE TO MED., SOFT TO MOD. SOFT, SHALEY 100.0-101.0, 103.0-104.0; SILTY 113.0-114.0			
1136.9	130					
			SHALE (SH) (132.0 - 139.0) MOD. SOFT, MINOR SILTY INTERBEDS			
1129.9	140		SANDSTONE (SS) (139.0 - 151.3) FINE TO MED., SOFT TO MED. SOFT, SHALEY, SILTY 139.0-143.0			
1117.6	150		BOTTOM OF HOLE			

HOLE NO. 1-11C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 4 SHEETS

1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	156142.00 2186488.60
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	1-11C
5. NAME OF DRILLER	R. CARROLL
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	7.5
8. DEPTH DRILLED INTO ROCK	146.4
9. TOTAL DEPTH OF HOLE	153.9
10. SIZE AND TYPE OF BIT	4" DIA CB
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 UNDISTURBED 11
14. TOTAL NUMBER CORE BOXES	14
15. ELEVATION GROUND WATER	NOT DETERMINED
16. DATE HOLE	STARTED 03/05/1987 COMPLETED 03/09/1987
17. ELEVATION TOP OF HOLE	1268.2
18. TOTAL CORE RECOVERY FOR BORING	71.0 %
19. SIGNATURE OF INSPECTOR	C. NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1264.7	4		SAND (SM) (0.0 - 3.5) FINE, LOOSE, MOIST, RED-BROWN. BORDERLINE (SC), DARK GRAY-BROWN 2.0-3.5'. FINE TO COARSE 3.0-3.5'.			AUGERED 0.0-13.0', CORED WITH 4" DIAMOND BIT 13.0-153.9'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. COMPARED CORE DESCRIPTIONS TO GEOPHYSICAL LOGS TO GET GEOPHYSICAL BASE. DID NOT ESTABLISH WATER TABLE IN HOLE. DESCRIPTION OF MATERIALS 0.0-7.5' IS FROM LOG 1-11A.
1260.7	8		CLAY (CL) (3.5 - 7.5) MODERATE STIFF, DAMP, DARK BROWN.			
	12		SANDSTONE (SS) (7.5 - 22.0) FINE, VERY SOFT, UNCEMENTED, SHALY, SILTY, RED-BROWN. VERY WEATHERED 7.5-13.0'; WEATHERED 13.0-23.7'. MOTTLED WITH YELLOW AND BLACK 17.0-22.0'.	PULL 1 35.0		
	16					
	20			RQD= 0%		
1246.2				PULL 2 64.0		
	24		SHALE (SH) (22.0 - 26.9) SOFT, BLOCKY, RED-BROWN MOTTLED WITH GREEN-GRAY. VERY SILTY 24.8-26.9'.	RQD= 44.0	CS-1	
1241.3	28		SILTSTONE (SI) (26.9 - 30.7) SOFT, VERY SHALY, RED-BROWN. MOTTLED WITH GREEN-GRAY 26.9-28.1'. INTERBEDDED SHALE 30.1-30.7'.	PULL 3 100.0	CS-2	
1237.5				RQD= 100.0		
	32		SANDSTONE (SS) (30.7 - 44.0) VERY FINE, SOFT, SHALY, VERY SILTY, MINOR CEMENT, SOME CROSS-BEDDING EVIDENT.	PULL 4 60.0	CS-3	
	36					
1228.2	40			RQD= 29.0		

CORE LOSSES

PULL	LENGTH	INTERVAL
1	5.2'	13.0-20.0'
2	2.7'	23.7-27.0'
4	4.0'	30.7-40.9'
5	0.6'	40.9-50.5'
6	4.6'	50.5-60.7'
7	4.3'	60.7-66.0'
8	4.9'	71.6-78.0'
9	4.7'	81.4-91.1'
10	3.7'	91.1-100.8'
11	1.6'	100.8-111.1'
12	1.4'	111.1-121.5'
13	1.0'	121.5-127.4'
15	0.4'	137.0-145.9'
16	1.2'	145.9-153.9'

SAMPLES
CORE BOXES:
1. 13.0-27.8'
2. 27.8-39.0'
3. 39.0-46.7'
4. 46.7-58.8'
5. 58.8-71.6'
6. 71.6-83.4'
7. 83.4-97.0'
8. 97.0-103.5'
9. 103.5-114.0'
10. 114.0-122.1'
11. 122.1-129.6'
12. 129.6-137.0'
13. 137.0-144.8'
14. 144.8-152.8'

152.8-153.9' PHOTOGRAPHED BUT NOT BOXED.

SAMPLE	DEPTH
CS-1	25.8- 26.9
CS-2	26.9- 27.8
CS-3	30.7- 31.7
CS-4	42.0- 42.7
CS-5	50.8- 51.6
CS-6	67.9- 68.8
CS-7	70.2- 71.2
CS-8	102.8-103.5
CS-9	128.9-129.6
CS-10	134.6-135.5
CS-11	138.4-139.4

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 4 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 156142.00 2186488.60		11. DATUM FOR ELEVATION SHOWN (MSL or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-11C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0	UNDISTURBED 11
5. NAME OF DRILLER R. CARROLL		14. TOTAL NUMBER CORE BOXES 14	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NOT DETERMINED	
7. THICKNESS OF OVERBURDEN 7.5		16. DATE HOLE STARTED 03/05/1987	COMPLETED 03/09/1987
8. DEPTH DRILLED INTO ROCK 146.4		17. ELEVATION TOP OF HOLE 1268.2	
9. TOTAL DEPTH OF HOLE 153.9		18. TOTAL CORE RECOVERY FOR BORING 71.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SANDSTONE (SS) (30.7 - 44.0) VERY FINE, SOFT, SHALY, VERY SILTY, MINOR CEMENT, SOME CROSS-BEDDING EVIDENT. MODERATE HARD, CEMENTED WITH SMALL CALCITE NODULES 42.0-44.0'.	PULL 4		
				PULL 5 93.0	CS-4	
1224.2	44		SHALE (SH) (44.0 - 44.3) VERY SANDY, SOFT, RED-BROWN.			
			SANDSTONE (SS) (44.3 - 66.1) FINE TO VERY FINE, SOFT TO VERY SOFT, VERY POORLY CEMENTED, RED-BROWN. NUMEROUS FRACTURES 43.6-50.8'. SHALY 44.3-45.7'.			
	48			RQD= 52.0		
			SHALE LAYER 50.5-51.6'.	PULL 6 54.0	CS-5	
	52		FINE TO MEDIUM GRAINED 51.6-52.1'. SHALE INTERBEDS 52.4-53.4' WITH SOME CARBONATE CEMENT IN THE SANDY INTERBEDS.			
	56					
	60			RQD= 15.0		
				PULL 7 60.0		
	64					
1202.1			SHALE (SH) (66.1 - 67.9) SOFT, BLOCKY. GREEN-GRAY SILTY SEAM 66.2-66.4'. CALCITE			
1200.3	68		NODULES, BROKEN 66.9-67.5'.		CS-6	
			SILTSTONE (SI) (67.9 - 70.2) SOFT, VERY POORLY CEMENTED, MINOR CLAY.			
1198.0			SANDSTONE (SS) (70.2 - 78.3) VERY FINE, SOFT, POORLY CEMENTED, RED-BROWN. NODULAR CEMENT 77.2-78.3'.	RQD= 39.0	CS-7	
	72			PULL 8 50.0		
	76					
1189.9			SANDSTONE (SS) (78.3 - 80.5) INTERBEDDED WITH THIN SHALE LAYERS, MODERATE SOFT, RED-BROWN. SOME CALCITE CEMENT IN SAND LAYERS.	RQD= 15.0		
1188.2	80					

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER	SHEET 3 OF 4 SHEETS
1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 4" DIA CB	
2. LOCATION (Coordinates or Station): 156142.00 / 2186488.60		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-11C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0 / UNDISTURBED 11	
5. NAME OF DRILLER: R. CARROLL		14. TOTAL NUMBER CORE BOXES: 14	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: NOT DETERMINED	
7. THICKNESS OF OVERBURDEN: 7.5		16. DATE HOLE: STARTED 03/05/1987 / COMPLETED 03/09/1987	
8. DEPTH DRILLED INTO ROCK: 146.4		17. ELEVATION TOP OF HOLE: 1268.2	
9. TOTAL DEPTH OF HOLE: 153.9		18. TOTAL CORE RECOVERY FOR BORING: 71.0 %	
		19. SIGNATURE OF INSPECTOR: C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1187.7			SANDSTONE (SS) (78.3 - 80.5) INTERBEDDED WITH THIN SHALE	PULL 8		
			SANDSTONE (SS) (80.5 - 95.6) VERY FINE, SOFT TO MEDIUM SOFT ZONES OF SMALL NODULAR CEMENT, RED-BROWN.	PULL 9 51.0		
	84					
	88					
			SHALY, VERY SOFT 90.5-91.1'.	RQD= 10.0		
	92			PULL 10 61.0		
1172.6	96		SHALE (SH) (95.6 - 96.8) MODERATE SOFT, VERY SANDY, IRREGULARLY CEMENTED, MOTTLED PURPLE, YELLOW-BROWN, AND GREEN-GRAY. (APPEARS REWORKED)			
1171.4			SANDSTONE (SS) (96.8 - 108.8) VERY FINE TO FINE, MODERATE SOFT TO SOFT, ZONES OF SMALL NODULAR CEMENT, YELLOW, IRREGULARLY BEDDED WITH RED-BROWN.	RQD= 31.0		
	100			PULL 11 84.0		
	104				CS-8	
	108		LARGE NODULE 108.6-108.8'.			
1159.4			SHALE (SH) (108.8 - 111.3) SOFT, POORLY BLOCKY, VERY SILTY, POORLY DEFINED LAMINA, RED-BROWN. SILTSTONE 110.4-110.7'	RQD= 65.0		
1156.9	112		SANDSTONE (SS) (111.3 - 127.4) FINE, MODERATE SOFT TO SOFT, POORLY CEMENTED WITH SMALL NODULAR CARBONATE, RED-BROWN.	PULL 12 86.0		
	116					
				RQD= 67.0		
1148.2	120					

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 4 OF 4 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 156142.00	2186488.60	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-11C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0	UNDISTURBED 11
5. NAME OF DRILLER R. CARROLL		14. TOTAL NUMBER CORE BOXES 14	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NOT DETERMINED	
7. THICKNESS OF OVERBURDEN 7.5		16. DATE HOLE STARTED 03/05/1987	COMPLETED 03/09/1987
8. DEPTH DRILLED INTO ROCK 146.4		17. ELEVATION TOP OF HOLE 1268.2	
9. TOTAL DEPTH OF HOLE 153.9		18. TOTAL CORE RECOVERY FOR BORING 71.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SANDSTONE (SS) (111.3 - 127.4) FINE, MODERATE SOFT TO SOFT, POORLY CEMENTED WITH SMALL NODULAR CARBONATE, RED-BROWN. SHALE 121.3-121.5'; 122.1-122.2'.FINE TO MEDIUM SAND-STONE 121.5-122.1',MODERATE SOFT WITH SOME LARGER NODULES OF FINE GRAINED MATERIAL AND CALCITE	PULL 12		
	124			PULL 13 83.0		
1140.8				RQD= 29.0		
	128		SHALE (SH) (127.4 - 136.0) MODERATE SOFT TO SOFT, VERY SILTY, SOME INTERBEDDED CEMENTED ZONES, MOTTLED DARK RED-BROWN AND MARRON WITH RED-BROWN. GREEN-GRAY SILTSTONE 130.4-130.9'.	PULL 14 100.0	CS-9	
	132					
			HARD CARBONATE ZONE 134.6-135.7'.		CS-10	
1132.2	136		SILTSTONE (SI) (136.0 - 140.0) MODERATE SOFT, GREEN-GRAY 136.0-136.5', MOTTLED WITH RED-BROWN 136.5-138.0, YELLOW 138.0-140.0'.	RQD= 99.0		
				PULL 15 95.0	CS-11	
1128.2	140		SANDSTONE (SS) (140.0 - 153.9) VERY FINE, MODERATE SOFT, POORLY CEMENTED, RED-BROWN. SOME SOFT UNCEMENTED ZONES. SHALE LAYERS 148.4-148.7' AND 152.7-152.8'.			
	144			RQD= 76.0		
				PULL 16 85.0		
	148					
	152			RQD= 83.0		
1114.3			BOTTOM OF HOLE			
	156					
	160					

DRILLING LOG

DIVISION: SOUTHWEST

INSTALLATION: TINKER

SHEET 1 OF 2 SHEETS

1. PROJECT: BUILDING 3001 IRP
2. LOCATION (Coordinates or Station): 155902.00 2184500.00
3. DRILLING AGENCY: TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number): 1-12C
5. NAME OF DRILLER: CARROLL
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 7.0
8. DEPTH DRILLED INTO ROCK: 146.0
9. TOTAL DEPTH OF HOLE: 153.0
10. SIZE AND TYPE OF BIT: 91/2RB,AG
11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 1194.7
16. DATE HOLE: STARTED 08/13/1986 COMPLETED 08/15/1986
17. ELEVATION TOP OF HOLE: 1262.8
18. TOTAL CORE RECOVERY FOR BORING: 0.0 %
19. SIGNATURE OF INSPECTOR: NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1260.8			CLAY (CL) (0.0 – 2.0) SOFT, RED-BROWN			AUGERED 0.0–10.0', ROCK-BIT 10.0–153.0' LOGGED HOLE WITH GEOPHYSICAL TOOLS. DESCRIPTION OF ROCK AND SOIL IS BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 71.2' ON 28 OCT. 86. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
			SAND (SM) (2.0 – 7.0) FINE, SOFT, BORDERLINE (SC).			
1255.8			SHALE (SH) (7.0 – 9.0) VERY SOFT, VERY SILTY.			
1253.8	10		SILTSTONE (SI) (9.0 – 13.0) SOFT, SHALY INTERBEDDEDS.			
1249.8			SANDSTONE (SS) (13.0 – 41.0) FINE SOFT TO VERY SOFT, VERY SILTY 31.0–32.0'.			
	20					
	30					
1221.8	40		SILTSTONE (SI) (41.0 – 55.0) SOFT TO MODERATE SOFT, SHALY, GRADES TO SAND 46.0–50.0'.			
	50					
1207.8			SANDSTONE (SS) (55.0 – 96.0) FINE TO MEDIUM GRAINED, MODERATE SOFT TO SOFT, VERY SILTY 80.0–82.0'.			
	60					
	70					
	80					
	90					
1166.8			SILTSTONE (SI) (96.0 – 99.0) MODERATE SOFT, SHALY.			
1163.8			SHALE (SH) (99.0 – 105.0) MODERATE SOFT TO SOFT, SILTY.			
1162.8	100					

DRILLING LOG

DIVISION	SOUTHWEST
INSTALLATION	TINKER
SHEET	2 OF 2 SHEETS
1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	155902.00 2184500.00
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	1-12C
5. NAME OF DRILLER	CARROLL
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	7.0
8. DEPTH DRILLED INTO ROCK	146.0
9. TOTAL DEPTH OF HOLE	153.0
10. SIZE AND TYPE OF BIT	91/2RB,AG
11. DATUM FOR ELEVATION SHOWN (MSL or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	1194.7
16. DATE HOLE	STARTED 08/13/1986 COMPLETED 08/15/1986
17. ELEVATION TOP OF HOLE	1262.8
18. TOTAL CORE RECOVERY FOR BORING	0.0 %
19. SIGNATURE OF INSPECTOR	NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1157.8			SHALE (SH) (99.0 – 105.0) MODERATE SOFT TO SOFT, SILTY.			
1151.8	110		SILTSTONE (SI) (105.0 – 111.0) MODERATE SOFT, VERY SHALY.			
1148.8			SHALE (SH) (111.0 – 114.0) MODERATE SOFT, VERY SILTY.			
	120		SANDSTONE (SS) (114.0 – 137.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, MINOR SILT 128.0–137.0'.			
	130					
1125.8						
1124.8			SHALE (SH) (137.0 – 138.0) MODERATE SOFT, SILTY.			
	140		SANDSTONE (SS) (138.0 – 153.0) FINE TO MEDIUM GRAINED SOFT TO MODERATE SOFT.			
	150					
1109.8			Bottom of Hole 153.0'			
	160					
	170					
	180					
	190					
	200					

HOLE NO. 1-13C

DRILLING LOG

DIVISION	SOUTHWEST
INSTALLATION	TINKER
SHEET	1 OF 2 SHEETS
1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	155095.00 2184500.00
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	1-13C
5. NAME OF DRILLER	CARROLL
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	5.0
8. DEPTH DRILLED INTO ROCK	145.0
9. TOTAL DEPTH OF HOLE	150.0
10. SIZE AND TYPE OF BIT	91/2RB,AG
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	1193.4
16. DATE HOLE	STARTED 08/21/1986 COMPLETED 08/22/1986
17. ELEVATION TOP OF HOLE	1265.3
18. TOTAL CORE RECOVERY FOR BORING	0.0 %
19. SIGNATURE OF INSPECTOR	NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1260.3			CLAY (CL) (0.0 – 5.0) SILTY, SANDY, SOFT, RED-BROWN.			AUGERED 0.0–10.0', ROCK-BIT 10.0–150.0'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. DESCRIPTION OF ROCK AND SOIL MATERIAL IS BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 74.8' ON 10 SEPT. 86. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OF TEN WELL CEMENTED WITH CARBONATE.
1237.3	10 20		SANDSTONE (SS) (5.0 – 28.0) FINE GRAINED, SOFT TO MODERATE SOFT.			
1219.3	30 40		SHALE (SH) (28.0 – 46.0) SOFT TO MODERATE SOFT, SILTY WITH SILTY INTERBEDS AT 31.0–33.0', 35.0–37.0'.			
1208.3	50		SANDSTONE (SS) (46.0 – 57.0) FINE GRAINED, SOFT TO MODERATE SOFT, VERY SILTY AT 46.0' GRADES TO MINOR SILT AT 52.0'.			
1204.3	60		SILTSTONE (SI) (57.0 – 61.0) VERY SHALY, SOFT.			
1195.3	70		SANDSTONE (SS) (61.0 – 70.0) FINE GRAINED, SOFT TO MODERATE SOFT.			
1183.3	80		SILTSTONE (SI) (70.0 – 82.0) SOFT TO MODERATE SOFT, VERY SHALY 70.0–72.0' INTERBEDDED FINE SANDSTONE 72.0–73.0', 77.0–79.0'.			
1180.3			SANDSTONE (SS) (82.0 – 85.0) FINE GRAINED, MODERATE SOFT.			
1173.3	90		SILTSTONE (SI) (85.0 – 92.0) VERY SANDY SOFT, GRADES INTO SANDSTONE AT 92.0'			
1165.3	100		SANDSTONE (SS) (92.0 – 150.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, INCREASING SILT 120.0–126.0', VERY SILTY, MINOR SHALE 126.0–128.0'.			

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 91/2RB,AG	
2. LOCATION (Coordinates or Station): 155095.00 2184500.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-13C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0	UNDISTURBED 0
5. NAME OF DRILLER: CARROLL		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1193.4	
		16. DATE HOLE: STARTED 08/21/1986	COMPLETED 08/22/1986
7. THICKNESS OF OVERBURDEN: 5.0		17. ELEVATION TOP OF HOLE: 1265.3	
8. DEPTH DRILLED INTO ROCK: 145.0		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
9. TOTAL DEPTH OF HOLE: 150.0		19. SIGNATURE OF INSPECTOR: NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	110		SANDSTONE (SS) (92.0 - 150.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, INCREASING SILT 120.0-126.0', VERY SILTY, MINOR SHALE 126.0-128.0'.			
	120					
	130					
	140					
1115.3	150		Bottom of Hole 150.0'			
	160					
	170					
	180					
	190					
	200					

HOLE NO. 1-14C

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 91/2RB,AG	
2. LOCATION (Coordinates or Station): 154420.00 2184506.00		11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-14C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0 / UNDISTURBED 0	
5. NAME OF DRILLER: CARROLL		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1193.5	
7. THICKNESS OF OVERBURDEN: 9.0		16. DATE HOLE: STARTED 08/26/1986 / COMPLETED 08/28/1986	
8. DEPTH DRILLED INTO ROCK: 140.5		17. ELEVATION TOP OF HOLE: 1266.7	
9. TOTAL DEPTH OF HOLE: 149.5		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1260.7			CLAY (CL) (0.0 – 6.0) SOFT, MOIST, RED-BROWN, OCCASIONAL GRAVELS.			AUGER 0.0–10.4', ROCKBIT 10.4–149.5'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. DESCRIPTION OF ROCK MATERIALS BELOW 10.4' IS BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN HOLE AT 76.2' ON 11 SEPT. 86. NOTES: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED BY CARBONATES.
1257.7			SAND (SM) (6.0 – 9.0) LOOSE, MOIST, RED-BROWN.			
1256.7	10		SANDSTONE (SS) (9.0 – 10.0) FINE GRAINED, SOFT, WEATHERED.			
1252.7			SHALE (10.0 – 14.0), SOFT			
1230.7	20 30		SANDSTONE (SS) (14.0 – 36.0) FINE TO VERY FINE GRAINED, SILTY, SOFT, VERY SILTY 19.0–22.0', 30.0–33.0'.			
1214.7	40 50		SHALE (SH) (36.0 – 52.0) SOFT, SILTY.			
	60 70 80 90		SANDSTONE (SS) (52.0 – 118.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 59.0–63.0', 70.0–73.0'.			
1166.7	100					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: BUILDING 3001 IRP

HOLE NO. 1-14C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2RB,AG	
2. LOCATION (Coordinates or Station) 154420.00 2184506.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-14C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1193.5	
7. THICKNESS OF OVERBURDEN 9.0		16. DATE HOLE STARTED 08/26/1986	COMPLETED 08/28/1986
8. DEPTH DRILLED INTO ROCK 140.5		17. ELEVATION TOP OF HOLE 1266.7	
9. TOTAL DEPTH OF HOLE 149.5		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1148.7	110		SANDSTONE (SS) (52.0 - 118.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 59.0-63.0', 70.0-73.0'.			
1145.7	120		SILTSTONE (SI) (118.0 - 121.0) SOFT.			
1139.7			SANDSTONE (SS) (121.0 - 127.0) FINE TO MEDIUM GRAINED, MODERATE SOFT.			
1134.7	130		SILTSTONE (SI) (127.0 - 132.0) INTERBEDDED WITH SHALE, SOFT.			
1124.7	140		SANDSTONE (SS) (132.0 - 142.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, VERY SILTY 137.0-139.0', GRADES TO SHALE AT 142.0'			
1117.2	150		SHALE (SH) (142.0 - 149.5) SOFT TO MODERATE SOFT, SILTY TO VERY SILTY.			
			Bottom of Hole 150.0'			
	160					
	170					
	180					
	190					
	200					

HOLE NO. 1-15C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2RB,AG	
2. LOCATION (Coordinates or Station) 155140.00	2186012.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-15C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1203.1	
7. THICKNESS OF OVERBURDEN 4.0		16. DATE HOLE STARTED 08/27/1986	COMPLETED 08/29/1986
8. DEPTH DRILLED INTO ROCK 146.0		17. ELEVATION TOP OF HOLE 1274.5	
9. TOTAL DEPTH OF HOLE 150.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1270.5			CLAY (CL) (0.0 – 4.0) STIFF, LOW PLASTIC, GRADES TO SHALE AT 4.0'.			AUGERED 0.0–10.0', ROCK-BIT 10.0–15.0'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. DESCRIPTION OF SOIL AND ROCK MATERIAL IS BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 71.4 ON 23 JUNE 1987. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1265.5			SHALE (SH) (4.0 – 9.0) SOFT TO VERY SOFT.			
1245.5	10 20		SANDSTONE (SS) (9.0 – 29.0) FINE TO VERY FINE GRAINED, SOFT, SILTY 25.0–29.0'.			
1235.5	30		SHALE (SH) (29.0 – 39.0) SOFT TO VERY SOFT.			
1205.5	40 50 60		SANDSTONE (SS) (39.0 – 69.0) FINE TO VERY FINE GRAINED, SOFT, SILTY 39.0–50.0', SHALY 58.0–60.0'.			
1202.5	70		SILTSTONE (SI) (69.0 – 72.0) SOFT, SHALY.			
1174.5	80 90 100		SANDSTONE (SS) (72.0 – 113.0) FINE TO MEDIUM GRAINED, SOFT, SILTY 104.0–107.0'.			

HOLE NO. 1-15C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2RB,AG	
2. LOCATION (Coordinates or Station) 155140.00 2186012.00		11. DATUM FOR ELEVATION SHOWN (MSL or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-15C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN DISTURBED 0	UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1203.1	
7. THICKNESS OF OVERBURDEN 4.0		16. DATE HOLE STARTED 08/27/1986	COMPLETED 08/29/1986
8. DEPTH DRILLED INTO ROCK 146.0		17. ELEVATION TOP OF HOLE 1274.5	
9. TOTAL DEPTH OF HOLE 150.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1161.5	110		SANDSTONE (SS) (72.0 - 113.0) FINE TO MEDIUM GRAINED, SOFT, SILTY 104.0-107.0'.			
1152.5	120		SHALE (SH) (113.0 - 122.0) VERY SILTY, SOFT TO MODERATE SOFT.			
1124.5	130 140 150		SANDSTONE (SS) (122.0 - 150.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 131.0-135.0'.			
	160 170 180 190 200		Bottom of Hole 150.0'			

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PROJECT BUILDING 3001 IRP

HOLE NO. 1-15C

HOLE NO. 1-16

DRILLING LOG

DIVISION: SOUTHWEST

INSTALLATION: TINKER

SHEET 1 OF 1 SHEETS

1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	153050.00 2184780.00
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	1-16
5. NAME OF DRILLER	CARROLL
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	5.2
8. DEPTH DRILLED INTO ROCK	19.8
9. TOTAL DEPTH OF HOLE	25.0
10. SIZE AND TYPE OF BIT	5.5 AG
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 4 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	1252.5
16. DATE HOLE	STARTED 11/17/1986 COMPLETED 11/17/1986
17. ELEVATION TOP OF HOLE	1271.0
18. TOTAL CORE RECOVERY FOR BORING	0.0 %
19. SIGNATURE OF INSPECTOR	NARDIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1265.8	4		CLAY (CL) (0.0 – 5.2) STIFF, LOW PLASTICITY, SILTY, SLIGHTY MOIST, BROWN–RED.		J–1	AUGERED 0.0–25.0'. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 21.3' ON 3 DEC 1986. SAMPLE DEPTH J–1 0.0– 5.2 J–2 5.2– 14.7 J–3 14.7– 20.0 J–4 20.0– 25.0
1256.3	8 12		SILTSTONE (SI) (5.2 – 14.7) SOFT, WEATHERED, RED.		J–2	
	16 20		SANDSTONE (SS) (14.7 – 25.0) FINE, SOFT, WEATHERED, RED, MOIST 15.0–16.0' WET 16.0–19.0' MOIST 19.0–25.0' SPECKLED WITH GREEN SHALE AT 20.0'.		J–3	
1246.0	24		BOTTOM OF HOLE		J–4	
	28 32 36 40					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: BUILDING 3001 IRP

HOLE NO. 1-16

HOLE NO. 1-17

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 51/2AG	
2. LOCATION (Coordinates or Station) 153575.00 2184760.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-17		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN DISTURBED 4	UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1256.3	
7. THICKNESS OF OVERBURDEN 3.5		16. DATE HOLE STARTED 11/18/1986	COMPLETED 11/18/1986
8. DEPTH DRILLED INTO ROCK 15.5		17. ELEVATION TOP OF HOLE 1268.0	
9. TOTAL DEPTH OF HOLE 19.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			CLAY (CL) (0.0 - 3.5) SILTY, MEDIUM TO LOW PLASTICITY, SOFT, MOIST, BROWN-RED.		J-1	AUGERED 0.0-19.0'. SET 4"PVC WELL. MEASURED WATER LEVEL IN WELL AT 14.7' ON 3 DECEMBER 1986.
1264.5	2					SAMPLE DEPTH J-1 0.0- 3.5 J-2 3.5- 6.0 J-3 6.0- 11.0 J-4 11.0- 19.0
			SILTSTONE (SI) (3.5 - 6.0) SHALY, RED SPECKLED WITH GREEN SHALE, SLIGHTLY MOIST, WEATHERED.		J-2	
1262.0	6					
			SANDSTONE (SS) (6.0 - 19.0) VERY FINE GRAINED, SLIGHTLY WEATHERED, ORANGE-BROWN, DRY. BECOMES FINE GRAINED, RED, AND WET AT 11.0'.		J-3	
	8					
	10					
	12					
	14				J-4	
	16					
	18					
1249.0			Bottom of Hole			
	20					

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PROJECT BUILDING 3001 IRP

HOLE NO. 1-17

DRILLING LOG

DIVISION	SOUTHWEST
INSTALLATION	TINKER
SHEET	1 OF 1 SHEETS
1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	153685.00 2184917.00
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	1-18
5. NAME OF DRILLER	CARROLL
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	16.0
8. DEPTH DRILLED INTO ROCK	6.5
9. TOTAL DEPTH OF HOLE	22.5
10. SIZE AND TYPE OF BIT	BAG
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	1257.1
16. DATE HOLE	STARTED 10/27/1986 COMPLETED 10/27/1986
17. ELEVATION TOP OF HOLE	1274.7
18. TOTAL CORE RECOVERY FOR BORING	0.0 %
19. SIGNATURE OF INSPECTOR	BOWEN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SILT (ML) (0.0 – 16.0) MEDIUM DENSE, LOW PLASTICITY, CALICHE PRESENT (0.0–6.0'), DRY, RED, BORDERLINE (CL). BECOMES MOIST AT 14.0'.		J-1	AUGERED 0.0–22.5'. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 20.7' ON 3 DECEMBER 1986. SAMPLE DEPTH J-1 0.0– 16.0 J-2 16.0– 22.0
	4					
	8					
	12					
1258.7	16					
			SANDSTONE (SS) (16.0 – 22.5) VERY FINE GRAINED, SOFT, POORLY CEMENTED, WEATHERED, RED, MOIST. BECOMES WET AT 18.0' BOH = 22.5		J-2	
	20					
1252.2						
	24		Bottom of Hole			
	28					
	32					
	36					
	40					

HOLE NO. 19A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS

1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 8AG	
2. LOCATION (Coordinates or Station) 155300.70	2186484.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1250	
4. HOLE NO. (As shown on drawing title and file number)	19A	13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES	0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	1214.4
7. THICKNESS OF OVERBURDEN 8.5		16. DATE HOLE STARTED 06/26/1984	COMPLETED 06/26/1984
8. DEPTH DRILLED INTO ROCK 73.5		17. ELEVATION TOP OF HOLE	1268.4
9. TOTAL DEPTH OF HOLE 82.0		18. TOTAL CORE RECOVERY FOR BORING	0.0 %
		19. SIGNATURE OF INSPECTOR LITTLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1267.5			() (0.0 – 0.9) ASPHALT AND FILL			DESCRIPTION OF MATERIALS 0.0–10.5' FROM WELL 19B. GAMMA LOGGED RADIAN WELL ON 19 FEB.87. DESCRIPTION OF ROCK MATERIAL 10.5–76.5' IS BASED ON INTERPRETATION OF GAMMA LOGS. MEASURED WATER IN RADIAN WELL AT 57.0' ON 29 JULY 1986. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1264.9			CLAY (CL) (0.9 – 3.5) MODERATE SOFT, MOIST, RED–BROWN.			
1261.4			SILT (ML) (3.5 – 7.0) LOOSE, BORDERLINE (CL), DAMP, DARK GRAY, MOTTLED WITH RED–BROWN CLAY LAYERS 5.5–7.0'.			
1259.9	10		SAND (SM) (7.0 – 8.5) FINE GRAINED, LOOSE DAMP, GRAY–BROWN, BORDERLINE (SC).			
			SANDSTONE (SS) (8.5 – 22.0) FINE TO VERY FINE GRAINED, SOFT, SILTY, POORLY CEMENTED, RED–BROWN, VERY SILTY 8.5–15.0'.			
1246.4	20		SHALE (SH) (22.0 – 29.5) SOFT TO VERY SOFT, SILTY.			
1238.9	30		SILTSTONE (SI) (29.5 – 36.0) SOFT, SHALY.			
1232.4			SANDSTONE (SS) (36.0 – 48.0) FINE TO VERY FINE GRAINED, SOFT, SILTY, SHALY 45.0–48.0'.			
1220.4	40		SHALE (SH) (48.0 – 55.0) SOFT TO MODERATE SOFT.			
1213.4	50		SANDSTONE (SS) (55.0 – 67.0) FINE TO VERY FINE GRAINED, SOFT.			
1201.4	60		SILTSTONE (SI) (67.0 – 70.0) SOFT, SHALY.			
1198.4	70		SANDSTONE (SS) (70.0 – 82.0) SOFT TO MODERATE SOFT, FINE GRAINED.			
1186.4	80		Bottom of Hole			
	90					
	100					

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PROJECT BUILDING 3001 IRP | HOLE NO. 19A

HOLE NO. 20A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 8AG	
2. LOCATION (Coordinates or Station) 154427.50	2186489.80	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1250	
4. HOLE NO. (As shown on drawing title and file number) 20A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1208.5	
7. THICKNESS OF OVERBURDEN 11.0		16. DATE HOLE STARTED 06/27/1984	COMPLETED 06/27/1984
8. DEPTH DRILLED INTO ROCK 79.0		17. ELEVATION TOP OF HOLE 1268.6	
9. TOTAL DEPTH OF HOLE 90.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR LITTLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1261.3			CLAY (CL) (0.0 – 7.3) GRAVELLY, SOFT, MOIST, RED-BROWN TO 2.0' STIFF, DAMP, REDDISH-BROWN 2.0' TO 4.0'. MODERATE STIFF TO STIFF, MINOR SAND, DAMP, RED-BROWN TO 7.3'			DESCRIPTION OF MATERIALS 0.0–11.0' FROM WELL 20B. GAMMA LOGGED RADIAN WELL ON 19 FEB.87. DESCRIPTION OF ROCK MATERIAL 11.0–87.8 IS BASED ON INTERPRETATION OF GAMMA LOGS.
1257.6	10		CLAY (CL) (7.3 – 11.0) LOOSE, DAMP, GRAY-BROWN, BORDERLINE (ML).			MEASURED WATER IN RADIAN WELL AT 63.0' ON 29 JULY 1986.
			SHALE (SH) (11.0 – 34.0) SOFT TO VERY SOFT, SILTY, INTERBEDDED SILTSTONES 14.0–34.0'.			NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
	20					
	30					
1234.6			SILTSTONE (SI) (34.0 – 50.0) SOFT, SANDY.			
	40					
1218.6	50		SANDSTONE (SS) (50.0 – 73.0) FINE TO VERY FINE GRAINED, SILTY, SILTSTONE 62.0–64.0'.			
	60					
	70					
1195.6			SILTSTONE (SI) (73.0 – 75.0) SOFT, MINOR SHALE.			
1193.6			SANDSTONE (SS) (75.0 – 81.0) FINE TO VERY FINE GRAINED, SOFT, SILTY.			
1187.6	80		SILTSTONE (SI) (81.0 – 90.0) SANDY, SOFT.			
1178.6	90		Bottom of hole			
	100					

HOLE NO. 21A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 8AG	
2. LOCATION (Coordinates or Station) 153841.10 2186498.50		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1250	
4. HOLE NO. (As shown on drawing title and file number) 21A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1205.2	
		16. DATE HOLE	STARTED 06/27/1984 / COMPLETED 06/27/1984
7. THICKNESS OF OVERBURDEN 8.2		17. ELEVATION TOP OF HOLE 1269.0	
8. DEPTH DRILLED INTO ROCK 81.8		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 90.0		19. SIGNATURE OF INSPECTOR LITTLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1267.5			SAND (SC) (0.0 – 1.5) GRAVELLY, MEDIUM LOOSE, MOIST, MOTTLED RED-BROWN AND BLACK, (FILL).			DESCRIPTION OF MATERIALS 0.0–8.2' IS FROM WELL 19B . GAMMA LOGGED RADIAN WELL ON 19 FEB. 87. DESCRIPTION OF ROCK MATERIAL 8.2–82.8' IS BASED ON INTERPRETATION OF GAMMA LOGS. MEASURED WATER IN RADIAN WELL AT 66.0' ON 29 JULY 1986. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1266.5						
1262.7			CLAY (CL) (1.5 – 2.5) MODERATE SOFT, MINOR SAND, DAMP, RED-BROWN.			
1260.8	10		SILT (ML) (2.5 – 6.3) LOOSE, MOIST, DARK GRAY.			
1256.0			SILT (ML) (6.3 – 8.2) LOOSE, DAMP, MOTTLED GRAY AND BROWN, BORDERLINE (CL). 6.9–8.2' SANDY SOME GRAY CALICHE.			
	20		SHALE (SH) (8.2 – 13.0) SOFT TO VERY SOFT, SILTY.			
1247.0			SANDSTONE (SS) (13.0 – 22.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT, SILTY.			
			SHALE (SH) (22.0 – 30.0) SOFT TO VERY SOFT, VERY SILTY 24.0–26.0'.			
1239.0	30		SILTSTONE (SI) (30.0 – 43.0) SOFT, VERY SANDY 33.0–36.0'.			
	40					
1226.0			SANDSTONE (SS) (43.0 – 62.0) FINE TO VERY FINE GRAINED, SOFT, SILTSTONE 57.0–59.0'.			
	50					
	60					
1207.0			SHALE (SH) (62.0 – 68.0) SOFT, VERY SILTY 62.0–64.0'.			
1201.0			SANDSTONE (SS) (68.0 – 90.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT.			
	70					
	80					
1179.0	90		Bottom of hole			
	100					

HOLE NO. 22A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT BAG	
2. LOCATION (Coordinates or Station) 155259.70 2187384.80		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1250	
4. HOLE NO. (As shown on drawing title and file number) 22A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1223.7	
		16. DATE HOLE STARTED 06/19/1984	COMPLETED 06/19/1984
7. THICKNESS OF OVERBURDEN 9.5		17. ELEVATION TOP OF HOLE 1252.5	
8. DEPTH DRILLED INTO ROCK 47.5		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 57.0		19. SIGNATURE OF INSPECTOR LITTLE	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
1252.1			SILT (ML) (0.0 – 1.0) SANDY, LOOSE, MOIST, DARK RED.			DESCRIPTION OF MATERIALS 0.0–10.0' IS FROM WELL 22B. GAMMA LOGGED RADIAN WELL ON 19 FEB. 87. DESCRIPTION OF ROCK MATERIAL 10.0–56.0' IS BASED ON INTERPRETATION OF GAMMA LOG. MEASURED WATER LEVEL IN RADIAN WELL AT 32.4' ON 29 JULY 1986. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1250.1			CLAY (CL) (1.0 – 6.0) MODERATE SOFT, DAMP, RED–BROWN.			
	10		SHALE (SH) (6.0 – 20.0) BLOCKY, SOFT, MINOR WEATHERING, RED–BROWN, VERY SILTY 9.0–13.0', 16.0–20.0'.			
1236.1	20					
			SANDSTONE (SS) (20.0 – 36.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT.			
	30					
1220.1						
			SILTSTONE (SI) (36.0 – 46.0) SOFT TO MODERATE SOFT, VERY SHALY 36.0–39.0', 42.0–45.0'.			
	40					
1210.1						
			SANDSTONE (SS) (46.0 – 57.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT.			
	50					
1195.5						
	60		Bottom of Hole			
	70					
	80					
	90					
	100					

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PROJECT BUILDING 3001 IRP

HOLE NO. 22A

HOLE NO. 23A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS

1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 8AG	
2. LOCATION (Coordinates or Station): 153935.20	2187392.90	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1250	
4. HOLE NO. (As shown on drawing title and file number): 23A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0	UNDISTURBED 0
5. NAME OF DRILLER: CARROLL		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1211.2	
		16. DATE HOLE: STARTED 06/19/1984	COMPLETED 06/19/1984
7. THICKNESS OF OVERBURDEN: 4.0		17. ELEVATION TOP OF HOLE: 1268.5	
8. DEPTH DRILLED INTO ROCK: 111.0		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
9. TOTAL DEPTH OF HOLE: 115.0		19. SIGNATURE OF INSPECTOR: UTTLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1274.2			SILT (ML) (0.0 – 1.0) SANDY, LOOSE, DAMP, DARK BROWN, ORGANIC MATERIAL, ROOTLETS.			DESCRIPTION OF MATERIALS 0.0–13.0' IS FROM WELL 238. GAMMA LOGGED RADIAN WELL ON 19 FEB. 87. DESCRIPTION OF ROCK MATERIAL 13.0–56.0' IS BASED ON INTERPRETATION OF GAMMA LOG. MEASURED WATER LEVEL IN RADIAN WELL AT 59.0' ON 29 JULY 1986. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
1271.2			SAND (SM) (1.0 – 4.0) VERY FINE, SILTY, LOOSE, DAMP, RED-BROWN.			
	10		SANDSTONE (SS) (4.0 – 26.5) VERY FINE GRAINED, SOFT, SITLY, POORLY CEMENTED, RED-BROWN. SHALY MOTTLED RED-BROWN AND GRAY 7.0–8.0'. VERY SILTY 11.0–17.0'.			
	20					
1248.7			SHALE (SH) (26.5 – 33.0) SOFT.			
	30					
1242.2			SANDSTONE (SS) (33.0 – 39.0) FINE TO VERY FINE GRAINED, SOFT TO MODERATE SOFT.			
1236.2			SHALE (SH) (39.0 – 41.0) SILTY, SOFT.			
1234.2	40		SANDSTONE (SS) (41.0 – 46.0) FINE TO VERY FINE GRAINED, SOFT TO MODERATE SOFT.			
1229.2			SILTSTONE (SI) (46.0 – 49.0) SOFT, SHALY.			
1226.2			SANDSTONE (SS) (49.0 – 84.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, VERY SILTY ZONES AT 63.0–64.0', 79.0–81.0'.			
	50					
	60					
	70					
	80					
1191.2			SILTSTONE (SI) (84.0 – 91.0) SOFT, SANDY.			
1184.2	90		SANDSTONE (SS) (91.0 – 115.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 95.0–97.0'.			
1168.5	100					

DRILLING LOG

DIVISION: SOUTHWEST

INSTALLATION: TINKER

SHEET 2 OF 2 SHEETS

1. PROJECT: BUILDING 3001 IRP
2. LOCATION (Coordinates or Station): 153935.20 2187392.90
3. DRILLING AGENCY: TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number): 23A
5. NAME OF DRILLER: CARROLL
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 10.5
8. DEPTH DRILLED INTO ROCK: 104.5
9. TOTAL DEPTH OF HOLE: 115.0
10. SIZE AND TYPE OF BIT: BAG
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1250
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 1211.2
16. DATE HOLE: STARTED 06/19/1984 COMPLETED 06/19/1984
17. ELEVATION TOP OF HOLE: 1268.5
18. TOTAL CORE RECOVERY FOR BORING: 0.0 %
19. SIGNATURE OF INSPECTOR: UTTLE

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1153.5	110		SANDSTONE (SS) (91.0 – 115.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 95.0–97.0'.			
	120		Bottom of Hole			
	130					
	140					
	150					
	160					
	170					
	180					
	190					
	200					

HOLE NO. 24A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS

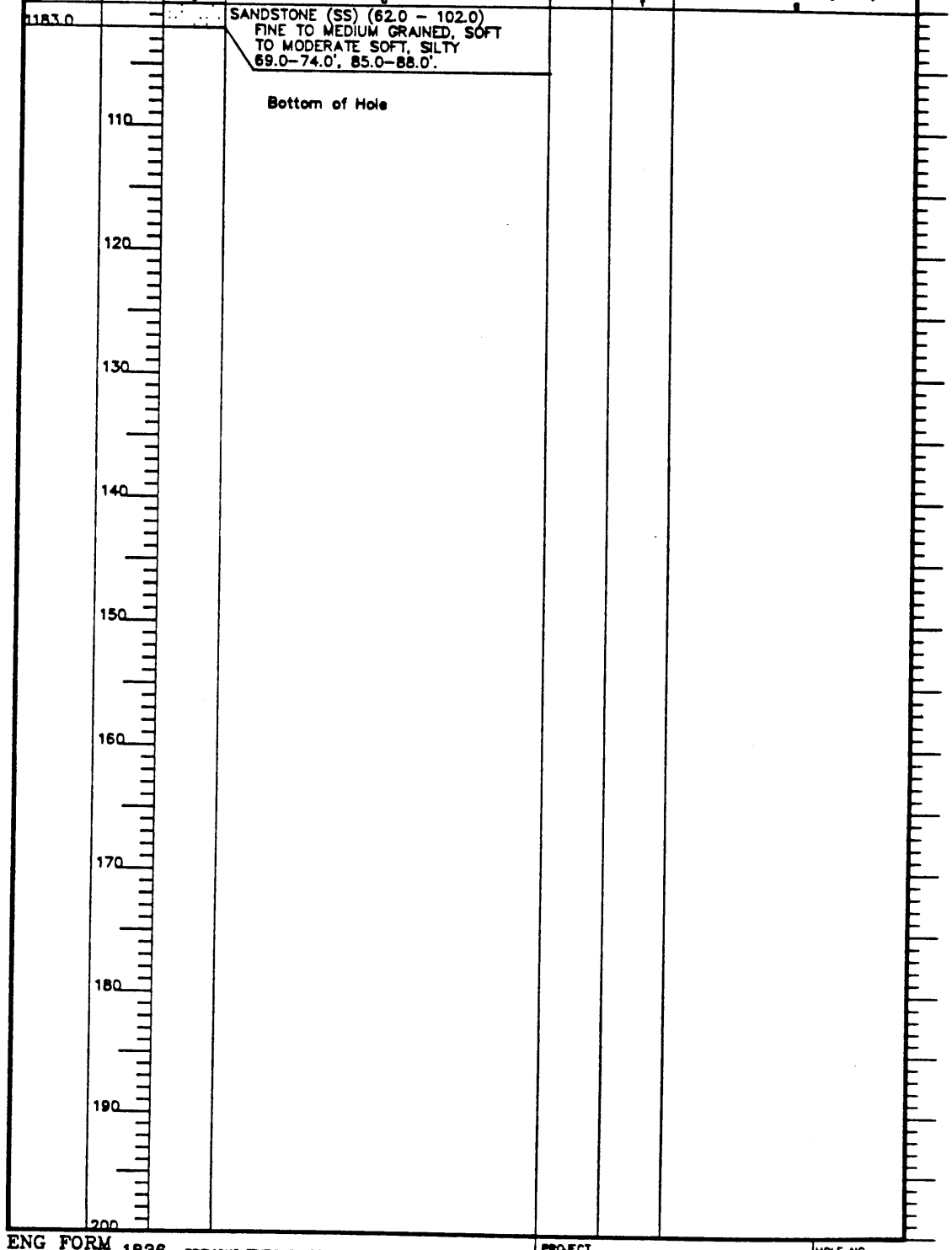
1. PROJECT	BUILDING 3001 IRP	10. SIZE AND TYPE OF BIT	8AG
2. LOCATION (Coordinates or Station)	-153757.90 2187442.70	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
3. DRILLING AGENCY	TULSA DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1250
4. HOLE NO. (As shown on drawing title and file number)	24A	13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 UNDISTURBED 0
5. NAME OF DRILLER	CARROLL	14. TOTAL NUMBER CORE BOXES	0
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER	1211.2
		16. DATE HOLE	STARTED 06/20/1984 COMPLETED 06/20/1984
7. THICKNESS OF OVERBURDEN	7.5	17. ELEVATION TOP OF HOLE	1285.0
8. DEPTH DRILLED INTO ROCK	94.5	18. TOTAL CORE RECOVERY FOR BORING	0.0 %
9. TOTAL DEPTH OF HOLE	102.0	19. SIGNATURE OF INSPECTOR	LITTLE

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1283.0			CLAY (CL) (0.0 – 2.0) MODERATE STIFF, MINOR SAND, DAMP, RED-BROWN AND GRAY.			DESCRIPTION OF MATERIALS 0.0–10.0' IS FROM WELL 24B. GAMMA LOGGED RADIAN WELL ON 19 FEB. 87. DESCRIPTION OF ROCK MATERIAL 10.0–102.6' IS FROM INTERPRETATION OF GAMMA LOG. MEASURED WATER LEVEL IN RADIAN WELL AT 80.9' ON 29 JULY 1986. NOTE: SANDSTONES IMMEDIATELY ABOVE A SHALE ARE OFTEN WELL CEMENTED WITH CARBONATE.
1276.8			SHALE (SH) (2.0 – 8.2) BLOCKY, SOFT, MOTTLED, RED-BROWN WITH MINOR GRAY CALICHE GRAVELS.			
1273.0	10		SANDSTONE (SS) (8.2 – 12.0) FINE, SILTY, SOFT TO VERY SOFT, POORLY CEMENTED, ORANGE-BROWN.			
1261.0	20		SHALE (SH) (12.0 – 24.0) SOFT, SILTY.			
1249.0	30		SANDSTONE (SS) (24.0 – 36.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT, SILTY 30.0–36.0'.			
1238.0	40		SILTSTONE (SI) (36.0 – 47.0) SOFT, MINOR SHALE.			
1227.0	50		SANDSTONE (SS) (47.0 – 58.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT.			
1223.0	60		SILTSTONE (SI) (58.0 – 62.0) SOFT, SHALY.			
	70		SANDSTONE (SS) (62.0 – 102.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 69.0–74.0', 85.0–88.0'.			
	80					
	90					
1185.0	100					

HOLE NO. 24A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT BAG	
2. LOCATION (Coordinates or Station) 153757.90	218442.70	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1250	
4. HOLE NO. (As shown on drawing title and file number) 24A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1211.2	
7. THICKNESS OF OVERBURDEN 7.5		16. DATE HOLE STARTED 06/20/1984	COMPLETED 06/20/1984
8. DEPTH DRILLED INTO ROCK 94.5		17. ELEVATION TOP OF HOLE 1285.0	
9. TOTAL DEPTH OF HOLE 102.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR LITTLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1183.0			SANDSTONE (SS) (62.0 – 102.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 69.0–74.0', 85.0–88.0'.			
			Bottom of Hole			



DRILLING LOG

DIVISION	SOUTHWEST
INSTALLATION	TINKER
SHEET	1 of 2 SHEETS
1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	153429.80 2184940.50
3. DRILLING AGENCY	TULSA DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	25C
5. NAME OF DRILLER	CARROLL
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	11.0
8. DEPTH DRILLED INTO ROCK	138.6
9. TOTAL DEPTH OF HOLE	149.6
10. SIZE AND TYPE OF BIT	91/2RB,AG
11. DATUM FOR ELEVATION SHOWN (GS or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	CME
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	1194.9
16. DATE HOLE	STARTED 08/12/1986 COMPLETED 08/18/1986
17. ELEVATION TOP OF HOLE	1275.0
18. TOTAL CORE RECOVERY FOR BORING	0.0 %
19. SIGNATURE OF INSPECTOR	FLAMING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1284.0	10		CLAY (CL) (0.0 – 11.0) STIFF TO MODERATE STIFF, SILTY, DAMP, RED-BROWN.			AUGERED 0.0–10.0', ROCK-BIT 10.0–149.6'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. DESCRIPTION OF SOIL AND ROCK MATERIAL IS BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 83.0' ON 1 OCT. 86. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
	20		SANDSTONE (SS) (11.0 – 35.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT, VERY SILTY, 11.0–14.0', 29.0–31.0'.			
1240.0	30					
	40		SILTSTONE (SI) (35.0 – 42.0) SOFT, SANDY, MINOR SHALE, 39.0–40.0'.			
1233.0	50		SANDSTONE (SS) (42.0 – 85.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT, VERY SILTY, 42.0–47.0'.			
	60					
	70					
	80					
1190.0			SHALE (SH) (85.0 – 90.0) SOFT TO MODERATE SOFT, SILTY.			
1185.0	90		SANDSTONE (SS) (90.0 – 106.0) FINE TO VERY FINE, SOFT TO MODERATE SOFT, SILTY 90.0–92.0'.			
1175.0	100					

HOLE NO. 25C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2RB,AG	
2. LOCATION (Coordinates or Station) 153429.80 2184940.50		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL CME	
4. HOLE NO. (As shown on drawing title and file number) 25C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1194.9	
		16. DATE HOLE STARTED 08/12/1986	COMPLETED 08/18/1986
7. THICKNESS OF OVERBURDEN 11.0		17. ELEVATION TOP OF HOLE 1275.0	
8. DEPTH DRILLED INTO ROCK 138.6		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 149.6		19. SIGNATURE OF INSPECTOR FLAMING	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1169.0			SANDSTONE (SS) (90.0 – 106.0) FINE TO VERY FINE , SOFT TO MODERATE SOFT, SILTY 90.0–92.0'.			
1161.0	110		SILTSTONE (SI) (106.0 – 114.0) SOFT.			
1157.0			SHALE (SH) (114.0 – 118.0) SOFT, SILTY.			
1139.0	120 130		SANDSTONE (SS) (118.0 – 136.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY. 118.0–120.0' 131.0–133.0'.			
1125.4	140 150		SHALE (SH) (136.0 – 149.6) SOFT TO MODERATE SOFT, SILTY. Bottom of hole			
	160 170 180 190 200					

HOLE NO. 1-26

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT BAG	
2. LOCATION (Coordinates or Station) 156053.00	2185152.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-26		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 6 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1259.2	
		16. DATE HOLE STARTED 10/23/1986	COMPLETED 10/27/1986
7. THICKNESS OF OVERBURDEN 12.0		17. ELEVATION TOP OF HOLE 1272.0	
8. DEPTH DRILLED INTO ROCK 5.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 17.0		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1273.0			CLAY (CL) (0.0 - 3.0) MODERATELY SOFT, MED-LOW PLASTICITY, MOIST, RED, ORGANIC MATERIAL PRESENT		JAR 1	USED HAND AUGER 0.0-10.0'. ENLARGED AND DEEPENED HOLE TO 17.0' WITH 8 INCH AUGER.
1269.0	4		CLAY (CL) (3.0 - 7.0) SOFT, MED PLASTICITY, WET FUEL ODOR, BLACKISH-BROWN		JAR 2	SET 4 INCH PVC WELL. WATER LEVEL TAKEN DAY AFTER HAND AUGERING TO 10.0. (5.1 ON 10/24/86). MEASURED LIQUID LEVEL IN WELL AT 16.6', 0.15' OF FUEL AND WATER LEVEL AT 16.45' ON 24 OCT. 1986. MEASURED LIQUID LEVELS IN WELL ON 23 JUNE 1987 AT FUEL: 15.53 AND WATER: 15.82.
1266.5	8		SAND (SP) (7.0 - 9.5) MED FINE, LOOSE, MOIST, STRONG FUEL ODOR, TAN		JAR 3	
1264.0	12		SAND (SM) (9.5 - 12.0) MED DENSE, FINE GRAINED, MOIST, RED		JAR 4	
1255.0	16		SANDSTONE (SS) (12.0 - 17.0) SILTY, FINE GRAINED, HIGHLY WEATHERED, NON-CEMENTED		JAR 5	
			BOTTOM OF HOLE		JAR 6	
	20					
	24					
	28					
	32					
	36					
	40					

SAMPLE	DEPTH
JAR 1	0.0- 3.0
JAR 2	3.0- 7.0
JAR 3	7.0- 9.5
JAR 4	9.5- 12.0
JAR 5	12.0- 14.0
JAR 6	14.0- 17.0

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PROJECT BUILDING 3001 IRP

HOLE NO. 1-26

HOLE NO. 1-27

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT BAG	
2. LOCATION (Coordinates or Station) 156112.00 2185218.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-27		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 6; UNDISTURBED 0	
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1258.2	
7. THICKNESS OF OVERBURDEN 9.3		16. DATE HOLE STARTED 10/23/1986 COMPLETED 10/24/1986	
8. DEPTH DRILLED INTO ROCK 14.7		17. ELEVATION TOP OF HOLE 1273.0	
9. TOTAL DEPTH OF HOLE 24.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1258.5			CLAY (CL) (0.0 – 1.0) SOFT, MED LOW PLASTICITY, ORGANIC MATERIAL, MOIST, BROWN		JAR 1	HAND AUGER 0.0–10.0'. ENLARGED AND DEEPENED HOLE TO 24.0' WITH 8 INCH AUGER.
					JAR 2	
			SAND (SC) (1.0 – 4.0) SILTY, MED LOOSE, FINE GRAINED MOIST, RED BECOMES SL MOIST @ 2.0; CALICHE PRESENT @ 2.0–4.0		JAR 3	WATER SEEPING (SLOWLY) FROM BORE HOLE WALLS 14.0 AND BELOW.
1272.0	4					SET 4 INCH PVC WELL
			SILT (ML) (4.0 – 8.5) MODERATELY STIFF, LOW PLASTICITY, SL MOIST, WEAK FUEL ODOR, GREY-GREEN		JAR 4	MEASURED WATER IN WELL AT 18.0' ON 7 JAN. 87. WATER HAD SMELL AND OILY FILM.
1267.5	8					
1266.7			SAND (SP) (8.5 – 9.3) MODERATELY FINE, LOOSE, SL MOIST, WEAK FUEL ODOR, TAN		JAR 5	MEASURED LIQUID LEVELS IN WELL ON 23 JUNE 1987 AT FUEL: 16.7 AND WATER: 16.82
			SANDSTONE (SS) (9.3 – 24.0) SILTY, FINE, POORLY CEMENTED, WEATHERED, MOIST, RED			
	12					
	16				JAR 6	
	20					
1249.0	24		BOTTOM OF HOLE			
	28					
	32					
	36					
	40					

SAMPLE	DEPTH
JAR 1	0.0– 1.0
JAR 2	1.0– 2.0
JAR 3	2.0– 4.0
JAR 4	4.0– 8.5
JAR 5	8.5– 9.3
JAR 6	9.3– 24.0

HOLE NO. 1-28A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS

1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 91/2RB,AG	
2. LOCATION (Coordinates or Station): 155855.00 2183786.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-28A		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2	UNDISTURBED 0
5. NAME OF DRILLER: CARROLL		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1196.6	
7. THICKNESS OF OVERBURDEN: 3.0		16. DATE HOLE: STARTED 11/18/1986	COMPLETED 11/20/1986
8. DEPTH DRILLED INTO ROCK: 97.0		17. ELEVATION TOP OF HOLE: 1259.5	
9. TOTAL DEPTH OF HOLE: 100.0		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1256.5			CLAY (CL) (0.0 – 3.0) STIFF, LOW PLASTICITY, SLIGHTY MOIST, RED-BROWN, ORGANIC MATERIAL.		JAR 1	AUGERED 0.0–9.5', ROCKBIT 9.5–100.0' LOGGED HOLE WITH GEOPHYSICAL TOOLS. DESCRIPTION OF ROCK BELOW 9.5' IS BASED ON INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" PVC WELL, MEASURED WATER LEVEL IN WELL AT 1196.6 ON 8 JAN. 87. NOTE: SANDSTONES IMMEDIATELY ABOVE A SHALE ARE OFTEN WELL CEMENTED WITH CARBONATE.
			SHALE (SH) (3.0 – 9.5) SOFT, BLOCKY, WEATHERED, RED SPECKLED WITH GREEN, SANDY AT 6.0' GRADES TO SANDSTONE AT 9.5'.		JAR 2	
1250.0	10		SANDSTONE (SS) (9.5 – 29.0) FINE TO VERY FINE GRAINED, SOFT, VERY SILTY ZONE 23.0–24.5'.			
1230.5	20					
	30		SILTSTONE (SI) (29.0 – 39.0) SOFT, VERY SANDY, 31.5–34.0'.			
1220.5	40		SANDSTONE (SS) (39.0 – 87.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 65.0–66.0'.			
	50					
	60					
	70					
	80					
1172.5						
1170.5	90		SHALE (SH) (87.0 – 89.0) SOFT, VERY SILTY.			
			SILTSTONE (SI) (89.0 – 100.0) SOFT INTERBEDDED SHALE AND SILTSTONE.			
1159.5	100		Bottom of hole			

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PROJECT: BUILDING 3001 IRP

HOLE NO. 1-28A

HOLE NO. 1-29

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 91/2RB	
2. LOCATION (Coordinates or Station) 156293.00	2183884.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-29		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1245.3	
7. THICKNESS OF OVERBURDEN 3.0		16. DATE HOLE STARTED 11/20/1986	COMPLETED 11/20/1986
8. DEPTH DRILLED INTO ROCK 27.0		17. ELEVATION TOP OF HOLE 1257.9	
9. TOTAL DEPTH OF HOLE 30.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		OVERBURDEN AND ROCK NOT LOGGED OR SAMPLED.			ROCKBIT 0.0-30.0' SET 4" PVC WELL. MEASURED WATER LEVEL IN WELL AT 15.6' ON 8 JANUARY 1987.
	4					
	8					
	12					
	16					
	20					
	24					
	28		BOTTOM OF HOLE			
	32					
	36					
	40					

HOLE NO. 1-30

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 4" DIA CB	
2. LOCATION (Coordinates or Station) 156117.70	2185148.40	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-30		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 23 / UNDISTURBED 5
5. NAME OF DRILLER R. CARROLL		14. TOTAL NUMBER CORE BOXES 3	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1256.1 SEE NOTE	
7. THICKNESS OF OVERBURDEN 10.5		16. DATE HOLE STARTED 03/03/1987	COMPLETED 03/03/1987
8. DEPTH DRILLED INTO ROCK 25.3		17. ELEVATION TOP OF HOLE 1272.0	
9. TOTAL DEPTH OF HOLE 35.8		18. TOTAL CORE RECOVERY FOR BORING 95.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1271.0			SILT (ML) (0.0 – 1.0) MEDIUM LOOSE, LOW PLASTICITY, RED, SLIGHTLY MOIST.(BORDER LINE (CL)).	ST-1		PUSHED 3 INCH SHELBY TUBE TO 10.5'. DENISON BARREL 10.5–11.4'. CORED 11.4–35.8'. TOOK JAR SAMPLES FROM SHELBY TUBES AND CORE, SHIPPED IN GLASS JARS FOR CHEMICAL TESTING
1270.0						
	4		SAND (SP) (1.0 – 2.0) MEDIUM TO COARSE GRAINED, MEDIUM DENSE, RED, SLIGHTLY MOIST.	ST-2	J-15 J-16	
			SAND (SC) (2.0 – 8.2) CLAYEY, VERY FINE GRAINED MEDIUM DENSE, GRAY-GREEN, SLIGHTLY MOIST, SLIGHT FUEL ODOR.	ST-3	J-17 J-18	SET 4 INCH PVC WELL MEASURED WATER AND FUEL LEVELS IN THE WELL AT 18.2' AND 16.9' RESPECTIVELY ON 10 MARCH 1987.
				ST-4	J-19 J-20	
1263.8	8					
			SAND (SP) (8.2 – 10.5) MEDIUM GRAINED, SLIGHTLY CLAYEY (BORDERLINE (SC)), MEDIUM DENSE, BROWNISH-TAN 8.2-10.0', RED 10.0-10.5'.	ST-5	J-21	LOGGED HOLE WITH GEOPHYSICAL TOOLS.
1261.5				ST-6	J-22	
	12		SANDSTONE (SS) (10.5 – 15.8) FINE GRAINED, SHALY, SOFT, WEAKLY CEMENTED, WEATHERED, RED.	DT-1 DT J-1 PULL 1 90.0	J-1 J-2	CORE LOSSES PULL LOSS INTERVAL 1 0.6' 11.4–13.0' 3 0.7' 28.8–32.0'
1256.2	16		SHALE (SH) (15.8 – 21.9) SOFT, SILTY, BLOCKY, RED WITH THIN GRAY-GREEN LAYERS.		J-3 J-4	THE REMAINING SHELBY TUBE SAMPLES AND THE DENISON TIN AND JAR SAMPLE DT J-1 WERE NOT SAVED.
	20			PULL 2 100.0	J-5 J-6	CORE BOXES 1 11.4–20.3 2 20.3–28.0' 3 28.0–35.8'
1250.1			SANDSTONE (SS) (21.9 – 28.2) FINE GRAINED, SOFT, POORLY CEMENTED, RED-BROWN, STRONG FUEL ODOR.		J-7 J-8	
	24					
1243.8	28				J-9 J-10	
1243.2			SHALE (SH) (28.2 – 28.8) SILTY, SOFT, BLOCKY, RED-BROWN.	PULL 3 90.0		
	32		SANDSTONE (SS) (28.8 – 35.8) MEDIUM TO FINE GRAINED, MODERATE SOFT, CARBONATE CEMENT, REDDISH-WHITE WITH OCCASIONAL GRAY-GREEN SOFT SILTSTONE LAYERS, MILD FUEL ODOR.		J-11 J-12	
1236.2	36		Bottom of hole		J-13 J-14	
	40					

SAMPLE	DEPTH
J-15	2.0– 2.5
J-16	2.5– 3.0
J-17	5.0– 5.5
J-18	5.5– 6.0
J-19	6.5– 7.0
J-20	7.0– 7.5
J-21	9.0– 9.5
J-22	10.0– 10.5
DT-1	10.5– 11.0
DT J-1	11.0– 11.4
J-1	12.0– 12.5
J-2	12.5– 13.0
J-3	16.6– 17.1
J-4	17.1– 17.6
J-5	19.3– 20.3
J-6	20.3– 20.8
J-7	24.2– 24.7
J-8	24.7– 25.2
J-9	27.2– 27.7
J-10	27.7– 28.2
J-11	31.7– 32.2
J-12	32.5– 33.0
J-13	34.6– 35.1
J-14	35.1– 35.6

HOLE NO. 1-31

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 8" AUGER	
2. LOCATION (Coordinates or Station): 0.00 / 0.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-31		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5	UNDISTURBED 0
5. NAME OF DRILLER: R. CARROLL		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 11.3(4 MAR. 87)	
7. THICKNESS OF OVERBURDEN: 17.0		16. DATE HOLE: STARTED 02/26/87	COMPLETED 02/26/87
8. DEPTH DRILLED INTO ROCK: 3.5		17. ELEVATION TOP OF HOLE: 1271 (SEE NOTE)	
9. TOTAL DEPTH OF HOLE: 20.5		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: C. NARDIN	

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
1270.8			GRASS () (0.0 – 0.2)			AUGER 0.0–20.5'. TOOK JAR SAMPLES. CLEANED OUT HOLE.
1270.5			ASPHALT () (0.2 – 0.5)			
			CLAY (CL) (0.5 – 4.0) SANDY, GRAVEL, MEDIUM STIFF, LOW PLASTICITY, BROWN–RED, (0.5–1.0'), RED (1.0–4.0'), MOIST, BORDERLINE (ML).		J-1	SET 4" PVC WELL. MEASURED WATER AND FUEL LEVELS IN WELL AT 14.24' AND 14.20' RESPECTIVELY ON 10 MARCH 1987.
1267.0	4		SAND (SC) (4.0 – 9.0) VERY FINE GRAINED, LOOSE, GREEN–GRAY, MOIST, SLIGHT FUEL ODOR.		J-2	SAMPLE / DEPTH: J-1 0.5–4.0; J-2 4.0–9.0; J-3 9.0–11.0; J-4 11.0–17.0; J-5 17.0–20.5
1262.0	8		SAND (SC) (9.0 – 11.0) FINE GRAINED, CLAYEY, LOOSE, TAN, MOIST, SLIGHT FUEL ODOR.		J-3	THE ELEVATION FOR THE HOLE WAS PICKED FROM A TWO FOOT CONTOUR MAP.
1260.0	12		SAND (SP) (11.0 – 17.0) FINE, LOOSE, RED, WET, MID FUEL ODOR.		J-4	
1254.0	16		TOP OF ROCK = 17.0'			
			SHALE (SH) (17.0 – 20.5) SANDY, MEDIUM, SOFT, BLOCKY, WEATHERED, RED, SPECKLED WITH GRAY–GREEN SPOTS.		J-5	
1250.5	20		Bottom of hole			
	24					
	28					
	32					
	36					
	40					

HOLE NO. 1-32

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) N. 156003.71 E. 2185291.37		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-32		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 3 / UNDISTURBED 0
5. NAME OF DRILLER R. CARROLL		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 14.7(4 MAR. 87)	
7. THICKNESS OF OVERBURDEN 15.0		16. DATE HOLE STARTED 03/02/87	COMPLETED 03/02/87
8. DEPTH DRILLED INTO ROCK 0.0		17. ELEVATION TOP OF HOLE 1274.0 (SEE NOTE)	
9. TOTAL DEPTH OF HOLE 15.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1272.8			CONCRETE () (0.0 – 1.2)			ROCKBIT THRU CONCRETE AND BASE COURSE. AUGERED 1.2' -15.0'. OBTAINED JAR SAMPLES. SET 2" PVC WELL. MEASURED FUEL LEVEL IN WELL AT 14.7' ON 4 MARCH 1987. NO MEASUREABLE WATER. SAMPLE DEPTH J-1 1.2- 5.0 J-2 5.0- 10.0 J-3 10.0- 15.0 THE HOLE ELEVATION WAS PICKED FROM A TWO FOOT CONTOUR MAP.
1269.0	2 4		SAND (SC) (1.2 – 5.0) CLAYEY, VERY FINE, MEDIUM DENSE, REDDISH-BROWN, SLIGHTY MOIST.		J-1	
1264.0	6 8 10		SAND (SP) (5.0 – 10.0) CLAYEY, FINE GRAINED, MEDIUM DENSE, GRAY-BLACK, MOIST, (5.0-6.0'), WET AT 10.0' MILD ODOR.		J-2	
1259.0	12 14		SAND (SM) (10.0 – 15.0) SILTY, FINE GRAINED, DENSE, TAN-BROWN (10.0'-13.0') RED-BROWN (13.0'-15.0') MOIST, SLIGHT FUEL ODOR.		J-3	
	16 18 20		Bottom of hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT BUILDING 3001 IRP

HOLE NO. 1-32

HOLE NO. 32C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 9RB,10D	
2. LOCATION (Coordinates or Station) 155052.00 2185178.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 32C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER RAINS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1195.1	
7. THICKNESS OF OVERBURDEN 4.4		16. DATE HOLE STARTED 08/05/1985 COMPLETED 08/09/1985	
8. DEPTH DRILLED INTO ROCK 144.6		17. ELEVATION TOP OF HOLE 1276.0	
9. TOTAL DEPTH OF HOLE 149.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR JABARA	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1275.4			CONCRETE			9" RB TO 102.0. SET 104.0 OF 4" CASING TO 102.0 WITH 2.0 STICKUP. 3-5/8 RB TO 149.0. BAILED HOLE. NO DRAW DOWN. W.L. AT 82.8. PUMPED HOLE FOR 20 MINUTES AT 10 G.P.M. NO DRAW DOWN. ESTIMATED W.L. AT 82.8. REAMED HOLE TO 9" TO 149.0. WASHED HOLE. PLACED WELL SCREEN 10' TOTAL W.TH SCREEN @ 142.4 BOTTOM SCREEN - 141.2 TOP SCREEN - 130.2 SAND FILTER TO 102.0 TOP SEAL TO - 94.0
1271.0			CLAY (CL) (0.6 - 5.0) SANDY, RED-BROWN			
	10		SHALE (SH) (5.0 - 22.0) SOFT, RED-BROWN			
1254.0	20					
	30		SANDSTONE (SS) (22.0 - 40.0) SOFT, POORLY CEMENTED, RED-BROWN, SILTY 32.0-36.0'.			
1236.0	40					
1230.0			SHALE (SH) (40.0 - 46.0) SOFT, RED-BROWN, SILTY 40.0-42.0'.			
	50		SANDSTONE (SS) (46.0 - 71.0) SOFT, RED-BROWN, SILTY 46.0-50.0'. MINOR SILTY ZONES 55.0-57.0'; 60.0-62.0'.			
	60					
1205.0	70					
1202.0			SHALE (SH) (71.0 - 74.0)			
			SANDSTONE (SS) (74.0 - 80.0)			
1196.0	80					
1194.0			SILTSTONE (SI) (80.0 - 82.0)			
	90		SANDSTONE (SS) (82.0 - 97.0) SOFT TO MODERATE SOFT.			
1179.0			SILTSTONE (SI) (97.0 - 113.0) MINOR SHALE ZONES 102.0-103.0' 107.0-109.0'.			
1176.0	100					

HOLE NO. 32C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 9RB,10D	
2. LOCATION (Coordinates or Station) 155052.00 2185178.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 32C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER RAINS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1195.1	
		16. DATE HOLE STARTED 08/05/1985	COMPLETED 08/09/1985
7. THICKNESS OF OVERBURDEN 4.4		17. ELEVATION TOP OF HOLE 1276.0	
8. DEPTH DRILLED INTO ROCK 144.6		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 149.0		19. SIGNATURE OF INSPECTOR JABARA	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SILTSTONE (SI) (97.0 – 113.0) MINOR SHALE ZONES 102.0–103.0' 107.0–109.0'.			
1163.0	110					
			SANDSTONE (SS) (113.0 – 134.0)			
	120					
	130					
1142.0			SILTSTONE (SI) (134.0 – 140.0)			
1136.0	140					
			SANDSTONE (SS) (140.0 – 149.0)			
1127.0			BOTTOM OF HOLE			
	150					
	160					
	170					
	180					
	190					
	200					

HOLE NO. 33C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 9RB	
2. LOCATION (Coordinates or Station) 155668.00	2185085.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 33C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER RAINS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1198.2	
7. THICKNESS OF OVERBURDEN 4.5		16. DATE HOLE STARTED 08/14/1985	COMPLETED 08/15/1985
8. DEPTH DRILLED INTO ROCK 145.1		17. ELEVATION TOP OF HOLE 1276.0	
9. TOTAL DEPTH OF HOLE 149.6		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR JABARA	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			CONCRETE			9" RB TO 149.6. DRILLING MOD. FAST. NO WATER LOSS. WASHED HOLE CLEAN. SET 142.4 OF 4" WELL CASING, WITH 10-FOOT WELL SCREEN TO 141.9 WITH 0.5 STICKUP FILTER SAND TO 105.0. TOP SEAL TO 100.0.
1271.0			CLAY (CL) (0.6 – 5.0) SOFT, SANDY, RED			
1265.0	10		SHALE (SH) (5.0 – 11.0) SOFT, RED			
1253.0	20		SANDSTONE (SS) (11.0 – 23.0) SOFT, RED			
1245.0	30		SHALE (SH) (23.0 – 31.0) SOFT,RED			
1232.0	40		SANDSTONE (SS) (31.0 – 44.0) SOFT, RED			
1225.0	50		SHALE (SH) (44.0 – 51.0) SOFT, RED			
1215.0	60		SANDSTONE (SS) (51.0 – 61.0) SOFT, RED			
1212.0			SHALE (SH) (61.0 – 64.0) SOFT, RED			
1205.0	70		SANDSTONE (SS) (64.0 – 71.0) SOFT, RED			
1201.0			SHALE (SH) (71.0 – 75.0) SOFT, RED			
1193.0	80		SANDSTONE (SS) (75.0 – 83.0) SOFT, RED			
1190.0			SHALE (SH) (83.0 – 86.0) SOFT, RED			
1176.0	90 100		SANDSTONE (SS) (86.0 – 100.0) SOFT, RED			

HOLE NO. 33C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 9RB	
2. LOCATION (Coordinates or Station) 155668.00 2185085.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 33C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER RAINS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1198.2	
7. THICKNESS OF OVERBURDEN 4.5		16. DATE HOLE STARTED 08/14/1985	COMPLETED 08/15/1985
8. DEPTH DRILLED INTO ROCK 145.1		17. ELEVATION TOP OF HOLE 1276.0	
9. TOTAL DEPTH OF HOLE 149.6		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR JABARA	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1176.0			SHALE (SH) (100.0 – 108.0) SOFT, RED			
1170.0						
1168.0			SANDSTONE (SS) (108.0 – 108.0) SOFT, RED			
	110		SHALE (SH) (108.0 – 112.0) SOFT, RED			
1164.0			SANDSTONE (SS) (112.0 – 149.6) SOFT, RED			
	120					
	130					
	140					
1126.4	150		BOTTOM OF HOLE			
	160					
	170					
	180					
	190					
	200					

HOLE NO. 34D

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 3 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 15RB	
2. LOCATION (Coordinates or Station) 155066.00 2185726.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 34D		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
5. NAME OF DRILLER WYATT&MITCHELL&VOILS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1096.3	
7. THICKNESS OF OVERBURDEN 4.0		16. DATE HOLE	STARTED 08/02/1986 / COMPLETED 08/03/1986
8. DEPTH DRILLED INTO ROCK 254.3		17. ELEVATION TOP OF HOLE 1276.0	
9. TOTAL DEPTH OF HOLE 258.3		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR STEWART	

ELEVATION	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1275.5			CONCRETE () (0.0 – 0.5)			ROCKBIT THRU CONCRETE FLOOR. AUGER 1.0–5.0'. ROCKBIT 5.0–258.3'. LOGGED HOLE WITH GEOPHYSICAL TOOLS. DESCRIPTION OF ROCK AND SOIL MATERIAL IS FROM INTERPRETATION OF GEOPHYSICAL LOGS. SET 4" STAINLESS STEEL WELL. MEASURED WATER LEVEL IN WELL AT 160.0' ON 11 AUGUST 1986. NOTE: SANDSTONES IMMEDIATELY ABOVE SHALES ARE OFTEN WELL CEMENTED WITH CARBONATE.
			CLAY (CL) (0.5 – 4.0) MODERATE STIFF TO STIFF, GRADES TO SHALE			
1272.0			SHALE (SH) (4.0 – 8.0) SOFT.			
1268.0	10		SANDSTONE (SS) (8.0 – 31.0) FINE TO VERY FINE GRAINED, SOFT TO VERY SOFT, VERY SILTY 8.0–11.0', 27.0–31.0'.			
	20					
1245.0	30		SHALE (SH) (31.0 – 37.0) SOFT, SILTY.			
1239.0	40		SANDSTONE (SS) (37.0 – 61.0) FINE TO VERY FINE GRAINED, SOFT TO MODERATE SOFT, SILTY 37.0–43.0'.			
	50					
1215.0	60		SHALE (SH) (61.0 – 66.0) SOFT TO MODERATE SOFT, VERY SILTY.			
1210.0	70		SANDSTONE (SS) (66.0 – 106.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 70.0–75.0', 100.0–106.0'.			
	80					
	90					
1176.0	100					

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 2 OF 3 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 15RB	
2. LOCATION (Coordinates or Station) 155066.00 2185726.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 34D		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN DISTURBED 0	UNDISTURBED 0
5. NAME OF DRILLER WYATT&MITCHELL&VOILS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1096.3	
7. THICKNESS OF OVERBURDEN 4.0		16. DATE HOLE STARTED 08/02/1986	COMPLETED 08/03/1986
8. DEPTH DRILLED INTO ROCK 254.3		17. ELEVATION TOP OF HOLE 1276.0	
9. TOTAL DEPTH OF HOLE 258.3		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR STEWART	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1170.0			SANDSTONE (SS) (66.0 – 106.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 70.0–75.0', 100.0–106.0'.			
1167.0			SILTSTONE (SI) (106.0 – 109.0) SOFT.			
	110		SANDSTONE (SS) (109.0 – 159.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, NUMEROUS SILTY OR SHALY STREAKS, SILTY 109.0–111.0'.			
	120					
	130					
	140					
	150					
1117.0	160		SILTSTONE (SI) (159.0 – 164.0) SOFT, SHALY.			
1112.0			SANDSTONE (SS) (164.0 – 174.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY 170.0–174.0'.			
	170					
1102.0			SILTSTONE (SI) (174.0 – 187.0) SOFT, SANDY INTERBEDS.			
	180					
1089.0			SANDSTONE (SS) (187.0 – 193.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, SILTY.			
1083.0	190		SHALE (SH) (193.0 – 207.0) SOFT TO MODERATE SOFT, SILTY, SILTSTONE 201.0–203.0', GRADES TO SILTSTONE AT 207.0'.			
1076.0	200					

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 3 OF 3 SHEETS

1. PROJECT	BUILDING 3001 IRP
2. LOCATION (Coordinates or Station)	155066.00 2185726.00
3. DRILLING AGENCY	USCE
4. HOLE NO. (As shown on drawing title and file number)	34D
5. NAME OF DRILLER	WYATT&MITCHELL&VOILS
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	4.0
8. DEPTH DRILLED INTO ROCK	254.3
9. TOTAL DEPTH OF HOLE	258.3
10. SIZE AND TYPE OF BIT	15RB
11. DATUM FOR ELEVATION SHOWN (GS or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	1096.3
16. DATE HOLE	STARTED 08/02/1986 COMPLETED 08/03/1986
17. ELEVATION TOP OF HOLE	1276.0
18. TOTAL CORE RECOVERY FOR BORING	0.0 %
19. SIGNATURE OF INSPECTOR	STEWART

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1069.0			SHALE (SH) (193.0 – 207.0) SOFT TO MODERATE SOFT, SILTY, SILTSTONE 201.0–203.0', GRADES TO SILTSTONE AT 207.0'.			
1053.0	210 220		SILTSTONE (SI) (207.0 – 223.0) SOFT, SANDY 212.0–216.0'.			
1025.0	230 240 250		SANDSTONE (SS) (223.0 – 251.0) FINE TO MEDIUM GRAINED, SOFT TO MODERATE SOFT, NUMEROUS SILTY OR SHALY STREAKS.			
1017.7			SHALE (SH) (251.0 – 258.3) SOFT TO MODERATE SOFT, SILTY.			
	260 270 280 290 300		BOTTOM OF HOLE			

HOLE NO. 35C

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER	SHEET 1 OF 2 SHEETS
1. PROJECT BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT 9RB	
2. LOCATION (Coordinates or Station) 155428.00 2185725.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 35C		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN DISTURBED 0	UNDISTURBED 0
5. NAME OF DRILLER RAINS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1201.6	
7. THICKNESS OF OVERBURDEN 0.8		16. DATE HOLE STARTED 08/23/1985	COMPLETED 08/27/1983
8. DEPTH DRILLED INTO ROCK 138.5		17. ELEVATION TOP OF HOLE 1276.0	
9. TOTAL DEPTH OF HOLE 139.3		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR JABARA	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1274.5			CONCRETE			9" RB TO 140.0. NO WATER LOSS. DRILLING MODERATELY FAST. SET 131.4 AT 4" WELL CASING WITH 9 WELL SCREEN TO 131.0 WITH 0.4 STICKUP FILTER SAND TO 106.0. SEAL TO 102.0.
1272.5			CLAY (CL) (0.8 – 1.5)			
1271.0			SHALE (SH) (1.5 – 3.5)			
			SANDSTONE (SS) (3.5 – 5.0)			
	10		SHALE (SH) (5.0 – 12.0)			
1264.0			SANDSTONE (SS) (12.0 – 32.0)			
	20					
	30					
1244.0			SHALE (SH) (32.0 – 41.0)			
	40					
1235.0			SANDSTONE (SS) (41.0 – 48.0)			
1228.0			SHALE (SH) (48.0 – 50.0)			
1226.0	50		SANDSTONE (SS) (50.0 – 66.0)			
	60					
1210.0			SHALE (SH) (66.0 – 69.0)			
1207.0	70		SANDSTONE (SS) (69.0 – 75.0)			
1201.0			SHALE (SH) (75.0 – 80.0)			
1196.0	80		SANDSTONE (SS) (80.0 – 93.0)			
	90					
1183.0			SHALE (SH) (93.0 – 96.0)			
1180.0			SANDSTONE (SS) (96.0 – 100.0)			
1176.0	100					

HOLE NO. 35C

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER	SHEET 2 OF 2 SHEETS
1. PROJECT: BUILDING 3001 IRP		10. SIZE AND TYPE OF BIT: 9RB	
2. LOCATION (Coordinates or Station): 155428.00	2185725.00	11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL	
3. DRILLING AGENCY: USCE		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 35C		13. TOTAL NO OF OVER-	DISTURBED: 0 / UNDISTURBED: 0
5. NAME OF DRILLER: RAINS		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1201.8	
7. THICKNESS OF OVERBURDEN: 0.8		16. DATE HOLE: STARTED 08/23/1985	COMPLETED 08/27/1983
8. DEPTH DRILLED INTO ROCK: 138.5		17. ELEVATION TOP OF HOLE: 1276.0	
9. TOTAL DEPTH OF HOLE: 139.3		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: JABARA	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1178.0			SHALE (SH) (100.0 – 112.0)			
1164.0	110		SANDSTONE (SS) (112.0 – 119.0)			
1157.0	120		SHALE (SH) (119.0 – 122.0)			
1154.0			SANDSTONE (SS) (122.0 – 139.3)			
1136.7	130		BOTTOM OF HOLE			
	140					
	150					
	160					
	170					
	180					
	190					
	200					

HOLE NO. 1-36

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 2 SHEETS
1. PROJECT SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) 155198.00 2186595.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-36		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 4 / UNDISTURBED 0
5. NAME OF DRILLER DUGGAN/VOILS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1216.6(3JUN1987	
7. THICKNESS OF OVERBURDEN 10.0		16. DATE HOLE STARTED 04/30/1987	COMPLETED 05/21/1987
8. DEPTH DRILLED INTO ROCK 47.5		17. ELEVATION TOP OF HOLE 1267.7	
9. TOTAL DEPTH OF HOLE 57.5		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1261.7	4		CLAY (CL) (0.0 - 6.0) SLIGHTY SANDY, STIFF, LOW PLASTICITY, BROWN-RED, DRY. (FILL).		J-1	AUGERED WITH 6 INCH AUGER TO 57.5'. INSTALLED 2 INCH PVC PIEZOMETER. MEASURED WATER LEVEL IN COMPLETED PIEZOMETER AT ELEVATION 1216.6 ON 3JUNE 1987. SAMPLE DEPTH J-1 0.0- 6.0 J-2 6.0- 10.0 J-3 10.0- 14.0 J-4 14.0- 19.0
1257.7	8		CLAY (CL) (6.0 - 10.0) STIFF, DAMP, LOW PLASTICITY, RED-BROWN.		J-2	
1253.7	12		SILTSTONE (ST) (10.0 - 14.0) SOFT, VERY POORLY CEMENTED, REDDISH-BROWN. BECOMES SHALY AT 13.0'		J-3	
	16		SANDSTONE (SS) (14.0 - 57.5) VERY FINE GRAINED, SILTY, SOFT, POORLY CEMENTED, WEATHERED, ORANGE-BROWN. BECOMES SHALY BELOW 19.0' BECOMES WET AT 50.0'		J-4	
	20					
	24					
	28					
	32					
	36					
1227.7	40					

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PROJECT SOLDIER CREEK PIEZOMETERS HOLE NO. 1-36

HOLE NO. 1-36

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER AFB	SHEET 2 OF 2 SHEETS
1. PROJECT: SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT: 6" AUGER	
2. LOCATION (Coordinates or Station): 155198.00	2186595.00	11. DATUM FOR ELEVATION SHOWN (Tilm or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-36		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4	UNDISTURBED 0
5. NAME OF DRILLER: DUGGAN/VOILS		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1216.6(3JUN1987	
7. THICKNESS OF OVERBURDEN: 10.0		16. DATE HOLE: STARTED 04/30/1987	COMPLETED 05/21/1987
8. DEPTH DRILLED INTO ROCK: 47.5		17. ELEVATION TOP OF HOLE: 1267.7	
9. TOTAL DEPTH OF HOLE: 57.5		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SANDSTONE (SS) (14.0 - 57.5) VERY FINE GRAINED, SILTY, SOFT, POORLY CEMENTED, WEATHERED, ORANGE-BROWN. BECOMES SHALY BELOW 19.0' BECOMES WET AT 50.0'			
	44					
	48					
	52					
	56					
1210.2			BOTTOM OF HOLE			
	60					
	64					
	68					
	72					
	76					
	80					

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PROJECT: SOLDIER CREEK PIEZOMETERS HOLE NO. 1-36

HOLE NO. 1-37

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT: SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT: 6" AUGER	
2. LOCATION (Coordinates or Station): 155199.00 2186710.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-37		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5	UNDISTURBED 0
5. NAME OF DRILLER: D. DUGGAN		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: NOT ENCOUNTERED	
7. THICKNESS OF OVERBURDEN: 12.0		16. DATE HOLE: STARTED 05/04/87	COMPLETED 05/04/87
8. DEPTH DRILLED INTO ROCK: 4.0		17. ELEVATION TOP OF HOLE: 1259.9	
9. TOTAL DEPTH OF HOLE: 16.0		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1255.9	4		SILT (ML) (0.0 – 4.0) SLIGHTLY CLAYEY, STIFF, LOW PLASTICITY, BROWN-RED, DRY. (FILL).		J-1	AUGERED WITH 6 INCH AUGER 0.0–16.0'. DID NOT ENCOUNTER PERCHED WATER TABLE ON SHALE. INSTALLED 2 INCH PVC PIEZOMETER TO MEASURE POSSIBLE OCCURANCE OF PERCHED WATER.
1252.4			CLAY (CL) (4.0 – 7.5) SILTY, MEDIUM SOFT, LOW PLASTICITY, BROWN-RED MOTTLED WITH DARK BROWN, SLIGHTLY MOIST. (FILL).		J-2	
1247.9	8 12		SAND (SP) (7.5 – 12.0) VERY FINE, MEDIUM DENSE, BROWN, SLIGHTLY MOIST.		J-3	
1244.9			SANDSTONE (SS) (12.0 – 15.0) VERY FINE, POORLY CEMENTED, VERY WEATHERED, RED, SLIGHTLY MOIST.		J-4	
1243.9	16		SHALE (SH) (15.0 – 16.0) SOFT, BLOCKY, RED-BROWN, SLIGHTLY MOIST. Bottom of hole		J-5	
	20					
	24					
	28					
	32					
	36					
	40					

SAMPLE	DEPTH
J-1	0.0– 4.0
J-2	4.0– 7.5
J-3	7.5– 12.0
J-4	12.0– 15.0
J-5	15.0– 16.0

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PROJECT: SOLDIER CREEK PIEZOMETERS HOLE NO. 1-37

HOLE NO. 1-38

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) 155199.00 2186825.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-38		13. TOTAL NO OF OVER- DISTURBED 5 UNDISTURBED 0	
5. NAME OF DRILLER DUGGAN/CAMP		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1218.5 (6-3-87)	
7. THICKNESS OF OVERBURDEN 11.0		16. DATE HOLE STARTED 05/01/87 COMPLETED 05/21/87	
8. DEPTH DRILLED INTO ROCK 29.6		17. ELEVATION TOP OF HOLE 1252.8	
9. TOTAL DEPTH OF HOLE 40.6		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1249.8			CLAY (CL) (0.0 – 3.0) STIFF, LOW PLASTICITY, BROWN-RED, DRY. (FILL)		J-1	AUGERED 0.0–40.6' WITH 6 INCH AUGER. SET 2 INCH PVC PIEZOMETER MEASURED WATER LEVEL IN COMPLETED PIEZOMETER AT ELEVATION 1218.5 ON 3 JUNE 1987. SAMPLE DEPTH J-1 0.0– 3.0 J-2 3.0– 6.0 J-3 6.0– 9.0 J-4 9.0– 11.0 J-5 11.0– 40.6
1246.8	4		CLAY (CL) (3.0 – 6.0) SILTY, MEDIUM STIFF, LOW PLASTICITY, RED, DAMP (FILL).		J-2	
1243.8	8		CLAY (CL) (6.0 – 9.0) MEDIUM SOFT, LOW PLASTICITY, RED, DAMP. (FILL)		J-3	
1241.8			SAND (SC) (9.0 – 11.0) CLAYEY, VERY FINE, MEDIUM LOOSE, DARK BROWN, DAMP.		J-4	
	12		SANDSTONE (SS) (11.0 – 40.6) VERY FINE, POORLY CEMENTED, WEATHERED, RED-BROWN, DAMP, SHALY AND SILTY TO 18.5'. BECOMES WET AT 35.0' VERY HARD SANDSTONE @ 40.6'			
	16					
	20					
	24				J-5	
	28					
	32					
	36					
1212.8	40		Bottom of hole 40.6'			

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PROJECT SOLDIER CREEK PIEZOMETERS HOLE NO. 1-38

HOLE NO. 1-39

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) 155200.00 2186955.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-39		13. TOTAL NO OF OVER- DISTURBED 4	UNDISTURBED 0
5. NAME OF DRILLER CAMP		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1224.8 (6-3-87)	
7. THICKNESS OF OVERBURDEN 8.5		16. DATE HOLE STARTED 05/14/87	COMPLETED 05/21/87
8. DEPTH DRILLED INTO ROCK 10.5		17. ELEVATION TOP OF HOLE 1239.2	
9. TOTAL DEPTH OF HOLE 19.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	4		CLAY (CL) (0.0 - 5.5) SILTY, STIFF, LOW PLASTICITY, DRY, BROWN-RED. (FILL)		J-1	AUGERED 0.0-19.0' WITH 6" AUGER. SET 2 INCH PVC PIEZOMETER. MEASURED WATER LEVEL ON 3 JUNE 1987 AT ELEVATION 1224.8'. SAMPLE DEPTH J-1 0.0- 5.5 J-2 5.5- 6.5 J-3 6.5- 8.5
1233.7			CLAY (CL) (5.5 - 6.5) SOFT, MEDIUM TO LOW PLASTICITY, DAMP, DARK BROWN.		J-2	
1232.7	8		SILT (ML) (6.5 - 8.5) SANDY, SOFT, LOW PLASTICITY, BROWN, MOIST.		J-3	
1230.7	12		SANDSTONE (SS) (8.5 - 19.0) FINE, SOFT, WEATHERED, RED, MOIST.			
	16		BECOMES WET AT 14.0'			
1220.2	20		Bottom of hole			
	24					
	28					
	32					
	36					
	40					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT SOLDIER CREEK PIEZOMETERS HOLE NO. 1-39

HOLE NO. 1-40

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) 155200.00 2187085.00		11. DATUM FOR ELEVATION SHOWN (Tilt or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-40		13. TOTAL NO OF OVER- DISTURBED 1 UNDISTURBED 0	
5. NAME OF DRILLER CAMP		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1225.3 (6-3-87)	
7. THICKNESS OF OVERBURDEN 0.0		16. DATE HOLE STARTED 05/20/87 COMPLETED 05/21/87	
8. DEPTH DRILLED INTO ROCK 12.3		17. ELEVATION TOP OF HOLE 1234.5	
9. TOTAL DEPTH OF HOLE 12.3		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	4		SANDSTONE (SS) (0.0 – 12.3) VERY SOFT, VERY WEATHERED, POORLY CEMENTED, RED-BROWN.		J-1	AUGERED 0.0 TO 12.3' WITH 6 INCH AUGER. SET 2 INCH PVC PIEZOMETER MEASURED WATER LEVEL IN PIEZOMETER AT ELEVATION 1225.3' ON 3 JUNE 1987. SOIL IN AREA HAD BEEN REMOVED TO ELIMINATE CONTAMINATION ALONG SOLDIER CREEK. SAMPLE J-1 DEPTH 0.0– 12.3
	8					
1222.2	12		Bottom of hole			
	16					
	20					
	24					
	28					
	32					
	36					
	40					

HOLE NO. 1-41

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT: SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT: 6" AUGER	
2. LOCATION (Coordinates or Station): 155201.00	2187165.00	11. DATUM FOR ELEVATION SHOWN (Tilw or MSL): MSL	
3. DRILLING AGENCY: TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 1-41		13. TOTAL NO OF OVER-	DISTURBED: 2 / UNDISTURBED: 0
5. NAME OF DRILLER: CAMP		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 1225.4 (6-3-87)	
7. THICKNESS OF OVERBURDEN: 0.0		16. DATE HOLE: STARTED 05/20/87 / COMPLETED 05/21/87	
8. DEPTH DRILLED INTO ROCK: 26.5		17. ELEVATION TOP OF HOLE: 1244.6	
9. TOTAL DEPTH OF HOLE: 26.5		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
		19. SIGNATURE OF INSPECTOR: C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1237.1	4		SHALE (SH) (0.0 - 7.5) SOFT, BLOCKY, BROWN-RED, SILTY, WEATHERED.		J-1	AUGERED 0.0-26.5 WITH 6 INCH AUGER. SET 2 INCH PVC PIEZOMETER MEASURED WATER LEVEL IN PIEZOMETER AT ELEVATION 1225.4' ON 3 JUNE 1987. SOIL IN AREA HAD BEEN REMOVED TO ELIMINATE CONTAMINATION ALONG SOLDIER CREEK. SAMPLE DEPTH J-1 0.0- 7.5 J-2 7.5- 26.5
	8		SANDSTONE (SS) (7.5 - 26.5) FINE, SOFT, UNCEMENTED, VERY WEATHERED, BROWN-RED, DAMP.			
	12					
	16				J-2	
	20					
	24		BECOMES VERY MOIST AT 24.0'. HARD SANDSTONE AT 26.5'.			
1218.1			Bottom of hole			
	28					
	32					
	36					
	40					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: SOLDIER CREEK PIEZOMETERS | HOLE NO. 1-41

HOLE NO. 1-42

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) 155201.00	2187265.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-42		13. TOTAL NO OF OVER- DISTURBED 3	UNDISTURBED 0
5. NAME OF DRILLER CAMP		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1225.3 (6-3-87)	
7. THICKNESS OF OVERBURDEN 2.5		16. DATE HOLE STARTED 05/20/87	COMPLETED 05/21/87
8. DEPTH DRILLED INTO ROCK 24.2		17. ELEVATION TOP OF HOLE 1249.9	
9. TOTAL DEPTH OF HOLE 26.7		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1247.4			CLAY (CL) (0.0 – 2.5) MEDIUM STIFF, LOW PLASTICITY, DAMP TO DRY, RED-BROWN.			AUGERED 0.0-26.7 WITH 6" AUGER. SET 2 INCH PVC PIEZOMETER MEASURED WATER LEVEL IN PIEZOMETER AT ELEVATION 1225.3 ON 3 JUNE 1987. SAMPLE DEPTH J-1 2.5- 10.0 J-2 10.0- 17.0 J-3 17.0- 25.1
	4		SHALE (SH) (2.5 – 17.0) SOFT, BLOCKY, WEATHERED, RED-BROWN.		J-1	
	8					
	12		BROWN-RED, SPECKLED WITH GRAY-GREEN SPOTS, SL. MOIST, 10.0-17.0'		J-2	
	16					
1232.9			SANDSTONE (SS) (17.0 – 26.7) FINE, SOFT, WEATHERED, UNCEMENTED, BROWN-RED, MOIST. BECOMES WET AT 23.5'.		J-3	
	20					
	24					
1223.2			Bottom of hole			
	28					
	32					
	36					
	40					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT SOLDIER CREEK PIEZOMETERS HOLE NO. 1-42

HOLE NO. 1-43A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) 153916.00 2186750.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-43A		13. TOTAL NO OF OVER- DISTURBED 5	UNDISTURBED 0
5. NAME OF DRILLER CAMP		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1240.1 (6-3-87)	
		16. DATE HOLE STARTED 06/01/87	COMPLETED 06/02/87
7. THICKNESS OF OVERBURDEN 12.0		17. ELEVATION TOP OF HOLE 1264.4	
8. DEPTH DRILLED INTO ROCK 18.7		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 30.7		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1259.9	4		SILT (ML) (0.0 - 4.5) MEDIUM DENSE, LOW PLASTICITY, RED-BROWN, DRY.		J-1	AUGERED 0.0-30.7' WITH 6" AUGER. SET 2 INCH PVC PIEZOMETER TO 30.7'. MEASURED WATER LEVEL IN PIEZOMETER AT ELEVATION 1240.1' ON 3 JUNE 1987. SAMPLE DEPTH J-1 0.0- 4.5 J-2 4.5- 12.0 J-3 12.0- 17.0 J-4 17.0- 25.0 J-5 25.0- 30.7
1252.4	8 12		SAND (SP) (4.5 - 12.0) FINE, MEDIUM LOOSE, RED, SLIGHTLY MOIST. BECOMES MOIST AT 10.0'.		J-2	
1247.4	16		SHALE (SH) (12.0 - 17.0) SILTY, SOFT, BLOCKY, RED-BROWN, MOTTLED WITH GREEN-GRAY, SLIGHTLY MOIST, VERY WEATHERED.		J-3	
1239.4	20 24		SANDSTONE (SS) (17.0 - 25.0) VERY FINE, SOFT, UNCEMENTED, WEATHERED, REDDISH-BROWN, SLIGHTLY MOIST. WET AT 25.0'		J-4	
1233.7	28		SHALE (SH) (25.0 - 30.7) SOFT, BLOCKY, REDDISH-BROWN, SLIGHTLY MOIST.		J-5	
	32 36 40		Bottom of hole			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT SOLDIER CREEK PIEZOMETERS HOLE NO. 1-43A

HOLE NO. 1-44A

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION TINKER AFB	SHEET 1 OF 1 SHEETS
1. PROJECT SOLDIER CREEK PIEZOMETERS		10. SIZE AND TYPE OF BIT 6" AUGER	
2. LOCATION (Coordinates or Station) 153991.00 2186972.00		11. DATUM FOR ELEVATION SHOWN (GS or MSL) MSL	
3. DRILLING AGENCY TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 1-44A		13. TOTAL NO OF OVER- DISTURBED 3 UNDISTURBED 0	
5. NAME OF DRILLER CAMP		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1212.8'(6-3-87)	
7. THICKNESS OF OVERBURDEN 30.0		16. DATE HOLE STARTED 06/02/87 COMPLETED 06/02/87	
8. DEPTH DRILLED INTO ROCK 12.0		17. ELEVATION TOP OF HOLE 1242.3	
9. TOTAL DEPTH OF HOLE 42.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		19. SIGNATURE OF INSPECTOR C. NARDIN	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SAND (SP) (0.0 – 30.0) VERY FINE GRAINED, VERY CLAYEY, SOFT, RED-BROWN, SLIGHTLY MOIST.		J-1	6 INCH AUGER 0.0–42.0'. INSTALLED 2 INCH PIEZOMETER. MEASURED WATER LEVEL IN PIEZOMETER AT ELEVATION 1212.8 ON 3 JUNE 1987. SAMPLE DEPTH J-1 0.0– 30.0 J-2 30.0– 36.0 J-3 36.0– 42.0
	4					
	8					
	12					
	16					
	20					
	24					
	28					
1212.3			SHALE (SH) (30.0 – 36.0) SILTY, SOFT, BLOCKY, MOIST, RED-BROWN.		J-2	
	32					
1206.3	36		SANDSTONE (SS) (36.0 – 42.0) VERY SHALEY, VERY FINE, GRAINED, SOFT, RED-BROWN, WET		J-3	
1200.3	40		Bottom of hole 42.0'			

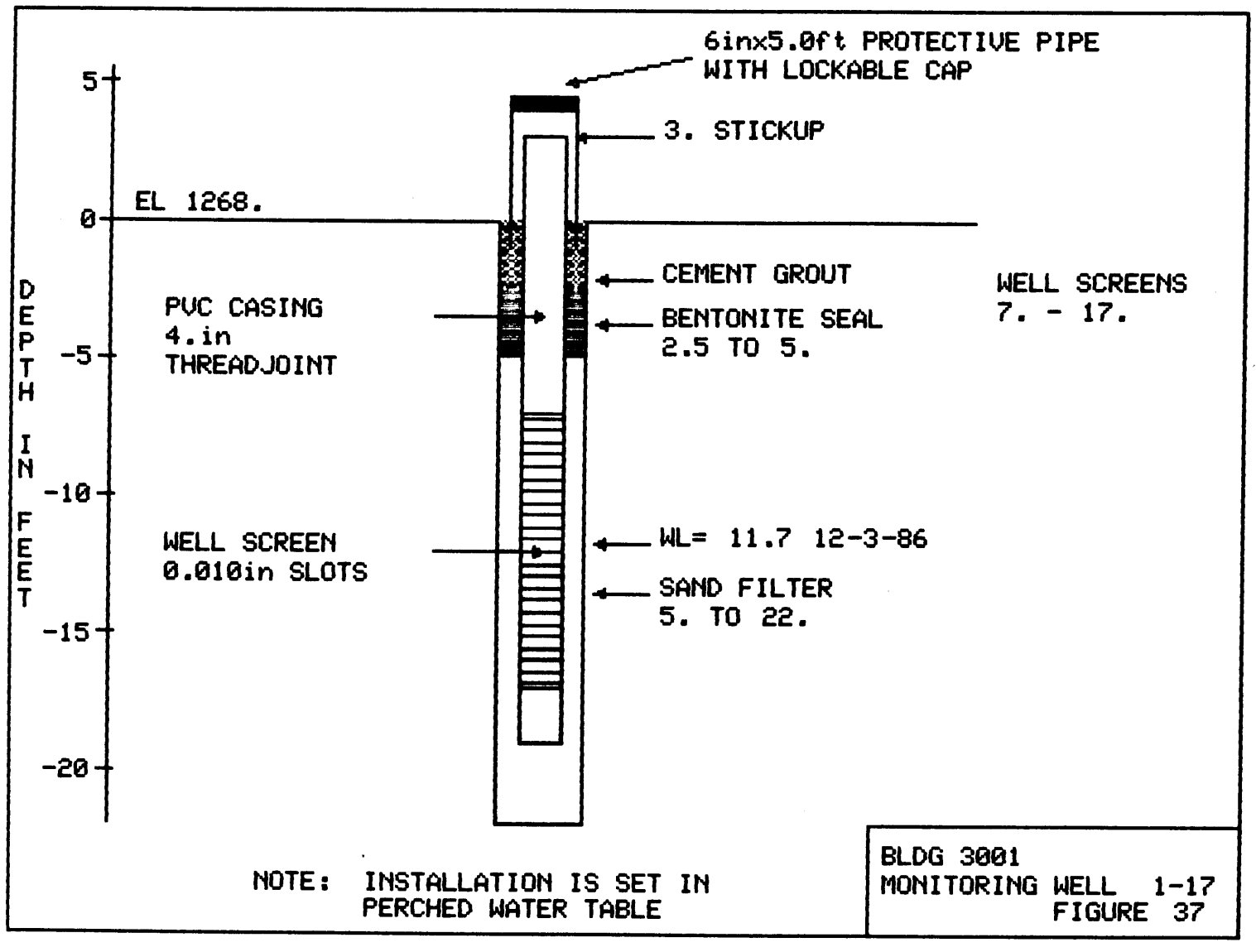
ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

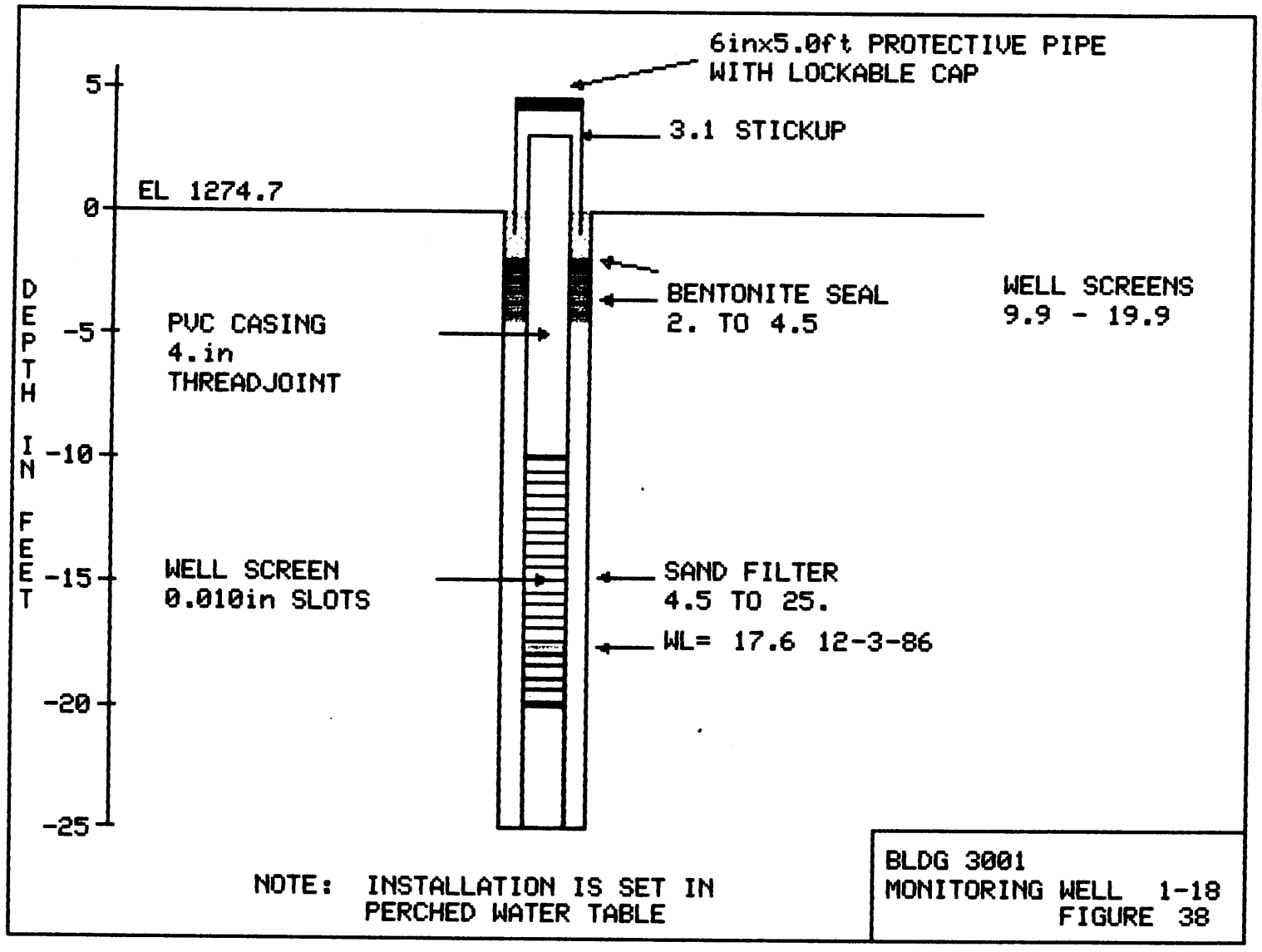
PROJECT SOLDIER CREEK PIEZOMETERS. HOLE NO. 1-44A

APPENDIX F

MONITOR WELL SCHEMATICS

REPRODUCED AT GOVERNMENT EXPENSE





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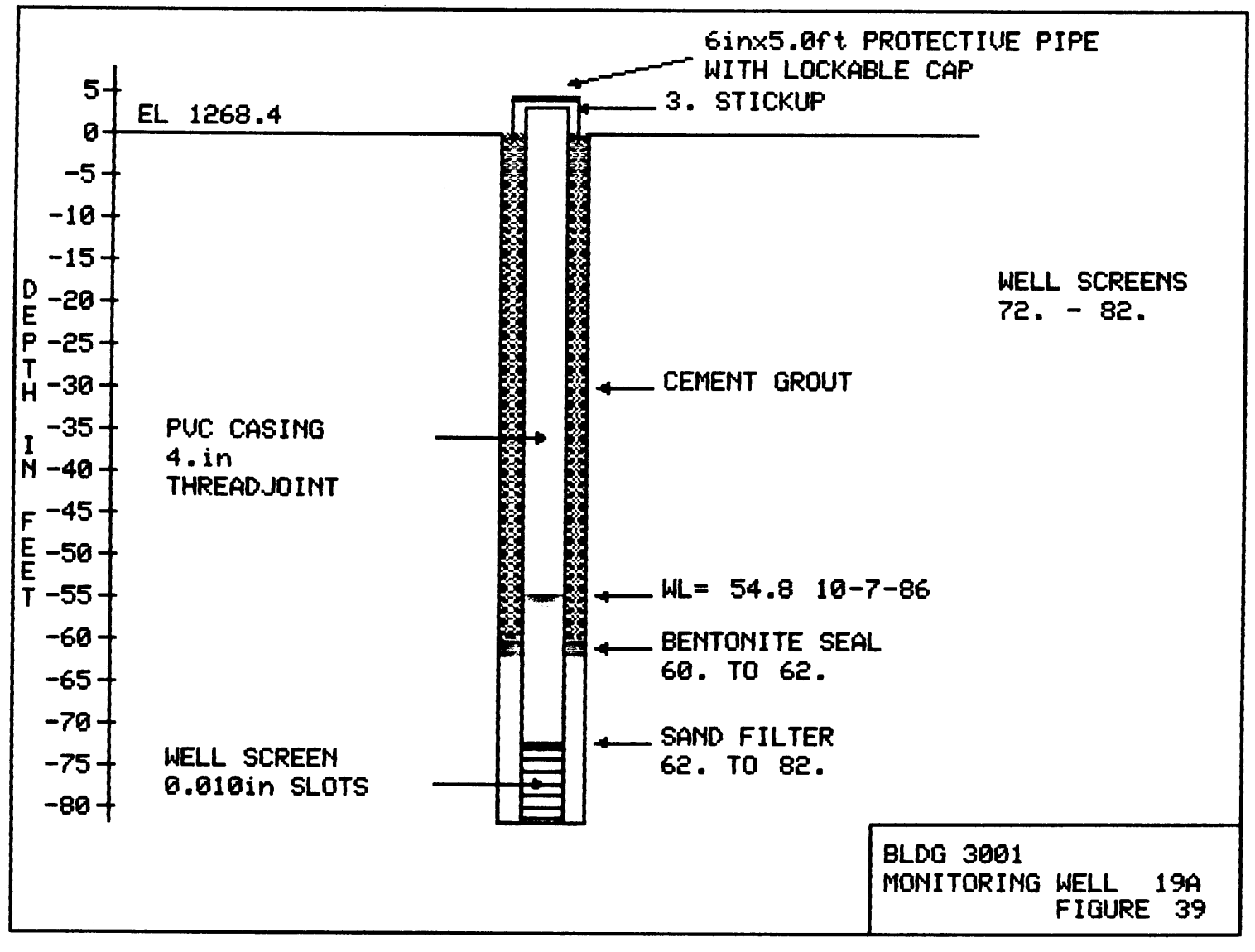
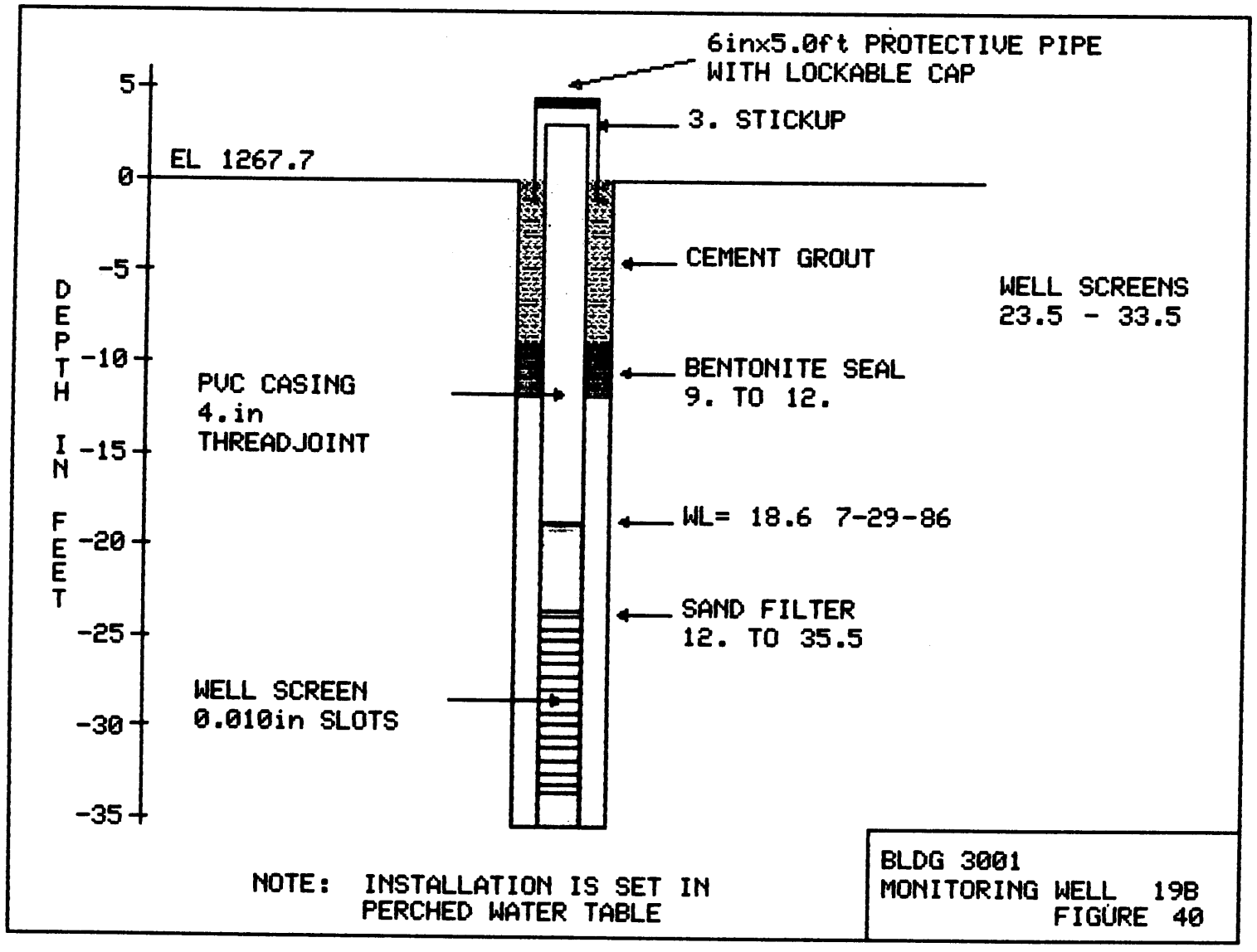

6inx5.0ft PROTECTIVE PIPE
WITH LOCKABLE CAP
3. STICKUP
EL 1268.4
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
DEPTH IN FEET
PVC CASING
4.in
THREADJOINT
WELL SCREEN
0.010in SLOTS
CEMENT GROUT
WL= 54.8 10-7-86
BENTONITE SEAL
60. TO 62.
SAND FILTER
62. TO 82.
WELL SCREENS
72. - 82.
BLDG 3001
MONITORING WELL 19A
FIGURE 39



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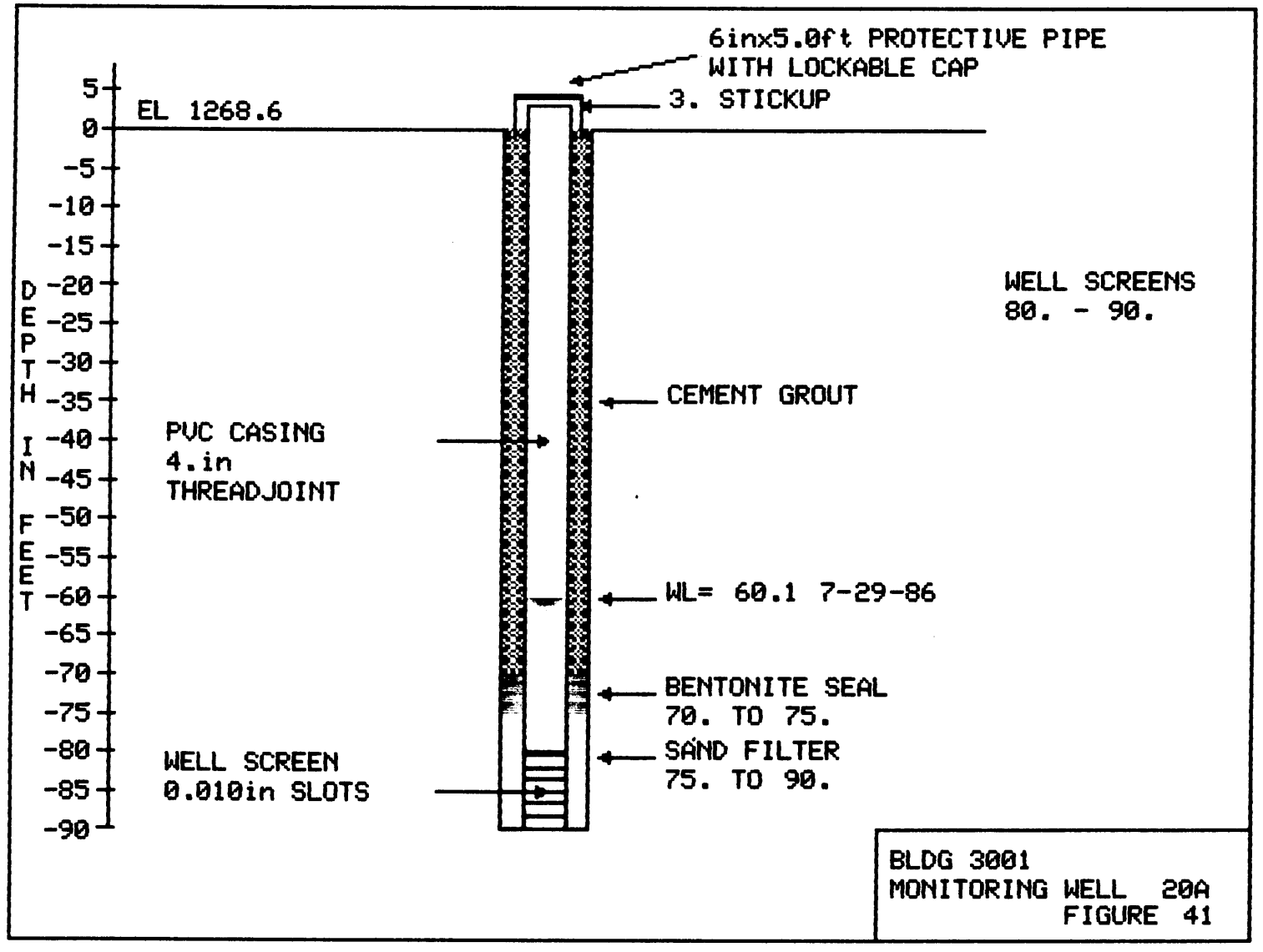

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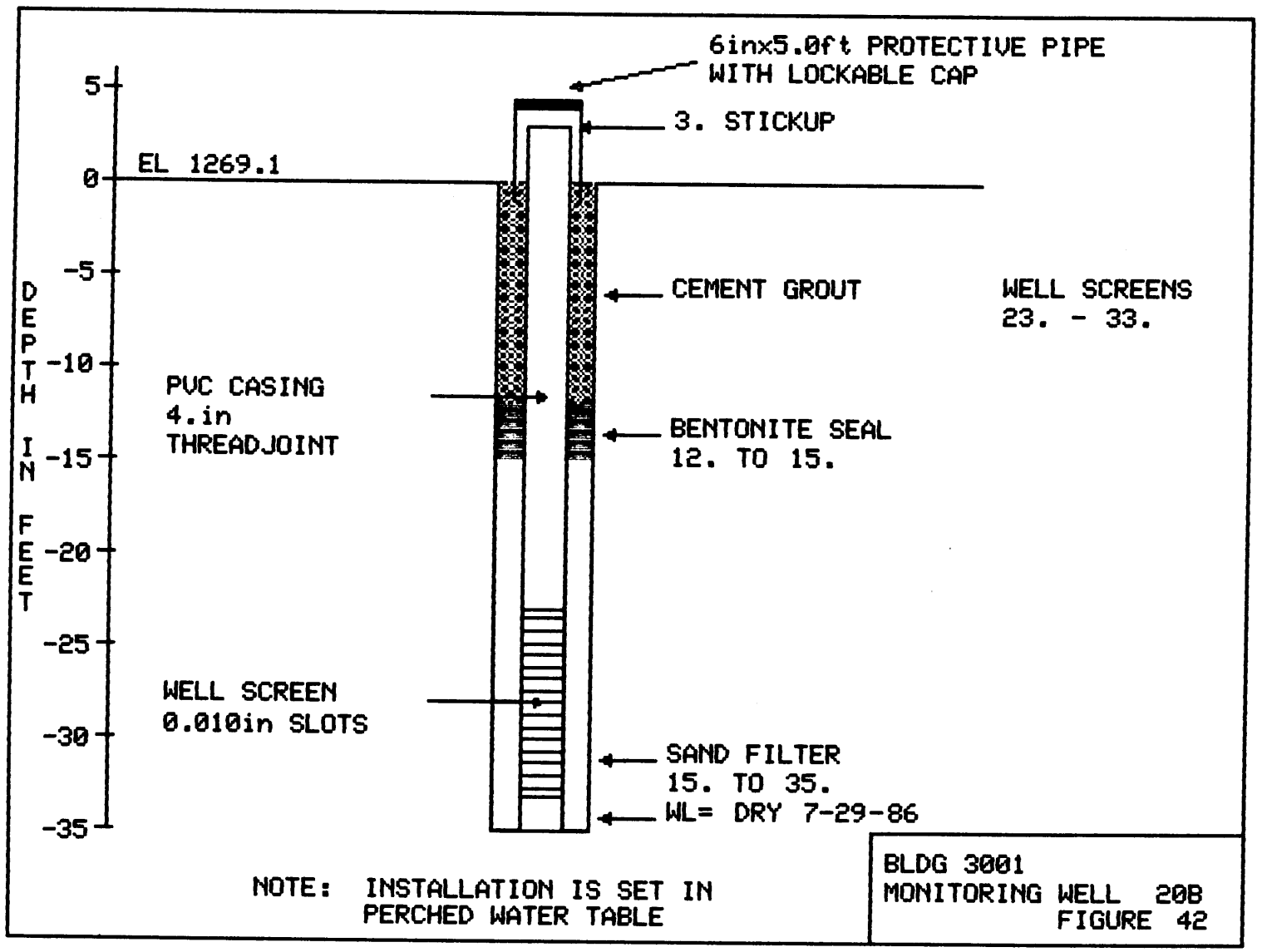
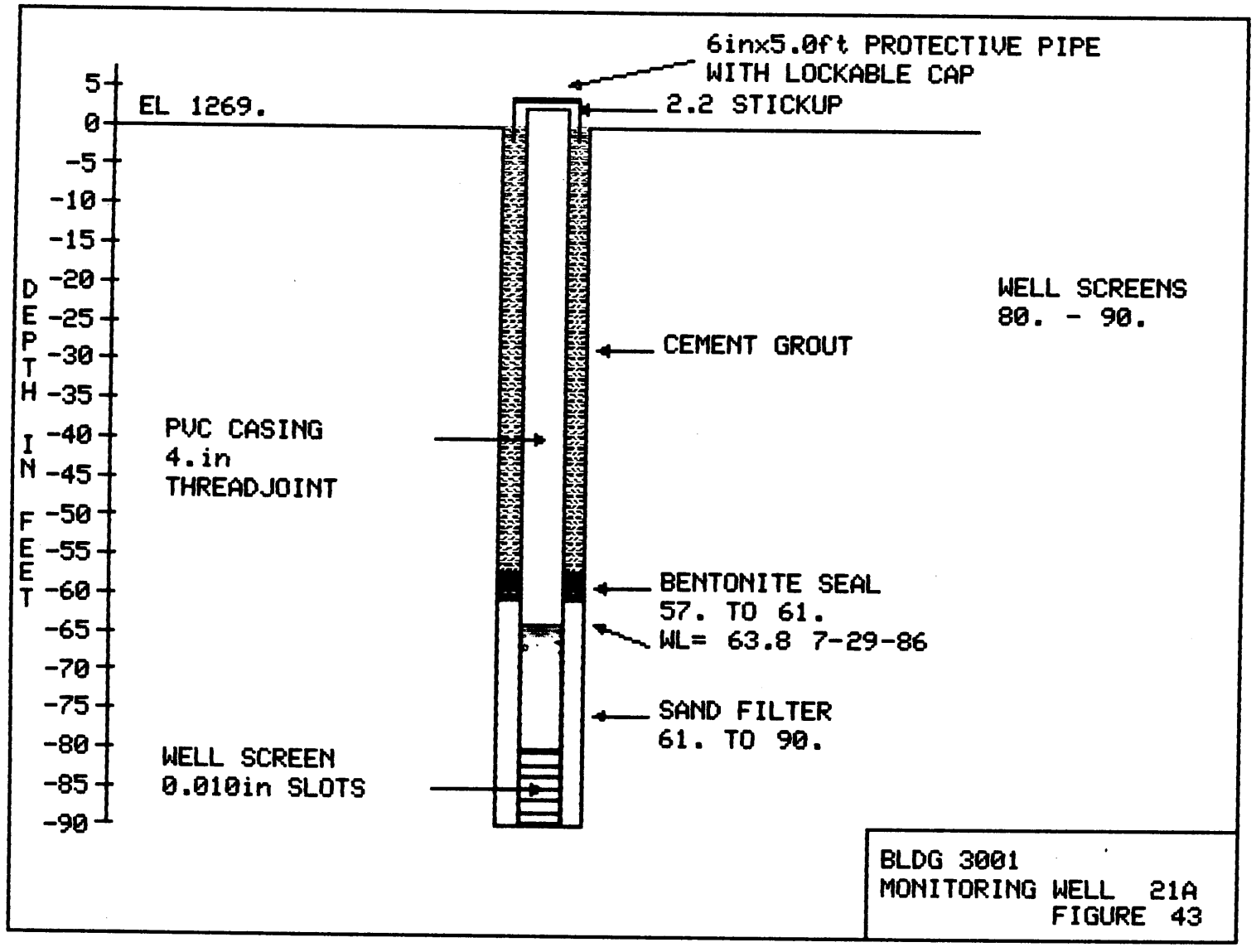
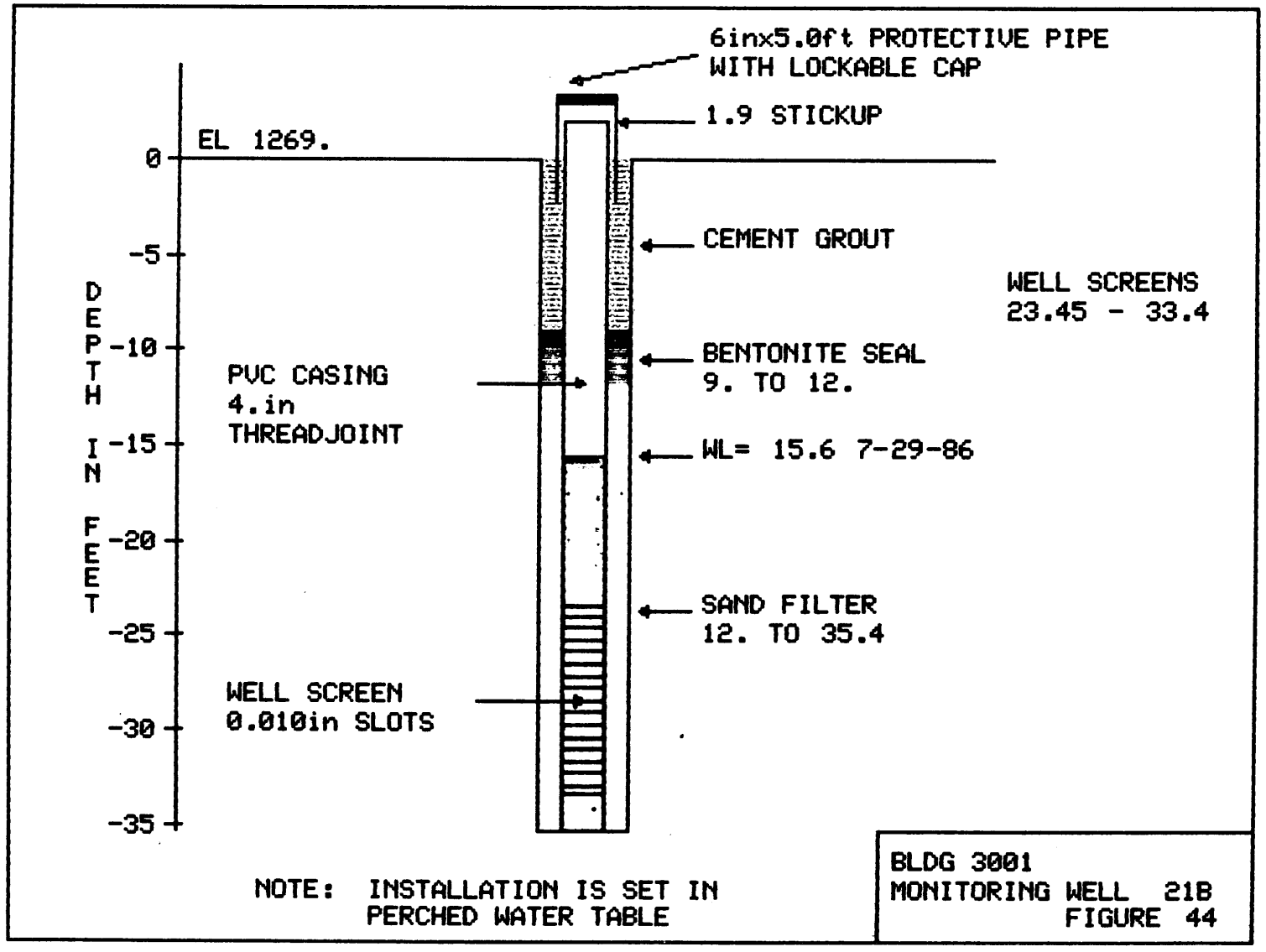

6inx5.0ft PROTECTIVE PIPE
WITH LOCKABLE CAP
3. STICKUP
EL 1269.1
CEMENT GROUT
WELL SCREENS
23. - 33.
DEPTH IN FEET
5
0
-5
-10
-15
-20
-25
-30
-35
PVC CASING
4.in
THREADJOINT
BENTONITE SEAL
12. TO 15.
WELL SCREEN
0.010in SLOTS
SAND FILTER
15. TO 35.
WL= DRY 7-29-86
NOTE: INSTALLATION IS SET IN
PERCHED WATER TABLE
BLDG 3001
MONITORING WELL 20B
FIGURE 42


6inx5.0ft PROTECTIVE PIPE
WITH LOCKABLE CAP
2.2 STICKUP
EL 1269.
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
DEPTH IN FEET
WELL SCREENS
80. - 90.
CEMENT GROUT
PVC CASING
4.in
THREADJOINT
BENTONITE SEAL
57. TO 61.
WL= 63.8 7-29-86
SAND FILTER
61. TO 90.
WELL SCREEN
0.010in SLOTS
BLDG 3001
MONITORING WELL 21A
FIGURE 43



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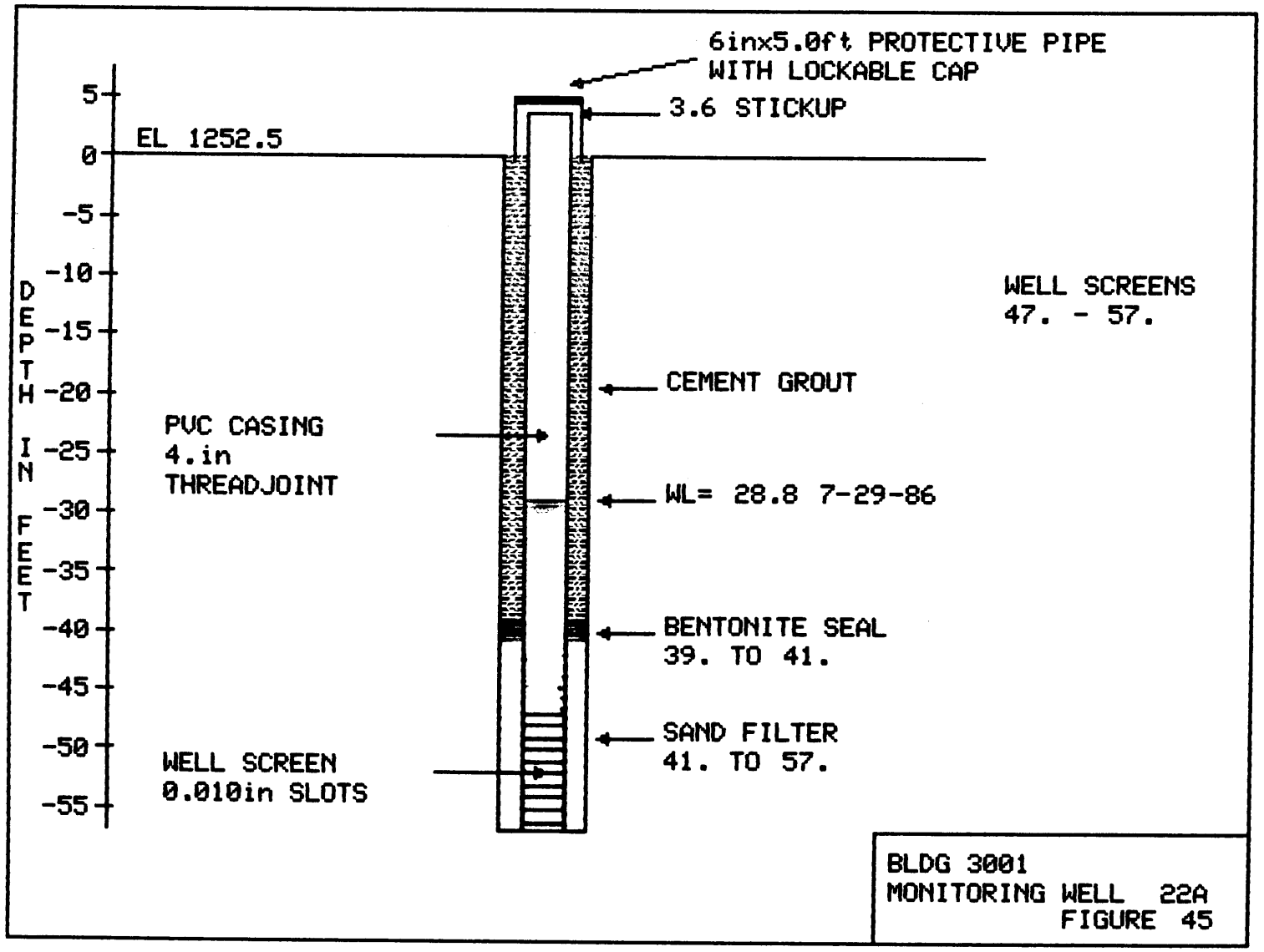
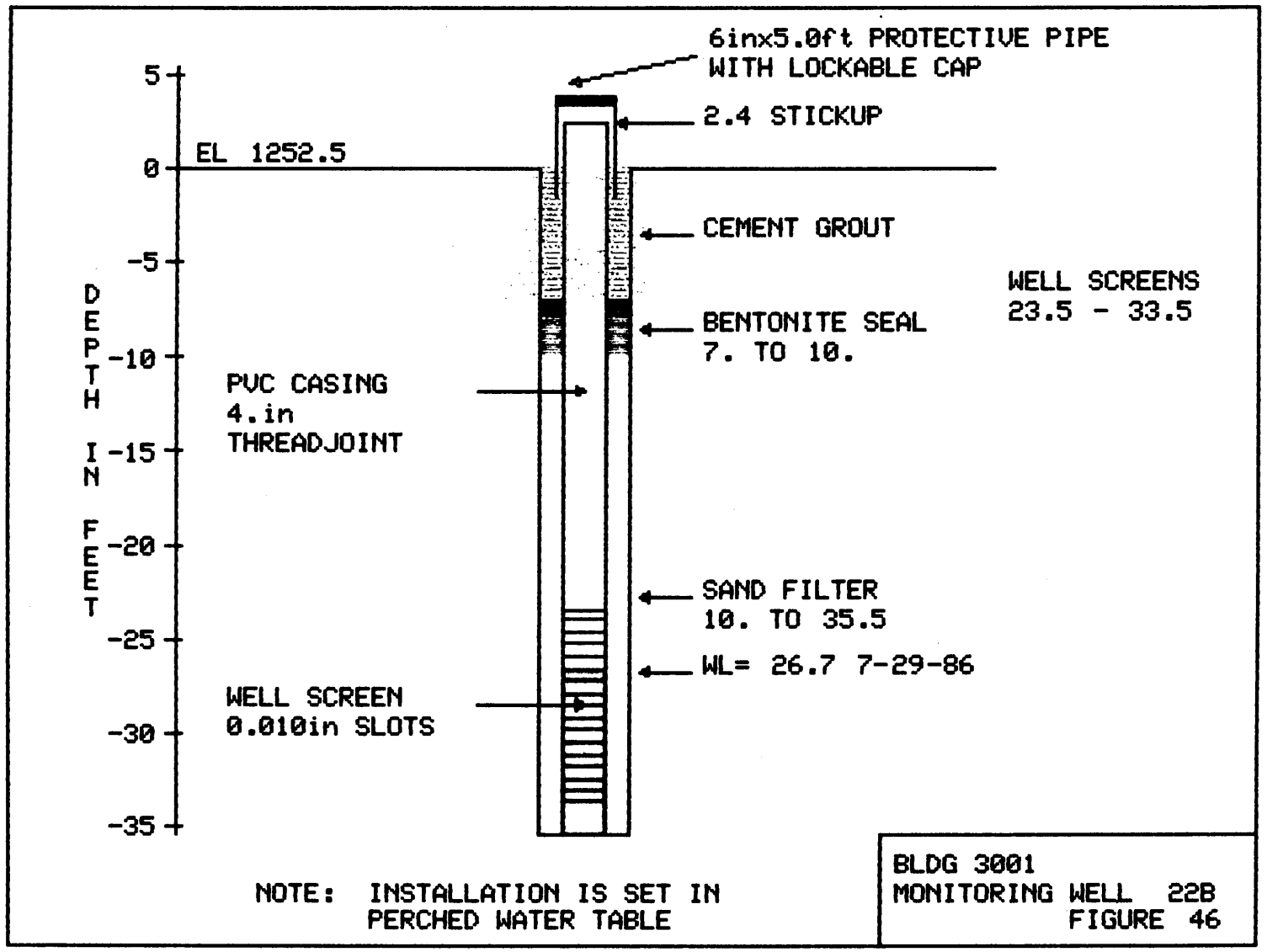

6inx5.0ft PROTECTIVE PIPE
WITH LOCKABLE CAP
3.6 STICKUP
EL 1252.5
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
DEPTH IN FEET
PVC CASING
4.in
THREADJOINT
WELL SCREEN
0.010in SLOTS
CEMENT GROUT
WL= 28.8 7-29-86
BENTONITE SEAL
39. TO 41.
SAND FILTER
41. TO 57.
WELL SCREENS
47. - 57.
BLDG 3001
MONITORING WELL 22A
FIGURE 45



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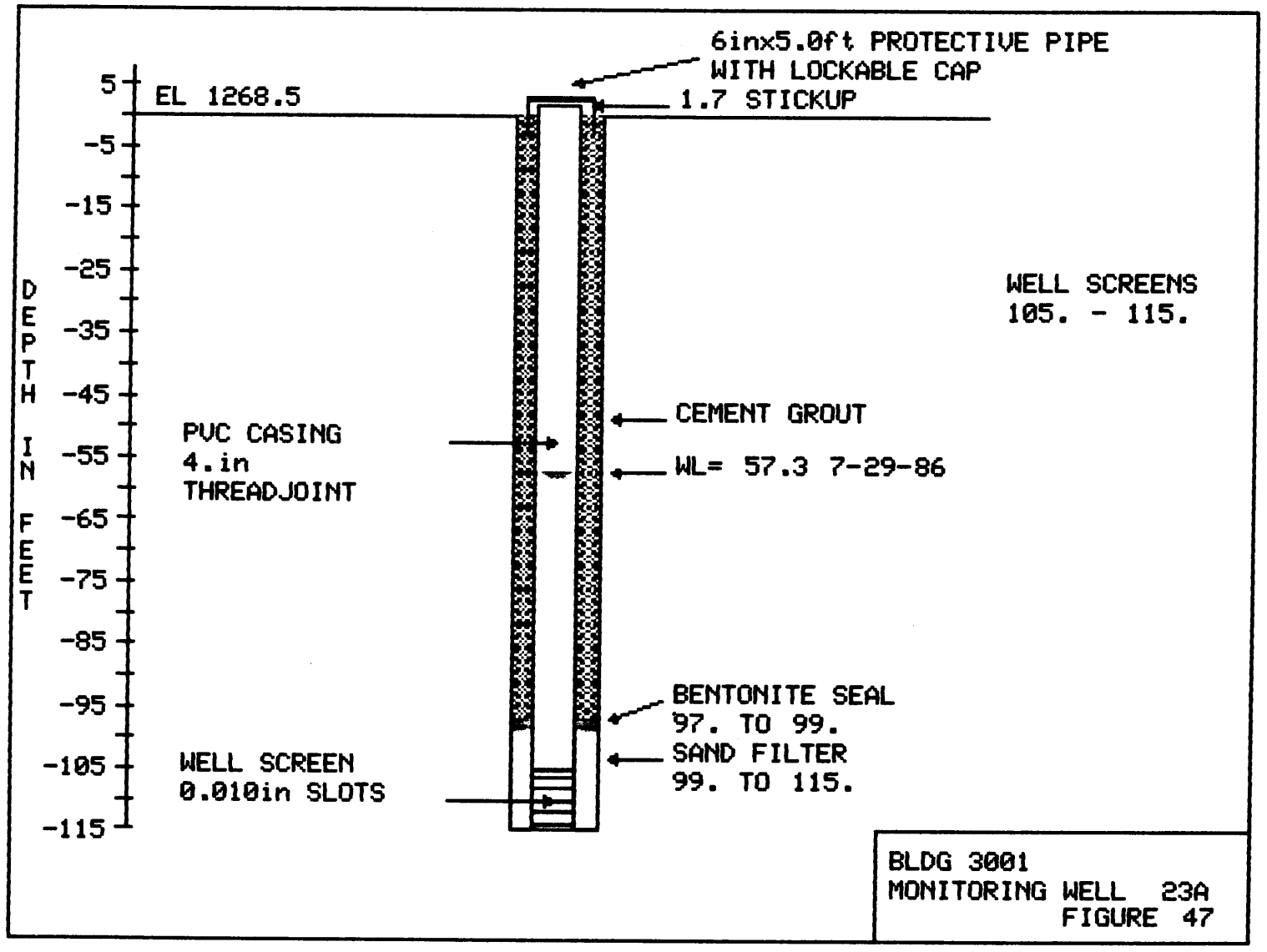

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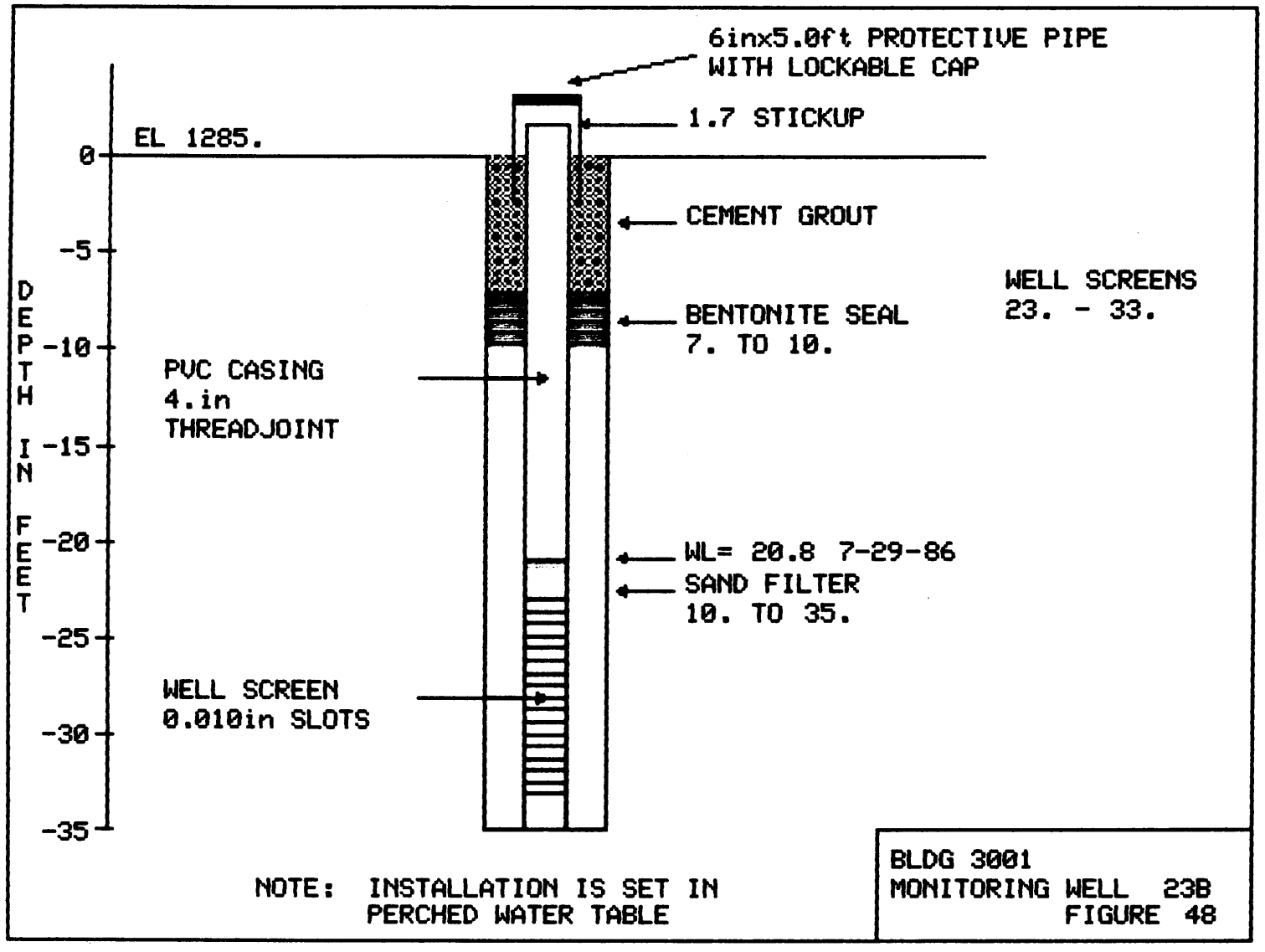

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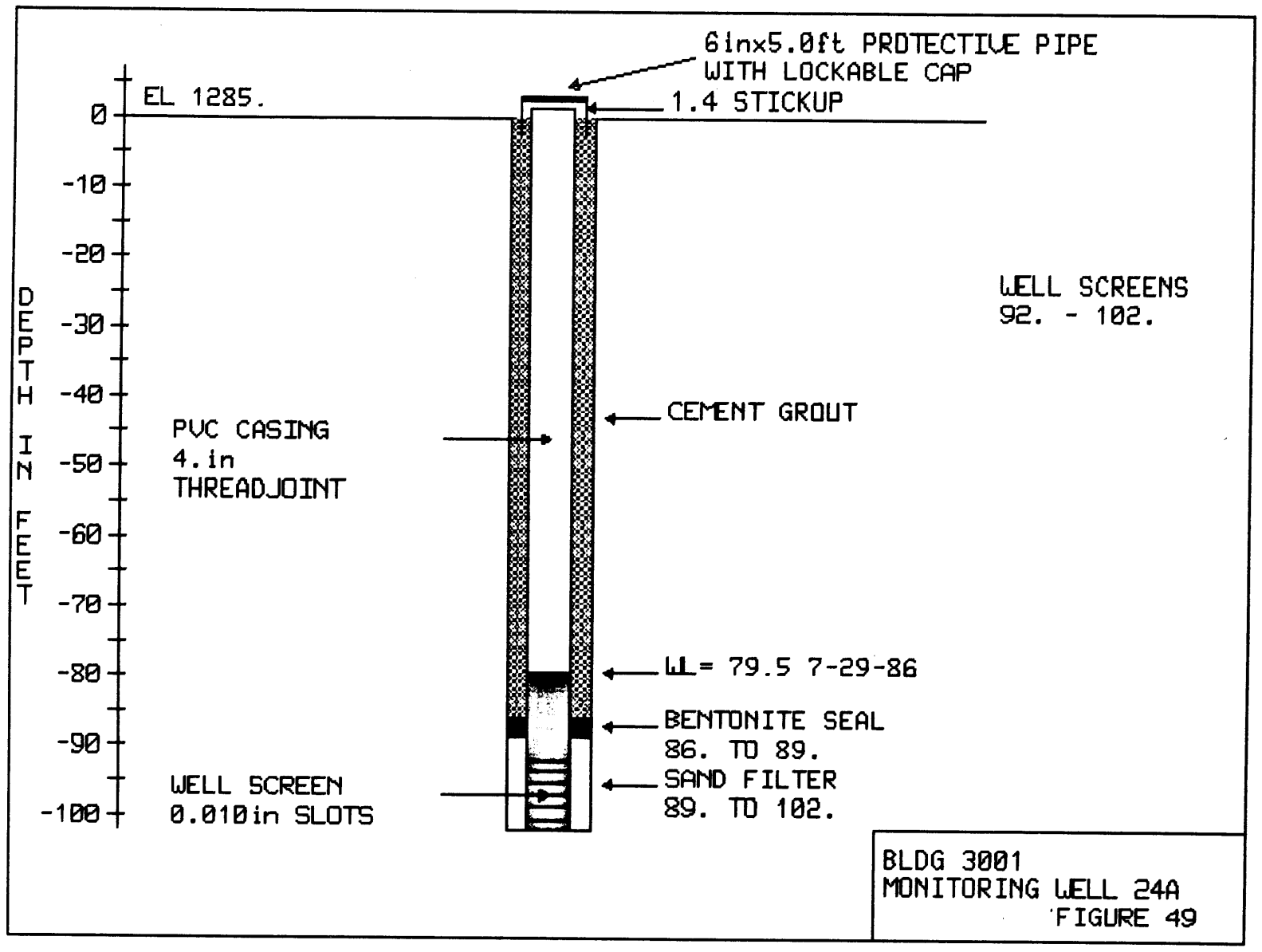

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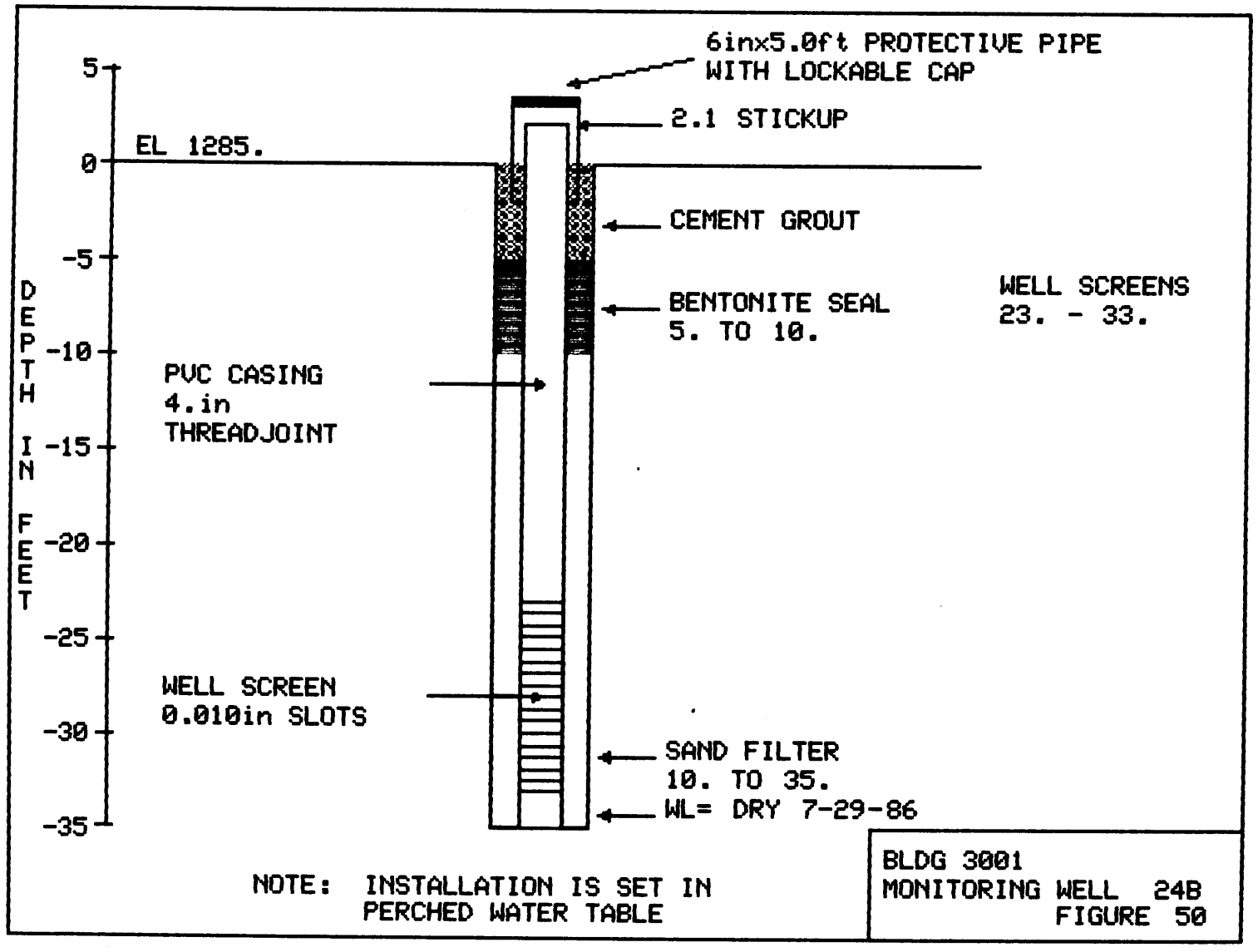

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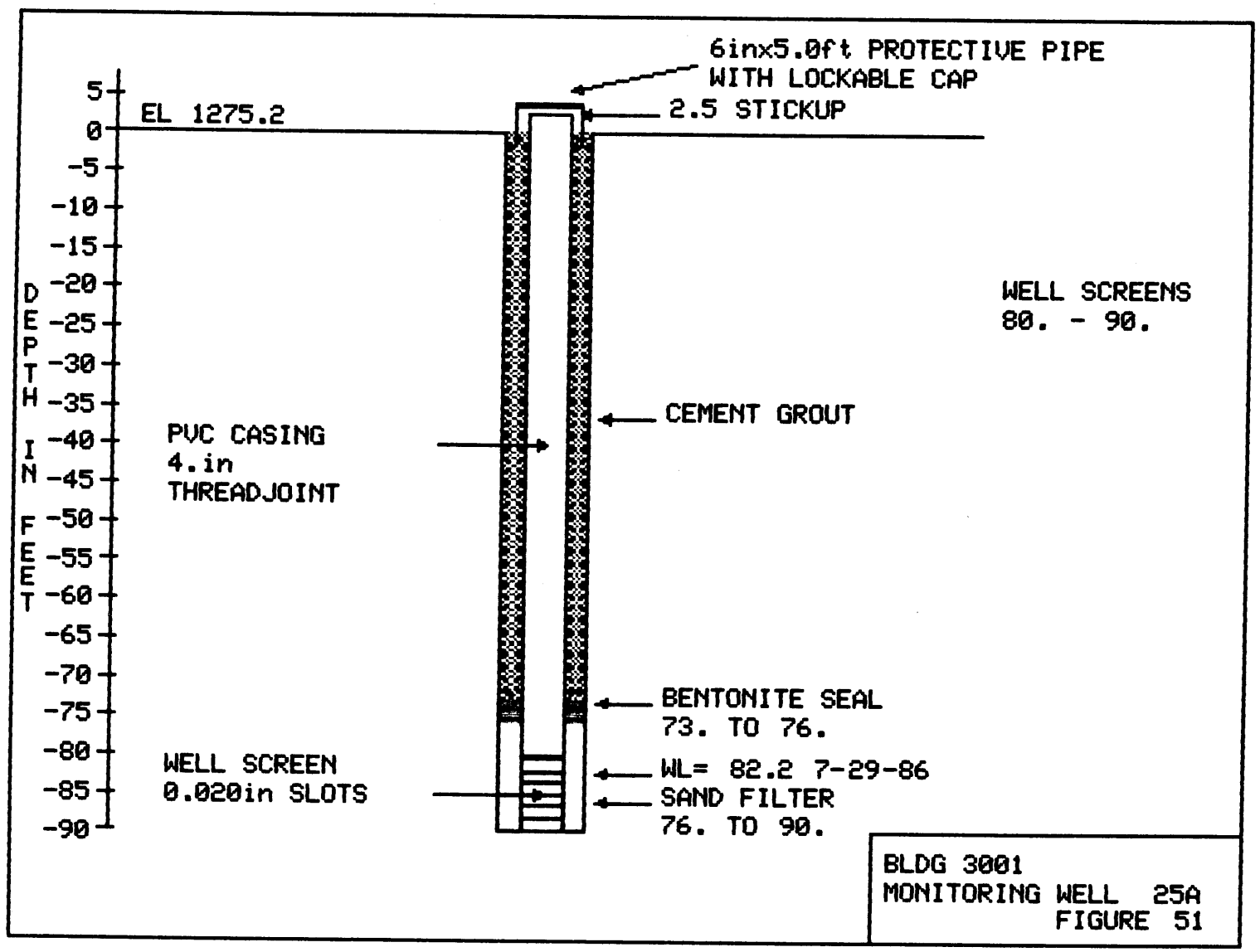

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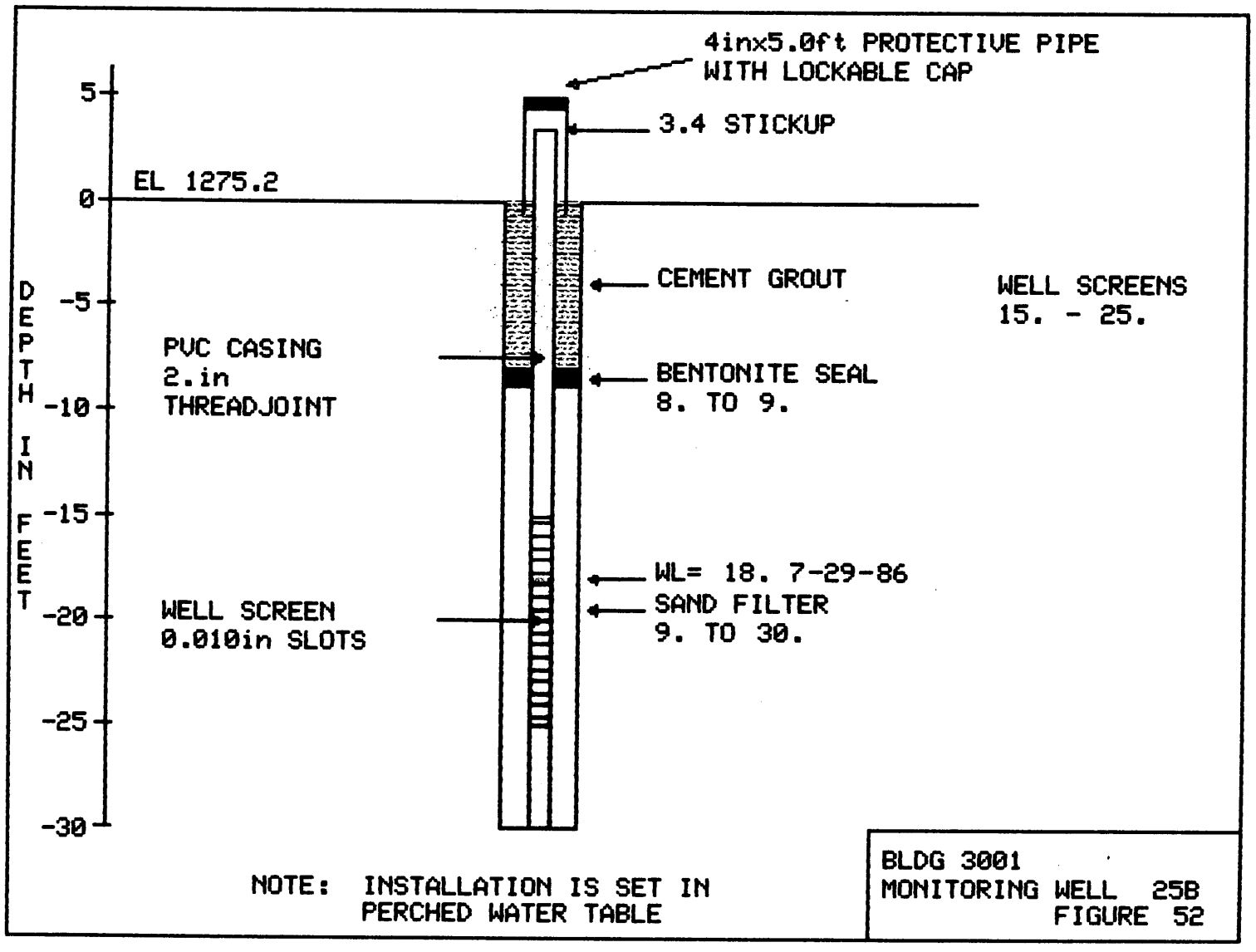

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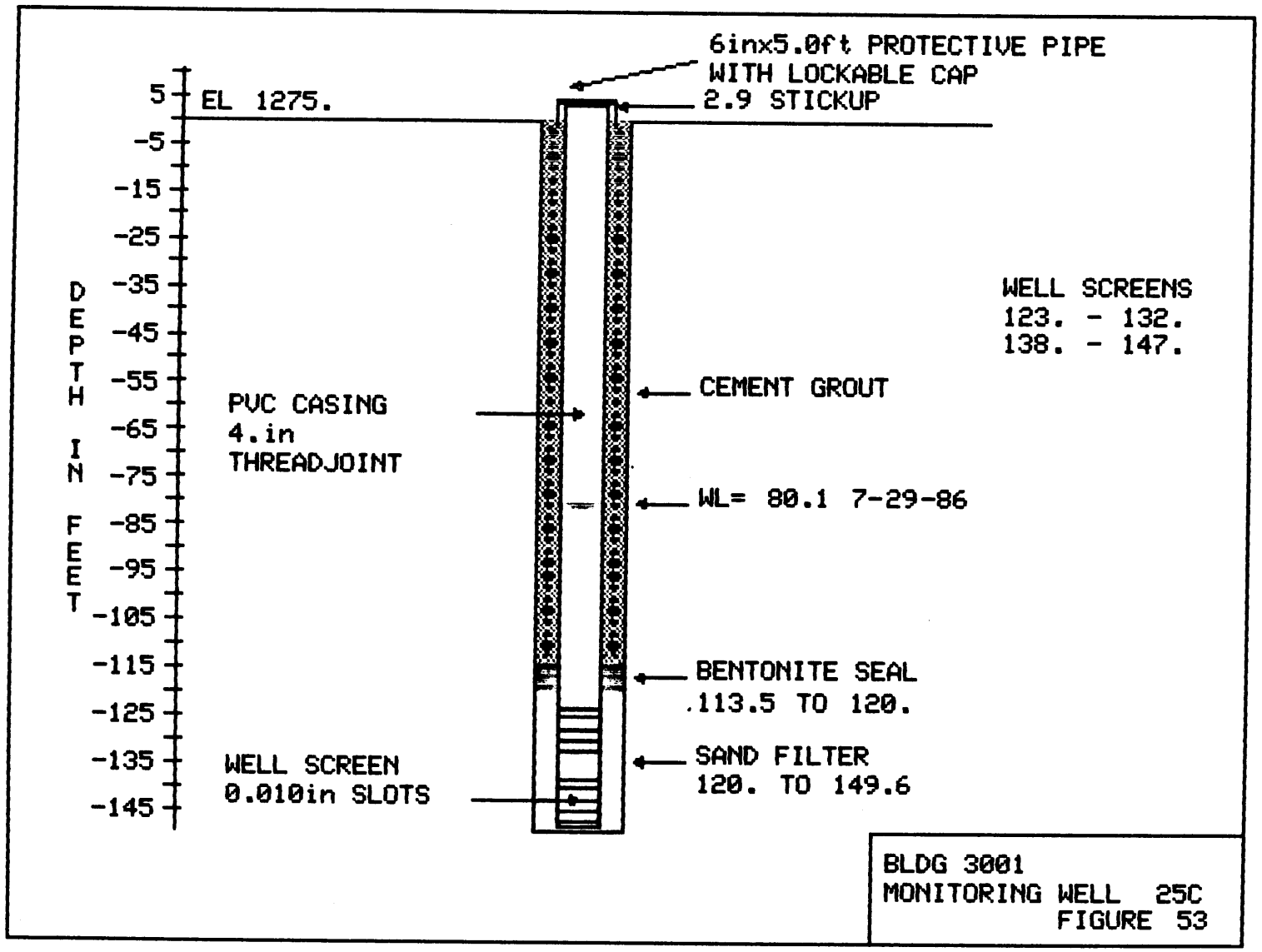

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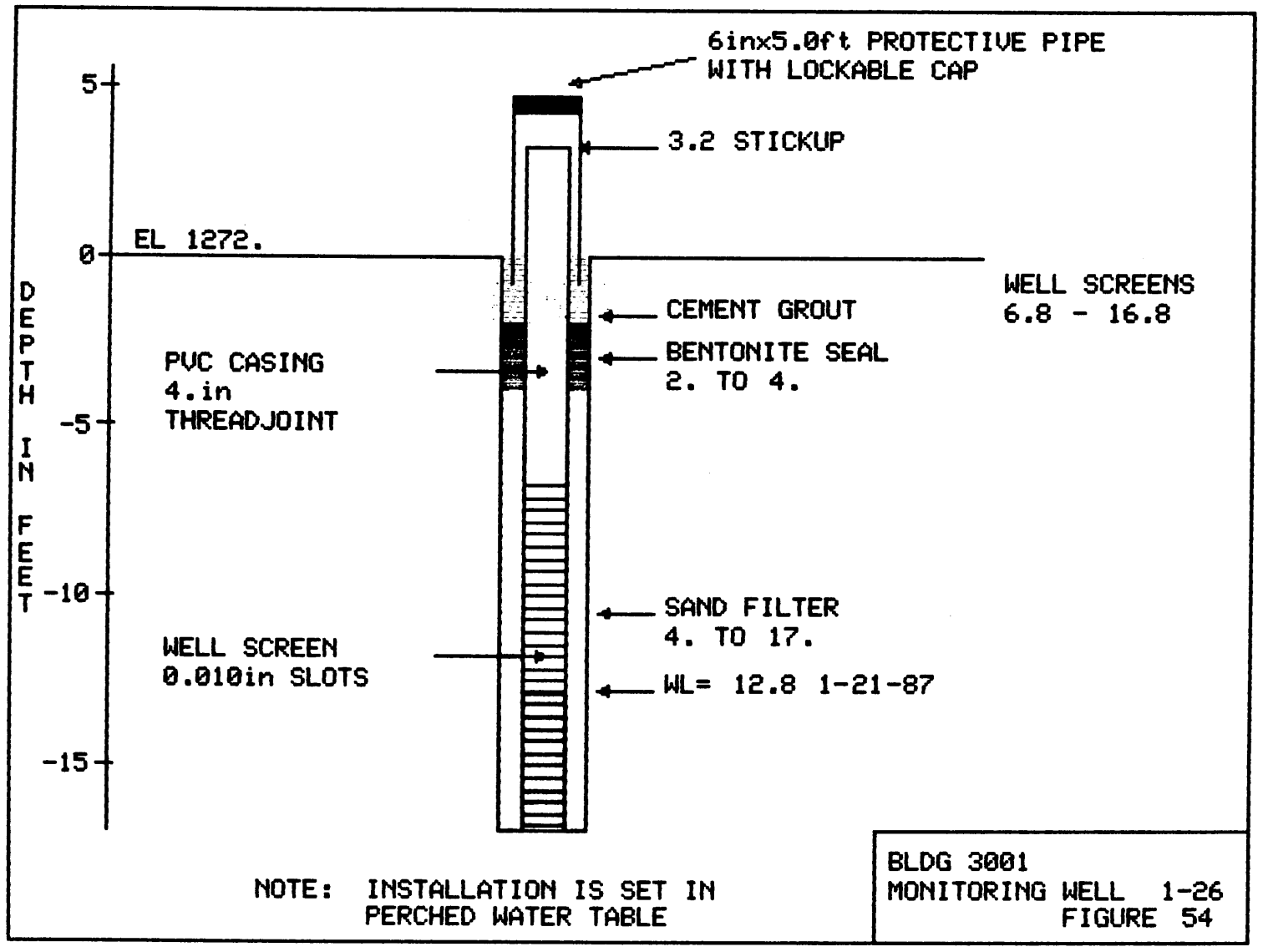

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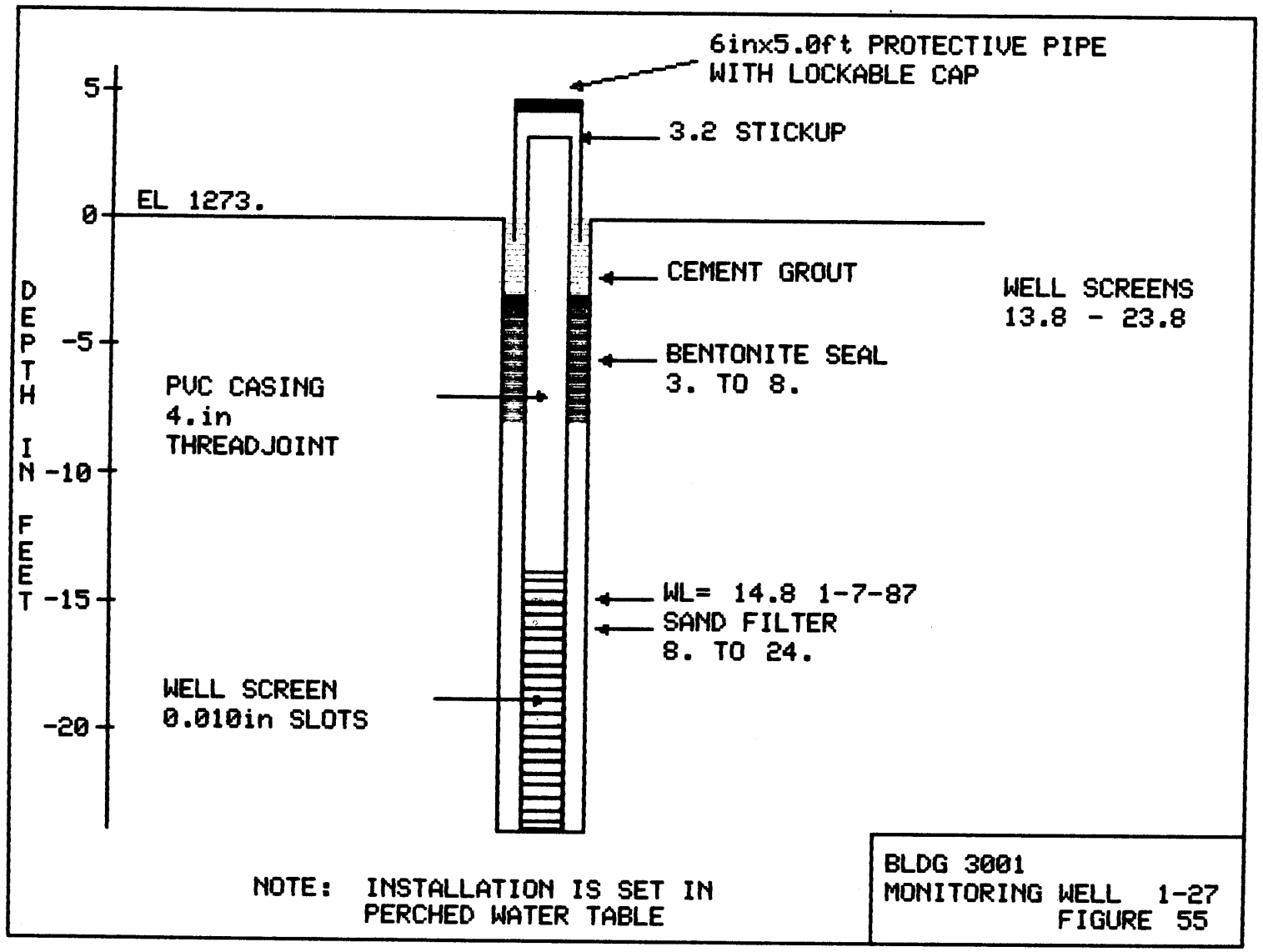
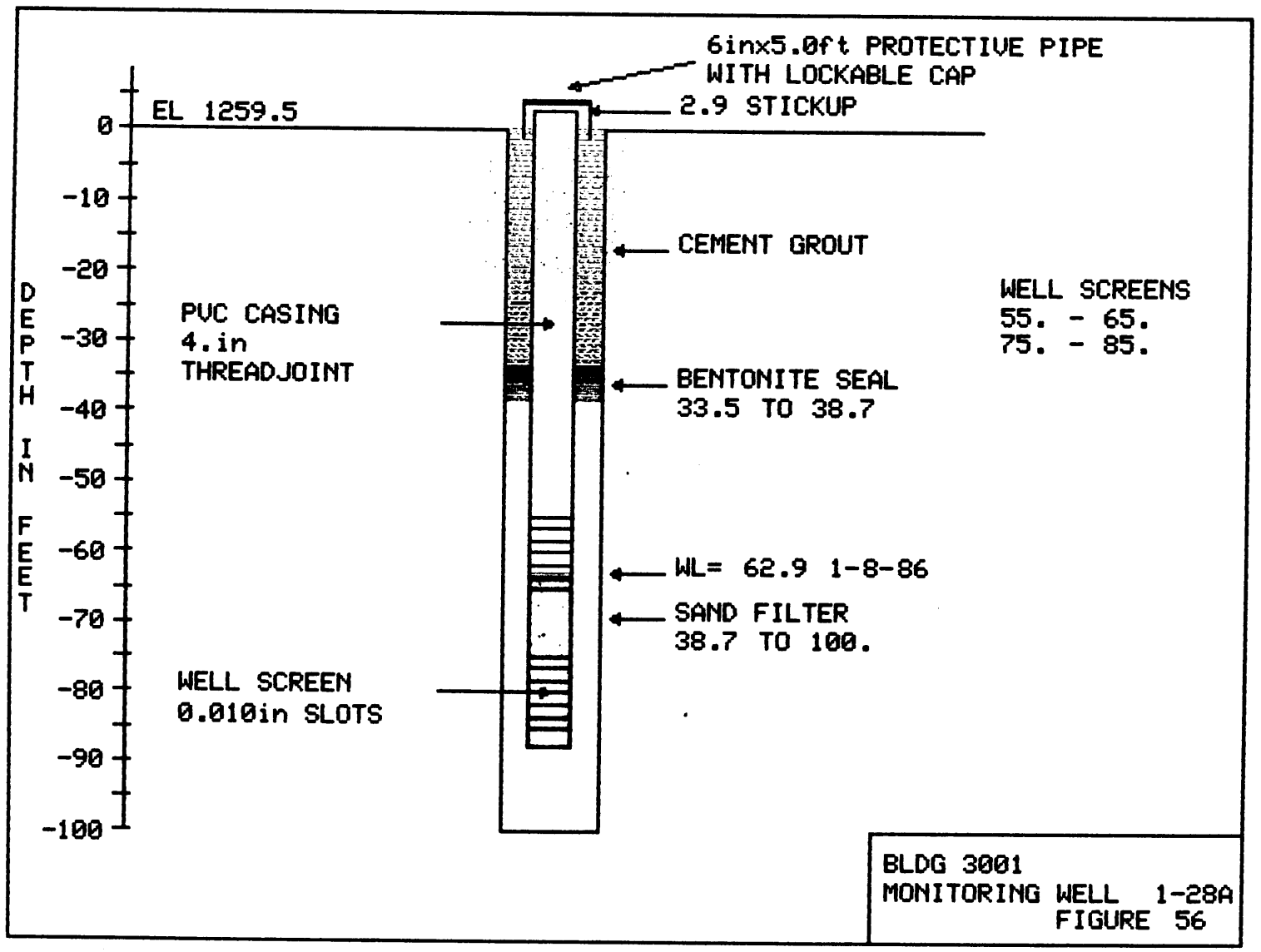
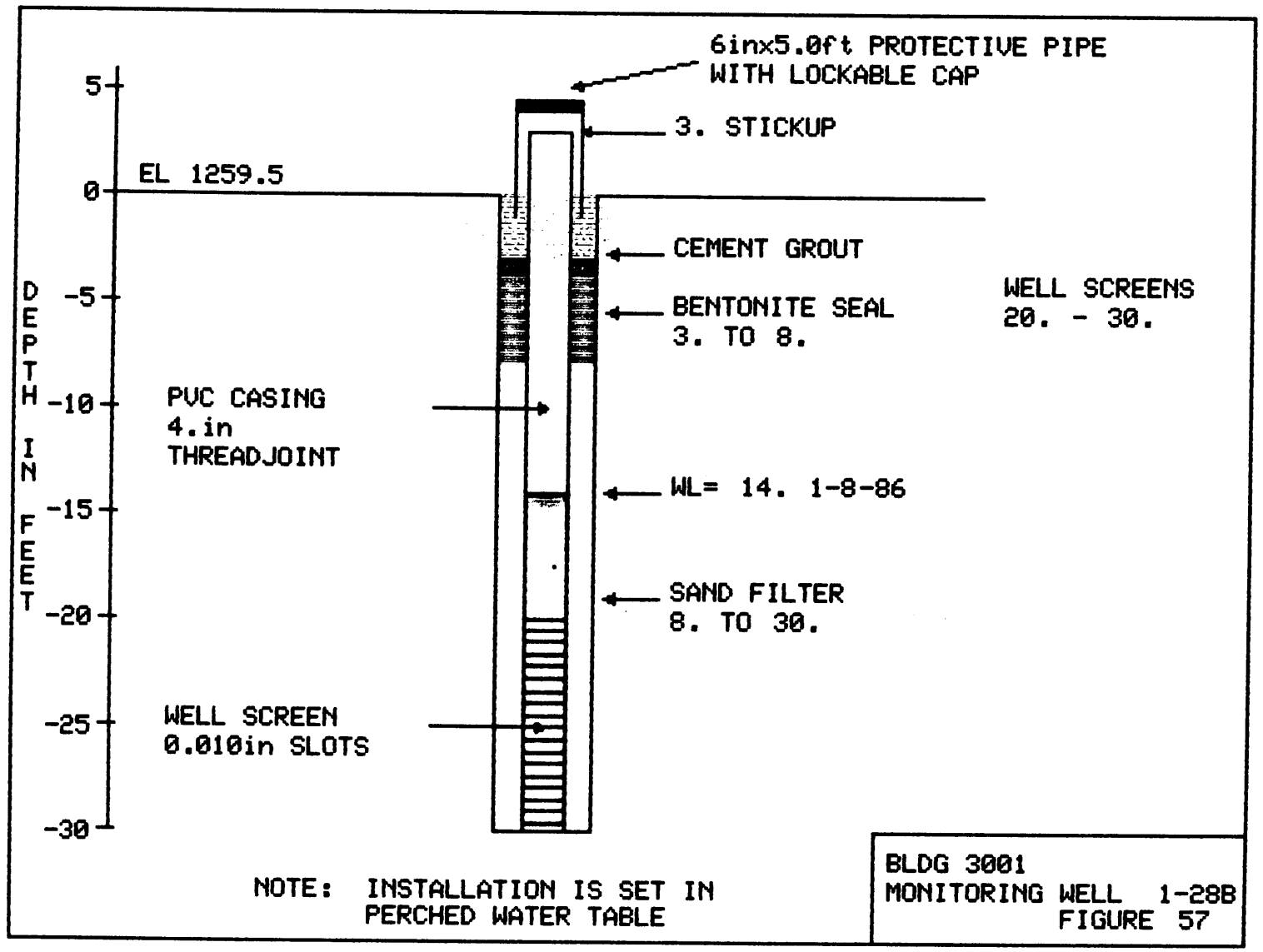
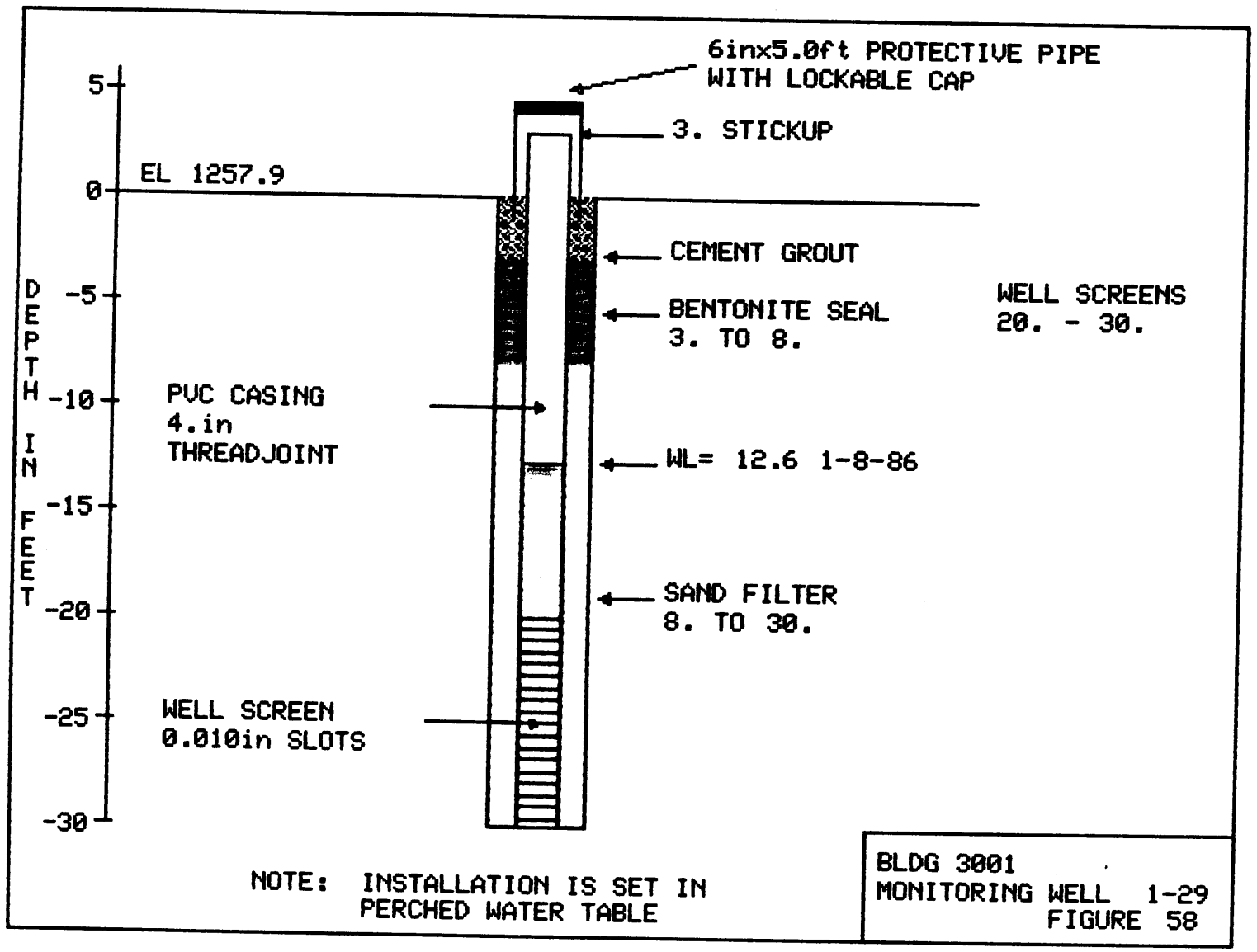


REPRODUCED AT GOVERNMENT EXPENSE

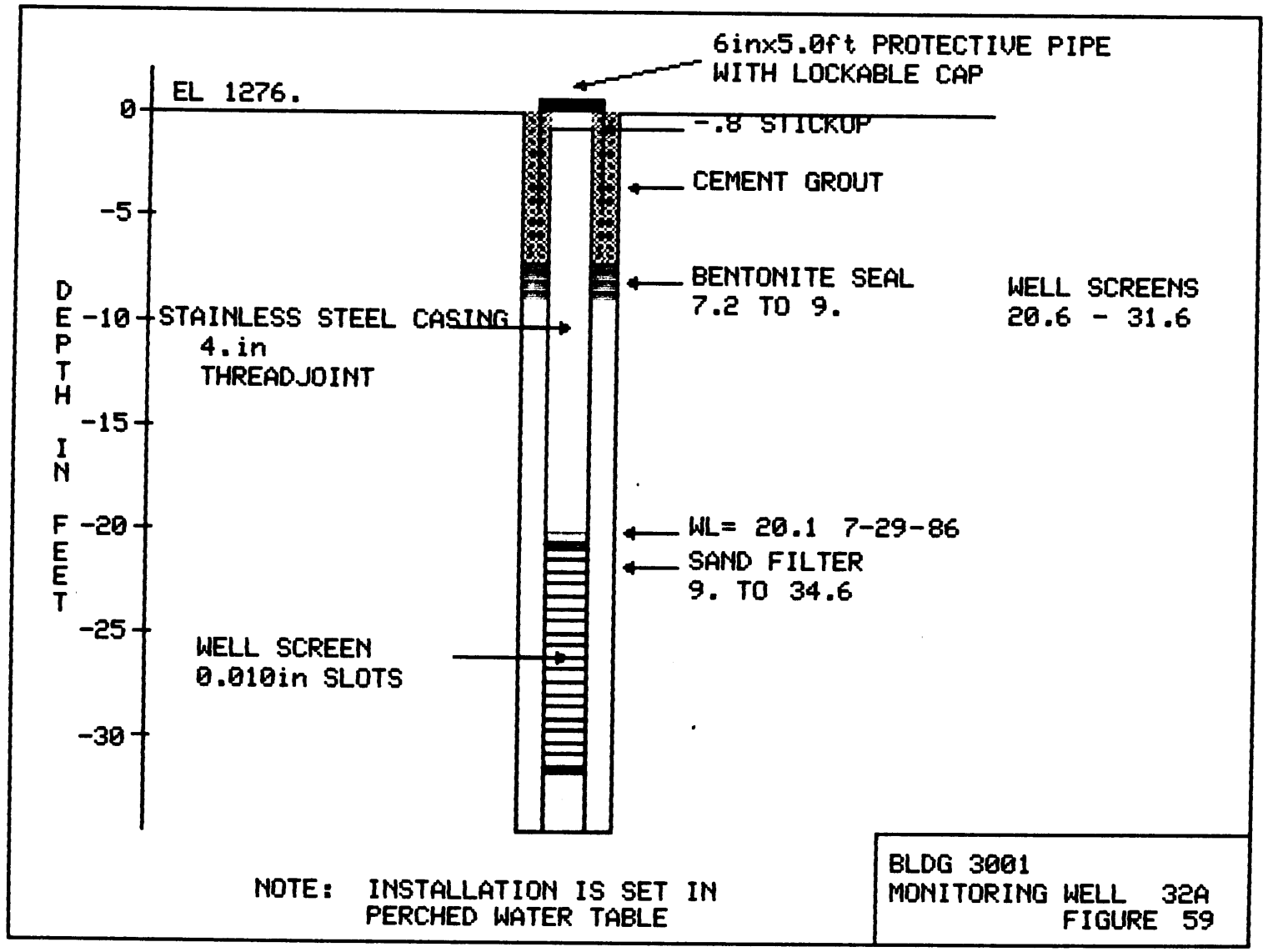

6inx5.0ft PROTECTIVE PIPE
WITH LOCKABLE CAP
2.9 STICKUP
EL 1259.5
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
DEPTH IN FEET
CEMENT GROUT
PVC CASING
4.in
THREADJOINT
WELL SCREENS
55. - 65.
75. - 85.
BENTONITE SEAL
33.5 TO 38.7
WL= 62.9 1-8-86
SAND FILTER
38.7 TO 100.
WELL SCREEN
0.010in SLOTS
BLDG 3001
MONITORING WELL 1-28A
FIGURE 56



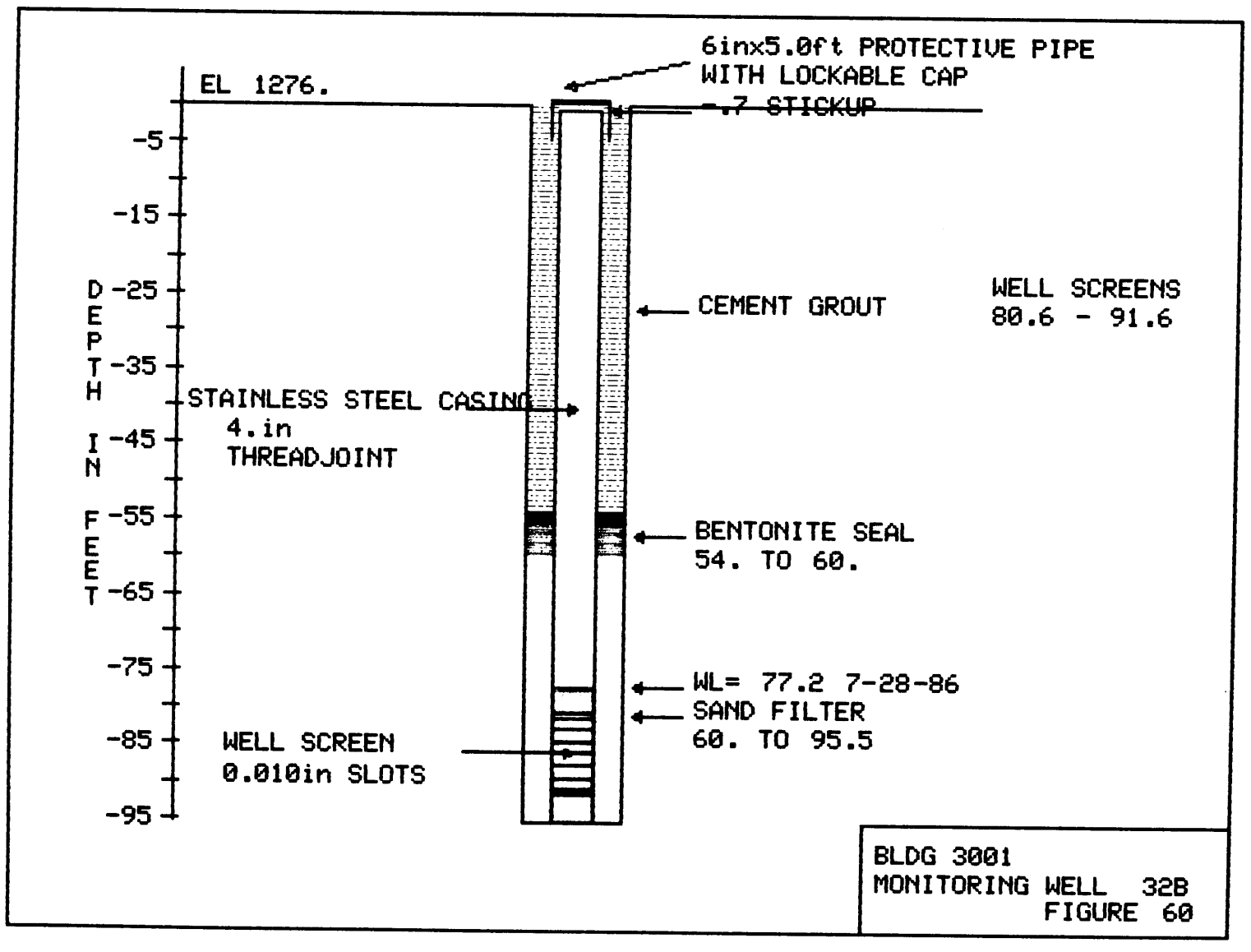
REPRODUCED AT GOVERNMENT EXPENSE



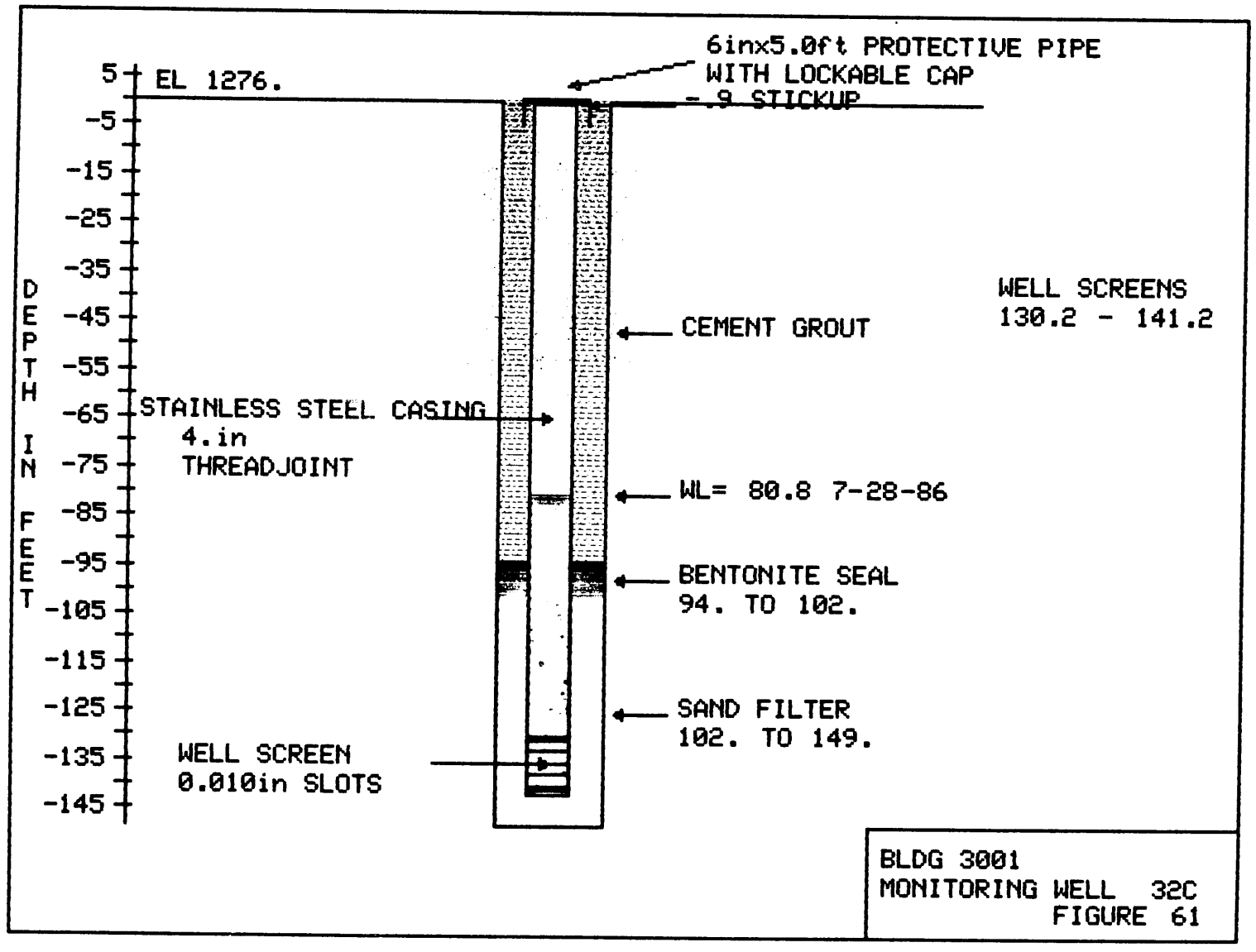
REPRODUCED AT GOVERNMENT EXPENSE



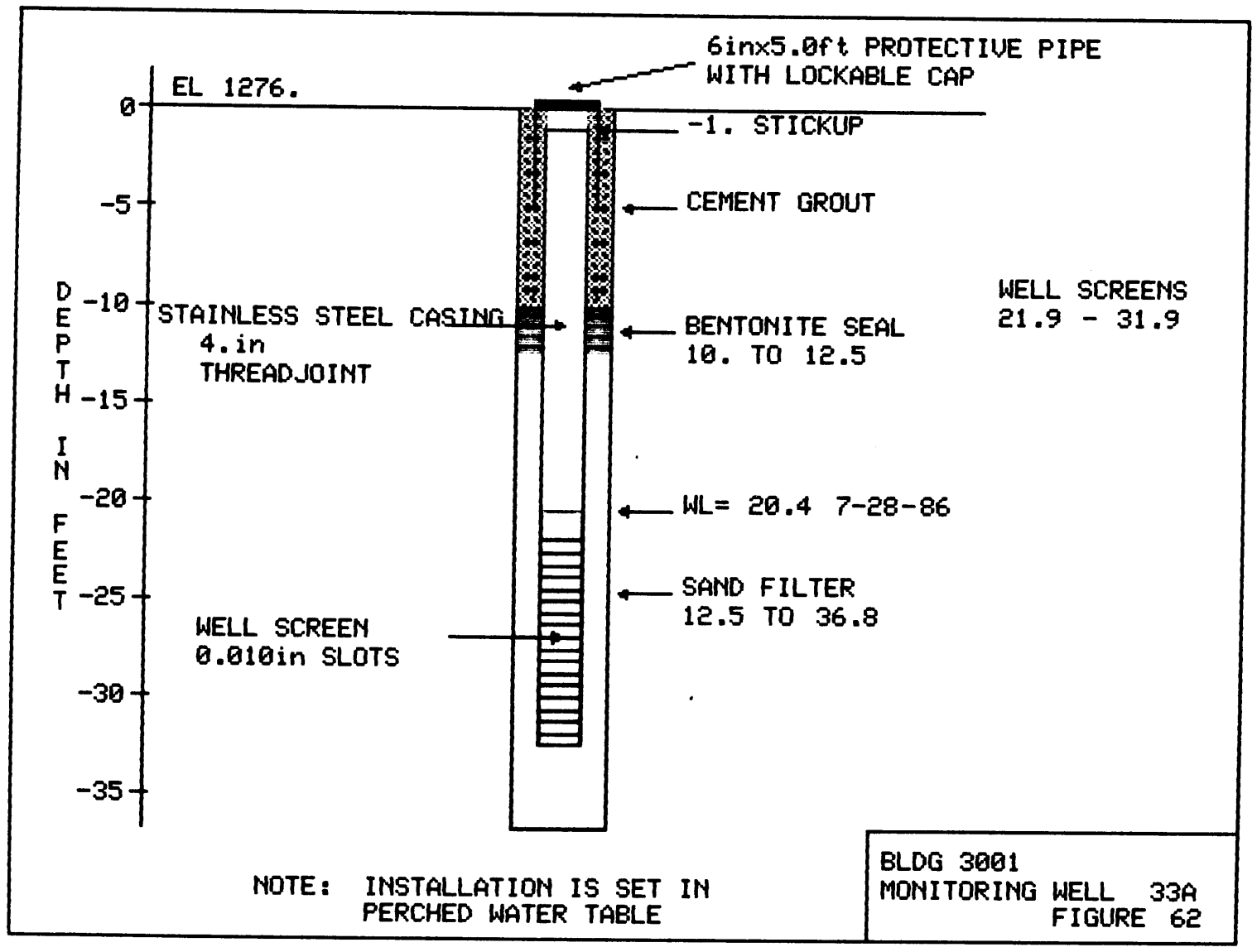
REPRODUCED AT GOVERNMENT EXPENSE



REPRODUCED AT GOVERNMENT EXPENSE



REPRODUCED AT GOVERNMENT EXPENSE



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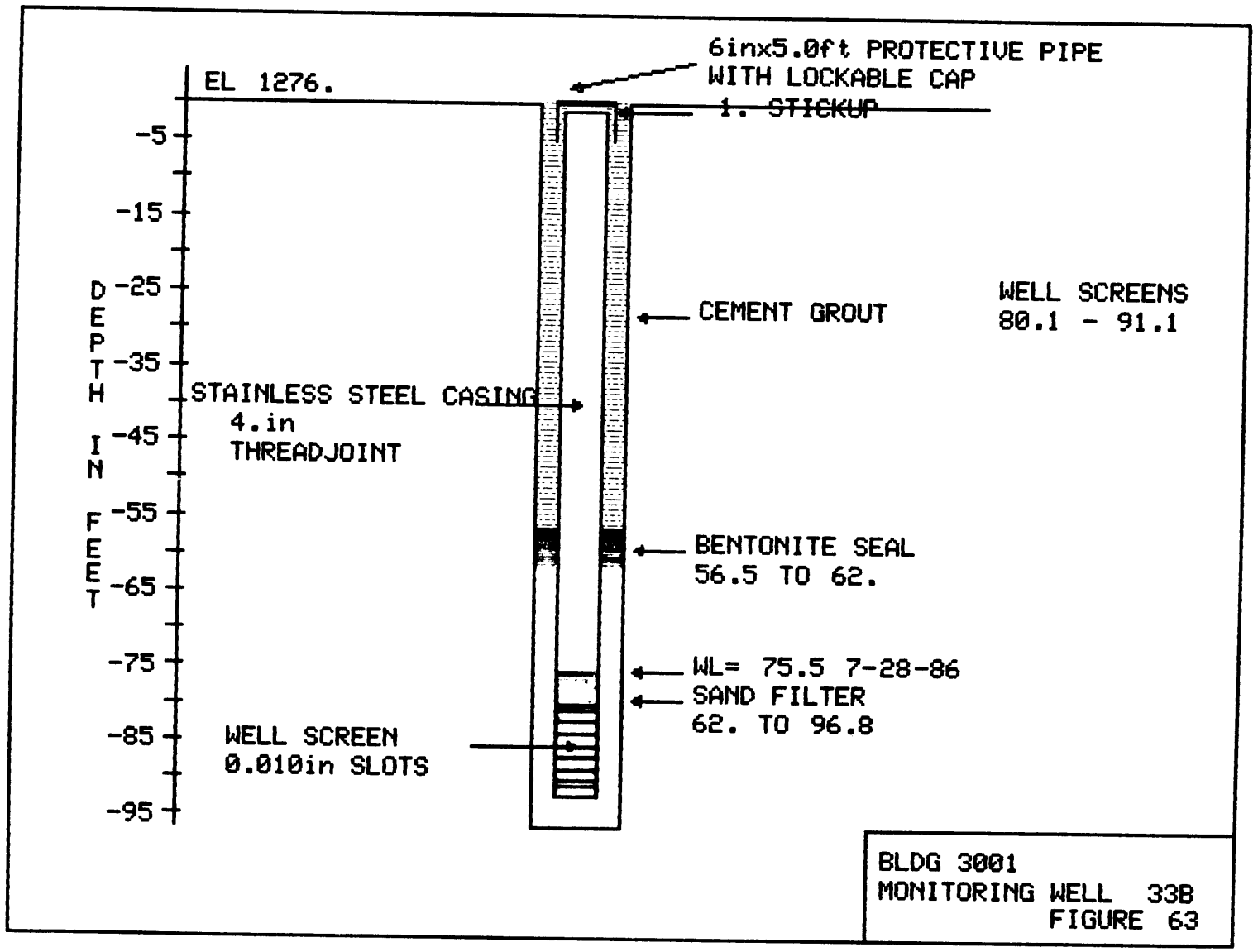

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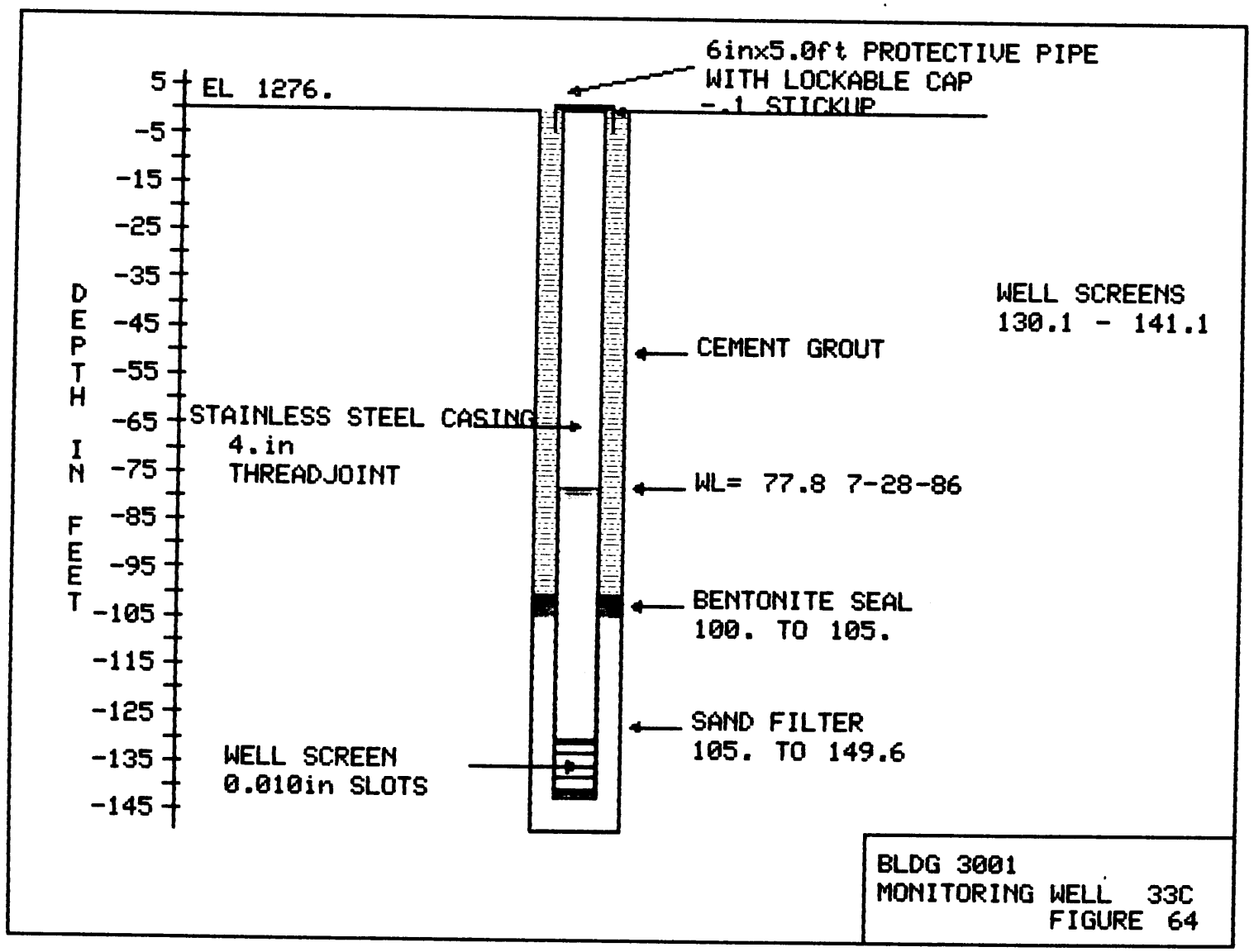
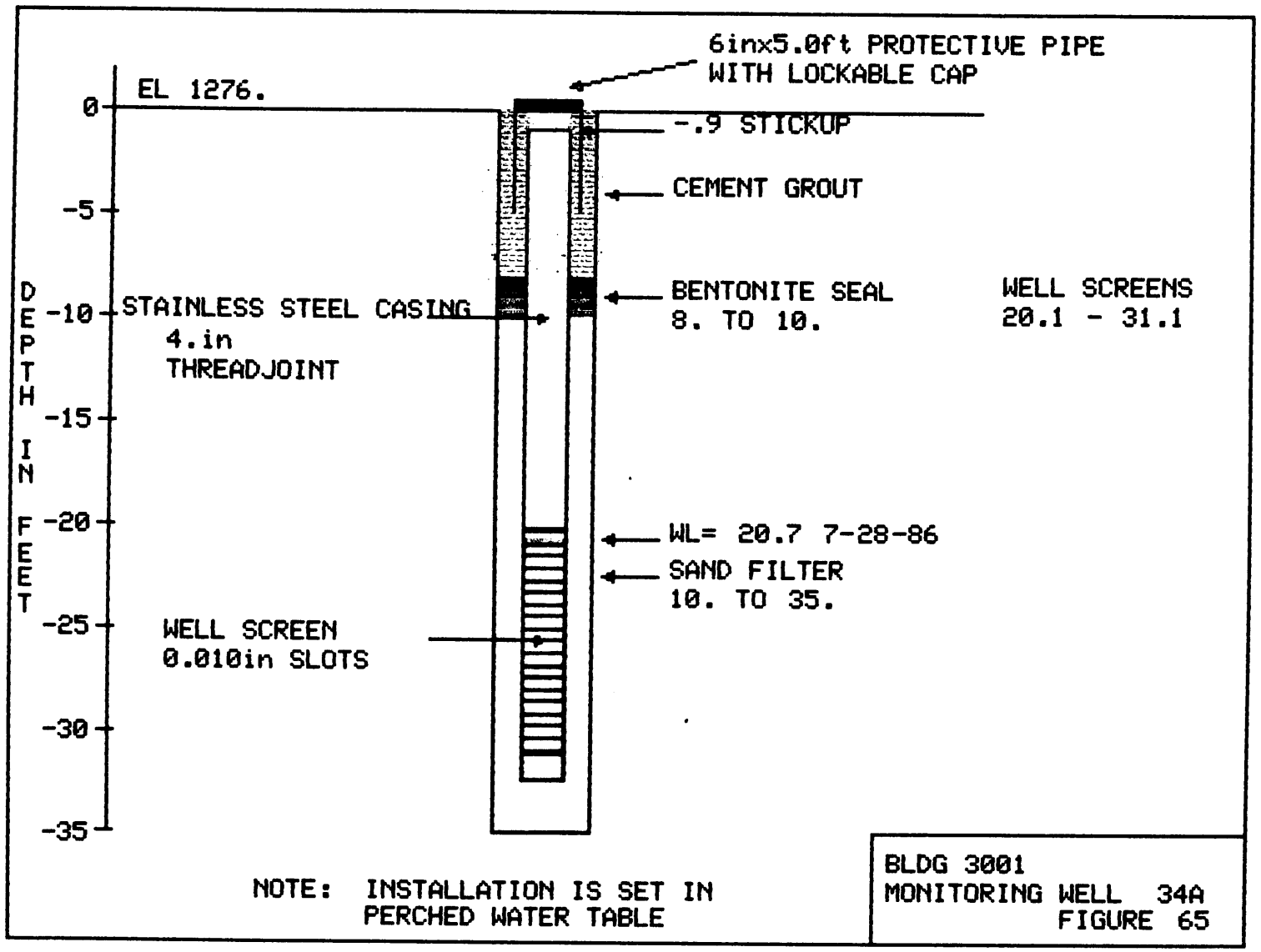
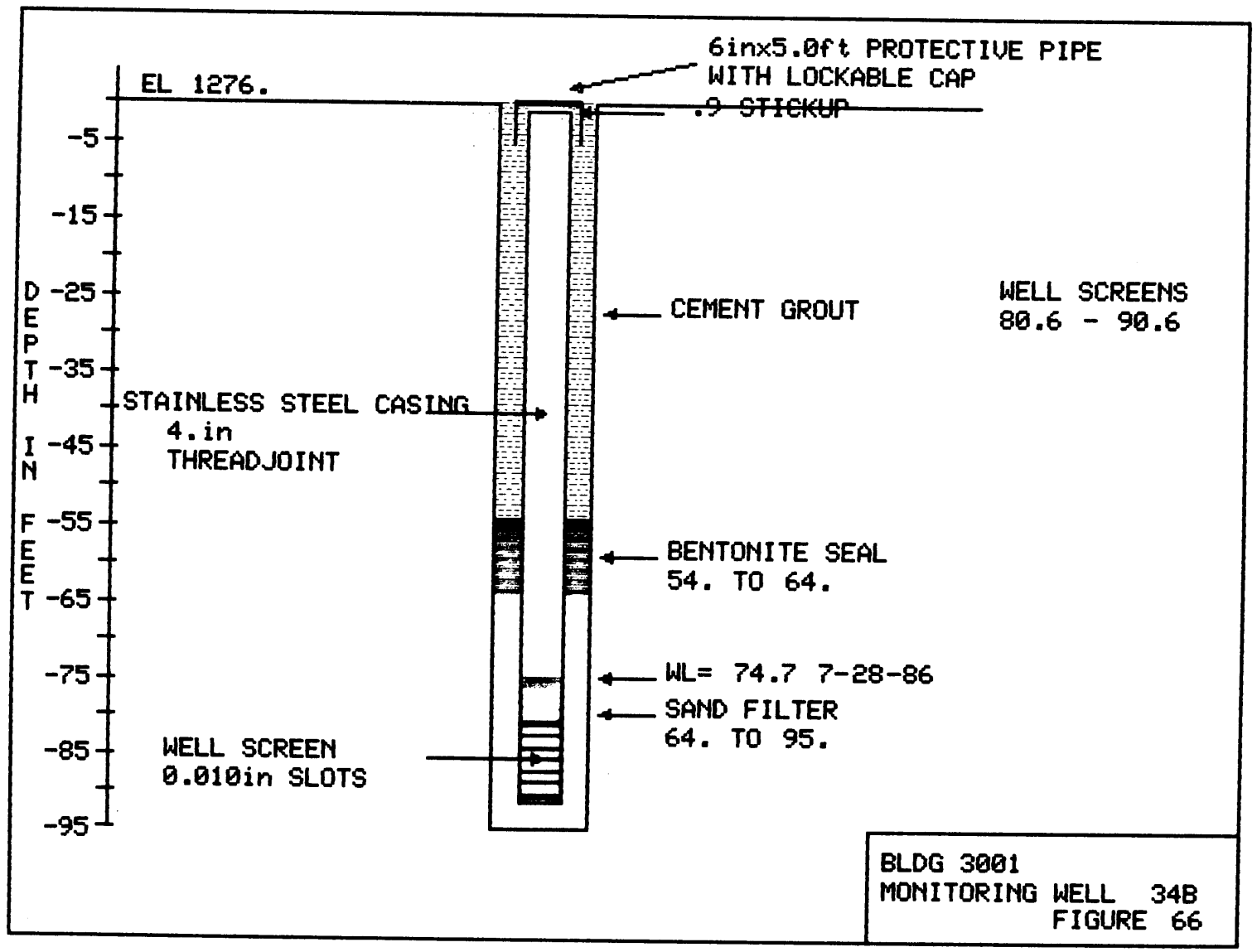
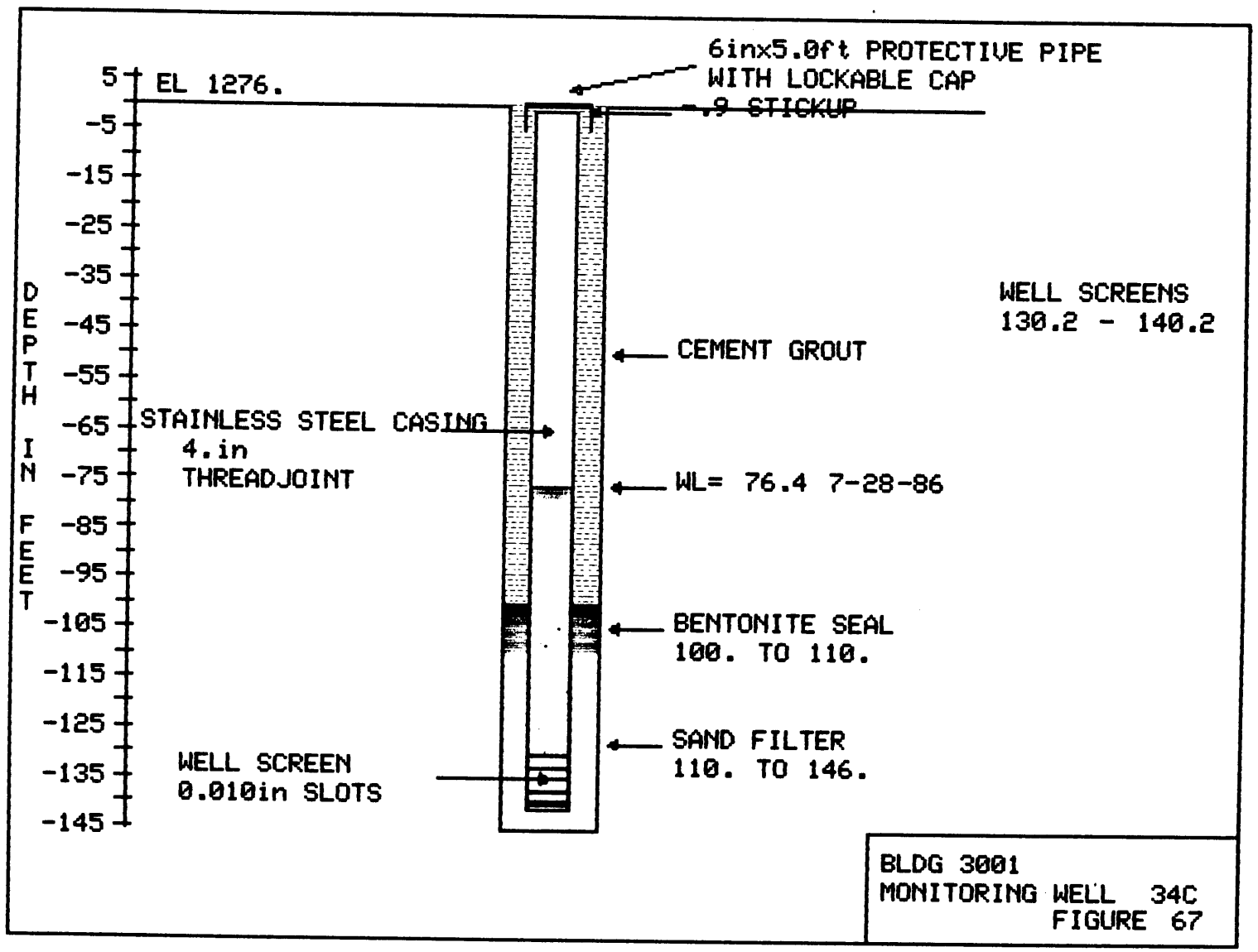

6inx5.0ft PROTECTIVE PIPE
WITH LOCKABLE CAP
-.1 STICKUP
EL 1276.
5
-5
-15
-25
-35
-45
-55
-65
-75
-85
-95
-105
-115
-125
-135
-145
DEPTH IN FEET
WELL SCREENS
130.1 - 141.1
CEMENT GROUT
STAINLESS STEEL CASING
4.in
THREADJOINT
WL= 77.8 7-28-86
BENTONITE SEAL
100. TO 105.
SAND FILTER
105. TO 149.6
WELL SCREEN
0.010in SLOTS
BLDG 3001
MONITORING WELL 33C
FIGURE 64



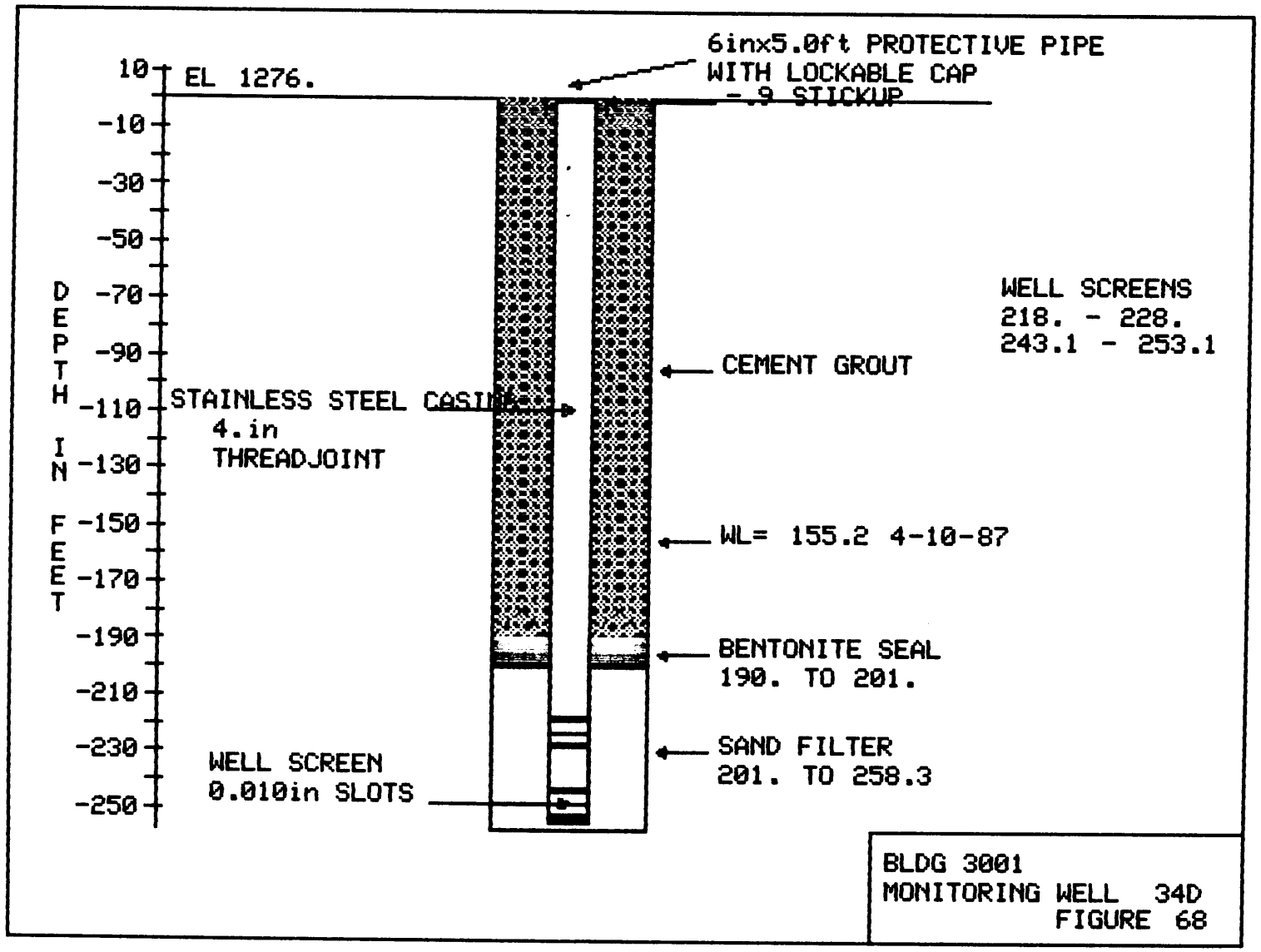
REPRODUCED AT GOVERNMENT EXPENSE



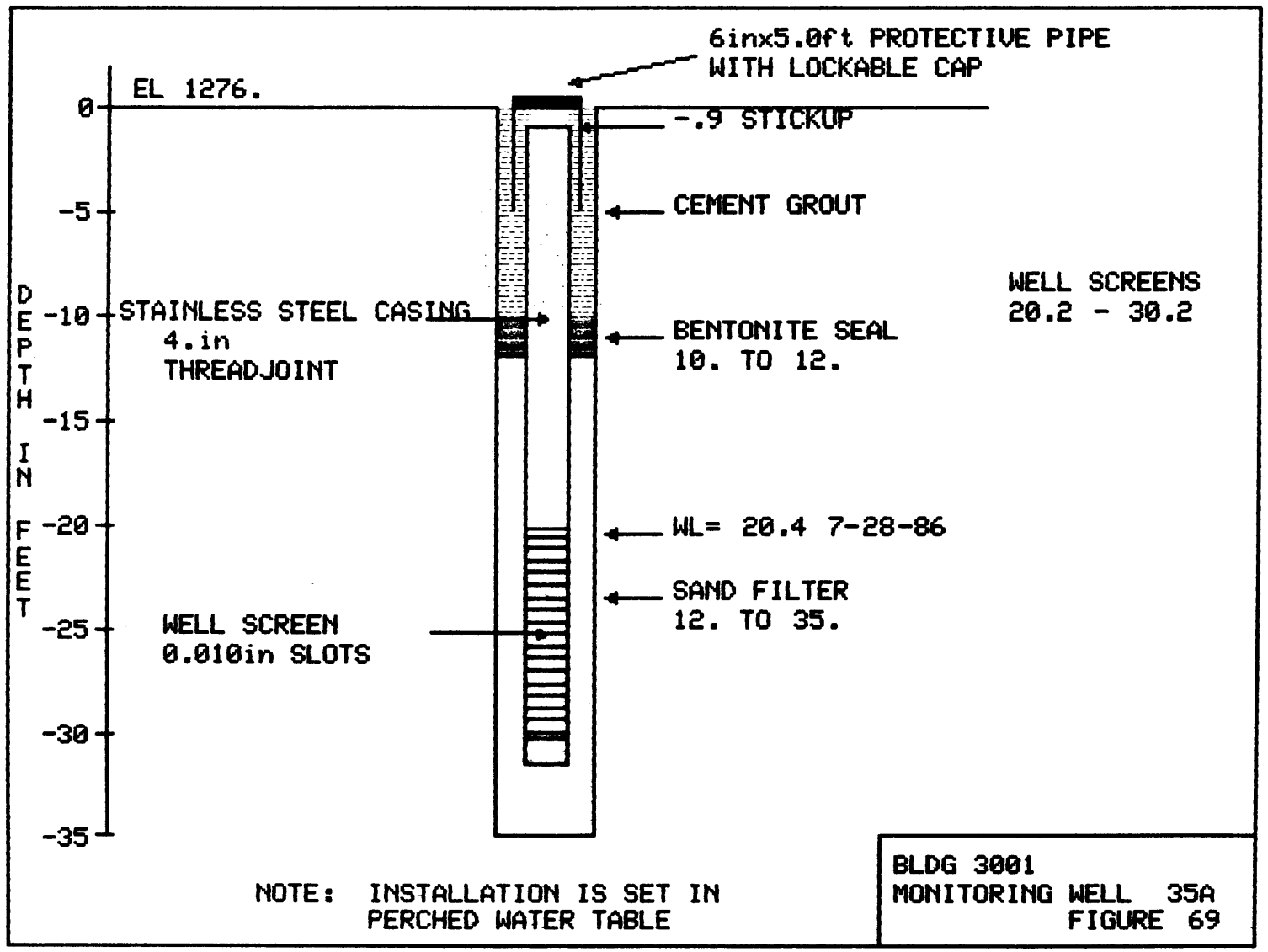
REPRODUCED AT GOVERNMENT EXPENSE


6inx5.0ft PROTECTIVE PIPE
WITH LOCKABLE CAP
.9 STICKUP
EL 1276.
5
-5
-15
-25
-35
-45
-55
-65
-75
-85
-95
-105
-115
-125
-135
-145
DEPTH IN FEET
WELL SCREENS
130.2 - 140.2
CEMENT GROUT
STAINLESS STEEL CASING
4.in
THREADJOINT
WL= 76.4 7-28-86
BENTONITE SEAL
100. TO 110.
SAND FILTER
110. TO 146.
WELL SCREEN
0.010in SLOTS
BLDG 3001
MONITORING WELL 34C
FIGURE 67

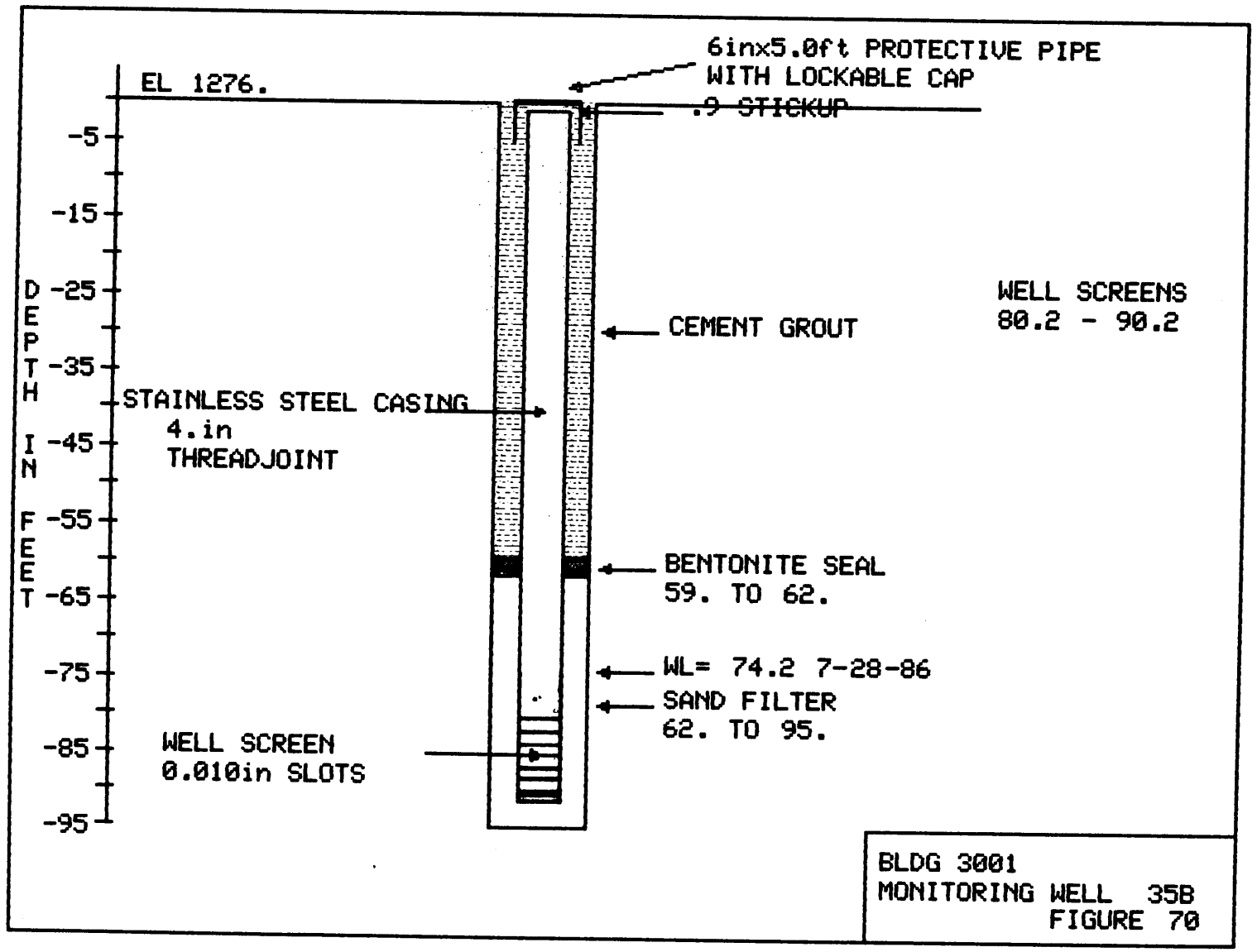
REPRODUCED AT GOVERNMENT EXPENSE



REPRC AT G MENT SE



REPRODUCED AT GOVERNMENT EXPENSE



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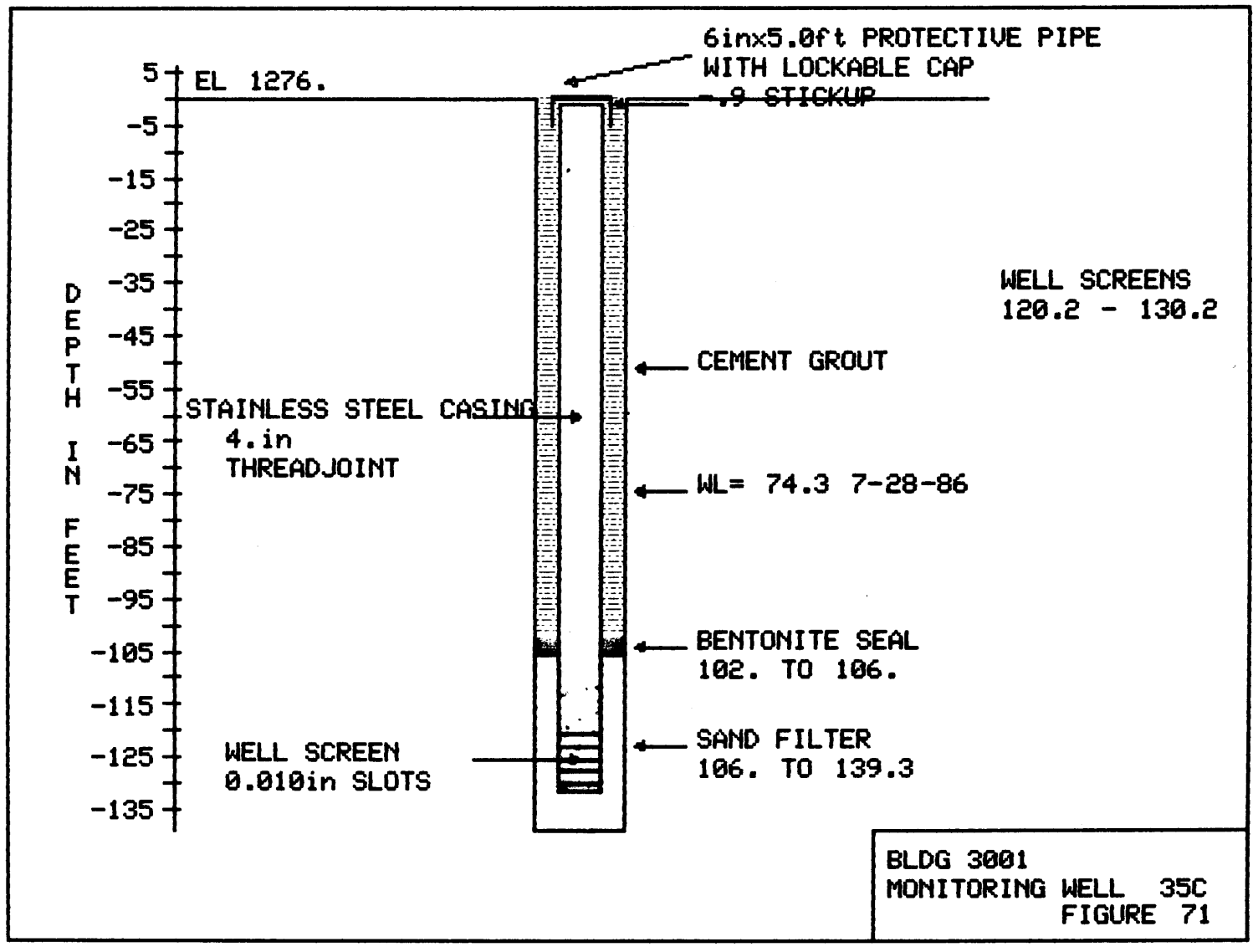
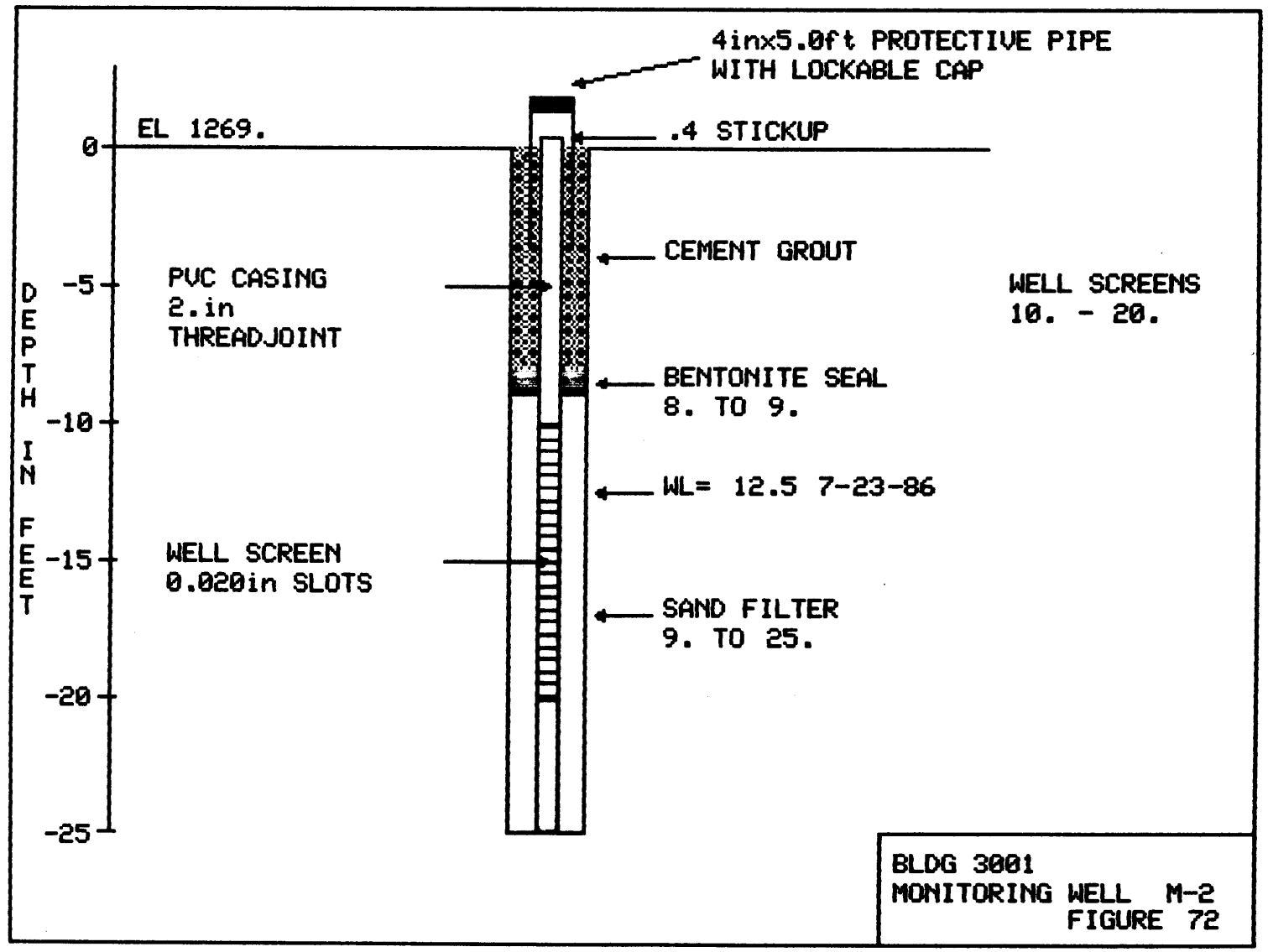
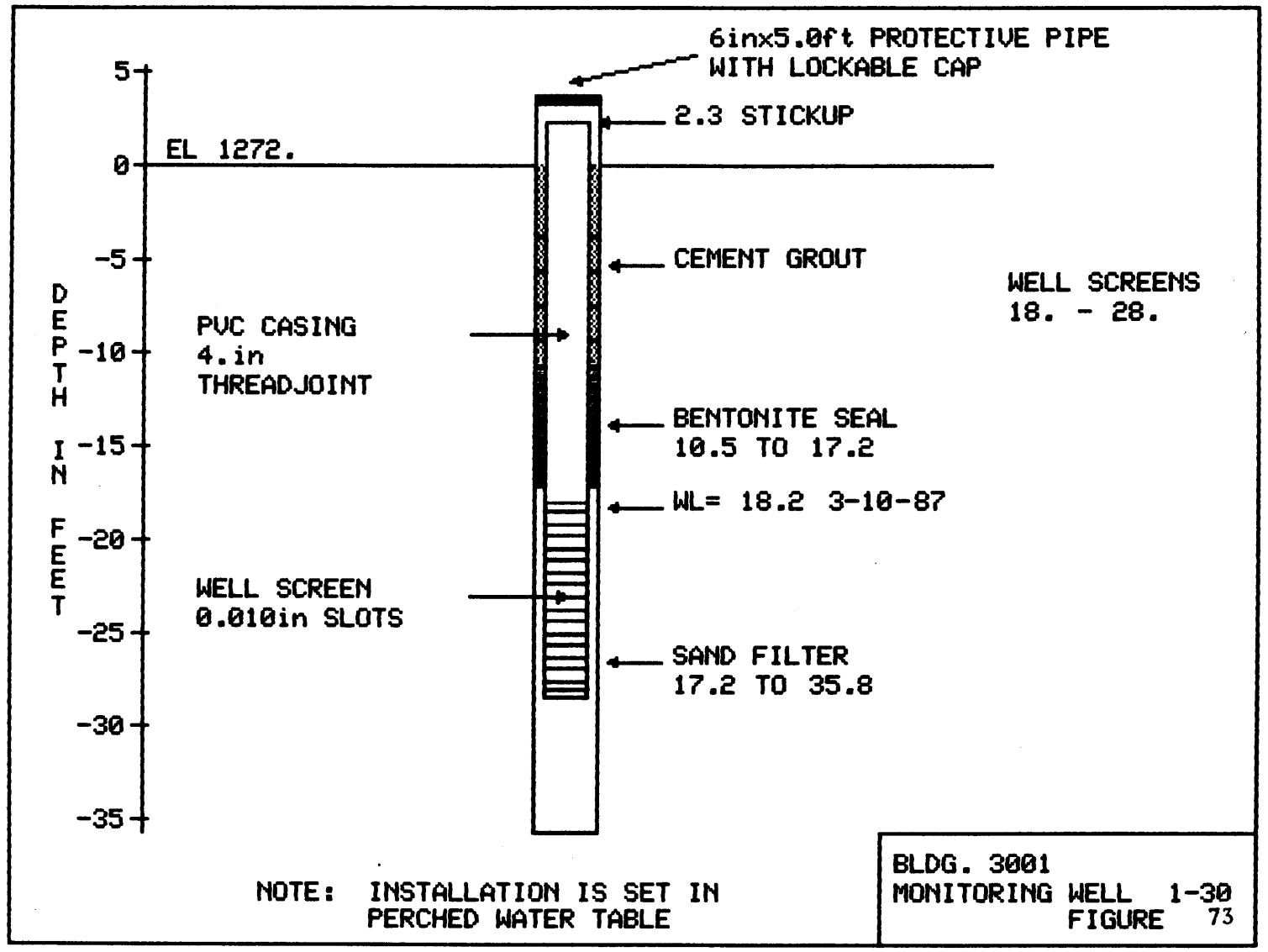


REPRODUCED AT GOVERNMENT EXPENSE

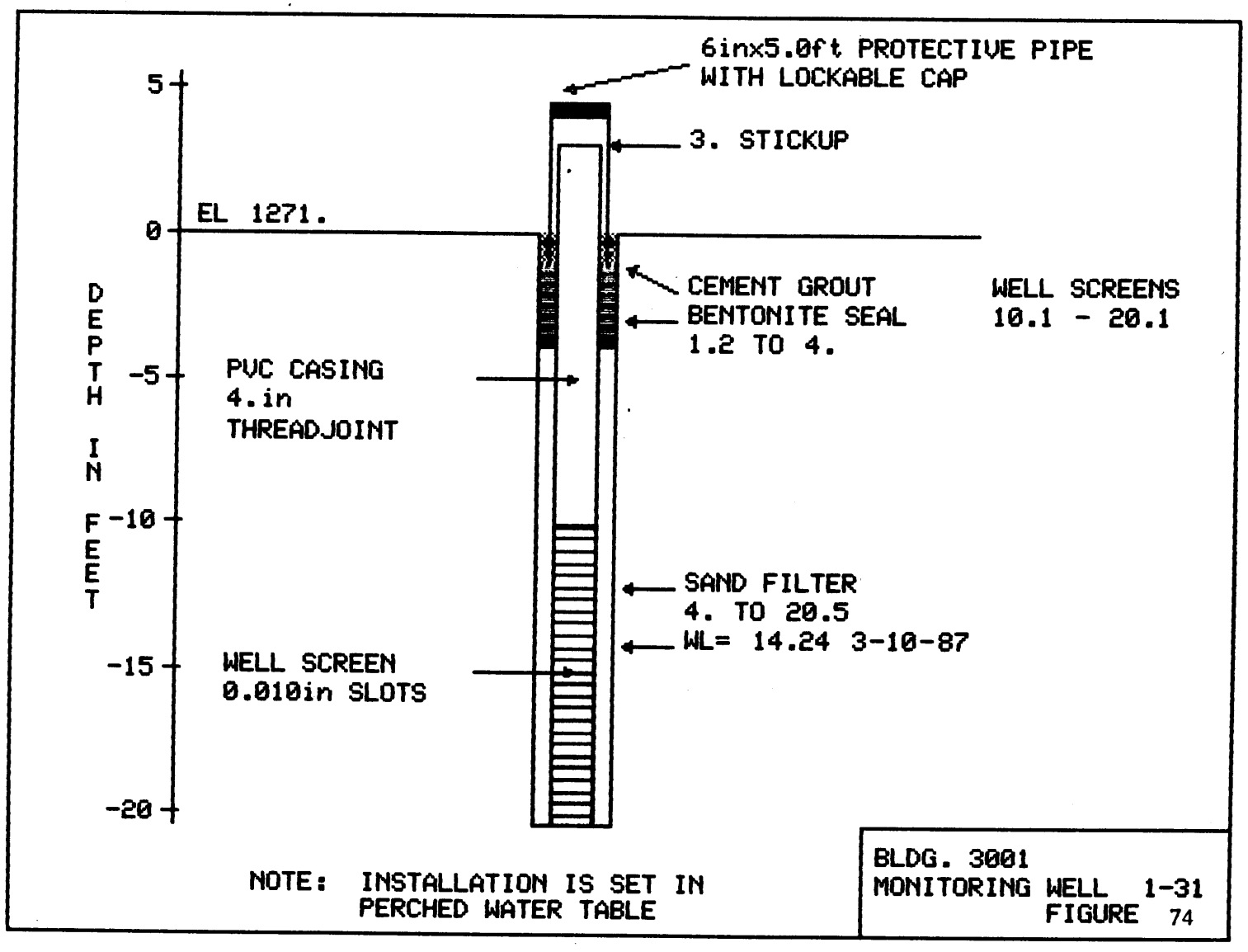


REPRODUCED AT GOVERNMENT EXPENSE



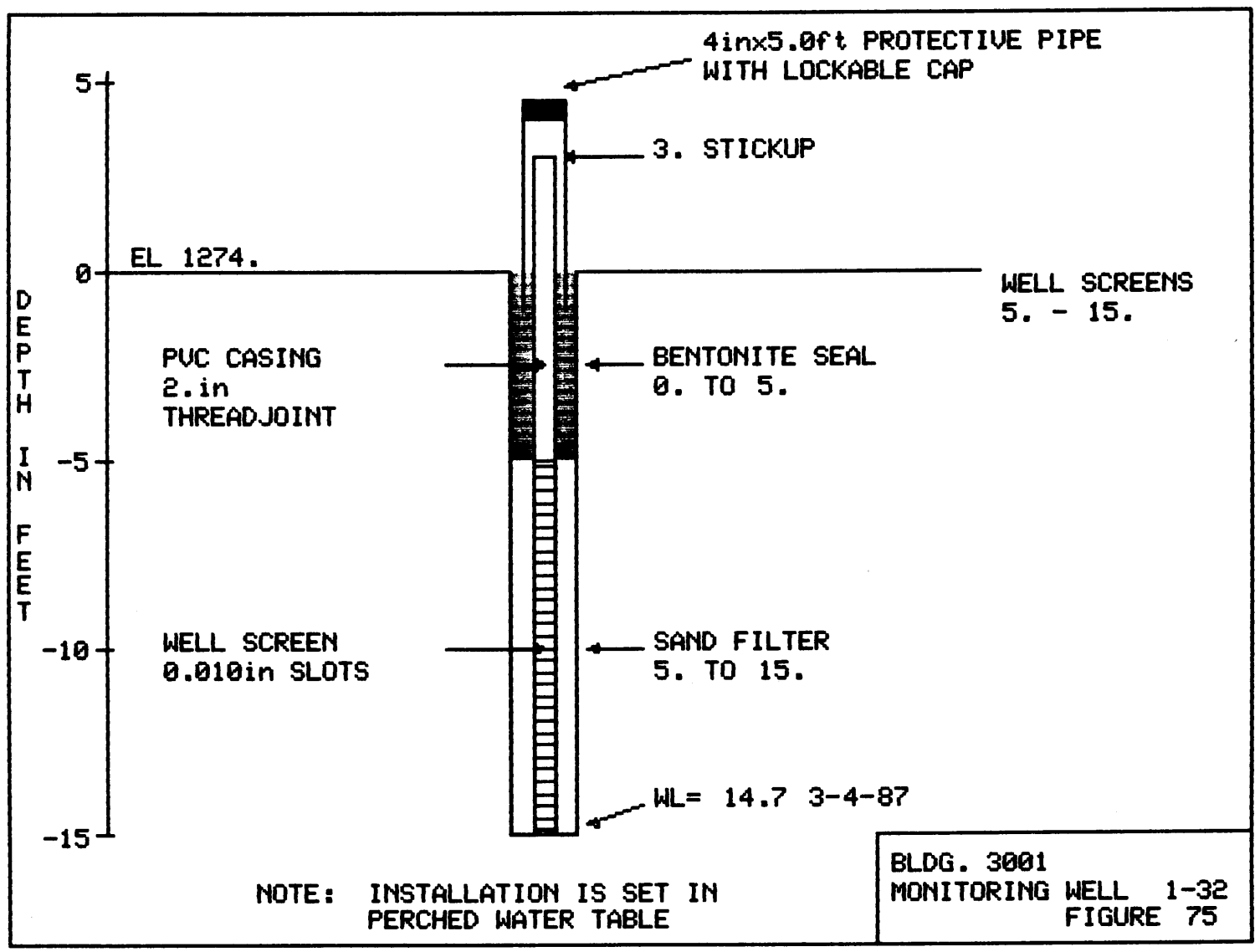
Fuel Level = 16.9 3-10-87

REPRODUCED AT GOVERNMENT EXPENSE



Fuel Level = 14.2 3-10-87

REPRODUCED AT GOVERNMENT EXPENSE



REPRODUCED AT GOVERNMENT EXPENSE

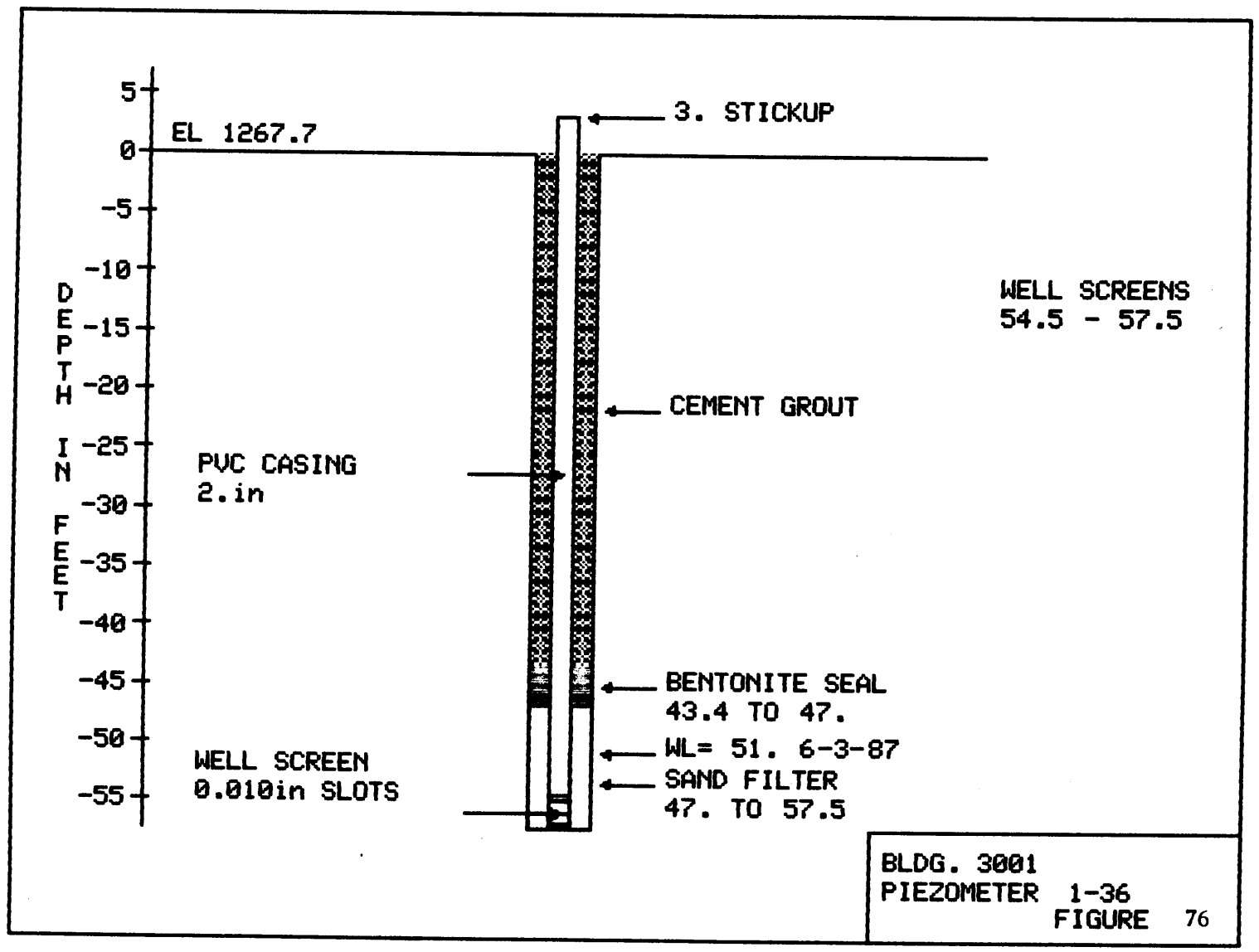
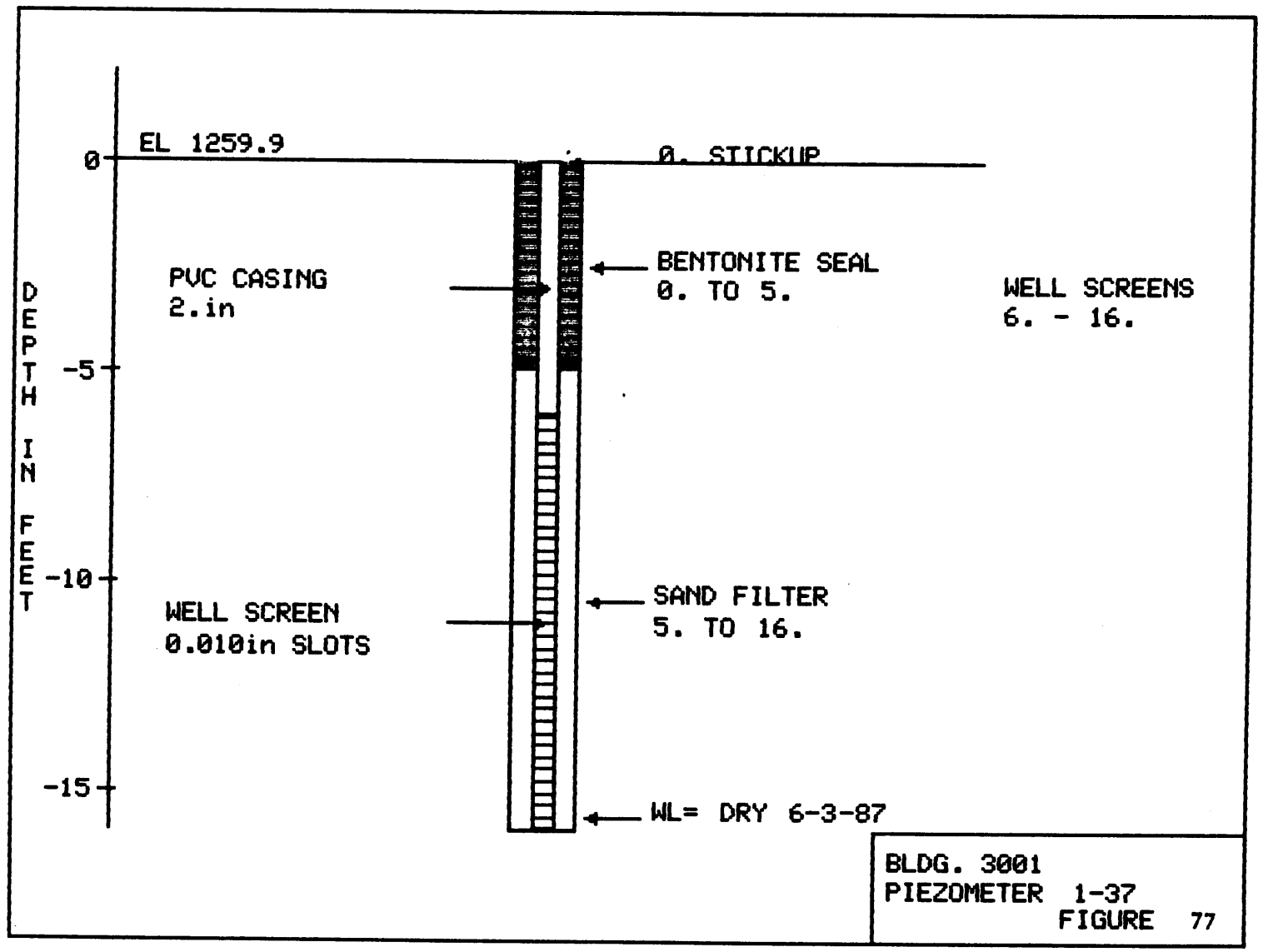
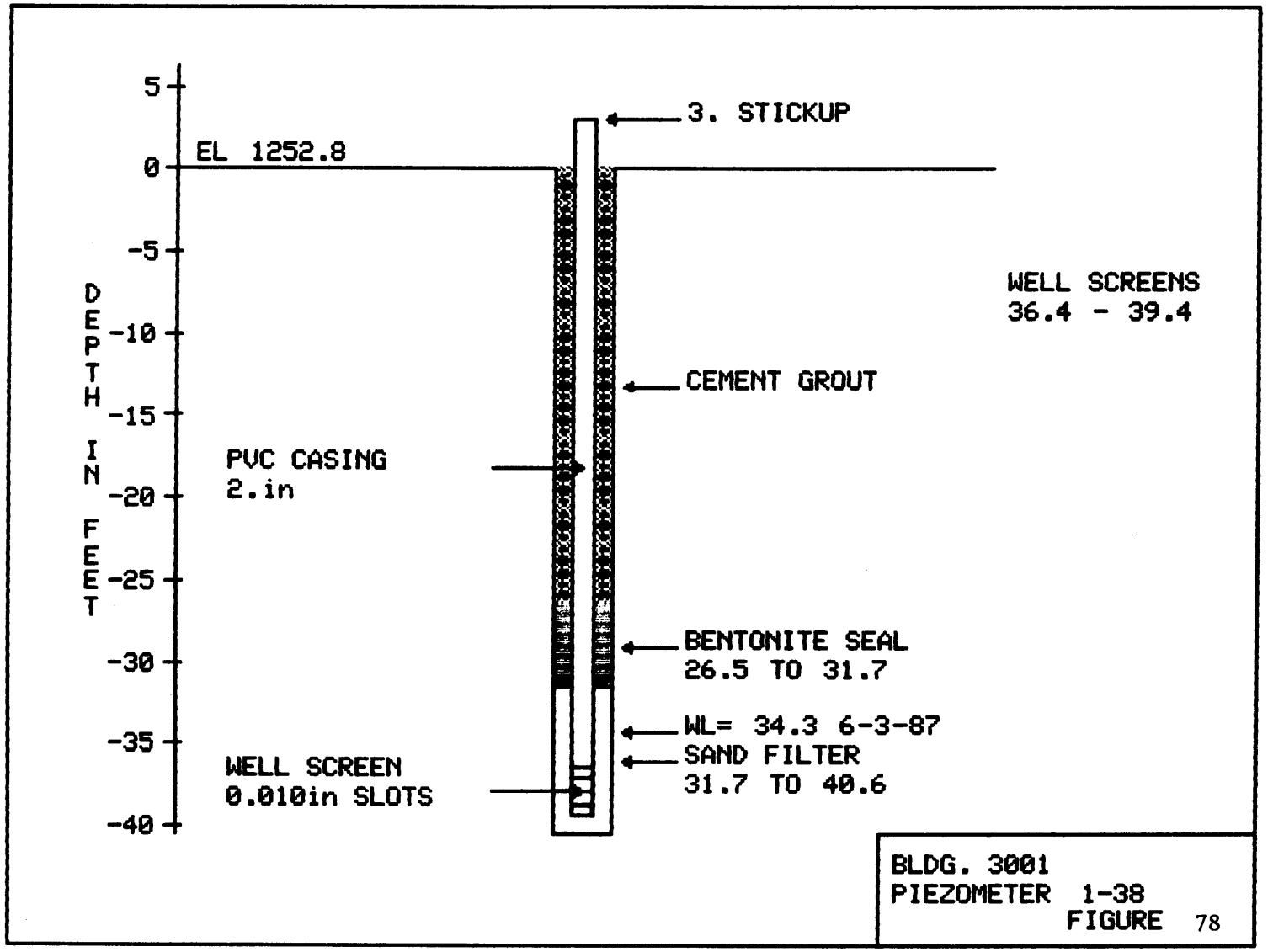


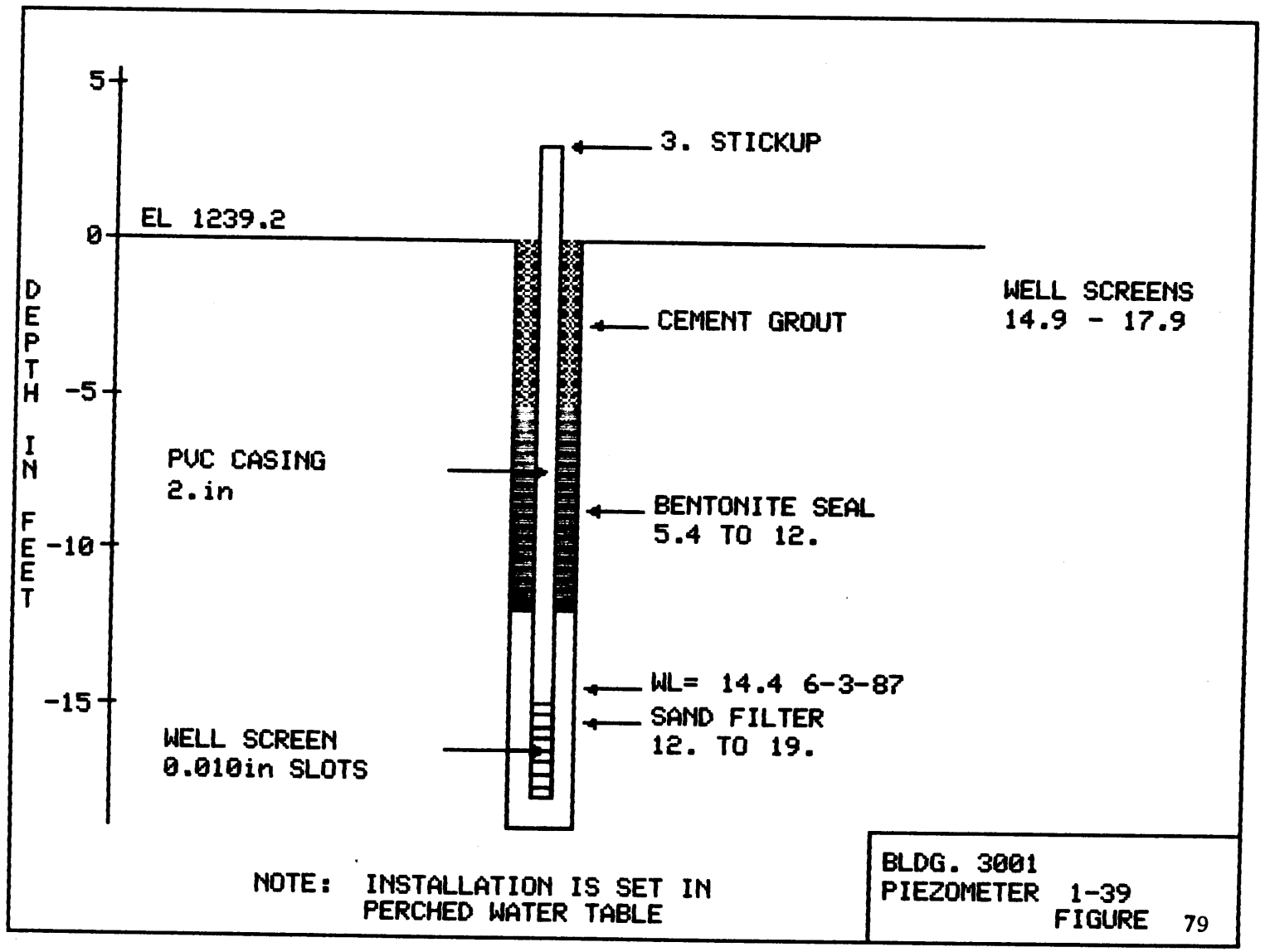
FIGURE 76

R... ...UCED ... ...VERNM... ...XPENS...



REPRODUCED AT GOVERNMENT EXPENSE




5
0
-5
-10
-15
DEPTH IN FEET
EL 1239.2
PVC CASING
2.in
WELL SCREEN
0.010in SLOTS
3. STICKUP
CEMENT GROUT
BENTONITE SEAL
5.4 TO 12.
WL= 14.4 6-3-87
SAND FILTER
12. TO 19.
WELL SCREENS
14.9 - 17.9
NOTE: INSTALLATION IS SET IN
PERCHED WATER TABLE
BLDG. 3001
PIEZOMETER 1-39
FIGURE 79

REPRODUCED AT GOVERNMENT EXPENSE

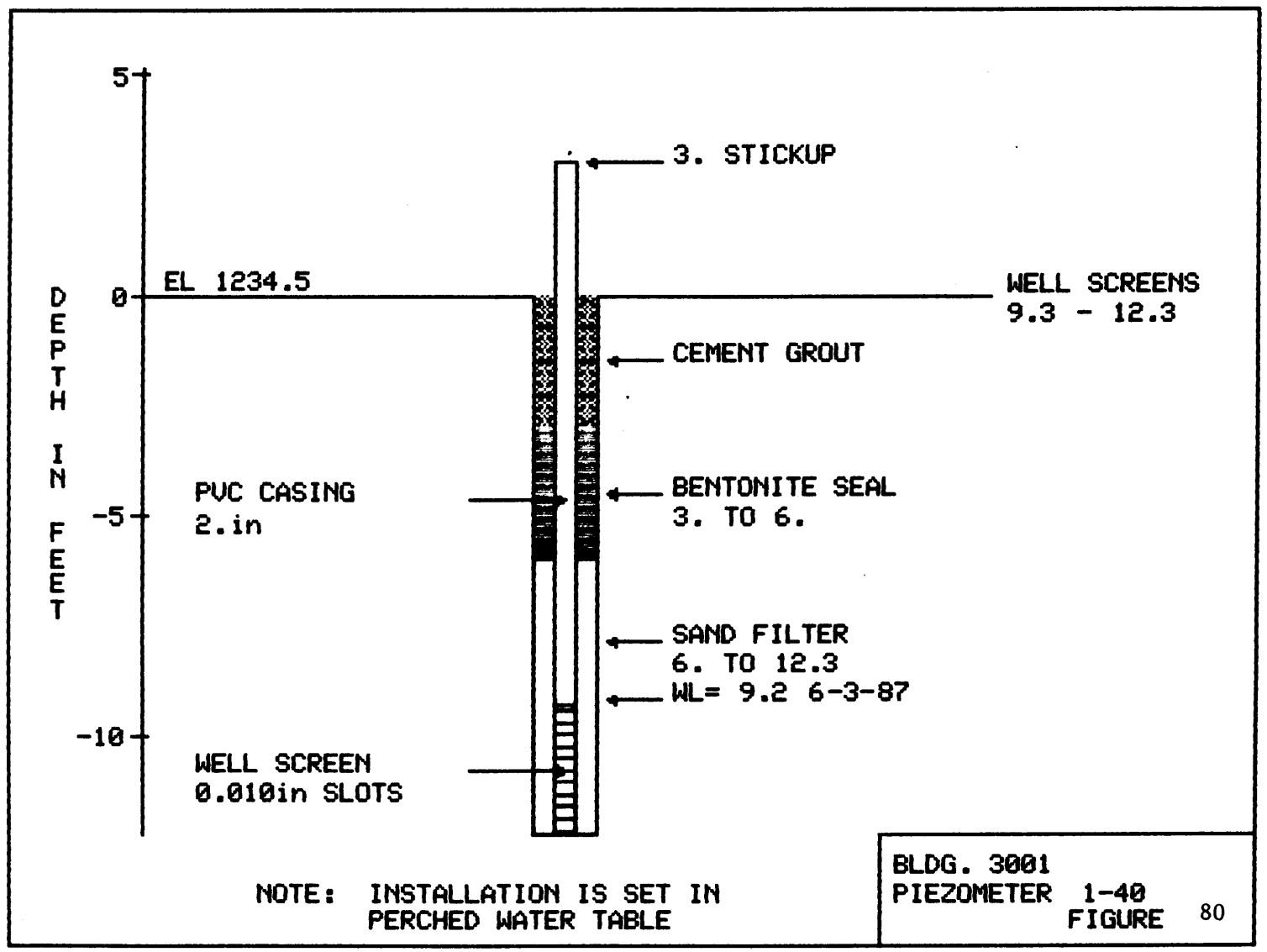
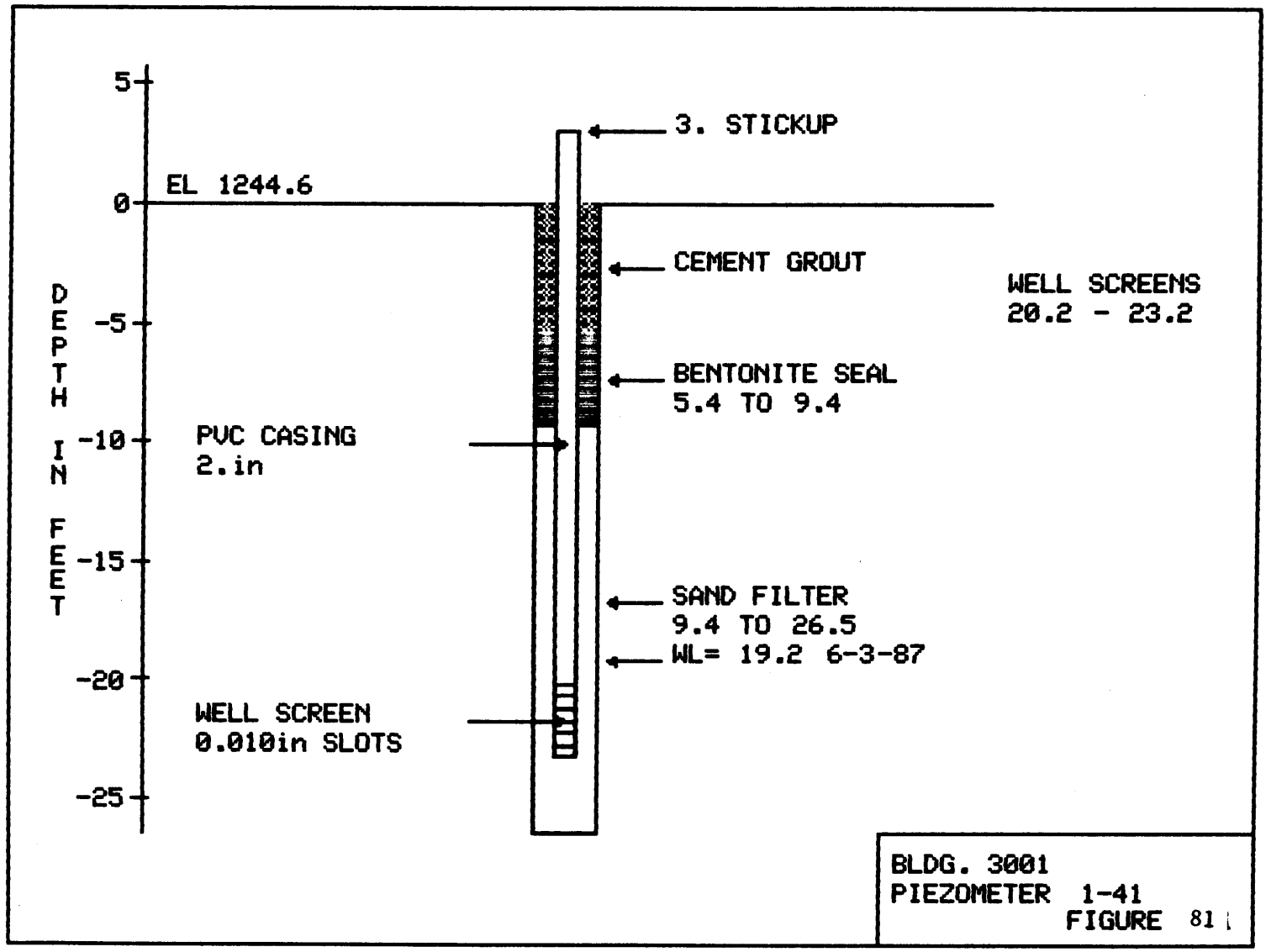
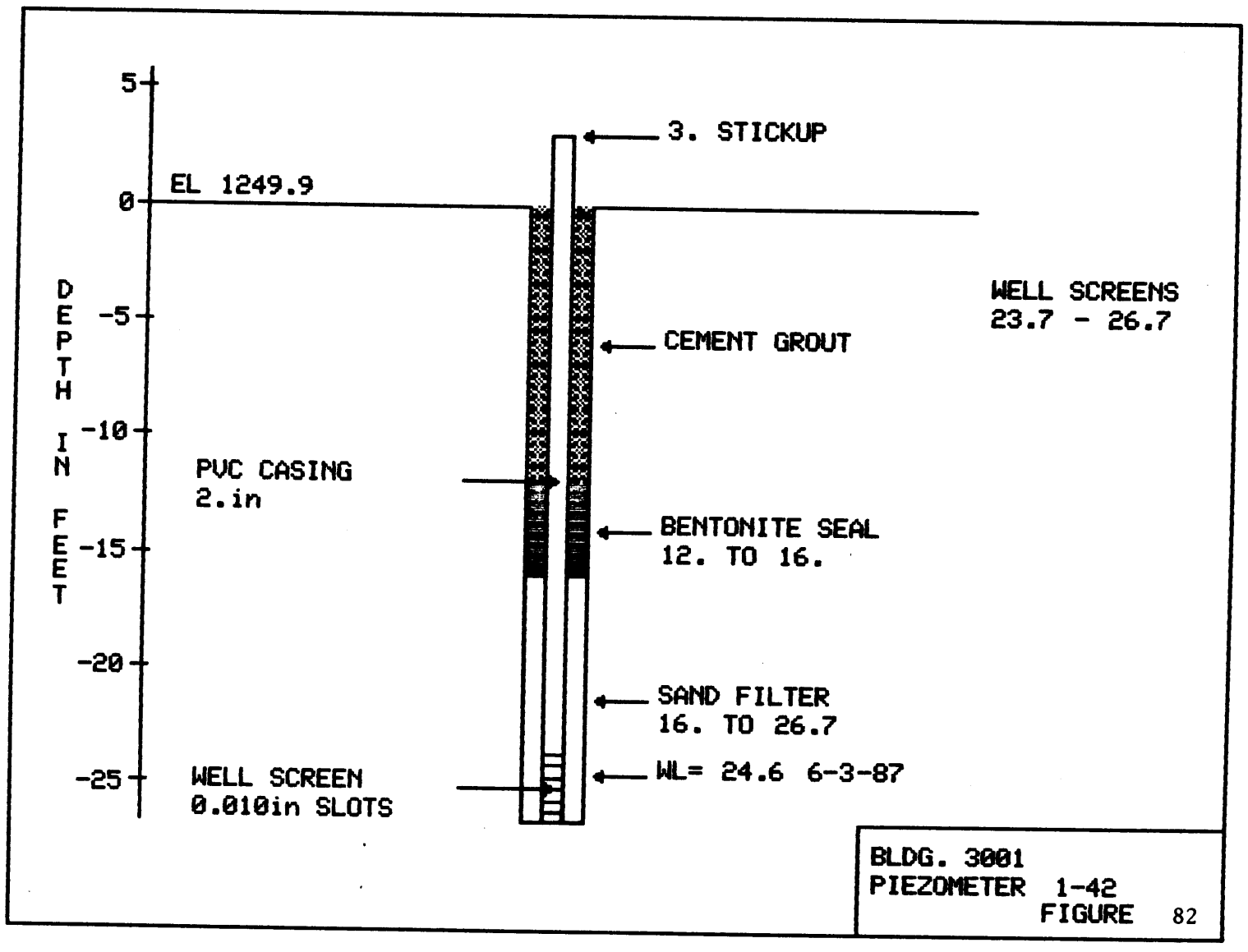


FIGURE 80

REPRODUCED AT GOVERNMENT EXPENSE

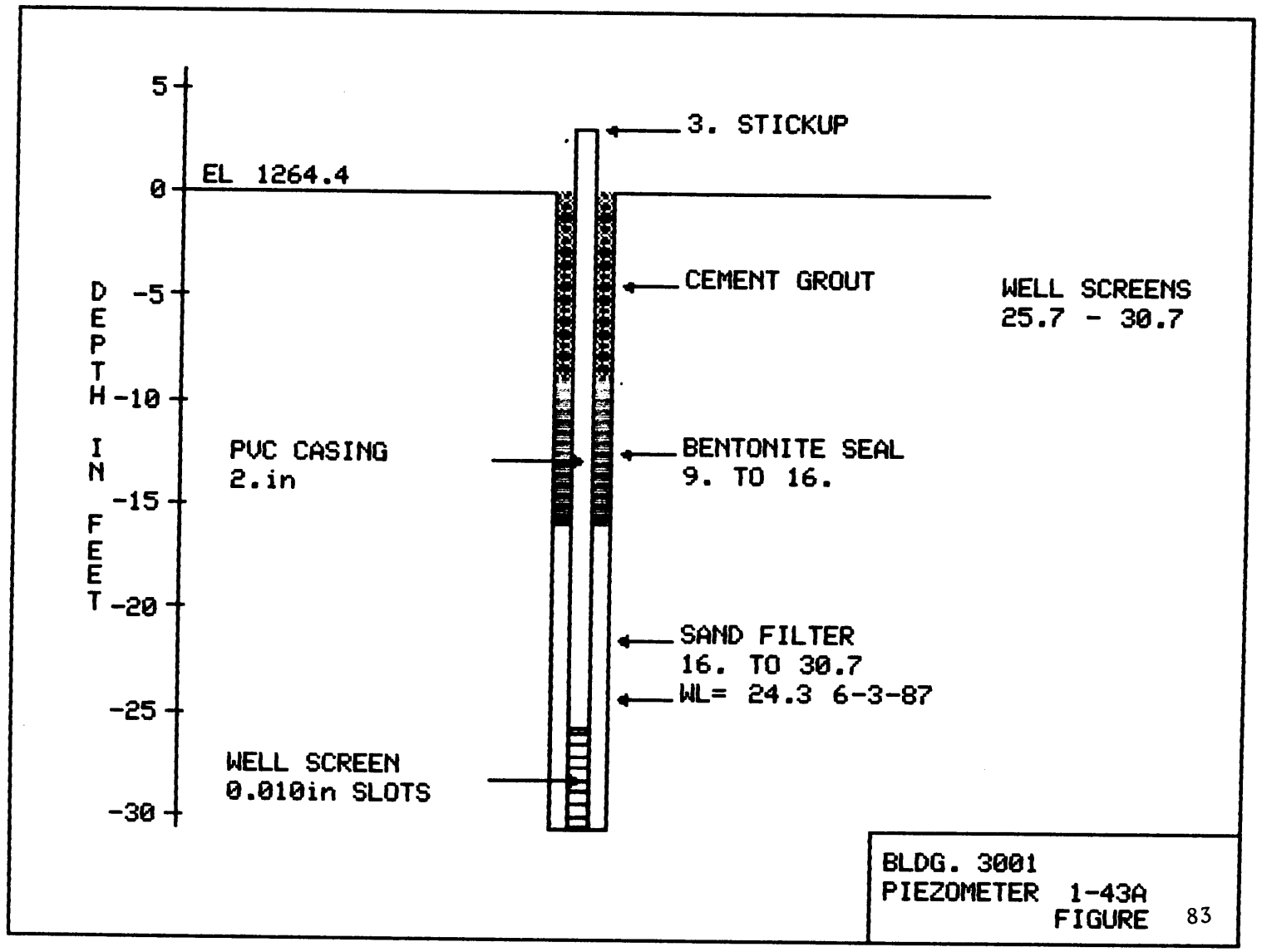


REPRODUCED AT GOVERNMENT EXPENSE

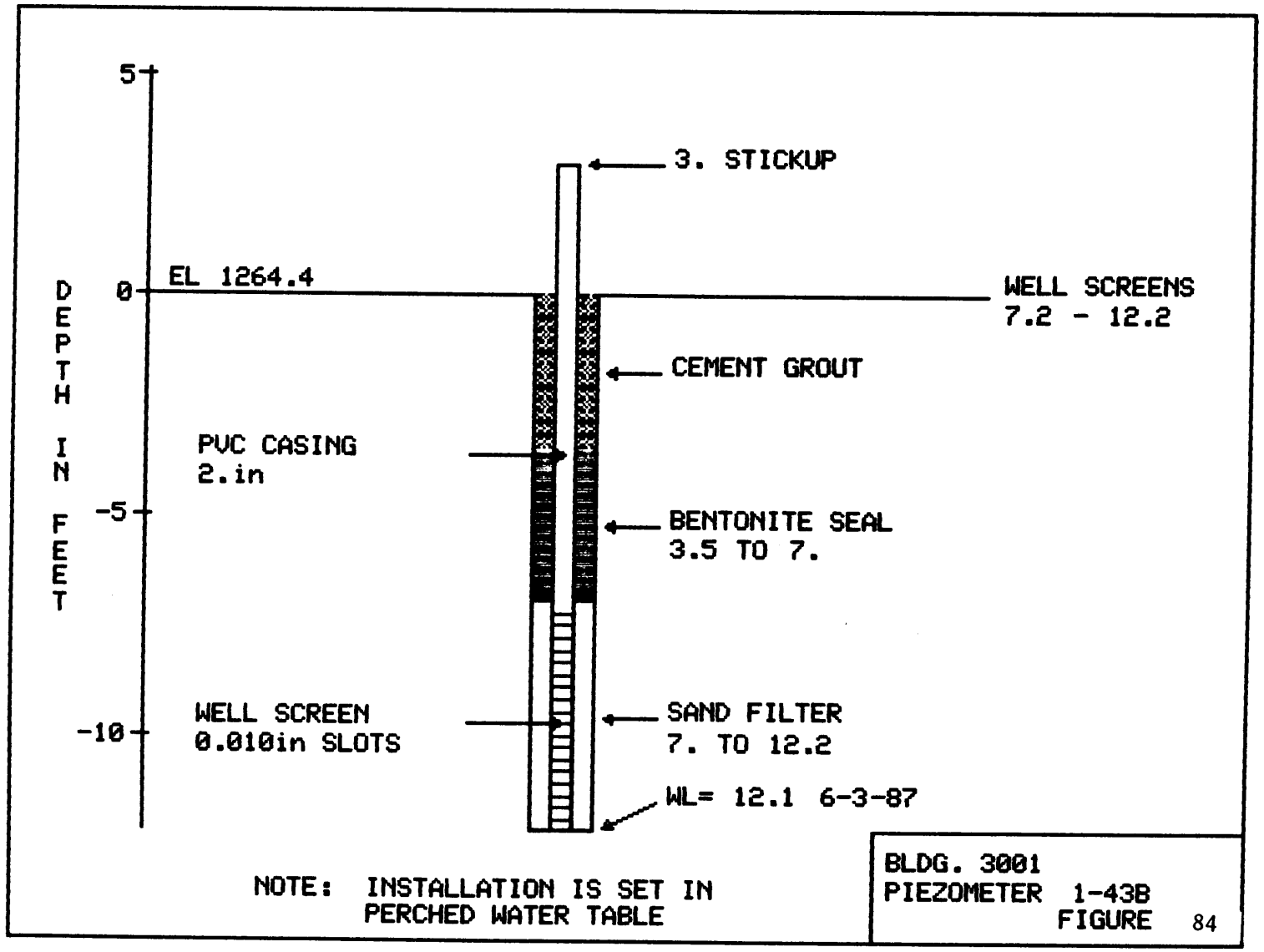


BLDG. 3001
PIEZOMETER 1-42
FIGURE 82

REPRODUCED AT GOVERNMENT EXPENSE



REPRODUCED AT GOVERNMENT EXPENSE



REPRODUCED AT GOVERNMENT EXPENSE

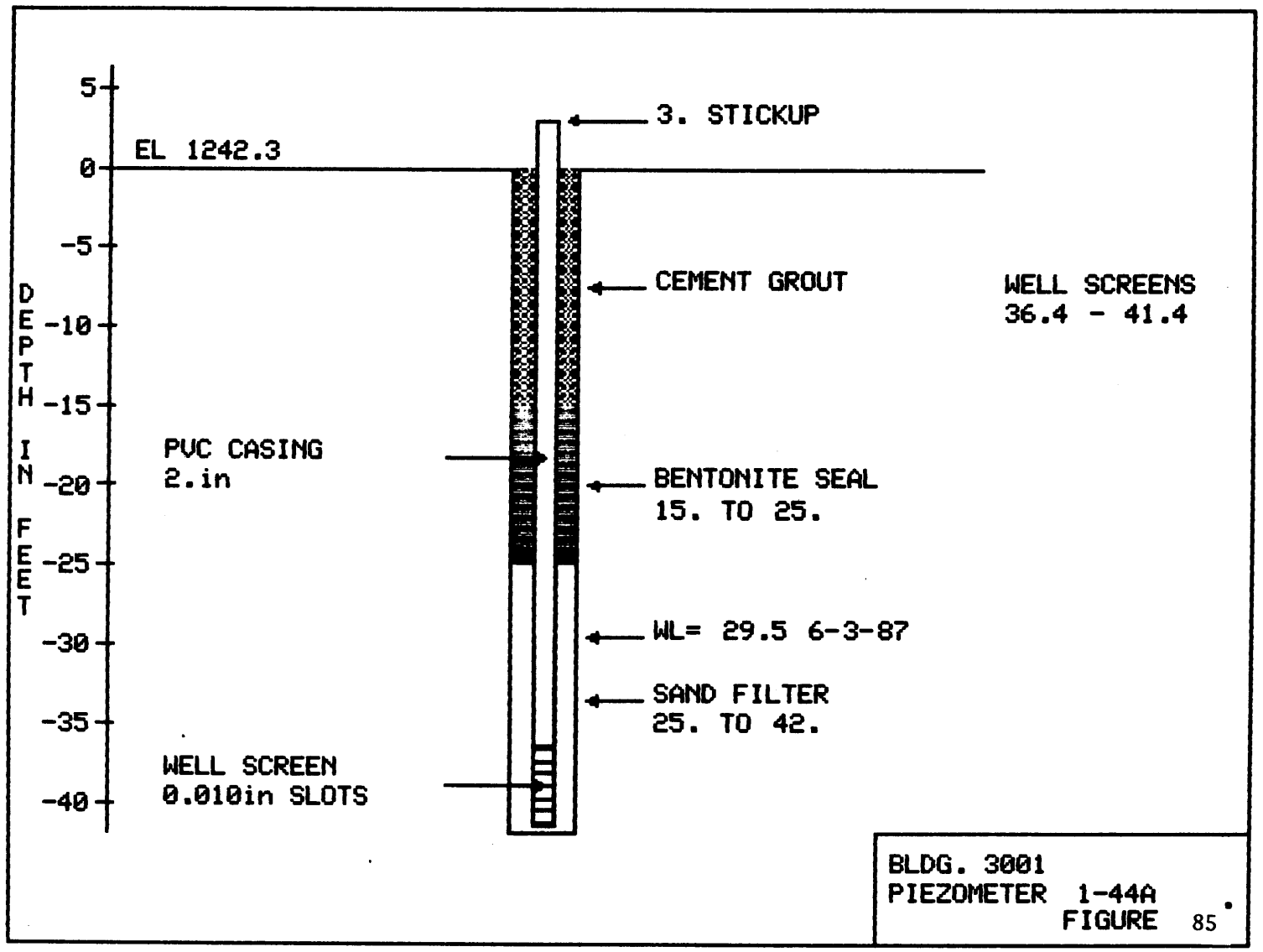
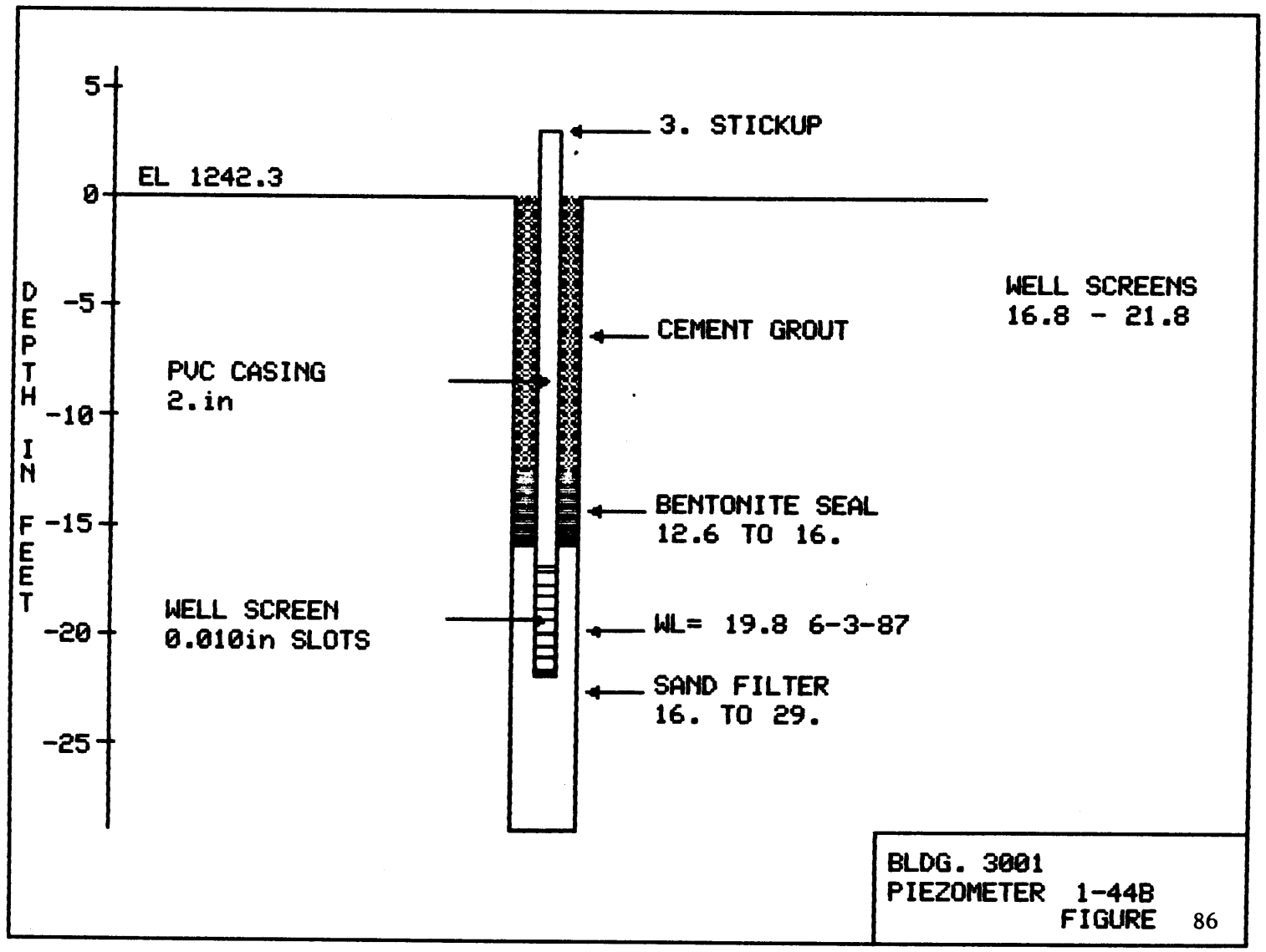
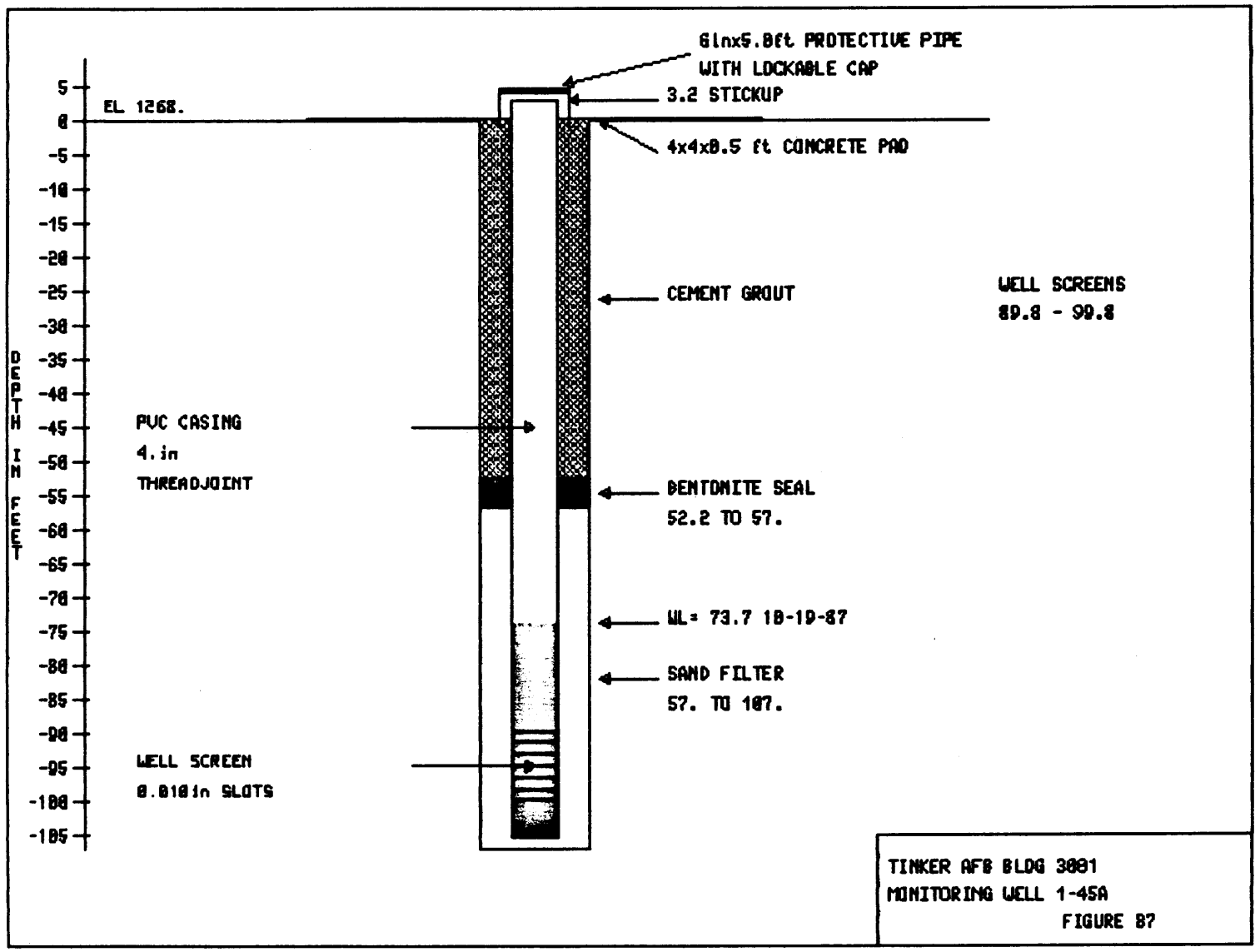


FIGURE 85

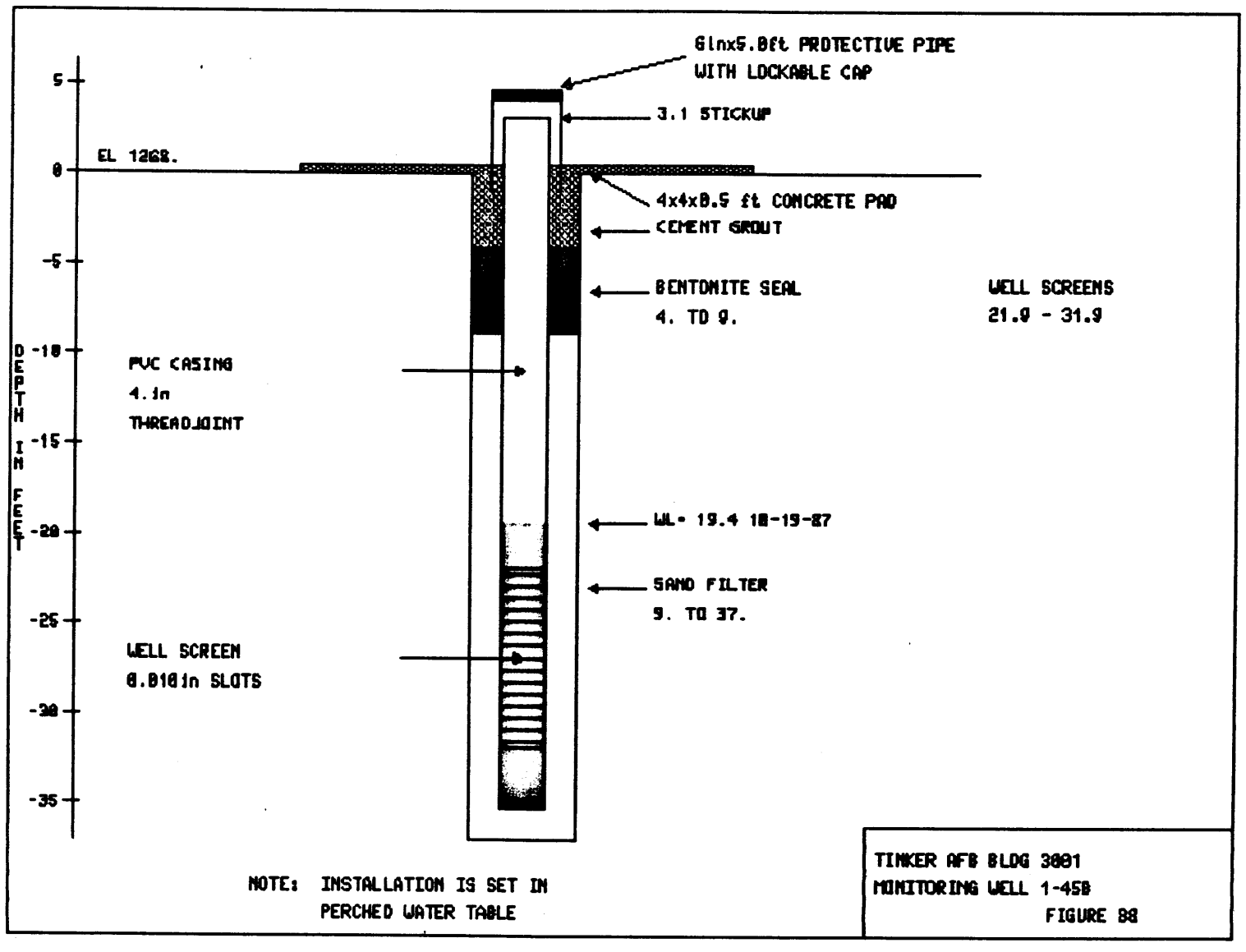
REPRODUCED AT GOVERNMENT EXPENSE



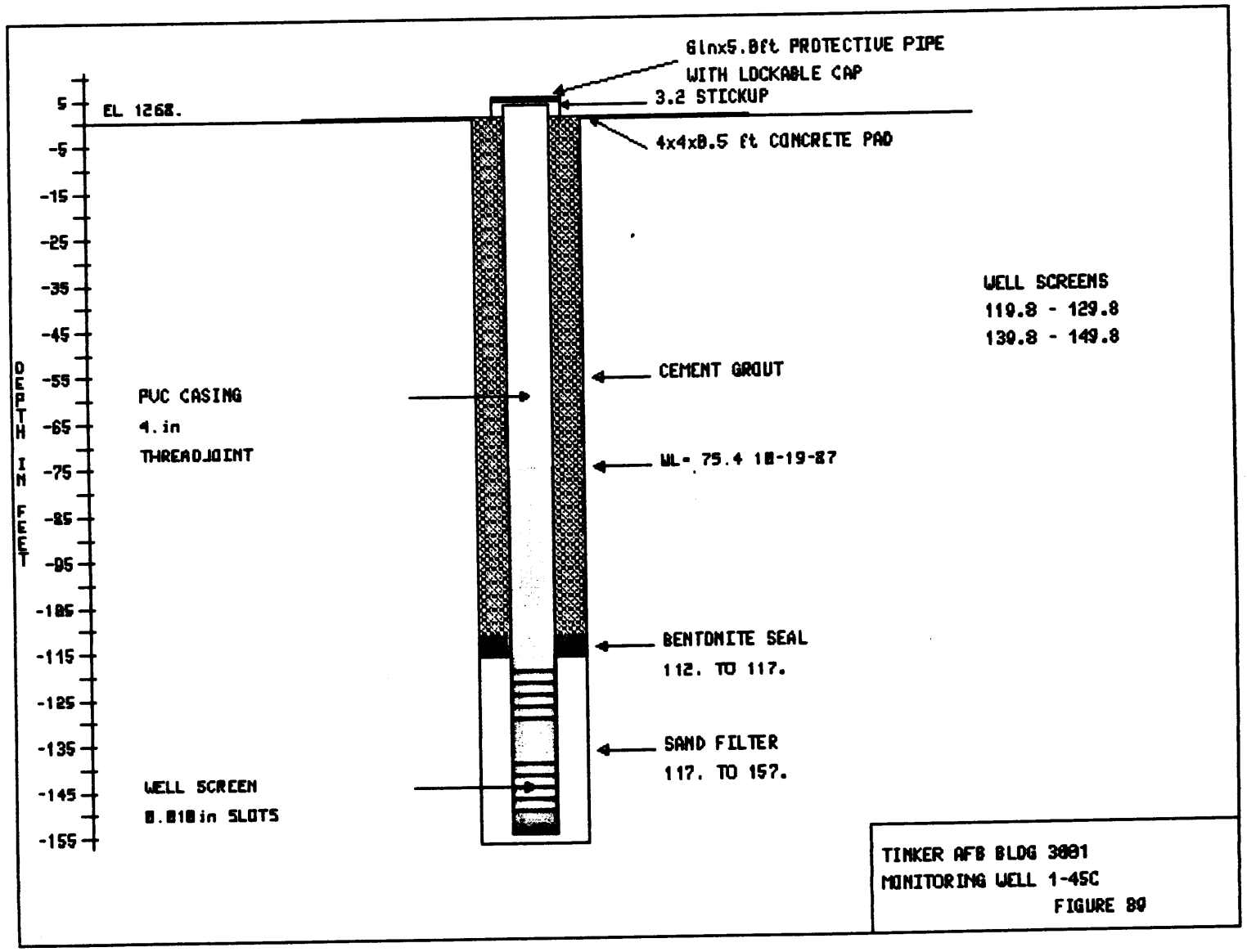
REPRODUCED AT GOVERNMENT EXPENSE



REPRODUCED AT GOVERNMENT EXPENSE



REPRODUCED AT GOVERNMENT EXPENSE



APPENDIX G

LABORATORY TEST RESULTS

APPENDIX G

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TINKER AIR FORCE BASE BUILDING 3001
RAW DATA

PARAMETER		UNITS	WELL 1-1A MAY 23, 1986
arsenic	**dissolved**	**ug/l**	**1**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**35**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**30**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**98**
arsenic	**total**	**ug/l**	**2**
barium	**total**	**ug/l**	**1100**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**60**
lead	**total**	**ug/l**	**35**
mercury	**total**	**ug/l**	**0.1**
nickel	**total**	**ug/l**	**63**
selenium	**total**	**ug/l**	**0.9**
silver	total	ug/l	<10.0
zinc	total	ug/l	110
total organic carbon		**mg/l**	**4.0**
pH, field			**6.97**
conductivity, lab		**umhos/cm**	**804**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**5.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**100.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000

bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-1B UNITS	MAY 7, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	200
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**73**
arsenic	total	ug/l	<1
barium	**total**	**ug/l**	**1300**
cadmium	**total**	**ug/l**	**8**
chromium	**total**	**ug/l**	**58**
lead	**total**	**ug/l**	**60**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**310**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**95**
total organic carbon		**mg/l**	**3.7**
pH, field			**6.81**
conductivity, lab		**umhos/cm**	**1153**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000

1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-1B UNITS	FEB 25, 1987
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	2300
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**45**
mercury	**dissolved**	**ug/l**	**0.2**
nickel	dissolved	ug/l	<10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**60**
iron	**dissolved**	**ug/l**	**140**
manganese	**dissolved**	**ug/l**	**1800.0**
arsenic	**total**	**ug/l**	**1**
barium	**total**	**ug/l**	**3800**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**50**
lead	**total**	**ug/l**	**70**
mercury	**total**	**ug/l**	**0.3**
nickel	**total**	**ug/l**	**60**
selenium	**total**	**ug/l**	**0.5**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**120**
iron	**total**	**ug/l**	**34.00**
manganese	**total**	**ug/l**	**2600.0**
total organic carbon		**mg/l**	**5.7**
oil and grease		mg/l	<1.00

chloride	mg/l	49
sulfate	mg/l	149
cyanide	mg/l	<0.200
pH, field		7.05
conductivity, lab	umhos/cm	1588
gross alpha	pc/l	16
gross alpha counting error	pc/l	7
gross beta	pc/l	8
gross beta counting error	pc/l	6
Ra-226 + Ra-228	pc/l	14.0
Ra-226 + Ra-228 count err	pc/l	7.0
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<2.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	6.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<50.000
bis(2-chloroethyl)ether	ug/l	<50.000
2-chlorophenol	ug/l	<50.000
1,3-dichlorobenzene	ug/l	<50.000
1,4-dichlorobenzene	ug/l	<50.000
benzyl alcohol	ug/l	<50.000

1,2-dichlorobenzene	ug/l	<50.000
2-methylphenol	ug/l	<50.000
bis(2-chloroisopropyl)eth	ug/l	<50.000
4-methylphenol	ug/l	<50.000
n-nitrosodipropylamine	ug/l	<50.000
hexachloroethane	ug/l	<50.000
nitrobenzene	ug/l	<50.000
isophorone	ug/l	<50.000
2-nitrophenol	ug/l	<50.000
2,4-dimethylphenol	ug/l	<50.000
benzoic acid	ug/l	<250.000
bis(2-chloroethoxy)methan	ug/l	<50.000
2,4-dichlorophenol	ug/l	<50.000
1,2,4-trichlorobenzene	ug/l	<50.000
naphthalene	ug/l	<50.000
4-chloroaniline	ug/l	<50.00
hexachlorobutadiene	ug/l	<50.000
p-chloro-m-cresol	ug/l	<50.000
2-methylnaphthalene	ug/l	<50.000
hexachlorocyclopentadiene	ug/l	<50.000
2,4,6-trichlorophenol	ug/l	<50.000
2,4,5-tricholorphenol	ug/l	<250.000
2-chloronaphthalene	ug/l	<50.000
2-nitroaniline	ug/l	<250.000
dimethyl phthalate	ug/l	<50.000
acenaphthylene	ug/l	<50.000
3-nitroaniline	ug/l	<250.000
acenaphthalene	ug/l	<50.000
2,4-dinitrophenol	ug/l	<250.000
4-nitrophenol	ug/l	<250.000
dibenzofuran	ug/l	<50.000
2,4-dinitrotoluene	ug/l	<50.000
2,6-dinitrotoluene	ug/l	<50.000
diethyl phthalate	ug/l	<50.000
4-chlorophenyl phenyl eth	ug/l	<50.000
fluorene	ug/l	<50.000
4-nitroaniline	ug/l	<250.00
4,6-dinitro-2-methylphenol	ug/l	<250.000
n-nitrosodiphenylamine	ug/l	<50.000
4-bromophenyl phenyl ether	ug/l	<50.000
hexachlorobenzene	ug/l	<50.000
pentachlorophenol	ug/l	<250.000
phenanthrene	ug/l	<50.000
anthracene	ug/l	<50.000
di-n-butyl phthalate	ug/l	<50.000
fluoranthene	ug/l	<50.000
pyrene	ug/l	<50.000
butyl benzyl phthalate	ug/l	<50.000
3,3-dichlorobenzidine	ug/l	<100.000
benzo(a)anthracine	ug/l	<50.000
bis(2-ethylhexyl)phthalate	ug/l	70.000
chrysene	ug/l	<50.000

di-n-octyl phthalate	ug/l	<50.000
benzo(b)fluoranthene	ug/l	<50.000
benzo(k)fluoranthene	ug/l	<50.000
benzo(a)pyrene	ug/l	<50.000
indeno(1,2,3-c,d)pyrene	ug/l	<50.000
dibenzo(a,h)anthracene	ug/l	<50.000
benzo(g,h,i)perylene	ug/l	<50.000
aldrin	ug/l	<100.000
a-BHC	ug/l	<50.000
b-BHC	ug/l	<50.000
g-BHC (lindane)	ug/l	<50.000
d-BHC	ug/l	<50.000
chlordane	ug/l	<1000.000
4,4-DDE	ug/l	<100.000
4,4-DDT	ug/l	<100.000
4,4-DDD	ug/l	<100.000
dieldrin	ug/l	<50.000
endosulfan I	ug/l	<50.000
endosulfan II	ug/l	<100.000
endosulfan sulfate	ug/l	<100.000
endrin	ug/l	<100.000
endrin aldehyde	ug/l	<100.000
heptachlor	ug/l	<50.000
heptachlor epoxide	ug/l	<100.000
toxaphene	ug/l	<1500.000
PCB 1016	ug/l	<500.000
PCB 1221	ug/l	<500.000
PCB 1232	ug/l	<1000.000
PCB 1242	ug/l	<1000.000
PCB 1248	ug/l	<1000.000
PCB 1254	ug/l	<1000.000
PCB 1260	ug/l	<1000.000

PARAMETER		WELL 1-10A UNITS	MAY 1, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	**dissolved**	**ug/l**	**0.4**
nickel	**dissolved**	**ug/l**	**85**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**20**
arsenic	**total**	**ug/l**	**2**
barium	**total**	**ug/l**	**530**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**50**
lead	**total**	**ug/l**	**45**
mercury	**total**	**ug/l**	**0.6**

nickel	total	ug/l	170
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	48
total organic carbon		mg/l	3.0
pH, field			7.79
conductivity, lab		umhos/cm	629
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	210.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-10B UNITS	MAY 2, 1986
arsenic	dissolved	ug/l	3
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	25
mercury	dissolved	ug/l	0.7

nickel	**dissolved**	**ug/l**	**68**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**18**
arsenic	**total**	**ug/l**	**3**
barium	**total**	**ug/l**	**540**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**30**
mercury	**total**	**ug/l**	**0.4**
nickel	**total**	**ug/l**	**170**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**18**
total organic carbon		**mg/l**	**5.4**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-10C UNITS	OCT 1, 1986
arsenic	**total**	**ug/l**	**2**
barium	**total**	**ug/l**	**3500**
cadmium	**total**	**ug/l**	**15**
chromium	**total**	**ug/l**	**18**
chromium	trivalent tot	ug/l	<40
chromium	hexavalent tot	ug/l	<40
lead	**total**	**ug/l**	**150**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**50**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**70**
total organic carbon		**mg/l**	**2.7**
pH, field			**12.94**
total hardness as CaCO3		**mg/l**	**380**
conductivity, lab		**umhos/cm**	**5**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		**ug/l**	**14.00**
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00

styrene		ug/l	<5.000
xylenes total		ug/l	16.000

PARAMETER		WELL 1-10C UNITS	APR 2, 1987
barium	total	ug/l	1300
iron	total	ug/l	0.12
manganese	total	ug/l	15.0
sodium	total	mg/l	35.00
calcium	total	mg/l	120.0
magnesium	total	mg/l	3.0
pH, field			11.91
bicarbonate		mg/l	<1
carbonate		mg/l	43
total hardness as CaCO3		mg/l	320
hydroxide alkalinity		mg/l	450
conductivity, lab		umhos/cm	45

PARAMETER		WELL 1-11A UNITS	MAY 5, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	100
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	88
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	13.0
zinc	dissolved	ug/l	55
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	160
lead	total	ug/l	<25
mercury	total	ug/l	0.7
nickel	total	ug/l	240
selenium	total	ug/l	<0.4
silver	total	ug/l	15.0
zinc	total	ug/l	73
total organic carbon		mg/l	6.6
pH, field			7.29
conductivity, lab		umhos/cm	1085
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	530.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	120.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000

1,1-dichloroethene		**ug/l**	**110.000**
1,1-dichloroethane		**ug/l**	**43.000**
trans-1,2-dichloroethene		**ug/l**	**1400.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		**ug/l**	**100.000**
carbon tetrachloride		**ug/l**	**14.0**
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		**ug/l**	**36.000**
trichloroethene		**ug/l**	**1100.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		**ug/l**	**11.00**
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		**ug/l**	**950.000**
1,1,2,2-tetrachloroethane		**ug/l**	**19.000**
toluene		**ug/l**	**6.00**
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		**ug/l**	**940.000**
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-11B UNITS	MAY 5, 1986
arsenic	**dissolved**	**ug/l**	**<1**
barium	**dissolved**	**ug/l**	**<500**
cadmium	**dissolved**	**ug/l**	**<8**
chromium	**dissolved**	**ug/l**	**<10**
lead	**dissolved**	**ug/l**	**28**
mercury	**dissolved**	**ug/l**	**<0.10**
nickel	**dissolved**	**ug/l**	**110**
selenium	**dissolved**	**ug/l**	**<0.4**
silver	**dissolved**	**ug/l**	**<10.0**
zinc	**dissolved**	**ug/l**	**90**
arsenic	**total**	**ug/l**	**<1**
barium	**total**	**ug/l**	**1300**
cadmium	**total**	**ug/l**	**<8**
chromium	**total**	**ug/l**	**13**
lead	**total**	**ug/l**	**28**
mercury	**total**	**ug/l**	**<0.10**
nickel	**total**	**ug/l**	**140**
selenium	**total**	**ug/l**	**<0.4**
silver	**total**	**ug/l**	**10.0**
zinc	**total**	**ug/l**	**110**

total organic carbon	**mg/l**	**4.7**
pH, field		**7.08**
conductivity, lab	**umhos/cm**	**1388**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	**ug/l**	**39.000**
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	**ug/l**	**6.000**
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-12A UNITS	SEP 10, 1986
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	**total**	**ug/l**	**8**
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**68**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**28**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**43**

total organic carbon	**mg/l**	**1.2**
pH, field		**7.50**
conductivity, lab	**umhos/cm**	**702**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	**ug/l**	**24.000**
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**1100.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-12A UNITS	OCT 28, 1986
arsenic	**dissolved**	**ug/l**	**5**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**73**
mercury	dissolved	ug/l	<0.4
nickel	**dissolved**	**ug/l**	**45**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**30**

arsenic	**total**	**ug/l**	**3**
barium	total	ug/l	<500
cadmium	**total**	**ug/l**	**8**
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**83**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**45**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**55**
pH, field			**7.26**
conductivity, lab		**umhos/cm**	**640**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**12.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**660.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-12A UNITS	APR 8, 1987
barium	**total**	**ug/l**	**640**

iron	total	ug/l	0.03
manganese	total	ug/l	20.0
sodium	total	mg/l	33.00
calcium	total	mg/l	58.0
magnesium	total	mg/l	25.0
pH, field			8.58
bicarbonate		mg/l	370
carbonate		mg/l	<1
total hardness as CaCO3		mg/l	250
hydroxide alkalinity		mg/l	<1
conductivity, lab		umhos/cm	55

PARAMETER		WELL 1-12B UNITS	SEP 10, 1986
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	8
chromium	total	ug/l	35
lead	total	ug/l	83
mercury	total	ug/l	<0.4
nickel	total	ug/l	75
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	110
total organic carbon		mg/l	2.6
pH, field			7.33
conductivity, lab		umhos/cm	970

chloromethane	ug/l	<1000.000
bromomethane	ug/l	<1000.000
vinyl chloride	ug/l	<1000.000
chloroethane	ug/l	<1000.000
methylene chloride	ug/l	<500.000
acetone	ug/l	1100.000
carbon disulfide	ug/l	<500.000
1,1-dichloroethene	ug/l	<500.000
1,1-dichloroethane	ug/l	<500.000
trans-1,2-dichloroethene	ug/l	4600.000
chloroform	ug/l	<500.0
1,2-dichloroethane	ug/l	<500.000
2-butanone (meth eth ket)	ug/l	<1000.000
1,1,1-trichloroethane	ug/l	<500.000
carbon tetrachloride	ug/l	<500.0
vinyl acetate	ug/l	<1000.000
bromodichloromethane	ug/l	<500.0
1,2-dichloropropane	ug/l	<500.000
trichloroethene	ug/l	47000.000
dibromochloromethane	ug/l	<500.0
1,1,2-trichloroethane	ug/l	<500.000
benzene	ug/l	<500.00
2-chloroethyl vinyl ether	ug/l	<1000.000
bromoform	ug/l	<500.0

2-hexanone	ug/l	<1000.000
4-methyl-2-pentanone	ug/l	<1000.00
tetrachloroethene	ug/l	<500.000
1,1,2,2-tetrachloroethane	ug/l	<500.000
toluene	ug/l	<500.00
cis-1,3-dichloropropene	ug/l	<500.000
trans-1,3-dichloropropene	ug/l	<500.000
chlorobenzene	ug/l	<500.000
ethylbenzene	ug/l	<500.00
styrene	ug/l	<500.000
xylenes total	ug/l	<500.000

PARAMETER		WELL 1-12B UNITS	OCT 28, 1986
arsenic	**dissolved**	**ug/l**	**2**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	50
mercury	dissolved	ug/l	<0.4
nickel	**dissolved**	**ug/l**	**53**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**43**
arsenic	**total**	**ug/l**	**6**
barium	**total**	**ug/l**	**720**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**15**
lead	**total**	**ug/l**	**73**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**60**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**30**
pH, field			**7.17**
conductivity, lab		**umhos/cm**	**796**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		**ug/l**	**23.000**
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		**ug/l**	**96.000**
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**2100.000**
chloroform		**ug/l**	**9.0**
1,2-dichloroethane		**ug/l**	**12.000**
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<4.0

vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**19000.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<3.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		**ug/l**	**32.000**
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-12C UNITS	SEP 10, 1986
arsenic	**total**	**ug/l**	**13**
barium	**total**	**ug/l**	**18000**
cadmium	**total**	**ug/l**	**10**
chromium	**total**	**ug/l**	**330**
lead	**total**	**ug/l**	**345**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**390**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**900**
total organic carbon		**mg/l**	**1.3**
pH, field			**8.87**
conductivity, lab		**umhos/cm**	**503**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0

vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**27.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-12C UNITS	OCT 28, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**50**
mercury	dissolved	ug/l	<0.4
nickel	**dissolved**	**ug/l**	**25**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**25**
arsenic	**total**	**ug/l**	**1**
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**50**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**20**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**45**
pH, field			**12.19**
conductivity, lab		**umhos/cm**	**1103**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000

carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	**ug/l**	**40.000**
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**95.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<3.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-12C UNITS	APR 10, 1987
arsenic	total	ug/l	<1
barium	**total**	**ug/l**	**1500**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**63**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**35**
iron	**total**	**ug/l**	**0.08**
manganese	**total**	**ug/l**	**18.0**
sodium	**total**	**mg/l**	**720.00**
calcium	**total**	**mg/l**	**96.0**
magnesium	**total**	**mg/l**	**3.5**
pH, field			**12.30**
bicarbonate		mg/l	<1
carbonate		**mg/l**	**64**
total hardness as CaCO3		**mg/l**	**250**

hydroxide alkalinity		mg/l	560
conductivity, lab		umhos/cm	220

PARAMETER		UNITS	WELL 1-13A SEP 11, 1986
arsenic	total	ug/l	21
barium	total	ug/l	24000
cadmium	total	ug/l	15
chromium	total	ug/l	370
lead	total	ug/l	410
mercury	total	ug/l	<0.4
nickel	total	ug/l	530
selenium	total	ug/l	2
silver	total	ug/l	10.0
zinc	total	ug/l	850
total organic carbon		mg/l	2.5
pH, field			12.38
conductivity, lab		umhos/cm	1886
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	47.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	6.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	97.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	84.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00

styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-13A UNITS	APR 10, 1987
barium	total	ug/l	1700
iron	total	ug/l	140.00
manganese	total	ug/l	690.0
sodium	total	mg/l	15.00
calcium	total	mg/l	140.0
magnesium	total	mg/l	88.0
pH, field			9.66
bicarbonate		mg/l	21
carbonate		mg/l	130
total hardness as CaCO3		mg/l	720
hydroxide alkalinity		mg/l	<1
conductivity, lab		umhos/cm	90

PARAMETER		WELL 1-13B UNITS	SEP 11, 1986
arsenic	total	ug/l	2
barium	total	ug/l	640
cadmium	total	ug/l	8
chromium	total	ug/l	13
lead	total	ug/l	63
mercury	total	ug/l	<0.4
nickel	total	ug/l	38
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	48
total organic carbon		mg/l	2.1
pH, field			7.43
conductivity, lab		umhos/cm	505
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	870.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0

1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-13C UNITS	SEP 11, 1986
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**53**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**23**
selenium	**total**	**ug/l**	**0.6**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**48**
total organic carbon		**mg/l**	**4.7**
pH, field			**11.35**
conductivity, lab		**umhos/cm**	**434**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		**ug/l**	**100.000**
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**7.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0

1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**48.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	**ug/l**	**280.00**
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	**ug/l**	**7.000**

PARAMETER		WELL 1-14A UNITS	SEP 12, 1986
arsenic	**total**	**ug/l**	**2**
barium	**total**	**ug/l**	**660**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**23**
lead	**total**	**ug/l**	**50**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**28**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**43**
total organic carbon		**mg/l**	**1.8**
pH, field			**6.60**
conductivity, lab		**umhos/cm**	**605**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**11.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		**ug/l**	**25.000**
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0

1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**34.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<3.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<3.00
styrene	ug/l	<5.000
xylenes total	**ug/l**	**8.000**

PARAMETER		WELL 1-14A UNITS	OCT 29, 1986
arsenic	**dissolved**	**ug/l**	**3**
barium	**dissolved**	**ug/l**	**690**
cadmium	dissolved	ug/l	<8
chromium	**dissolved**	**ug/l**	**10**
lead	**dissolved**	**ug/l**	**45**
mercury	dissolved	ug/l	<0.4
nickel	**dissolved**	**ug/l**	**130**
selenium	**dissolved**	**ug/l**	**0.5**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**73**
arsenic	**total**	**ug/l**	**3**
barium	**total**	**ug/l**	**750**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**15**
lead	**total**	**ug/l**	**60**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**45**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**58**
pH, field			**7.30**
conductivity, lab		**umhos/cm**	**448**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000

1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	**ug/l**	**19.000**
chloroform	ug/l	<5.0
1,2-dichloroethane	**ug/l**	**29.000**
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**170.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<1.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-14B UNITS	SEP 18, 1986
arsenic	**total**	**ug/l**	**5**
barium	**total**	**ug/l**	**3300**
cadmium	**total**	**ug/l**	**13**
chromium	**total**	**ug/l**	**240**
lead	**total**	**ug/l**	**120**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**180**
selenium	**total**	**ug/l**	**5**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**280**
total organic carbon		**mg/l**	**1.7**
oil and grease		mg/l	<1.00
chloride		mg/l	<1
sulfate		mg/l	<1
cyanide		mg/l	<0.200
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000

carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	20.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-14B UNITS	OCT 29, 1986
arsenic	**dissolved**	**ug/l**	**1**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	**dissolved**	**ug/l**	**45**
lead	**dissolved**	**ug/l**	**43**
mercury	dissolved	ug/l	<0.4
nickel	**dissolved**	**ug/l**	**58**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**48**
arsenic	**total**	**ug/l**	**3**
barium	**total**	**ug/l**	**890**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**45**
lead	**total**	**ug/l**	**63**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**100**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0

zinc	**total**	**ug/l**	**110**
pH, field			**7.27**
conductivity, lab		**umhos/cm**	**1310**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	35.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-14C UNITS	SEP 12, 1986
arsenic	total	**ug/l**	**3**
barium	total	**ug/l**	**27000**
cadmium	total	**ug/l**	**15**
chromium	total	**ug/l**	**930**
lead	total	**ug/l**	**400**
mercury	total	ug/l	<0.4
nickel	total	**ug/l**	**1100**
selenium	total	**ug/l**	**0.6**
silver	total	**ug/l**	**15.0**
zinc	total	**ug/l**	**1300**

total organic carbon	**mg/l**	**5.1**
pH, field		**8.06**
conductivity, lab	**umhos/cm**	**641**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<4.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<4.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	**ug/l**	**120.000**

PARAMETER		WELL 1-14C UNITS	OCT 28, 1986
arsenic	**dissolved**	**ug/l**	**21**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**58**
mercury	dissolved	ug/l	<0.4
nickel	**dissolved**	**ug/l**	**35**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**45**

arsenic	**total**	**ug/l**	**43**
barium	**total**	**ug/l**	**3400**
cadmium	**total**	**ug/l**	**10**
chromium	**total**	**ug/l**	**820**
lead	**total**	**ug/l**	**370**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**1100**
selenium	total	ug/l	<0.4
silver	**total**	**ug/l**	**20.0**
zinc	**total**	**ug/l**	**1400**
pH, field			**8.07**
conductivity, lab		**umhos/cm**	**455**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**7.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**110.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		**ug/l**	**49.00**
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		**ug/l**	**20.00**
styrene		ug/l	<5.000
xylenes total		**ug/l**	**530.000**

PARAMETER		WELL 1-15A UNITS	OCT 8, 1986
arsenic	**total**	**ug/l**	**12**

barium	**total**	**ug/l**	**4600**
cadmium	**total**	**ug/l**	**10**
chromium	**total**	**ug/l**	**340**
chromium	trivalent tot	ug/l	<40
chromium	hexavalent tot	ug/l	<40
lead	**total**	**ug/l**	**220**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**580**
selenium	total	ug/l	<0.4
silver	**total**	**ug/l**	**18.0**
zinc	**total**	**ug/l**	**400**
total organic carbon		**mg/l**	**6.2**
pH, field			**10.21**
total hardness as CaCO3		**mg/l**	**56**
conductivity, lab		**umhos/cm**	**492**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**16.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**35.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<4.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER			WELL 1-15B UNITS	OCT 8, 1986
arsenic	**total**		**ug/l**	**26**
barium	**total**		**ug/l**	**1900**
cadmium	**total**		**ug/l**	**15**
chromium	**total**		**ug/l**	**460**
chromium	**trivalent**	**tot**	**ug/l**	**60**
chromium	hexavalent	tot	ug/l	<40
lead	**total**		**ug/l**	**230**
mercury	total		ug/l	<0.4
nickel	**total**		**ug/l**	**450**
selenium	total		ug/l	<0.4
silver	**total**		**ug/l**	**10.0**
zinc	**total**		**ug/l**	**480**
total organic carbon			**mg/l**	**8.2**
pH, field				**7.90**
total hardness as CaCO3			**mg/l**	**280**
conductivity, lab			umhos/cm	0
chloromethane			ug/l	<10.000
bromomethane			ug/l	<10.000
vinyl chloride			ug/l	<10.000
chloroethane			ug/l	<10.000
methylene chloride			ug/l	<5.000
acetone			ug/l	<10.000
carbon disulfide			ug/l	<5.000
1,1-dichloroethene			ug/l	<5.000
1,1-dichloroethane			ug/l	<5.000
trans-1,2-dichloroethene			**ug/l**	**31.000**
chloroform			ug/l	<5.0
1,2-dichloroethane			ug/l	<5.000
2-butanone (meth eth ket)			ug/l	<10.000
1,1,1-trichloroethane			ug/l	<5.000
carbon tetrachloride			ug/l	<5.0
vinyl acetate			ug/l	<10.000
bromodichloromethane			ug/l	<5.0
1,2-dichloropropane			ug/l	<5.000
trichloroethene			**ug/l**	**440.000**
dibromochloromethane			ug/l	<5.0
1,1,2-trichloroethane			ug/l	<5.000
benzene			ug/l	<5.00
2-chloroethyl vinyl ether			ug/l	<10.000
bromoform			ug/l	<5.0
2-hexanone			ug/l	<10.000
4-methyl-2-pentanone			ug/l	<10.00
tetrachloroethene			ug/l	<5.000
1,1,2,2-tetrachloroethane			ug/l	<5.000
toluene			ug/l	<5.00
cis-1,3-dichloropropene			ug/l	<5.000
trans-1,3-dichloropropene			ug/l	<5.000
chlorobenzene			ug/l	<5.000
ethylbenzene			ug/l	<5.00

styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER			WELL 1-15C UNITS	OCT 14, 1986
arsenic	total		ug/l	35
barium	total		ug/l	36000
cadmium	total		ug/l	20
chromium	total		ug/l	950
chromium	trivalent	tot	ug/l	70
chromium	hexavalent	tot	ug/l	300
lead	total		ug/l	580
mercury	total		ug/l	<0.4
nickel	total		ug/l	1900
selenium	total		ug/l	<0.4
silver	total		ug/l	25.0
zinc	total		ug/l	910
total organic carbon			mg/l	1.8
pH, field				8.40
total hardness as CaCO3			mg/l	94
conductivity, lab			umhos/cm	520
chloromethane			ug/l	<10.000
bromomethane			ug/l	<10.000
vinyl chloride			ug/l	<10.000
chloroethane			ug/l	<10.000
methylene chloride			ug/l	<5.000
acetone			ug/l	<10.000
carbon disulfide			ug/l	<5.000
1,1-dichloroethene			ug/l	<5.000
1,1-dichloroethane			ug/l	<5.000
trans-1,2-dichloroethene			ug/l	35.000
chloroform			ug/l	<5.0
1,2-dichloroethane			ug/l	<5.000
2-butanone (meth eth ket)			ug/l	<10.000
1,1,1-trichloroethane			ug/l	<5.000
carbon tetrachloride			ug/l	<5.0
vinyl acetate			ug/l	<10.000
bromodichloromethane			ug/l	<5.0
1,2-dichloropropane			ug/l	<5.000
trichloroethene			ug/l	36.000
dibromochloromethane			ug/l	<5.0
1,1,2-trichloroethane			ug/l	<5.000
benzene			ug/l	<5.00
2-chloroethyl vinyl ether			ug/l	<10.000
bromoform			ug/l	<5.0
2-hexanone			ug/l	<10.000
4-methyl-2-pentanone			ug/l	<10.00
tetrachloroethene			ug/l	<5.000
1,1,2,2-tetrachloroethane			ug/l	<5.000
toluene			ug/l	<5.00
cis-1,3-dichloropropene			ug/l	<5.000

trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-16 UNITS	DEC 3, 1986
arsenic	**total**	**ug/l**	**5**
barium	**total**	**ug/l**	**580**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**13**
lead	**total**	**ug/l**	**38**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**43**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**38**
pH, field			**7.47**
conductivity, lab		**umhos/cm**	**2**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**27.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		**ug/l**	**25.00**
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000

chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000
		WELL 1-17	
PARAMETER		UNITS	DEC 3, 1986
arsenic	**total**	**ug/l**	**8**
barium	**total**	**ug/l**	**3200**
cadmium	**total**	**ug/l**	**8**
chromium	**total**	**ug/l**	**210**
lead	**total**	**ug/l**	**110**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**150**
selenium	total	ug/l	<0.4
silver	**total**	**ug/l**	**13.0**
zinc	**total**	**ug/l**	**150**
pH, field			**7.59**
conductivity, lab		**umhos/cm**	**2**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		**ug/l**	**5.000**
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**370.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		**ug/l**	**37.00**
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00

styrene	ug/l	<5.000
xylenes total	ug/l	10.000

PARAMETER		WELL 1-18 UNITS	DEC 3, 1986
arsenic	total	ug/l	3
barium	total	ug/l	28000
cadmium	total	ug/l	15
chromium	total	ug/l	870
lead	total	ug/l	290
mercury	total	ug/l	<0.10
nickel	total	ug/l	600
selenium	total	ug/l	<0.4
silver	total	ug/l	15.0
zinc	total	ug/l	630
pH, field			7.00
conductivity, lab		umhos/cm	870
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	1600.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	47.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	1200.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	15.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	41.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	26.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000

xylenes total		ug/l	<5.000

PARAMETER		WELL 1-2A UNITS	MAY 23, 1986
arsenic	**dissolved**	**ug/l**	**1**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**30**
mercury	**dissolved**	**ug/l**	**0.10**
nickel	**dissolved**	**ug/l**	**63**
selenium	**dissolved**	**ug/l**	**2**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**120**
arsenic	**total**	**ug/l**	**2**
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**25**
mercury	**total**	**ug/l**	**0.2**
nickel	**total**	**ug/l**	**48**
selenium	**total**	**ug/l**	**2**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**60**
total organic carbon		**mg/l**	**12.0**
pH, field			**10.22**
conductivity, lab		**umhos/cm**	**926**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		**ug/l**	**9.000**
acetone		**ug/l**	**370.000**
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**21.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**490.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0

2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-2B UNITS	MAY 7, 1986
arsenic	dissolved	ug/l	<1
barium	**dissolved**	**ug/l**	**1400**
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**25**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**93**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**95**
arsenic	total	ug/l	<1
barium	**total**	**ug/l**	**2800**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**110**
lead	**total**	**ug/l**	**43**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**70**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**170**
total organic carbon		**mg/l**	**3.0**
pH, field			**7.18**
conductivity, lab		**umhos/cm**	**1067**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000

carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-26 UNITS	JAN 22, 1987
arsenic	**total**	**ug/l**	**4**
barium	**total**	**ug/l**	**13000**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**40**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**23**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**50**
pH, field			**7.20**
conductivity, lab		**umhos/cm**	**1088**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0

vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-27 UNITS	JAN 7, 1987
arsenic	**total**	**ug/l**	**8**
barium	**total**	**ug/l**	**13000**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**43**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**38**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**43**
pH, field			**6.83**
conductivity, lab		**umhos/cm**	**1228**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000

bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	**ug/l**	**5.00**
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	**ug/l**	**38.000**

PARAMETER		WELL 1-29 UNITS	JAN 8, 1987
arsenic	**total**	**ug/l**	**3**
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**13**
selenium	**total**	**ug/l**	**0.8**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**38**
pH, field			**7.46**
conductivity, lab		**umhos/cm**	**429**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0

1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-3A UNITS	MAY 23, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	0.2
nickel	dissolved	ug/l	13
selenium	dissolved	ug/l	0.9
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	50
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.10
nickel	total	ug/l	35
selenium	total	ug/l	0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	53
total organic carbon		mg/l	10.0
pH, field			11.35
conductivity, lab		umhos/cm	1193
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	23.000
acetone		ug/l	190.000
carbon disulfide		ug/l	<5.000

1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-3A UNITS	APR 3, 1987
barium	total	ug/l	2000
iron	total	ug/l	1.50
manganese	total	ug/l	55.0
sodium	total	mg/l	500.00
calcium	total	mg/l	210.0
magnesium	total	mg/l	4.0
pH, field			13.80
bicarbonate		mg/l	<1
carbonate		mg/l	150
total hardness as CaCO3		mg/l	540
hydroxide alkalinity		mg/l	970
conductivity, lab		umhos/cm	91

PARAMETER		WELL 1-3B UNITS	MAY 8, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	8
chromium	dissolved	ug/l	<10

lead	dissolved	ug/l	33
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	340
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	98
arsenic	total	ug/l	<1
barium	total	ug/l	1500
cadmium	total	ug/l	8
chromium	total	ug/l	58
lead	total	ug/l	63
mercury	total	ug/l	<0.10
nickel	total	ug/l	340
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	95
total organic carbon		mg/l	3.1
pH, field			7.31
conductivity, lab		umhos/cm	4
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00

styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-30 UNITS	MAR 10, 1987
arsenic	**total**	**ug/l**	**28**
barium	**total**	**ug/l**	**18000**
cadmium	**total**	**ug/l**	**13**
chromium	**total**	**ug/l**	**1100**
lead	**total**	**ug/l**	**570**
mercury	**total**	**ug/l**	**0.2**
nickel	**total**	**ug/l**	**1100**
selenium	total	ug/l	<0.4
silver	**total**	**ug/l**	**30.0**
zinc	**total**	**ug/l**	**1300**
iron	**total**	**ug/l**	**520.00**
manganese	**total**	**ug/l**	**25000.0**
pH, field			**7.30**
conductivity, lab		**umhos/cm**	**6**
chloromethane		ug/l	<1000.000
bromomethane		ug/l	<1000.000
vinyl chloride		ug/l	<1000.000
chloroethane		ug/l	<1000.000
methylene chloride		ug/l	<500.000
acetone		ug/l	<1000.000
carbon disulfide		ug/l	<500.000
1,1-dichloroethene		ug/l	<500.000
1,1-dichloroethane		ug/l	<500.000
trans-1,2-dichloroethene		ug/l	<500.000
chloroform		ug/l	<500.0
1,2-dichloroethane		ug/l	<500.000
2-butanone (meth eth ket)		ug/l	<1000.000
1,1,1-trichloroethane		ug/l	<500.000
carbon tetrachloride		ug/l	<500.0
vinyl acetate		ug/l	<1000.000
bromodichloromethane		ug/l	<500.0
1,2-dichloropropane		ug/l	<500.000
trichloroethene		ug/l	<500.000
dibromochloromethane		ug/l	<500.0
1,1,2-trichloroethane		ug/l	<500.000
benzene		**ug/l**	**260.00**
2-chloroethyl vinyl ether		ug/l	<1000.000
bromoform		ug/l	<500.0
2-hexanone		ug/l	<1000.000
4-methyl-2-pentanone		ug/l	<1000.00
tetrachloroethene		ug/l	<500.000
1,1,2,2-tetrachloroethane		ug/l	<500.000
toluene		**ug/l**	**390.00**
cis-1,3-dichloropropene		ug/l	<500.000
trans-1,3-dichloropropene		ug/l	<500.000
chlorobenzene		ug/l	<500.000

ethylbenzene	ug/l	<500.00
styrene	ug/l	<500.000
xylenes total	ug/l	780.000

PARAMETER		WELL 1-31 UNITS	MAR 10, 1987
arsenic	total	ug/l	4
barium	total	ug/l	670
cadmium	total	ug/l	8
chromium	total	ug/l	38
lead	total	ug/l	40
mercury	total	ug/l	<0.10
nickel	total	ug/l	63
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	130
iron	total	ug/l	40.00
manganese	total	ug/l	1700.0
pH, field			6.85
conductivity, lab		umhos/cm	1530
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	120.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	810.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	100.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	460.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000

chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-4A UNITS	MAY 23, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	510
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	0.10
nickel	dissolved	ug/l	18
selenium	dissolved	ug/l	0.6
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	50
arsenic	total	ug/l	1
barium	total	ug/l	550
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.10
nickel	total	ug/l	18
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	68
total organic carbon		mg/l	3.0
pH, field			7.39
conductivity, lab		umhos/cm	497
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	240.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000

benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-4B UNITS	MAY 8, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	28
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	230
selenium	dissolved	ug/l	0.7
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	58
arsenic	total	ug/l	<1
barium	total	ug/l	2400
cadmium	total	ug/l	<8
chromium	total	ug/l	68
lead	total	ug/l	35
mercury	total	ug/l	<0.10
nickel	total	ug/l	160
selenium	total	ug/l	0.6
silver	total	ug/l	<10.0
zinc	total	ug/l	140
total organic carbon		mg/l	2.3
pH, field			7.63
conductivity, lab		umhos/cm	1659
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	54.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0

1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-5A UNITS	MAY 21, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	740
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	25
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	60
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	55
arsenic	total	ug/l	<1
barium	total	ug/l	1400
cadmium	total	ug/l	8
chromium	total	ug/l	40
lead	total	ug/l	120
mercury	total	ug/l	0.1
nickel	total	ug/l	230
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	190
total organic carbon		mg/l	7.0
pH, field			11.95
conductivity, lab		umhos/cm	2
chloromethane		ug/l	<10.000

bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	**ug/l**	**220.000**
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**42.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER			WELL 1-5A UNITS	OCT 16, 1986
arsenic	**dissolved**		**ug/l**	**2**
barium	**dissolved**		**ug/l**	**2100**
cadmium	**dissolved**		**ug/l**	**8**
chromium	**dissolved**		**ug/l**	**18**
chromium	trivalent	diss	ug/l	<40.0
chromium	hexavalent	diss	ug/l	<40.0
lead	**dissolved**		**ug/l**	**170**
mercury	dissolved		ug/l	<0.4
nickel	**dissolved**		**ug/l**	**58**
selenium	dissolved		ug/l	<0.4
silver	dissolved		ug/l	<10.0
zinc	**dissolved**		**ug/l**	**60**
arsenic	**total**		**ug/l**	**5**
barium	**total**		**ug/l**	**4000**

cadmium	total	ug/l	10
chromium	total	ug/l	25
chromium	trivalent tot	ug/l	<40
chromium	hexavalent tot	ug/l	<40
lead	total	ug/l	310
mercury	total	ug/l	<0.4
nickel	total	ug/l	63
selenium	total	ug/l	<0.4
silver	total	ug/l	10.0
zinc	total	ug/l	68
heterotropic plate count		per ml	7
pH, field			12.89
total hardness as CaCO3		mg/l	880
conductivity, lab		umhos/cm	4

PARAMETER		WELL 1-5A UNITS	APR 7, 1987
barium	total	ug/l	870
iron	total	ug/l	2.10
manganese	total	ug/l	58.0
sodium	total	mg/l	120.00
calcium	total	mg/l	160.0
magnesium	total	mg/l	5.8
pH, field			12.45
bicarbonate		mg/l	<1
carbonate		mg/l	110
total hardness as CaCO3		mg/l	410
hydroxide alkalinity		mg/l	550
conductivity, lab		umhos/cm	120

PARAMETER		WELL 1-5B UNITS	MAY 8, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	33
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	60
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	95
arsenic	total	ug/l	<1
barium	total	ug/l	3000
cadmium	total	ug/l	<8
chromium	total	ug/l	210
lead	total	ug/l	80
mercury	total	ug/l	<0.10
nickel	total	ug/l	320
selenium	total	ug/l	<0.4

silver	**total**	**ug/l**	**<10.0**
zinc	**total**	**ug/l**	**240**
total organic carbon		**mg/l**	**2.9**
pH, field			**7.23**
conductivity, lab		**umhos/cm**	**17**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**18.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**1600.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		**ug/l**	**10.000**
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-5B UNITS	OCT 16, 1986
arsenic	**dissolved**	**ug/l**	**1**
barium	dissolved	ug/l	<500
cadmium	**dissolved**	**ug/l**	**8**
chromium	dissolved	ug/l	<10
chromium	trivalent diss	ug/l	<40.0
chromium	hexavalent diss	ug/l	<40.0
lead	**dissolved**	**ug/l**	**90**
mercury	dissolved	ug/l	<0.4

nickel	dissolved		ug/l	18
selenium	dissolved		ug/l	<0.4
silver	dissolved		ug/l	<10.0
zinc	dissolved		ug/l	55
arsenic	total		ug/l	2
barium	total		ug/l	730
cadmium	total		ug/l	8
chromium	total		ug/l	28
chromium	trivalent	tot	ug/l	<40
chromium	hexavalent	tot	ug/l	<40
lead	total		ug/l	85
mercury	total		ug/l	<0.4
nickel	total		ug/l	100
selenium	total		ug/l	<0.4
silver	total		ug/l	<10.0
zinc	total		ug/l	95
heterotropic plate count			per ml	100000
pH, field				7.75
total hardness as CaCO3			mg/l	480
conductivity, lab			umhos/cm	1076

PARAMETER		WELL 1-6A UNITS	MAY 21, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	700
cadmium	dissolved	ug/l	8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	55
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	50
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	130
arsenic	total	ug/l	<1
barium	total	ug/l	1900
cadmium	total	ug/l	<8
chromium	total	ug/l	45
lead	total	ug/l	60
mercury	total	ug/l	0.2
nickel	total	ug/l	63
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	120
total organic carbon		mg/l	8.0
pH, field			8.60
conductivity, lab		umhos/cm	623
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000

acetone		**ug/l**	**1400.000**
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**27.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-6B UNITS	MAY 8, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	**dissolved**	**ug/l**	**10**
lead	**dissolved**	**ug/l**	**53**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**460**
selenium	**dissolved**	**ug/l**	**5**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**53**
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**18**
lead	**total**	**ug/l**	**58**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**490**
selenium	**total**	**ug/l**	**6**

silver	total	ug/l	<10.0
zinc	total	ug/l	75
total organic carbon		mg/l	6.5
pH, field			6.89
conductivity, lab		umhos/cm	5
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	35.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-7A UNITS	MAY 21, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	1000
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	70
lead	dissolved	ug/l	30
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	43
selenium	dissolved	ug/l	<0.4

silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	100
arsenic	total	ug/l	<1
barium	total	ug/l	1400
cadmium	total	ug/l	<8
chromium	total	ug/l	83
lead	total	ug/l	38
mercury	total	ug/l	<0.10
nickel	total	ug/l	80
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	130
total organic carbon		mg/l	5.0
pH, field			7.48
conductivity, lab		umhos/cm	692
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	490.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	220.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	150.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	2400.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-7B UNITS	MAY 20, 1986
arsenic	**dissolved**	**ug/l**	**3**
barium	dissolved	ug/l	<500
cadmium	**dissolved**	**ug/l**	**8**
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**48**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**35**
selenium	**dissolved**	**ug/l**	**2**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**78**
arsenic	**total**	**ug/l**	**4**
barium	**total**	**ug/l**	**960**
cadmium	**total**	**ug/l**	**13**
chromium	**total**	**ug/l**	**140**
lead	**total**	**ug/l**	**250**
mercury	**total**	**ug/l**	**0.1**
nickel	**total**	**ug/l**	**130**
selenium	**total**	**ug/l**	**3**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**670**
total organic carbon		**mg/l**	**6.0**
pH, field			**7.60**
conductivity, lab		**umhos/cm**	**1289**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**130.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00

tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-8A UNITS	MAY 22, 1986
arsenic	dissolved	ug/l	2
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	25
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	23
selenium	dissolved	ug/l	4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	60
arsenic	total	ug/l	1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	10
lead	total	ug/l	25
mercury	total	ug/l	<0.10
nickel	total	ug/l	25
selenium	total	ug/l	4
silver	total	ug/l	<10.0
zinc	total	ug/l	48
total organic carbon		mg/l	6.0
pH, field			11.23
conductivity, lab		umhos/cm	906
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000

bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-8B UNITS	MAY 22, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	28
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	18
selenium	dissolved	ug/l	3
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	45
arsenic	total	ug/l	1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.10
nickel	total	ug/l	20
selenium	total	ug/l	3
silver	total	ug/l	<10.0
zinc	total	ug/l	58
total organic carbon		mg/l	5.0
pH, field			7.54
conductivity, lab		umhos/cm	755
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	11.000
acetone		ug/l	49.000

carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**45.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**12.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 1-9A UNITS	MAY 23, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**30**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**33**
selenium	**dissolved**	**ug/l**	**2**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**110**
arsenic	**total**	**ug/l**	**1**
barium	**total**	**ug/l**	**1500**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**55**
lead	**total**	**ug/l**	**43**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**90**
selenium	**total**	**ug/l**	**0.5**
silver	total	ug/l	<10.0

zinc	**total**	**ug/l**	**230**
total organic carbon		**mg/l**	**7.0**
pH, field			**7.96**
conductivity, lab		**umhos/cm**	**437**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		**ug/l**	**390.000**
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**7.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**130.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		**ug/l**	**6.00**
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 1-9B UNITS	MAY 23, 1986
arsenic	**dissolved**	**ug/l**	**2**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**30**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**23**
selenium	**dissolved**	**ug/l**	**2**
silver	dissolved	ug/l	<10.0

zinc	**dissolved**	**ug/l**	**110**
arsenic	**total**	**ug/l**	**3**
barium	**total**	**ug/l**	**990**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**90**
lead	**total**	**ug/l**	**50**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**100**
selenium	**total**	**ug/l**	**0.6**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**110**
total organic carbon		**mg/l**	**5.0**
pH, field			**7.32**
conductivity, lab		**umhos/cm**	**635**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**25.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**96.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		**ug/l**	**15.000**
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 12WS UNITS	JUN 4, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	<10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	20
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	33
mercury	total	ug/l	<0.4
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	28
total organic carbon		mg/l	3.0
oil and grease		mg/l	<1.00
chloride		mg/l	5
sulfate		mg/l	5
cyanide		mg/l	<0.200
pH, field			7.27
conductivity, lab		umhos/cm	470
gross alpha		pc/l	<2
gross beta		pc/l	<3
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0

1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000

2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000

PCB 1260	ug/l	<200.000

PARAMETER	WELL 12WS UNITS	SEP 24, 1986
chloromethane	ug/l	<1.000
bromomethane	ug/l	<1.000
vinyl chloride	ug/l	<1.000
chloroethane	ug/l	<1.000
methylene chloride	ug/l	<0.500
acetone	ug/l	<1.000
carbon disulfide	ug/l	<0.500
1,1-dichloroethene	ug/l	<0.500
1,1-dichloroethane	ug/l	<0.500
trans-1,2-dichloroethene	ug/l	<0.500
chloroform	ug/l	<0.5
1,2-dichloroethane	ug/l	<0.500
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<0.500
carbon tetrachloride	ug/l	<0.5
vinyl acetate	ug/l	<1.000
bromodichloromethane	ug/l	<0.5
1,2-dichloropropane	ug/l	<0.500
trichloroethene	ug/l	<0.500
dibromochloromethane	ug/l	<0.5
1,1,2-trichloroethane	ug/l	<0.500
benzene	ug/l	<0.50
2-chloroethyl vinyl ether	ug/l	<1.000
bromoform	ug/l	<0.5
2-hexanone	ug/l	<1.000
4-methyl-2-pentanone	ug/l	<1.00
tetrachloroethene	ug/l	<0.500
1,1,2,2-tetrachloroethane	ug/l	<0.500
toluene	ug/l	<0.50
cis-1,3-dichloropropene	ug/l	<0.500
trans-1,3-dichloropropene	ug/l	<0.500
chlorobenzene	ug/l	<0.500
ethylbenzene	ug/l	<0.50
styrene	ug/l	<0.500
xylenes total	ug/l	<0.500

PARAMETER		WELL 13WS UNITS	JUN 4, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**33**
mercury	dissolved	ug/l	<0.4
nickel	**dissolved**	**ug/l**	**15**
selenium	dissolved	ug/l	<0.4

silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**50**
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**40**
mercury	total	ug/l	<0.4
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**33**
total organic carbon		**mg/l**	**7.0**
oil and grease		mg/l	<1.00
chloride		**mg/l**	**5**
sulfate		**mg/l**	**5**
cyanide		mg/l	<0.200
pH, field			**6.95**
conductivity, lab		**umhos/cm**	**425**
gross alpha		pc/l	<2
gross beta		pc/l	<3
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000

chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000

phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER	WELL 13WS UNITS	SEP 24, 1986
chloromethane	ug/l	<1.000
bromomethane	ug/l	<1.000
vinyl chloride	ug/l	<1.000
chloroethane	ug/l	<1.000
methylene chloride	ug/l	<0.500
acetone	ug/l	<1.000

carbon disulfide	ug/l	<0.500
1,1-dichloroethene	ug/l	<0.500
1,1-dichloroethane	ug/l	<0.500
trans-1,2-dichloroethene	ug/l	<0.500
chloroform	ug/l	<0.5
1,2-dichloroethane	ug/l	<0.500
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<0.500
carbon tetrachloride	ug/l	<0.5
vinyl acetate	ug/l	<1.000
bromodichloromethane	ug/l	<0.5
1,2-dichloropropane	ug/l	<0.500
trichloroethene	ug/l	<0.500
dibromochloromethane	ug/l	<0.5
1,1,2-trichloroethane	ug/l	<0.500
benzene	ug/l	<0.50
2-chloroethyl vinyl ether	ug/l	<1.000
bromoform	ug/l	<0.5
2-hexanone	ug/l	<1.000
4-methyl-2-pentanone	ug/l	<1.00
tetrachloroethene	ug/l	<0.500
1,1,2,2-tetrachloroethane	ug/l	<0.500
toluene	ug/l	<0.50
cis-1,3-dichloropropene	ug/l	<0.500
trans-1,3-dichloropropene	ug/l	<0.500
chlorobenzene	ug/l	<0.500
ethylbenzene	ug/l	<0.50
styrene	ug/l	<0.500
xylenes total	ug/l	<0.500

PARAMETER		WELL 14WS UNITS	JUN 4, 1986
arsenic	**dissolved**	**ug/l**	**12**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	**dissolved**	**ug/l**	**25**
lead	**dissolved**	**ug/l**	**25**
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	<10
selenium	**dissolved**	**ug/l**	**130**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**40**
arsenic	**total**	**ug/l**	**12**
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**30**
lead	total	ug/l	<25
mercury	total	ug/l	<0.4
nickel	total	ug/l	<10
selenium	**total**	**ug/l**	**140**
silver	total	ug/l	<10.0

zinc total	ug/l	33
total organic carbon	mg/l	4.0
oil and grease	mg/l	<1.00
chloride	mg/l	29
sulfate	mg/l	2
cyanide	mg/l	<0.200
pH, field		7.78
conductivity, lab	umhos/cm	655
gross alpha	pc/l	27
gross alpha counting error	pc/l	7
gross beta	pc/l	7
gross beta counting error	pc/l	3
Ra-226 + Ra-228	pc/l	<1.0
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000

1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000

bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER	WELL 14WS UNITS	SEP 24, 1986
chloromethane	ug/l	<1.000
bromomethane	ug/l	<1.000
vinyl chloride	ug/l	<1.000
chloroethane	ug/l	<1.000
methylene chloride	ug/l	<0.500
acetone	ug/l	<1.000
carbon disulfide	ug/l	<0.500
1,1-dichloroethene	ug/l	<0.500
1,1-dichloroethane	ug/l	<0.500
trans-1,2-dichloroethene	ug/l	<0.500
chloroform	ug/l	<0.5
1,2-dichloroethane	ug/l	<0.500
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<0.500

carbon tetrachloride	ug/l	<0.5
vinyl acetate	ug/l	<1.000
bromodichloromethane	ug/l	<0.5
1,2-dichloropropane	ug/l	<0.500
trichloroethene	ug/l	<0.500
dibromochloromethane	ug/l	<0.5
1,1,2-trichloroethane	ug/l	<0.500
benzene	ug/l	<0.50
2-chloroethyl vinyl ether	ug/l	<1.000
bromoform	ug/l	<0.5
2-hexanone	ug/l	<1.000
4-methyl-2-pentanone	ug/l	<1.00
tetrachloroethene	ug/l	<0.500
1,1,2,2-tetrachloroethane	ug/l	<0.500
toluene	ug/l	<0.50
cis-1,3-dichloropropene	ug/l	<0.500
trans-1,3-dichloropropene	ug/l	<0.500
chlorobenzene	ug/l	<0.500
ethylbenzene	ug/l	<0.50
styrene	ug/l	<0.500
xylenes total	ug/l	<0.500

PARAMETER		WELL 15WS UNITS	JUN 4, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	580
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	20
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	58
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.4
nickel	total	ug/l	10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	33
total organic carbon		mg/l	8.0
oil and grease		mg/l	<1.00
chloride		mg/l	5
sulfate		mg/l	6
cyanide		mg/l	<0.200
pH, field			7.54
conductivity, lab		umhos/cm	448

gross alpha	pc/l	<2
gross beta	pc/l	<3
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000

2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000

b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER	WELL 15WS UNITS	SEP 24, 1986
chloromethane	ug/l	<1.000
bromomethane	ug/l	<1.000
vinyl chloride	ug/l	<1.000
chloroethane	ug/l	<1.000
methylene chloride	ug/l	<0.500
acetone	ug/l	<1.000
carbon disulfide	ug/l	<0.500
1,1-dichloroethene	ug/l	<0.500
1,1-dichloroethane	ug/l	<0.500
trans-1,2-dichloroethene	ug/l	<0.500
chloroform	ug/l	<0.5
1,2-dichloroethane	ug/l	<0.500
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<0.500
carbon tetrachloride	ug/l	<0.5
vinyl acetate	ug/l	<1.000
bromodichloromethane	ug/l	<0.5
1,2-dichloropropane	ug/l	<0.500
trichloroethene	**ug/l**	**0.700**
dibromochloromethane	ug/l	<0.5
1,1,2-trichloroethane	ug/l	<0.500
benzene	ug/l	<0.50
2-chloroethyl vinyl ether	ug/l	<1.000
bromoform	ug/l	<0.5
2-hexanone	ug/l	<1.000

4-methyl-2-pentanone		ug/l	<1.00
tetrachloroethene		ug/l	<0.500
1,1,2,2-tetrachloroethane		ug/l	<0.500
toluene		ug/l	<0.50
cis-1,3-dichloropropene		ug/l	<0.500
trans-1,3-dichloropropene		ug/l	<0.500
chlorobenzene		ug/l	<0.500
ethylbenzene		ug/l	<0.50
styrene		ug/l	<0.500
xylenes total		ug/l	<0.500

PARAMETER		WELL 16WS UNITS	SEP 24, 1986
arsenic	dissolved	ug/l	2
barium	dissolved	ug/l	900
cadmium	dissolved	ug/l	8
chromium	dissolved	ug/l	10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	13
selenium	dissolved	ug/l	1
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	15
arsenic	total	ug/l	<1
barium	total	ug/l	680
cadmium	total	ug/l	13
chromium	total	ug/l	10
lead	total	ug/l	45
mercury	total	ug/l	<0.4
nickel	total	ug/l	25
selenium	total	ug/l	2
silver	total	ug/l	<10.0
zinc	total	ug/l	43
total organic carbon		mg/l	0.9
cyanide		mg/l	<0.200
pH, field			7.88
conductivity, lab		umhos/cm	470
chloromethane		ug/l	<1.000
bromomethane		ug/l	<1.000
vinyl chloride		ug/l	<1.000
chloroethane		ug/l	<1.000
methylene chloride		ug/l	<0.500
acetone		ug/l	<1.000
carbon disulfide		ug/l	<0.500
1,1-dichloroethene		ug/l	<0.500
1,1-dichloroethane		ug/l	<0.500
trans-1,2-dichloroethene		ug/l	1.900
chloroform		ug/l	<0.5
1,2-dichloroethane		ug/l	<0.500
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<0.500

carbon tetrachloride	ug/l	<0.5
vinyl acetate	ug/l	<1.000
bromodichloromethane	ug/l	<0.5
1,2-dichloropropane	ug/l	<0.500
trichloroethene	**ug/l**	**1.900**
dibromochloromethane	ug/l	<0.5
1,1,2-trichloroethane	ug/l	<0.500
benzene	ug/l	<0.50
2-chloroethyl vinyl ether	ug/l	<1.000
bromoform	ug/l	<0.5
2-hexanone	ug/l	<1.000
4-methyl-2-pentanone	ug/l	<1.00
tetrachloroethene	**ug/l**	**0.700**
1,1,2,2-tetrachloroethane	ug/l	<0.500
toluene	ug/l	<0.50
cis-1,3-dichloropropene	ug/l	<0.500
trans-1,3-dichloropropene	ug/l	<0.500
chlorobenzene	ug/l	<0.500
ethylbenzene	ug/l	<0.50
styrene	ug/l	<0.500
xylenes total	ug/l	<0.500
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000

acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000

PCB 1016		ug/l	<100.000
PCB 1221		ug/l	<100.000
PCB 1232		ug/l	<200.000
PCB 1242		ug/l	<200.000
PCB 1248		ug/l	<200.000
PCB 1254		ug/l	<200.000
PCB 1260		ug/l	<200.000

PARAMETER		WELL 19A UNITS	MAR 19, 1986
arsenic	**dissolved**	**ug/l**	**2**
barium	**dissolved**	**ug/l**	**1500**
cadmium	dissolved	ug/l	<8
chromium	**dissolved**	**ug/l**	**38**
lead	**dissolved**	**ug/l**	**45**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**50**
selenium	**dissolved**	**ug/l**	**2**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**100**
arsenic	**total**	**ug/l**	**1**
barium	**total**	**ug/l**	**1400**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**35**
lead	**total**	**ug/l**	**48**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**45**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**210**
total organic carbon		**mg/l**	**16.1**
oil and grease		mg/l	<1.00
chloride		**mg/l**	**18**
sulfate		**mg/l**	**5**
cyanide		mg/l	<0.200
pH, field			**6.87**
conductivity, lab		**umhos/cm**	**592**
gross alpha		pc/l	<2
gross beta		pc/l	<3
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**16.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000

2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	**ug/l**	**7.000**
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**490.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**7.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	**ug/l**	**43.000**
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000

2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	**ug/l**	**7.000**
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**490.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**7.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	**ug/l**	**43.000**
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000

2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	**ug/l**	**300.000**
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**34.000**
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<10.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<100.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<20.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000

heptachlor epoxide	ug/l	<10.000
toxaphene	ug/l	<200.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<200.000
PCB 1232	ug/l	<100.000
PCB 1242	ug/l	<100.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 19A UNITS	OCT 7, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
chromium	trivalent diss	ug/l	<40.0
chromium	hexavalent diss	ug/l	<40.0
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	13
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	23
arsenic	total	ug/l	<1
barium	total	ug/l	1600
cadmium	total	ug/l	10
chromium	total	ug/l	43
chromium	trivalent tot	ug/l	<40
chromium	hexavalent tot	ug/l	<40
lead	total	ug/l	70
mercury	total	ug/l	<0.4
nickel	total	ug/l	25
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	40
heterotropic plate count		per ml	30000
pH, field			6.86
total hardness as CaCO3		mg/l	230
conductivity, lab		umhos/cm	6

PARAMETER		WELL 19B UNITS	MAY 5, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	370
lead	dissolved	ug/l	40
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	300

selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	88
arsenic	total	ug/l	<1
barium	total	ug/l	1200
cadmium	total	ug/l	<8
chromium	total	ug/l	1200
lead	total	ug/l	65
mercury	total	ug/l	<0.10
nickel	total	ug/l	290
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	98
total organic carbon		mg/l	3.5
pH, field			6.72
conductivity, lab		umhos/cm	1580
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	61.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	14.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER			WELL 19B UNITS	OCT 7, 1986
arsenic	dissolved		ug/l	<1
barium	dissolved		ug/l	<500
cadmium	dissolved		ug/l	<8
chromium	dissolved		ug/l	280
chromium	trivalent	diss	ug/l	<40.0
chromium	hexavalent	diss	ug/l	220.0
lead	dissolved		ug/l	40
mercury	dissolved		ug/l	<0.4
nickel	dissolved		ug/l	33
selenium	dissolved		ug/l	<0.4
silver	dissolved		ug/l	<10.0
zinc	dissolved		ug/l	45
arsenic	total		ug/l	3
barium	total		ug/l	<500
cadmium	total		ug/l	10
chromium	total		ug/l	340
chromium	trivalent	tot	ug/l	<40
chromium	hexavalent	tot	ug/l	100
lead	total		ug/l	58
mercury	total		ug/l	<0.4
nickel	total		ug/l	40
selenium	total		ug/l	<0.4
silver	total		ug/l	<10.0
zinc	total		ug/l	58
heterotropic plate count			per ml	73000
pH, field				6.43
total hardness as CaCO3			mg/l	350
conductivity, lab			umhos/cm	1170

PARAMETER			WELL 20A UNITS	MAR 19, 1986
arsenic	dissolved		ug/l	2
barium	dissolved		ug/l	<500
cadmium	dissolved		ug/l	<8
chromium	dissolved		ug/l	<10
lead	dissolved		ug/l	40
mercury	dissolved		ug/l	<0.10
nickel	dissolved		ug/l	38
selenium	dissolved		ug/l	2
silver	dissolved		ug/l	<10.0
zinc	dissolved		ug/l	130
arsenic	total		ug/l	3
barium	total		ug/l	<500
cadmium	total		ug/l	<8
chromium	total		ug/l	<10
lead	total		ug/l	35
mercury	total		ug/l	<0.10
nickel	total		ug/l	40

selenium	total	ug/l	<0.4
silver	total	ug/l	13.0
zinc	total	ug/l	73
total organic carbon		mg/l	3.7
oil and grease		mg/l	<1.00
chloride		mg/l	35
sulfate		mg/l	29
cyanide		mg/l	<0.200
pH, field			6.90
conductivity, lab		umhos/cm	0
gross alpha		pc/l	<2
gross beta		pc/l	<3
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	44.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	77.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000
phenol		ug/l	38.000
bis(2-chloroethyl)ether		ug/l	<10.000
2-chlorophenol		ug/l	<10.000
1,3-dichlorobenzene		ug/l	<10.000
1,4-dichlorobenzene		ug/l	<10.000

benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	**ug/l**	**43.000**
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**43.000**

chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<10.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<100.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<20.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<10.000
toxaphene	ug/l	<200.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<200.000
PCB 1232	ug/l	<100.000
PCB 1242	ug/l	<100.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 21A UNITS	MAR 19, 1986
arsenic	dissolved	ug/l	2
barium	dissolved	ug/l	630
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	58
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	60
selenium	dissolved	ug/l	2
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	110
arsenic	total	ug/l	2
barium	total	ug/l	640
cadmium	total	ug/l	<8
chromium	total	ug/l	10
lead	total	ug/l	58

mercury	total	ug/l	<0.10
nickel	total	ug/l	20
selenium	total	ug/l	1
silver	total	ug/l	13.0
zinc	total	ug/l	130
total organic carbon		mg/l	3.7
oil and grease		mg/l	1.00
chloride		mg/l	32
sulfate		mg/l	12
cyanide		mg/l	<0.200
pH, field			7.17
conductivity, lab		umhos/cm	905
gross alpha		pc/l	<2
gross beta		pc/l	6
gross beta counting error		pc/l	3
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000
phenol		ug/l	86.000

bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	**ug/l**	**31.000**
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000

butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**23.000**
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<10.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<100.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<20.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<10.000
toxaphene	ug/l	<200.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<200.000
PCB 1232	ug/l	<100.000
PCB 1242	ug/l	<100.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 21A UNITS	APR 8, 1987
barium	**total**	**ug/l**	**770**
iron	**total**	**ug/l**	**0.29**
manganese	**total**	**ug/l**	**30.0**
sodium	**total**	**mg/l**	**31.00**
calcium	**total**	**mg/l**	**76.0**
magnesium	**total**	**mg/l**	**50.0**
pH, field			**7.43**
bicarbonate		**mg/l**	**560**
carbonate		mg/l	<1
total hardness as CaCO3		**mg/l**	**400**
hydroxide alkalinity		mg/l	<1

conductivity, lab		umhos/cm	73

PARAMETER		WELL 21B UNITS	MAY 5, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	600
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	30
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	95
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	40
arsenic	total	ug/l	<1
barium	total	ug/l	1600
cadmium	total	ug/l	<8
chromium	total	ug/l	68
lead	total	ug/l	50
mercury	total	ug/l	<0.10
nickel	total	ug/l	250
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	120
total organic carbon		mg/l	2.8
pH, field			6.62
conductivity, lab		umhos/cm	1518
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0

2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		WELL 22A UNITS	MAR 19, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	48
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	28
selenium	dissolved	ug/l	0.8
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	120
arsenic	total	ug/l	1
barium	total	ug/l	580
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	53
mercury	total	ug/l	<0.10
nickel	total	ug/l	40
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	100
total organic carbon		mg/l	6.0
oil and grease		mg/l	2.20
chloride		mg/l	21
sulfate		mg/l	9
cyanide		mg/l	<0.200
pH, field			11.36
conductivity, lab		umhos/cm	711
gross alpha		pc/l	7
gross alpha counting error		pc/l	5
gross beta		pc/l	<3
radium-226		pc/l	<0.6
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000

carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000

p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**27.000**
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<10.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<100.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000

endosulfan I	ug/l	<20.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<10.000
toxaphene	ug/l	<200.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<200.000
PCB 1232	ug/l	<100.000
PCB 1242	ug/l	<100.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 22B UNITS	MAY 7, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	560
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	120
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	65
arsenic	total	ug/l	<1
barium	total	ug/l	660
cadmium	total	ug/l	<8
chromium	total	ug/l	13
lead	total	ug/l	33
mercury	total	ug/l	<0.10
nickel	total	ug/l	170
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	80
total organic carbon		mg/l	1.8
pH, field			7.13
conductivity, lab		umhos/cm	1141
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000

chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 23A UNITS	MAR 24, 1986
arsenic	**dissolved**	**ug/l**	**3**
barium	**dissolved**	**ug/l**	**780**
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**60**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**40**
selenium	**dissolved**	**ug/l**	**0.6**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**640**
arsenic	**total**	**ug/l**	**4**
barium	**total**	**ug/l**	**740**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**43**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**28**
selenium	**total**	**ug/l**	**0.4**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**140**
total organic carbon		mg/l	1.9
oil and grease		mg/l	<1.00
chloride		mg/l	0

sulfate	mg/l	5
cyanide	mg/l	<0.200
pH, field		8.68
conductivity, lab	umhos/cm	551
gross alpha	pc/l	<2
gross beta	pc/l	14
gross beta counting error	pc/l	6
radium-228	pc/l	<1.0
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	20.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	24.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000

4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**42.000**
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000

benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<10.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<100.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<20.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<10.000
toxaphene	ug/l	<200.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<200.000
PCB 1232	ug/l	<100.000
PCB 1242	ug/l	<100.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 23B UNITS	MAY 7, 1986
arsenic	dissolved	ug/l	<1
barium	**dissolved**	**ug/l**	**1500**
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**120**
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**65**
arsenic	total	ug/l	<1
barium	**total**	**ug/l**	**2300**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**130**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0

zinc total	**ug/l**	**65**
total organic carbon	**mg/l**	**2.2**
pH, field		**6.80**
conductivity, lab	**umhos/cm**	**655**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	**ug/l**	**60.000**
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 24A UNITS	MAR 24, 1986
arsenic	**dissolved**	**ug/l**	**2**
barium	**dissolved**	**ug/l**	**920**
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**65**
mercury	dissolved	ug/l	<0.10
nickel	**dissolved**	**ug/l**	**53**
selenium	**dissolved**	**ug/l**	**1**
silver	dissolved	ug/l	<10.0

zinc	**dissolved**	**ug/l**	**580**
arsenic	**total**	**ug/l**	**2**
barium	**total**	**ug/l**	**670**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**48**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**30**
selenium	**total**	**ug/l**	**0.8**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**120**
total organic carbon		**mg/l**	**7.9**
oil and grease		mg/l	<1.00
chloride		**mg/l**	**96**
sulfate		**mg/l**	**49**
cyanide		mg/l	<0.200
gross alpha		pc/l	<2
gross beta		**pc/l**	**11**
gross beta counting error		**pc/l**	**4**
radium-228		pc/l	<1.0
pH, field			**9.37**
conductivity, lab		**umhos/cm**	**893**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000

trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000

pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<10.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<100.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<20.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<10.000
toxaphene	ug/l	<200.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<200.000
PCB 1232	ug/l	<100.000
PCB 1242	ug/l	<100.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 25A UNITS	MAR 25, 1986
arsenic	**dissolved**	**ug/l**	**6**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**63**

mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	50
selenium	dissolved	ug/l	<1
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	600
arsenic	total	ug/l	7
barium	total	ug/l	870
cadmium	total	ug/l	<8
chromium	total	ug/l	10
lead	total	ug/l	50
mercury	total	ug/l	<0.10
nickel	total	ug/l	35
selenium	total	ug/l	0.9
silver	total	ug/l	<10.0
zinc	total	ug/l	100
total organic carbon		mg/l	1.1
oil and grease		mg/l	<1.00
chloride		mg/l	38
sulfate		mg/l	7
cyanide		mg/l	<0.200
pH, field			7.75
conductivity, lab		umhos/cm	658
gross alpha		pc/l	12
gross alpha counting error		pc/l	6
gross beta		pc/l	7
gross beta counting error		pc/l	3
radium-226		pc/l	<0.6
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0

2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000

fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<10.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<100.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<20.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<10.000
toxaphene	ug/l	<200.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<200.000
PCB 1232	ug/l	<100.000
PCB 1242	ug/l	<100.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 25A UNITS	APR 10, 1987
barium	total	ug/l	970
iron	total	ug/l	5.60
manganese	total	ug/l	170.0
sodium	total	mg/l	170.00
calcium	total	mg/l	44.0
magnesium	total	mg/l	31.0
pH, field			8.70
bicarbonate		mg/l	310
carbonate		mg/l	<1
total hardness as CaCO3		mg/l	240
hydroxide alkalinity		mg/l	<1
conductivity, lab		umhos/cm	109

PARAMETER		WELL 25B UNITS	JUN 13, 1986
arsenic	dissolved	ug/l	40
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	13
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	23
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	78
arsenic	total	ug/l	44
barium	total	ug/l	1000
cadmium	total	ug/l	<8
chromium	total	ug/l	110
lead	total	ug/l	88
mercury	total	ug/l	<0.4
nickel	total	ug/l	65
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	190
cyanide		mg/l	<0.200
pH, field			6.96
conductivity, lab		umhos/cm	1968
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	16.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	52.000

chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**380.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	**ug/l**	**580.00**
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	**ug/l**	**560.00**
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	**ug/l**	**6.000**

PARAMETER		WELL 25C UNITS	OCT 1, 1986
arsenic	**total**	**ug/l**	**13**
barium	**total**	**ug/l**	**900**
cadmium	**total**	**ug/l**	**10**
chromium	total	ug/l	<10
chromium	hexavalent tot	ug/l	<40
chromium	trivalent tot	ug/l	<40
lead	**total**	**ug/l**	**240**
mercury	total	ug/l	<0.4
nickel	**total**	**ug/l**	**55**
selenium	**total**	**ug/l**	**0.4**
silver	**total**	**ug/l**	**13.0**
zinc	**total**	**ug/l**	**73**
total organic carbon		**mg/l**	**2.2**
pH, field			**12.33**
total hardness as CaCO3		**mg/l**	**100**
conductivity, lab		**umhos/cm**	**2**
chloromethane		ug/l	<500.000
bromomethane		ug/l	<500.000
vinyl chloride		ug/l	<500.000
chloroethane		ug/l	<500.000
methylene chloride		ug/l	<250.000
acetone		ug/l	<500.000
carbon disulfide		ug/l	<250.000

1,1-dichloroethene	ug/l	<250.000
1,1-dichloroethane	ug/l	<250.000
trans-1,2-dichloroethene	ug/l	<250.000
chloroform	ug/l	<250.0
1,2-dichloroethane	ug/l	<250.000
2-butanone (meth eth ket)	ug/l	<500.000
1,1,1-trichloroethane	ug/l	<250.000
carbon tetrachloride	ug/l	<250.0
vinyl acetate	ug/l	<500.000
bromodichloromethane	ug/l	<250.0
1,2-dichloropropane	ug/l	<250.000
trichloroethene	ug/l	<250.000
dibromochloromethane	ug/l	<250.0
1,1,2-trichloroethane	ug/l	<250.000
benzene	**ug/l**	**430.00**
2-chloroethyl vinyl ether	ug/l	<500.000
bromoform	ug/l	<250.0
2-hexanone	ug/l	<500.000
4-methyl-2-pentanone	ug/l	<500.00
tetrachloroethene	ug/l	<250.000
1,1,2,2-tetrachloroethane	ug/l	<250.000
toluene	**ug/l**	**13000.00**
cis-1,3-dichloropropene	ug/l	<250.000
trans-1,3-dichloropropene	ug/l	<250.000
chlorobenzene	ug/l	<250.000
ethylbenzene	ug/l	<250.00
styrene	ug/l	<250.000
xylenes total	ug/l	<250.000

PARAMETER	WELL 25C UNITS	JAN 22, 1987
pH, field		**10.62**
conductivity, lab	**umhos/cm**	**342**
phenol	ug/l	<7.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000

2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<3.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<4.000
3,3-dichlorobenzidine	ug/l	<10.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**1300.000**
chrysene	ug/l	<10.000
di-n-octyl phthalate	**ug/l**	**37.000**
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000

chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 25C UNITS	APR 3, 1987
barium	total	ug/l	1100
iron	total	ug/l	0.14
manganese	total	ug/l	28.0
sodium	total	mg/l	45.00
calcium	total	mg/l	68.0
magnesium	total	mg/l	8.0
pH, field			12.24
bicarbonate		mg/l	<1
carbonate		mg/l	43
total hardness as CaCO3		mg/l	200
hydroxide alkalinity		mg/l	230
conductivity, lab		umhos/cm	104

PARAMETER		WELL 32A UNITS	APR 16, 1986
arsenic	dissolved	ug/l	3
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	30
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	30
selenium	dissolved	ug/l	0.6
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	63
arsenic	total	ug/l	2
barium	total	ug/l	840

cadmium	**total**	**ug/l**	**8**
chromium	**total**	**ug/l**	**300**
lead	**total**	**ug/l**	**95**
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**190**
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**420**
total organic carbon		**mg/l**	**2.7**
oil and grease		mg/l	<1.00
chloride		**mg/l**	**98**
sulfate		**mg/l**	**48**
cyanide		mg/l	<0.200
pH, field			**7.80**
conductivity, lab		**umhos/cm**	**1085**
gross alpha		**pc/l**	**30**
gross alpha counting error		**pc/l**	**19**
gross beta		**pc/l**	**42**
gross beta counting error		**pc/l**	**12**
radium-226		pc/l	<0.6
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		**ug/l**	**540.000**
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**20.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**210.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000

chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000

phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 32B UNITS	APR 16, 1986
arsenic	**dissolved**	**ug/l**	**15**
barium	**dissolved**	**ug/l**	**760**
cadmium	**dissolved**	**ug/l**	**10**
chromium	**dissolved**	**ug/l**	**200**
lead	**dissolved**	**ug/l**	**78**
mercury	dissolved	ug/l	<0.10

nickel	**dissolved**	**ug/l**	**110**
selenium	**dissolved**	**ug/l**	**0.9**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**230**
arsenic	**total**	**ug/l**	**12**
barium	**total**	**ug/l**	**1800**
cadmium	total	ug/l	<8
chromium	**total**	**ug/l**	**390**
lead	**total**	**ug/l**	**80**
mercury	**total**	**ug/l**	**1.0**
nickel	**total**	**ug/l**	**170**
selenium	**total**	**ug/l**	**0.8**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**280**
total organic carbon		**mg/l**	**3.0**
oil and grease		mg/l	<1.00
chloride		**mg/l**	**23**
sulfate		**mg/l**	**3**
cyanide		mg/l	<0.200
gross alpha		**pc/l**	**18**
gross alpha counting error		**pc/l**	**13**
gross beta		**pc/l**	**34**
gross beta counting error		**pc/l**	**12**
radium-226		**pc/l**	**1.4**
Ra-226 counting error		**pc/l**	**1.2**
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		**ug/l**	**59.000**
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		**ug/l**	**16.000**
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		**ug/l**	**930.000**
chloroform		ug/l	<5.0
1,2-dichloroethane		**ug/l**	**67.000**
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		**ug/l**	**10.000**
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**6900.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00

tetrachloroethene	**ug/l**	**33.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	**ug/l**	**10.000**
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00

4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 32C UNITS	APR 16, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	13
chromium	dissolved	ug/l	53
lead	dissolved	ug/l	90
mercury	dissolved	ug/l	0.2
nickel	dissolved	ug/l	43
selenium	dissolved	ug/l	0.8
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	110
arsenic	total	ug/l	2
barium	total	ug/l	580
cadmium	total	ug/l	8
chromium	total	ug/l	150
lead	total	ug/l	150
mercury	total	ug/l	0.2
nickel	total	ug/l	78
selenium	total	ug/l	0.6
silver	total	ug/l	<10.0
zinc	total	ug/l	310
total organic carbon		mg/l	5.8
oil and grease		mg/l	<1.00
chloride		mg/l	34
sulfate		mg/l	28
cyanide		mg/l	<0.200
gross alpha		pc/l	<2
gross beta		pc/l	<3
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	11.000
acetone		ug/l	75.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	46.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	7.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	540.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00

2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**28.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000

diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 33A UNITS	APR 15, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	30
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	63
selenium	dissolved	ug/l	1
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	120
arsenic	total	ug/l	1
barium	total	ug/l	<500
cadmium	total	ug/l	10
chromium	total	ug/l	100
lead	total	ug/l	58
mercury	total	ug/l	<0.10
nickel	total	ug/l	100
selenium	total	ug/l	1
silver	total	ug/l	<10.0
zinc	total	ug/l	150
total organic carbon		mg/l	3.5
oil and grease		mg/l	<1.00
chloride		mg/l	110
sulfate		mg/l	84
cyanide		mg/l	<0.200
pH, field			7.16
conductivity, lab		umhos/cm	1437
gross alpha		pc/l	<2
gross beta		pc/l	7
gross beta counting error		pc/l	5
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	9.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	120.000
chloroform		ug/l	48.0
1,2-dichloroethane		ug/l	390.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000

trichloroethene	**ug/l**	**18000.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	**ug/l**	**60.000**
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**170.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	**ug/l**	**12.000**
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000

4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000

PCB 1248		ug/l	<200.000
PCB 1254		ug/l	<200.000
PCB 1260		ug/l	<200.000

PARAMETER		WELL 33A UNITS	DEC 21, 1986
arsenic	dissolved	ug/l	1
barium	dissolved	ug/l	630
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
chromium	trivalent diss	ug/l	<40.0
chromium	hexavalent diss	ug/l	<40.0
lead	dissolved	ug/l	78
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	320
selenium	dissolved	ug/l	1
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	170
iron	dissolved	ug/l	140
manganese	dissolved	ug/l	390.0
sodium	dissolved	mg/l	31.00
potassium	dissolved	mg/l	5.90
calcium	dissolved	mg/l	75.0
magnesium	dissolved	mg/l	42.0
arsenic	total	ug/l	4
barium	total	ug/l	800
cadmium	total	ug/l	<8
chromium	total	ug/l	220
chromium	trivalent tot	ug/l	40
chromium	hexavalent tot	ug/l	140
lead	total	ug/l	110
mercury	total	ug/l	<0.4
nickel	total	ug/l	530
selenium	total	ug/l	1
silver	total	ug/l	<10.0
zinc	total	ug/l	210
iron	total	ug/l	42.00
manganese	total	ug/l	880.0
sodium	total	mg/l	40.00
potassium	total	mg/l	8.80
calcium	total	mg/l	80.0
magnesium	total	mg/l	47.0
silica		mg/l	21.0
heterotropic plate count		per ml	12000
chloride		mg/l	150
fluoride		mg/l	0.42
sulfate		mg/l	97
nitrate	diss	mg/l	3.7
pH, field			6.52
total dissolved solids		mg/l	760
bicarbonate		mg/l	420

carbonate		mg/l	0
total hardness as CaCO3		mg/l	430
conductivity, lab		umhos/cm	1204

PARAMETER		WELL 33B UNITS	APR 15, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	30
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	88
selenium	dissolved	ug/l	0.6
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	98
arsenic	total	ug/l	<1
barium	total	ug/l	690
cadmium	total	ug/l	<8
chromium	total	ug/l	300
lead	total	ug/l	80
mercury	total	ug/l	<0.10
nickel	total	ug/l	300
selenium	total	ug/l	0.6
silver	total	ug/l	<10.0
zinc	total	ug/l	130
total organic carbon		mg/l	1.2
oil and grease		mg/l	<1.00
chloride		mg/l	4
sulfate		mg/l	6
cyanide		mg/l	<0.200
pH, field			7.35
conductivity, lab		umhos/cm	673
gross alpha		pc/l	20
gross alpha counting error		pc/l	12
gross beta		pc/l	20
gross beta counting error		pc/l	6
radium-226		pc/l	<0.6
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	74.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	13.000
acetone		ug/l	23.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	12.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	240.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	700.000

2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**14000.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**1200.000**
1,1,2,2-tetrachloroethane	**ug/l**	**22.000**
toluene	**ug/l**	**7.00**
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	**ug/l**	**6.000**
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000

2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000

heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER			WELL 33B UNITS	DEC 21, 1986
arsenic	dissolved		ug/l	<1
barium	dissolved		ug/l	580
cadmium	dissolved		ug/l	<8
chromium	dissolved		ug/l	<10
chromium	trivalent	diss	ug/l	<40.0
chromium	hexavalent	diss	ug/l	<40.0
lead	dissolved		ug/l	43
mercury	dissolved		ug/l	<0.4
nickel	dissolved		ug/l	38
selenium	dissolved		ug/l	0.4
silver	dissolved		ug/l	<10.0
zinc	dissolved		ug/l	130
iron	dissolved		ug/l	230
manganese	dissolved		ug/l	60.0
sodium	dissolved		mg/l	18.00
potassium	dissolved		mg/l	0.51
calcium	dissolved		mg/l	50.0
magnesium	dissolved		mg/l	25.0
arsenic	total		ug/l	2
barium	total		ug/l	1000
cadmium	total		ug/l	<8
chromium	total		ug/l	260
chromium	trivalent	tot	ug/l	60
chromium	hexavalent	tot	ug/l	100
lead	total		ug/l	78
mercury	total		ug/l	<0.4
nickel	total		ug/l	320
selenium	total		ug/l	<0.4
silver	total		ug/l	<10.0
zinc	total		ug/l	160
iron	total		ug/l	10.00
manganese	total		ug/l	330.0
sodium	total		mg/l	16.00
potassium	total		mg/l	6.40
calcium	total		mg/l	100.0
magnesium	total		mg/l	30.0
silica			mg/l	11.0
heterotropic plate count			per ml	230000
chloride			mg/l	25

fluoride		mg/l	0.22
sulfate		mg/l	15
nitrate	diss	mg/l	3.3
pH, field			6.97
total dissolved solids		mg/l	320
bicarbonate		mg/l	320
carbonate		mg/l	<10
total hardness as CaCO3		mg/l	250
conductivity, lab		umhos/cm	575

PARAMETER		WELL 33C UNITS	APR 15, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	640
cadmium	dissolved	ug/l	8
chromium	dissolved	ug/l	83
lead	dissolved	ug/l	30
mercury	dissolved	ug/l	0.8
nickel	dissolved	ug/l	55
selenium	dissolved	ug/l	0.8
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	85
arsenic	total	ug/l	2
barium	total	ug/l	930
cadmium	total	ug/l	8
chromium	total	ug/l	170
lead	total	ug/l	80
mercury	total	ug/l	2.5
nickel	total	ug/l	120
selenium	total	ug/l	0.7
silver	total	ug/l	<10.0
zinc	total	ug/l	160
total organic carbon		mg/l	8.4
oil and grease		mg/l	<1.00
chloride		mg/l	120
sulfate		mg/l	12
cyanide		mg/l	<0.200
pH, field			12.00
conductivity, lab		umhos/cm	4
gross alpha		pc/l	<2
gross beta		pc/l	34
gross beta counting error		pc/l	12
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	15.000
acetone		ug/l	16.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000

1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**75.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000

hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000

endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER			WELL 33C UNITS	DEC 21, 1986
arsenic	dissolved		ug/l	<1
barium	dissolved		ug/l	<500
cadmium	dissolved		ug/l	<8
chromium	dissolved		ug/l	110
chromium	trivalent	diss	ug/l	60.0
chromium	hexavalent	diss	ug/l	50.0
lead	dissolved		ug/l	78
mercury	dissolved		ug/l	<0.4
nickel	dissolved		ug/l	60
selenium	dissolved		ug/l	0.9
silver	dissolved		ug/l	<10.0
zinc	dissolved		ug/l	120
iron	dissolved		ug/l	770
manganese	dissolved		ug/l	15.0
sodium	dissolved		mg/l	27.00
potassium	dissolved		mg/l	10.00
calcium	dissolved		mg/l	170.0
magnesium	dissolved		mg/l	0.1
arsenic	total		ug/l	2
barium	total		ug/l	500
cadmium	total		ug/l	8
chromium	total		ug/l	120
chromium	trivalent	tot	ug/l	120
chromium	hexavalent	tot	ug/l	<40
lead	total		ug/l	110
mercury	total		ug/l	<0.4
nickel	total		ug/l	73
selenium	total		ug/l	1
silver	total		ug/l	<10.0
zinc	total		ug/l	150
iron	total		ug/l	0.77
manganese	total		ug/l	28.0
sodium	total		mg/l	34.00
potassium	total		mg/l	11.00
calcium	total		mg/l	170.0

magnesium	total	mg/l	3.0
silica		mg/l	2.3
heterotropic plate count		per ml	60
chloride		mg/l	150
fluoride		mg/l	0.37
sulfate		mg/l	13
nitrate	diss	mg/l	3.7
pH, field			12.52
total dissolved solids		mg/l	730
bicarbonate		mg/l	78
carbonate		mg/l	11
total hardness as CaCO3		mg/l	440
conductivity, lab		umhos/cm	2

PARAMETER		WELL 34A UNITS	APR 22, 1986
arsenic	dissolved	ug/l	2
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	10
chromium	dissolved	ug/l	64000
lead	dissolved	ug/l	95
mercury	dissolved	ug/l	0.2
nickel	dissolved	ug/l	45
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	150
arsenic	total	ug/l	<1
barium	total	ug/l	1600
cadmium	total	ug/l	10
chromium	total	ug/l	80000
lead	total	ug/l	130
mercury	total	ug/l	0.2
nickel	total	ug/l	70
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	150
total organic carbon		mg/l	4.5
oil and grease		mg/l	<1.00
chloride		mg/l	123
sulfate		mg/l	370
cyanide		mg/l	<0.200
gross alpha		pc/l	<2
gross beta		pc/l	<3
pH, field			7.37
conductivity, lab		umhos/cm	1397
chloromethane		ug/l	<10000.000
bromomethane		ug/l	<10000.000
vinyl chloride		ug/l	<10000.000
chloroethane		ug/l	<10000.000
methylene chloride		ug/l	<5000.000
acetone		ug/l	<10000.000

carbon disulfide	ug/l	<5000.000
1,1-dichloroethene	ug/l	<5000.000
1,1-dichloroethane	ug/l	<5000.000
trans-1,2-dichloroethene	ug/l	<5000.000
chloroform	ug/l	<5000.0
1,2-dichloroethane	ug/l	<5000.000
2-butanone (meth eth ket)	ug/l	<10000.000
1,1,1-trichloroethane	ug/l	<5000.000
carbon tetrachloride	ug/l	<5000.0
vinyl acetate	ug/l	<10000.000
bromodichloromethane	ug/l	<5000.0
1,2-dichloropropane	ug/l	<5000.000
trichloroethene	**ug/l**	**330000.000**
dibromochloromethane	ug/l	<5000.0
1,1,2-trichloroethane	ug/l	<5000.000
benzene	ug/l	<5000.00
2-chloroethyl vinyl ether	ug/l	<10000.000
bromoform	ug/l	<5000.0
2-hexanone	ug/l	<10000.000
4-methyl-2-pentanone	ug/l	<10000.00
tetrachloroethene	ug/l	<5000.000
1,1,2,2-tetrachloroethane	ug/l	<5000.000
toluene	ug/l	<5000.00
cis-1,3-dichloropropene	ug/l	<5000.000
trans-1,3-dichloropropene	ug/l	<5000.000
chlorobenzene	ug/l	<5000.000
ethylbenzene	ug/l	<5000.00
styrene	ug/l	<5000.000
xylenes total	ug/l	<5000.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000

p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**15.000**
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000

endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 34A UNITS	DEC 22, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	8
chromium	dissolved	ug/l	98000
chromium	trivalent diss	ug/l	430.0
chromium	hexavalent diss	ug/l	97000.0
lead	dissolved	ug/l	78
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	25
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	65
iron	dissolved	ug/l	38
manganese	dissolved	ug/l	240.0
sodium	dissolved	mg/l	47.00
potassium	dissolved	mg/l	5.00
calcium	dissolved	mg/l	90.0
magnesium	dissolved	mg/l	50.0
arsenic	total	ug/l	3
barium	total	ug/l	<500
cadmium	total	ug/l	8
chromium	total	ug/l	120000
chromium	trivalent tot	ug/l	2300
chromium	hexavalent tot	ug/l	110000
lead	total	ug/l	80
mercury	total	ug/l	<0.4
nickel	total	ug/l	110
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	110
iron	total	ug/l	24.00
manganese	total	ug/l	500.0
sodium	total	mg/l	51.00

potassium	total	mg/l	6.70
calcium	total	mg/l	99.0
magnesium	total	mg/l	53.0
silica		mg/l	16.0
heterotropic plate count		per ml	17000
chloride		mg/l	100
fluoride		mg/l	0.67
sulfate		mg/l	660
nitrate	diss	mg/l	6.8
pH, field			7.11
total dissolved solids		mg/l	1000
bicarbonate		mg/l	450
carbonate		mg/l	<10
total hardness as CaCO3		mg/l	460
conductivity, lab		umhos/cm	1365

PARAMETER		WELL 34B UNITS	APR 22, 1986
arsenic	dissolved	ug/l	12
barium	dissolved	ug/l	760
cadmium	dissolved	ug/l	18
chromium	dissolved	ug/l	80
lead	dissolved	ug/l	110
mercury	dissolved	ug/l	0.3
nickel	dissolved	ug/l	43
selenium	dissolved	ug/l	0.5
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	53
arsenic	total	ug/l	43
barium	total	ug/l	12000
cadmium	total	ug/l	13
chromium	total	ug/l	1700
lead	total	ug/l	250
mercury	total	ug/l	0.2
nickel	total	ug/l	580
selenium	total	ug/l	<0.4
silver	total	ug/l	15.0
zinc	total	ug/l	1000
total organic carbon		mg/l	7.9
oil and grease		mg/l	2.20
chloride		mg/l	45
sulfate		mg/l	4
cyanide		mg/l	<0.200
gross alpha		pc/l	100
gross alpha counting error		pc/l	69
gross beta		pc/l	127
gross beta counting error		pc/l	39
radium-226		pc/l	5.6
Ra-226 counting error		pc/l	3.6
radium-228		pc/l	<1.0
pH, field			8.77

conductivity, lab	**umhos/cm**	**472**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	**ug/l**	**12.000**
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	**ug/l**	**47.000**
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**30000.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**130.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	**ug/l**	**35.000**
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000

benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000

PARAMETER	WELL 34B UNITS	MAY 12, 1987
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	**ug/l**	**13.000**
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	**ug/l**	**63.000**
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**25000.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**170.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	**ug/l**	**57.000**
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		WELL 34C UNITS	APR 22, 1986
arsenic	dissolved	ug/l	3
barium	dissolved	ug/l	640
cadmium	dissolved	ug/l	10
chromium	dissolved	ug/l	690
lead	dissolved	ug/l	50
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	50
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	120
arsenic	total	ug/l	4
barium	total	ug/l	1100
cadmium	total	ug/l	13
chromium	total	ug/l	1200
lead	total	ug/l	90
mercury	total	ug/l	0.1
nickel	total	ug/l	70
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	190
total organic carbon		mg/l	5.3
oil and grease		mg/l	<1.00
chloride		mg/l	16
sulfate		mg/l	5
cyanide		mg/l	<0.200
gross alpha		pc/l	<2
gross beta		pc/l	<3
pH, field			8.77
conductivity, lab		umhos/cm	930
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	36.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	1000.000
dibromochloromethane		ug/l	<5.0

1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**25.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000

2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	**ug/l**	**19.000**
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<20.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000

PCB 1260		ug/l	<200.000

PARAMETER		WELL 34C UNITS	DEC 22, 1986
arsenic	dissolved	ug/l	4
barium	dissolved	ug/l	900
cadmium	dissolved	ug/l	8
chromium	dissolved	ug/l	460
chromium	trivalent diss	ug/l	50.0
chromium	hexavalent diss	ug/l	310.0
lead	dissolved	ug/l	68
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	50
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	120
iron	dissolved	ug/l	60
manganese	dissolved	ug/l	120.0
sodium	dissolved	mg/l	26.00
potassium	dissolved	mg/l	3.40
calcium	dissolved	mg/l	75.0
magnesium	dissolved	mg/l	43.0
arsenic	total	ug/l	5
barium	total	ug/l	1400
cadmium	total	ug/l	8
chromium	total	ug/l	540
chromium	trivalent tot	ug/l	160
chromium	hexavalent tot	ug/l	280
lead	total	ug/l	68
mercury	total	ug/l	<0.4
nickel	total	ug/l	83
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	93
iron	total	ug/l	1.60
manganese	total	ug/l	150.0
sodium	total	mg/l	30.00
potassium	total	mg/l	3.30
calcium	total	mg/l	75.0
magnesium	total	mg/l	43.0
silica		mg/l	9.9
heterotropic plate count		per ml	29000
chloride		mg/l	17
fluoride		mg/l	0.17
sulfate		mg/l	7
nitrate	diss	mg/l	1.0
pH, field			6.93
total dissolved solids		mg/l	640
bicarbonate		mg/l	470
carbonate		mg/l	<10
total hardness as CaCO3		mg/l	390

conductivity, lab	umhos/cm	705

PARAMETER		WELL 34C UNITS	MAY 12, 1987
chloromethane		ug/l	<1.000
bromomethane		ug/l	<1.000
vinyl chloride		ug/l	4.000
chloroethane		ug/l	<1.000
methylene chloride		ug/l	9.000
acetone		ug/l	<1.000
carbon disulfide		ug/l	<0.500
1,1-dichloroethene		ug/l	1.000
1,1-dichloroethane		ug/l	3.000
trans-1,2-dichloroethene		ug/l	58.000
chloroform		ug/l	<0.5
1,2-dichloroethane		ug/l	3.000
2-butanone (meth eth ket)		ug/l	<1.000
1,1,1-trichloroethane		ug/l	<0.500
carbon tetrachloride		ug/l	<0.5
vinyl acetate		ug/l	<1.000
bromodichloromethane		ug/l	<0.5
1,2-dichloropropane		ug/l	<0.500
trichloroethene		ug/l	370.000
dibromochloromethane		ug/l	<0.5
1,1,2-trichloroethane		ug/l	<0.500
benzene		ug/l	1.00
2-chloroethyl vinyl ether		ug/l	<1.000
bromoform		ug/l	<0.5
2-hexanone		ug/l	<1.000
4-methyl-2-pentanone		ug/l	<1.00
tetrachloroethene		ug/l	21.000
1,1,2,2-tetrachloroethane		ug/l	<0.500
toluene		ug/l	1.00
cis-1,3-dichloropropene		ug/l	<0.500
trans-1,3-dichloropropene		ug/l	<0.500
chlorobenzene		ug/l	40.000
ethylbenzene		ug/l	<0.50
styrene		ug/l	<0.500
xylenes total		ug/l	<0.500

PARAMETER		WELL 34D UNITS	AUG 12, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	1200
cadmium	dissolved	ug/l	8
chromium	dissolved	ug/l	20
lead	dissolved	ug/l	45
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	25
selenium	dissolved	ug/l	<0.4

silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	40
arsenic	total	ug/l	18
barium	total	ug/l	3000
cadmium	total	ug/l	13
chromium	total	ug/l	440
lead	total	ug/l	340
mercury	total	ug/l	<0.4
nickel	total	ug/l	380
selenium	total	ug/l	<0.4
silver	total	ug/l	13.0
zinc	total	ug/l	1700
total organic carbon		mg/l	1.9
pH, field			10.53
conductivity, lab		umhos/cm	262
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	7.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	7.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER	WELL 34D UNITS	MAY 12, 1987
chloromethane	ug/l	<1.000
bromomethane	ug/l	<1.000
vinyl chloride	ug/l	<1.000
chloroethane	ug/l	<1.000
methylene chloride	**ug/l**	**6.000**
acetone	ug/l	<1.000
carbon disulfide	ug/l	<0.500
1,1-dichloroethene	ug/l	<0.500
1,1-dichloroethane	ug/l	<0.500
trans-1,2-dichloroethene	**ug/l**	**1.000**
chloroform	ug/l	<0.5
1,2-dichloroethane	ug/l	<0.500
2-butanone (meth eth ket)	ug/l	<1.000
1,1,1-trichloroethane	**ug/l**	**1.000**
carbon tetrachloride	ug/l	<0.5
vinyl acetate	ug/l	<1.000
bromodichloromethane	ug/l	<0.5
1,2-dichloropropane	ug/l	<0.500
trichloroethene	**ug/l**	**7.000**
dibromochloromethane	ug/l	<0.5
1,1,2-trichloroethane	ug/l	<0.500
benzene	ug/l	<0.50
2-chloroethyl vinyl ether	ug/l	<1.000
bromoform	ug/l	<0.5
2-hexanone	ug/l	<1.000
4-methyl-2-pentanone	ug/l	<1.00
tetrachloroethene	**ug/l**	**2.000**
1,1,2,2-tetrachloroethane	ug/l	<0.500
toluene	**ug/l**	**1.00**
cis-1,3-dichloropropene	ug/l	<0.500
trans-1,3-dichloropropene	ug/l	<0.500
chlorobenzene	ug/l	<0.500
ethylbenzene	ug/l	<0.50
styrene	ug/l	<0.500
xylenes total	ug/l	<0.500

PARAMETER		WELL 35A UNITS	APR 17, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	**dissolved**	**ug/l**	**13**
chromium	dissolved	ug/l	<10
lead	**dissolved**	**ug/l**	**100**
mercury	**dissolved**	**ug/l**	**0.2**
nickel	**dissolved**	**ug/l**	**78**
selenium	**dissolved**	**ug/l**	**1**
silver	dissolved	ug/l	<10.0
zinc	**dissolved**	**ug/l**	**140**

arsenic	total	ug/l	<1
barium	total	ug/l	1700
cadmium	total	ug/l	10
chromium	total	ug/l	260
lead	total	ug/l	130
mercury	total	ug/l	0.2
nickel	total	ug/l	220
selenium	total	ug/l	0.8
silver	total	ug/l	<10.0
zinc	total	ug/l	260
total organic carbon		mg/l	2.5
oil and grease		mg/l	<1.00
chloride		mg/l	260
sulfate		mg/l	90
cyanide		mg/l	<0.200
pH, field			7.08
conductivity, lab		umhos/cm	1838
gross alpha		pc/l	23
gross alpha counting error		pc/l	17
gross beta		pc/l	26
gross beta counting error		pc/l	11
radium-226		pc/l	4.7
Ra-226 counting error		pc/l	3.5
radium-228		pc/l	<1.0
chloromethane		ug/l	<100.000
bromomethane		ug/l	<100.000
vinyl chloride		ug/l	<100.000
chloroethane		ug/l	<100.000
methylene chloride		ug/l	<50.000
acetone		ug/l	190.000
carbon disulfide		ug/l	<50.000
1,1-dichloroethene		ug/l	<50.000
1,1-dichloroethane		ug/l	<50.000
trans-1,2-dichloroethene		ug/l	<50.000
chloroform		ug/l	<50.0
1,2-dichloroethane		ug/l	<50.000
2-butanone (meth eth ket)		ug/l	<100.000
1,1,1-trichloroethane		ug/l	<50.000
carbon tetrachloride		ug/l	<50.0
vinyl acetate		ug/l	<100.000
bromodichloromethane		ug/l	<50.0
1,2-dichloropropane		ug/l	<50.000
trichloroethene		ug/l	<50.000
dibromochloromethane		ug/l	<50.0
1,1,2-trichloroethane		ug/l	<50.000
benzene		ug/l	<50.00
2-chloroethyl vinyl ether		ug/l	<100.000
bromoform		ug/l	<50.0
2-hexanone		ug/l	<100.000
4-methyl-2-pentanone		ug/l	<100.00
tetrachloroethene		ug/l	<50.000
1,1,2,2-tetrachloroethane		ug/l	<50.000

toluene	ug/l	<50.00
cis-1,3-dichloropropene	ug/l	<50.000
trans-1,3-dichloropropene	ug/l	<50.000
chlorobenzene	ug/l	<50.000
ethylbenzene	ug/l	<50.00
styrene	ug/l	<50.000
xylenes total	ug/l	<50.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000

4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 35B UNITS	APR 17, 1986
arsenic	dissolved	ug/l	<1
barium	**dissolved**	**ug/l**	**550**
cadmium	**dissolved**	**ug/l**	**8**

chromium	dissolved	ug/l	20
lead	dissolved	ug/l	110
mercury	dissolved	ug/l	0.3
nickel	dissolved	ug/l	63
selenium	dissolved	ug/l	0.6
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	180
arsenic	total	ug/l	<1
barium	total	ug/l	2300
cadmium	total	ug/l	8
chromium	total	ug/l	180
lead	total	ug/l	150
mercury	total	ug/l	0.3
nickel	total	ug/l	140
selenium	total	ug/l	0.5
silver	total	ug/l	<10.0
zinc	total	ug/l	320
total organic carbon		mg/l	3.6
oil and grease		mg/l	<1.00
chloride		mg/l	30
sulfate		mg/l	5
cyanide		mg/l	<0.200
pH, field			7.16
conductivity, lab		umhos/cm	769
gross alpha		pc/l	17
gross alpha counting error		pc/l	12
gross beta		pc/l	15
gross beta counting error		pc/l	10
radium-226		pc/l	<0.6
radium-228		pc/l	<1.0
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	200.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	61.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	17.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	1200.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00

2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000
2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000

diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000
PCB 1260	ug/l	<200.000

PARAMETER		WELL 35C UNITS	APR 17, 1986
arsenic	dissolved	ug/l	4
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	10
chromium	dissolved	ug/l	10
lead	dissolved	ug/l	90
mercury	dissolved	ug/l	<0.10
nickel	dissolved	ug/l	35
selenium	dissolved	ug/l	0.7
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	120
arsenic	total	ug/l	6
barium	total	ug/l	660
cadmium	total	ug/l	13
chromium	total	ug/l	80
lead	total	ug/l	130
mercury	total	ug/l	0.2
nickel	total	ug/l	120
selenium	total	ug/l	0.6
silver	total	ug/l	<10.0
zinc	total	ug/l	170
total organic carbon		mg/l	6.9
oil and grease		mg/l	1.80
chloride		mg/l	16
sulfate		mg/l	7
cyanide		mg/l	<0.200
pH, field			9.75
conductivity, lab		umhos/cm	259
gross alpha		pc/l	<2
gross beta		pc/l	<3
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	12.000
chloroform		ug/l	8.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	25.000
dibromochloromethane		ug/l	<5.0

1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	10.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<10.000
bis(2-chloroethyl)ether	ug/l	<10.000
2-chlorophenol	ug/l	<10.000
1,3-dichlorobenzene	ug/l	<10.000
1,4-dichlorobenzene	ug/l	<10.000
benzyl alcohol	ug/l	<10.000
1,2-dichlorobenzene	ug/l	<10.000
2-methylphenol	ug/l	<10.000
bis(2-chloroisopropyl)eth	ug/l	<10.000
4-methylphenol	ug/l	<10.000
n-nitrosodipropylamine	ug/l	<10.000
hexachloroethane	ug/l	<10.000
nitrobenzene	ug/l	<10.000
isophorone	ug/l	<10.000
2-nitrophenol	ug/l	<10.000
2,4-dimethylphenol	ug/l	<10.000
benzoic acid	ug/l	<50.000
bis(2-chloroethoxy)methan	ug/l	<10.000
2,4-dichlorophenol	ug/l	<10.000
1,2,4-trichlorobenzene	ug/l	<10.000
naphthalene	ug/l	<10.000
4-chloroaniline	ug/l	<10.00
hexachlorobutadiene	ug/l	<10.000
p-chloro-m-cresol	ug/l	<10.000
2-methylnaphthalene	ug/l	<10.000
hexachlorocyclopentadiene	ug/l	<10.000
2,4,6-trichlorophenol	ug/l	<10.000
2,4,5-tricholorphenol	ug/l	<50.000
2-chloronaphthalene	ug/l	<10.000
2-nitroaniline	ug/l	<50.000
dimethyl phthalate	ug/l	<10.000
acenaphthylene	ug/l	<10.000
3-nitroaniline	ug/l	<50.000
acenaphthalene	ug/l	<10.000
2,4-dinitrophenol	ug/l	<50.000
4-nitrophenol	ug/l	<50.000
dibenzofuran	ug/l	<10.000

2,4-dinitrotoluene	ug/l	<10.000
2,6-dinitrotoluene	ug/l	<10.000
diethyl phthalate	ug/l	<10.000
4-chlorophenyl phenyl eth	ug/l	<10.000
fluorene	ug/l	<10.000
4-nitroaniline	ug/l	<50.00
4,6-dinitro-2-methylphenol	ug/l	<50.000
n-nitrosodiphenylamine	ug/l	<10.000
4-bromophenyl phenyl ether	ug/l	<10.000
hexachlorobenzene	ug/l	<10.000
pentachlorophenol	ug/l	<50.000
phenanthrene	ug/l	<10.000
anthracene	ug/l	<10.000
di-n-butyl phthalate	ug/l	<10.000
fluoranthene	ug/l	<10.000
pyrene	ug/l	<10.000
butyl benzyl phthalate	ug/l	<10.000
3,3-dichlorobenzidine	ug/l	<20.000
benzo(a)anthracine	ug/l	<10.000
bis(2-ethylhexyl)phthalate	ug/l	<10.000
chrysene	ug/l	<10.000
di-n-octyl phthalate	ug/l	<10.000
benzo(b)fluoranthene	ug/l	<10.000
benzo(k)fluoranthene	ug/l	<10.000
benzo(a)pyrene	ug/l	<10.000
indeno(1,2,3-c,d)pyrene	ug/l	<10.000
dibenzo(a,h)anthracene	ug/l	<10.000
benzo(g,h,i)perylene	ug/l	<10.000
aldrin	ug/l	<200.000
a-BHC	ug/l	<10.000
b-BHC	ug/l	<10.000
g-BHC (lindane)	ug/l	<10.000
d-BHC	ug/l	<10.000
chlordane	ug/l	<200.000
4,4-DDE	ug/l	<20.000
4,4-DDT	ug/l	<20.000
4,4-DDD	ug/l	<20.000
dieldrin	ug/l	<10.000
endosulfan I	ug/l	<10.000
endosulfan II	ug/l	<20.000
endosulfan sulfate	ug/l	<20.000
endrin	ug/l	<20.000
endrin aldehyde	ug/l	<20.000
heptachlor	ug/l	<10.000
heptachlor epoxide	ug/l	<20.000
toxaphene	ug/l	<300.000
PCB 1016	ug/l	<100.000
PCB 1221	ug/l	<100.000
PCB 1232	ug/l	<200.000
PCB 1242	ug/l	<200.000
PCB 1248	ug/l	<200.000
PCB 1254	ug/l	<200.000

PCB 1260		ug/l	<200.000

PARAMETER		WELL 1-28A UNITS	JAN 8, 1987
arsenic	**total**	**ug/l**	**9**
barium	**total**	**ug/l**	**1600**
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.10
nickel	**total**	**ug/l**	**30**
selenium	**total**	**ug/l**	**1**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**38**
pH, field			**7.53**
conductivity, lab		**umhos/cm**	**577**
chloromethane		ug/l	<100.000
bromomethane		ug/l	<100.000
vinyl chloride		ug/l	<100.000
chloroethane		ug/l	<100.000
methylene chloride		ug/l	<50.000
acetone		ug/l	<100.000
carbon disulfide		ug/l	<50.000
1,1-dichloroethene		ug/l	<50.000
1,1-dichloroethane		ug/l	<50.000
trans-1,2-dichloroethene		**ug/l**	**58.000**
chloroform		ug/l	<50.0
1,2-dichloroethane		ug/l	<50.000
2-butanone (meth eth ket)		ug/l	<100.000
1,1,1-trichloroethane		ug/l	<50.000
carbon tetrachloride		ug/l	<50.0
vinyl acetate		ug/l	<100.000
bromodichloromethane		ug/l	<50.0
1,2-dichloropropane		ug/l	<50.000
trichloroethene		**ug/l**	**360.000**
dibromochloromethane		ug/l	<50.0
1,1,2-trichloroethane		ug/l	<50.000
benzene		ug/l	<50.00
2-chloroethyl vinyl ether		ug/l	<100.000
bromoform		ug/l	<50.0
2-hexanone		ug/l	<100.000
4-methyl-2-pentanone		ug/l	<100.00
tetrachloroethene		ug/l	<50.000
1,1,2,2-tetrachloroethane		ug/l	<50.000
toluene		ug/l	<50.00
cis-1,3-dichloropropene		ug/l	<50.000
trans-1,3-dichloropropene		ug/l	<50.000
chlorobenzene		ug/l	<50.000
ethylbenzene		ug/l	<50.00
styrene		ug/l	<50.000
xylenes total		ug/l	<50.000

PARAMETER		WELL 1-28B UNITS	JAN 8, 1987
arsenic	**total**	**ug/l**	**2.5**
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**33**
mercury	total	ug/l	<0.10
nickel	total	ug/l	<10
selenium	**total**	**ug/l**	**2.3**
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**40**
pH, field			**7.60**
conductivity, lab		**umhos/cm**	**642**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		**ug/l**	**11.000**
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

APPENDIX H

SAMPLING AND ANALYSIS PLAN
AND
QUALITY ASSURANCE/QUALITY CONTROL PLAN

GROUNDWATER SAMPLING AND ANALYSIS PLAN
TINKER AIR FORCE BASE, OKLAHOMA
TULSA DISTRICT, CORPS OF ENGINEERS

I. Overview.

A. Purpose and scope. This sampling and analysis plan presents the methodology for collection, preparation, shipment, testing, and quality control for groundwater samples taken at Tinker Air Force Base by Tulsa District sampling personnel. Detailed sampling procedures are given in Section II, and transmittal forms used in sampling are given in Section III.

B. References. The following references were used in the preparation of this plan:

1. American Public Health Association and American Waterworks Association, *Standard Methods for the Examination of Water and Wastewater,* 16th ed., 1985.

2. U. S. Environmental Protection Agency, *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document,* draft,August, 1985.

3. U. S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste,* SW 846, July, 1982.

4. U. S. Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-79-020, 1979.

5. U. S. Environmental Protection Agency, *Handbook for Sampling and Sample Preservation of Water and Wastewater,* EPA-600/4-82-029, 1982.

6. U. S. Environmental Protection Agency, *Volatile organic compounds in water by purge and trap GC/MS,* Environmental Monitoring and Support Laboratory, 1983.

C. Field procedures. Field procedures are discussed in detail in Section II. Samples should be collected by a sampling team using a teflon bailer. Filtering, preservation, and refrigeration should be performed in a laboratory at Tinker. Samples should be shipped daily by bus or other conveyance in ice-packed ice chests to the testing laboratories with a field data form and a chain of custody form. These forms are shown in Section III. Sampling personnel should be thoroughly trained in collection and preparation techniques. As much of the sample preparation as possible should be performed in the field laboratory where controlled and clean conditions exist. Equipment and travel blanks should be taken weekly. Field blanks are discussed in Section II.

D. Parameters to be tested. Table F-1 lists the parameters and test methods which will be included in the testing program.

Table F-1
Parameters to be tested in groundwater samples

parameter	EPA method	reference	notes
pH	150.1	4	A
conductivity	205	1	A
arsenic	7060	3	B
barium	7080	3	B
cadmium	7130	3	B
chromium	7190	3	B
lead	7421	3	B
mercury	7470	3	B
nickel	7520	3	B
selenium	7740	3	B
silver	7760	3	B
zinc	7950	3	B
potassium	258.1	4	B
sodium	273.1	4	B
calcium	215.1	4	B
magnesium	242.1	4	B
total dissolved solids	209B	1	
total organic carbon	415.1	4	
alkalinity	403	4	
chloride	325.3	4	
sulfate	375.4	4	
volatile organics	524.1	6	C
semi-volatiles	8270	3	

A. To be performed in the field
B. Use a 10-fold concentration for water supply well samples
C. Obtain a detection limit of at least 0.5 ug/l for TCE

E. Laboratory qualifications. Testing laboratories should be certified by the Oklahoma Water Resources Board and should use the Environmental Protection Agency's Contract Laboratory Program protocol. A copy of the lab's QA/QC plan should be on file.

II. Groundwater sample collection, preparation, and shipment.

A. General. The objective of collecting groundwater for analysis is to provide a sample to the laboratory which represents the same geochemical conditions which occur in the aquifer. Because certain parameters are more susceptible to change than others, various techniques are needed depending on what will be tested. The purpose of this sampling plan is to discuss sample collection techniques for all of the parameters recommended for long term monitoring at Tinker Air Force Base. The best sequence of operations for sampling is as follows:

1. Evacuate slow recharge wells at the outset of the sampling day.
2. Evacuate and sample other wells.
3. Sample slow rechargers, if possible.
4. Return to lab to preserve samples.

5. Prepare samples for shipment.
6. Deliver samples to bus station.

Do not sample more wells than you can filter and prepare for shipment in one day. Refrigerate samples as soon as sampling is complete or more frequently if sampling is not proceeding expeditiously. Most of the wells should recharge quickly.

B. Collection

1) **Static water levels.** Before any other work is done at the well, the water level should be taken with an electric probe, and measured from the top of the casing or water level port. Record the water level to the nearest hundredth of a foot in the logbook (described in Section III) as well as any problems noted with the general condition of the well. An engineer's rule will be required to measure from the probe's tic marks. Rinse the probe in distilled water immediately before lowering it into the well and after removing it from the well. If the well is heavily contaminated, then additional rinses may be required.

2) **Well evacuation procedures.** Standing water within the well should be removed and fresh formation water should be sampled. Well water can be pumped onto the ground unless it has been specifically forbidden. For slowly recharging wells, pump them dry. Plan to sample as soon as there is sufficient recharge to fill the sample containers. For wells which cannot be evacuated to dryness, pump them for a sufficient period of time to remove 3 casing volumes of water. Sample immediately after evacuation. Operational water supply wells do not need to evacuated.

3) **Types of setups used at TAFB.**

a. **Perimeter wells.** All of the perimeter wells at Tinker are open wells. These wells, which do not contain dedicated equipment, should be evacuated with a teflon bailer, a portable purge pump, or a portable sample pump. The purge and sample pumps are operated by a portable gasoline-driven compressor mounted on a driver-controller unit, which provides a pressurized air supply. The pump and tubing should be thoroughly washed with water and rinsed with distilled water after each use. The bailer should be taken to the field laboratory and cleaned as described in Section C) 3. Enough bailers should be available so that field cleaning will not be necessary. For heavily contaminated wells, purge pumps and tubing should be cleaned in a similar manner.

b. **Base water supply wells.** There are 25 water wells which pump from the Garber-Wellington at Tinker. The water levels in these wells is about 200 feet deep, and the pumps are about 600 to 700 feet deep. Sampling can only be done when the well is operational.

4. **Well sampling.**

a. **General procedures.** The only equipment which may be used to remove a sample is a dedicated bladder pump or a teflon bailer. Each sample container should be filled directly from the spout or discharge tube of the well. A common container should not be used. Care should be

taken to prevent sample contamination through carelessness. Sampling equipment or containers should not be placed on the bare ground for any reason. Plastic sheets will be available to provide a clean working surface. You will be given a list of parameters for each well to be sampled and labels provided by the laboratory. These labels will have printed on them the type and size of container, preservation instructions, and parameters. Affix them to the appropriate containers before leaving the field lab, and when the sample is taken, write the well ID and date on them with a permanent marker. Table F-2 lists the requirements for all of the parameters in this monitoring program.

Table F-2
Sampling procedures for parameters to be tested

parameter	container size	container type	refrigeration required	preparation
pH and cond.	1/2 pt	either	no	do in field
TOC	40 ml	glass**	yes	fill to brim, hydrochloric acid to pH <2
metals, total	liter	plastic	no	nitric acid to pH <2
volatile organics	2, 40 ml	glass**	yes	brim full, no air bubbles or agitation
semivolatile organics	2, liter	glass**	yes	brim full, no air bubbles or agitation
chloride, sulfate, TDS, alkalinity	liter	plastic	yes	none required

** All glass containers have teflon-lined caps.

b. PH and specific conductance. These two parameters should be determined in the field with pH and conductivity meters before additional sample is taken. Enough sample should be collected and put into a beaker to allow the electrodes to be immersed. Calibrate the meter with two of the buffer solutions, either pH 4.0 and 7.0 or pH 7.0 and 9.0, and then measure and record the pH of the sample to the nearest 0.05 unit. The electrodes should be rinsed with distilled water between each sample or buffer solution. After the pH measurements, determine the specific conductance in a similar manner, following the directions with the conductivity meter. The approximate temperature must be known, which can be determined from the pH meter. Rinse the probe between samples. Discard this sample when pH and specific conductance measurements are completed.

C. **Preparation techniques.**

1) **Sample preparation.**

a. **Refrigeration.** Samples must be kept under refrigeration as much as possible. After collection is complete, put the samples into the refrigerator. Remove them to filter and preserve them, and return them to the refrigerator until they are put into the ice chests for shipment. Refrigerate all of the samples if space permits. Otherwise refrigerate only those so indicated in table F-2.

b. **Adding acids.** Acids (hydrochloric and nitric) are added to adjust the pH of the sample to prevent chemical reactions which would change the concentration of the parameter to be tested. Add acids with a dropper bottle, testing the pH with a meter until it is at the required level.

2) **Blanks.** Blanks are used to verify that the sample collection and handling processes have not resulted in cross contamination. The two types of blanks you will prepare are described below.

a. **Travel blanks.** Once a week, fill two containers, one for organics and one for inorganics, with distilled water and carry them around with you during the day. Prepare them as though they were an actual sample, affix travel blank labels, and ship them in in a separate ice chest. Rotate the containers so that different parameters are tested each week.

b. **Equipment blanks.** Also on that day, fill two containers, one organic and one inorganic, with distilled water drawn by one of the bailers to be used that day after it has been cleaned and rinsed. Use the same preservation and filtering procedures as described above. Ship these in the ice chest with the trip blanks. Rotate the containers so that different parameters are tested each week.

3) **Cleaning.** Sampling equipment should be cleaned using one of the following procedures:

a. **Sampling for inorganic compounds.** Sampling equipment not used for organics may be cleaned with dilute hydrochloric acid and distilled water as described above.

b. **Sampling for organic compounds.** Bailers and other equipment used in organics sampling must be cleaned with a non-phosphate detergent. The equipment should then be rinsed with tap water, distilled water, and hexane. The hexane rinse should be done under the hood. No smoking during the hexane rinses. It is very flammable.

D. **Shipment.** Cover each label with a strip of wide tape to protect it. Pack the samples for each well in a separate ice chest. Fit the glass containers into the styrofoam contours and the plastic containers into the spaces between the glass containers. Fill the chest with ice and insert the data sheet and chain of custody form (described in Section III) into the ziplock bag taped to the inside lid of the ice chest. Close the ice

chest and seal with duct tape or fiber tape. Drop off the ice chests at the Greyhound station at the end of each workday. Do not ship samples on Friday unless the laboratory is aware of it.

E. Paperwork.

1) **Fieldbook.** Keep a field book of all operations and record the following: well number, date, water level, well evacuation procedure and rate of recharge, sample method, pH and conductivity readings, any unusual conditions noted (odor or color of water, well damage, etc), time of collection, time of preservation, time dropped off at bus station, your names, and any information regarding blanks. The information from the field book will be transferred to the two forms described below.

2) **Field data form.** This form includes selected information transferred from the log book such as water level, pH, conductivity, and unusual observations. It is shipped in the ice chest. A copy of this form is found in Section III.

3) **Chain of custody form.** The chain of custody form is required to establish possession of the samples from their collection to their final receipt in the laboratory. Fill it out from the logbook, as shown by the enclosed sample, and enclose in the ice chest. Two signatures are required before it leaves your possession: the sample collector and the sample preparer. A copy of this form is found in Section III.

SECTION III

FIELD DATA FORM AND CHAIN OF CUSTODY FORM

GROUNDWATER MONITORING WELL
FIELD DATA FORM

Location _____ Date ____ ____ ____
Y Y M M D D

Site _____

Well number _____ Csg diameter _____ Csg type _____

Rate of recharge _____

Riser elevation _____

Depth to water from top of casing _____ Time of measurement _____

Water table _____ Measuring device _____

PH Measurements

_____ Time of measurement _____

_____ Meter type and model _____

_____

_____

Specific conductance, mhos/cm

_____ Time of measurement _____

_____ Meter type and model _____

_____ Temperature _____

_____

Notes concerning condition of well, odor, color, and any problems:

_____

_____

_____

Sample collector _____

GROUNDWATER MONITORING WELL CHAIN OF CUSTODY RECORD

TULSA DISTRICT, CORPS OF ENGINEERS

Location _____ Date _____

Site _____ Well number _____

Number of containers in shipment

	glass	plastic
liter	_____	_____
40 ml	_____	

Parameters sampled

pH	____
conductivity	____
metals, total	____
metals, total, plus K, Mg, Na, Ca	____
chloride, sulfate, TDS, alkalinity	____
TOC	____
purgeables	____
semivolatiles	____

CUSTODY RECORD
signature and title

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Report on Quality Assurance and Quality Control of Chemistry Unit Southwestern Division Laboratory US Army Corps of Engineers

01 August 1986

I. Laboratory Personnel

A. Jeffrey Tye, Chief Chemist

1. Provide work assignments, coordiante projects
2. Maintain QA/QC program
3. Train personnel
4. Purchase equipment, materials, outside services
5. Consult engineers, geologists, field personnel

B. Manfred Ray, Chemist, Microbiologist

1. Preparation and analysis of environmental samples for organic and inorganic analysis
2. Microbiological analyses
3. Asbestoes identifications

C. Paula Wright, Technician

1. Wet chemistry
2. Sample receiving
3. Computer operations, data management

D. Leon Peterson, Technician

1. Sample preparation and analysis for trace metals
2. Wet chemistry
3. QA/QC coordinating

E. Mark Hansen, Technician

1. Wet chemistry
2. Special projects

F. Resumes (see following pages)

JEFFREY R. ZIE
2017 Moser Ave. #146
Dallas, Texas 75206
Res. (214) 827-1643

JOB
OBJECTIVE: Project or profit center management with a technology driven organization.

EXPERIENCE SOUTHWESTERN DIVISION LABORATORY, U.S. ARMY CORPS OF ENGINEERS, Dallas, Texas

(1982-Present) Chief Chemist

Supervise and coordinate chemical analyses for all hazardous waste site investigations and engineering designs conducted by Southwestern Division. Supervise two other chemists, three to five technicians, report to Laboratory Director. Responsible for $900,000 budget.

Consult District engineers on protocols for sampling, chain-of-custody, analytical methods and selection of parameters. Train field personnel in sampling, safety and field testing. Consult Division engineers in development of Quality Management Plans for environmental projects.

Inspect all commercial laboratories which provide analytical services. Write contract requirements, manage sample data flow.

Altered procedures, purchased capital equipment, instituted QA/QC program, trained personnel resulting in 50% reduction in turnaround time, 40% increase in revenues. Solidified Laboratory's position for providing analytical services to Division and Districts outside of Division.

(1981-1982) Chemist

Through in-house and outside training, developed expertise in organic and inorganic analysis of environmental samples. Instrumentation, wet methods. EPA, Corps, A.S.T.M. and other methodologies. Promoted.

N.D.E.-AIDS, INC.
Fort Worth, Texas

(1979-1980) Chemist, Metallographer

Coordinated all phases of destructive and nondestructive testing for casting and forging evaluations for regional aerospace industries; performed failure analyses for litigations. Documented all testing methods performed by laboratory.

AN-TECH LABORATORIES, INC.
Houston, Texas

(1978-1979) Chemist

Provided chemical analyses of wide range of alloys, some highly specialized. Regular customer contact. Offered promotion.

TEXAS YOUTH COMMISSION
Crockett, Texas

(1977) Case Worker

Worked with and counseled delinquent youths in wilderness environment.

EDUCATION

(1983-1985) SOUTHERN METHODIST UNIVERSITY, Dallas, Texas.
M.B.A. Academic emphasis: Finance.

(1977-1978) UNIVERSITY OF CALIFORNIA AT DAVIS,
Davis, California
Graduate work in organic chemistry

(1972-1977) MILLSAPS COLLEGE, Jackson, Mississippi.
B.S. in Chemistry. Degree Accredited by American Chemical Society; four times Dean's List, 150 semester hours.

PERSONAL Volunteer for Committee for Foreign Visitors - Council on World Affairs, active in swimming, sailing, racketball, travel.

Manfred G. Ray
1118 Kathy Lane
Lewisville, TX 75067

PERSONAL: Age 41, Male, Single, no dependents, born [illegible], Bad Wiessee, Germany. US Citizen, Health: Excellent

EDUCATION: NORTH TEXAS STATE UNIVERSITY.
Major: MS Biology
1972 - 1976

UNIVERSITY OF OKLAHOMA.
Major: BS Chemistry
1971 - 1972

UNIVERSITY OF OKLAHOMA
Major: BS Microbiology
1963 - 1967

CLASSEN HIGH SCHOOL, Oklahoma City, OK.
1963

HISTORY: U.S. Army Corps of Engineers, Dallas, Texas.
Chemist, Chemistry Laboratory.
Analyze water, soil, bottom sediment, etc. for metals, pesticides, and various other parameters using appropriate instruments and wet chemistry laboratory procedures. Instrumentation used are a Perkin-Elmer Sigma 1 GC and a 5000 AA Spectrophotometer, HGA-500 graphite furnace, electron and light microscopes, ultracentrifuge, autoclave and incubating oven.
August 1986 - Present.

North Texas State University. Teaching Assistant
Instructed students in microbiology or immunology laboratories.
January 1969 - August 1971.

U. S. Army, Medical Laboratory Technician.
Worked in various hospitals doing medical technology work.
January 1969 - August 1971.

ASSOCIATIONS: Texas Branch of the American Society for Microbiology.
American Chemical Society.

PAPERS: "Relationship of Certain Fungi to Azotobacter" (presented at the Fall 1974 Meeting of the Texas Branch of the American Society for Microbiology in Galveston, Texas).

PAULA DIANE WRIGHT
2524 Waits Avenue
Fort Worth, Texas 76109
(817)924-4433

OBJECTIVE: GEOLOGIST or HYDROLOGIST

EDUCATION:

UNIVERSITY of TEXAS at AUSTIN, Austin, Texas.
Major: BS Geology.
September, 1978 - May, 1984.

R.L. PASCHAL HIGH SCHOOL, Fort Worth, Texas.
Cum Laude Graduate.
1974 - 1978.

EMPLOYMENT:

U.S. ARMY CORPS of ENGINEERS, Dallas, Texas.
PHYSICAL SCIENCES TECHNICIAN, Chemistry Laboratory.
Perform data management using an IBM PC AT with Wordstar, Lotus, dBase III.
Prepare and analyze environmental samples by EPA methodologies.
Atomic Absorption Spectrophotometry, wet methods.
February, 1986 - present.

REED OPERATING COMPANY, INC., Fort Worth, Texas.
GEOLOGIST.
Contoured maps, correlated logs, drew cross-sections, drafted.
Created prospects, assisted in writing of prospect brochures, library research work.
Well site experience.
November, 1984 - November, 1985.

THOMAS D. COFFMAN, INC., Oil Producer, Austin, Texas.
LAND AND GEOLOGICAL TECHNICIAN.
Entered well data on Digital VT-100 computer.
Set up files and card files for all lessees.
Ran blue line machine, spliced and contoured maps.
Assisted in delay rental payments, lease recordings.
June, 1982 - May, 1984.

ENGINEERING AIDE
Distributed drilling reports and production to investors.
Recorded production graphs.
Assisted in filling out Railroad Commission forms.
September, 1980 - May, 1981.

FORTEX CORPORATION, Fort Worth, Texas.
SECRETARY. June, 1981 - August, 1981.

PAULA DIANE WRIGHT
2524 Waits Avenue
Fort Worth, Texas 76109
(817)924-4433

EMPLOYMENT:

HARRIS HOSPITAL, Fort Worth, Texas.
VOLUNTEER. September, 1977 - December, 1977.

WOODBINE CORPORATION, Fort Worth, Texas.
SECRETARY. June - August, 1976. 1977.

ACTIVITIES:

American Association of Petroleum Geologists
Fort Worth Geological Society
Society of Professional Well Log Analysts
Texas Exes Association
Interests: Sports, sewing, reading.

PERSONAL:

Date of Birth: March 26, 1960
Marital Status: Single

REFERENCES:

Available upon request.

Leon Peterson
1105 Tall Tree Court
Arlington, Tx 76010

OBJECTIVE

Seeking a position that can utilize experience and ... in Computer Operations, Administration and/or ... Relations.

EDUCATION

University of Utah; 1982 - 1984
Salt Lake City, Utah

SUMMARY OF QUALIFICATIONS

Excellent knowledge of computer operations and p...
Maintaining accurate information and reports.
Keeping current business up-to-date
Excellent people skills.
Very mechanically inclined.
Quick learner and perform tasks thoroughly.
Work well alone and as a team member.

EMPLOYMENT HISTORY

1985-1986 — Simulflite training/DFW Airport, Texas
Technician. Setting up and administering simulator discrepancy system...working with electronics and aircraft systems...operating H.P. and CDC computers.

1984-1985 — Airborne Freight, Salt Lake City Airport, Utah
Night Ramp Supervisor and loader ... the loading of DC-9 aircraft..calculating weight and balance...flaging out night ...

1982-1983 — Rocky Mountain Wrecker, Salt Lake City, Utah
Steel Fabricator. Performing steel ... and welding...setting up hydraulic ... wiring electrical systems of wrecker...

Summers, 1979-1982 — Willow Creek Country Club, Sandy, Utah
Assistant to Golf Pro. Assisting in ... aspects of general maintenance of ... carts, sales and shop/tournament setup.

PERSONAL — Born: 6/13/64...Single...Excellent health.

REFERENCES — Available upon request.

MARK A. HANSEN
1325 S. College Street
Arlington, TX 76010
(817) 860-9837

CAREER GOALS

After obtaining my degree in Mechanical Engineering, I hope to secure a fulfilling occupation which will allow me to combine field and office work with an emphasis in computer aided engineering.

EDUCATION

University of Texas at Arlington - 8/82 to Present. Expected completion of BS in Mechanical Engineering August 1986.

Texas A&M University, College Station, TX - September 19[illegible] to May 1981.

Findlay High School, Findlay, OH. - September 19[illegible] to May 1978.

WORK EXPERIENCE

U.S. Army Corps of Engineers. January 198[illegible] to present. 4815 Cass Street, Dallas, TX. 75235.
Engineering Technician: Responsibilities included [illegible] use of computers and basic programming. Systems included IBM-AT, Apple 2,2+, Lotus 1-2-3, and HP-41CX. Other tasks include soil analysis (consolidation, Triaxial, etc.), concrete analysis (mix design, freeze-thaw, etc.), and chemical analysis (drinking water samples).

Mrs. Baird's bread. September 1982 to January 19[illegible]. 7301 S. Freeway, Fort Worth, TX 76134.
Hotshot driver: Responsible for delivering bread to [illegible] and businesses.

Nowsco Services, Inc. September 1981 to January 19[illegible]. P.O. Box 3218, Bryan, TX 77801.
Materials transport driver: Assisted in all aspects of [illegible] job operation.

Marathon Oil Co. Summer employment (1978 - 19[illegible]). Route #3, Box 29, Pauls Valley, OK. 73075.

Summer Employee: Duties included roustabout and pumper [illegible] secondary production oil field. Field was composed of twenty-six natural gas operated pumping units, 4 rod [illegible] and utilized salt water injection to increase production.

PERSONAL

Marital status:	Married with one child
Birthdate:	March 30, 1960
Health:	Excellent
Hobbies:	Outdoor sports, Racquetball

REFERENCES

William Tanner	(214) 767-2411 Director U. S. Army Corps of Engineers Southwestern Division Labo[illegible]
Doug Hewitt	(817) 293-6230 Supervisor Mrs. Baird's Bread
Earl Bingham	(713) 779-1079 Supervisor Nowsco Services
Jim Prince	(405) 238-6129 Supervisor Marathon Oil Company

II. Equipment

A. Instrumentation

Item	Manufactures	Model	No.	Age, Yr
pH Meter	Cole-Parmer	5986-60	1	1
Specific Ion Analyzer	Orion	901	1	9
Conductivity Meter	Barnstead	PM 70-CB	1	1
UV-Visible Spectrophotometer	B & L	Spectronic 100	1	10
Atomic Absorption Spectrophotometer	Perkin-Elmer	401	1	13
	Perkin-Elmer	5000, HGA 500	1	2
Carbon Analyzer	O.I.	700	1	1
Gas Chromatograph	Perkin-Elmer	Sigma-1	1	8
Kjeldahl Digestion System	Labconco		1	11
BOD Analyzer	YSI	54A	1	2
Continuous Flow Analyzer	Technicon	TRAACS 800	1	1

B. General Laboratory Equipment

Item	Manufacturer	Model	No.	Age, Yr
Oven (Convection)	Blue M	OV-18C	1	28
Oven (Radiant Heat)	Lab Line	Imperial III	1	8
Oven (forced draft)	Blue M	OV-500	1	28
Furnace	Hoskins		1	28
	Heavi Duty		1	28
Refrigerator, 3x5x6	Nor-Lake		6	5
Refrigerator, 3x3x5	Kenmore	19	2	7
Fume Hood	Labconco		3	10
4-1/2 x 2-1/2 x 8	Unknown		1	28
Distillation System	Barnstead	A-1013	1	3
Ion Exchange System	Millipore	Milli-Q	1	8
Centrifuge	IEC	2K	1	9
	IEC	EXD	1	23
	Lab Line	Imperial III		9
	Barnstead	1250		9
Balance	Fisher	B-5	2	20
	Mettler	PC400	1	10
	Mettler	K-7	1	20
Cell Disruptor	Heat Systems	W-375	1	4
Roto Evaporator	Buchii	B-465	1	5
Ultrasonic Cleaner	Mettler		1	7
Water Bath	Blue M		2	6
Vortex Mixer	S/I	K-550-G	1	4
Autoclave	Barnstead	1250	1	7
Ampule Sealer	O.I.C.		1	1
Vacuum Pump	Lammert		2	3

III. Source of Methodologies

A. Methods for Water, Wastewater, Soils and Sediments

1. United States Environmental Protection Agency/U.S. Army Corpsof Engineers. Procedures for Handling and Chemical Analysis of Sediment and Water Samples. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station; Vicksburg, Mississippi. (19

2. United States Environmental Protection Agency. Methods for Chemical Analysis of Water and Wastes. EPA; Cincinnati, Ohio. (1979).

3. American Public Health Association. Standard Methods for the Examination of Water and Wastewater. 16th Edition APHA; New York, New York. (1985).

4. Army Corps of Engineers. Ecological Evaluation of Proposed Discharge of Dredged or Fill Material into Navigable Waters. Environmental Effects Laboratory, U. S. Army Engineer Waterways Experiment Station. (1976).

5. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. SW-846. (1982). United States Environmental Protection Agency

6. Contract Laboratory Program Statement of Work Inorganic Analysis Multi-Media Multi-Concentration. July 1984 United States Environmental Protection Agency.

B. Methods for Construction Materials

1. American Society for Testing and Materials. Annual Methods. A.S.T.M. Philadelphia, PA (1985)

2. Army Corps of Engineers Handbook for Concrete and Cement US Army Engineer Waterways Experiment Station (1985).

IV. Methods Routinely Followed

A. Constituent	Method Source	Method Number
Preparation of aqeuous and Soil Samples for Flame Absorption Spectroscopy	5	3010
Preparation of Soils for HGA Atomic Absorption Spectroscopy	5	3020
Antimony	5	7040
Arsenic	In House	HGA, See attachment
Barium	5	7080
Beryllium	5	7090
Cadmium	5	7130
Chromium	5	7190
Lead	In House	HGA, See attachment
Mercury	3	303F
Nickel	5	7520
Selenium	In House	HGA, See attachment
Silver	5	7760
Thallium	5	7840
Other Metals	1	
Extraction of Organochlorine Pesticides and PCBs from aqueous samples	5	3510
Extraction of Organochlorine Pesticides and PCBs from soil samples	5	3550
Organochlorine Pesticides and PCB's	5	8080
Chlorinated Herbicides	5	8150

Nitrogen-Kjeldahl, Total in aqueous samples	2	351.3
Nitrogen-Kjeldahl, Total in soil samples	2	350.2
Oil and Grease	2	413.1
Chloride	3	407B.
Flouride	3	413B
Sulfate	3	426.C
Phosphorous	3	424D
pH	2	150.1
Conductivity	3	205
EP Toxicity Preparation	5	1310
Elutriate Preparation	4	
Biochemical Oxygen Demond	3	507
Chemical Oxygen Demond	3	508
Fecal Colifdrm	3	908A-D
Cyanide	2	335.2
Total Organic Carbon	2	415.1

B. Bound copies of Standard Operating Procedures are maintained and available to every analyst.

V. Initial Calibration and Calibration Verification

A. Standards shall be prepared using certified materials in the case of metals and organic analyses and reagent grade materials for other tests.

B. Data from standards shall be accumulated starting with the lowest concentration and ending with the highest.

C. Calibration shall be verified using another source of standard material. When available, an EPA Quality Control Sample could be used. Calibration should be verified at a frequency of at least 10%.

D. Calibration data shall be recorded on raw data sheets, which are kept in bound notebooks.

E. A method blank shall be prepared for every set of samples (defined as 20 samples or less) containing appropriate amounts of reagents used in sample preparation. Data from the blank shall be determined and recorded after calibration. If the method blank is above the required detection limit and if the lowest analyte is less than 10 x the blank concentration the entire sample set must be reanalyzed.

VI. Spiked Sample Analysis

A. Spiked samples shall be prepared starting with the initial step (digestion, extraction, etc) and be performed for every sample matrix at a frequency of not less than 10%. Spikes shall be prepared with certified reference material EPA Quality Control Check Samples or reagent grade material.

B. Individual percent recoveries shall be calculated as follows:

$$\% \text{ Recovery} = \frac{(SSR-SR)}{SA} 100$$

where SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Added

Data on spike recoveries is accumulate for each constituent on the Accuracy Control Chart shown in the attachment. Percent Recoveries outside of the range 75-125% shall be considered outliers. Spike recoveries shall be disregarded for samples in which the concentration is four or more times the spike amount. Original sample results which are less than the required detection limits shall be made equal to zero for % recovery calculations.

VII. Duplicate Sample Analysis

A. A duplicate sample shall be prepared for each sample matrix at a frequency of not less than 10%.

B. The relative percent differences (RPD) for each constituent are calcualted as follows:

$$RPD = \frac{ID1-D21}{(D1+D2)/2} \times 100$$

where RPD = Relative Percent Difference
D1 = First Sample Value
D2 = Second Sample Value (duplicate)

RPD data is collected for each constituent on the precision control chart shown in the attachment.

C. Results of duplicate analyses for samples with concentrations greater than 5 times the required detection limit shall have RPD <20% to be acceptable. Samples which have concentrations less than 5 times the required detection limit have a control limit such that RPD + required detection limit. RPD is not calculated for samples with concentrations less than the required detection limit.

VIII. Corrective Action

A. If some, but not all, Spikes and/or repeats are found to be outliers the sample set shall be reanalyzed using the same extract or digestate.

B. If all Spikes and/or repeats are outliers, the entire sample set must be reanalyzed starting from the initial step. An investigation should also commence regarding the method, reagents, instrument condition and calibration and any other factors which may contribute to problems of precision and accurancy.

IX. External Quality Assurance Program

A. SWD Laboratory participates in QA program as provided by U.S. EPA Environmental Monitoring and Support Laboratory of Cincinnati, Ohio, Oklahoma Water Resources Board and Analytical Products Group, Inc.

B. Analyses include trace metals, nutrients, minerals, chlorinated pesticides and PCB's.

C. The results of the analyses are used to make assesments of methodology selection and operation quality.

D. Audits are used to check the proficiency of individual analysts.

X. Instrument Maintenance

A. Atomic absorption spectrophotometers models 403, 5000, and HGA 500 along with gas chromatograph model Sigma 1 are covered under service contracts with the Perkin-Elmer Corp.

B. Other instrumentation is maintained in-house.

XI. Chain-of-Custody Procedures

A. All samples are received in a designated area of the SWD Laboratory.

B. Written notification is provided to client district using SWD receiving form along with chain-of-custody forms provided by district.

C. An in-house sample number is assigned to each sample.

D. Records of samples which include all information provided by district and SWD Lab number are maintained in log books and in microcomputer files.

E. Chain-of-custody forms accompany all samples which are sent to other laboratories for analysis. Forms are returned to SWD laboratory and kept on file.

XII. Sample Storage

A. Samples are stored at 4 C (checked daily) in six 3x5x6 refrigerators.

B. Samples are stored for a minimum of six weeks after data has been submitted and are then discarded.

C. Samples known or suspected to be classified as hazardous waste shall be retained by the laboratory until arrangements have been made for legal disposal.

XIII. Reporting System and Record Keeping

A. Written reports are submitted after project is completed.
   1. Report identifies samples by districts identification as well as by SWD Laboratory numbers.
   2. Minimum reportable concentrations are submitted

with each constituent reported.

3. Reports include, data on spiked sample recoveries and repeats applicable to the data set.

B. Information is available by telephone, computer interface by modum or computer disk.

C. Laboratory Director maintains files of all reports submitted to client districts.

D. Chemistry unit maintains files of raw data used for generating reports, hard copy of final reports and computer backup of reports submitted by computer disk.

XIV. Training

A. Full time employees receive periodic outside training in environmental analysis, sampling, hazardous waste management and computer operations.

B. Students and part time employees receive one-on-one training from the lead chemist, observe slide presentations produced by Savant Corp. and must demonstrate proficiency before being allowed to analyze samples.

XV. Safety

A. Laboratory is equipped with four overhead showers, two eye washers, and four fire extinguishers.

B. Personnel are provided with lab coats, disposable aprons, gloves and protective eye wear and are also given medical examinations annually.

C. Personnel are trained in safe laboratory procedures and laboratory participates in the J.T. Baker Safety program.

OKLAHOMA WATER RESOURCES BOARD

Hereby Recognizes That

Corps of Engineers, S.W. Division Lab.

Laboratory No. 8602

is a participant in the Oklahoma Water Resources Board's LABORATORY CERTIFICATION PROGRAM and maintains on file a List of Parameters for which it is certified to perform analyses.

Done this 10 day of June, 1986

James R. Barrett Executive Director

This certificate is valid only for JULY 1 THROUGH DECEMBER 31 1986

WATER QUALITY DIVISION (405) 271-2541
1000 N.E. TENTH STREET P.O. BOX 53585
OKLAHOMA CITY, OKLAHOMA 73152

LABORATORY CERTIFICATION PROGRAM
UPDATED LIST OF CERTIFIED PARAMETERS FOR 1986

CATEGORY I (MINERALS), CATEGORY II (NUTRIENTS), AND CATEGORY III (METALS & TOXIC SUBSTANCES)

****

Each laboratory shall provide a copy of this list (including Category IV) to any of their clients that are permitted by the Oklahoma Water Resources Board and/or EPA.

****

MAY 27, 1986

+ The following parameters are certified for the SECOND HALF of 1986. These are the parameters which were successfully analyzed in the Spring Test of 1986, or successfully analyzed in both the Spring and Fall Tests of 1985.

CORPS OF ENG., SW DIVISION LAB ID # 8602

JEFFERY TYE TEL. (316) 767-2411
4815 CASS STREET
DALLAS TX 75235

+ The following parameters are certified from 7-1-86 to 12-31-86

Hardness	Chloride	Dis. Solids	Spec. Conductance
Ammonia-Nitrogen	Nitrate-Nitrogen	Tot. Phosphorus	pH
Aluminum	Arsenic	Barium	Cadmium
Calcium	Chromium	Copper	Iron
Lead	Magnesium	Manganese	Nickel
Potassium	Selenium	Sodium	Zinc

OKLAHOMA WATER RESOURCES BOARD (OWRB)
WATER QUALITY DIVISION (405) 271-2541
1000 NE 10th STREET, P.O. BOX 53585
OKLAHOMA CITY, OKLAHOMA 73152

LABORATORY CERTIFICATION PROGRAM
UPDATED LIST OF PARAMETERS CERTIFIED FOR 1986

CATEGORY IV (MISCELLANEOUS)

*****

Each laboratory shall provide a copy of this list to any of their clients that are permitted by the Oklahoma Water Resources Board and/or EPA.

*****

June 10, 1986

All of the following parameters are certified from July 1, 1986 to December 31, 1986. The updated certification list for 1987 will be ready for distribution by January 1, 1987.

CORPS OF ENGINEERS (SOUTHWEST DIVISION LAB)
Antimony (Sb), Beryllium (Be), Cyanide, Oil and Grease, Silver (Ag), Thallium (Tl), TOC

HGA APPLICATIONS DATA SHEET

Element: As Matrix: _____

_____

HGA-500 Program Location: _____ L'vov Platform

Instrumental Parameters

Inst. Model : _____

Wavelength : 193.7

Spectral Bandwidth: _____

Light Source : EDL

Current/Watts : 8

Background Correction? Z

Readout Parameters

Absorbance/Conc: _____

☐ Peak Height; time _____

☒ Peak Area; time 5 sec

☐ Recorder: _____

_____

_____

HGA Parameters

HGA Model : 500

Graphite Tube : Pyro

Sample Aliquot: 20 ml .1% nickel nitrate

Sample Introduction

Manual: _____

Automated: X

Replicates: 2

Purge Gas : Ar

Alternate Gas : Nxle

Keyboard Entries

Step	1	2	3	4	5	6	7	8	9
Temp °C	160	1500	2500	2600	20				
Ramp (s)	1	1	0	1	1				
Hold (s)	75	45	5	6	20				
Read			X						
Rec.			-3						
Baseline									
Int.Flow ml/min			0						
Int.Alt. ml/min									
Ext.Alt. ml/min									

Shorter dry time up .4% Nickel Nitrate (5 ml)

HGA APPLICATIONS DATA SHEET

Element: Pb Matrix: _____

_____

HGA-500 Program Location: L'vov Platform

Instrumental Parameters

Inst. Model : 5000

Wavelength : 283.3

Spectral Bandwidth: H 0.7

Light Source : EDL

Current/Watts : 10

Background Correction? Zeeman

Energy - 50

Readout Parameters

Absorbance/Conc: Conc

[X] Peak Height; time 6 S

[ ] Peak Area; time _____

[ ] Recorder: _____

HGA Parameters

HGA Model : 500

Graphite Tube Pyro

Sample Aliquot: 10 ml

Sample Introduction

Manual: _____

Automated: X

Replicates: _____

Purge Gas : Ar

Alternate Gas : _____

Alt vol: 10 ml

10% NH_4Cl

2.5% Na Cl 0.2% HHO3

Keyboard Entries

Step	1	2	3	4	5	6	7	8	9
Temp °C	150	200	600	2100	20	2700	20		
Ramp (s)	30	10	10	1	1	1	1		
Hold (s)	20	20	20	4	5	3	10		
Read				X					
Rec.				-5					
Baseline									
Int.Flow ml/min				0					
Int.Alt. ml/min									
Ext.Alt. ml/min									

HGA APPLICATIONS DATA SHEET

Element: Se Matrix: _____

_____

HGA-500 Program Location: _____ Livor Platform

Instrumental Parameters

Inst. Model : _____

Wavelength : 196.0

Spectral Bandwidth: 2.0

Light Source : EDL

Current/Watts : 6

Background Correction? _____

Readout Parameters

Absorbance/Conc: _____

☐ Peak Height; time _____

☒ Peak Area; time 5 sec

☐ Recorder: _____

_____

_____

HGA Parameters

HGA Model : _____

Graphite Tube : Pyro

Sample Aliquot: 20 ml

20 ml 1% nickel nitrate Sample Introduction

Manual: _____

Automated: X

Replicates: _____

Purge Gas : Ar

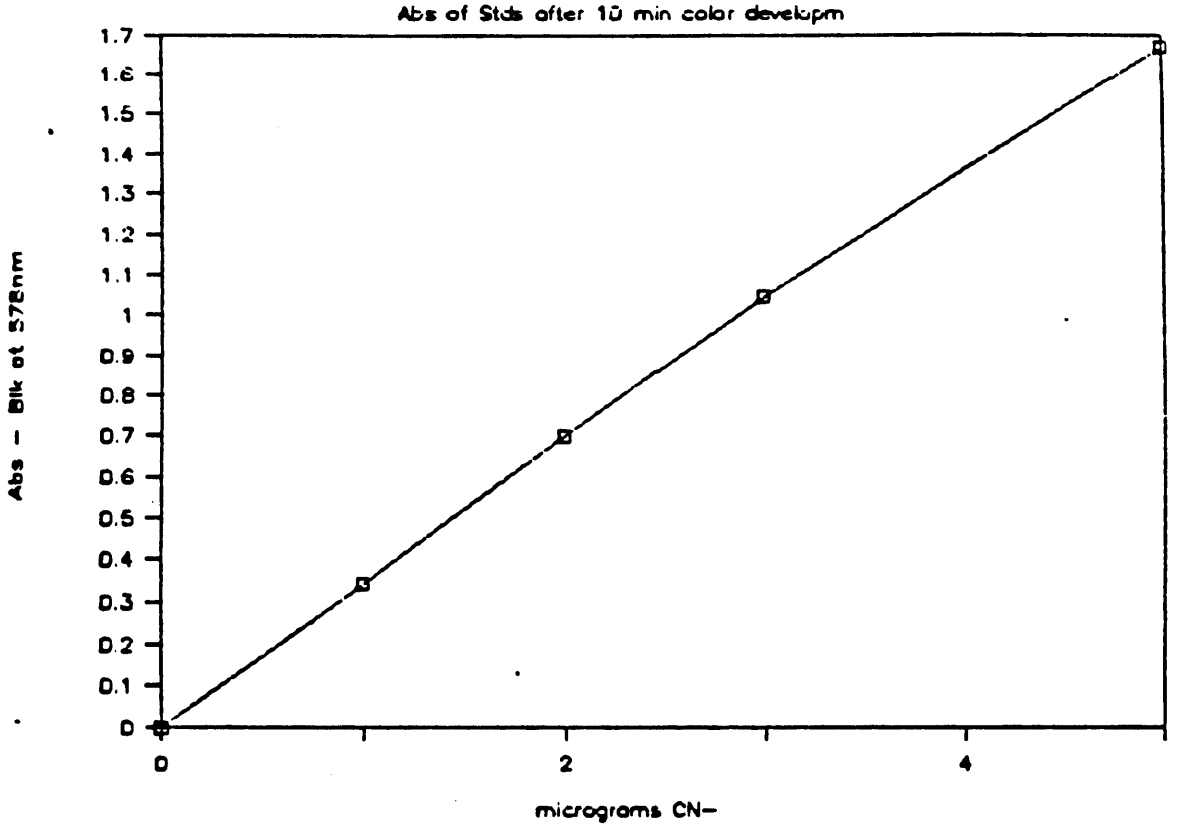
Alternate Gas : _____

Keyboard Entries

Step	1	2	3	4	5	6	7	8	9
Temp °C	160	900	2000	2600	20				
Ramp (s)	1	1	0	1	1				
Hold (s)	75	45	5	6	20				
Read			X						
Rec.			-3						
Baseline									
Int.Flow ml/min			0						
Int.Alt. ml/min									
Ext.Alt. ml/min									

Cal Optical Pyrometer @ 2000

Cyanide Colorimetric Proc 15 July 86



CHAIN-OF-CUSTODY-SEAL

SOUTHWESTERN DIVISION LABORATORY
US ARMY CORPS OF ENGINEERS
DALLAS, TEXAS

ENVIRONMENTAL SAMPLE
CHAIN OF CUSTODY RECORD

TULSA DISTRICT, CORPS OF ENGINEERS

Location _____ Date _____

Site _____

Box number	Hole number	Samples
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Total number of boxes _____ Total number of samples ____

CUSTODY RECORD
signature and title

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

PRECISION CONTROL CHART FOR:_____

(element or parameter)

Lab No.	First Sample Value (D1)	Second Sample Value (D2)	Relative Percent Differences (RPD)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

$RPD = |D1 - D2| / (D1 + D2)/2 * 100$

Acceptable Range: 0% - 20%

ACCURACY CONTROL CHART FOR: _____
(element or parameter)

Lab No.	Sample Result (SR)	Spiked Sample Result (SSR)	Spike Added (SA)	Percent Recovery
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

% Recovery = (SSR-SR)/SA * 100

Acceptable Range: 75% - 125%

E.P.A. TEMPERATURE CHECK

DATE	TEMPERATURE	DATE	TEMPERATURE

APPENDIX I

LABORATORY RESULTS FROM NORTH TANK AREA

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 14236 - 33 (14 pages)

PROJECT: TINKER AIRFORCE BASE
Feature: GROUNDWATER INVESTIGATION

Contract No.

TEST REQUEST NO.: MIL 86 - 87
Dated: 24 MARCH 86
Received: 28 MARCH 86

From: CHIEF, GEOTECHNICAL BRANCH

MATERIAL:
No. and type of samples: 22 soil samples, 2 water samples

Identified by the following well numbers:

1-30 soils, 1-30 water, 1-31 water
water results for fuel type only

Date received: 4 MARCH 87, 11 MARCH 87

REMARKS:

Results for volatile organics will be reported the week of 11 May 87.

Report sent to:	Copy furnished:
Tulsa District	

Date:	Name and title:	Signature
	WILLIAM R. TANNER Director SWD Laboratory	

TABLE 1

B...-GL Report No. 14236 Results of Chemical Analyses of Soil Samples Tinker Air Force Base

BORING NO.	SWD NO.	FLD NO.	DEPTH, FT.	Ag	As	Ba	Cd	Cr	Hg	Ni	Pb	Se	Zn
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	1.0	0.1	1.0
Results reported in mg/Kg													
	Soil Samples												
1-30	7-252		2 - 2.5	<0.5	1.3	48	0.51	11	<0.1	5.6	13	0.22	7.6
1-30	7-253		2.5 - 3	<0.5	<1.0	100	0.56	5.8	<0.1	6.4	7.2	0.17	5.3
1-30	7-254		5 - 5.3	<0.5	1.1	60	0.56	6.7	<0.1	5.6	7.3	0.21	7.0
1-30	7-255		5.5 - 6	<0.5	5.0	170	0.79	13	<0.1	14	25	0.21	11
1-30	7-256		6.5 - 7	<0.5	<1.0	73	0.50	9.1	<0.1	6.1	6.3	0.17	9.1
1-30	7-257		7 - 7.5	<0.5	<1.0	55	0.53	10	<0.1	5.5	7.9	0.18	7.1
1-30	7-258		9 - 9.5	<0.5	<1.0	130	0.50	8.3	<0.1	6.0	8.8	0.14	5.5
1-30	7-259		10 - 10.5	<0.5	<1.0	99	<0.5	8.0	<0.1	7.3	5.6	0.17	7.0
	7-260		12 - 12.5	<0.5	<1.0	330	0.73	5.8	<0.1	16	7.5	0.17	11
1-30	7-261		12.5 - 13	1.4	<1.0	240	1.2	10	<0.1	9.8	13	0.11	8.7
1-30	7-262		17.1 - 17.6	<0.5	<1.0	120	0.54	<5.0	<0.1	5.6	4.6	0.16	4.8
1-30	7-263		17.8 - 20.3	<0.5	<1.0	52	0.51	6.3	<0.1	4.3	2.1	0.16	2.8
Mean Percent Recovery of Spiked Material				95%	85%	103%	101%	105%	80%	101%	89%	105%	94%
Mean Relative Percent Differences of Repeats				0%	12%	3.4%	0%	5.9%	0%	6.3%	5.7%	7.9%	4.2%

TABLE 1

S...-SL Report No. 14236 Results of Chemical Analyses of Soil Samples Tinker Air Force Base

BORING NO.	SWD NO.	FLD NO.	DEPTH, FT.	Ag	As	Ba	Cd	Cr	Hg	Ni	Pb	Se	Zn
Minimum Reported Concentration Results reported in mg/Kg				0.5	1.0	20.0	0.5	5.0	0.1	1.0	1.0	0.1	1.0
1-30	7-264		20.3 - 20.8	<0.5	<1.0	41	<0.5	5.2	<0.1	14	6.9	<0.1	9.6
1-30	7-265		24.2 - 24.7	<0.5	<1.0	<20	<0.5	5.3	<0.1	<1.0	3.8	<0.1	1.2
1-30	7-266		24.7 - 25.2	<0.5	<1.0	<20	<0.5	<5.0	<0.1	3.5	2.9	<0.1	3.8
1-30	7-267		27.2 - 27.4	<0.5	<1.0	28	<0.5	5.5	<0.1	4.7	3.3	<0.1	4.4
1-30	7-268		27.7 - 28.2	<0.5	<1.0	33	<0.5	<5.0	<0.1	3.0	4.5	<0.1	3.3
1-30	7-269		31.7 - 32.2	<0.5	<1.0	<20	<0.5	<5.0	<0.1	1.1	3.0	<0.1	1.9
1-30	7-270		32.5 - 33	<0.5	<1.0	35	<0.5	<5.0	<0.1	3.0	3.2	<0.1	3.4
1-30	7-271		35.1 - 35.6	<0.5	<1.0	<20	<0.5	<5.0	<0.1	1.4	4.2	<0.1	1.4
	7-272		37.1 - 37.6	<0.5	<1.0	40	<0.5	<5.0	<0.1	14	7.2	<0.1	9.9
1-30	7-273			<0.5	<1.0	96	<0.5	7.1	<0.1	14	4.5	<0.1	1[illegible]
Mean Percent Recovery of Spiked Material				95%	75%	91%	89%	112%	80%	101%	98%	*	95%
Mean Relative Percent Differences of Repeats				0%	15%	2.6%	0%	15%	0%	5.2%	7.6%	0%	5.4%

* Calculated by standard additions

RADIAN
CORPORATION

27 April 1987

RC No. 325-001-03-01

Mr. Jeff Tye
Southwestern Division Laboratory
Corps of Engineers, U.S. Army
P.O. Box 36045
4815 Cass Street
Dallas, TX 75235-8011

Dear Jeff:

Enclosed please find the results from the analysis of soil samples for benzene, toluene, and xylenes by Method 8020 and analysis of the soils for total hydrocarbons and fuel type by GC-FID. The two water samples for fuel type have also been reported.

A brief description of the methodology is included. We have identified the organic in the soil and water as fuel oil by the boiling point range. It could possibly be a weathered diesel, but fuel oil looks like a diesel without the lighter hydrocarbons. We have included a chromatogram of diesel and one of the soil samples for your review. The benzene, toluene, and xylene have also been reported.

If I can be of further service, please feel free to call me any time at (512) 454-4797, extension 5309. Thank you very much for your interest in Radian Corporation.

Sincerely,

Larry D. Ogle

Larry D. Ogle
Senior Scientist

LDO:maf
Encl: a/s

cc: F. L. Shore

RADIAN
CORPORATION

DCN: 87-325-001-03-01
RC No.: 325-001-03-01

ANALYSIS OF SOIL AND WATER SAMPLES FOR FUEL TYPE AND BENZENE, TOLUENE AND XYLENES

Prepared for:

Mr. Jeff Tye
Southwestern Division Laboratory
Corps of Engineers, U.S. Army
P.O. Box 36045
4815 Cass Street
Dallas, Texas 75235-8011

Prepared by:

Radian Corporation
8501 MoPac Boulevard
P.O. Box 9948
Austin, Texas 78766

27 April 1987

1.0 METHODS FOR FUEL FINGERPRINTING AND QUANTITATION

Twenty-two soil and two water samples were analyzed by GC-FID (Table 1-1) to determine fuel type (gasoline, diesel or fuel oil), total non-methane hydrocarbon concentration (TNMHC), and boiling point range. Soil samples were extracted by sonicating ten grams of soil for two minutes in five mL of methylene chloride. Water samples were extracted for sixteen hours using methylene chloride in a continuous heavier-than-water extractor. The extracts were dried and concentrated to 10 mL for analysis. Quantitation limits were determined by the minimum response which could be used to identify a hydrocarbon pattern.

A three-point calibration curve consisting of C_8, C_{12}, and C_{16} was injected in duplicate at 10, 100 and 1,000 ug/mL to determine an average response factor. In addition, a C_6-C_{36} n-paraffin standard was used to generate a boiling point versus retention time relationship.

Each sample was analyzed and a TNMHC value was determined using the response factor previously mentioned. The retention time at 10% and 90% of the sample's cumulative area was determined for use in fingerprinting. This retention time was corrected for any drift by comparing the samples solvent (methylene chloride) retention time to the solvent retention time in the standard used to generate Figure 1-1. The 10% and 90% retention times were converted to boiling points by means of the boiling point/retention time curve. The boiling point ranges were compared to the boiling point ranges listed in Table 1-2 to determine fuel type.

2.0 QA/QC

An EPA QC consisting of C_{12}, C_{14}, C_{17}, C_{20}, C_{23}, and C_{26} was analyzed and the results are listed in Table 2-1. Gasoline and diesel matrix spikes were also analyzed and the resulting recoveries are reported in Table 2-2.

TABLE 1-1. INSTRUMENT CONDITIONS USED TO ANALYZE U.S. ARMY CORPS OF ENGINEERS FUEL SAMPLES

Instrument:		Hewlett-Packard 5890 GC
Column:		60m x 0.75 mm I.D. SPB-5 megabore capillary
Carrier Gas:		He at 9.8 cc/min.
Detector:		Flame ionization detector
Detector Temp.:		300°C
Injector Temp.:		225°C
Oven Program:		
Initial Temp.	=	35°C
Initial Time	=	3.0 min.
Ramp	=	8°C/min.
Final Temp.	=	320°C
Final Time	=	15 min.
Injection Volume:		2 uL

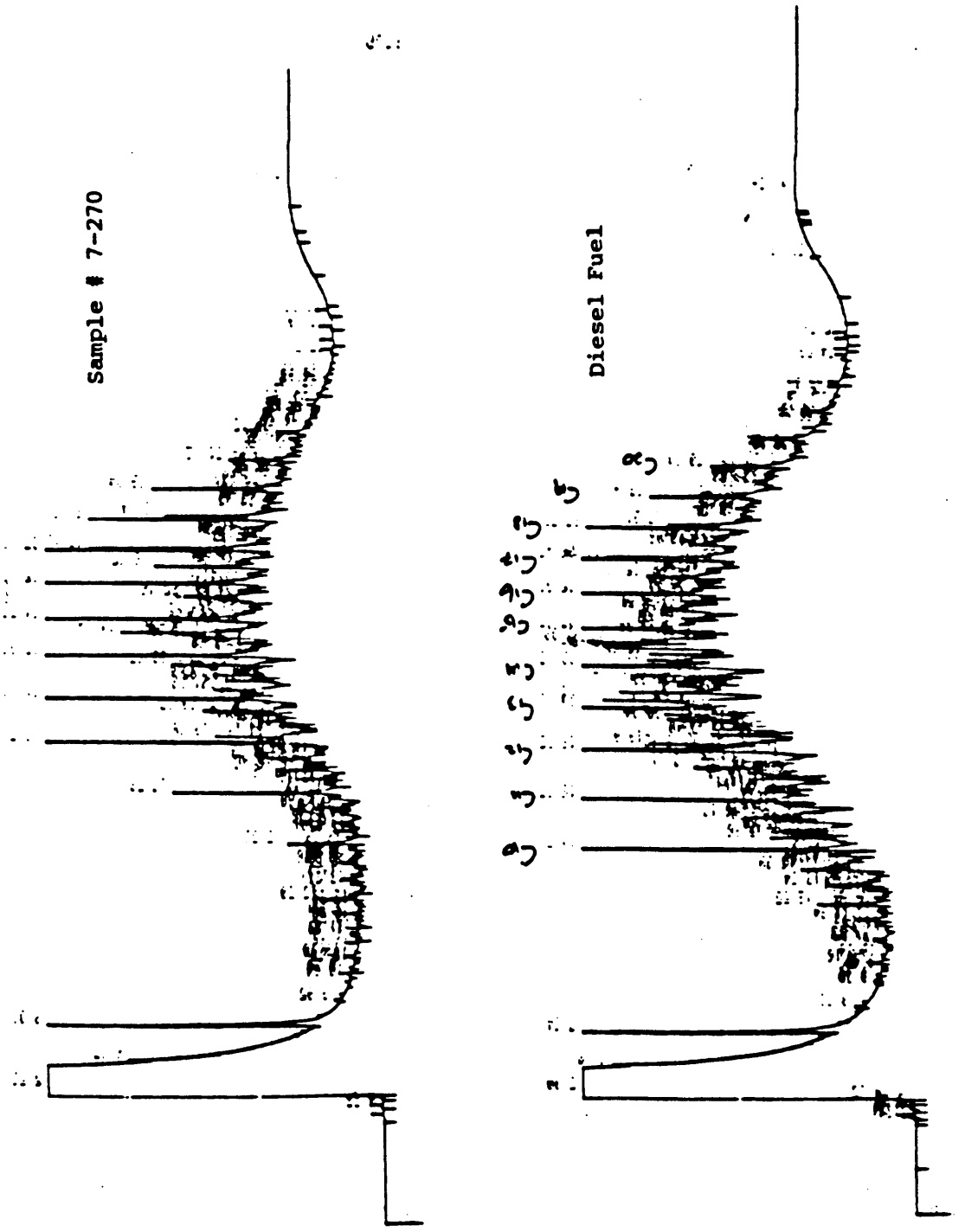


Figure 1-1. Comparison of Sample # 7-270 to Diesel Fuel

TABLE 1-2. BOILING POINT RANGES FOR GASOLINE, DIESEL AND FUEL OIL

Fuel Type	Boiling Point Range in °C 10%	90%
Gasoline[a]	<40°F	174
Diesel[b]	174	292
Fuel Oil[c]	215	288 (338[d])

[a]As calculated from the analysis of Gulf regular gasoline.

[b]As calculated from the analysis of Gulf diesel fuel.

[c]Obtained from the ASTM D specifications for distillation points (Grade No. 1).

[d]90% maximum for ASTM D Grade No. 2.

TABLE 2-1. ANALYTICAL RESULTS OF EPA QC 483 NO. 2

Experimental Value[a]	True Value[a,b]	Percent Recovery
29	31	94

[a]Total ug of carbon.
[b]EPA QC 483 No. 2 diluted 1:10.

TABLE 2-2. RESULTS OF SPIKED SOIL ANALYSES

Fuel Type	Experimental Value[a]	Amount Spiked[a]	Percent Recovery
Gasoline	950	970	98
Diesel	170	270	63

[a]Total ng of carbon.

Normal laboratory QA such as system and extraction blanks, extraction and analytical duplicates, and daily response checks were also conducted.

The solvent peak and any impurities in the blanks were subtracted from the samples total area count.

3.0 RESULTS AND DISCUSSION

The analytical results for the soil and water samples are given in Tables 3-1 and 3-2, respectively. The samples containing the higher TNMHC concentrations required from 1:10 to 1:1,000 dilutions. The component in most of the samples containing a detectable pattern was identified as fuel oils.

The boiling point ranges for gasoline and diesel were obtained from the analysis of Gulf products which may not be representative of all manufacturers' products. A fuel oil standard was not available for comparison. The overlap between diesel and fuel oil boiling point ranges makes positive identification difficult, especially for weathered fuels. The samples appeared to have a slightly higher boiling point range than that exhibited by the diesel standard and were, therefore, identified as fuel oils.

Soil samples for benzene, toluene, and xylene were analyzed using EPA Method 8020. The results are reported in Table 3-3.

RADIAN
CORPORATION

Total Report ≈ 6776.00

TABLE 3-1. RESULTS FROM SOIL SAMPLES ANALYZED FOR FUEL TYPE AND TNMHC
total nonmethane hydrocarbon conc.

Field ID	J-30 Depth (ft)	Boiling Point (°C) 10 %	90%	Concentration[a] ug C/g Soil	Fuel Type
7-252	2 - 2.5	--	--	<100	--
7-253	2.5 - 3.0	--	--	<100	--
7-253 Dup		--	--	<100	--
7-254	5.0 - 5.3	--	--	<100	--
7-255	5.5 - 6.0	--	--	<100	--
7-256	6.5 - 7.0	--	--	<100	--
7-257	7.0 - 7.5	--	--	<100	--
7-258	9.0 - 9.5	--	--	<100	--
7-259	10.0 - 10.5	--	--	<100	--
7-260	12.0 - 12.5	160	330	19,000	Diesel & Fuel Oil
7-261	12.5 - 13.0	220	310	170	Fuel Oil
7-262	17.1 - 17.6	220	280	4500	Fuel Oil
7-263	17.8 - 20.3	220	320	120	Fuel Oil
7-264	20.3 - 20.8	--	--	<100	--
7-265	24.2 - 24.7	200	320	120,000	Fuel Oil
7-266	24.7 - 25.2	200	320	130,000	Fuel Oil
7-267	27.2 - 27.4	200	320	140,000	Fuel Oil
7-268	27.7 - 28.2	220	340	400,000	Fuel Oil
7-269	31.7 - 32.2	200	320	140,000	Fuel Oil
7-269 Dup		200	320	140,000	Fuel Oil
7-270	32.5 - 33.0	200	320	110,000	Fuel Oil
7-271	35.1 - 35.6	--	--	<100	--
7-272	37.1 - 37.6	--	--	<100	--
7-273		220	310	1200	Fuel Oil

[a] Method quantitation limit = 100 ug C/g soil.

TABLE 3-2. RESULTS FROM WATER SAMPLES ANALYZED FOR FUEL TYPE AND TNMHC

Field ID	Boiling Point Range (°C) 10%	90%	Concentration[a] mg C/L	Fuel Type
I-30	200	320	21,000	Fuel Oil
I-31	---	---	<0.010	---

[a]Method quantitation limit 10 ug C/L water.

TABLE 3-3. RESULTS FROM SOIL SAMPLES ANALYZED FOR BENZENE, TOLUENE AND XYLENE

Sample Number	Concentration (ug/g) Benzene	Toluene	p-Xylene	m-Xylene	o-Xylene
7-252	ND[a]	ND[b]	ND[c]	ND[d]	ND[e]
7-253	ND	ND	ND	ND	ND
7-254	ND	ND	ND	ND	ND
7-255	ND	ND	ND	ND	ND
7-256	ND	ND	ND	ND	ND
7-257	ND	ND	ND	ND	ND
7-258	ND	ND	ND	ND	ND
7-259	ND	ND	ND	ND	ND
7-260	ND	ND	ND	ND	ND
7-261	ND	ND	ND	ND	ND
7-262	ND	ND	ND	ND	ND
7-263	ND	ND	ND	ND	ND
7-264	ND	ND	ND	ND	ND
7-265	ND	ND	22	39	34
7-266	ND	ND	13	32	26
7-267	ND	ND	13	24	18
7-268	ND	ND	20	33	28
7-269	ND	ND	12	19	16
7-270	ND	ND	15	25	20
7-271	ND	ND	ND	ND	ND
7-272	ND	ND	ND	ND	ND
7-273	ND	ND	ND	ND	ND

[a] ND is less than the detection limit of 0.03 ug/g.

[b] ND is less than the detection limit of 0.03 ug/g.

[c] ND is less than the detection limit of 0.01 ug/g.

[d] ND is less than the detection limit of 0.03 ug/g.

[e] ND is less than the detection limit of 0.03 ug/g.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4615 Caeg Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 14234 - 33A (49 pages)

PROJECT: TINKER AIRFORCE BASE
Feature: GROUNDWATER INVESTIGATION

Contract No.

TEST REQUEST NO.: MIL 86 - 87
Dated: 24 MARCH 86
Received: 26 MARCH 86

From: CHIEF, GEOTECHNICAL BRANCH

MATERIAL:
No. and type of samples: 11 soil samples

Identified by the following boring number:

J-30

Date received: 4 MARCH 87

REMARKS:

THIS COMPLETES REPORT NUMBER 14234 - 33.

Report sent to:

Tulsa District

Copy furnished:

Date:

Name and title:
WILLIAM R. TANNER
Director
SWD Laboratory

Signature

INST ID: 4000

SAMPLE NUMBER: 7-263 1-30

17.8-20.3'

ORGANIC ANALYSIS DATA SHEET -

)RATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302301
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.T.O...
PERCENT MOISTURE: 10%...

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87...
PH: —.....

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V01A
DILUTION FACTOR: 5.60.....

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	56 U	
C015	BROMOMETHANE	56 U	
C020	VINYL CHLORIDE	56 U	
C025	CHLOROETHANE	56 U	
C030	METHYLENE CHLORIDE	28	200
C035	ACETONE	56	44 J
C040	CARBON DISULFIDE	28 U	
C045	1,1-DICHLOROETHENE	28 U	
C050	1,1-DICHLOROETHANE	28 U	
C055	TRANS-1,2-DICHLOROETHENE	28 U	
C060	CHLOROFORM	28 U	
C065	1,2-DICHLOROETHANE	28 U	
C110	2-BUTANONE	56 U	
C115	1,1,1-TRICHLOROETHANE	28 U	
C120	CARBON TETRACHLORIDE	28 U	
C125	VINYL ACETATE	56 U	
C130	BROMODICHLOROMETHANE	28 U	
C140	1,2-DICHLOROPROPANE	28 U	
C145	TRANS-1,3-DICHLOROPROPENE	28 U	
C150	TRICHLOROETHENE	28 U	
C155	DIBROMOCHLOROMETHANE	28 U	
C160	1,1,2-TRICHLOROETHANE	28 U	
C165	BENZENE	28 U	
C170	CIS-1,3-DICHLOROPROPENE	28 U	
C175	2-CHLOROETHYLVINYLETHER	56 U	
C180	BROMOFORM	28 U	
C210	2-HEXANONE	56 U	
C205	4-METHYL-2-PENTANONE	56 U	
C220	TETRACHLOROETHENE	28 U	
C225	1,1,2,2-TETRACHLOROETHANE	28 U	
C230	TOLUENE	28	35
C235	CHLOROBENZENE	28	36
C240	ETHYLBENZENE	28	160
C245	STYRENE	28 U	
C250	TOTAL XYLENES	28	530

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-263 1-30
17.8-20.3'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V01A

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT
				UG/l
109-99-9	FURAN, TETRAHYDRO- *	190	991	71 J
3073-66-3	CYCLOHEXANE, 1,1,3-TRIMETHYL-	499	898	150 J
4551-51-3	1H-INDENE, OCTAHYDRO-, CIS-	505	757	150 J
4126-78-7	CYCLOHEPTANE, METHYL-	524	905	53 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	552		110 J
13151-98-9	CYCLOOCTANE, 1,4-DIMETHYL-, TRANS-	584	758	730 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- B

SAMPLE NUMBER: 7-264 1-30

20.3-20.8'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302302
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.T.
PERCENT MOISTURE: 9.1

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: -

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V02
DILUTION FACTOR: 5.50

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	55 U	
C015	BROMOMETHANE	55 U	
C020	VINYL CHLORIDE	55 U	
C025	CHLOROETHANE	55 U	
C030	METHYLENE CHLORIDE	27	330
C035	ACETONE	55 U	
C040	CARBON DISULFIDE	27 U	
C045	1,1-DICHLOROETHENE	27 U	
C050	1,1-DICHLOROETHANE	27 U	
C055	TRANS-1,2-DICHLOROETHENE	27 U	
C060	CHLOROFORM	27 U	
C065	1,2-DICHLOROETHANE	27 U	
C110	2-BUTANONE	55 U	
C115	1,1,1-TRICHLOROETHANE	27 U	
C120	CARBON TETRACHLORIDE	27 U	
C125	VINYL ACETATE	55 U	
C130	BROMODICHLOROMETHANE	27 U	
C140	1,2-DICHLOROPROPANE	27 U	
C145	TRANS-1,3-DICHLOROPROPENE	27 U	
C150	TRICHLOROETHENE	27 U	
C155	DIBROMOCHLOROMETHANE	27 U	
C160	1,1,2-TRICHLOROETHANE	27 U	
C165	BENZENE	27 U	
C170	CIS-1,3-DICHLOROPROPENE	27 U	
C175	2-CHLOROETHYLVINYLETHER	55 U	
C180	BROMOFORM	27 U	
C210	2-HEXANONE	55 U	
C205	4-METHYL-2-PENTANONE	55 U	
C220	TETRACHLOROETHENE	27 U	
C225	1,1,2,2-TETRACHLOROETHANE	27 U	
C230	TOLUENE	27 U	
C235	CHLOROBENZENE	27 U	
C240	ETHYLBENZENE	27 U	
C245	STYRENE	27	450
C250	TOTAL XYLENES	27 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-264 1-30
20.3-20.8'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V02

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/K	
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	42		36	J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	103		18	J
109-99-9	FURAN, TETRAHYDRO- *	193	978	29	J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	501		19	J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	570		120	J
2958-76-1	NAPHTHALENE, DECAHYDRO-2-METHYL-	588	806	18	J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

24.2-24.7'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302303
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.T.O...
PERCENT MOISTURE: 14%...

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87...
PH: ---.....

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V03A
DILUTION FACTOR: 2900.00...

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	29000 U	
C015	BROMOMETHANE	29000 U	
C020	VINYL CHLORIDE	29000 U	
C025	CHLOROETHANE	29000 U	
C030	METHYLENE CHLORIDE	14500 U	
C035	ACETONE	29000 U	
C040	CARBON DISULFIDE	14500 U	
C045	1,1-DICHLOROETHENE	14500 U	
C050	1,1-DICHLOROETHANE	14500 U	
C055	TRANS-1,2-DICHLOROETHENE	14500 U	
C060	CHLOROFORM	14500 U	
C065	1,2-DICHLOROETHANE	14500 U	
C110	2-BUTANONE	29000 U	
C115	1,1,1-TRICHLOROETHANE	14500 U	
C120	CARBON TETRACHLORIDE	14500 U	
C125	VINYL ACETATE	29000 U	
C130	BROMODICHLOROMETHANE	14500 U	
C140	1,2-DICHLOROPROPANE	14500 U	
C145	TRANS-1,3-DICHLOROPROPENE	14500 U	
C150	TRICHLOROETHENE	14500 U	
C155	DIBROMOCHLOROMETHANE	14500 U	
C160	1,1,2-TRICHLOROETHANE	14500 U	
C165	BENZENE	14500 U	
C170	CIS-1,3-DICHLOROPROPENE	14500 U	
C175	2-CHLOROETHYLVINYLETHER	29000 U	
C180	BROMOFORM	14500 U	
C210	2-HEXANONE	29000 U	
C205	4-METHYL-2-PENTANONE	29000 U	
C220	TETRACHLOROETHENE	14500 U	
C225	1,1,2,2-TETRACHLOROETHANE	14500 U	
C230	TOLUENE	14500 U	
C235	CHLOROBENZENE	14500 U	
C240	ETHYLBENZENE	14500 U	
C245	STYRENE	14500 U	
C250	TOTAL XYLENES	14500	17000

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-265 1-30
24.2-24.7'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V03A

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT
				UG/
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	38		25000 J
109-99-9	FURAN, TETRAHYDRO-*	187	974	22000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	208		17000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	583		58000 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000 SAMPLE NUMBER: [illegible]

24.7'-25.2'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302304
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.J.O.
PERCENT MOISTURE: 14.9

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: -

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V04
DILUTION FACTOR: 2930.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	29300 U	
C015	BROMOMETHANE	29300 U	
C020	VINYL CHLORIDE	29300 U	
C025	CHLOROETHANE	29300 U	
C030	METHYLENE CHLORIDE	14650 U	
C035	ACETONE	29300	9960 J
C040	CARBON DISULFIDE	14650 U	
C045	1,1-DICHLOROETHENE	14650 U	
C050	1,1-DICHLOROETHANE	14650 U	
C055	TRANS-1,2-DICHLOROETHENE	14650 U	
C060	CHLOROFORM	14650 U	
C065	1,2-DICHLOROETHANE	14650 U	
C110	2-BUTANONE	29300 U	
C115	1,1,1-TRICHLOROETHANE	14650 U	
C120	CARBON TETRACHLORIDE	14650 U	
C125	VINYL ACETATE	29300 U	
C130	BROMODICHLOROMETHANE	14650 U	
C140	1,2-DICHLOROPROPANE	14650 U	
C145	TRANS-1,3-DICHLOROPROPENE	14650 U	
C150	TRICHLOROETHENE	14650 U	
C155	DIBROMOCHLOROMETHANE	14650 U	
C160	1,1,2-TRICHLOROETHANE	14650 U	
C165	BENZENE	14650 U	
C170	CIS-1,3-DICHLOROPROPENE	14650 U	
C175	2-CHLOROETHYLVINYLETHER	29300 U	
C180	BROMOFORM	14650 U	
C210	2-HEXANONE	29300 U	
C205	4-METHYL-2-PENTANONE	29300 U	
C220	TETRACHLOROETHENE	14650 U	
C225	1,1,2,2-TETRACHLOROETHANE	14650 U	
C230	TOLUENE	14650	7728 J
C235	CHLOROBENZENE	14650 U	
C240	ETHYLBENZENE	14650	10347 J
C245	STYRENE	14650	20000
C250	TOTAL XYLENES	14650	31000

U UNDETECTED AT THE LISTED DETECTION LIMIT
= COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
* COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-266 1-30
24.7-25.2'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V04

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT
				UG
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	42		50000
2919-23-5	CYCLOBUTANOL	106	879	51000
109-99-9	FURAN, TETRAHYDRO- *	191	970	28000
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	212		27000
73-66-3	CYCLOHEXANE, 1,1,3-TRIMETHYL-	499	816	21000
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	504		15000
13151-98-9	CYCLOOCTANE, 1,4-DIMETHYL-, TRANS-	583	765	48000
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	588		45000

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SAMPLE NUMBER: [illegible]

27.2-27.4'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302305
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TJO
PERCENT MOISTURE: 17%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: .....

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V05
DILUTION FACTOR: 1510.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	15100 U	
C015	BROMOMETHANE	15100 U	
C020	VINYL CHLORIDE	15100 U	
C025	CHLOROETHANE	15100 U	
C030	METHYLENE CHLORIDE	7550 U	
C035	ACETONE	15100	2190 J
C040	CARBON DISULFIDE	7550 U	
C045	1,1-DICHLOROETHENE	7550 U	
C050	1,1-DICHLOROETHANE	7550 U	
C055	TRANS-1,2-DICHLOROETHENE	7550 U	
C060	CHLOROFORM	7550 U	
C065	1,2-DICHLOROETHANE	7550 U	
C110	2-BUTANONE	15100 U	
C115	1,1,1-TRICHLOROETHANE	7550 U	
C120	CARBON TETRACHLORIDE	7550 U	
C125	VINYL ACETATE	15100 U	
C130	BROMODICHLOROMETHANE	7550 U	
C140	1,2-DICHLOROPROPANE	7550 U	
C145	TRANS-1,3-DICHLOROPROPENE	7550 U	
C150	TRICHLOROETHENE	7550 U	
C155	DIBROMOCHLOROMETHANE	7550 U	
C160	1,1,2-TRICHLOROETHANE	7550 U	
C165	BENZENE	7550 U	
C170	CIS-1,3-DICHLOROPROPENE	7550 U	
C175	2-CHLOROETHYLVINYLETHER	15100 U	
C180	BROMOFORM	7550 U	
C210	2-HEXANONE	15100 U	
C205	4-METHYL-2-PENTANONE	15100 U	
C220	TETRACHLOROETHENE	7550 U	
C225	1,1,2,2-TETRACHLOROETHANE	7550 U	
C230	TOLUENE	7550	3968 J
C235	CHLOROBENZENE	7550 U	
C240	ETHYLBENZENE	7550	6448 J
C245	STYRENE	7550 U	
C250	TOTAL XYLENES	7550	18000

U = COMPOUND UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-267 1-30
27.2-27.4'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V05

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	42		24000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	460		8900 J
3073-66-3	CYCLOHEXANE, 1,1,3-TRIMETHYL-	499	967	11000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	504		11000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	583		66000 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

INST ID: 4000 SAMPLE NUMBER: [illegible]

27.7-28.2'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302306
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TTO
PERCENT MOISTURE: 19.1%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/04/87
PH: -

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V06
DILUTION FACTOR: 3080.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	30800 U	
C015	BROMOMETHANE	30800 U	
C020	VINYL CHLORIDE	30800 U	
C025	CHLOROETHANE	30800 U	
C030	METHYLENE CHLORIDE	15400 U	
C035	ACETONE	30800 U	
C040	CARBON DISULFIDE	15400 U	
C045	1,1-DICHLOROETHENE	15400 U	
C050	1,1-DICHLOROETHANE	15400 U	
C055	TRANS-1,2-DICHLOROETHENE	15400 U	
C060	CHLOROFORM	15400 U	
C065	1,2-DICHLOROETHANE	15400 U	
C110	2-BUTANONE	30800 U	
C115	1,1,1-TRICHLOROETHANE	15400 U	
C120	CARBON TETRACHLORIDE	15400 U	
C125	VINYL ACETATE	30800 U	
C130	BROMODICHLOROMETHANE	15400 U	
C140	1,2-DICHLOROPROPANE	15400 U	
C145	TRANS-1,3-DICHLOROPROPENE	15400 U	
C150	TRICHLOROETHENE	15400 U	
C155	DIBROMOCHLOROMETHANE	15400 U	
C160	1,1,2-TRICHLOROETHANE	15400 U	
C165	BENZENE	15400 U	
C170	CIS-1,3-DICHLOROPROPENE	15400 U	
C175	2-CHLOROETHYLVINYLETHER	30800 U	
C180	BROMOFORM	15400 U	
C210	2-HEXANONE	30800 U	
C205	4-METHYL-2-PENTANONE	30800 U	
C220	TETRACHLOROETHENE	15400 U	
C225	1,1,2,2-TETRACHLOROETHANE	15400 U	
C230	TOLUENE	15400 U	
C235	CHLOROBENZENE	15400 U	
C240	ETHYLBENZENE	15400	10132 J
C245	STYRENE	15400	27000
C250	TOTAL XYLENES	15400	22000

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-268 1-30
27.7-28.2'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V06

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT
				UG/L
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	41		29000 J
123-77-3	DIAZENEDICARBOXAMIDE	104	872	23000 J
109-99-9	FURAN, TETRAHYDRO-*	188	966	13000 J
629-14-1	ETHANE, 1,2-DIETHOXY-	209	900	8700 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	563		15000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	583		12000
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	588		13000

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SAMPLE NUMBER: 7-269 1-30
31.7-32.2'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302307
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TJD
PERCENT MOISTURE: 15%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: —

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V07
DILUTION FACTOR: 2930.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	29300 U	
C015	BROMOMETHANE	29300 U	
C020	VINYL CHLORIDE	29300 U	
C025	CHLOROETHANE	29300 U	
C030	METHYLENE CHLORIDE	14650 U	
C035	ACETONE	29300 U	
C040	CARBON DISULFIDE	14650 U	
C045	1,1-DICHLOROETHENE	14650 U	
C050	1,1-DICHLOROETHANE	14650 U	
C055	TRANS-1,2-DICHLOROETHENE	14650 U	
C060	CHLOROFORM	14650 U	
C065	1,2-DICHLOROETHANE	14650 U	
C110	2-BUTANONE	29300 U	
C115	1,1,1-TRICHLOROETHANE	14650 U	
C120	CARBON TETRACHLORIDE	14650 U	
C125	VINYL ACETATE	29300 U	
C130	BROMODICHLOROMETHANE	14650 U	
C140	1,2-DICHLOROPROPANE	14650 U	
C145	TRANS-1,3-DICHLOROPROPENE	14650 U	
C150	TRICHLOROETHENE	14650 U	
C155	DIBROMOCHLOROMETHANE	14650 U	
C160	1,1,2-TRICHLOROETHANE	14650 U	
C165	BENZENE	14650 U	
C170	CIS-1,3-DICHLOROPROPENE	14650 U	
C175	2-CHLOROETHYLVINYLETHER	29300 U	
C180	BROMOFORM	14650 U	
C210	2-HEXANONE	29300 U	
C205	4-METHYL-2-PENTANONE	29300 U	
C220	TETRACHLOROETHENE	14650 U	
C225	1,1,2,2-TETRACHLOROETHANE	14650 U	
C230	TOLUENE	14650 U	
C235	CHLOROBENZENE	14650 U	
C240	ETHYLBENZENE	14650	8086 J
C245	STYRENE	14650 U	
C250	TOTAL XYLENES	14650	20000

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-269 1-30
31.7-32.2'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V07

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT
				UG/
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	40		37000 J
109-99-9	FURAN, TETRAHYDRO- *	192	959	24000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	591		37000 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

7-270 1-30
32.5-33'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302308
PLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TTO
PERCENT MOISTURE: 15%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH:

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V08
DILUTION FACTOR: 2930.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	29300 U	
C015	BROMOMETHANE	29300 U	
C020	VINYL CHLORIDE	29300 U	
C025	CHLOROETHANE	29300 U	
C030	METHYLENE CHLORIDE	14650 U	
C035	ACETONE	29300 U	
C040	CARBON DISULFIDE	14650 U	
C045	1,1-DICHLOROETHENE	14650 U	
C050	1,1-DICHLOROETHANE	14650 U	
C055	TRANS-1,2-DICHLOROETHENE	14650 U	
C060	CHLOROFORM	14650 U	
C065	1,2-DICHLOROETHANE	14650 U	
C110	2-BUTANONE	29300 U	
C115	1,1,1-TRICHLOROETHANE	14650 U	
C120	CARBON TETRACHLORIDE	14650 U	
C125	VINYL ACETATE	29300 U	
C130	BROMODICHLOROMETHANE	14650 U	
C140	1,2-DICHLOROPROPANE	14650 U	
C145	TRANS-1,3-DICHLOROPROPENE	14650 U	
C150	TRICHLOROETHENE	14650 U	
C155	DIBROMOCHLOROMETHANE	14650 U	
C160	1,1,2-TRICHLOROETHANE	14650 U	
C165	BENZENE	14650 U	
C170	CIS-1,3-DICHLOROPROPENE	14650 U	
C175	2-CHLOROETHYLVINYLETHER	29300 U	
C180	BROMOFORM	14650 U	
C210	2-HEXANONE	29300 U	
C205	4-METHYL-2-PENTANONE	29300 U	
C220	TETRACHLOROETHENE	14650 U	
C225	1,1,2,2-TETRACHLOROETHANE	14650 U	
C230	TOLUENE	14650 U	
C235	CHLOROBENZENE	14650 U	
C240	ETHYLBENZENE	14650 U	
C245	STYRENE	14650	10475 J
C250	TOTAL XYLENES	14650 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-270 1-30
325-33'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V08

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	42		52000
56-41-7	L-ALANINE	109	645	58000
109-99-9	FURAN, TETRAHYDRO- *	193	961	26000
629-14-1	ETHANE, 1,2-DIETHOXY-	213	904	18000
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	515		35000
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	525		16000
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	591		25000

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

35.1-35.6'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302309
IPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.D.
PERCENT MOISTURE: 10.%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: --

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V09
DILUTION FACTOR: 1400.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	14000	U
C015	BROMOMETHANE	14000	U
C020	VINYL CHLORIDE	14000	U
C025	CHLOROETHANE	14000	U
C030	METHYLENE CHLORIDE	7000	U
C035	ACETONE	14000	U
C040	CARBON DISULFIDE	7000	U
C045	1,1-DICHLOROETHENE	7000	U
C050	1,1-DICHLOROETHANE	7000	U
C055	TRANS-1,2-DICHLOROETHENE	7000	U
C060	CHLOROFORM	7000	U
C065	1,2-DICHLOROETHANE	7000	U
C110	2-BUTANONE	14000	U
C115	1,1,1-TRICHLOROETHANE	7000	U
C120	CARBON TETRACHLORIDE	7000	U
C125	VINYL ACETATE	14000	U
C130	BROMODICHLOROMETHANE	7000	U
C140	1,2-DICHLOROPROPANE	7000	U
C145	TRANS-1,3-DICHLOROPROPENE	7000	U
C150	TRICHLOROETHENE	7000	U
C155	DIBROMOCHLOROMETHANE	7000	U
C160	1,1,2-TRICHLOROETHANE	7000	U
C165	BENZENE	7000	U
C170	CIS-1,3-DICHLOROPROPENE	7000	U
C175	2-CHLOROETHYLVINYLETHER	14000	U
C180	BROMOFORM	7000	U
C210	2-HEXANONE	14000	U
C205	4-METHYL-2-PENTANONE	14000	U
C220	TETRACHLOROETHENE	7000	U
C225	1,1,2,2-TETRACHLOROETHANE	7000	U
C230	TOLUENE	7000	U
C235	CHLOROBENZENE	7000	U
C240	ETHYLBENZENE	7000	U
C245	STYRENE	7000	U
C250	TOTAL XYLENES	7000	U

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-271 1-30
35.1-35.6'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V09

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/K
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	43		12000 J
109-99-9	FURAN, TETRAHYDRO- *	193	977	6400 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	213		8200 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	572		6000 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

37.1-37.6'
7-272 1-30

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302310
LE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TTO
PERCENT MOISTURE: 9%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: -

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V10
DILUTION FACTOR: 1380.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	13800 U	
C015	BROMOMETHANE	13800 U	
C020	VINYL CHLORIDE	13800 U	
C025	CHLOROETHANE	13800 U	
C030	METHYLENE CHLORIDE	6900 U	
C035	ACETONE	13800 U	
C040	CARBON DISULFIDE	6900 U	
C045	1,1-DICHLOROETHENE	6900 U	
C050	1,1-DICHLOROETHANE	6900 U	
C055	TRANS-1,2-DICHLOROETHENE	6900 U	
C060	CHLOROFORM	6900 U	
C065	1,2-DICHLOROETHANE	6900 U	
C110	2-BUTANONE	13800 U	
C115	1,1,1-TRICHLOROETHANE	6900 U	
C120	CARBON TETRACHLORIDE	6900 U	
C125	VINYL ACETATE	13800 U	
C130	BROMODICHLOROMETHANE	6900 U	
C140	1,2-DICHLOROPROPANE	6900 U	
C145	TRANS-1,3-DICHLOROPROPENE	6900 U	
C150	TRICHLOROETHENE	6900 U	
C155	DIBROMOCHLOROMETHANE	6900 U	
C160	1,1,2-TRICHLOROETHANE	6900 U	
C165	BENZENE	6900 U	
C170	CIS-1,3-DICHLOROPROPENE	6900 U	
C175	2-CHLOROETHYLVINYLETHER	13800 U	
C180	BROMOFORM	6900 U	
C210	2-HEXANONE	13800 U	
C205	4-METHYL-2-PENTANONE	13800 U	
C220	TETRACHLOROETHENE	6900 U	
C225	1,1,2,2-TETRACHLOROETHANE	6900 U	
C230	TOLUENE	6900 U	
C235	CHLOROBENZENE	6900 U	
C240	ETHYLBENZENE	6900 U	
C245	STYRENE	6900 U	
C250	TOTAL XYLENES	6900 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-272 1-30
37.1-37.6'

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION

CASE NO.: ---

QC REPORT NO.: -

ANALYST: ROD

DATAFILE: 4U03023V10

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	41		15000 J
75-31-0	2-PROPANAMINE	107	819	17000 J
109-99-9	FURAN, TETRAHYDRO-*	190	969	6000 J
629-14-1	ETHANE, 1,2-DIETHOXY-	210	895	7800 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SAMPLE NUMBER: 7-272 1-30
37.1-37.6'

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302310
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TTO
PERCENT MOISTURE: 9.7

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH:

VOLATILES

CONCENTRATION: ~~LOW~~ MEDIUM ~~NOT~~
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V10A
DILUTION FACTOR: 68:80

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	688 U	
C015	BROMOMETHANE	688 U	
C020	VINYL CHLORIDE	688 U	
C025	CHLOROETHANE	688 U	
C030	METHYLENE CHLORIDE	344	183 J
C035	ACETONE	688	1920
C040	CARBON DISULFIDE	344 U	
C045	1,1-DICHLOROETHENE	344 U	
C050	1,1-DICHLOROETHANE	344 U	
C055	TRANS-1,2-DICHLOROETHENE	344 U	
C060	CHLOROFORM	344 U	
C065	1,2-DICHLOROETHANE	344 U	
C110	2-BUTANONE	688	6100
C115	1,1,1-TRICHLOROETHANE	344 U	
C120	CARBON TETRACHLORIDE	344 U	
C125	VINYL ACETATE	688 U	
C130	BROMODICHLOROMETHANE	344 U	
C140	1,2-DICHLOROPROPANE	344 U	
C145	TRANS-1,3-DICHLOROPROPENE	344 U	
C150	TRICHLOROETHENE	344 U	
C155	DIBROMOCHLOROMETHANE	344 U	
C160	1,1,2-TRICHLOROETHANE	344 U	
C165	BENZENE	344 U	
C170	CIS-1,3-DICHLOROPROPENE	344 U	
C175	2-CHLOROETHYLVINYLETHER	688 U	
C180	BROMOFORM	344 U	
C210	2-HEXANONE	688 U	
C205	4-METHYL-2-PENTANONE	688 U	
C220	TETRACHLOROETHENE	344 U	
C225	1,1,2,2-TETRACHLOROETHANE	344 U	
C230	TOLUENE	344	85 J
C235	CHLOROBENZENE	344 U	
C240	ETHYLBENZENE	344 U	
C245	STYRENE	344 U	
C250	TOTAL XYLENES	344	82 J

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-272 1- 3
37.1-37.6

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V10A

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT
				UG
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	36		900
2919-23-5	CYCLOBUTANOL	104	771	300
109-99-9	FURAN, TETRAHYDRO- *	189	970	260
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	210		8300

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

7-283 1-30

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302311
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: JP
PERCENT MOISTURE: 11.7

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/04/87
PH: -

VOLATILES

CONCENTRATION: MEDIUM
DATE EXTRACTED/PREPARED: 03/16/87
DATE ANALYZED: 03/16/87

DATAFILE: 4U03023V11
DILUTION FACTOR: 1400.00

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	14000 U	
C015	BROMOMETHANE	14000 U	
C020	VINYL CHLORIDE	14000 U	
C025	CHLOROETHANE	14000 U	
C030	METHYLENE CHLORIDE	7000 U	
C035	ACETONE	14000 U	
C040	CARBON DISULFIDE	7000 U	
C045	1,1-DICHLOROETHENE	7000 U	
C050	1,1-DICHLOROETHANE	7000 U	
C055	TRANS-1,2-DICHLOROETHENE	7000 U	
C060	CHLOROFORM	7000 U	
C065	1,2-DICHLOROETHANE	7000 U	
C110	2-BUTANONE	14000 U	
C115	1,1,1-TRICHLOROETHANE	7000 U	
C120	CARBON TETRACHLORIDE	7000 U	
C125	VINYL ACETATE	14000 U	
C130	BROMODICHLOROMETHANE	7000 U	
C140	1,2-DICHLOROPROPANE	7000 U	
C145	TRANS-1,3-DICHLOROPROPENE	7000 U	
C150	TRICHLOROETHENE	7000 U	
C155	DIBROMOCHLOROMETHANE	7000 U	
C160	1,1,2-TRICHLOROETHANE	7000 U	
C165	BENZENE	7000 U	
C170	CIS-1,3-DICHLOROPROPENE	7000 U	
C175	2-CHLOROETHYLVINYLETHER	14000 U	
C180	BROMOFORM	7000 U	
C210	2-HEXANONE	14000 U	
C205	4-METHYL-2-PENTANONE	14000 U	
C220	TETRACHLOROETHENE	7000 U	
C225	1,1,2,2-TETRACHLOROETHANE	7000 U	
C230	TOLUENE	7000 U	
C235	CHLOROBENZENE	7000 U	
C240	ETHYLBENZENE	7000 U	
C245	STYRENE	7000 U	
C250	TOTAL XYLENES	7000 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-273 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: ROD DATAFILE: 4U03023V11

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT
				UG/L
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	38		16000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	105		17000 J
109-99-9	FURAN, TETRAHYDRO-*	187	960	6000 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	208		7400 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- B
SAMPLE NUMBER: 7-252 1-80

2.0-2.5

ORGANIC ANALYSIS DATA SHEET -

ORATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 870302203
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.D.
PERCENT MOISTURE: 14%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: ---

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/14/87
DATE ANALYZED: 03/14/87

DATAFILE: 4U03022V03
DILUTION FACTOR: 1.17

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6 U	
C035	ACETONE	12 U	
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12 U	
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-252 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: CKT DATAFILE: 4U03022V03

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/KG
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	40		6 J
2919-23-5	CYCLOBUTANOL	113	642	13 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

INST ID: 4000

SPECTRIX DC # ---- 8
SAMPLE NUMBER: 7-253 1-30
2.5-3.0

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 870302204
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: J.D.
PERCENT MOISTURE: 14.9

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: .....

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/14/87
DATE ANALYZED: 03/14/87

DATAFILE: 4U03022V04
DILUTION FACTOR: 1.16

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6	3 J
C035	ACETONE	12	19
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12 U	
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-253 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: CKT DATAFILE: 4U03022V04

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/K
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	39		6 J
124-38-9	CARBON DIOXIDE (ACN)	109	841	13 J
109-99-9	FURAN, TETRAHYDRO-	191	969	5 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	584		11 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

INST ID: 4000

SPECTRIX DC # ---- B
SAMPLE NUMBER: 7-254 1-30
5.0-5.3

ORGANIC ANALYSIS DATA SHEET -

ORATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 870302205
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.TD.
PERCENT MOISTURE: 16.9

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: -

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/14/87
DATE ANALYZED: 03/14/87

DATAFILE: 4U03022V05
DILUTION FACTOR: 1.19

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6	5 J
C035	ACETONE	12 U	
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12 U	
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-255 1-3C

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V06

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	41		7
124-38-9	CARBON DIOXIDE (ACN)	108	960	21
109-99-9	FURAN, TETRAHYDRO- *	193	953	8

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- B
SAMPLE NUMBER: 7-256 1-30
6.5-7.0

ORGANIC ANALYSIS DATA SHEET -

ORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302207
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.T.
PERCENT MOISTURE: 16%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: .....

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V07
DILUTION FACTOR: 1.14

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6	4 J
C035	ACETONE	12 U	
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12 U	
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-254 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: CKT DATAFILE: 4U03022V05

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/L
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	37		3
75-31-0	2-PROPANAMINE	115		5
109-99-9	FURAN, TETRAHYDRO-	186		5

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

INST ID: 4000

SAMPLE NUMBER: 7-255 1-20

5.5-6.0

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302206
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.T.
PERCENT MOISTURE: 16.9

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: ---

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V06
DILUTION FACTOR: 1.19

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6	5 J
C035	ACETONE	12 U	
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12 U	
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-256 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V07

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/L
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	41		6 J
2919-23-5	CYCLOBUTANOL	108	847	14 J
109-99-9	FURAN, TETRAHYDRO- *	193	975	6 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SAMPLE NUMBER: 7-257 1-30

70-75

ORGANIC ANALYSIS DATA SHEET -

ORATORY NAME: SPECTRIX
SAMPLE ID NO.: 870302208
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TTD
PERCENT MOISTURE: 14%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: —

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V08
DILUTION FACTOR: 1.17

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6	14
C035	ACETONE	12 U	
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12 U	
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-257 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

GC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V08

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/K
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	40		5 J
109-99-9	FURAN, TETRAHYDRO- *	193	975	7 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SAMPLE NUMBER: 7-258 1-30
9.0-9.5

ORGANIC ANALYSIS DATA SHEET -

ORATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 870302209
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TJO
PERCENT MOISTURE: 11.9

CASE NO.: ---
GC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: —

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V09
DILUTION FACTOR: .....

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	11 U	
C015	BROMOMETHANE	11 U	
C020	VINYL CHLORIDE	11 U	
C025	CHLOROETHANE	11 U	
C030	METHYLENE CHLORIDE	6	5 J
C035	ACETONE	11	59
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	11 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	11 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	11 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	11 U	
C205	4-METHYL-2-PENTANONE	11 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-258 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V09

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	40		6
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	107		13
109-99-9	FURAN, TETRAHYDRO- *	191	975	7

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SAMPLE NUMBER: 7-259 1-30

10.0-10.5

ORGANIC ANALYSIS DATA SHEET -

ORATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 870302210
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TJD
PERCENT MOISTURE: 12%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87
PH: ---

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V10
DILUTION FACTOR: 1:14

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	11 U	
C015	BROMOMETHANE	11 U	
C020	VINYL CHLORIDE	11 U	
C025	CHLOROETHANE	11 U	
C030	METHYLENE CHLORIDE	6	3 J
C035	ACETONE	11	52
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	11 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	11 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	11 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	11 U	
C205	4-METHYL-2-PENTANONE	11 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6 U	
C240	ETHYLBENZENE	6 U	
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000 SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-259 1-3

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V10

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	41		5
28292-43-5	2-HEXANAMINE, 5-METHYL-	108	794	17
109-99-9	FURAN, TETRAHYDRO- *	192	964	8

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8
SAMPLE NUMBER: 7-260 1-30

12.0-12.5

ORGANIC ANALYSIS DATA SHEET -

BORATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 87030221
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.O...
PERCENT MOISTURE: 13%.

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/06/87...
PH: .....

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V11
DILUTION FACTOR: 1.16.....

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6	5 J
C035	ACETONE	12	62
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12	5 J
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6	15
C240	ETHYLBENZENE	6	9
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6	8

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-260 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V11

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/K
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	109		12 J
4516-69-2	CYCLOPENTANE, 1,1,3-TRIMETHYL-	411	864	9 J
3073-66-3	CYCLOHEXANE, 1,1,3-TRIMETHYL-	499	843	22 J
4551-51-3	1H-INDENE, OCTAHYDRO-, CIS-	504	824	12 J
3-77-7	CYCLOHEXANE, 1-ETHYL-2-METHYL-, CIS-	524	795	6 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	552		28 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	563		41 J
1315-98-9	CYCLOOCTANE, 1,4-DIMETHYL-, TRANS-	583	780	89 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

INST ID: 4000

SPECTRIX DC # ---- 8
SAMPLE NUMBER: 7-261 1-30
12.5-13.0

ORGANIC ANALYSIS DATA SHEET -

JRATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 870302212
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: T.D...
PERCENT MOISTURE: ..8%..

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/04/87..
PH: ..-.....

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V12
DILUTION FACTOR: ..1.0..

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	11 U	
C015	BROMOMETHANE	11 U	
C020	VINYL CHLORIDE	11 U	
C025	CHLOROETHANE	11 U	
C030	METHYLENE CHLORIDE	5	3 J
C035	ACETONE	11	35
C040	CARBON DISULFIDE	5 U	
C045	1,1-DICHLOROETHENE	5 U	
C050	1,1-DICHLOROETHANE	5 U	
C055	TRANS-1,2-DICHLOROETHENE	5 U	
C060	CHLOROFORM	5 U	
C065	1,2-DICHLOROETHANE	5 U	
C110	2-BUTANONE	11 U	
C115	1,1,1-TRICHLOROETHANE	5 U	
C120	CARBON TETRACHLORIDE	5 U	
C125	VINYL ACETATE	11 U	
C130	BROMODICHLOROMETHANE	5 U	
C140	1,2-DICHLOROPROPANE	5 U	
C145	TRANS-1,3-DICHLOROPROPENE	5 U	
C150	TRICHLOROETHENE	5 U	
C155	DIBROMOCHLOROMETHANE	5 U	
C160	1,1,2-TRICHLOROETHANE	5 U	
C165	BENZENE	5 U	
C170	CIS-1,3-DICHLOROPROPENE	5 U	
C175	2-CHLOROETHYLVINYLETHER	11 U	
C180	BROMOFORM	5 U	
C210	2-HEXANONE	11 U	
C205	4-METHYL-2-PENTANONE	11 U	
C220	TETRACHLOROETHENE	5 U	
C225	1,1,2,2-TETRACHLOROETHANE	5 U	
C230	TOLUENE	5 U	
C235	CHLOROBENZENE	5 U	
C240	ETHYLBENZENE	5 U	
C245	STYRENE	5 U	
C250	TOTAL XYLENES	5 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

SAMPLE NUMBER: 7-261 1-30

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

GC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V12

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG/L
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	39		5 J
75-31-0	2-PROPANAMINE	105	804	10 J
109-99-9	FURAN, TETRAHYDRO- *	190	969	6 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	499		5 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	568		22 J
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	581		77 J

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

* ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8
SAMPLE NUMBER: 7-262 1-30
17.1 -17.6

ORGANIC ANALYSIS DATA SHEET -

LABORATORY NAME: SPECTRIX
LAB SAMPLE ID NO.: 870302213
SAMPLE MATRIX: SOIL
DATA RELEASE AUTHORIZED BY: TD
PERCENT MOISTURE: 15%

CASE NO.: ---
QC REPORT NO.: -
CONTRACT NO.: -
DATE SAMPLE RECEIVED: 03/04/87
PH: -

VOLATILES

CONCENTRATION: LOW
DATE EXTRACTED/PREPARED: 03/15/87
DATE ANALYZED: 03/15/87

DATAFILE: 4U03022V13
DILUTION FACTOR: 1.18

	COMPOUND	DETECTION LIMIT (MICROGRAMS / KG)	AMOUNT FOUND
C010	CHLOROMETHANE	12 U	
C015	BROMOMETHANE	12 U	
C020	VINYL CHLORIDE	12 U	
C025	CHLOROETHANE	12 U	
C030	METHYLENE CHLORIDE	6	9
C035	ACETONE	12 U	
C040	CARBON DISULFIDE	6 U	
C045	1,1-DICHLOROETHENE	6 U	
C050	1,1-DICHLOROETHANE	6 U	
C055	TRANS-1,2-DICHLOROETHENE	6 U	
C060	CHLOROFORM	6 U	
C065	1,2-DICHLOROETHANE	6 U	
C110	2-BUTANONE	12 U	
C115	1,1,1-TRICHLOROETHANE	6 U	
C120	CARBON TETRACHLORIDE	6 U	
C125	VINYL ACETATE	12 U	
C130	BROMODICHLOROMETHANE	6 U	
C140	1,2-DICHLOROPROPANE	6 U	
C145	TRANS-1,3-DICHLOROPROPENE	6 U	
C150	TRICHLOROETHENE	6 U	
C155	DIBROMOCHLOROMETHANE	6 U	
C160	1,1,2-TRICHLOROETHANE	6 U	
C165	BENZENE	6 U	
C170	CIS-1,3-DICHLOROPROPENE	6 U	
C175	2-CHLOROETHYLVINYLETHER	12 U	
C180	BROMOFORM	6 U	
C210	2-HEXANONE	12	10 J
C205	4-METHYL-2-PENTANONE	12 U	
C220	TETRACHLOROETHENE	6 U	
C225	1,1,2,2-TETRACHLOROETHANE	6 U	
C230	TOLUENE	6 U	
C235	CHLOROBENZENE	6	13
C240	ETHYLBENZENE	6	3 J
C245	STYRENE	6 U	
C250	TOTAL XYLENES	6 U	

U = UNDETECTED AT THE LISTED DETECTION LIMIT
J = COMPOUND IS PRESENT, BUT BELOW THE LISTED DETECTION LIMIT
B = COMPOUND ALSO FOUND IN BLANK

INST ID: 4000

SPECTRIX DC # ---- 8

SAMPLE NUMBER: 7-262 1-3c

ORGANICS ANALYSIS DATA SHEET - PAGE 4

LABORATORY NAME: SPECTRIX CORPORATION CASE NO.: ---

QC REPORT NO.: - ANALYST: TTO DATAFILE: 4U03022V13

B. TENTATIVELY IDENTIFIED COMPOUNDS

CAS #	VOLATILE COMPOUND NAMES	SCAN#	PURITY	AMOUNT UG
4516-69-2	CYCLOPENTANE, 1,1,3-TRIMETHYL-	411	902	32
2207-03-6	CYCLOHEXANE, 1,3-DIMETHYL-, TRANS-	440	847	67
3726-47-4	CYCLOPENTANE, 1-ETHYL-3-METHYL-	466	825	860
3073-66-3	CYCLOHEXANE, 1,1,3-TRIMETHYL-	498	905	570
(1-51-3	1H-INDENE, OCTAHYDRO-, CIS-	504	817	210
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	524		170
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	552		660
	UNKNOWN-DOESN'T MATCH ANY LIBRARY SPECTRA	562		1100
13151-98-9	CYCLOOCTANE, 1,4-DIMETHYL-, TRANS-	583	787	2100

J = ESTIMATED VALUE - A 1:1 RESPONSE FACTOR IS ASSUMED

APPENDIX J

LABORATORY RESULTS FROM SOIL SAMPLES AT SOUTHWEST TANK AREA

TABLE 5-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)

A. S. of Bldg. 3108 (10 tanks with 100 octane or solvent) (Figure 2)

SAMPLE I.D.	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
B-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-1 17'	<1.0	<1.0	<1.0	<1.0	<0.1
B-1 25'	<1.0	550.0	85.8	1117.8	<0.1
B-2 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-2 16'	<1.0	<1.0	<1.0	<1.0	<0.1
B-2 25'	146.0	732.0	110.0	1438.0	<0.1
B-3 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-3 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-4 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-4 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-4 25'	<1.0	168.0	25.0	310.0	<0.1
B-5 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-5 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-5 25'	<1.0	1535.0	<1.0	14318.0	0.22
B-6 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-6 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-6 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-6 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 25'	<1.0	2133.0	<1.0	19453.0	<0.1
B-8 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-8 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-8 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-9 10'	<1.0	<1.0	<1.0	<1.0	<0.1
B-9 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-9 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-10 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-10 27'	<1.0	<1.0	<1.0	<1.0	<0.1
B-11 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-11 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-11 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-12 10'	<1.0	<1.0	<1.0	<1.0	<0.1
B-12 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-12 20'	<1.0	<1.0	<1.0	<1.0	<0.2*
B-12 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 25'	<1.0	<1.0	<1.0	<1.0	<0.1

* NOTE: Variance in detection limit due to matrix interference.

TABLE 5-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D.	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
B-14 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-14 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-14 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-14 25'	<1.0	220.0	113.0	1140.0	<0.1
B-15 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-15 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-15 20'	<1.0	313.0	53.0	614.0	<0.1
B-15 25'	<1.0	277.0	33.0	432.0	<0.1
B-16 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-16 24'	<1.0	<1.0	<1.0	<1.0	<0.1
B-17 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-18 20'	<1.0	30.0	<1.0	729.0	0.4
B-18 25'	52.0	1191.0	<1.0	11691.0	0.9
B-18 30'	8.0	5.0	<1.0	127.0	<0.1
B-18 35'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 30'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 35'	<1.0	<1.0	<1.0	<1.0	<0.1
B-20 20'	<1.0	<1.0	<1.0	34.0	<0.1
B-20 25'	<1.0	<1.0	<1.0	<1.0	<0.1
M-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
M-1 15'	<1.0	18.4	6.9	393.3	<0.1
M-1 20'	<1.0	809.0	120.0	1944.0	<0.1
M-1 25	<1.0	1480.0	207.7	3165.0	<0.1
M-6 8'	<1.0	<1.0	<1.0	<1.0	<0.1
M-6 15'	<1.0	<1.0	<1.0	<1.0	<0.1
M-6 20'	<1.0	<1.0	<1.0	<1.0	<0.1

Appendix K

Installation Restoration Program
Groundwater Flow and Contaminant Transport Model

INSTALLATION RESTORATION PROGRAM
TINKER AIR FORCE BASE, OKLAHOMA
BUILDING 3001 / REMEDIAL INVESTIGATIONS

GROUNDWATER FLOW AND CONTAMINANT TRANSPORT MODEL

Appendix K

by
U. S. Army Corps of Engineers
Tulsa District

January 1988

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INSTALLATION RESTORATION PROGRAM
TINKER AIR FORCE BASE, OKLAHOMA
BUILDING 3001 / REMEDIAL INVESTIGATIONS
GROUNDWATER FLOW AND CONTAMINANT TRANSPORT MODEL

1. Introduction. Computer modeling of groundwater contamination is a useful tool for simulating plume migration under no action and various remedial alternatives. The computer model utilizes field, laboratory, and published data to simulate aquifer conditions and predict future groundwater flow and contaminant migration. A groundwater flow and contaminant transport computer model was developed for the Building 3001 site at Tinker Air Force Base. Past industrial operations at the facility have resulted in contamination of a perched aquifer and the upper portions of the Garber-Wellington Aquifer. The primary contaminants are trichloroethylene (TCE) and chromium (Cr), although other organic compounds and trace metals are present. Both TCE and Cr plumes were modeled. The modeling results presented in the Remedial Investigations (RI) report simulated contaminant plume future movement in 10, 25, and 50 years under a no remedial action plan. Migration rates, flow directions, and amounts of dispersion of contaminant plumes were analyzed over time. The same model will be used to evaluate various groundwater withdrawal plans in the feasibility study in order to select the most effective plan. The remainder of this report presents a description of the model selection, equipment used, site conditions and model development.

2. Model Selection. In selecting the computer model, a number of different models were examined. The main points looked for were proven acceptance of the model, ability to simulate the heterogeneous site hydrogeology, ability to make calculations based on confined or unconfined conditions, and ability to provide results that are meaningful and easily understood. Research of the available literature was performed and the DISCRETE RANDOM WALK MASS TRANSPORT MODEL from Thomas A. Prickett & Ass. was selected. This model provides the user with the basic codes so changes can be made to modify the program and recreate site conditions. The model is well documented and recommended and is able to simulate heterogeneous conditions of the aquifer. Results are connected with a graphics package that provides concentration contours and head contours of the results.

3. Equipment. A variety of hardware and software was used to model the site and the specific problems encountered. The model used was the DISCRETE RANDOM WALK MASS TRANSPORT MODEL by T.A.Prickett and Associates, Urbana,Ill. This model is a combination of a heterogeneous groundwater model and a contaminant transport model. The modeling results were sent to the SURFER graphics package by Golden Software, Inc., Golden Co. The program was run on a IBM AT with a 8087 math coprocessor. An Epson FX-286e and a HP 7550A Graphics Plotter were used for printouts and graphics from the model. A MICROSOFT QUICKBASIC compiler from the Microsoft Corp. was used to compile the basic codes as program modifications were needed. An extended randomed access memory (RAM) card and support software was required to run the program with buffer memory dimensions of a size capable of examining the range of concentrations with adequate resolution.

4. Site Description. Tinker AFB is located in central Oklahoma, in the southeast portion of the Oklahoma City metropolitan area. Building 3001 occupies the northeast portion of the base immediately east of the north-south runway, as shown in figure K-1.

The contamination is mainly under the building and limited to the top 175 feet below the surface. Contamination occurred by vertical and horizontal migration from solvent pits, utility lines, and possibly East and West Soldier Creeks.

The Garber-Wellington aquifer underlies Tinker AFB and consists of lenticular and interbedded sandstones, shales, and siltstones. It has a thickness of approximately 900 feet under the Base. The recharge area for the aquifer covers the eastern half of Oklahoma County including Tinker AFB. The aquifer is an important source of potable water in the Oklahoma City area. Wells on Tinker AFB are generally screened at depths of approximately 250 to 700 feet.

Remedial investigations (RI) revealed complex and variable hydrogeologic conditions. A conceptual model was developed which divides the aquifer into 4 typical zones, based roughly on depth.

The first zone encountered is a perched aquifer, which is the most affected by the contamination. Groundwater contours for the perched aquifer are shown on drawing 7 of the RI report. The perched aquifer serves as a recharge and contaminant source to deeper aquifer zones. Complete tables of the contaminants detected in the perched aquifer are given in the RI report in tables 8.11 and 8.12. The plumes of 11 of the most significant contaminants are contoured on drawings 10-20. This aquifer is unconfined and located at an approximate depths of 15 to 35 feet below the surface.

The next aquifer zone is referred to as the top of regional zone, which is a semi-confined leaky aquifer encountered between depths of approximately 70 to 110 feet below the surface. Piezometric contours for the zone are shown on drawing 8 of the RI report. The listing of contaminants detected in this zone is given in the RI Report in table 8.14 and plume drawings for 8 of the most significant contaminants are shown as drawings 21-28.

The third zone is called the regional zone and is a confined aquifer with a piezometric surface just a few feet below the piezometric surface of the top of regional zone. The regional zone is encountered between depths of approximately 110 and 175 feet below the surface with much lower contaminant concentrations and smaller areas of contaminant plume spread. Piezometric contours for this zone are shown on drawing 9 of the RI report. A complete list of detected contaminant concentrations and acreage is given in the RI Report in Table 8.16. Plumes for 7 of the most significant contaminants are shown on drawings 30-36.

The fourth zone is the producing zone, the zone where the water supply wells are screened. This zone is encountered at 250 to 700 feet below the surface. Six procucing wells are located in the vincinity of Building 3001. This aquifer zone was not modeled because only trace levels of contaminants were detected in two of the six wells.

The perched, top of regional, and regional groundwater zones were modeled. Although several contaminants are present in the 3 zones, only TCE and Cr were modeled because they contain the most significant range of concentrations and their plumes cover the largest areas of the site. All other contaminants lie within the plumes of TCE and Cr. Table 4.1 lists the range of concentrations of TCE and CR and their approximate plume areas in the 3 zones.

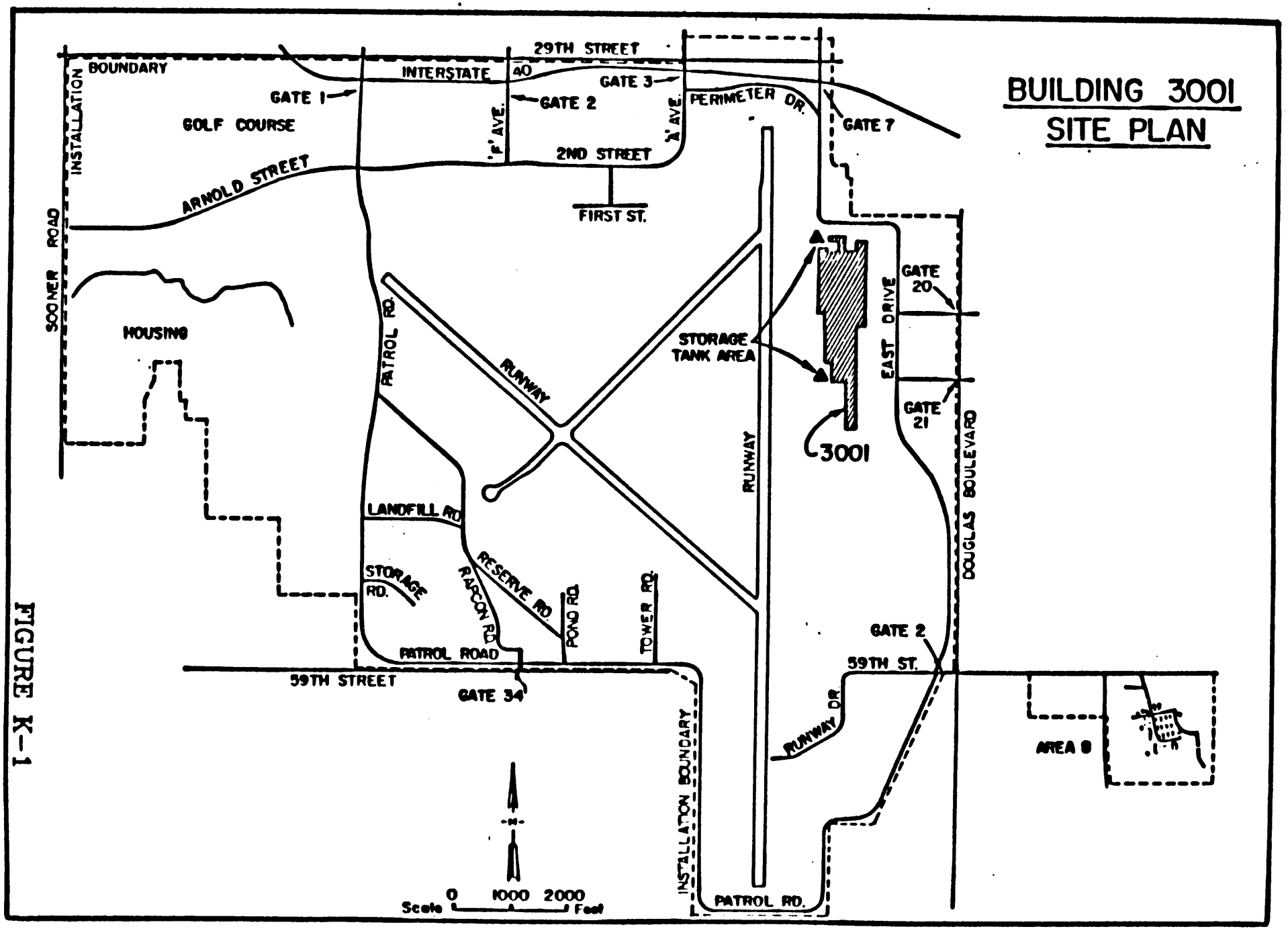

BUILDING 3001
SITE PLAN
INSTALLATION BOUNDARY
GATE 1
GOLF COURSE
INTERSTATE 40
29TH STREET
GATE 3
GATE 2
'F' AVE.
'A' AVE.
PERIMETER DR.
GATE 7
2ND STREET
ARNOLD STREET
FIRST ST.
SOONER ROAD
HOUSING
PATROL RD.
RUNWAY
STORAGE TANK AREA
3001
GATE 20
EAST DRIVE
GATE 21
RUNWAY
DOUGLAS BOULEVARD
LANDFILL RD.
STORAGE RD.
RESERVE RD.
RACCON RD.
POND RD.
TOWER RD.
PATROL ROAD
59TH STREET
GATE 34
GATE 2
59TH ST.
RUNWAY DR.
AREA B
INSTALLATION BOUNDARY
PATROL RD.
0 1000 2000
Scale Feet

FIGURE K-1

TABLE 4.1

ZONE	TCE range (PPB)	TCE area (acres)	CR range (PPB)	CR area (acres)
PERCHED	<5 - 330,000	137	<10 - 80,000	221
TOP-REGIONAL	<5 - 30,000	181	<10 - 1,700	153
REGIONAL	<5 - 1,000	78	<10 - 1,200	145

5. Model Application. The specific area simulated by the model is a square 4800 feet by 4800 feet with the southwest corner at state plane coordinates East 2,182,700 and North 151,800 as shown on figure K-2. A map of this area was overlayed with a 16 by 16 node grid that resulted in a 300 feet node spacing for parameter input. The number of nodes in the grid was limited by the available RAM that was utilized to have a large buffer space to accommodate the large range of concentrations. The simulation of the groundwater flow and contaminant transport was accomplished in two stages. The first stage was the development and implementation of a groundwater flow model to calculate heads and velocities of the groundwater in each zone, and the second stage incorporated the output from the groundwater model to simulate movement of the contaminants. Calibration of the model is discussed in paragraph 5c.

a. Groundwater Parameters. The hydrogeologic parameters input to the groundwater flow model include:

Hydraulic head
Hydraulic conductivity (permeability)
Aquifer confining top layer elevation
Aquifer confining bottom layer elevation
Withdrawal coefficent/unit area
Leakance coefficent
Leakance source head elevation
Storage coefficent

The groundwater flow model parameters were obtained from a variety of field measurements, slug tests, laboratory tests, published data, and evaluation of geophysical logs. The slug testing is discussed in detail in Appendix N. A definition of each parameter is provided in the following paragraphs, as well as the rationale for assigning parameter values. The parameters can be input in english or metric units. In this case english units were used and are given for some of the parameters along with ranges and average values in table 5.1.

TABLE 5.1
Selected Hydrogeologic Parameters For The Groundwater Model

Parameter	Perched Zone		Top-Regional		Regional	
	Range	Ave.	Range	Ave.	Range	Ave.
Permeability (gpd/ft^2)	12-24	15.5	10-34	15.61	4-8	6.8
Thickness (ft)	1-29	11.5	11-40	26.3	42.5-59.7	50.8
Storage C. (unitless)	42E-5-.042	.0032	0-.001	.17E-4	1E-5 -.001	48E-5
Leakance C. (gpd/ft^3)	0-.007	.001063	0-.0009	.71E-4	0-.04701	.001087
Withdrawal C. (gpd/ft^2)	0-.0199	.001987	0-.018	.002856	0-.018	.002968

1) Hydraulic Head. The hydraulic head is the water table elevation for the perched zone and it is the piezometric surface for the top of regional and regional zones. The piezometric surface is the elevation to which the confined water will rise in a well open to the atmosphere. The hydraulic head was input in units of feet at each grid node based on contour maps obtained from field measurements in monitoring wells across the site. Contour maps for each zone were obtained from 46 monitoring wells screened in the perched zone, 30 wells in the top of regional zone, and 12 wells in the regional zone.

2) Hydraulic Conductivity. The hydraulic conductivity (permeability) is a measurement of the aquifer's ability to conduct water through the subsurface stratum under the influence of a hydraulic gradient, which is the difference in heads divided by the distance between two points. It is a property of both the porous medium and the fluid flowing through it. The higher the permeability the better the aquifer conducts water. The hydraulic conductivity was input in gallons per day per square feet (gpd/ft^2) ateach node. Values for this parameter were obtained from slug tests in 5 wells in the perched, 9 wells in the top of regional, and 2 wells in the regional zones. This data was used to contour a map of hydraulic conductivity so that a value at each node could be input to the model. The methods used to calculate hydraulic conductivity are described in appendix N.

3) Aquifer Confining Layers Elevations. Aquifer upper and lower confining layer elevations were input to the model at each node (in feet) from contour maps obtained from the geophysical logs of 36 boreholes across the site. In the confined aquifer zones, the computer model uses this data to determine thickness of the aquifer at each node. In the perched aquifer zone the computer

model subtracts the bottom confining layer elevation from water table elevation to determine thickness at each node. The thickness is utilized by the model to calculate a transmissivity value for each node. Transmissivity is the ability of the aquifer to transmit water through its entire thickness; it is equal to the product of the hydraulic conductivity and the thickness of the saturated zone. The model calculated this parameter at each node and utilized it for calculations of contaminant movement.

4) Withdrawal Coefficent Per Unit Area. The withdrawal coefficent represents a constant volume of water leaving the aquifer per day, per unit area. Examples of this are discharges from the aquifer into the lower zones, gaining streams, constant pumping to the surface, and/or evapotransporation. If the value is input as a negative number, this would result in a constant volume of water entering the aquifer. The withdrawal coefficent per unit area was input at each node in units of gallons per day per square feet (gpd/ft^2). This parameter was determined by trial and error in conjunction with the leakance coefficent to calibrate the model so that the head at each node would remain constant with time.

5) Leakance Coefficent Per Unit Area. The leakance coefficent represents the amount of water leaking into the aquifer per unit area from the surface or the aquifer zone above per day, per difference between the source head and the aquifer head. The units of this parameter are gallons per day per cubic feet (gpd/ft^3) and can be determined by the quotient of the permeability of the soil above the aquifer divided by the head difference between the source and the aquifer. The leakance coefficent was determined by trial and error in conjunction with the withdrawal coefficent to calibrate the groundwater model to maintain the constant head elevations with time.

6) Leakance Source Head Elevation. This is the elevation of the source that is leaking into the aquifer, such as a surface water body that is infiltrating into an aquifer, leachate from landfills, or an upper aquifer that is leaking downward. The hydraulic head for the aquifer is subtracted from the leakance source head into the aquifer to determine a head difference. In the model, this head difference is multiplied by the leakance coefficient per unit area to calculate a volume of water leaking into the aquifer per unit area. This results in a water volume source that is head dependent. As the aquifer head drops, the volume of water leaking into the aquifer increases, and as the head rises, the volume decreases. If the hydraulic head in the aquifer rises above the source head the result would be a volume of water leaving the aquifer. In the perched aquifer zone this elevation was taken to be at a constant height of 3 feet above the hydraulic head to simplify the calibration of the groundwater flow model. In the top of regional aquifer zone the leakance source is the perched water table and in the regional aquifer zone it is the piezometric surface of the top of regional zone.

7) Storage Coefficient. In an unconfined aquifer, such as the perched zone, the storage coefficent is essentially equal to its specific yield , the volume of water that a saturated soil will yield per unit volume of aquifer under the sole influence of gravity. In a confined aquifer, such as the regional zone, the storage coefficient is the volume of water that an aquifer will release or take into storage per unit surface area of the aquifer per unit change in the

elevation of head for that surface. This parameter was estimated from slug tests (it is discussed in more detail in Appendix N) and compared with other general methods of estimations (Todd, 1980) and published data (Wood, 1968). Five values in the perched aquifer, 9 in the top of regional and 2 in the regional aquifer zones were used to make contour maps of the storage coefficent values. The maps were then overlaid with the grid and storage coefficent values were input to the model at each node as a unitless number.

b. Transport Parameters. The contaminant transport model parameters were input as average values for each aquifer zone and include:

Porosity
Longitudinal Dispersivity
Transverse Dispersivity
Retardation Coefficient
Particle Mass

Values assigned to these parameters were obtained from laboratory tests, published data, existing contaminant plume spread, and desired concentration resolution within a given computer random access memory (RAM) size. A definition of each parameter and the rationale for assigning parameter values is given in the following paragraphs. Table 5.2 lists values for the parameters used in the transport phase of the model.

Table 5.2

Basic Transport Coefficients

	Perched	Top-of-Regional	Regional
Porosity	.20	.20	.20
Longitudinal Dispersivity (ft)	90	180	200
Transverse Dispersivity (ft)	15	30	75
Retardation Coefficent	1	1	1
Particle Mass (lb)	TCE-.6	TCE-.3	TCE-.2
	CR-.2	CR-.2	CR-.2

1) Porosity. Porosity is an aquifer parameter defined as the volume of voids per total volume of the unit of aquifer media and is expressed as a decimal. In the model, the effective porosity, which is the portion of voids interconnected through the total volume of the unit of media, is needed. This parameter was estimated by laboratory testing of soil samples from the 3 aquifer zones, resulting in a range of .17 to .32. Values were compared with published data (Wood, 1968) and an average effective porosity of .20 was used in the three zones modeled.

2) Longitudinal Dispersivity. Longitudinal dispersivity accounts for lateral diffusion and velocity stratification in the direction of the groundwater flow. The longitudinal dispersivity in the perched zone was based on the assumption that 10% of the contaminants have traveled approximately 900 feet in 35 years. Similar assumptions were made for the top-of-regional and the regional zones. These assumptions were based on the distance beyond the assumed source from which contamination has migrated during approximate time of industrial use of the chemical. Plume movements were repeated with differing longitudinal and transverse dispersivities until a dispersivity combination was found to accomplish a movement equal to the assumed past movement.

3) Transverse Dispersivity. Transverse dispersivity accounts for lateral diffusion and velocity stratification perpendicular to the direction of goundwater flow. The transverse dispersivity in the perched zone was based on the assumption that 10% of the contaminants had traveled approximately 150 feet in 35 years. Similar assumptions were made for the top-of-regional and the regional zones. These assumptions were based on the transverse distance beyond the assumed source from which contamination has migrated during approximate time of industrial use of the chemical. Plume movements were repeated with differing transverse dispersivities in conjunction with differing longitudinal dispersivities until a combination of longitudinal and transverse dispersivities was determined to accomplish a movement equal to the assumed past movement.

4) Retardation Coefficient. The retardation coefficent represents the effect of chemical adsorption to the aquifer media of the contaminant. This adsorption retards the flow of the solute in relationship to the flow of other solutes that do not adsorb to the media. A retardation coefficient of 1 was used for both TCE and Cr since the plumes appear to have spread equally. This is based on estimates of past movements of the contaminates in relation to groundwater flow and the fact that the TCE is soluble above the concentrations in the aquifer. Migration due primarily to groundwater flow was modeled, which is the case of no remedial actions. As a worst case during the modeling of the recovery systems, the retardation coefficient for Cr may be raised accordingly by calculation and estimation of past sources and movements of the plumes. Tracer tests for determining movement parameters were considered to be impractical in a reasonable time frame due to low permabilities in the aquifers.

5) Particle Mass. The particle mass represents a unit of contaminant in the model and is calculated from the size of a single grid area, thickness of the aquifer zone, porosity, desired concentration per particle, and density of water. A particle mass was calculated to be as low as possible to achieve the greatest resolution within a grid area (ideally 10 ppb). In the perched zone a large number of particles of small mass was needed to represent the large range of concentrations (10 to over 300,000 ppb) at a node. The number of particles was limited by the random access memory (RAM) of the computer since the dimension statement had to be changed to create a buffer space for the large number of particles. This necessitated a balance between the need to simulate large concentrations and the desire for high resolution.

c. Continuous Source Contaminants. This is a 2-dimensional model but the movement of contaminants is 3-dimensional. Therefore, it was necessary to

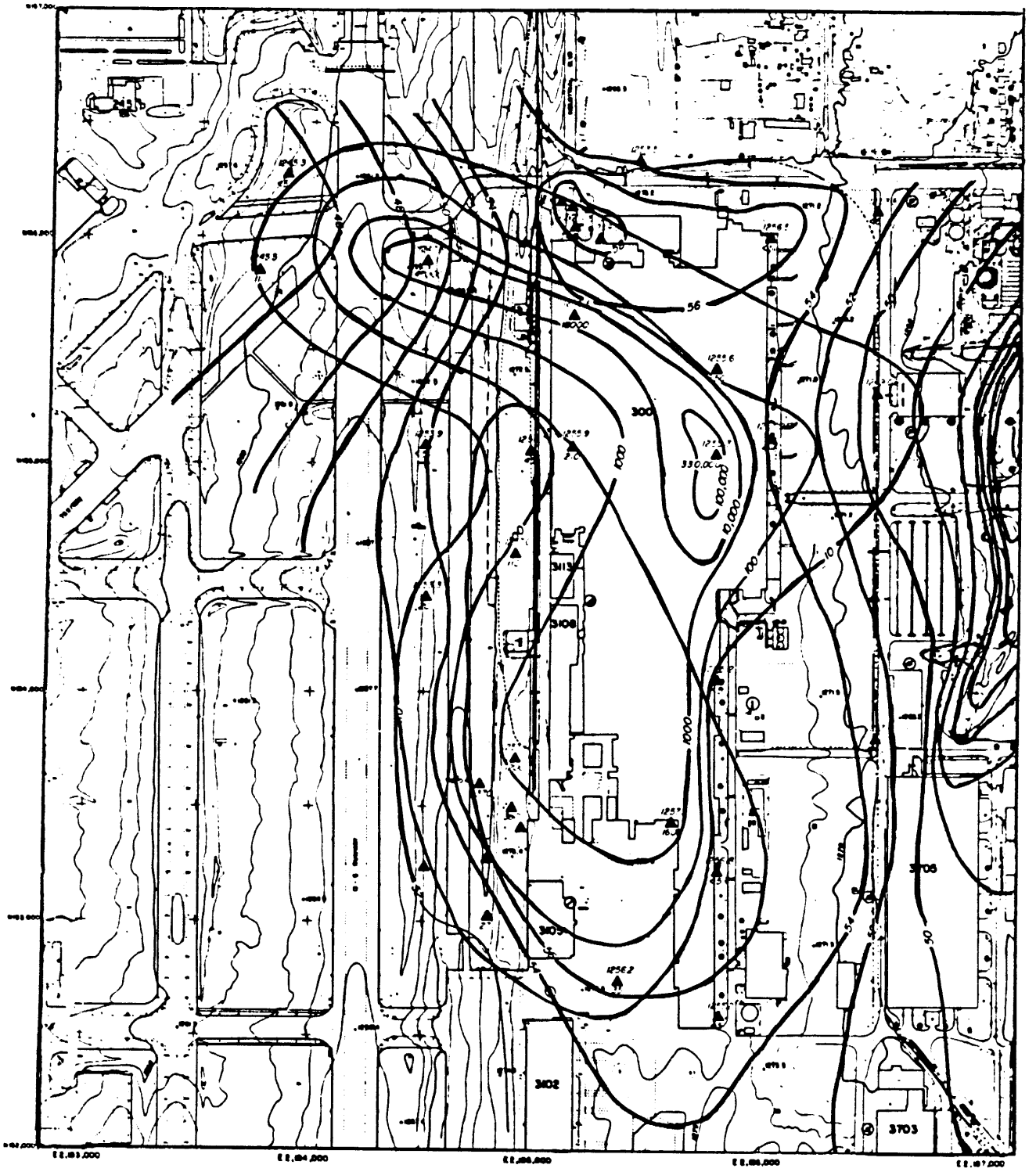
introduce contaminant continuous sources to each of the 3 zones to accurately simulate the complex aquifer system. If the water that is leaving a node is contaminated, the model will automatically remove contaminant particles during the movement simulation. The incoming continuous source particles had to be calculated and inserted into the model by determining the volume of water at a node that was leaking into the aquifer and assuming a concentration of the water based on concentration at the nodes above and/or below the leaking node. The calculated amount of particles was input at the leaking node per given time span of movement. The initial number of continuous source particles was assumed to decrease by 10% each decade of movement. This assumption was based on the theory that, as the contaminating sources have been removed, the infiltration of clean water through the recharge area under and around the site will flush the contaminated soil, decreasing the contamination until there is minimal contamination in the unsaturated zone. This will remove any source for the perched zone, which will clean itself over an extended period of time by discharging contaminants into Soldier Creek and the lower aquifer zones and also through lateral dilution. This will remove the source for the top of regional aquifer zone which will clean itself as contaminants move to the regional aquifer zone and laterally through dilution. This process will continue until all of the contamination has diluted or moved to lower zones.

d. Calibration. Due to the fact that historical data on specific location of sources, time of initial contamination, duration of contamination, and past groundwater elevations are not available, the model was calibrated assuming that the heads in the zones are constant over time. Also, the present contaminant concentrations are the starting point for the modeling (see figure K-2).

The groundwater model was calibrated by adjusting the leakance and withdrawal coefficients to maintain the present heads to within plus or minus one foot over a hundred year movement and to within .5 percent of unaccounted water. A comparison of the present heads, as input elevations, with computer generated heads after 25 years of simulated movement is shown in figure K-3 for the perched zone. This was accomplished by a trial and error method of adjusting coefficients and running the model repeatedly until resulting heads were within the limits stated above. The withdrawal from the perched zone was considered to be the leakance into the top of regional zone and the same was done for the top of regional into the regional zone. The matrices on figure K-3 that are titled catagory printout represent the elevations of the hydraulic head at each node. The node elevation can also be shown in a printout to the hundreth of a foot.

The contaminant transport portion of the model was calibrated by inserting contaminant particles until the initial model concentration contours were a reasonable reflection of the present contours generated from the monitoring well network laboratory data. An example of initial concentration input and resulting concentrations is shown in figure K-4.

e. Discussion. The resolution required to look at a range of 10 to 300,000 PPB concentrations in a single aquifer required a very large number of contaminant particles, each having a small mass. This necessitated one of the many changes in the program codes. Each time a change was made to a program code it had to be recompiled to run efficiently. As a result of increases in the dimension statement, a large amount of RAM resident memory was required to run the program. The large range of concentrations and the size of the plumes also increased the amount and the complexity of data input. An example of this is the



SITE MAP OF BUILDING 3001 WITH PERCHED

G.W. CONTOURS AND TCE CONC. CONTOURS

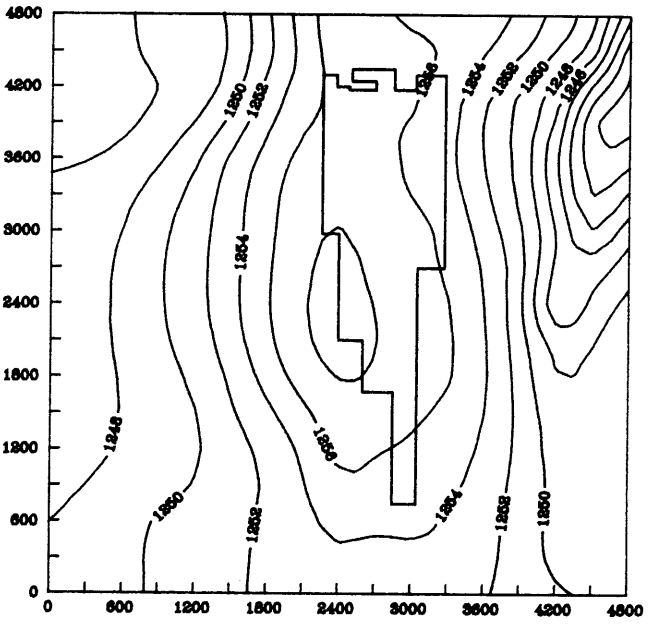
FIGURE K-2

Water into storage = 910.2582 Water due to pumpage = 46440
Water due to R(I,J) = 47367.61
Percentage of unaccounted water =-3.737181E-02

CATEGORY PRINTOUT

44 45 46 46 48 51 55 57 56 55 55 54 53 50 48 41
44 45 46 46 47 51 54 57 57 56 55 53 52 49 47 37
44 45 45 46 48 52 54 56 56 56 54 52 49 47 40 37
45 45 46 47 50 53 55 56 56 55 54 51 49 45 36 37
45 46 47 49 52 54 56 56 56 55 54 51 49 43 37 39
46 47 48 50 52 55 57 57 56 55 54 52 49 44 38 42
46 47 49 50 53 55 57 58 57 56 55 53 50 45 40 45
47 47 49 50 53 55 57 58 57 56 55 53 51 44 44 47
47 47 49 50 53 55 57 58 57 57 56 53 50 42 46 48
47 47 49 50 52 55 57 58 57 57 56 54 51 46 47 49
47 47 48 50 52 54 56 58 57 57 56 54 51 47 48 49
47 47 48 49 51 53 55 57 57 56 55 54 51 48 48 49
47 47 48 49 50 52 54 56 55 55 54 53 51 49 48 49
47 48 48 49 50 51 53 55 55 54 54 53 51 49 49 49
47 48 49 50 51 51 53 54 54 54 53 52 50 49 49 49
47 48 50 50 51 52 53 53 52 53 53 52 50 49 49 49

PRESENT PERCH G.W. ELEV. MATRIX
FROM COMPUTER PRINTOUT OF HEADS



PRESENT GROUNDWATER CONTOURS

Water into storage = 63.4385 Water due to pumpage = 45801
Water due to R(I,J) = 45881.29
Percentage of unaccounted water =-3.678447E-02

CATEGORY PRINTOUT

45 45 47 46 48 51 55 57 56 55 55 55 53 51 49 42
45 45 46 46 48 51 54 57 57 56 55 54 52 49 47 37
45 45 45 46 48 52 55 56 56 56 55 52 49 47 41 37
45 45 46 47 50 53 55 56 56 56 55 51 49 46 36 37
45 46 47 49 52 54 56 57 56 55 54 52 49 44 38 39
46 47 49 50 53 55 57 57 56 55 55 52 49 45 39 42
47 48 49 51 53 55 57 58 57 56 55 53 50 46 41 46
47 48 49 51 53 55 57 58 57 56 56 54 51 45 45 47
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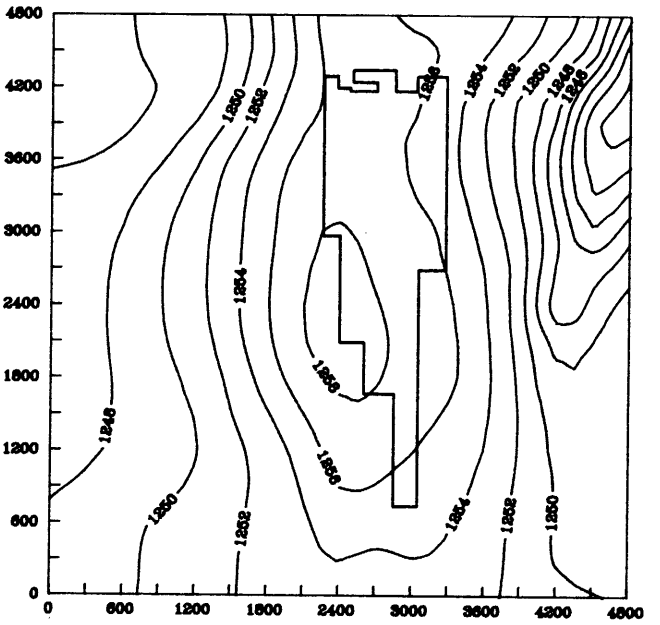
47 48 49 50 52 54 57 58 58 57 56 54 51 47 48 50
47 48 49 49 51 53 55 57 57 56 55 54 51 48 48 50
47 48 49 49 51 52 54 57 56 56 55 54 51 49 49 49
48 48 49 50 51 52 54 56 55 55 54 53 51 49 49 49
48 49 50 50 51 52 53 54 54 54 54 53 51 49 49 49
48 49 50 50 51 52 53 54 53 54 53 52 51 49 49 49

25 YR PROJ. PERCH G.W. ELEV. MATRIX
FROM COMPUTER PRINTOUT OF HEADS

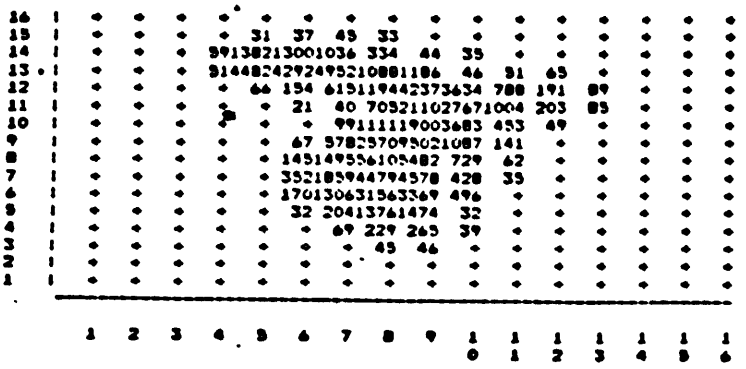


PROJECTED 25 YEAR PERCH G.W. CONTOURS

COMPARISON OF G.W. ELEV. IN PERCHED ZONE

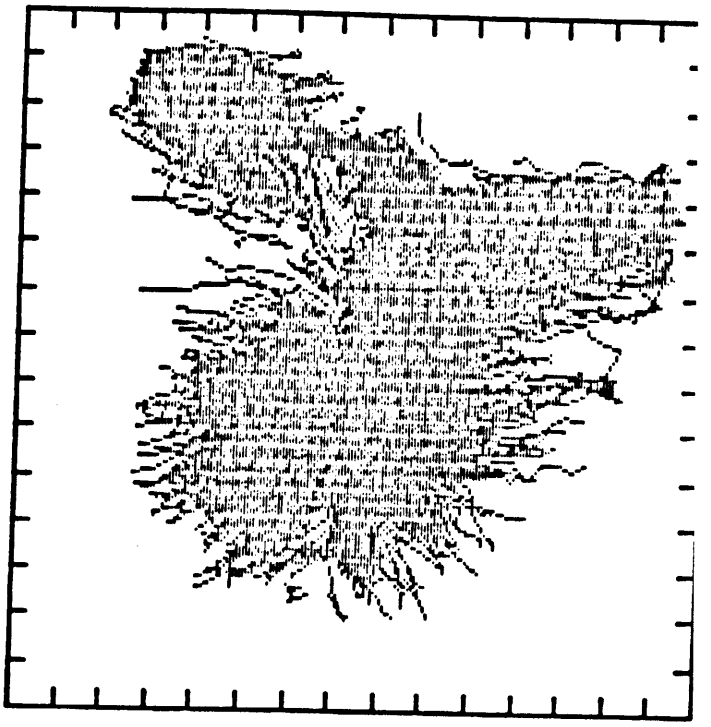
BEFORE AND AFTER 25 YEARS OF MOVEMENT

FIGURE K-3



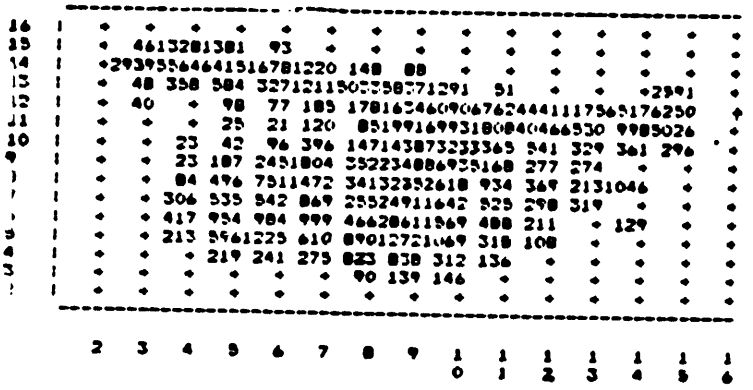
INPUT TCE CONC. IN PERCHED ZONE (PPB)

FROM THE COMPUTER PRINTOUT



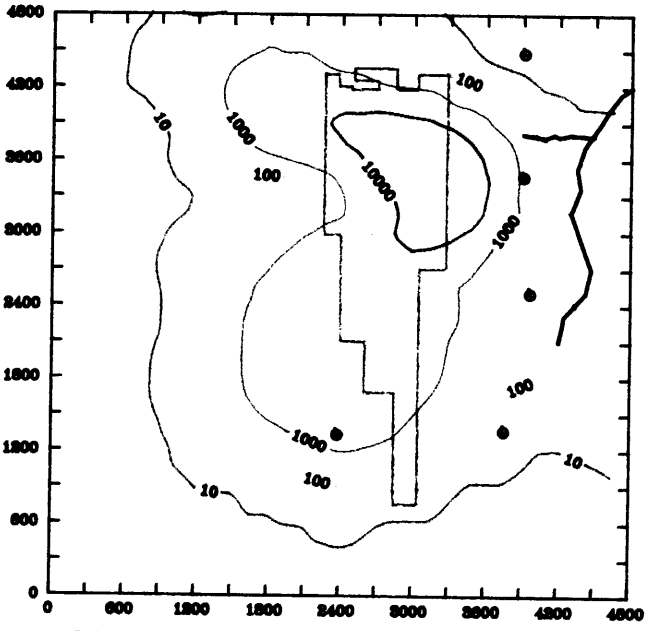
TCE PARTICLES MOVING DURING 25 YEARS IN

PERCHED ZONE FROM THE COMPUTER PRINTOUT



TCE CONC. IN PERCHED ZONE (PPB) AFTER 25 YEARS

OF SIMULATED MOVEMENT FROM THE COMPUTER PRINTOUT



PROJECTED CONC. AT 25 YEARS (PPB)

AN EXAMPLE OF COMPUTER SIMULATED CONTAMINANT MOVEMENT IN THE PERCHED ZONE

FIGURE K-4

14,500 particles initially input to simulate the TCE plume in the perched aquifer zone at present. To simulate the effect of the continuous sources, another 8,630 particles were input during the 10 year movement simulation, 11,205 particles were input during the 10 to 25 year movement simulation, and 14,636 particles were input during the 25 to 50 year movement simulation. The ppb concentration map of the perched TCE plume is shown on the upper left hand corner of figure K-4. The concentrations can also be shown in ppm or the number of particles assigned to each node can also be mapped. These different maps are very useful in getting a quick idea of where the particles are moving, the resulting concentrations after particle input, or new concentrations after movement. The map of particle movements for the 10 to 25 year simulation is shown in the upper right hand corner of figure K-4.

The graphic output of the modeling assumes a homogeneous concentration within the thickness of the zone modeled. Shown in figures 8-12, 13, 16, 17, 20, and 21 of the RI report is the fate of the contaminants currently in the aquifer zones and the additional continuous source contaminants migrating into the aquifer during the simulated movements. The "3-D" surface representative plots shown in the RI report of the groundwater zones (figures 8-10, 11, 14, 15, 18, and 19 shown in the RI report) indicate that direction of flow and thickness of the aquifer zones have a great influence on the contaminant concentrations at present and with future migration. The biggest problem encountered with the modeling was the lack of data to directly obtain some parameters. Although numerous wells were installed and a large number of tests were run, it is very difficult to obtain such parameters as dispersivity and retardation coefficients for inorganics. The sheer magnitude of the contamination and the size of the site created special difficulties in studying the aquifer system with sufficient detail adequate to recreate the complex heterogeneous hydrogeologic system.

6. Summary. A groundwater flow and contaminant transport model was developed and calibrated to simulate the aquifer zones and plume movements. The simulated effects of groundwater flow on TCE and CR plume migrations in 10, 25, and 50 years has been modeled for a no remedial action plan in the perched, top of regional, and regional zones. The results are discussed in section 8.5 of the RI report (volume 1).

References

1. Golden Software, Inc., Golden, CO, 1987, "Surfer" Computer Graphics."
2. Microsoft, "Microsoft Quick Basic Compiler for IBM Personal Computers and Compatibles.", Version 3.0, 1987,
3. Prickett, T.A. and Lonnquist, C.G.,"Selected Digital Computer Techniques for Groundwater Resource Evaluation.", Illinois State Water Survey BullIetin 55, 1971, NTIS PB220-415
4. Prickett T.A., Naymik T.G. and Lonnquist C.G., "A `Random-Walk' Solute Transport Model for Selected Groundwater Quality Evaluation.", Bulletin 65, Illinois State Water Survey, Champaign, IL, 1981
5. Prickett T.A. & Associates, Inc.; "Selected Plasm and Random Walk Groundwater Models for the IBM-PC Desktop Computer.", Version 3.0, Urbana, IL, 1985
6. Todd D.K., Groundwater Hydrology., Second Edition, John Wiley Publishing,1980
7. U. S. Army Corps of Engineers, Tulsa District, January 1988, "Building 3001 Remedial Investigations Report."
8. Wood P.R., and Burton L.C., "Ground-Water Resources Cleveland and Oklahoma Counties.", Oklahoma Geological Survey Circular 71, 1968

APPENDIX L

CONSULTANT TECHNICAL REVIEW SUMMARY

CESWTED-GP

11 June 1987

MEMORANDUM FOR RECORD

SUBJECT: Responses to Recommendations in AE Technical Review, Building 3001 Site Evaluation, Tinker AFB, Installation Restoration Program (IRP)

1. In March 1987, P. E. LaMoreaux and Associates (PELA) prepared a technical review report of the IRP remedial investigations to date conducted by the Tulsa District COE at Building 3001, on Tinker AFB. PELA is a consulting firm specializing in hydrogeology and environmental science. The objectives of the study were to evaluate the available data and prepare recommendations concerning additional data necessary for design of a remedial action, conducting field tests, and the validity of the Tulsa District interpretation of the complex hydrogeologic conditions and the contaminant plumes. The report is titled "Summary Report of Existing Data, Building 3001 Site Evaluation, Installation Restoration Program, Tinker Air Force Base, Oklahoma", and was done by Contract No. DACA56-87-M-0017. PELA made nine recommendations, which are listed on pages 4 through 7 of the report. The Tulsa District's responses to these recommendations are discussed below.

2. Responses to Recommendations.

a. Recommendation 1. Three borings were made at the site (borings 1-7c, 1-8c, and 1-11c) in March 1987, collecting undisturbed soil samples for testing and correlating with geophysical logs. Samples were tested for dry density, hydraulic conductivity, grain size, moisture content, specific gravity, and Atterburg limits. Samples were compared with the corresponding geophysical logs to establish a baseline for geophysical signatures. A hydrogeologic correlation was then developed with the remaining wells at the site, where only geophysical logs were produced.

b. Recommendation 2. An evaluation of the geophysical logs at the site was performed and the shale and sandstone units, characteristic of the aquifer zones, were mapped out. Also laboratory test results for chemical and physical parameters were evaluated along with groundwater elevations to correlate the relationships of the surface waters, perched aquifer, and regional aquifer. A groundwater model has been developed for aiding in evaluating the complex aquifer systems. Data obtained in the above mentioned evaluations was used to help calibrate the computer model.

c. Recommendation 3. Drainage patterns are known at the site based on topographic maps and utility drawings. A study of these, along with the perched water table contours, helped identify recharge zones to the aquifer.

d. Recommendation 4. A soil survey inside Building 3001 is planned for July 1987. At least 3 locations will be drilled and sampled to depths of approximately 25 feet. Samples will be analyzed to determine the concentrations of contaminants in the vadose zone so that the feasibility of in-situ treatments (such as flushing) can be evaluated.

e. Recommendation 5. High pH values and Ba concentrations are being evaluated. Contours of the pH indicate that values are elevated beneath the building in the upper regional zones. Ba concentration contours appear higher closer to or beneath the building in the perched and top of regional zones, but do not correlate in the regional zone. Resampling of the wells is scheduled to be done and parameters such as sulfates, calcium hardness, hydroxide, carbonate, and bicarbonate alkalinities, Na, Ba, Ca, K, Mg, pH, chlorides, and nitrates will be evaluated.

f. Recommendation 6. A pumping test was conducted at the site in April 1987. Water supply wells 14, 15, and 16 were pumped and several monitor wells were continuously recorded for a 2-week period. Although the production wells affected each other, there was no noticeable affect on the monitor wells in the upper regional zones and the perched zone. The Tinker AFB Groundwater Assessment recommends that water levels be recorded in all water supply wells when sampled and recorded at least monthly. Some wells are recommended to be shut down for a 2-week period twice a year so static water levels can be obtained. The groundwater assessment also recommends that flow meters be installed on each water supply well so actual quantities pumped can be recorded on a monthly basis. This data will assist in determining cones of depression and areas of influence.

g. Recommendation 7. Head differentials have been evaluated in all of the aquifer zones. Contour maps have been developed.

h. Recommendation 8. Seven piezometers have been installed in the vicinity of East Soldier Creek in order to determine the relationships between the perched water and creek. The results indicate that the perched water discharges to the creek.

i. Recommendation 9. The wells referred to as being drilled with improper techniques are seven wells installed during earlier phases of the IRP, which employed air drilling techniques. Holes were advanced with air through the perched aquifer, into the regional aquifer and left open for 24 hours. This can promote vertical migration of contaminants from the perched water into the regional zones. All wells installed by the COE were installed by casing off between groundwater zones or using natural drilling mud to seal off the zones.

CLIF WARREN
Civil Engineer

P.E. LaMoreaux & Associates
Consulting Hydrologists, Geologists & Environmental Scientists

HAND DELIVERED

March 27, 1987

Mr. John Roberts
Tulsa District
U.S. Army Corps of Engineers
224 South Boulder
Post Office Box 61
Tulsa, Oklahoma 74121-0061

RE: Contract No. DACA56-87-M-0017
PELA No. 486600

Dear Mr. Roberts:

P. E. LaMoreaux & Associates, Inc. (PELA) is pleased to transmit one (1) unbound original and two (2) bound copies of PELA's report entitled "Summary Report of Existing Data, Building 3001 Site Evaluation, Installation Restoration Program, Tinker Air Force Base, Oklahoma, Phase IV Remedial Actions."

If you have any questions, please call,

Sincerely yours,

Lois D. George
Project Director

Philip E. LaMoreaux, Jr.
Vice President

LDG/PELjr/bjm
B77A/01

Enclosures: Three

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PELA

SUMMARY REPORT OF EXISTING DATA, BUILDING 3001
SITE EVALUATION, INSTALLATION RESTORATION PROGRAM
TINKER AIR FORCE BASE, OKLAHOMA
PHASE IV REMEDIAL ACTIONS

CONTRACT NO. DACA56-87-M-0017

(PELA No. 486600)

Prepared for

Tulsa District
U.S. Army Corps of Engineers
224 South Boulder
Tulsa, Oklahoma 74121-0061

By

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March 27, 1987

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CONCLUSIONS AND RECOMMENDATIONS

The Tulsa Corps of Engineers' professional staff has completed the assimilation and evaluation of the data that provide a basis for an understanding of the geology, hydrogeology, geochemistry and identification of contamination within the vertical-horizontal plume. The interpretation to date also provides the basis for identification of specific steps required for the development of the most effective remedial plan.

The following are conclusions based on PELA's evaluation of the interpretation of basic data completed by the Tulsa Corps of Engineers (COE) and literature furnished to PELA by the COE. (For a complete list of data provided see Selected References.)

Conclusions

1. On a regional basis the saturated units are hydraulically connected throughout the entire sequence and therefore are considered as a single aquifer. However, a shallow perched zone occurs under Building 3001 that is separated from the main body of ground water by an aquitard. The extent and recharge area of the perched zone have not been fully defined.

2. Lithologies in the vicinity of Building 3001 are variable in nature and require further evaluation as related to other

phases of the feasibility studies. The parameters associated with depositional environments (deposit thickness, shape and orientation, and lithologic characteristics) of the aquifer must be interpreted to aid in positioning remedial wells in the most beneficial locations.

3. The relationship between surface-water drainage and ground water needs to be more clearly defined for the perched zone in the vicinity of Soldier Creek. If hydraulically connected, Soldier Creek could serve as a discharge point for contaminated perched water. In addition, Soldier Creek could be an additional source of contamination from surface runoff not related to the Building 3001 site.

4. Contaminants have been detected in water supply wells 18 and 19. A review of the well plugging report indicates corrosion holes in the casing and open sections along the annulus that could have been avenues for the movement of contaminants. These wells have since been plugged to required specifications and should no longer be considered as pathways for downward migration of contaminants.

5. The area of influence caused by the pumping of the water supply wells that intercept point sources of contamination is a potential mechanism for the migration of contaminants. An adequate system does not exist to determine individual supply

well pump rates and drawdown or to determine the area of influence caused by pumping within the aquifers. The existing data indicate that the top of the regional aquifer is not affected by the pumping of supply wells.

6. On the basis of review of available lithologic descriptions and the results of slug tests, there is a vertical variation in the transmissivity of the Garber-Wellington aquifer.

7. Elevated concentrations of TCE and chromium in the aquifers are illustrated by the geochemical and hydrologic maps prepared by the Tulsa COE. These maps effectively define the vertical and horizontal extent of the two contaminants. The higher concentrations are in the upper, non-producing level of the regional aquifer and the perched aquifer under Building 3001. The contaminant plume extends from Building 3001 in two directions suggesting a lithologic influence on migration of contaminants.

8. At and adjacent to Building 3001, the contaminant source area, the highest concentrations of chromium appear to be located in water below the thickest section of surficial clay/-shale. Heavy metals, of which chromium is one, have an affinity for clay particles. This is additional evidence that lithology and depositional environment will have an affect on migration of contaminants.

9. Anomalous values for pH, specific conductivity, barium, and total volatile organics are indicated by the COE's laboratory results. The drinking water standard for barium is exceeded in several wells. Contamination extends beyond the boundary of Building 3001. The vertical and horizontal extent is well defined for TCE and chromium.

10. The air drilling techniques used in the early stages of the program to install monitoring wells may have promoted migration of contamination.

Recommendations

The recommendations provided herein are based on PELA's review and interpretation of the data available regarding the geology, hydrology, and water quality in the vicinity of Building 3001. The implementation of these recommendations will provide the necessary facts on which to detail the development of the most effective remediation plan.

1. A more detailed definition of geology has to be determined by correlating geophysical logs with detailed lithologic descriptions of new monitoring wells. PELA recommends drilling of at least three (3) test holes for collection and description of samples and geophysical logging. The lithologic descriptions should be prepared utilizing standard methods to include the use of standard color and grain size charts. With this

recommended approach a geohydrologic correlation can be developed for all wells on the Base for which geophysical logs are available. Particular attention to lithology as it relates to permeability is of utmost importance. Establishing the environment of deposition will assist in determining preferential flow for migration of contaminants and the locating of any remedial wells where they would be most beneficial.

2. Perform a detailed evaluation of geophysical logs of the perched zone and the clay/shale unit overlying the first sandstone as an aid in determining the physical character and hydraulic characteristics, the relationship of the perched zone with respect to Building 3001, and relationship with the regional aquifer.

3. Investigate drainage of runoff from precipitation at the building and runway as it would affect recharge and contamination to the perched zone.

4. Perform a soil survey to determine the concentration of contaminants in the zone of aeration. Collect undisturbed samples of the clay/shale unit from at least three locations. Consideration should be given to locating one boring in Building 3001 near well 34 if access to the location is feasible. Clay samples should be analyzed for trivalent and hexavalent

chromium, volatile organics, barium, permeability, and particle size.

5. Investigate the anomalies and variations of pH, specific conductivity, barium, and total volatile organics in well clusters 1-5 and 34 and other wells as indicated by the COE's laboratory results. Vertical and horizontal distribution of the parameters should be contoured and illustrated in cross sections and compared to the patterns represented by the distribution of chromium and TCE.

6. Develop a system that would provide a means for measuring water levels in and accurately measuring the discharge from supply wells. Deep monitoring wells should be installed at selected locations in the vicinity of Building 3001 and other Installation Restoration Program sites. By performing water level monitoring on monitor wells and supply wells, data (cone of depression and area of influence) will be generated and utilized to benefit the design of an efficient remediation program. In the absence of this system, radius of influence should be calculated for the supply wells using available data and the most appropriate techniques.

7. Perform evaluation of head differential between various depths in the hydrologic system. Using the data covered in item 6

above will allow for the evaluation of the vertical hydraulics associated with lithologic variations.

8. Determine the relationship between the perched ground water and Soldier Creek and the potential for Soldier Creek as a discharge point for contaminated perched ground water or as a source of contamination from surface runoff.

9. In any future well installations, precautionary drilling techniques (such as advancing casing during drilling or use of drilling mud) should be used to preclude downward migration of contaminants.

INTRODUCTION

Purpose and Scope

P. E. LaMoreaux & Associates, Inc. (PELA) was authorized by the Tulsa District Corps of Engineers to prepare a summary report of work completed to date on the geology, hydrology, extent of contamination, and corrective actions at Building 3001, Tinker Air Force Base, Oklahoma. This investigation included the review of data available on the site obtained from previous work by Engineering Science; Radian Corporation; A. L. Burke Engineers, Inc,; Dansby & Associates, Inc.; the Tulsa District Corps of Engineers; and information obtained from published and unpublished data from the U.S. Geological Survey and the Oklahoma Geological Survey.

The objectives of the study are to obtain, review, and evaluate available data and prepare recommendations concerning additional data necessary for design of collection and treatment systems, conducting field tests, and the validity of the Tulsa District's interpretation of complex hydrogeologic conditions and the contaminant plume.

Characterization of the ground water, soil contamination, and source pollutants within the depositional environments of the aquifer systems will influence the development of pilot projects and remedial action designs.

The specific areas where remedial action should be taken can be identified following the completion of the additional phases of studies recommended to address the geologic, hydrogeologic, and depositional environment of this site.

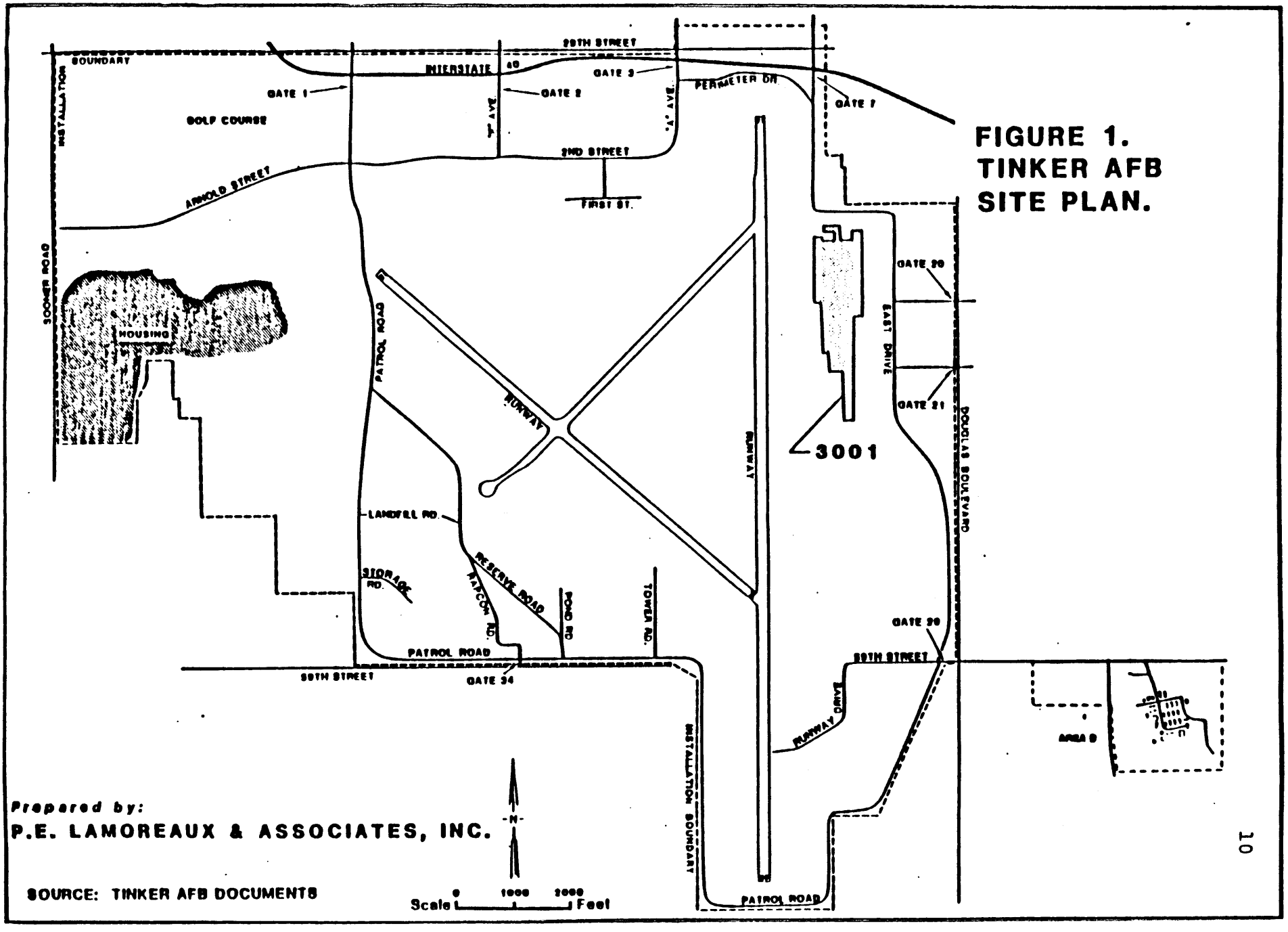
Site Location and History

Tinker Air Force Base is located in the central Redbed Plains section of the Central Lowland physiographic province of Oklahoma. Within Oklahoma County, the Base is adjacent to Oklahoma City, Midwest City, and Del City. The Base is bounded by Interstate 40 to the north, Douglas Boulevard to the east, Sooner Road to the west, and industrial and undeveloped land to the south. The Base lies within a transition zone from residential and commercial land use to the north and west to agricultural land use to the east and south. A general map of Tinker Air Force Base is shown in Figure 1.

Site chronology which follows is summarized based on review of previous studies, memoranda and correspondence, and interpretation of aerial photographs.

Building 3001 has expanded considerably in size since first opening in 1942. During its history numerous hazardous materials were utilized for the refurbishing of aircraft and aircraft parts.

At least four investigatory reports on site contamination at Building 3001 have been prepared since 1982. In 1982, Engineering Science performed a records search. In 1984, Radian Corporation performed an investigation for the Installation Restoration Program. The investigation was a confirmation/quantification of contamination of Tinker Air Force Base. In 1986, A. L. Burke Engineers, Inc. performed an investigation of underground tanks at the Base that included soil sniffer tests and installation of a few monitoring wells. In 1986 Dansby & Associates, Inc. prepared a report on the plugging procedures of water supply wells 18 and 19.



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Based on the data and reports available, the Tulsa Corps of Engineers' professional staff has essentially completed the investigations and assimilation of the data that provide a basis for an understanding of the geology, hydrogeology, geochemistry, and identification of contamination in the vertical-horizontal plume. The interpretation to date also provides the basis for identification of specific steps required for the development of the most effective remedial plan.

GENERAL HYDROGEOLOGY

The complex geology in the area is comprised of unconsolidated deposits of Pleistocene age overlying Permian sedimentary rock units. The unconsolidated deposits are stream deposited alluvial materials or the product of weathering of underlying bedrock. The unconsolidated deposits are predominantly interfingering lenses of sand, silt, clay, and gravel.

The underlying sedimentary rock units are nearly flat-lying, with a reported regional dip of 40 feet per mile in a general westward direction. These rocks are composed of massive, cross-bedded sandstone interbedded and interfingered with shale and siltstone. The bedrock stratigraphy consists of, in descending order, the Hennessey Group, Garber Sandstone, and Wellington Formation.

Ground water in Oklahoma County is derived from precipitation, snow melt, infiltration, and streams which contribute to the recharge of the ground-water reservoir. The geologic setting for the ground-water reservoir in Oklahoma County includes rocks of Permian age.

Tinker Air Force Base lies within the Garber-Wellington ground-water basin. The main source of ground water for the Oklahoma City area is the Garber Sandstone and Wellington Formation which are considered to be a single aquifer. They were deposited under similar deltaic conditions and consist of lenticular beds of deep-red to reddish-orange, massive, friable, cross-bedded, fine-grained sandstone. The sandstone is interbedded and interfingered with red, purple, maroon, and gray shale and siltstone. These lenticular beds vary in

thickness over short horizontal distances. The principal source of ground water to wells is derived from these lenticular beds of sandstone in the aquifer. Most wells that produce more than 100 gpm will have multiple screen settings opposite these sand beds.

The Garber-Wellington aquifer crops out in the northern one-half of the Air Force Base where the ground water occurs under conditions varying from confined to unconfined at depths varying from 30 to 100 feet below land surface. In the southern portion of the Base, the Garber and Wellington Formations are overlain by a thin layer of the Hennessey Group. In this portion of the Base the Garber-Wellington is considered confined since the less permeable siltstone and shale are overlying the Garber Sandstone. Since Building 3001 is located in the Garber-Wellington aquifer outcrop area, it is assumed to be situated in a recharge zone.

SITE HYDROGEOLOGY

Site-specific information is available in boring and drilling data collected by Radian Corporation, A. L. Burke Engineers, Inc., and the Tulsa District Corps of Engineers. Ninety-five (95) site locations were utilized in data assessment for Building 3001. Site data include geophysical and lithologic logs of production wells, monitoring wells, and soil borings. The stratigraphy of the site consists of, in descending order, the Garber Sandstone and Wellington Formation. These bedrock units are essentially flat-lying and greatly vary in thickness over short distances. Site-specific hydrogeologic cross sections were prepared by the COE. The lithology of the material is generalized into major categories. Predominant lithologies include clay, sandy clay, shale, siltstone, and sandstone.

A comprehensive understanding of the site conditions and environment of deposition can be developed by a detailed investigation of the geophysical logs provided for each well or boring. To utilize the geophysical logs, entire boring depth lithologic samples will need to be correlated to the geophysical logs.

To calibrate the existing geophysical logs at least three (3) holes need to be drilled for collection and description of lithologic samples. Geophysical logs should be run on these three (3) test holes to provide a set of master geophysical logs from which all existing geophysical logs may be calibrated.

From July 28 through 30, 1986, a comprehensive set of 156 water levels were measured in wells on Tinker Air Force Base. From this

data ground-water contours of the perched aquifer were generated along with potentiometric contours of the upper portion of the regional aquifer. The contours indicate that the regional ground-water gradient is to the southwest while the ground-water gradient of the perched aquifer is in two directions, one northeast toward Soldier Creek, and the other to the west. The ground-water contours of the perched aquifer also indicate a source of recharge under or near Building 3001 that is not identified.

Information from monitoring well clusters indicates the presence of a perched aquifer and at least two individual saturated zones within the regional aquifer. A differential of head between various depths in the hydrologic system also has been noted on the cross sections prepared by the COE. These zones of saturation are artesian but have decreasing heads with depth.

Soldier Creek is located just east of Building 3001. The relationship between surface water and ground water is not clearly understood. Cross section B-B' prepared by the COE shows that the perched aquifer water levels and regional aquifer water levels approach the same elevation east of Soldier Creek. This graphic implies that Soldier Creek has no impact on the perched or regional aquifer.

Contour maps prepared by the COE indicate there is no significant influence on the upper portion of the aquifer by the Air Force Base water supply wells. The area of influence caused by the pumping of the water supply wells that intercept point sources of contamination is a potential mechanism for the migration of contaminants. The area of influence within the aquifers developed by the water supply wells have

not been interpreted. However, the Tulsa COE investigations are indicating this has not occurred yet. Additional data should be collected on the water supply wells to determine the radius of influence caused by pumping from multiple zones of the Garber-Wellington aquifer. This may require modification of construction of and equipment on existing wells in order to obtain accurate water levels and pump rates and the installation of additional regional monitoring wells to determine the radius of influence. The approximate radius of influence and piezometric levels in the vicinity of Building 3001 should be calculated using available data from supply wells and the most appropriate techniques.

Bailed hole/recovery tests were performed on twelve borings in Building 3001 to estimate permeability. Permeability is defined as the capacity of a porous medium for transmitting water. Permeability on these bailed hole/recovery tests ranged from 1×10^{-5} to 8.6×10^{-6} cm/sec. From these permeabilities, estimated rates of migration of contaminants can be generated. Understanding the variability of aquifer characteristics (permeability, transmissibility) which control contaminant migration will allow for recommendations for effective design of the collection and treatment system. Transmissibility (T) is defined as the rate of flow through a vertical section of the aquifer with the height equal to the thickness of the aquifer and a width of 1 foot. Units with higher T and permeability values will allow easier groundwater withdrawal. Units with low T and small permeability values, the range of those determined at the site, will result in longer retention

time and exposure to contaminants and poor recovery of contaminated ground water.

WATER QUALITY

During the early stages of the Installation Restoration Program (Phase II, Quantification/Confirmation), some of the techniques utilized for the installation of monitoring wells potentially created pathways for downward migration of contaminants. Specifically, certain wells (wells 19A, 20A, 21A, 22A, 23A, 24A, and 25A) were drilled with the air method in which water levels were allowed to stabilize before casing and screen were installed. By leaving the borehole open for a period of time, contaminants contained in stratigraphically higher units could migrate to the borehole and downward through the borehole to less contaminated units. Such methods should be avoided in future investigations.

The Tulsa COE has determined that water supply wells 18 and 19 have provided contaminant movement primarily because of poor well condition and not a result of aquifer drawdown. A review of the well plugging report indicates corrosion holes in the casing and open sections along the annulus that could have been avenues for the movement of contaminants. Water supply wells 18 and 19 have since been plugged to required specifications and should no longer be considered as pathways for downward migration of contaminants.

Water samples collected from monitor wells were analyzed for priority pollutants and other water quality parameters. Anomalous and elevated values were reported for pH, specific conductivity, certain volatile organics, barium, TCE and chromium. TCE and chromium concentrations are depicted graphically as an aid in evaluating the

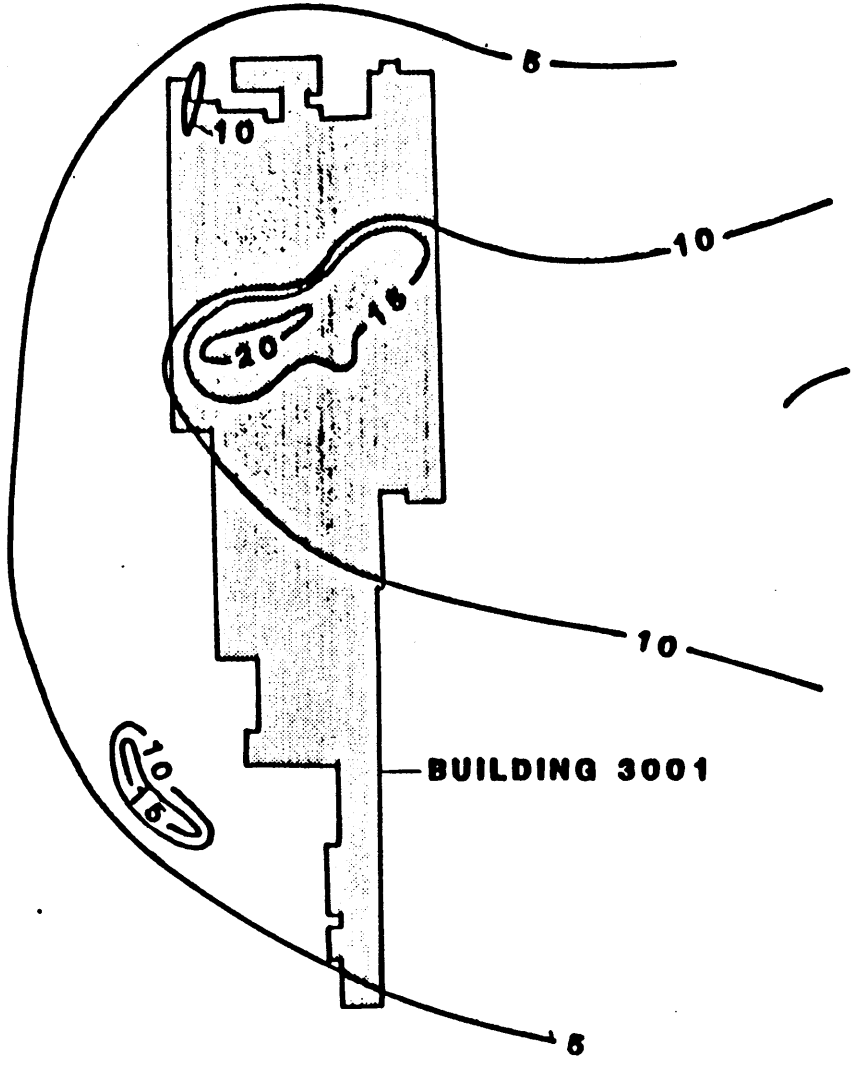
configuration of the contamination plume shown in the Corps of Engineers illustrations. The other anomalies should be investigated due to extreme values in Well 1A5, pH of 12.89, specific conductivity of 3.57, and barium 4.0 ppm. Other wells have similar anomalies that are not listed but should be investigated.

An isopach map of a surficial clay/shale (stratigraphic unit above the first sandstone) was prepared by PELA (Figure 2). The configuration of this analysis indicates that the highest concentration of chromium contamination occurs in water below the thickest sequences of clay/shale and the highest TCE contamination occurs below thinner sections of clay, at and adjacent to Building 3001, the contaminant source area.

The orientation of the highest concentration of chromium corresponds with the orientation of the thick clay/shale sequences (southwest, northeast) whereas the highest concentration of TCE occurs in a northwest-south direction below a thin sequence of clay/shale (Figure 2). The extension of the high concentration of TCE in the perched zone is indicative of a preferential flow direction away from the Building 3001 area.

The results of the analysis of the isopach map of the clay/shale thickness further suggests that chromium has an affinity for the clay. Contaminant migration may be influenced by the periodic flushing of the clay with infiltration of precipitation or storm runoff. This theory would indicate that lithology and environment of deposition have an influence on the direction and rate of migration of contaminants.

FIGURE 2. GENERALIZED ISOPACH MAP OF SURFICIAL CLAY/SHALE AT BUILDING 3001.



EXPLANATION

10 ISOPACH OF SURFICIAL CLAY/SHALE CONTOUR INTERVAL IS 5 FEET

Prepared by:
P.E. LAMOREAUX & ASSOCIATES, INC.

Additional correlations between lithology and contaminant configurations should be performed in order to develop a full understanding of contaminant migration patterns and a prediction of effects caused by remedial pumping.

Information on the chemical characteristics of the soil is not sufficient to determine the concentrations of contaminants in the soil. A soil sampling program to determine the concentration of contaminants hydraulic characteristics in the zone of aeration and clay/shale unit should be performed since contaminants may be introduced to the ground water by a periodic flushing of the zone of aeration by infiltration of precipitation or storm runoff.

SELECTED REFERENCES

Burke Engineers, Inc., A. L., 1986, Investigation of underground tanks, Tinker Air Force Base, Oklahoma: Consultant report prepared for Department of Air Force, Air Logistics Center, Tinker Air Force Base, Oklahoma, Contract No. F34650-85-C-0238.

Dansby & Associates, Inc., 1986, Report of plugging procedures water wells 18 and 19: Consultant report prepared for Department of Air Force Directorate of Contracting and Manufacturing, Oklahoma City Air Logistics Center/PM, Tinker Air Force Base, Oklahoma, Contract No. F34650-85-C-0404.

Engineering Science, Inc., 1982, Installation restoration program, phase I, records search, Tinker AFB, Oklahoma: Consultant report prepared for United States Air Force AFESC/DEV Tyndall AFB, Florida.

Jacobson, C. L., and Reed, E. W., 1949, Ground-water supplies in the Oklahoma City area, Oklahoma: Oklahoma Geologic Survey Mineral Report 20.

Radian Corporation, 1984, Installation restoration program, phase II - confirmation/quantification, stage 2: Consultant report prepared for U.S Air Force, Occupational and Environmental Health Laboratory (OEHL), Brooks Air Force Base, Texas, Contract No. F33615-83-D-4001.

Warren, Clif, 1986, Personal communication: U.S. Army Corps of Engineers, Tulsa District, Tulsa, Oklahoma.

U.S. Army, Corps of Engineers, 1986, Tinker AFB Installation Restoration Program.

APPENDIX M

FLORA AND FAUNA BIOTA

Appendix M. General Flora and Fauna at Tinker AFB

The following general information concerning the flora and fauna biota at Tinker AFB and the Oklahoma City area comes from an excerpt from the "F16 Beddown Environmental Assessment", prepared by Argonne National Laboratories for Tinker Air Force Base.

"Most of the vegetated areas on the base are mowed and landscaped. Little natural habitat exists. The varieties of grass include bluestem, poverty grass, triple lawn, and Johnson. Scattered trees and shrubs occur around many buildings, the golf course, and on less developed portions of the base. The largest wood habitats occur along the watercourses. Woody species include oaks, elms, willows, cottonwoods, box elders, sycamores, redbuds, ashes, and sumacs. The habitats must suited for wildlife occur primarily in mowed grassy fields and undeveloped/underutilized areas associated with drainages.

The most common species of birds from the Oklahoma City area which are common to habitat types occurring at Tinker AFB are Canada goose, killdeer, rock dove, mourning dove, common night hawk, chimney swift, scissor-tailed flycatcher, American crow, American robin, European starling, common grackle, and house sparrow. The area is in the central flyways for migratory waterfowl. The concerns at Tinker AFB regarding wildlife are related mostly to aircraft operations in the presence of resident and migratory birds.

Mammals common to habitats at Tinker AFB include eastern fox, squirrel, thirteen-lined ground squirrel, plains pocket gopher, eastern cottontail rabbit, white-footed mouse, striped skunk, racoon, opossum, Norway rat, and house mouse.

Creeks and ponds constitute the aquatic habitats on Tinker AFB. Ponds are managed for largemouth bass and channel catfish. Other fish that could occur in these habitats include red shiner, plains minnow, carp, black bullhead, green sunfish and bluegill.

No threatened or endangered plant species are reported from Oklahoma County. Several federal threatened or endangered animal species may occasionally occur in the Tinker AFB area. The threatened species are the Arctic peregrine falcon and the piping plova. The endangered species are the bald eagle, American peregrine falcon, whooping crane, and the interior population of the least tern. However, the potential for the occurrence of these species in the immediate vicinity of Tinker AFB is low because preferred habitat and known areas of congregation for these species are not located near the base."

APPENDIX N

SLUG TEST PROCEDURES AND METHODS OF ANALYSIS

Appendix N

Slug Test Procedures and Methods of Analysis at Building 3001

1. Introduction. Slug tests were conducted in selected monitoring wells across the Building 3001 site in order to estimate the in-situ hydraulic conductivity (permeability) and transmissivity of the aquifer zones. Accurate determinations of the hydraulic conductivity and transmissivity are critical to the technical feasibility of a groundwater control and collection scheme since the parameters provide a measure of how much water can be withdrawn from the aquifer over a given period of time. Slug tests are small-scale tests which can be applied in existing monitoring wells.

The contaminated aquifer zones beneath Building 3001 can be divided into 3 zones based roughly on depth. These zones are, from shallowest to deepest, the perched zone, top of regional zone, and the regional zone. The perched zone is unconfined, the top of regional zone is semi-confined, and the regional zone is confined. Slug tests were performed in 5 wells screened in the perched zone, 9 wells screened in the top of regional zone, and 2 wells screened in the regional zone. The tests are suitable for this site because the tests do not require contaminated groundwater to be collected or additional water to be introduced to the aquifer. The test is commonly used in the hydrogeologic field (refs. 2, 4, and 5). An EPA test method or similar standard does not exist, but this report describes the methods used to conduct the test and analyze the data.

2. Test Procedures. The slug tests were performed by inserting a pipe of known volume (slug) into a monitoring well and creating an instantaneous displacement of the water level. The falling head of the water levels were then recorded over the time required for the levels to re-stabilize. The rate at which the initial conditions are re-established is a function of the permeability of the aquifer media near the well. Submersible pressure transducers were used to record the falling heads. Many references describe the test procedures (refs. 1-6). Figures N-1 and N-2 present schematics of the slug tests applied to the unconfined and confined aquifer zones at the site.

3. Analysis of Data. The technique of analyzing data was originally developed by Hvorslev (1951) and has been expanded by others (ref. 5) to fit a variety of field situations. The methods used at Building 3001 were the Hvorslev method, as expanded by Cedergren in 1977 (ref. 1), the Bouwer and Rice method (ref. 5), and the Cooper, Bredehoeft, and Papadopulos method (ref. 6). The Hvorslev method can be applied to either unconfined or confined conditions and various well configurations (ref. 1). For an unconfined aquifer and partially penetrating well, the equation for calculating the hydraulic conductivity is:

$$k = \frac{d^2}{8L\,(t_2 - t_1)} \ln\left(\frac{2L}{D}\right) \ln\left(\frac{h_1}{h_2}\right) \qquad \text{(ref. 1)}$$

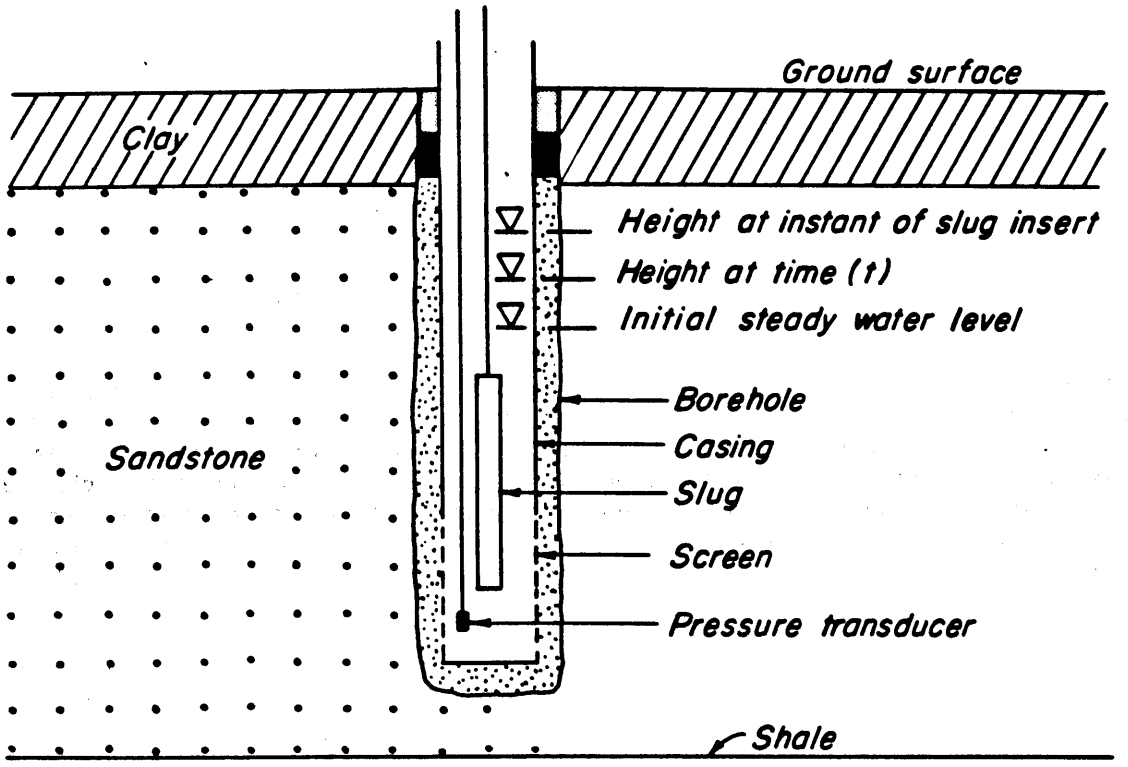


Figure N-1. Schematic of slug test in unconfined aquifer.

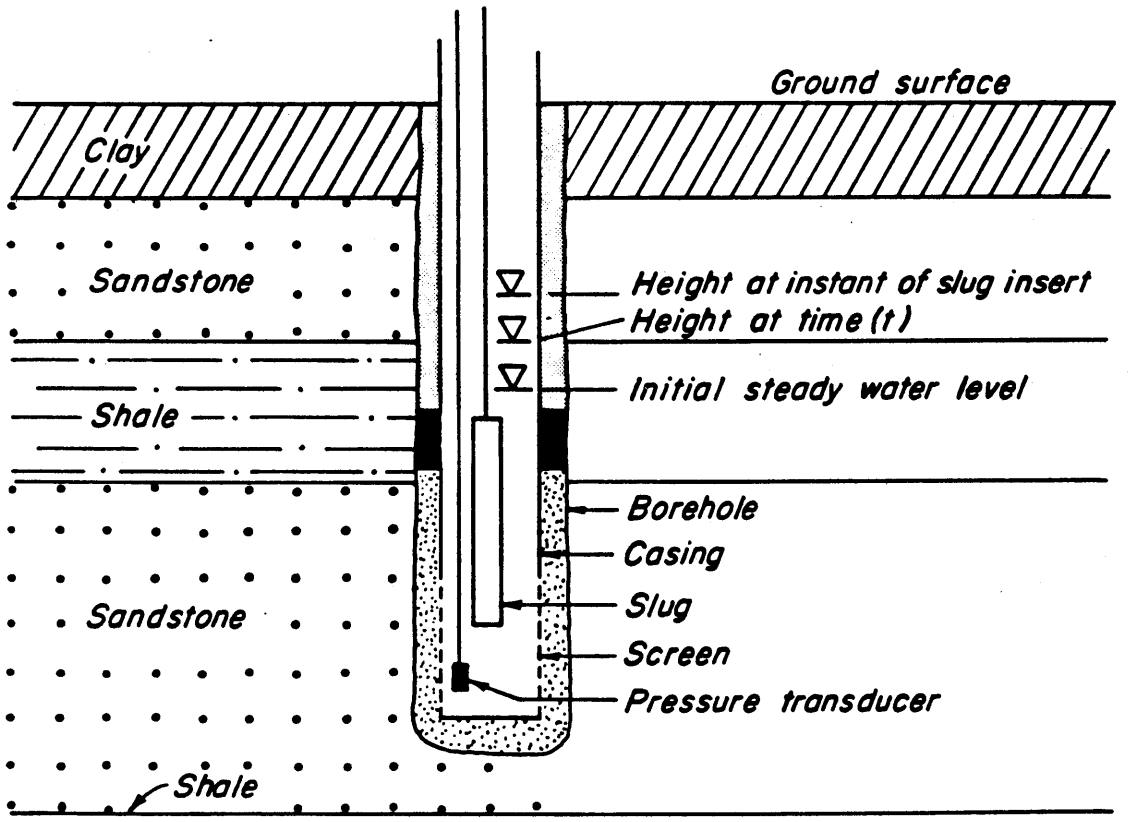


Figure N-2. Schematic of slug test in confined aquifer.

where:

k = hydraulic conductivity (ft/sec)
d = diameter of well casing (ft)
L = screen length (ft)
t = time (sec.)
h_1 = piezometric head at time = t_1 (ft)
h_2 = piezometric head at time = t_2 (ft)
D = diameter of the intake (effective diameter) (ft)

For a confined aquifer and partially penetrating well, the equation is:

$$k = \frac{d^2}{8L(t_2-t_1)} \ln\left(\frac{4L}{D}\right) \ln\left(\frac{h_1}{h_2}\right) \qquad \text{(ref. 1)}$$

Consistent conversions can be applied to these equations to express the hydraulic conductivity in either gallons per day per square feet (gpd/ft^2) or centimeters per second (cm/sec). The transmissivity can be estimated by multiplying the hydraulic conductivity by the aquifer thickness at the well location.

The Bouwer and Rice method (Bouwer, 1978) was applied to slug tests in the unconfined aquifer by using the following equations:

$$k = \frac{d^2}{2\,NL\,(t_2-t_1)} \ln \frac{h_1}{h_2} \qquad \text{(refs. 3 and 4)}$$

and

$$N = \frac{1.1}{\ln(Lp/D)} + \frac{C_1+C_2 \ln[(hu-Lp)/D]}{L/D}$$

where:

N = dimensionless value equal to $1/\ln(r_e/D)$
r_e = radius of influence (ft)
C = dimensionless values determined from chart (fig. N-3)
Lp = depth from water level to bottom of screen (ft)
h_u = saturated aquifer thickness (ft)

For both the Hvorslev method and the Bouwer and Rice method the falling heads (h_t) are plotted as log h_t versus t and a straight line is obtained. Points for h_1 and h_2 at corresponding times t_1 and t_2 are chosen from the straight line. An example of the plotted data is shown in figure N-4.

The Cooper, Bredehoeft, and Papadopulos (1967) method was applied to confined aquifer conditions. Using this method, the volume of the slug is determined, and h_o (the height of the column of water at the instant the slug is injected) is calculated from:

$$h_o = \frac{\text{Volume of slug}}{TT\ r_c^2} \qquad \text{(ref. 6)}$$

where:

r_c = radius of well casing where water fluctuates (ft).

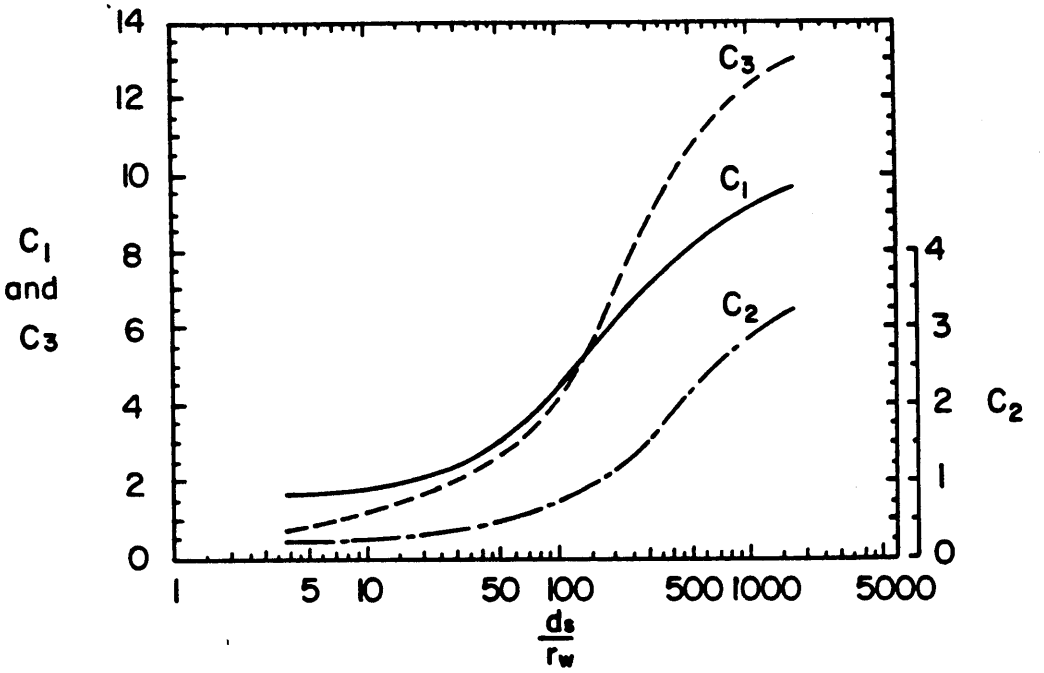


Figure N-3. Curves required in a slug test (ref. 3).

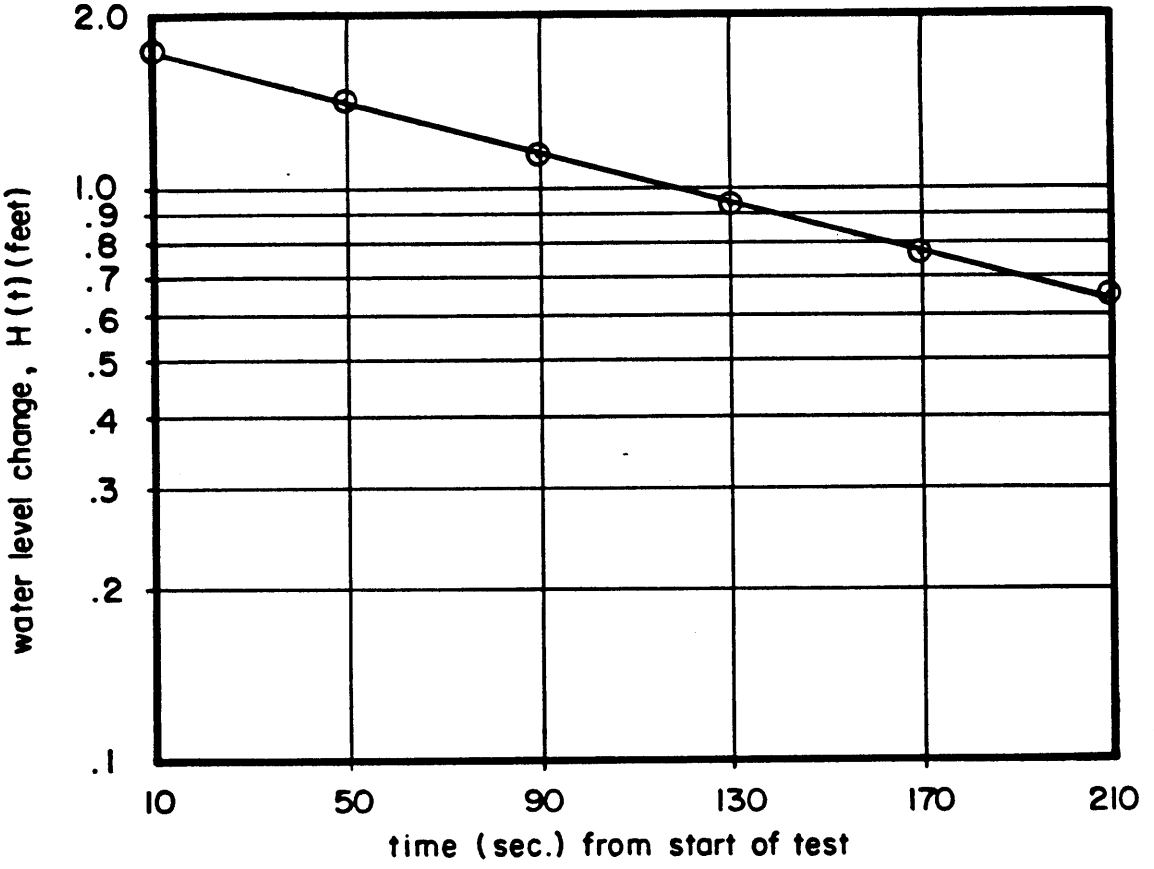


Figure N-4. Plotted data from slug test.

From the measured values of h_t at corresponding time intervals, t, values of h_t/h_o are computed and plotted on a linear scale versus time on a logarithmic scale. The obtained curve is then matched with a type curve. The value of t is determined at $Tt/r_c^2 = 1.0$ (match point on curve). An example of a curve obtained from field data is shown in figure N-5 and a family of type curves is shown in figure N-6. The value of t is input into the following equation to calculate the transmissivity (T):

$$T = \frac{1.0\ r_c^2}{t} \qquad \text{(ref. 6)}$$

Storage coefficients (S) were also estimated at the well locations by applying the method derived from Cooper, Bredehoeft, and Papadopulos (1967) where:

$$S = \frac{r_c^2}{r_s^2}\ a \quad \text{[dimensionless]} \qquad \text{(ref. 6)}$$

and

r_c = radius of casing interval over which water level fluctuates (ft.)
r_s = effective radius of intake (ft.)
a = type curve which best fits plotted data from falling head test

The values determined are not reliable without comparing them with other estimates of S based on a knowledge of geologic conditions. According to Todd (1980), S normally varies directly with aquifer thickness and can be estimated by

$$S = 3 \times 10^{-6}\ b$$

where: b = aquifer thickness.

4. Results. The Hvorslev method was used to analyze the data from all the wells. The equations for unconfined conditions were used to analyze the perched wells. The equations for confined conditions were used to analyze the top of regional and regional wells. The Bouwer and Rice method was applied to the data in the perched zone wells and compared to the Hvorslev method. The Cooper, Bredehoeft, and Papadopulos method was applied to the data in the top of regional and regional zone wells and compared to the Hvorslev method. The results of the methods are shown in table N.1. As shown in the table, the comparison methods gave similar results to the Hvorslev method. The results of the Hvorslev method were presented in the text because the method applies to wells only partially screened across the saturated aquifer thickness. The Bouwer and Rice method and Cooper, Bredehoeft, and Papadopulos method are primarily applicable to fully penetrating wells (refs 4 and 6) and their application to partially penetrating wells requires some judgement. However, the values generally apply to the part of the aquifer in which the well is screened (ref 3).

5. Conclusions. Slug tests are widely used and provide sufficiently accurate estimates of hydraulic conductivity and transmissivity for site assessments and remedial action designs (refs. 1, 2, 4, and 6). They have the advantage of being a rapid and inexpensive test, and they do not require the collection and disposal of contaminated water. The parameters obtained from the slug tests at Building

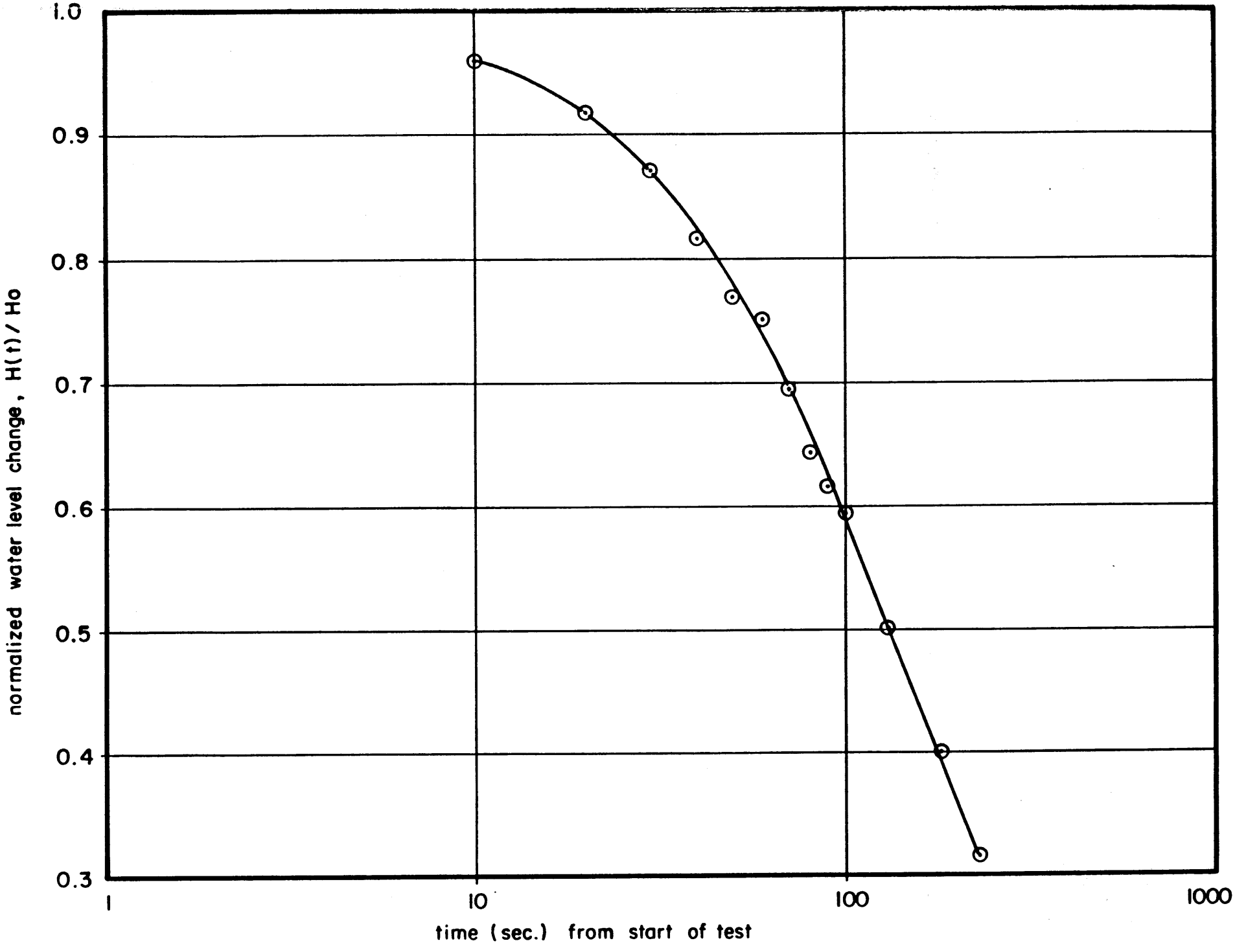
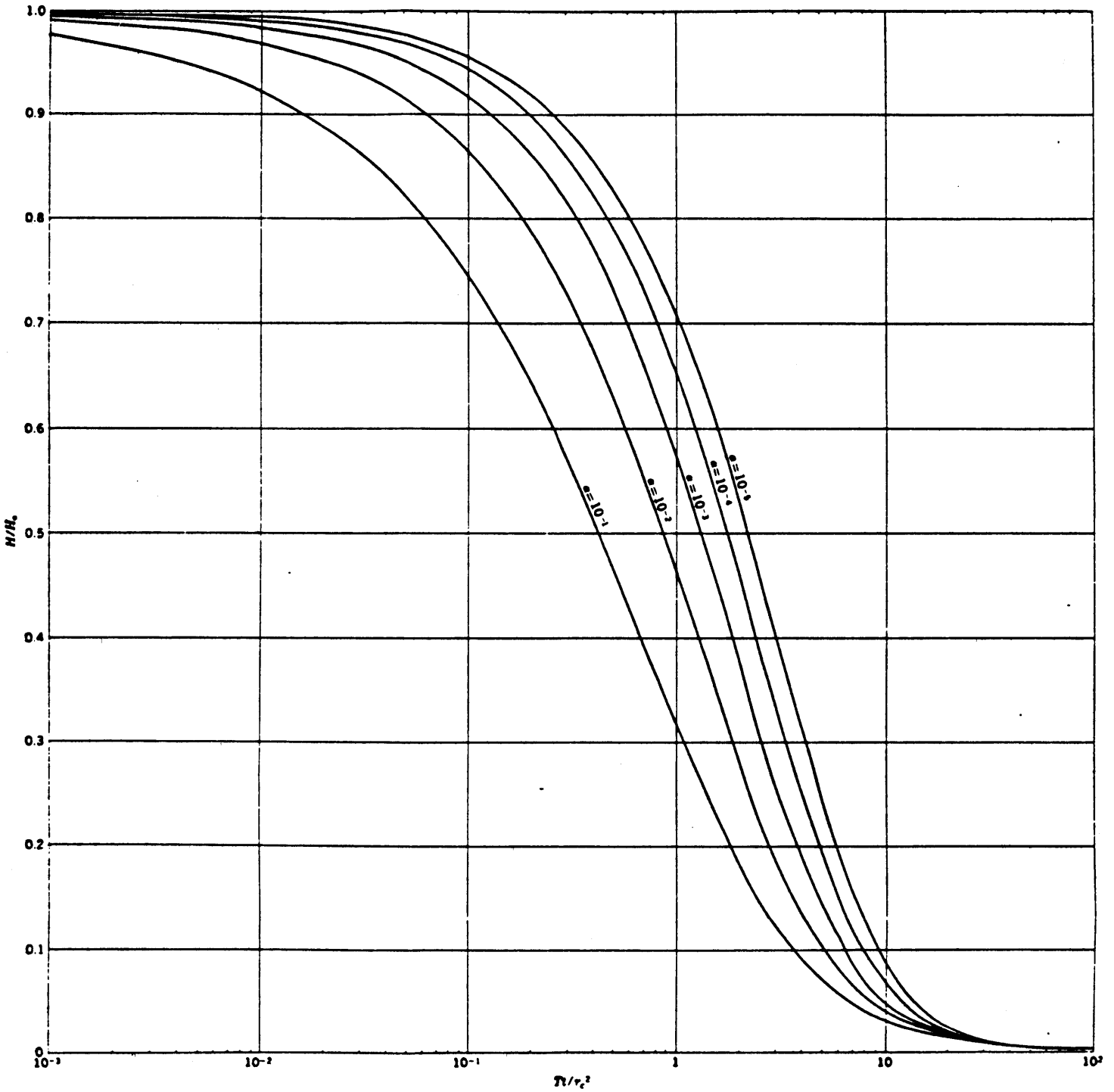


Figure N-5. Plotted data from slug test.



TYPE CURVES FOR H/H_o VERSUS Tt/r_c^2 FOR FIVE VALUES OF α

After Cooper, Bredehoeft, and Papadopulos (1967, table 1)

reproduced from ref. 6

Figure N–6. Example of type curves.

3001 were input into the groundwater model to more accurately represent the variable conditions across the site. The parameters will also be applied to the feasibility study of remedial action alternatives for groundwater collection and control. The parameters presented in the text were obtained using the Hvorslev method of analysis because of its applicability to the partially penetrating wells present at the Building 3001 site. However, two other methods of data analysis were used, and results compared favorably to the Hvorslev results.

Table N.1
Slug Test Results

Well No.	Aquifer Zone	Aquifer Thickness (feet)	Method A[1] K[4]	Method A[1] T[5]	Method B[2] K	Method B[2] T	Method C[3] K	Method C[3] T
1-6B	perched	6	$6x10^{-4}$	72	$6x10^{-4}$	72		
1-8B	perched	24	$6x10^{-4}$	312	$8x10^{-4}$	432		
1-4B	perched	11	$6x10^{-4}$	143	$6x10^{-4}$	132		
1-5B	perched	19	$1x10^{-3}$	513	$1x10^{-3}$	437		
1-11B	perched	12	$1x10^{-3}$	252	$8x10^{-4}$	192		
1-2A	top of reg.	12	$6x10^{-4}$	168			$7x10^{-4}$	141
1-4A	top of reg.	19	$9x10^{-4}$	361			$6x10^{-4}$	122
19A	top of reg.	27	$6x10^{-4}$	324			$5x10^{-4}$	114
1-7A	top of reg.	13	$7x10^{-4}$	195			$6x10^{-4}$	130
25A	top of reg.	16	$7x10^{-4}$	256			$1x10^{-3}$	234
1-1A	top of reg.	21	$6x10^{-4}$	252			$8x10^{-3}$	166
23A	top of reg.	14	$2x10^{-3}$	434			$5x10^{-4}$	101
21A	top of reg.	22	$9x10^{-4}$	418			$5x10^{-3}$	1037
1-11A	top of reg.	11	$1x10^{-3}$	231			$1x10^{-3}$	281
25C	regional	13	$5x10^{-4}$	130			$4x10^{-4}$	203
1-10C	regional	16	$2x10^{-4}$	64			$2x10^{-4}$	108

1 Hvorslev method
2 Bouwer and Rice method
3 Cooper, Bredehoeft, and Papadopulos method
4 K = hydraulic conductivity (cm/sec)
5 T = transmissivity (gpd/ft)

References

1. Cedergren, H.R., Seepage, Drainage, and Flow Nets, 2nd ed., Wiley and Sons, 1977, pgs. 66-77.

2. Freeze, R.A., and Cherry, J.A., Groundwater, Prentice-Hall, 1979, pgs. 339-342.

3. Kashef, A.A., Groundwater Engineering, 1st ed., McGraw Hill, 1986, pgs. 233-235.

4. Pandit, N.S., and Miner, R.F., "Interpretation of Slug Test Data", Ground Water, Vol. 24, No. 6, Nov. - Dec., 1986, pgs. 743-749.

5. Thompson, D.B. "A Microcomputer Program for Interpreting Time-Lag Permeability Tests", Groundwater, Vol. 25, No. 2, March - April 1987, pgs 212-218.

6. U.S. Geological Survey, Ground Water Hydraulics, Survey Paper 708, 1979, pgs. 27-30.

7. Todd, D.K. "Groundwater Hydrology", 2nd ed., Wiley and Sons, 1980, pgs. 45-46.

APPENDIX O

WORK PLAN

INSTALLATION RESTORATION PROGRAM
TINKER AIR FORCE BASE
BUILDING 3001 WORK PLAN

1. General. The Tulsa District is prepared to begin field investigations at the Building 3001 site. The work will consist of sampling the existing water wells, investigating subsurface container pits within the building, investigating the soil and groundwater around the building, conducting an aquifer pumping test, and installing additional groundwater monitoring wells. The goal of these tasks is to provide information to properly assess the subsurface conditions and design remedial cleanup plans for the groundwater. All of the drilling, sampling, and testing will be performed in accordance with the Corps of Engineers Quality Assurance/Quality Control Plan, previously furnished.

2. Sampling Existing Wells. All of the existing wells at the site will be sampled during this phase. They are broken down as follows:

6 water supply wells
19 monitoring wells

Included in this list are 12 monitoring wells inside the building. Samples will be tested for the parameters specified in the Corps of Engineers Groundwater Assessment Work Plan, previously furnished.

3. Subsurface Pit Investigations. Subsurface container pits within the building, south of the 81-Column Line, will be investigated. The purpose is to identify any pits which may contain contaminants or which may have leaked contaminants into the soil and groundwater in the past. The term "pit" as discussed in this work plan will refer to any sump, tank, trench, or other depression below the floor which may have contained solvents or other chemicals. These pits will be bored into and sampled unless records indicate that no contaminating chemicals were contained in them. The following methods will be used to locate the pits:

Records Search
Geophysical Survey
Personnel Interviews
Visual Floor Inspections

The geophysical survey will be conducted with a ground-penetrating radar unit which will record subsurface features. The features will be analyzed and potential pits will be investigated. Coordination with base personnel will be necessary such that the areas for the survey and the pit drilling can be accessible with as little inconvenience as possible to normal operations within the building.

a. Drilling and Sampling Procedure - The floor slab will be cored through with the use of a concrete coring drill machine. Water, used in conjunction with the coring machine, will be continuously picked up with wet vacuums. The pits should contain either sand or fluids.

Samples of pit contents will be collected using appropriate methods in accordance with the quality assurance/quality control plan. The following parameters will be tested for:

total organic carbon	chromium
volatile organics	lead
arsenic	mercury
barium	selenium
cadmium	silver

Both EP toxicity and total extraction tests will be performed on the metals.

b. Additional Investigations. Additional investigations may be conducted beneath and around contaminated pits to determine the extent of contamination.

4. Groundwater Sampling around the Building. Borings will be drilled throughout the area with groundwater samples taken to evaluate the extent of contamination. The borings will be analyzed to determine water zones, gradients, and permeability characteristics. The samples will be tested for the following parameters:

conductivity	cadmium
pH	chromium
total organic carbon	lead
volatile organics	mercury
arsenic	selenium
barium	silver

Proper clearance will be obtained before drilling at a location to prevent damage to underground utilities.

6. Aquifer Pumping Test. One or more pumping tests will be conducted to determine aquifer parameters necessary for the design of a remedial groundwater cleanup plan. The pumping tests will be designed after results of the previously mentioned investigations are obtained.

7. Additional Monitoring Wells. The monitoring wells will be installed at locations necessary to accurately monitor the groundwater conditions before and after cleanup operations are conducted. The number and locations of wells will be determined after other investigations are completed.

APPENDIX P

SAFETY PLAN

TINKER AIR FORCE BASE
INSTALLATION RESTORATION PROGRAM

SAFETY PLAN
FOR
CORPS OF ENGINEERS PERSONNEL

MARCH 1986

WORKER PROTECTION PLAN FOR EXPLORATORY SUBSURFACE INVESTIGATION AT TINKER AFB BLDG. 3001 AND LANDFILL SITES

1. PURPOSE:

This program is to establish procedures to protect Corps of Engineers' employees from potential safety and health hazards arising from subsurface investigation activities at Tinker Air Force Base.

2. APPLICABILITY:

This plan applies to Corps of Engineers personnel and authorized visitors working in the identified areas. Supervisors are to make certain employees understand and follow these guidelines.

3. REFERENCES:

a. COE Safety and Occupational Health Requirements Manual 385-1-1, October 1984

b. 29 CFR 1910 & 1926 OSHA Regulations

c. Tulsa District Respiratory Protection Program

4. SITE DESCRIPTION:

a. Ten (10) landfills were used for the disposal of waste at Tinker AFB. Expanded preliminary descriptions of the landfills are shown as Attachment No. 1. Six of these landfills were generally used for domestic refuse and industrial waste, which typically were paints and solvents. These mixed wastes are found in sites 1, 2, 4, 5, and 6.

b. Landfill site 3 contains vacuum tubes of low level radioactivity, empty barrels, insecticide cans as well as general refuse. Additional radioactive material was reported to have been disposed of in a deep pit adjacent to the northwest corner of landfill site 3.

c. Sites 201S and 1030W are designated as Radiological Waste Disposal Sites (RWDS). Very little is known about these sites except that the wastes were radium paint solids and radium paint dials. No radioactive activity higher than normal has been noted at the ground surface in these areas.

d. Wells located in Bldg. 3001 are included in this work. This building was extensively drilled at varying depths during the Bldg. 3001 renovation. No additional drilling hazards were identified during that period in 1985.

e. A fourth radioactive site was identified in the report. The Air Force asserts this site was cleaned up in 1955.

5. GENERAL - DRILLING OPERATIONS:

a. It is anticipated that drilling and sampling activities have the potential for exposing employees to low volumes of methane gas and its mixtures, which could have been produced during refuse decomposition; corrosive materials (mainly acids), which were deposited in the landfill soils which have been contaminated with solvents, sludge, and pesticides, and items contaminated with low level radiation.

b. Normal drilling and sample gathering procedures will be followed with three exceptions. The exceptions are air monitoring for combustible gases, monitoring for radioactivity, and wearing special protective equipment and clothing.

c. The Safety and Occupational Health Office (S&OHO) will conduct periodic inspections to determine if modifications are needed in the safety and health procedures established for this work. The Industrial Hygienist (IH) will be on-site during the start-up operations, and as necessary throughout the project. The IH will determine what airborne and other sampling is necessary for protection of core drill personnel.

d. Core drill employees and supervisors are experienced in all phases of drilling operations at hazardous waste sites on the Pine Bluff Arsenal. That experience provided an excellent opportunity for them to learn and practice safe work procedures in areas moderately to highly contaminated with heavy metals, solvents and pesticide procedures including DDT. No adverse health effects resulted from the previous work.

e. Attachment No. 2, "Personal Protection Guide for Corps of Engineers Employees at Tinker AFB Landfills", provides additional information and discussion of safety and health requirements on site to be used by the COE employees.

6. MONITORING - DRILLING OPERATIONS:

a. A combustible gas meter and radiation meter will be used to detect the presence of combustible gaseous emissions and potential low level radiation. The S&OHO personnel will train on-site personnel in the use of the meters. The on-site supervisor will immediately notify the S&OHO of any abnormal conditions.

b. Combustible gas meter:

(1) A continous reading combustible gas meter with audible alarm will be used if available. The Lower Explosive Limit (LEL) alarm will be set at 25% of the LEL, which will be approximately 1-1.25%. (The LEL of methane is 5%.) If the alarm sounds, indicating the preset alarm level was exceeded, all operations will be shut down immediately. Particular attention will be given to stopping spark producing equipment and gasoline/propane/diesel motors. Employees will leave the area until the gas concentration drops below 1-1.25% range.

(2) In the event a continous reading monitor with alarm is not available, the standard model will be used. The air will be checked

intermittantly as determined by the IH throughout the drilling operation and any time gas is suspected.

c. Radiation detection meter:

(1) The core drill supervisor shall use the radiation detection meter while working in the areas of potential radiation exposure. These sites are northwest of the northwest corner of site 3, site 3, and the RWD sites 201S and 1030W. In the event that readings greater than background counts are noted, the supervisors will stop operations immediately. He will notify the S&OHO and the Tinker AFB Radiation Protection Officer.

(2) Readings with the radiation detection meter will be taken on the borings (cuttings) each time the auger is removed from a drill hole drilled in the RWDS areas site 3 and northwest of site 3. The S&OHO personnel will instruct all on-site employees and supervisors in the use of this meter.

7. WORKER PROTECTION DURING DRILLING OPERATIONS:

a. Emergency Station and Equipment: The supervisor shall place the emergency station upwind of the drilling operations. The emergency station shall be equipped with an emergency escape breathing apparatus; eye and hand wash facilities including soap, towels and potable water; and a standard first aid kit.

b. Respirators: The respirators provided will be MSHA or NIOSH approved dual cartridge, air purifying respirators as selected by the I.H. The respirators will be worn as determined necessary by the I.H. and at such additional times the supervisor thinks they might be needed. The selection, use and care of the respirators will be in accordance with OSHA 1910.134 regulation and the Tulsa District Respiratory Protection Program.

c. Protective Clothing: Drilling personnel will be required to wear Tyvex brand disposable clothing to minimize bodily contact with landfill fluids. The disposable coveralls will be discarded in a plastic trash bag each day at quitting time. The coveralls will not be worn away from the job site.

d. Hand and Foot Protection: Chemically impervious safety toe boots and gloves will be worn to minimize bodily contact with landfill fluids. The I.H. will determine the type boots and gloves needed for protection against the potential exposures to chemicals known to exist in the waste sites. Employees must wash their hands before breaks, smoking, and lunch periods even though they are wearing protective gloves. Employees are encouraged to shower immediately after work.

e. No smoking is allowed in the landfill drilling sites, or wherever else prohibited by TAFB regulations.

f. Hearing protection will be worn where noise is greater than 85dB(A) or as required in certain production areas of Bldg. 3001.

g. Safety glasses, goggles or other eye protection are required where necessary as specified by TAFB, Corps of Engineers or OSHA regulations.

8. PHYSICALS:

The COE provides core drill employees working on these projects an in-depth physical examination, including blood chemistry with complete blood count and differential; urinalysis; medical history; required chest X-rays; audiograms; pulmonary function testing; physician's interpretation for the employee's ability to wear a respirator. As required, the examination may include testing for heavy metals, i.e., lead, arsenic, mercury, PCB's and pesticides such as DDT, DDD, DDE.

9. SAFETY MEETINGS:

a. The initial meeting will be given by personnel from the S&OHO. The subjects covered will include a summary of the history of the work sites and the potential hazards that may be encountered such as corrosive leachate, gaseous conditions while drilling, and low level radioactive waste. During the initial meeting, employees will be instructed in wearing air-purifying respirators, and use of the emergency/escape breathing apparatus. Each employee will have the respirator qualitatively fit-tested at this time. Employees will also receive instruction in the use of the explosive gas meter and the radiation detection meter.

b. Additional safety meetings will be held as required throughout the life of the project.

NAME OF EMPLOYEE _____ Attach 2

PERSONAL PROTECTION GUIDE FOR EXPLORATORY SUBSURFACE INVESTIGATIONS

AT TINKER AFB LANDFILLS

1. PURPOSE:

This is to provide guidance for on-the-job hygiene and use of personal protective equipment while employees are involved in core drilling activities at Tinker AFB.

2. APPLICABILITY:

This guide applies to Tulsa District personnel who are core drilling and/or handling contaminated soil at the TAFB landfills.

3. Reference:

a. Code of Federal Regulations 29 CFR 1910.134 OSHA Respiratory Standards.

b. Tulsa District Respiratory Protection Program.

c. Site descriptions, Attachment 1.

d. Worker Protection Plan for Work at TAFB Landfills

4. Definitions:

a. Contamination: Any harmful or irritating material that is not normal to the atmosphere, soil or water.

b. Corrosives: Any acidic or basic material or liquid that causes irritation or tissue damage to the skin or eyes.

c. Leachate: A solution obtained by the percolation of water through the material in a landfill.

d. Dust: A very small (submicroscopic to visible) solid that is a product of drilling, grinding, or crushing.

e. PEL: Permissible exposure limit. A limit established by the Occupational Safety and Health Administration (OSHA) for treating air contamination. This allowable standard for breathing air is based on an employee's 8-hour work exposure to a contaminate. The limit has been established for individual contaminates.

5. GENERAL:

a. The monitoring wells show some low level pollution in all areas. It is very unlikely that these pollutants could present a breathing hazard, but there could be some skin absorption of the well liquids. A greater hazard from fire could exist because of the low level methane gas which could have been produced in these landfill areas.

b. A combustible gas meter will be used to check for potential gasing problems. The meter is used to detect any developing gas conditions, so that work can be stopped before the condition becomes dangerous. Safety and Occupational Health personnel will train the core drill employees in the use and care of the combustible gas meter.

c. The radioactive waste disposal sites were determined to be radium paint waste, but records are sketchy. Therefore, the radiation detection meter will be used while drilling in the radioactive waste disposal sites to check the soil as it is removed from the hole. The radiation detection meter allows us to detect a potentially hazardous situation if one should develop. If a high reading is obtained (readings above the source on the meter) the operation will be stopped and then evaluated by safety and health personnel.

d. During the start up and periodically through the job, safety and occupational health personnel will sample the operation. The core drill work

will be similar to past jobs at Pine Bluff where personal sampling of the breathing zone air was required. The air will be sampled by an air pump clipped to your belt, connected to a filter attached at your collar. With this sampling equipment, dust samples or solvent samples can be taken from your breathing zone. You will be given the results and allowable levels of the sampling.

6. HYGIENE:

a. Your most likely exposure to material in the landfills will be skin contact. It will be up to you to use good hygiene practice to keep the exposure low. Clean water, soap, and disposable towels will be at the rig for washing your hands and face whenever the need arises. Be sure to wash before you: eat lunch, smoke a cigarette, chew tobacco, drink a pop, or use the bathroom. Put all used towels and waste from the rig area into the trash bags.

b. All of your lunches, cigarettes, tobacco, gum, and drinks must be kept in a box that will stay closed and clean. You will be able to have any of these items in the box after you wash up.

c. You are reminded to:

(1) Stop and think about the dirt that gets on your face and hands while you are working. If you don't wash first, anything you touch could result in your swallowing a little dirt each time you eat, drink, or smoke. The contaminates could thus accumulate in your body.

(2) The general physical examination you received is sufficient to evaluate physical change for overexposure to the anticipated chemicals in the landfills. If anything additional is determined to be necessary it will be added to the general physical examination requirements.

7. RESPIRATORS:

a. Respirators will be available for your use. They will not be required to be worn unless air sampling shows a need or the results exceeds an OSHA requirement. The respirator you will be fit tested with was chosen because it protects you from breathing very small particles of dust. The respirator has been approved for protection from dusts by MSHA-NIOSH.

b. An emergency escape respirator will also be available at the site. If a high level of gas is noted or the combustible gas meter alarm goes off, all employees are to move upwind until the gas clears. During the movement away from the site all operations and running equipment must be stopped to prevent explosion. In the event a person does not get away from the rig the emergency escape respirator will be used to remove the employee. At no time would you use the escape respirator to secure equipment or turn off the rig. You would stay at least 50 feet upwind away from the rig.

c. Remember when wearing a respirator:

(1) Check it thoroughly. Make sure it's clean and no parts are missing.

(2) Always use both the bottom and top straps to secure the respirator.

(3) After the respirator is on, check the seal by giving yourself a negative and positive pressure test - you may have to use a piece of plastic to seal out the air for the check.

(4) Anytime the filters get wet, or it's hard to breathe wearing the respirator, change the filters.

(5) Do not use a respirator that has been worn by anyone else until it has been thoroughly cleaned. At the end of each day, clean your respirator with soap and water. Put it in a clean plastic bag with your name on it so it will be ready for the next day's use.

8. PROTECTIVE CLOTHING:

a. For your protection, you will be wearing disposal coveralls. The purpose of the coveralls is to keep you from being covered with contaminated dirt and splashed with contaminated liquids or muds. You must help reduce the potential of contamination by showering as soon as possible after you finish your work shift. The disposal coveralls are to be removed and discarded daily. Be careful not to get dirt from your coveralls on your clean clothes.

b. You will also be wearing protective gloves to keep the landfill liquids and materials from entering your bloodstream through your hands. You will use a latex or surgical glove under your regular leather gloves, but remember, the leather gloves become contaminated. The leather gloves you use must be kept in a plastic bag during the job and thrown away at the end of the project. The thin latex gloves need to be changed daily or anytime a leak develops. If the latex gloves don't work it will be necessary to wear a butyl or PVC glove. These gloves are more cumbersome to use due to their size but if they have to be used, leather gloves will not be needed.

c. You will be issued protective safety toe boots. Please, do not wear your dirty boots into eating areas or your sleeping quarters. You can contaminate these areas with the dirt off your boots. A plastic bag can be used to carry your boots with you to and from the sites. The dirt from the drill sites will stay on leather shoes and cannot be cleaned, so wear your boots which can be washed.

9. HEARING PROTECTION:

a. As usual, ear plugs or muffs must always be used when drilling. This is required by the OSHA regulations as well as by the Department of the Army. The ear plugs issued to you were designed to let you hear each other talking and yet block the harmful noises.

b. Noise sampling similar to air sampling may be conducted while you are working. While you are working in Bldg. 3001, TAFB regulations may require you to wear hearing protection in other than the drilling areas.

10. NO SMOKING:

You can smoke in the landfill areas no closer than 50' to the drilling operations. As mentioned under the hygiene section, you always carry some dirt from your hands to your mouth so wash before smoking. Certain areas in Bldg. 3001 may be no smoking areas due to work processes or Tinker regulations.

11. EYE PROTECTION:

Safety glasses, goggles, or other eye protection may be required in Bldg. 3001 due to operations in the area such as milling, grinding, sanding of equipment.

12. SUMMARY: The safety plan can only protect a person who uses it. Worker safety and health depend on you, and your opinion is valuable. If you think additional training, instruction and equipment are necessary, we can expand our efforts. Your suggestions for improving this plan are welcome. Don't leave your safety and health up to someone else.

Attach 1

2.4.1 Landfills 1-4 Site Description

Six landfills used for the disposal of refuse were identified at Tinker AFB. These landfills were grouped into two zones for the Phase II (Stage 1) study. Zone 1 consists of Landfills 1 through 4, and Zone 2 consists of Landfills 5 and 6. Five of the landfills are located on the base, and one is located on leased propety adjoining Area "D" east of the base.

Zone 1 - Landfill No. 1 is a small area, approximately 1 acre in size, south of Crutcho Creek along Air Depot Boulevard. This landfill was used from the start of operations at Tinker AFB in 1942 until 1945. Primarily general refuse (paper, household garbage, other non-industrial solid waste) from the base was disposed in the landfill, although the site may also have received waste solids from the domestic wastewater treatment plant. Refuse was disposed in trenches running east-west, and was typically burned to to reduce volume. The trenches extended to a depth of 10 to 25 feet, through a 6 to 8 foot clay layer into a sand/rock zone. Landfill No. 1 is well covered and shows no exposure of the disposal cells; however, settlement in the trenches has resulted in surface depressions where water collects from rainfalls. This water evaporates or percolates through the landfill.

After closure of Landfill No. 1, Landfill No. 2 was opened south of Landfill Road and west of Reserve Road. This landfill was utilized from 1945 until its closure in 1952. Approximately 20 acres were filled during this time period. Although most of the waste disposed of consisted of general refuse from the base, small quantities of paints and solvents were also buried. The waste was disposed of in trenches approximately 20 feet in depth and 35 to 40 feet wide, in an east-west orientation. The refuse was covered daily with several inches of excavated material, and completed trenches were covered with 3 to 4 feet of material.

Landfill No. 2 is well covered and vegetated with grasses and shows no erosion or exposure of landfill material. Several surface depressions with collected rain water caused by material settlement in the trenches are evident on the landfill. A pond, several acres in area, is also located on Landfill

No. 2. The pond was constructed in the mid-1960s either partly on top or adjacent to the landfill area. From the air, the outlines of trenches can be seen along the boundary of the pond where the water level is high enough to inundate portions of the trenches. Overflow from the pond enters the upper reaches of Crutcho Creek. It is presently unknown to what extent the pond waters percolate through the landfilled material.

During the time period 1952-1961, wastes were disposed of in an eight acre area designated as Landfill No. 3. This area is located adjacent to Landfill No. 2 north of Landfill Road and south of Crutcho Creek. Crutcho Creek crosses the northeast corner of Landfill No. 3. The type of waste disposed of and disposal methods were similar to previous landfills. The landfilled material consisted primarily of general refuse, but did include paint buckets, insecticide cans, and empty barrels. A number of vacuum tubes which contained low levels of radioactivity were also disposed of at this site. Landfill materials were disposed of in trenches running the length of the landfill. Trenches were approximately 25 feet deep, and extended through a surface clay layer into a sand/rock layer. The refuse was covered daily, and a final cover of 3 to 4 feet of excavated material was placed on completed trenches.

Additional radioactive material was reported to have been disposed of in a deep pit adjacent to the northwest corner of landfill No. 3. The area was formerly posted with radioactivity warning signs, which have been destroyed.

Landfill No. 3 shows no evidence of erosion along the creek or elsewhere around the landfill. At present, additional dirt and hardfill are being stored on top of the landfill. This practice has been in effect for approximately 5 years.

After closure of the Landfill No. 3, a 16-acre site south of Landfill Road between Landfill No. 2 and Air Depot Boulevard was utilized for

refuse disposal and designated Landfill No. 4. Disposal practices were essentially the same as previous landfills, with a daily cover of 3 to 6 inches of compacted excavated material applied to the refuse and a final cover of several feet of soil used for completed trenches. The landfill was closed in 1968.

Surface leachate and associated gases have been observed along the west slope of the landfill along Air Depot Boulevard on several occasions since closure. A major problem with leachate from the west bank of landfill No. 4 occurred during 1979. Unusually heavy rainfall occurred during that year. Leachate occurred in a drainage ditch eventually leading to Crutcho Creek. Leachate and drainage ditch wastewater samples analysis data indicated high concentrations of COD, oil and grease, phenols, and heavy metals. Unusually high concentrations of mercury (Hg) were also found in the leachate and drainage ditch samples, indicating that significant hazardous wastes quantities may be present in Landfill No. 4.

Although the landfill area was covered with a layer of top soil, small discharges of leachate are still observeable along the west and north of Landfill No. 4. Surface runoff from these areas, including leachate, enters the drainage ditch and eventually enters Crutcho Creek.

Also included in Zone 1 are Fire Training Area (FTA) No. 1 and Radiological Waste Disposal Site (RWDS) 1030W. FTA No. 1, in use from approximately 1950 to 1962, consisted of an unlined, diked area where fuel oil and unknown waste materials were ignited and extinguished. RWDS-1030W consisted of a pit in which radium final wastes (rags and acetone solutions which contained radium) were buried. A verbal report referenced in an Air Force document asserts that all radioactive wastes were removed in 1955 when the sanitary landfill was established (Engineering-Science, 1982).

Landfills 5 & 6 Site Description

Zone 2 - Landfill No. 5 located north of Patrol Road and east of Tower Road, was used during the period 1968-1970. The disposal practices and types of wastes were the same as at Landfill No. 4. The three acre site is well covered and no waste material is exposed; however, waste compaction in the trenches has resulted in surface depressions which collect and hold rain water. A small area of seepage is noticeable on the northeastern edge of the landfill adjacent to West Crutcho Creek. Recent (1984) construction activities have disrupted a portion of the landfill surface.

Landfill No. 6 was used for the disposal of refuse from 1970 to 1979. This landfill is located in Area "D" approximately 1/2 mile east of Tinker AFB along S.E. 59th Street on land leased from Oklahoma City. Although 40 acres are available at the site, only about 20 acres on the western half of the landfill were used prior to the closing of the site during 1979. Base refuse since that time has been disposed of off-site by private contractor.

Materials disposed in Landfill No. 6 consisted primarily of general refuse with small quantities of industrial waste materials such as paint buckets, insecticide cans, etc. Industrial wastewater treatment plant sludge was also intermittently disposed of in this landfill. The refuse was covered daily with 6 to 8 inches of compacted soil, and several feet of compacted cover was used as a final trench covering. Highly permeable river sand was used for daily cover for several years, although other areas had a cover of excavated clay and sand/rock. After closure, the site was revegetated with grasses. Field reconnaissance of the site indicated moderate surface erosion and no observed leachate.

FTA's 1 & 2 Site Descriptions

Fire Protection Training

Fire Protection Training (FPT) activities of the Fire Department on Tinker AFB commenced about 1950. Since that time, three Fire Training Areas (FTA) have been utilized, as shown on Figures 4.2.

FTA No. 1 was located directly south of the abandoned wastewater treatment facility, north of Crutcho Creek, and west of Air Depot Boulevard as shown on Figure 4.3. The training pit was diked and had a gravel bottom, but was unlined. FPT activities were conducted from approximately 1950 to 1962 at this location, with the heaviest usage occurring in the early 1950's. The procedure was to first add water to the pit to saturate the soil and reduce infiltration and then fuel was added on top of the water. Although fuel oil was often burned in the fire training practice, sometimes the operation included the burning of waste material from 55-gallon drums. No information is available concerning the types of materials contained in these drums; however, it is likely that materials such as solvents and waste oils were consumed in FTA No. 1. After waste materials and/or fuel were added to the pit, it was ignited and then extinguished with water and/or a protein-based foam. The residual mixture remaining in the pit would evaporate or infiltrate into the soil prior to the next training exercise.

After closure of FTA No. 1, fire control training activities were conducted in a temporary pit (FTA No. 2) located several hundred feet west of the present site, as shown on Figure 4.4. The training pit, diked but unlined, was used infrequently between 1962 and 1966. The practice of disposing of drummed waste in the fire training area was discontinued at this time. Fuel was brought in by tank truck, ignited and extinguished in the training pit in the same location. The residue was left in the pit to evaporate and infiltrate prior to the next exer-

RWDS 201S & 1030W - Site Description

Radioactive Waste Disposal Site (RWDS) 201S is located adjacent to the overhead conveyor south of Building 201 as shown in Figure 4.12. The site is marked by a concrete post, although radiation warning signs are not posted. Very little information is available concerning radioactive waste disposal at this site. The burial area encompasses approximately 10 square feet and was used for the disposal of radium paint dials and radium paint solids. The dates of operation of this disposal site are not known, and the area is no longer used for disposal of radioactive wastes. No information is available concerning the construction of the disposal pit, depth of burial, or quantity of waste disposed. Radiological monitoring of the site by the Bioenvironmental Engineering Services Division in October 1981 indicated no radioactivity in excess of natural background levels.

The fourth radioactive waste burial site was identified as being located 1200 feet west and 550 feet north of Building 1030. The site is under water in one of the base's fishing ponds. The area purportedly contained radium dial wastes. A verbal report referenced in an Air Force document asserts that all radioactive wastes were removed in 1955, when the sanitary landfill was established.

Building 3001 - Site Description

Building 3001 houses numerous maintenance and repair activities and shops which support the mission of the Oklahoma City Air Logistic Center. This command operates an overhaul and modification complex engaged in repairing and upgrading aircraft including a vast quantity of engines and many thousands of accessory items. Industrial operations within the Building 3001 area encompass a variety of repair and maintenance facilities which include:

- Disassembly, cleaning, and inspection of aircraft systems and components;
- Plating, painting, heat treating, testing of metal parts and components;
- Accessory shops including electrical, valve and governor, gear box, tubing and cable, fuel controls, nozzles, pumps, bearings, and other specialized repair ships; and
- Assembly and testing and packaging of aircraft and aircraft components.

In addition, other functions housed within this or other nearby buildings include utility (water, power and steam production), administrative and engineering offices, parts and material storage, and others.

Construction of the Oklahoma Aircraft Assembly Plant (as the Building 3001 complex was known originally) began in 1942. Since then it has been operated as an aircraft overhaul and repair facility, as it is today. Although the specific aircraft and associated engines have changed, in most cases the nature of the industrial repair functions pertinent to this investigation have remained basically the same.

Halogenated hydrocarbon solvents have been and continue to be used primarily for cleaning and degreasing of metal engine parts undergoing overhaul or repair. Trichloroethylene was the solvent of choice for most degreasing operations from the early 1940's until the early 1970's, when tetrachloroethylene began to be substituted because of its lower vapor pressure.

As originally designed, degreasing operations took place in metal tanks set below the floor level in concrete pits. These pits ranged in depth from three to eight feet and in size from approximately 8x10 up to 30x90 feet. Coincident with the shift from trichloroethylene to tetrachloroethylene, these below-floor pits were closed (typically filled with sand and topped with a concrete cap) and replaced with specially designed degreasing machines (complete system including all piping, tanks and pumps) which are above ground or floor level.

Changes in the layout and purpose of the repair shops in this complex have coincided with shift from reciprocating to jet engine repair and overhaul. These changes affected the nature and number of underground storage tanks in the Building 3001 area. Most of the storage tanks were and are for use during testing of aircraft engines or components, or for fuel storage for the utility boilers and electrical generators. Also there are solvent (not halogenated) storage tanks for a variety of uses but mostly connected with aircraft surface painting and cleaning. As the function or location of various shops changed, tanks were added and old tanks were either relocated or abondoned. Storage tanks for aviation (high octane) gasoline were converted over to either kerosene type fuels used in jet engines or to solvent storage. Records and interviews at Tinker indicate a practice of "abandoning in place" old tanks which were either no longer needed or not functioning (leaking). This was accomplished by removing surface connections and filling with sand where possible.

Zone 6 (Building 3001 Wells)

Zone six consists of two Base water supply wells (Wells 18 and 19) located within Building 3001 (The Oklahoma City Air Logistics Center manufacturing complex) in the northeast portion of the Base (Figure 2-9). An Air Force monitoring program had discovered both trichloroethylene (TCE) and tetrachloroethylene in these wells, so both were taken out of service. Radian was tasked with a preliminary assessment of the contamination in these wells.

Both Wells 18 and 19 are deep (>1,000 feet), high capacity water supply wells, pumping directly into the distribution system, which supplies both industrial and potable uses. The wells were drilled in 1942 and incomplete construction records remain. No driller's or geophysical logs were available, but partial casing and perforation records were found.

APPENDIX Q

LABORATORY ANALYSES OF TRAVEL AND EQUIPMENT BLANKS

PARAMETER	UNITS	EQUIPMENT BLANK MAR 7, 1986
pH, field		**6.75**
conductivity, field	**umhos/cm**	**5.1**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<50.000
bis(2-chloroethyl)ether	ug/l	<50.000
2-chlorophenol	ug/l	<50.000
1,3-dichlorobenzene	ug/l	<50.000
1,4-dichlorobenzene	ug/l	<50.000
benzyl alcohol	ug/l	<50.000
1,2-dichlorobenzene	ug/l	<50.000
2-methylphenol	ug/l	<50.000
bis(2-chloroisopropyl)eth	ug/l	<50.000
4-methylphenol	ug/l	<50.000
n-nitrosodipropylamine	ug/l	<50.000
hexachloroethane	ug/l	<50.000

nitrobenzene	ug/l	<50.000
isophorone	ug/l	<50.000
2-nitrophenol	ug/l	<50.000
2,4-dimethylphenol	ug/l	<50.000
benzoic acid	ug/l	<250.000
bis(2-chloroethoxy)methan	ug/l	<50.000
2,4-dichlorophenol	ug/l	<50.000
1,2,4-trichlorobenzene	ug/l	<50.000
naphthalene	ug/l	<50.000
4-chloroaniline	ug/l	<50.00
hexachlorobutadiene	ug/l	<50.000
p-chloro-m-cresol	ug/l	<50.000
2-methylnaphthalene	ug/l	<50.000
hexachlorocyclopentadiene	ug/l	<50.000
2,4,6-trichlorophenol	ug/l	<50.000
2,4,5-tricholorphenol	ug/l	<250.000
2-chloronaphthalene	ug/l	<50.000
2-nitroaniline	ug/l	<250.000
dimethyl phthalate	ug/l	<50.000
acenaphthylene	ug/l	<50.000
3-nitroaniline	ug/l	<250.000
acenaphthalene	ug/l	<50.000
2,4-dinitrophenol	ug/l	<250.000
4-nitrophenol	ug/l	<250.000
dibenzofuran	ug/l	<50.000
2,4-dinitrotoluene	ug/l	<50.000
2,6-dinitrotoluene	ug/l	<50.000
diethyl phthalate	ug/l	<50.000
4-chlorophenyl phenyl eth	ug/l	<50.000
fluorene	ug/l	<50.000
4-nitroaniline	ug/l	<250.00
4,6-dinitro-2-methylphenol	ug/l	<250.000
n-nitrosodiphenylamine	ug/l	<50.000
4-bromophenyl phenyl ether	ug/l	<50.000
hexachlorobenzene	ug/l	<50.000
pentachlorophenol	ug/l	<250.000
phenanthrene	ug/l	<50.000
anthracene	ug/l	<50.000
di-n-butyl phthalate	ug/l	<50.000
fluoranthene	ug/l	<50.000
pyrene	ug/l	<50.000
butyl benzyl phthalate	ug/l	<50.000
3,3-dichlorobenzidine	ug/l	<100.000
benzo(a)anthracine	ug/l	<50.000
bis(2-ethylhexyl)phthalate	ug/l	70.000
chrysene	ug/l	<50.000
di-n-octyl phthalate	ug/l	<50.000
benzo(b)fluoranthene	ug/l	<50.000
benzo(k)fluoranthene	ug/l	<50.000
benzo(a)pyrene	ug/l	<50.000
indeno(1,2,3-c,d)pyrene	ug/l	<50.000
dibenzo(a,h)anthracene	ug/l	<50.000

benzo(g,h,i)perylene	ug/l	<50.000
aldrin	ug/l	<100.000
a-BHC	ug/l	<50.000
b-BHC	ug/l	<50.000
g-BHC (lindane)	ug/l	<50.000
d-BHC	ug/l	<50.000
chlordane	ug/l	<1000.000
4,4-DDE	ug/l	<100.000
4,4-DDT	ug/l	<100.000
4,4-DDD	ug/l	<100.000
dieldrin	ug/l	<50.000
endosulfan I	ug/l	<50.000
endosulfan II	ug/l	<100.000
endosulfan sulfate	ug/l	<100.000
endrin	ug/l	<100.000
endrin aldehyde	ug/l	<100.000
heptachlor	ug/l	<50.000
heptachlor epoxide	ug/l	<100.000
toxaphene	ug/l	<1500.000
PCB 1016	ug/l	<500.000
PCB 1221	ug/l	<500.000
PCB 1232	ug/l	<1000.000
PCB 1242	ug/l	<1000.000
PCB 1248	ug/l	<1000.000
PCB 1254	ug/l	<1000.000
PCB 1260	ug/l	<1000.000

PARAMETER	TRAVEL BLANK UNITS	MAR 27, 1986
pH, field		**6.75**
conductivity, field	**umhos/cm**	**5.1**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0

1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000
phenol	ug/l	<50.000
bis(2-chloroethyl)ether	ug/l	<50.000
2-chlorophenol	ug/l	<50.000
1,3-dichlorobenzene	ug/l	<50.000
1,4-dichlorobenzene	ug/l	<50.000
benzyl alcohol	ug/l	<50.000
1,2-dichlorobenzene	ug/l	<50.000
2-methylphenol	ug/l	<50.000
bis(2-chloroisopropyl)eth	ug/l	<50.000
4-methylphenol	ug/l	<50.000
n-nitrosodipropylamine	ug/l	<50.000
hexachloroethane	ug/l	<50.000
nitrobenzene	ug/l	<50.000
isophorone	ug/l	<50.000
2-nitrophenol	ug/l	<50.000
2,4-dimethylphenol	ug/l	<50.000
benzoic acid	ug/l	<250.000
bis(2-chloroethoxy)methan	ug/l	<50.000
2,4-dichlorophenol	ug/l	<50.000
1,2,4-trichlorobenzene	ug/l	<50.000
naphthalene	ug/l	<50.000
4-chloroaniline	ug/l	<50.00
hexachlorobutadiene	ug/l	<50.000
p-chloro-m-cresol	ug/l	<50.000
2-methylnaphthalene	ug/l	<50.000
hexachlorocyclopentadiene	ug/l	<50.000
2,4,6-trichlorophenol	ug/l	<50.000
2,4,5-tricholorphenol	ug/l	<250.000
2-chloronaphthalene	ug/l	<50.000
2-nitroaniline	ug/l	<250.000
dimethyl phthalate	ug/l	<50.000
acenaphthylene	ug/l	<50.000
3-nitroaniline	ug/l	<250.000
acenaphthalene	ug/l	<50.000
2,4-dinitrophenol	ug/l	<250.000
4-nitrophenol	ug/l	<250.000
dibenzofuran	ug/l	<50.000

2,4-dinitrotoluene	ug/l	<50.000
2,6-dinitrotoluene	ug/l	<50.000
diethyl phthalate	ug/l	<50.000
4-chlorophenyl phenyl eth	ug/l	<50.000
fluorene	ug/l	<50.000
4-nitroaniline	ug/l	<250.00
4,6-dinitro-2-methylphenol	ug/l	<250.000
n-nitrosodiphenylamine	ug/l	<50.000
4-bromophenyl phenyl ether	ug/l	<50.000
hexachlorobenzene	ug/l	<50.000
pentachlorophenol	ug/l	<250.000
phenanthrene	ug/l	<50.000
anthracene	ug/l	<50.000
di-n-butyl phthalate	ug/l	<50.000
fluoranthene	ug/l	<50.000
pyrene	ug/l	<50.000
butyl benzyl phthalate	ug/l	<50.000
3,3-dichlorobenzidine	ug/l	<100.000
benzo(a)anthracine	ug/l	<50.000
bis(2-ethylhexyl)phthalate	ug/l	70.000
chrysene	ug/l	<50.000
di-n-octyl phthalate	ug/l	<50.000
benzo(b)fluoranthene	ug/l	<50.000
benzo(k)fluoranthene	ug/l	<50.000
benzo(a)pyrene	ug/l	<50.000
indeno(1,2,3-c,d)pyrene	ug/l	<50.000
dibenzo(a,h)anthracene	ug/l	<50.000
benzo(g,h,i)perylene	ug/l	<50.000
aldrin	ug/l	<100.000
a-BHC	ug/l	<50.000
b-BHC	ug/l	<50.000
g-BHC (lindane)	ug/l	<50.000
d-BHC	ug/l	<50.000
chlordane	ug/l	<1000.000
4,4-DDE	ug/l	<100.000
4,4-DDT	ug/l	<100.000
4,4-DDD	ug/l	<100.000
dieldrin	ug/l	<50.000
endosulfan I	ug/l	<50.000
endosulfan II	ug/l	<100.000
endosulfan sulfate	ug/l	<100.000
endrin	ug/l	<100.000
endrin aldehyde	ug/l	<100.000
heptachlor	ug/l	<50.000
heptachlor epoxide	ug/l	<100.000
toxaphene	ug/l	<1500.000
PCB 1016	ug/l	<500.000
PCB 1221	ug/l	<500.000
PCB 1232	ug/l	<1000.000
PCB 1242	ug/l	<1000.000
PCB 1248	ug/l	<1000.000
PCB 1254	ug/l	<1000.000

PCB 1260	ug/l	<1000.000

EQUIPMENT BLANK

PARAMETER	UNITS	APR 22, 1986
pH, field		**7.15**
conductivity, field	**umhos/cm**	**3.6**
total organic carbon	**mg/l**	**0.87**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	**ug/l**	**8.000**
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	**ug/l**	**6.000**
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

TRAVEL BLANK

PARAMETER	UNITS	APR 27, 1986
pH, field		**7.15**
conductivity, field	**umhos/cm**	**3.6**
total organic carbon	**mg/l**	**1.4**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000

vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

EQUIPMENT BLANK

PARAMETER	UNITS	MAY 2, 1986
total organic carbon	**mg/l**	**0.9**
pH, field		**6.41**
conductivity, field	**umhos/cm**	**19.1**

TRAVEL BLANK

PARAMETER	UNITS	MAY 2, 1986
total organic carbon	**mg/l**	**1.4**
pH, field		**6.41**
pH, field		**6.41**
conductivity, field	**umhos/cm**	**19.1**
conductivity, field	**umhos/cm**	**19.1**

EQUIPMENT BLANK

PARAMETER		UNITS	JUN 10, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	<10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	88
arsenic	total	ug/l	1.4
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.4
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	88

TRAVEL BLANK

PARAMETER		UNITS	JUN 10, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	<10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	120
arsenic	total	ug/l	1.8
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	<25
mercury	total	ug/l	<0.1
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	160

PARAMETER		EQUIPMENT BLANK UNITS	SEP 9, 1986
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	25
mercury	total	ug/l	<0.4
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	130
total organic carbon		mg/l	1.0
pH, field			4.20
conductivity, field		umhos/cm	25
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	13.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		UNITS	TRAVEL BLANK SEP 9, 1986
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	28
mercury	total	ug/l	<0.4
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	78
total organic carbon		mg/l	1.6
pH, field			3.43
conductivity, field		umhos/cm	111
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	53.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	<5.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000
chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER	EQUIPMENT BLANK UNITS	SEP 10, 1986
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	**ug/l**	**7.000**
acetone	**ug/l**	**240.000**
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER	EQUIPMENT BLANK UNITS	SEP 11, 1986
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	**ug/l**	**29.000**
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000

chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

EQUIPMENT BLANK

PARAMETER		UNITS	OCT 28, 1986
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**30**
mercury	total	ug/l	<0.4
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**90**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	<5.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000

1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		TRAVEL BLANK UNITS	OCT 10, 1986
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	30
mercury	dissolved	ug/l	<0.4
nickel	dissolved	ug/l	10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	93
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	30
mercury	total	ug/l	<0.4
nickel	total	ug/l	13
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	80
pH, field			3.38
conductivity, field		umhos/cm	110
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000

methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		EQUIPMENT BLANK UNITS	OCT 29, 1986
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	35
mercury	total	ug/l	<0.4
nickel	total	ug/l	35
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	78
pH, field			6.37
conductivity, field		umhos/cm	3.9

PARAMETER	EQUIPMENT BLANK UNITS	NOV 13, 1986
chloromethane	ug/l	<10.000

bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

TRAVEL BLANK

PARAMETER	UNITS	NOV 10, 1986
benzene	ug/l	<1.00
toluene	ug/l	<1.20
xylenes total	ug/l	<6.000

EQUIPMENT BLANK

PARAMETER		UNITS	FEB 25, 1987
arsenic	**dissolved**	**ug/l**	**2.5**
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.1
nickel	**dissolved**	**ug/l**	**10**

selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	18
arsenic	total	ug/l	2.5
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	10
lead	total	ug/l	<25
mercury	total	ug/l	<0.1
nickel	total	ug/l	15
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	23
pH, field			4.49
pH, field			4.49
pH, field			4.49
pH, field			4.48
conductivity, field		umhos/cm	40.6
conductivity, field		umhos/cm	40.6
conductivity, field		umhos/cm	40.6
conductivity, field		umhos/cm	39.9
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		ug/l	93.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	30.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000
bromodichloromethane		ug/l	<5.0
1,2-dichloropropane		ug/l	<5.000
trichloroethene		ug/l	<5.000
dibromochloromethane		ug/l	<5.0
1,1,2-trichloroethane		ug/l	<5.000
benzene		ug/l	7.00
2-chloroethyl vinyl ether		ug/l	<10.000
bromoform		ug/l	<5.0
2-hexanone		ug/l	<10.000
4-methyl-2-pentanone		ug/l	<10.00
tetrachloroethene		ug/l	<5.000
1,1,2,2-tetrachloroethane		ug/l	<5.000
toluene		ug/l	<5.00
cis-1,3-dichloropropene		ug/l	<5.000
trans-1,3-dichloropropene		ug/l	<5.000

chlorobenzene		ug/l	<5.000
ethylbenzene		ug/l	<5.00
styrene		ug/l	<5.000
xylenes total		ug/l	<5.000

PARAMETER		TRAVEL BLANK UNITS	NOV 25, 1986
arsenic	dissolved	ug/l	2.5
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.1
nickel	dissolved	ug/l	10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	13
arsenic	total	ug/l	2.7
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	25
mercury	total	ug/l	<0.1
nickel	total	ug/l	13
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	20
pH, field			4.67
pH, field			4.67
pH, field			4.67
pH, filed			4.65
conductivity, field		umhos/cm	58.1
conductivity, field		umhos/cm	58.1
conductivity, field		umhos/cm	58.1
conductivity, field		umhos/cm	57.9
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<3.000
acetone		ug/l	<10.000
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000
1,1-dichloroethane		ug/l	<5.000
trans-1,2-dichloroethene		ug/l	<5.000
chloroform		ug/l	33.0
1,2-dichloroethane		ug/l	<5.000
2-butanone (meth eth ket)		ug/l	<10.000
1,1,1-trichloroethane		ug/l	<5.000
carbon tetrachloride		ug/l	<5.0
vinyl acetate		ug/l	<10.000

bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

EQUIPMENT BLANK

PARAMETER	UNITS	DEC 3, 1986
pH, field		**4.75**
conductivity, field	**umhos/cm**	**25**
benzene	**ug/l**	**2.30**
toluene	ug/l	<1.20
xylenes total	ug/l	<6.000

TRAVEL BLANK

PARAMETER	UNITS	DEC 3, 1986
pH, field		**4.75**
conductivity, field	**umhos/cm**	**25**
benzene	ug/l	<1.00
toluene	ug/l	<1.20
xylenes total	ug/l	<6.000

EQUIPMENT BLANK

PARAMETER		UNITS	JAN 1, 1987
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**28**
mercury	total	ug/l	<0.1
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**30**
pH, field			**4.22**

conductivity, field	**umhos/cm**	**37.7**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	**ug/l**	**40.0**
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	**ug/l**	**6.0**
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER		TRAVEL BLANK UNITS	FEB 25, 1987
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	**total**	**ug/l**	**33**
mercury	total	ug/l	<0.1
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	**total**	**ug/l**	**25**
pH, field			**4.22**
conductivity, field		**umhos/cm**	**37.7**

chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	**ug/l**	**40.0**
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	**ug/l**	**6.0**
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

EQUIPMENT BLANK

PARAMETER	UNITS	FEB 18, 1987
pH, field		**4.14**
conductivity, field	**umhos/cm**	**21.8**
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0

1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	83.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

PARAMETER	TRAVEL BLANK UNITS	FEB 18, 1987
pH, field		4.14
conductivity, field	umhos/cm	21.8
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00

2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

EQUIPMENT BLANK

PARAMETER		UNITS	MAR 11, 1987
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.1
nickel	dissolved	ug/l	<10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	<10
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	25
mercury	total	ug/l	<0.1
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	<10
total organic carbon		mg/l	<0.1
oil and grease		mg/l	<1.00
chloride		mg/l	<1
sulfate		mg/l	<1
cyanide		mg/l	<0.200
pH, field			**3.66**
conductivity, field		**umhos/cm**	**81.4**
chloromethane		ug/l	<10.000
bromomethane		ug/l	<10.000
vinyl chloride		ug/l	<10.000
chloroethane		ug/l	<10.000
methylene chloride		ug/l	<5.000
acetone		**ug/l**	**12.000**
carbon disulfide		ug/l	<5.000
1,1-dichloroethene		ug/l	<5.000

1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	**ug/l**	**150.00**
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	**ug/l**	**5.00**
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	**ug/l**	**10.000**
xylenes total	ug/l	<5.000

PARAMETER		UNITS	TRAVEL BLANK MAR 11, 1987
arsenic	dissolved	ug/l	<1
barium	dissolved	ug/l	<500
cadmium	dissolved	ug/l	<8
chromium	dissolved	ug/l	<10
lead	dissolved	ug/l	<25
mercury	dissolved	ug/l	<0.1
nickel	dissolved	ug/l	<10
selenium	dissolved	ug/l	<0.4
silver	dissolved	ug/l	<10.0
zinc	dissolved	ug/l	<10
arsenic	total	ug/l	<1
barium	total	ug/l	<500
cadmium	total	ug/l	<8
chromium	total	ug/l	<10
lead	total	ug/l	25
mercury	total	ug/l	<0.1
nickel	total	ug/l	<10
selenium	total	ug/l	<0.4
silver	total	ug/l	<10.0
zinc	total	ug/l	<10
total organic carbon		mg/l	<0.1

oil and grease	mg/l	<1.00
chloride	mg/l	<1
sulfate	mg/l	<1
cyanide	mg/l	<0.200
pH, field		3.80
conductivity, lab	umhos/cm	60.1
chloromethane	ug/l	<10.000
bromomethane	ug/l	<10.000
vinyl chloride	ug/l	<10.000
chloroethane	ug/l	<10.000
methylene chloride	ug/l	<5.000
acetone	ug/l	<10.000
carbon disulfide	ug/l	<5.000
1,1-dichloroethene	ug/l	<5.000
1,1-dichloroethane	ug/l	<5.000
trans-1,2-dichloroethene	ug/l	<5.000
chloroform	ug/l	<5.0
1,2-dichloroethane	ug/l	<5.000
2-butanone (meth eth ket)	ug/l	<10.000
1,1,1-trichloroethane	ug/l	<5.000
carbon tetrachloride	ug/l	<5.0
vinyl acetate	ug/l	<10.000
bromodichloromethane	ug/l	<5.0
1,2-dichloropropane	ug/l	<5.000
trichloroethene	ug/l	<5.000
dibromochloromethane	ug/l	<5.0
1,1,2-trichloroethane	ug/l	<5.000
benzene	ug/l	<5.00
2-chloroethyl vinyl ether	ug/l	<10.000
bromoform	ug/l	<5.0
2-hexanone	ug/l	<10.000
4-methyl-2-pentanone	ug/l	<10.00
tetrachloroethene	ug/l	<5.000
1,1,2,2-tetrachloroethane	ug/l	<5.000
toluene	ug/l	<5.00
cis-1,3-dichloropropene	ug/l	<5.000
trans-1,3-dichloropropene	ug/l	<5.000
chlorobenzene	ug/l	<5.000
ethylbenzene	ug/l	<5.00
styrene	ug/l	<5.000
xylenes total	ug/l	<5.000

EQUIPMENT BLANK

PARAMETER	UNITS	OCT 22, 1987
total organic carbon	mg/l	3.5

TRAVEL BLANK

PARAMETER	UNITS	OCT 22, 1987
total organic carbon	mg/l	3.7