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June 18, 2003

North Carolina Division of Water Quality
Water Quality Section; Non-Discharge Permitting Unit
Attention: Mr. Kim Colson
1617 Mail Service Center
Raleigh, North Carolina 27699-1617

Re.: ***Non-Discharge Permit Application***
Flint Hills Resources, North Terminal
Wilmington, North Carolina
CATLIN Project No. 201-125

To Whom It May Concern:

CATLIN Engineers and Scientists (CATLIN) is submitting this *Non-Discharge Permit Application* on behalf of the Applicant, Reiss Remediation, Inc. (Reiss). Reiss is affiliated through partially common ownership to the property owner, Flint Hills Resources (FHR), LP, and is responsible to FHR for the remediation activities at the site. Attached to this letter is the completed Non-Discharge Permit Application Form (Attachment A) and the supportive documentation. CATLIN prepared a Corrective Action Plan Addendum (CAPA) dated August 9, 2002 that proposed groundwater remediation associated with this non-discharge permit. North Carolina Department of Environment and Natural Resources (NCDENR), Groundwater Section (GWS) personnel reviewed the CAPA and submitted a Statement of General Agreement in October 2002. Please note that Reiss will be installing and operating this system on behalf of FHR. Should Reiss be dissolved or otherwise not able to implement the work, FHR would assume responsibility for operation of the system.

The site is located at 3325 River Road in Wilmington, North Carolina as illustrated on Sheet 1 of the Construction Plans (Attachment E). As discussed in the CAPA, the North Terminal is subdivided into two facilities. These facilities are identified as the PX Facility and the Gasoline/#2 Fuel Oil Facility on Sheet 2 of the Construction Plans (Attachment E). This Non-Discharge Permit Application is for groundwater remediation (referred to as pre-treatment in the CAPA) portion of the proposed remediation system enhancement for the PX Facility identified on Sheet 3 of the Construction Plans and the Loading Rack Area portion of the Gasoline/#2 Fuel Oil Facility illustrated on Sheet 4 (herein referred to as Loading Rack Area). This application does not address the proposed in situ groundwater remediation. The proposed in situ groundwater remediation system is currently being reviewed by the NCDENR UIC Program.

The following attachments are included as required submittals within the Non-Discharge Application Form, primarily by Page 6 of 9. Some required attachments may actually have two separate attachments, one for the PX Facility and one for the Loading Rack Area. Where applicable, the attachments have been combined.

Attachment A - Consists of one original and three copies of the completed and appropriately executed application form.
The following attachments are included as supportive documents to the information provided on the Non-Discharge Permit Application Form in Attachment A:

Attachment A1- ***Provided for PX Facility ONLY (Not Applicable at Loading Rack Area)***

Identified Sources of On-Site Paraxylene (PX) Subsurface Contamination Within the Paraxylene Facility - Information is provided as part of requested information in Section III, Number 6 of the Non-Discharge Permit Application Form.

Attachment A2 - Requirement of a Soil Scientist - The Non-Discharge Permit Application Form states that a licensed soil scientist is to provide an evaluation of the soils where the infiltration gallery will be located. Attachment A2 is a copy of a letter from the North Carolina Board of Examiners For Engineers and Surveyors which states, "By copy of this letter to the Department of Environment and Natural Resources the Board requests that either a licensed Soil Scientist or a licensed Professional Engineer be allowed to provide the infiltration gallery determination required by paragraph V.3." Based upon the hydraulics of a closed loop system for our proposed groundwater remediation system, the soil structure was not used to determine the loading rate. The geologic and hydrogeologic information provided by our licensed Geologists, and the nature of the proposed groundwater treatment system was used to determine the loading rate applicable for the proposed system. Based on the intent of our system and the letter referenced above, the loading rate (infiltration rate) has been determined from the pilot test conducted and evaluated by a licensed Professional Engineer as discussed on the next page.

Attachment A3 - ***PX Facility***

Summary of Pilot Test Activities for Infiltration Trench at Paraxylene Facility - Attachment provides a summary of the information gathered during the

pilot test activities to assist with providing the design information for the infiltration trenches (galleries) requested in Section V of the Non-Discharge Permit Application Form.

Loading Rack Area

Summary of Pilot Test Activities for Infiltration Trench at Loading Rack Area - Attachment provides a summary of the information gathered during the pilot test activities to assist with providing the design information for the infiltration trenches (galleries) requested in Section V of the Non-Discharge Permit Application Form.

Attachment B - Non-discharge systems with a loading rate of >10,000 gallons per day are classified as a major permit system. Each of the proposed systems will discharge greater than 10,000 gallons per day. Such systems require a NCDENR processing/annual administrative fee of $1,090.00.

Attachment C - Attachment is intended to be two copies of the Corrective Action Plan Addendum dated August 9, 2002 and two copies of the Comprehensive Site Assessment dated August 7, 2000. These copies have been provided under separate cover to the Non-Discharge Permitting Unit only. It is our assumption that others have a copy of these reports.

Attachment D - Attachment is intended to be used for providing a copy of the existing Non-Discharge Permit. This application is for a new Non-Discharge Permit; therefore, this attachment is not applicable to this project.

Attachment E - Consists of four sets of the Construction Plans for the Groundwater Remediation System. Please note that four copies have been submitted to the Non-Discharge Permitting Unit. Only one copy was submitted to others. The Construction Plans consist of the following sheets:

- SHEET 1 (COVER SHEET AND INDEX) includes the site location map, general project information and the index for the Construction Plans.
- SHEET 2 (SITE MAP). As illustrated, the site is subdivided into the PX Facility and the Gasoline/#2 Fuel Oil Facility. The Loading Rack Area is within the Gasoline/Fuel Oil Facility.
- SHEET 3 (CURRENT LAYOUT OF SITE AT PX FACILITY). This sheet illustrates the existing layout at the PX Facility as reported in the CAPA along with the new items constructed/modified since the CAPA submittal.
- SHEET 4 (CURRENT LAYOUT OF SITE AT LOADING RACK AREA). This sheet illustrates the existing layout at the Loading

Rack Area as reported in the CAPA along with the new items constructed/modified since the CAPA submittal.

- SHEET 5 (PROPOSED ADDITIONS TO CURRENT LAYOUT OF SITE AT PX FACILITY). This sheet illustrates the approximate location of the proposed recovery well trenches, the groundwater remediation system and the infiltration gallery at the PX Facility.
- SHEET 6 (PROPOSED ACTIVE REMEDIATION SYSTEM LAYOUT AT LOADING RACK AREA). This sheet illustrates the approximate location of the proposed recovery wells, the groundwater remediation system and the infiltration gallery at the Loading Rack Area.
- SHEET 7 (REMEDIATION SYSTEM SCHEMATIC FOR PX FACILITY). Illustrated is the schematic for the major components of the groundwater remediation system at the PX Facility.
- SHEET 8 (REMEDIATION SYSTEM SCHEMATIC FOR LOADING RACK AREA). Illustrated are the schematic for the major components of the groundwater remediation system at the Loading Rack Area.
- SHEET 9 (MISCELLANEOUS DETAILS). Miscellaneous details illustrated include:
  - Recovery well details (cross section and plan view)
  - Typical Infiltration Gallery Detail
  - Typical Infiltration Gallery Trench Section Detail
  - Typical Trench Section for Recovery Pump Electrical Conduit/Discharge Line

A topographic map with the approximate location of the site is included with the copy of the CAPA. As discussed in the CAPA, water supply wells are not located within a 1/4-mile of the site, therefore, a map showing the water supply well locations has not been included. Please note that the CSA report illustrates a non-potable water well on-site. This well has been abandoned since the preparation of the CSA.

Attachment F- ***PX Facility***

Consists of four copies of the tabulated data for all wells within the PX Facility. This data is presented in the attached table identified as Summary of Representative Monitoring Well Network Data.

Loading Rack Area

Consists of four copies of the tabulated data for all wells within the Loading Rack Area. This data is presented in the attached table identified as Summary of Representative Monitoring Well Network Data.

Please note that four copies have been submitted only to the Non-Discharge Permitting Unit. Only one copy was submitted to others.

Attachment G - Attachment is intended to be a copy of a soil scientist report. As discussed above in Attachment A2, a soil scientist was not obtained for this project; therefore, this attachment is not applicable to this project.

Attachment H - ***Attachment H1 - PX Facility***

Consists of the hydrogeologic information requested for the PX Facility portion of the North Terminal.

Attachment H2 - Loading Rack Area

Consists of the hydrogeologic information requested for the Loading Rack Area portion of the North Terminal.

Attachment I - ***PX Facility***

This attachment includes a description of the injection procedures of the treated groundwater. Also included with this attachment is a copy of the Breen GeoScience Management Inc. (BREEN) Technical Memorandum, which provides modeling illustrating hydraulic control over the contaminant plume with the injection of the treated groundwater through the infiltration gallery.

Loading Rack Area

This attachment includes a description of the injection procedures of the treated groundwater. Also included with this attachment is a copy of the BREEN Technical Memorandum, which provides modeling illustrating hydraulic control over the contaminant plume with the injection of the treated groundwater through the infiltration gallery.

Attachment J - ***PX Facility***

Attachment includes the monitoring and maintenance activities upon construction of the proposed groundwater remediation system at the PX Facility. These activities were reported within the CAPA.

Loading Rack Area

Attachment includes the monitoring and maintenance activities to be completed upon construction of the proposed groundwater remediation system at the Loading Rack Area. These activities were reported within the CAPA.

Please note that an Operation and Maintenance Manual will be developed upon approval of this application. This Operation and Maintenance Manual will include but not be limited to the monitoring and maintenance activities documented in this attachment.

Attachment K - Attachment is intended to be a discussion of the method for determining mechanical integrity of injection wells. This section is not applicable because injection wells are not being proposed as part of this application.

Attachment L - ***PX Facility***

Attachment is to include a complete analysis of the contaminated groundwater within the PX Facility that was utilized to design the proposed remediation system. A summary is provided in the attachment.

Loading Rack Area

Attachment is to include a complete analysis of the contaminated groundwater within the Loading Rack Area that was utilized to design the proposed remediation system. A summary is provided in the attachment.

Attachment M - ***PX Facility***

Attachment is intended to provide the groundwater remediation system effluent concentrations for the PX Facility. The groundwater remediation system was designed for an effluent discharge concentration that meets 2L requirements (current 2L Standards) for paraxylene (530 ppb) and MTBE (200 ppb). The information regarding the effluent concentrations has been provided in the attached Basis of Design (Attachment O).

Loading Rack Area

Attachment is intended to provide the groundwater remediation system effluent concentrations for the Loading Rack Area. The groundwater remediation system was designed for an effluent discharge concentration that meets 2L requirements for the following parameters (current 2L standards) Benzene (1 ppb), sec-Butylbenzene (70 ppb), Ethyl Benzene (29 ppb), MTBE (200 ppb), Naphthalene (6 ppb), Propylbenzene (70 ppb), Toluene (1,000 ppb), 1,2,4-Trimethylbenzene (350 ppb), and Xylenes (530 ppb). The information regarding the effluent concentrations has been provided in the attached Basis of Design (Attachment O).

Attachment N - ***PX Facility***

Attachment is intended to include the contaminant plume (horizontal and vertical limits) and groundwater flow direction for the PX facility. This

information is provided on Figures 4, 5, and 6 of the CAPA. Please refer to the attached copy of the CAPA (in Attachment C) for these figures.

Loading Rack Area

Attachment is intended to include the contaminant plume (horizontal and vertical limits) and groundwater flow direction for the Loading Rack Area. This information is provided on Figures 10 to 14 of the CAPA. Please refer to the attached copy of the CAPA (in Attachment C) for these figures.

Attachment O - Four copies of the supportive document, Basis of Design, has been included with this attachment. Please note that four copies have been submitted only to the Non-Discharge Permitting Unit. Only one copy was submitted to others.

Attachment P - This attachment consists of a copy of the surface water body classification.

Please feel free to contact us with any questions or if you should require additional information at (910) 452-586.

Sincerely,

Jeffery K. Becken, P.E.
Project Engineer

Steve A. Tyler
Project Manager

Attachments

cc: Charles F. Stehman, Ph.D., P.G., NCDENR Wilmington
Frank VanRyn, Reiss Remediation, Inc.

ATTACHMENT A

APPLICATION FORM

State of North Carolina
Department of Environment and Natural Resources
Division of Water Quality

Non-Discharge Permit Application Form

(THIS FORM MAY BE PHOTOCOPIED FOR USE AS AN ORIGINAL)

GROUNDWATER REMEDIATION SYSTEMS

This permit application form is for systems which use either infiltration galleries or injection wells to discharge treated groundwater into the subsurface. Each section of this application must be completed unless otherwise noted. Contact the Groundwater Section at (919) 733-3221 to obtain Groundwater Remediation Permit Application Guidelines.

I. GENERAL INFORMATION:

1. Applicant's name (please specify the name of the municipality, corporation, individual, etc.):
   Reiss Remediation, Inc.

2. Print Owner's or Signing Official's name *and* title (the person who is legally responsible for the facility* and its compliance): ***Marc Coggeshall, President***

3. Mailing address: ***4111 East 37th Street North***
   City: ***Wichita*** State: ***Kansas*** Zip: ***67220***
   Telephone Number: (***316***) ***828-2146***

4. Project Name (please specify the name of the facility or establishment - should be consistent on all documents included in this application package: ***Flint Hills Resources, LP - North Terminal***

5. Location of Remediation Activities (Street Address): ***3325 River Road***
   City: ***Wilmington*** State: ***NC*** Zip: ***28412***

6 County of Remediation Acitivities: ***New Hanover***

7. Latitude: ***34 deg. 11' 12"*** ; Longitude ***W 77 deg. 57' 9"*** of Remediation Activities. ***(Front Gate of Facility)***

8. Contact person who can answer questions about application:
   Name: ***Frank Van Ryn*** Telephone Number: (***316***) ***828-2146***

9. Application Date: ***6/18/03***

10. Fee Submitted: $ ***1,090*** [The permit processing fee should be as specified in 15A NCAC 2H .0205(c)(5).]

II. PERMIT INFORMATION: Application No. (will be completed by DWQ): _____

1. Specify whether project is: ***X*** new; _____ renewal*; _____ modification
   * For renewals, complete only sections I, II, and applicant signature (on page 8). Submit only pages 1, 2, and 8 (original and three copies of each). Engineer's signature not required for renewal without other modifications.

2. If this application is being submitted as a result of a renewal or modification to an existing permit, list the existing permit number _____ and its issue date _____

*** Reiss Remediation, Inc. is responsible for the groundwater remediation system and for compliance with the terms of this permit.**

III. INFORMATION ON CONTAMINATED GROUNDWATER:

1. List the principal products or services provided by facility: ***PX Facility is a bulk chemical terminal that currently stores paraxylene only. Loading Rack Area portion of the facility was a bulk fuels terminal that has been inactive since April of 2001.***

2. Remediation Site Owner: ___ Federal; ___ State; ***X*** Private; ___ Public; ___ Native American Lands;

   ___ Other (specify) _____

3. Groundwater Incident Number (if known): ***15475 and 3261***

4. Is this application for facilities subject to UST Trust Fund reimbursement? _____ Yes; ***X*** No.

5. Has a comprehensive site assessment and corrective action plan been submitted and approved for this project?

   X Yes; ____ No. Please provide two copies of each and two copies of the approval letter (if applicable).

6. Provide a brief description of the events or cause of the groundwater contamination:

   PX Facility - See Attachment A1.

   Loading Rack Area - The only specific event that is known to have caused the groundwater contamination is a rail car release in the late 1970's. No other known releases are known for this area. However, since the surficial groundwater has been impacted with dissolved gasoline, fuel oil, and paraxylene constituents, it has been assumed this is the result of historical operation of the truck and railcar loading rack areas.

7. List contaminants detected: ***PX Facility - Contaminants of concern are paraxylene and methyl tert-butyl ether (MTBE).***

   Loading Rack Area - Contaminants of concern are residual concentrations of volatile and semi-volatile organic compounds. The compounds detected to date are provided in Attachment L.

8. Volume of groundwater to be remediated per day: ***PX Facility - 115,200 Loading Rack Area - 57,600 (maximum design values)*** gallons (per day)

9. Explanation of how volume was determined: ***Based on historical groundwater recovery data and groundwater flow modeling data presented in the CAPA dated August 9, 2002, the groundwater recovery rate of each recovery well will be less than 18 gallons per minute (gpm) for the PX Facility and less than 10 gpm for the Loading Rack Area. As indicated on the attached SHEETS 5 and 6 of the construction plans, the proposed groundwater remediation systems consists of three recovery wells for the PX Facility and four recovery wells for the Loading Rack Area. Volume of groundwater to be remediated per day was rounded to 20 gpm per recovery well at the PX Facility (with the assumption of future installation of an additional recovery well) and 10 gpm per recovery well at the Loading Rack Area.***

IV. GENERAL DESIGN INFORMATION:

1. Specify the type of system that is being installed: ***X*** infiltration gallery; _____ injection well;

   _____ other (specify): _____

2. Provide a brief description of all components of the treatment and disposal system (i.e., treatment units, pumps, tanks, chemical feed system, injection and/or recovery wells, etc.):

   The remediation system components will consist of the following for each system: groundwater recovery well pumps, an oil/water separator, transfer pumps, a shallow tray type air stripper, an effluent tank, an infiltration gallery, and all associated piping as illustrated on the Construction Plans in Attachment E.

3. 15A NCAC 2C .0213 (Well Construction Standards, Applicable to Injection Wells) requires that contaminant levels in the fluid injected into any well be monitored; therefore, a sampling port must be provided on the effluent lines (treated water prior to being injected into the wells or infiltration gallery). The permit will specify the requirements for monitoring this effluent. Identify the location in the plans/specifications where the sampling port design is detailed:

Sampling port is identified on the schematics shown on Sheet 7 at a location within the system between the effluent tank and the infiltration gallery.

V. DESIGN INFORMATION FOR INFILTRATION GALLERIES:

1. Specify the dimensions of each infiltration gallery: (a) L= *123* ft. W= *10* ft. D= *5* ft.
   (b) L= _____ ft. W= _____ ft. D= _____ ft.
   (c) L= _____ ft. W= _____ ft. D= _____ ft.

2. The static groundwater level at the gallery location is *10.23** feet. The vertical separation between the gallery trench bottom and the mean seasonal high water table is *3 to 5* feet. * *At time of pilot test.*

3. A North Carolina licensed soil scientist must provide an evaluation of the soils where the infiltration gallery will be located and must specify an acceptable loading rate (amount of water gallery can accept). This evaluation should determine whether the loading rate shall be based upon only the surface area of the infiltration gallery or whether it is appropriate to include some of the side wall depth. ***(See the Cover Letter and Attachment A2 regarding the requirement of a soil scientist)***

   a. What is the area used to determine the loading rate? *30 (See Attachment A3)* square feet. This area should include only the surface area. No side wall depth should be included in this calculation.

   b. The recommended loading rate is *0.13 gpm per SF (see Attachment A3)* (Attach all calculations).

   c. Indicate the theory behind the loading rate determination: *See Attachment A3 for a summary of the pilot test used to determine the loading rate (infiltration rate).*

4. Briefly describe any mounding of groundwater, above the static groundwater levels, that may result from infiltration (Attach calculations and/or diagrams):

   Based on information provided in Attachment A3, approximately 1 to 2 feet of head (surficial groundwater mounding) may accumulate with a loading rate of approximately 0.13 gpm per square foot. System design includes infiltration gallery sensors to shut-off the system recovery wells in the event of excessive mounding.

VI. DESIGN INFORMATION FOR INJECTION WELLS: *NOT APPLICABLE*

1. Identify the principal aquifer to which the injection wells will be discharging:

2. Is the aquifer identified above the same aquifer from which the contaminated groundwater was extracted?
   ___ Yes ___ No. If No, describe how the aquifers are hydraulically related: _____

3. Briefly describe any mounding of groundwater, above the static groundwater levels, that may result from the injection (please attach calculations and/or diagrams): _____

3. 15A NCAC 2C .0213 (Well Construction Standards, Applicable to Injection Wells) requires that contaminant levels in the fluid injected into any well be monitored; therefore, a sampling port must be provided on the effluent lines (treated water prior to being injected into the wells or infiltration gallery). The permit will specify the requirements for monitoring this effluent. Identify the location in the plans/specifications where the sampling port design is detailed:

Sampling port is identified on the schematics shown on Sheet 8 at a location within the system between the effluent tank and the infiltration gallery.

V. DESIGN INFORMATION FOR INFILTRATION GALLERIES:

1. Specify the dimensions of each infiltration gallery: (a) L= *107* ft. W= *10* ft. D= *2.5* ft.
   (b) L= _____ ft. W= _____ ft. D= _____ ft.
   (c) L= _____ ft. W= _____ ft. D= _____ ft.

2. The static groundwater level at the gallery location is *4 to 6 ** feet. The vertical separation between the gallery trench bottom and the mean seasonal high water table is *1.5 to 3.5* feet. **** At time of CAPA preparation.***

3. A North Carolina licensed soil scientist must provide an evaluation of the soils where the infiltration gallery will be located and must specify an acceptable loading rate (amount of water gallery can accept). This evaluation should determine whether the loading rate shall be based upon only the surface area of the infiltration gallery or whether it is appropriate to include some of the side wall depth. ***(See the Cover Letter and Attachment A2 regarding the requirement of a soil scientist)***

   a. What is the area used to determine the loading rate? *40 (See Attachment A3)* square feet. This area should include only the surface area. No side wall depth should be included in this calculation.

   b. The recommended loading rate is *0.075 gpm per SF (See Attachment* (Attach all calculations).

   c. Indicate the theory behind the loading rate determination: *See Attachment A3 for a summary of the pilot test used to determine the loading rate (infiltration rate).*

4. Briefly describe any mounding of groundwater, above the static groundwater levels, that may result from infiltration (Attach calculations and/or diagrams):
   Based on information provided in Attachment A3, approximately 1 to 2 feet of head (surficial groundwater mounding) may accumulate with a loading rate of approximately 0.075 gpm per square foot. System design includes infiltration gallery sensors to shut-off the system recovery wells in the event of excessive mounding.

VI. DESIGN INFORMATION FOR INJECTION WELLS: *NOT APPLICABLE*

1. Identify the principal aquifer to which the injection wells will be discharging:

2. Is the aquifer identified above the same aquifer from which the contaminated groundwater was extracted?
   ___ Yes ___ No. If No, describe how the aquifers are hydraulically related: _____

3. Briefly describe any mounding of groundwater, above the static groundwater levels, that may result from the injection (please attach calculations and/or diagrams): _____

4. Characteristics of injection well(s) [attach additional sheets if necessary]:

Injection Well Characteristics	Well A	Well B	Well C
Depth (feet)			
Diameter (inches)			
Injection rate (GPM)			
Injection volume (GPD)			
Injection pressure (PSI)			
Injection temp. (°C)			
Casing material			
Depth of casing (feet)			
Casing diameter (inches)			
Casing schedule number			
Cement grout (primary or inner casing)	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.
Cement grout (outer casing, if applicable)	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.
Screened or uncased interval (if applicable)	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.
Type of screen manufactured or hand slotted (if applicable)			
Screens inner diameter (inches-if applicable)			
Gravel pack (if applicable)	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.	from _____ ft. to _____ ft.
Well contractor			
Contractor Registration No.			

VII. ADDITIONAL INFORMATION:

1. Classification of the closest downslope surface waters: ___*SC*___ (as established by the Environmental Management Commission and specified on page 7 of this application). ***(See Attachment P)***

2. In accordance with 15A NCAC 2H .0219 (j) (3), describe which measure is being utilized to prevent overflows into downslope surface waters or adjacent aquifers in the event of a power failure or equipment malfunction.

   The recovery well pumps will be controlled through a control panel which includes a pump protector that will shut the system off if power failure and/or power surges occur (See Attachments E and O). The control logic for the oil/water separator, the air stripper and the effluent tank will have overflow protection devices to prevent overflow which will shut down recovery well pumps (see the Construction Plans in Attachment E for Control Logic). In addition, recovery well discharge lines and the remediation system components will have secondary containment. In the event of a shutdown, the remediation system will only be restarted manually.

3. The applicable buffers should be met in accordance with 15A NCAC 2H .0200 and 15A NCAC 2H .0400. Some of those buffers are described below:

   a. 100 feet between injection wells or infiltration galleries and any private or public water supply source;
   b. 50 feet between injection wells and waters classified as WS, B, or other streams, canals, marshes, lakes, impoundments, or coastal waters;
   c. 100 feet between infiltration galleries and waters classified as WS, B, or other streams, canals, marshes, lakes, impoundments, or other coastal waters;
   d. 100 feet between injection wells or infiltration galleries and the mean high water of waters classified as SA or SB;
   e. 100 feet from injection well and infiltration gallery treatment and disposal systems and the normal high water of Class I and Class II impounded reservoirs which are used as a source of drinking water;
   f. 50 feet from injection well and infiltration gallery treatment and disposal systems and property lines.

   If any of the applicable buffers cannot be met, please explain how the proposed buffers will provide equal or better protection of the surface or groundwaters with no increased potential for nuisance conditions:

   _____

   _____

   _____

   _____

4. Substances may be added to enhance in situ treatment. If microbial additives or cultures are added in the effluent, the approval must be provided by the North Carolina Division of Epidemiology certifying its use for remediation purposes. In lieu of the Division of Epidemiology approval, risk assessment data, toxicological exposure data, or approval from another State may be provided certifying an exposure risks. Will any substances be added to the effluent to enhance in situ treatment? _____ Yes; _*X*_ No. If Yes, provide a detailed description of these substances, including amounts to be added. In addition, please attach any studies which describes the instances in which these substances have been used:

   _____

   _____

   _____

   _____

   _____

   _____

THE FOLLOWING ITEMS ARE SUBMITTED AS ATTACHMENTS TO THIS APPLICATION.

THIS APPLICATION PACKAGE WILL NOT BE ACCEPTED BY THE DIVISION OF WATER QUALITY UNLESS ALL OF THE APPLICABLE ITEMS ARE INCLUDED WITH THE SUBMITTAL

a. One original and three copies of the completed and appropriately executed application form.

b. The appropriate permit processing fee in accordance with 15A NCAC 2H .0205(c)(5).

c. Submit two copies of the Corrective Action Plan and comprehensive site assessment.

d. Four copies of the existing permit if a renewal or modification.

e. Four sets of detailed plans and specifications signed and sealed by a North Carolina Professional Engineer. The plans must include a general location map; a topographic map which extends one mile beyond property boundaries and depicts the facility and each of its intake and discharge structures (with the quadrangle name); a scaled site-specific map which indicates where borings or hand auger samples were taken; and a map showing the groundwater treatment/disposal facilities, buffers, structures and property lines. A map must also identify any hazardous waste treatment, storage, and disposal facilities; each well where fluids from the facility are injected underground; and those wells, springs and other surface water bodies and drinking water wells listed in public records or otherwise known to the applicant within a quarter mile of the facility property boundary. Each sheet of the plans, including any plan pages that are incorporated into a bound document, and the first page of the specifications, must be signed/sealed by a North Carolina Professional Engineer.

f. Four copies of a tabulation of data on all wells which are within the area of review and which penetrate the proposed injection zone. Such data shall include an identification number (same number referenced on map required in "e" above) for each well, a description of each well type, date installed, depth of well, and record of completion or abandonment (if available).

g. A soil scientist report which includes texture, color, and structure of the soils down to a depth of seven feet; depth, thickness and type of any restrictive horizons, hydraulic conductivity in the most restrictive horizon, Cation Exchange Capacity, depth of the mean seasonal high water table, soil pH, soil maps (if available, even if unpublished), and recommended loading rates (when using an infiltration gallery). This report must be signed by the soil scientist.

h. A hydrogeologic description, soils description, and cross section of the subsurface to a depth that includes the known or projected depth of contamination. The number of borings shall be sufficient to determine significant changes in lithology, the vertical permeability of the unsaturated zone, the hydraulic conductivity of the saturated zone, the depth to the mean seasonal high water table, and a determination of transmissivity and specific yield of the unconfined aquifer (show calculations used for transmissivity and specific yield). Report should also indicate whether the aquifer is attributable to fracture porosity storage or stratigraphically controlled (bedding planes). Include a general map and cross section illustrating the regional geologic setting.

i. Describe the proposed injection procedure and describe expected changes in pressure and direction of movement of injected fluid (provide data from fracture studies where applicable). Applicant must demonstrate complete hydraulic control over contaminant plume and injectate if injectate does not meet 2L standards.

j. Proposal for groundwater monitoring (e.g., schedule, analytical methods, etc.).

k. Describe the method for determining mechanical integrity of injection well over a five year period.

l. A complete analysis of the contaminated groundwater to include, but not limited to BTEX, volatile and semivolatile compounds, pH, nitrates, and phosphates or any additional information the Director deems necessary to evaluate the proposed treatment and disposal system.

m. Describe contaminant concentrations in the effluent given the proposed treatment. Include expected treatment efficiency. Provide calculations or documentation to show how proposed degree of treatment was derived.

n. Diagram of the contaminant plume both horizontally and vertically, including vadose zone contamination (isoconcentration maps and plume cross sections). Include direction of groundwater flow for both surface aquifer and deep aquifers.

o. Four copies of all reports, evaluations, agreements, supporting calculations, etc., must be submitted as a part of the supporting documents which are signed and sealed by the North Carolina Professional Engineer. Although certain portions of this required submittal must be developed by other professionals, inclusion of these materials under the signature and seal of a NC PE signifies that he or she has reviewed this material and has judged it to be consistent with his or her proposed design.

p. An properly executed page 7, which has been completed by the appropriate Regional Water Quality personnel, and reincorporated into the application form prior to submittal of the application package.

SEE ATTACHMENT P FOR A COMPLETED COPY OF THIS PAGE.

This form must be completed by the appropriate DWQ regional office and included as a part of the project submittal information.

INSTRUCTIONS TO APPLICANT

In order to determine the classification of the watershed in which the subject facility will be located, you are required to submit this form, with items 1 through 7 completed, to the appropriate Division of Water Quality Regional Water Quality Supervisor (see attached listing) prior to submittal of the application for permitting. At a minimum, you must include an 8.5" by 11" copy of the portion of a 7.5 minute USGS Topographic Map which shows the subject surface waters. You must identify the location of the facility and the closest downslope surface waters (waters for which you are requesting the classification) on the submitted map copy. **The application may not be submitted for final permitting until this form is completed by the appropriate regional office and included with the submittal.**

1. Applicant (please specify the name of the municipality, corporation, individual, or other):

   _____

2. Address of Applicant: _____

   _____

   City: _____ State: _____ Zip: _____

   Telephone Number: (____) _____ Fax Number: (____) _____

3. County(ies) where the facility is located: _____

4. Project Name: _____

5. Name of closest surface waters: _____

6. Map name and date: _____

7. Applicant Signature: _____

TO: REGIONAL WATER QUALITY SUPERVISOR

Please provide me with the classification of the watershed and appropriate river basin where these activities will occur, as identified on the attached map segment:

Name of surface waters: _____

Classification (as established by the EMC): _____

Proposed Classification, if applicable: _____

River Basin the Facility is Located: _____

Signature of regional office personnel: _____ Date: _____

Name and Complete Address of Engineering Firm: *CATLIN Engineers and Scientists*

220 Old Dairy Road

City: *Wilmington* State: *NC* Zip: *28405*

Telephone Number: (*910*) *452-5861* Fax Number: (*910*) *452-7563*

Professional Engineer's Certification:

I, *Jeffery K. Becken*, attest that this application for *a Groundwater Remediation Non-Discharge Permit*

has been reviewed by me and is accurate and complete to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations. Although certain portions of this submittal package may have been developed by other professionals, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

North Carolina Professional Engineer's Seal, Signature, and Date:

Applicant's Certification:

I, Marc Coggeshall, attest that this application for *a Groundwater Remediation Non-Discharge Permit*

has been reviewed by me and is accurate and complete to the best of my knowledge. I understand that if all required parts of this application are not completed and that if all required supporting information and attachments are not included, this application package will be returned to me as incomplete.

Signature Marc Coggeshall Date June 19, 2003

THE COMPLETED APPLICATION PACKAGE, INCLUDING ALL SUPPORTING INFORMATION AND MATERIALS, SHOULD BE SENT TO THE FOLLOWING ADDRESS:

NORTH CAROLINA DIVISION OF WATER QUALITY

WATER QUALITY SECTION

NON-DISCHARGE PERMITTING UNIT

POST OFFICE BOX 29535

RALEIGH, NORTH CAROLINA 27626-0535

TELEPHONE NUMBER: (919) 733-5083

FAX NUMBER: (919) 733-0719

Name and Complete Address of Engineering Firm: *CATLIN Engineers and Scientists*

220 Old Dairy Road

City: *Wilmington* State: *NC* Zip: *28405*

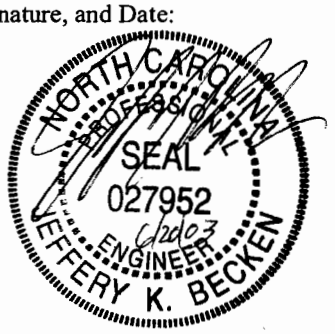
Telephone Number: (*910*) *452-5861* Fax Number: (*910*) *452-7563*

Professional Engineer's Certification:

I, *Jeffery K. Becken*, attest that this application for *a Groundwater Remediation Non-Discharge Permit*

has been reviewed by me and is accurate and complete to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations. Although certain portions of this submittal package may have been developed by other professionals, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

North Carolina Professional Engineer's Seal, Signature, and Date:



Applicant's Certification:

I, Marc Coggeshall, attest that this application for *a Groundwater Remediation Non-Discharge Permit*

has been reviewed by me and is accurate and complete to the best of my knowledge. I understand that if all required parts of this application are not completed and that if all required supporting information and attachments are not included, this application package will be returned to me as incomplete.

Signature _____ Date June 19, 2003

THE COMPLETED APPLICATION PACKAGE, INCLUDING ALL SUPPORTING INFORMATION AND MATERIALS, SHOULD BE SENT TO THE FOLLOWING ADDRESS:

NORTH CAROLINA DIVISION OF WATER QUALITY

WATER QUALITY SECTION

NON-DISCHARGE PERMITTING UNIT

POST OFFICE BOX 29535

RALEIGH, NORTH CAROLINA 27626-0535

TELEPHONE NUMBER: (919) 733-5083

FAX NUMBER: (919) 733-0719

DIVISION OF WATER QUALITY REGIONAL OFFICES

Asheville Regional WQ Supervisor
59 Woodfin Place
Asheville, NC 28801
(704) 251-6208
Fax (704) 251-6452

Avery	Macon
Buncombe	Madison
Burke	McDowell
Caldwell	Mitchell
Cherokee	Polk
Clay	Rutherford
Graham	Swain
Haywood	Transylvania
Henderson	Yancey
Jackson	

Washington Regional WQ Supervisor
943 Washington Square Mall
Washington, NC 27889
(919) 946-6481
Fax (919) 975-3716

Beaufort	Jones
Bertie	Lenoir
Camden	Martin
Chowan	Pamlico
Craven	Pasquotank
Currituck	Perquimans
Dare	Pitt
Gates	Tyrell
Greene	Washington
Hertford	Wayne
Hyde	

Raleigh Regional WQ Supervisor
Post Office Box 27687
Raleigh, NC 27611
(919) 571-4700
Fax (919) 571-4718

Chatham	Nash
Durham	Northampton
Edgecombe	Orange
Franklin	Person
Granville	Vance
Halifax	Wake
Johnston	Warren
Lee	Wilson

Fayetteville Regional WQ Supervisor
Wachovia Building, Suite 714
Fayetteville, NC 28301
(910) 486-1541
Fax (910) 486-0707

Anson	Moore
Bladen	Robeson
Cumberland	Richmond
Harnett	Sampson
Hoke	Scotland
Montgomery	

Mooresville Regional WQ Supervisor
919 North Main Street
Mooresville, NC 28115
(704) 663-1699
Fax (704) 663-6040

Alexander	Lincoln
Cabarrus	Mecklenburg
Catawba	Rowan
Cleveland	Stanly
Gaston	Union
Iredell	

Wilmington Regional WQ Supervisor
127 Cardinal Drive Extension
Wilmington, NC 28405-3845
(910) 395-3900
Fax (910) 350-2004

Brunswick	New Hanover
Carteret	Onslow
Columbus	Pender
Duplin	

Winston-Salem Regional WQ Supervisor
585 Waughtown Street
Winston-Salem, NC 27107
(910) 771-4600
Fax (910) 771-4631

Alamance	Rockingham
Alleghany	Randolph
Ashe	Stokes
Caswell	Surry
Davidson	Watauga
Davie	Wilkes
Forsyth	Yadkin
Guilford	

ATTACHMENT A1

IDENTIFIED SOURCES OF ON-SITE PARAXYLENE SUBSURFACE CONTAMINATION WITHIN THE PARAXYLENE FACILITY

(NOT APPLICABLE FOR THE LOADING RACK AREA)

Identified Sources of On-Site Subsurface Contamination Within the Paraxylene Facility

PX Pipeline - In January 1981, prior to FHR's (formerly known as Koch Petroleum Group, LP) ownership, 291,000 gallons of PX were released from a subsurface pipeline 100 feet northwest of Tank 301. Former and ongoing remediation activities concerning this release have been well documented, and are on file at the NCDENR-WIRO.

AST 301 - On March 19, 1995 AST 301 was overfilled and released approximately 12,306 gallons of PX. Initial remedial actions involved excavation of all accessible impacted soils and pumping free-phase product from recovery wells installed adjacent to AST 301.

A soil vapor extraction (SVE) and groundwater recovery system are operated continuously to address remnant soil and groundwater contamination. To date, active remediation measures within this area have removed more PX than the volume lost in the March 19, 1995 release. However, enough residual PX remains from the March 19, 1995 and adjacent 1981 pipeline releases that continued active remediation is still warranted.

AST 801 - On July 20, 1999, approximately 594 gallons of PX were released at AST 801. Initial remedial actions involved excavating accessible impacted soils and recovering free-phase product from the resulting excavations.

Although over 594 gallons of PX were recovered, the subsurface excavations revealed remnants of previous PX release(s) within the same area.

PX Facility Unknown(s) – In assessing the AST 301 and AST 801 incidents, it became evident that there remains soil and surficial groundwater PX contamination from release events prior to the 1995 and 1999 incidents.

ATTACHMENT A2

REQUIREMENT OF A SOIL SCIENTIST

NORTH CAROLINA BOARD OF EXAMINERS
FOR ENGINEERS AND SURVEYORS
310 West Millbrook Road
Raleigh, North Carolina 27609

July 9, 2002

Mr. Richard G. Catlin, PE, PG
Catlin Engineers and Scientists
PO Box 10279
Wilmington, NC 28404-0279

Re: DENR Non-Discharge Permit Application Form

Dear Mr. Catlin:

The North Carolina Board of Examiners for Engineers and Surveyors considered a request from Jeffery K. Becken, PE of your firm at its June 13 meeting. The issue regarding the requirement for a Soil Scientist was confirmed in your letter that was also signed by Mr. Becken and Michael E. Mason, PE that we received on June 24, 2002. The Board's position is that the infiltration gallery determination required in paragraph V.3. of the Non-Discharge Permit Application Form (form GWRS 06/98) is also within the practice of engineering as defined and regulated by the Engineering Licensing Statute Chapter 89C and can be performed by a licensed Professional Engineer who is competent to do such work by education, training or experience.

By copy of this letter to the Department of Environment and Natural Resources the Board requests that either a licensed Soil Scientist or a licensed Professional Engineer be allowed to provide the infiltration gallery determination required by paragraph V.3. The Professional Engineer is required to sign the Non-Discharge Permit Application Form and is required to be in responsible charge of the work that he or she is certifying and uses his or her professional judgment in involving other professionals.

The Board appreciates your firm bringing this matter to the Board's attention and thanks DENR for their attention to this matter. Please contact me at extension 101 if anyone has any questions.

For the Board,

Andrew L. Ritter
Executive Director

DST/

cc: Mr. Greg Thorpe, Deputy Director, DENR Water Quality
Ms. Coleen Sullins, DENR Water Quality Section Head

ATTACHMENT A3

SUMMARY OF PILOT TEST ACTIVITIES FOR INFILTRATION TRENCH

PX FACILITY

SUMMARY OF PILOT TEST ACTIVITIES FOR INFILTRATION TRENCH AT THE PX FACILITY

SUMMARY OF PILOT TEST ACTIVITIES FOR INFILTRATION GALLERY AT PARAXYLENE FACILITY FOR NON-DISCHARGE PERMIT APPLICATION FLINT HILLS RESOURCES, LP NORTH TERMINAL WILMINGTON, NORTH CAROLINA

INTRODUCTION

Flint Hills Resources, LP (FHR) authorized CATLIN Engineers and Scientists (CATLIN) to prepare a Non-Discharge Application for a proposed Groundwater Remediation System at the FHR North Terminal (See Figure 1) for submittal to the North Carolina Department of Environment and Natural Resources, Division of Water Quality. To determine an "acceptable loading rate" as required in Section V - Design Information For Infiltration Galleries, Subsection 3 of the application, CATLIN performed an on-site infiltration gallery pilot test. This Summary discusses the field activities and findings associated with this pilot test.

FIELD ACTIVITIES

CATLIN field personnel constructed the pilot test infiltration gallery on June 10, 2002 at the Paraxylene Facility of the North Terminal as shown on the attached Figures 2 and 3. Temporary piezometers were installed at the locations illustrated on the attached Figure 4 using a hand auger. The temporary piezometers were installed into the water table to monitor fluctuation during the pilot test and to ensure the bottom of the gallery was constructed at least 1 foot above the ground water table. A summary of the piezometers is provided on the attached Table 1.

The gallery was constructed within the area of interest using a rubber tire backhoe. The gallery was excavated 10 feet long by 4 feet wide to approximately 5 feet below land surface at the location indicated on Figures 2 and 3. The native material excavated was primarily medium grained SAND with few fines. The bottom of the test pit was constructed with dimensions of approximately 10 feet long by 3 feet wide. Due to the sandy nature of the native material and the depth of the gallery, the excavation side slopes were sloughing, therefore, the dimensions near the existing ground surface were greater than at the bottom of the gallery ($\pm$ 1 foot each direction).

Upon completion of the excavation, a non-woven geotextile fabric was placed against the bottom and sides of the gallery. Washed NCDOT No. 57 stone (granite) was placed on the geotextile fabric to near ground surface. A temporary piezometer (PXP-4) was installed in the approximate center of the gallery. A plan view and cross-section of the constructed gallery are provided on the attached Figures 4 and 5.

CATLIN field personnel conducted the infiltration gallery pilot test on June 12, 2002. Water was pumped from an on-site fire hydrant into the top of the stone layer at various flow rates. Flow rates were gauged and controlled by using an on-line flow meter and gate valve. Flow rates were adjusted and the water level within the gallery was allowed to stabilize. Initially the flow rate was 15 gallons per minute (gal./min.) however, the groundwater level continued rising (mounding) in adjacent temporary piezometers, therefore, we decreased the flow rate to 10 gal./min. At 10 gal./min. the groundwater level also continued to rise (mound) in adjacent temporary piezometers, therefore, we decreased the flow rate to 5 gal./min. At 5 gal./min. the groundwater levels generally leveled off. Therefore, we assumed a flow rate of slightly less than 5 gal./min. as the design flow.

FINDINGS

An evaluation of the pilot test data indicates an acceptable loading rate of approximately 4 gallons per minute with approximately 1 to 2 feet of head (based on the change in groundwater level in temporary piezometers during a 5 gal./min. pumping rate) within a 10 feet long, 3 feet wide, and 5 feet deep gallery. Based on this loading rate information, an infiltration rate of 0.13 gallons per minute per square feet (measured along the bottom of the gallery) were determined. Based on this infiltration rate and a factor of safety of 2, an infiltration gallery of 1,231 square feet would need to be constructed to accept the anticipated 80 gal./min. of treated groundwater from the proposed groundwater remediation system. See attached calculation sheets for the determination of the size of the infiltration gallery.

TABLES

TABLE 1

SUMMARY OF TEMPORARY PIEZOMETERS FOR PILOT TEST INFILTRATION TRENCH AT PARAXYLENE FACILITY

FLINT HILLS RESOURCES, LP
NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

PIEZOMETER	DIAMETER (IN.)	TOTAL DEPTH (FT.)	APPROXIMATE LENGTH OF STICK-UP (FT.)	INITIAL DEPTH TO WATER (FT.)
PXP-1	2	13.44	2.50	12.56
PXP-2	2	15.19	3.60	13.83
PXP-3	2	15.45	4.28	14.52
PXP-4	2	5.41	1.55	No Water
PXP-5	2	15.44	5.14	14.48
PXP-6	2	15.43	4.52	14.26

TABLE 2

SUMMARY OF FIELD DATA FOR PILOT TEST
INFILTRATION TRENCH AT PARAXYLENE FACILITY

FLINT HILLS RESOURCES, LP
NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

Actual Time	Approximate Flow Rate	Change in Groundwater Level in Temporary Piezometers Between Measurements.						
		PXP-1	PXP-2	PXP-3	PXP-4	PXP-5	PXP-6	MW-5
9:21	± 15 gal/min.	0	0	0	No Water	0	0	0
9:26	± 15 gal/min.	+0.01	-0.01	0	No Water	+0.02	0	NM
9:31	± 15 gal/min.	0	+0.01	0	No Water	0	0	NM
9:36	± 15 gal/min.	0	0	0	No Water	0	0	NM
9:41	± 15 gal/min.	0	0	0	0	0	0	NM
9:46	± 15 gal/min.	0	0	0	+0.09	-0.01	0	NM
9:51	± 15 gal/min.	0	0	0	+0.32	+0.01	0	0
10:01	± 15 gal/min.	0	0	NM	-0.22	0	0	0
10:11	± 15 gal/min.	0	+0.05	0	+0.11	0	0	0
10:21	± 15 gal/min.	0	+0.11	0	+0.07	0	+0.02	0
10:31	± 15 gal/min.	+0.03	+0.11	0	+0.05	0	+0.03	0
10:41	± 15 gal/min.	+0.03	+0.14	+0.02	+0.04	+0.01	+0.07	0
10:51	± 15 gal/min.	+0.04	+0.09	+0.01	+0.02	+0.01	+0.07	0
Total Change at 15 gal./min. =		+0.11	+0.50	+0.03	+.48	+0.04	+0.19	0
SHUTDOWN AT 10:55 AND ADJUSTED FLOW RATE								
10:56	± 10 gal/min.	0	0	0	0	0	0	0
11:01	± 10 gal/min.	+0.03	+0.07	+0.01	-0.16	+0.02	+0.04	NM
11:06	± 10 gal/min.	+0.04	+0.05	+0.02	-0.08	+0.01	+0.04	NM
11:11	± 10 gal/min.	-0.01	+0.02	+0.04	-0.05	+0.03	+0.02	0
11:16	± 10 gal/min.	+0.02	+0.02	-0.04	-0.03	+0.01	+0.05	NM
11:21	± 10 gal/min.	+0.02	+0.03	+0.01	-0.03	+0.02	+0.05	NM
11:26	± 10 gal/min.	+0.02	+0.04	+0.01	+0.08	+0.02	+0.06	+0.02
11:36	± 10 gal/min.	+0.03	+0.05	+0.01	-0.12	+0.05	+0.13	NM
11:46	± 10 gal/min.	+0.03	+0.06	+0.02	-0.02	+0.04	+0.08	NM
11:56	± 10 gal/min.	+0.03	+0.05	+0.02	0	+0.03	+0.07	+0.02
12:06	± 10 gal/min.	+0.03	+0.08	+0.01	-0.01	+0.04	+0.06	NM
Total Change at 10 gal./min. =		+0.21	+0.40	+0.10	-0.26	+0.25	+0.56	+0.04
SHUTDOWN AT 12:09 AND ADJUSTED FLOW RATE								
12:12	± 5 gal/min.	0	0	0	0	0	0	0
12:17	± 5 gal/min.	+0.04	+0.01	+0.02	-0.36	+0.03	+0.06	+0.01
12:22	± 5 gal/min.	0	-0.01	0	No Water	+0.02	+0.02	NM
12:32	± 5 gal/min.	+0.03	-0.03	+0.02	No Water	+0.04	+0.02	NM
12:42	± 5 gal/min.	+0.01	0	+0.01	No Water	+0.02	+0.02	+0.01
12:52	± 5 gal/min.	+0.02	-0.02	+0.02	No Water	-0.05	+0.01	NM
13:02	± 5 gal/min.	+0.02	0	+0.01	No Water	+0.12	+0.01	NM
13:12	± 5 gal/min.	+0.01	+0.01	+0.01	No Water	+0.02	+0.01	+0.03
13:22	± 5 gal/min.	+0.01	0	+0.01	No Water	+0.02	0	NM
13:32	± 5 gal/min.	+0.01	0	0	No Water	+0.01	0	NM
13:42	± 5 gal/min.	0	0	+0.02	No Water	+0.01	0	+0.02
Total Change at 5 gal./min. =		+0.11	-0.04	+0.10	No Water	+0.19	+0.09	+0.06
SHUTDOWN AT 13:44								

NM = Not Measured

FIGURES

SCALE 1:24 000

1 MILE
0
1/2
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
1 .5 0

GN 1°39' 29 MILS
MN 5½° 98 MILS

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
THE MEAN RANGE OF TIDE IS APPROXIMATELY 3.6 FEET

QUADRANGLE LOCATION

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

PROJECT: FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE: GENERAL LOCATION
USGS TOPOGRAPHIC QUADRANGLE

FIGURE 1

JOB NO: 195033 | DATE: JULY 2002 | SCALE: AS SHOWN | DRAWN BY: HCS | CHECKED BY: JKB

195033-NOND-JULY2002-01

N

NORTH CAROLINA
STATE PORTS AUTHORITY EAST
EQUIPMENT STORAGE YARD

ESTIMATED LOCATION OF ABANDONED PARAXYLENE LINES

NORTH CAROLINA
STATE PORTS AUTHORITY
PROPERTY

TANK 501
TANK 601
PARA-XYLENE FACILITY
TANK 301
TANK 401
TANK 501
TANK 402
TANK 1101

FLINT HILLS RESOURCES, LP FUELS PROPERTY
LOADING RACK AREA

RAIL CAR LOADING RACK AREA

PILOT TEST SITE

POLISHING POND #2
POLISHING POND #1
FWTP
SETTLING POND
TANK 5
RIVER ROAD
TANK 8
TANK 3
TANK 1
GASOLINE/#2 FUEL OIL FACILITY
TANK 7
TANK 4
TANK 2
CSX RAILROAD

FLINT HILLS RESOURCES, LP
NORTH TERMINAL

PETROLEUM FUEL PROPERTY

LEGEND

- PROPERTY LINE W/MARKER
- SD — STORM DRAIN W/CATCH BASIN
- X — TEMPORARY BENCH MARK (TBM)
- RAILROAD TRACKS
- RECOVERY WELL
- FWTP — FACILITY WASTEWATER TREATMENT PLANT

200 0 200
SCALE IN FEET

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

PROJECT: FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

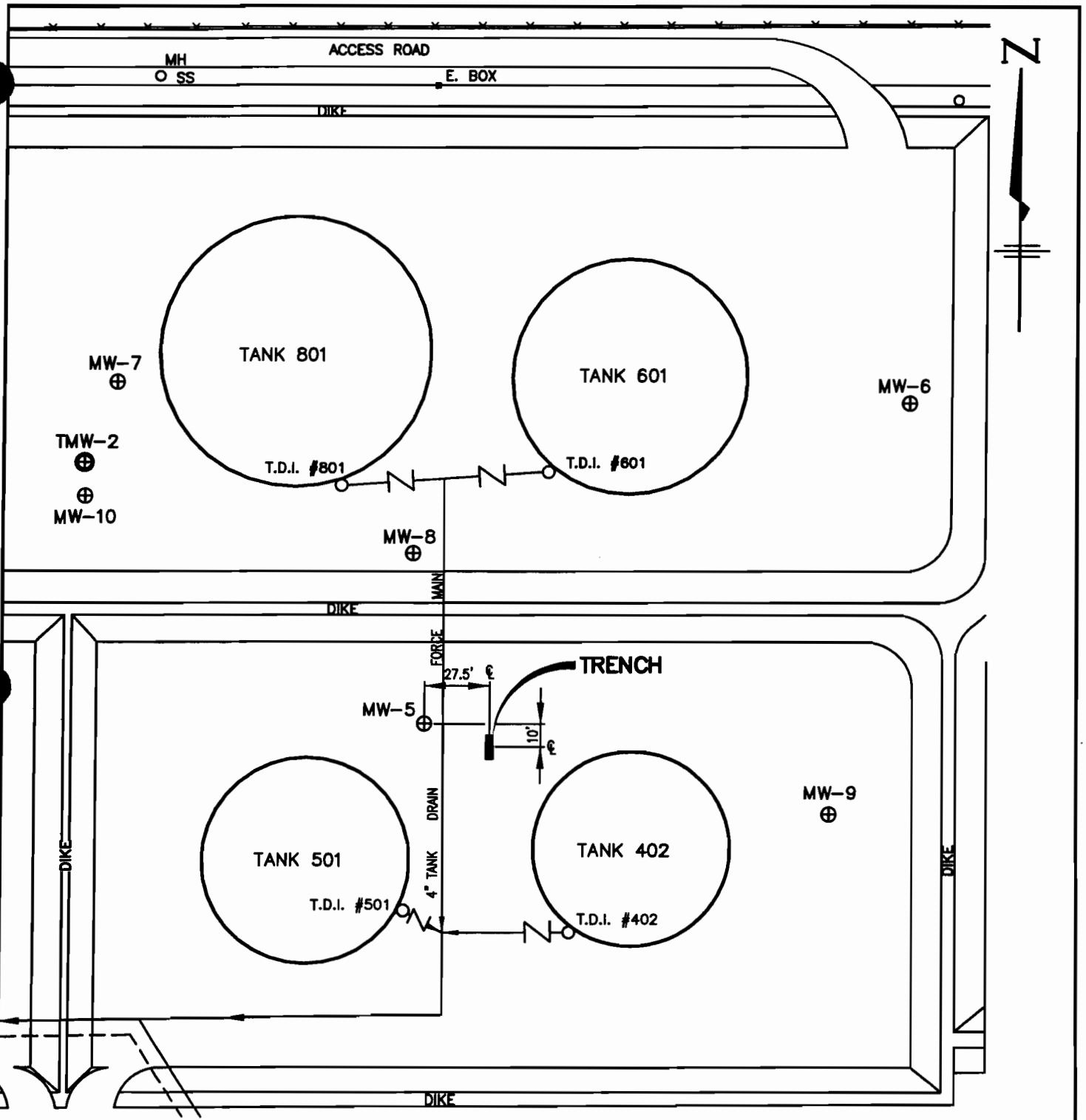
JOB NO. 195033 | DATE: JULY 2002

TITLE: SITE MAP

SCALE: 1"=200' | DRAWN BY: HCS | CHECKED BY: JKB

FIGURE 2

195033-NOND-JULY2002-02



LEGEND

EXISTING	DESCRIPTION
⊕	TYPE II WELL
⊕	TYPE III WELL

NOTE:
LOCATION OF TRENCH FOR PILOT TEST IS BASED ON FIELD MEASUREMENTS BY TAPE MEASURE

60 30 0 60

SCALE IN FEET

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

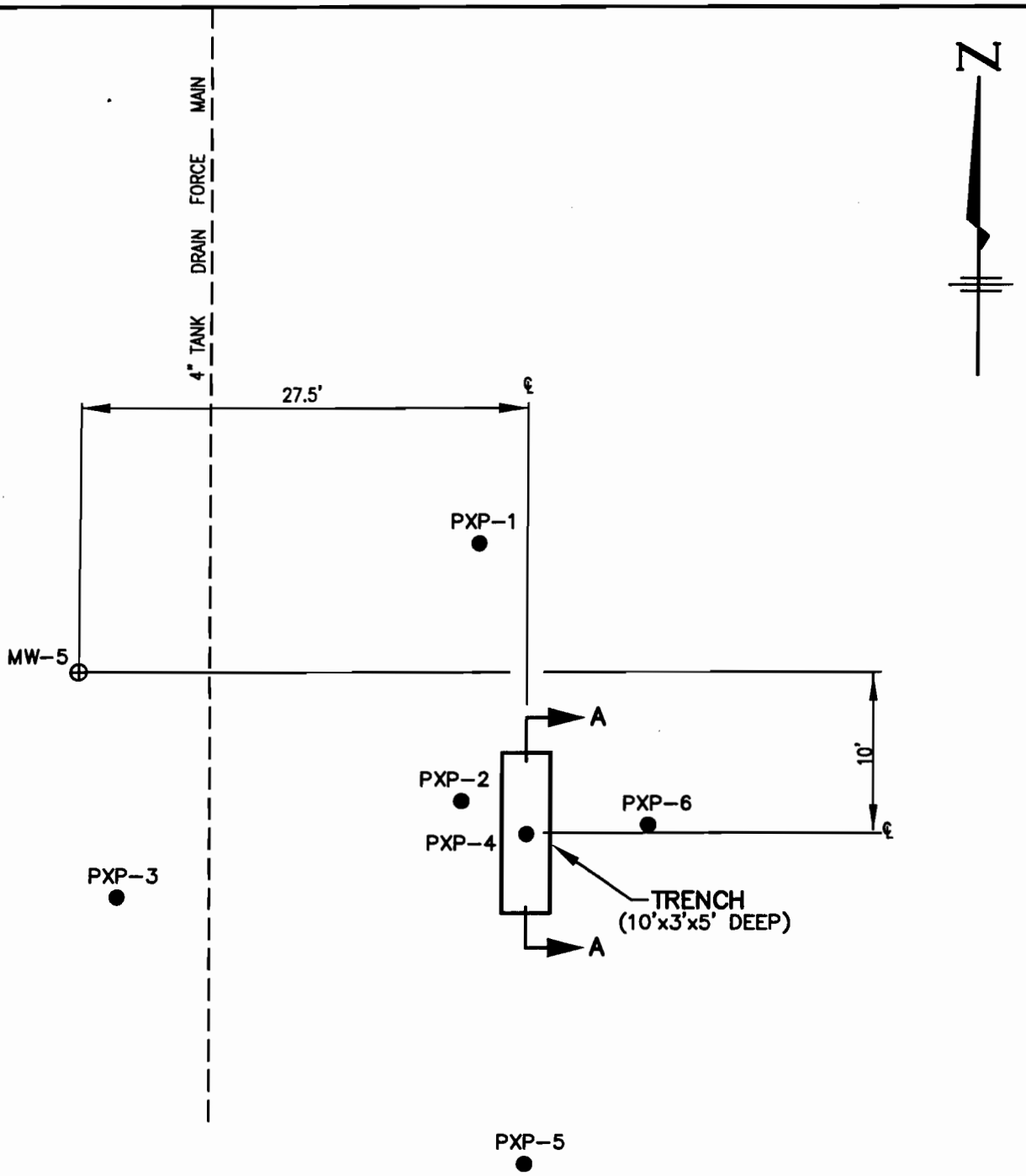
PROJECT: FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE: LOCATION OF PILOT TEST FOR INFILTRATION GALLERY AT PX FACILITY

FIGURE 3

JOB NO: 195033 | DATE: JULY 2002 | SCALE: 1"= 60' | DRAWN BY: HCS | CHECKED BY: JKB

195033-NOND-OCT2002-03



LEGEND

SYMBOL	DESCRIPTION
⊕	TYPE II WELL
●	APPROXIMATE LOCATION OF TEMPORARY PIEZOMETER

NOTE:
LOCATION OF TRENCH AND TEMPORARY PIEZOMETERS FOR PILOT TEST IS BASED ON FIELD MEASUREMENTS BY TAPE MEASURE

10 5 0 10

SCALE IN FEET

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

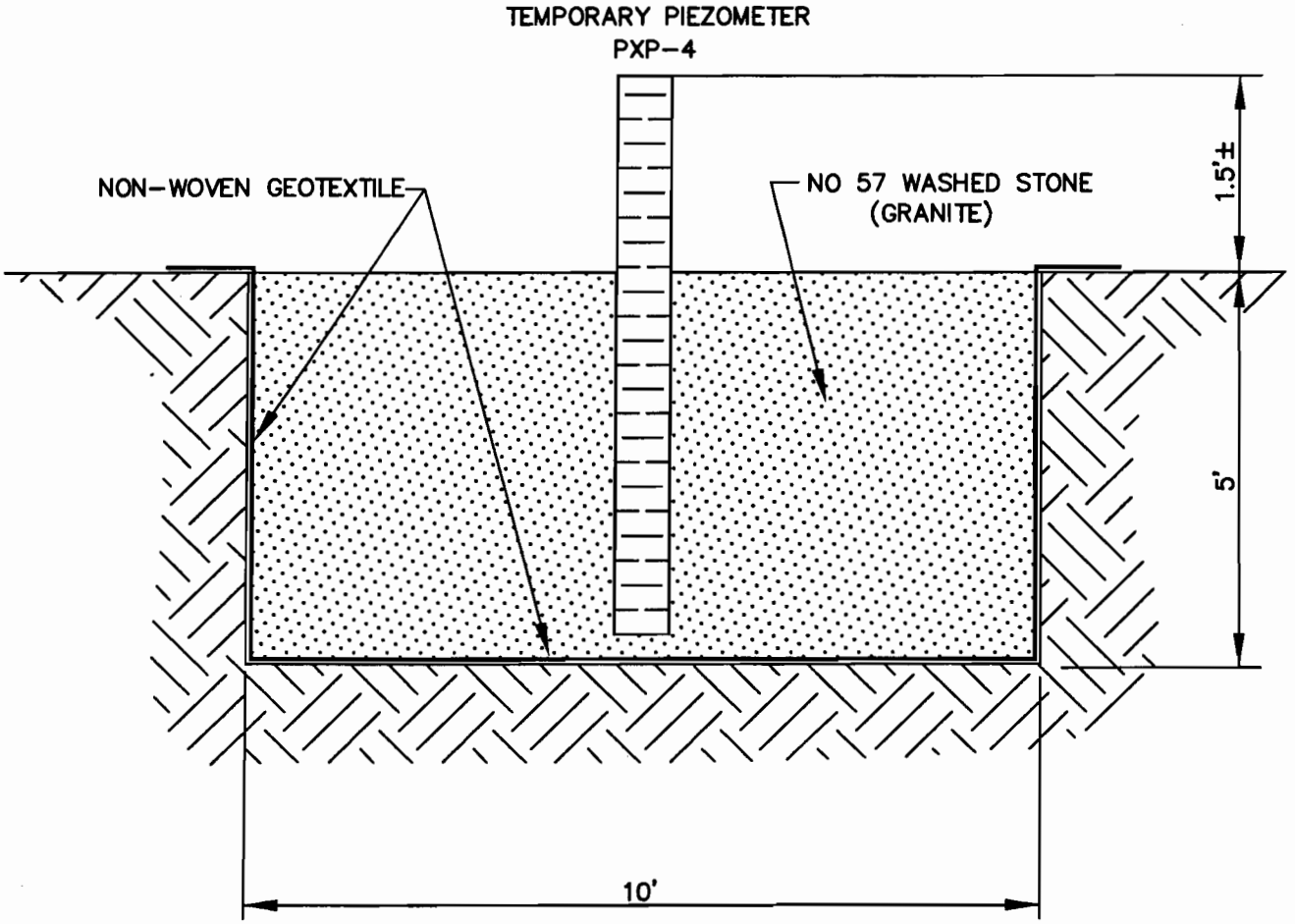
PROJECT: FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE: PILOT TEST
FOR INFILTRATION GALLERY
AT PX FACILITY

FIGURE 4

JOB NO: 195033 | DATE: JULY 2002 | SCALE: 1"= 10' | DRAWN BY: HCS | CHECKED BY: JKB

195033-NOND-OCT2002-04



SECTION A-A
NOT TO SCALE

CATLIN ENGINEERS and SCIENTISTS, WILMINGTON, NORTH CAROLINA	PROJECT: FLINT HILLS RESOURCES, LP NORTH TERMINAL RIVER ROAD WILMINGTON, N.C.	TITLE: SECTION A-A THROUGH PILOT TEST GALLERY			FIGURE 5
	JOB NO: 195033	DATE: JULY 2002	SCALE: NTS	DRAWN BY: HCS	CHECKED BY: JKB

195033-NOND-OCT2002-05

CALCULATIONS

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT: PX Area
Flint Hills Resources - North Terminal
CATLIN #: 195-033

Drawn/Calculated by: JKB
Date: 6/26/06
Reviewed by: MEM

Determine Size of Infiltration Gallery

Summarize Pilot Test Data

- Based on info provided in Table 2, approximate flow rates of 15 gal/min, 10 gal/min and 5 gal/min were used for this pilot test. The drawdown increased (groundwater elevations rose) in all of the temporary piezometer wells during the 15 gal/min flow rate. The drawdown increased in the adjacent temporary piezometer wells and decreased in the temporary piezometer well inside the trench during the 10 gal/min flow rate. The depth to groundwater decreased in the temporary piezometer installed inside the trench at the 5 gal/min flow rate. The immediate down gradient temporary piezometer initially decreased at the 5 gal/min flow rate; however it remained the same or slightly increased after 30 min of pumping water at this flowrate. All other wells gradually leveled off or slightly increased at the 5 gal/min flow rate. Therefore, our conclusion is a flow rate slightly less than 5 gal/min would establish a stabilized water level. For purposes of this design a flow rate of 4 gal/min will be used. Refer to figure 4 and 5 for location and size of pilot test trench.

- The head at 5 gal/min was increased approximately 1 to 2 feet above the initial head.

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT: Flint Hills Resources LP - North Terminal PX Area
CATLIN #: 195-033

Drawn/Calculated by: JKB
Date: 6/26/02
Reviewed by: MEM - 7/5/02

Determine Size of Infiltration Gallery (cont.)

Determine Surface Area of Pilot Test Trench

- Based on Figure 4, trench is 10'x 3'x 5' deep

Surface Area = 10' x 3' = 30 Square Feet (SF)

Determine Flow per Surface Area of Pilot Test Trench

= 4 gal/min / 30 SF

= 0.13 gal/min/SF

Determine Size of Infiltration Gallery

- Based on information provided by Steve Tyler, CATLIN, the maximum discharge flow rate from the groundwater remediation system will be 80 gal/min.

Assume
- Infiltration Gallery will be 10 feet wide*
- Safety Factor for clogging = 2

80 gpm / 0.13 gal/min/SF = 615 SF

615 SF x 2 (↑ Safety Factor) = 1231 SF

Infiltration Gallery = 10 feet x 123 feet

*Pending utilities encountered, infiltration gallery may be increased or decreased in width or multiple trenches may be used however total surface area is to be a minimum of 1231 SF.

LOADING RACK AREA

SUMMARY OF PILOT TEST ACTIVITIES FOR INFILTRATION TRENCH AT THE LOADING RACK AREA

SUMMARY OF PILOT TEST ACTIVITIES FOR INFILTRATION GALLERY AT LOADING RACK AREA FOR NON-DISCHARGE PERMIT APPLICATION FLINT HILLS RESOURCES, LP NORTH TERMINAL WILMINGTON, NORTH CAROLINA

INTRODUCTION

Flint Hills Resources, LP (FHR) authorized CATLIN Engineers and Scientists (CATLIN) to prepare a Non-Discharge Permit Application for a proposed Groundwater Remediation System at the FHR North Terminal (See Figure 1) for submittal to the North Carolina Department of Environment and Natural Resources, Division of Water Quality. To determine an "acceptable loading rate" as required in Section V - Design Information For Infiltration Galleries, Subsection 3 of the application, CATLIN performed an on-site infiltration gallery pilot test. This Summary discusses the field activities and findings associated with this pilot test.

FIELD ACTIVITIES

CATLIN field personnel constructed the pilot test infiltration gallery on June 10, 2002 at the Loading Rack Area of the North Terminal as shown on the attached Figures 2 and 3. Temporary piezometers were installed at the locations illustrated on the attached Figure 4 using a hand auger. The temporary piezometers were installed into the water table to monitor fluctuation during the pilot test and to ensure the bottom of the gallery was constructed at least 1 foot above the ground water table. A summary of the piezometers is provided on the attached Table 1.

The gallery was constructed within the area of interest using a rubber tire backhoe. The gallery was excavated 10 feet long by 5 feet wide to approximately 2.5 feet below land surface at the location indicated on Figures 2 and 3. The native material excavated was primarily medium grained SAND with few fines. The bottom of the test pit was constructed with dimensions of approximately 10 feet long by 4 feet wide. Due to the sandy nature of the native material and the depth of the gallery, the excavation side slopes were sloughing; therefore, the dimensions near the existing ground surface were greater than at the bottom of the gallery ($\pm$ 1 foot each direction).

Upon completion of the excavation, a non-woven geotextile fabric was placed against the bottom and sides of the gallery. Washed NCDOT No. 57 stone (granite) was placed on the geotextile fabric to near ground surface. A temporary piezometer (LRP-8) was installed within the gallery. A plan view and cross-section of the constructed gallery are provided on the attached Figures 4 and 5.

CATLIN field personnel conducted the infiltration gallery pilot test on June 11, 2002. Water was pumped from an on-site fire hydrant into the top of the stone layer at various flow rates. Flow rates were gauged and controlled by using an on-line flow meter and gate valve. Flow rates were adjusted and the water level within the gallery was allowed to stabilize. Initially the flow rate was 2 gallons per minute (gal./min.); however, the groundwater level continued rising (mounding) in adjacent temporary piezometers. We assumed this rise was due to the saturation of the soils. Therefore, we increased the flow rate to 10 gal./min in an attempt to increase the saturation process. At 10 gal./min. the groundwater level continued to rise (mound) in adjacent temporary piezometers (assumed soil was saturated during this time frame), therefore, we decreased the flow rate to 5 gal./min. At 5 gal./min. the groundwater level generally continued to rise in the adjacent temporary piezometers, therefore, we decreased the flow rate to 3 gal./min. At 3 gal./min. the groundwater levels generally leveled off. Therefore, we assumed a flow rate of 3 gal./min. as the design flow.

FINDINGS

An evaluation of the pilot test data indicates an acceptable loading rate of approximately 3 gallons per minute with approximately 1 to 2 feet of head (based on the change in groundwater level in temporary piezometers during a 4 gal./min. pumping rate) within a 10 feet long, 4 feet wide, and 2.5 feet deep gallery. Based on this loading rate information, an infiltration rate of 0.075 gallons per minute per square feet (measured along the bottom of the gallery) were determined. Based on this infiltration rate and a factor of safety of 2, an infiltration gallery of 1060 square feet would need to be constructed to accept the anticipated 40 gal./min. of treated groundwater from the proposed groundwater remediation system. See attached calculation sheets for the determination of the size of the infiltration gallery.

TABLES

TABLE 1

SUMMARY OF TEMPORARY PIEZOMETERS FOR PILOT TEST FOR INFILTRATION GALLERY AT LOADING RACK AREA

FLINT HILLS RESOURCES
NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

PIEZOMETER	DIAMETER (IN.)	TOTAL DEPTH (FT.)	LENGTH OF STICK-UP (FT.)	DEPTH TO WATER (FT.)
LRP-1	2	7.35	1.75	5.39
LRP-2	2	7.90	1.91	6.43
LRP-3	2	8.47	2.51	6.64
LRP-4	2	5.43	1.35	4.39
LRP-5	2	5.43	0.82	4.35
LRP-6	2	8.31	2.25	7.15
LRP-7	2	7.56	1.50	5.57
LRP-8	2	5.41	3.15	No Water

TABLE 2

SUMMARY OF FIELD DATA FOR PILOT TEST
FOR INFILTRATION GALLERY AT LOADING RACK AREA

FLINT HILLS RESOURCES
NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

Actual Time	Approximate Flow Rate	Change in Drawdown in Temporary Piezometers							
		LRP-1	LRP-2	LRP-3	LRP-4	LRP-5	LRP-6	LRP-7	LRP-8
8:41	± 2 gal/min.	0	0	0	0	0	0	0	No Water
8:46	± 2 gal/min.	+0.04	+0.04	+0.04	+0.01	0	-0.01	+0.03	No Water
8:51	± 2 gal/min.	+0.12	+0.07	0	+0.07	+0.03	0	+0.04	No Water
8:56	± 2 gal/min.	+0.07	+0.05	+0.01	+0.05	+0.02	0	+0.04	No Water
9:01	± 2 gal/min.	+0.06	+0.03	+0.02	+0.04	+0.02	0	+0.04	No Water
9:06	± 2 gal/min.	+0.03	+0.03	0	+0.04	+0.01	0	+0.03	No Water
9:11	± 2 gal/min.	+0.04	+0.03	+0.01	+0.03	+0.01	0	+0.02	No Water
9:16	± 2 gal/min.	+0.02	+0.01	0	+0.02	0	0	+0.03	No Water
9:21	± 2 gal/min.	+0.03	+0.02	+0.01	+0.03	0	0	+0.01	No Water
9:26	± 2 gal/min.	+0.01	+0.03	+0.01	+0.02	+0.01	0	+0.02	0 **
9:31	± 2 gal/min.	+0.02	+0.01	0	+0.01	+0.02	0	+0.01	+0.02 **
9:36	± 2 gal/min.	+0.01	+0.01	+0.01	+0.02	+0.01	+0.01	+0.02	No Water
9:41	± 2 gal/min.	+0.02	0	0	+0.01	0	0	+0.01	No Water
9:46	± 2 gal/min.	+0.02	+0.02	+0.02	+0.01	+0.01	0	+0.01	No Water
9:51	± 2 gal/min.	+0.01	+0.01	0	+0.02	0	0	+0.01	No Water
9:56	± 2 gal/min.	+0.01	+0.01	0	+0.01	0	0	+0.02	No Water
10:01	± 2 gal/min.	+0.01	+0.01	0	+0.01	+0.01	0	+0.01	No Water
10:06	± 2 gal/min.	+0.01	+0.02	0	+0.01	0	0	0	No Water
10:11	± 2 gal/min.	+0.01	0	0	+0.01	+0.01	0	+0.01	No Water
Total Change at 2 gal./min.		+0.54	+0.40	+0.13	+0.42	+0.16	0	+0.36	+0.02
SHUTDOWN AT 10:13 AND ADJUSTED FLOW									

TABLE 2

SUMMARY OF FIELD DATA FOR PILOT TEST
FOR INFILTRATION GALLERY AT LOADING RACK AREA

FLINT HILLS RESOURCES
NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

Actual Time	Approximate Flow Rate	Change In Drawdown in Temporary Piezometers							
		LRP-1	LRP-2	LRP-3	LRP-4	LRP-5	LRP-6	LRP-7	LRP-8
10:15	± 10 gal/min.	0	0	0	0	0	0	0	No Water
10:20	± 10 gal/min.	+0.03	+0.01	+0.01	+0.02	+0.01	-0.01	+0.02	No Water
10:25	± 10 gal/min.	+0.07	+0.05	+0.01	+0.03	+0.01	0	+0.01	No Water
10:30	± 10 gal/min.	+0.06	+0.05	+0.02	+0.03	+0.01	+0.01	+0.04	No Water
10:35	± 10 gal/min.	+0.06	+0.03	0	+0.03	+0.02	0	+0.02	0
10:40	± 10 gal/min.	+0.04	+0.03	+0.01	+0.02	0	0	+0.01	+0.11
10:45	± 10 gal/min.	+0.06	+0.04	+0.01	+0.02	+0.02	0	+0.03	+0.10
10:50	± 10 gal/min.	+0.07	+0.04	+0.02	+0.04	+0.02	0	+0.03	+0.12
10:55	± 10 gal/min.	+0.06	+0.03	0	+0.03	+0.02	0	+0.03	+0.08
Total Change at 10 gal./min.		+0.45	+0.28	+0.20	+0.22	+0.11	0	+0.19	+0.41
SHUTDOWN AT 10:59 AND ADJUSTED FLOW									
11:01	± 5 gal/min.	0	0	0	0	0	0	0	0
11:06	± 5 gal/min.	+0.03	+0.05	+0.01	+0.05	+0.01	-0.01	+0.03	-0.15
11:11	± 5 gal/min.	+0.02	+0.01	0	+0.02	-0.01	0	+0.02	-0.03
11:16	± 5 gal/min.	+0.02	+0.02	0	+0.02	0	0	+0.02	-0.01
11:21	± 5 gal/min.	+0.01	+0.02	0	+0.02	0	0	+0.01	0
11:26	± 5 gal/min.	+0.01	0	+0.01	+0.01	0	0	+0.02	0
11:31	± 5 gal/min.	+0.02	+0.01	0	+0.02	+0.04	+0.01	+0.01	0
11:36	± 5 gal/min.	+0.02	+0.02	+0.01	+0.02	0	0	+0.02	+0.03
11:41	± 5 gal/min.	+0.01	+0.02	0	+0.01	-0.03	0	+0.01	-0.01
11:46	± 5 gal/min.	+0.02	+0.01	+0.01	+0.02	+0.02	0	+0.01	+0.01
11:51	± 5 gal/min.	+0.01	+0.01	+0.01	+0.01	-0.02	0	+0.01	+0.01
Total Change at 5 gal./min.		+0.17	+0.17	+0.05	+0.20	+0.01	0	+0.16	-0.15
SHUTDOWN AT 11:54 AND ADJUSTED FLOW									

TABLE 2

SUMMARY OF FIELD DATA FOR PILOT TEST
FOR INFILTRATION GALLERY AT LOADING RACK AREA

FLINT HILLS RESOURCES
NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

Actual Time	Approximate Flow Rate	Change in Drawdown in Temporary Piezometers							
		LRP-1	LRP-2	LRP-3	LRP-4	LRP-5	LRP-6	LRP-7	LRP-8
11:57	± 3 gal/min.	0	0	0	0	0	0	0	0
12:02	± 3 gal/min.	-0.01	0	-0.01	+0.01	+0.02	0	+0.02	-0.20
12:07	± 3 gal/min.	-0.01	+0.01	0	+0.02	+0.01	0	+0.01	-0.05
12:12	± 3 gal/min.	0	-0.01	+0.01	0	+0.01	-0.01	+0.01	-0.05
12:17	± 3 gal/min.	-0.01	0	0	+0.01	0	0	0	-0.03
12:22	± 3 gal/min.	-0.01	0	0	0	-0.05*	0	0	-0.04
12:27	± 3 gal/min.	0	0	0	0	+0.04	+0.01	+0.01	-0.02
12:32	± 3 gal/min.	0	0	0	0	+0.01	0	0	-0.02 ***
12:37	± 3 gal/min.	0	0	0	0	+0.02	0	0	0 ***
Total Change at 3 gal./min.		-0.04	0	0	+0.04	+0.08	0	+0.05	-0.41
SHUTDOWN AT 12:40									

* Checked twice, unsure why significant change.
** Possible condensate.
*** Water is from inside cap of piezometer.

FIGURES

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

1° 39' / 29 MILS

5½° / 98 MILS

GN

MN

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER

THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE

THE MEAN RANGE OF TIDE IS APPROXIMATELY 3.6 FEET

QUADRANGLE LOCATION

CATLIN ENGINEERS and SCIENTISTS

WILMINGTON, NORTH CAROLINA

PROJECT: FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE: GENERAL LOCATION
USGS TOPOGRAPHIC QUADRANGLE

FIGURE 1

JOB NO: 201125-07 | DATE: OCT 2002 | SCALE: AS SHOWN | DRAWN BY: HCS | CHECKED BY: JKB

201125-NOND-OCT2002-01

N

STATE PORTS AUTHORITY EAST
EQUIPMENT STORAGE YARD

ESTIMATED LOCATION OF
ABANDONED PARAXYLENE LINES

STATE PORTS AUTHORITY
PROPERTY

FLINT HILLS RESOURCES, LP FUELS PROPERTY
LOADING RACK AREA

PARA-XYLENE FACILITY

TANK 501

TANK 601

TANK 301

TANK 401

TANK 501

TANK 402

TANK 1101

OFFICE

TRAIL CAR
LOADING RACK
AREA

RIVER ROAD

POLISHING POND 2

POLISHING POND 1

FWTP

SETTLING POND

TANK 8

TANK 8

TANK 3

TANK 1

GASOLINE/#2 FUEL OIL FACILITY

TANK 7

TANK 4

TANK 2

FLINT HILLS RESOURCES, LP
NORTH TERMINAL

PETROLEUM FUEL PROPERTY

PILOT TEST SITE

LEGEND

PROPERTY LINE W/MARKER

SD STORM DRAIN W/CATCH BASIN

X TEMPORARY BENCH MARK (TBM)

RAILROAD TRACKS

RECOVERY WELL

FWTP FACILITY WASTEWATER TREATMENT PLANT

200 0 200
SCALE IN FEET

CATLIN
ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

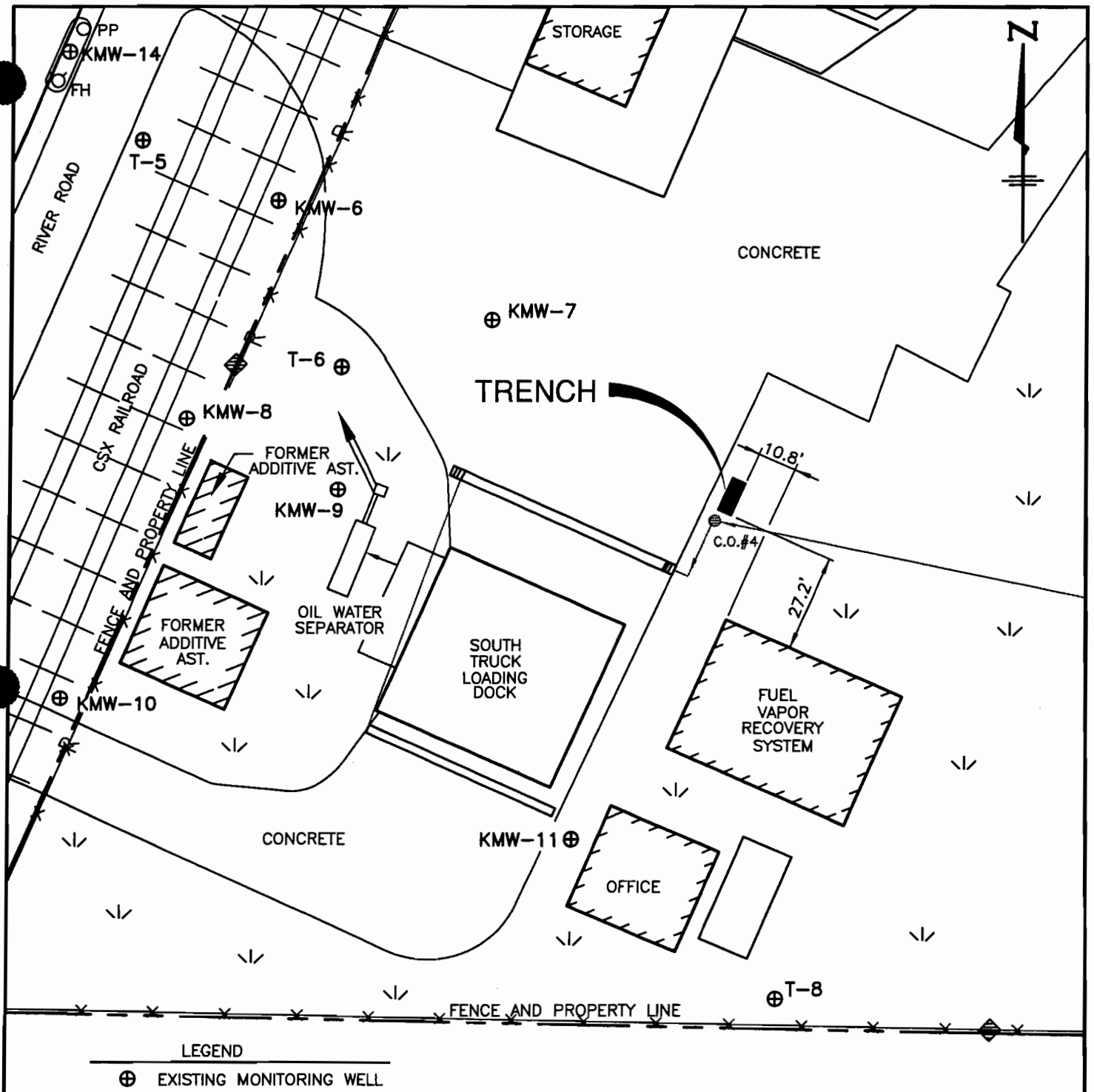
PROJECT
FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE
SITE MAP

FIGURE
2

JOB NO. 201125-07 DATE: OCT 2002 SCALE: 1"=200' DRAWN BY: HCS CHECKED BY: JKB

210125-NOND-OCT2002-02



NOTE:
LOCATION OF TRENCH FOR PILOT TEST IS BASED ON FIELD MEASUREMENTS BY TAPE MEASURE

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

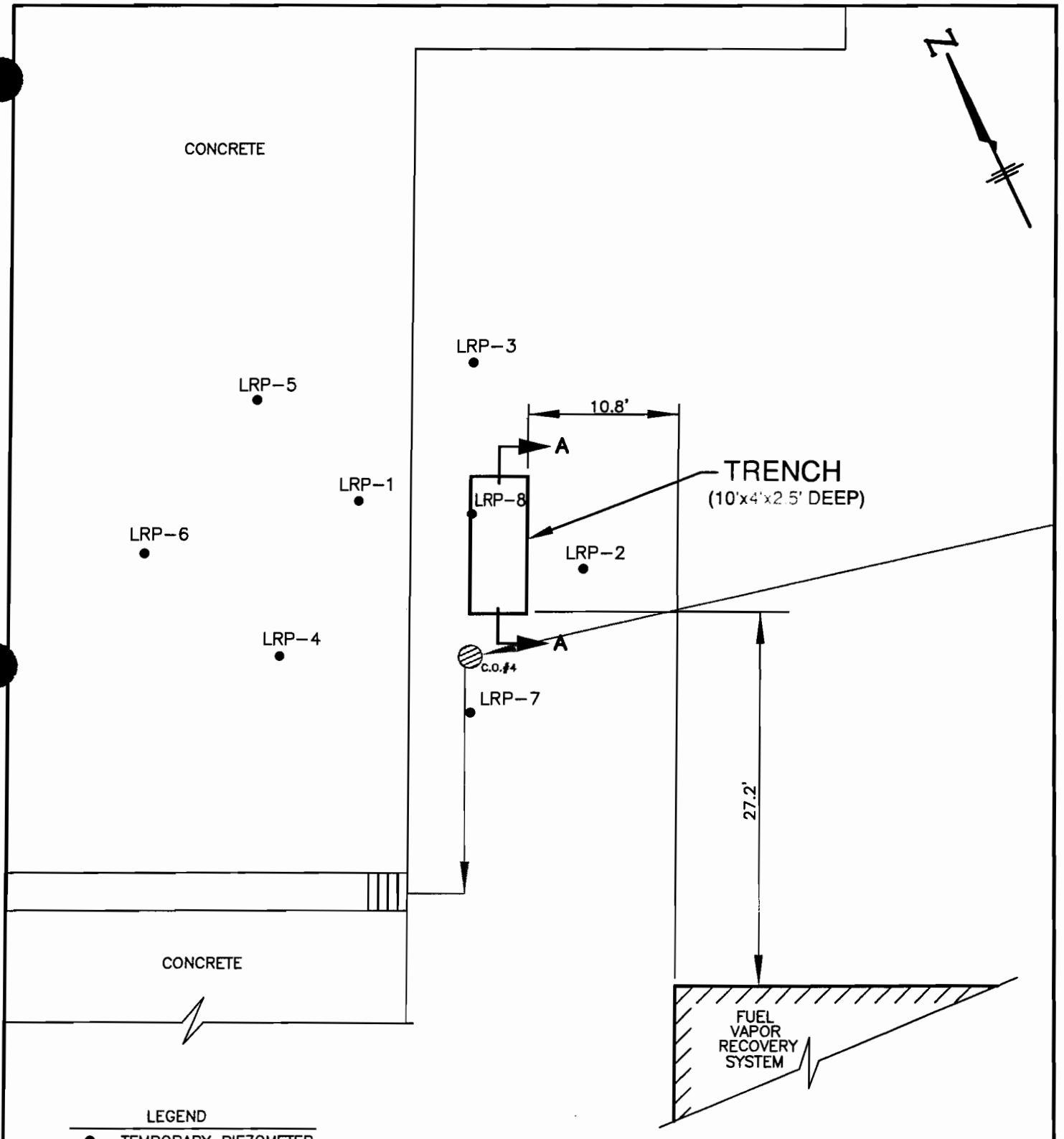
PROJECT: FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE: LOCATION OF PILOT TEST FOR INFILTRATION GALLERY AT LOADING RACK AREA

FIGURE 3

JOB NO: 201125-07 | DATE: OCT 2002 | SCALE: 1"=40' | DRAWN BY: HCS | CHECKED BY: JKB

201125-NOND-OCT2002-03



NOTE:
LOCATION OF TRENCH AND TEMPORARY PIEZOMETERS FOR PILOT TEST IS BASED ON FIELD MEASUREMENTS BY TAPE MEASURE.

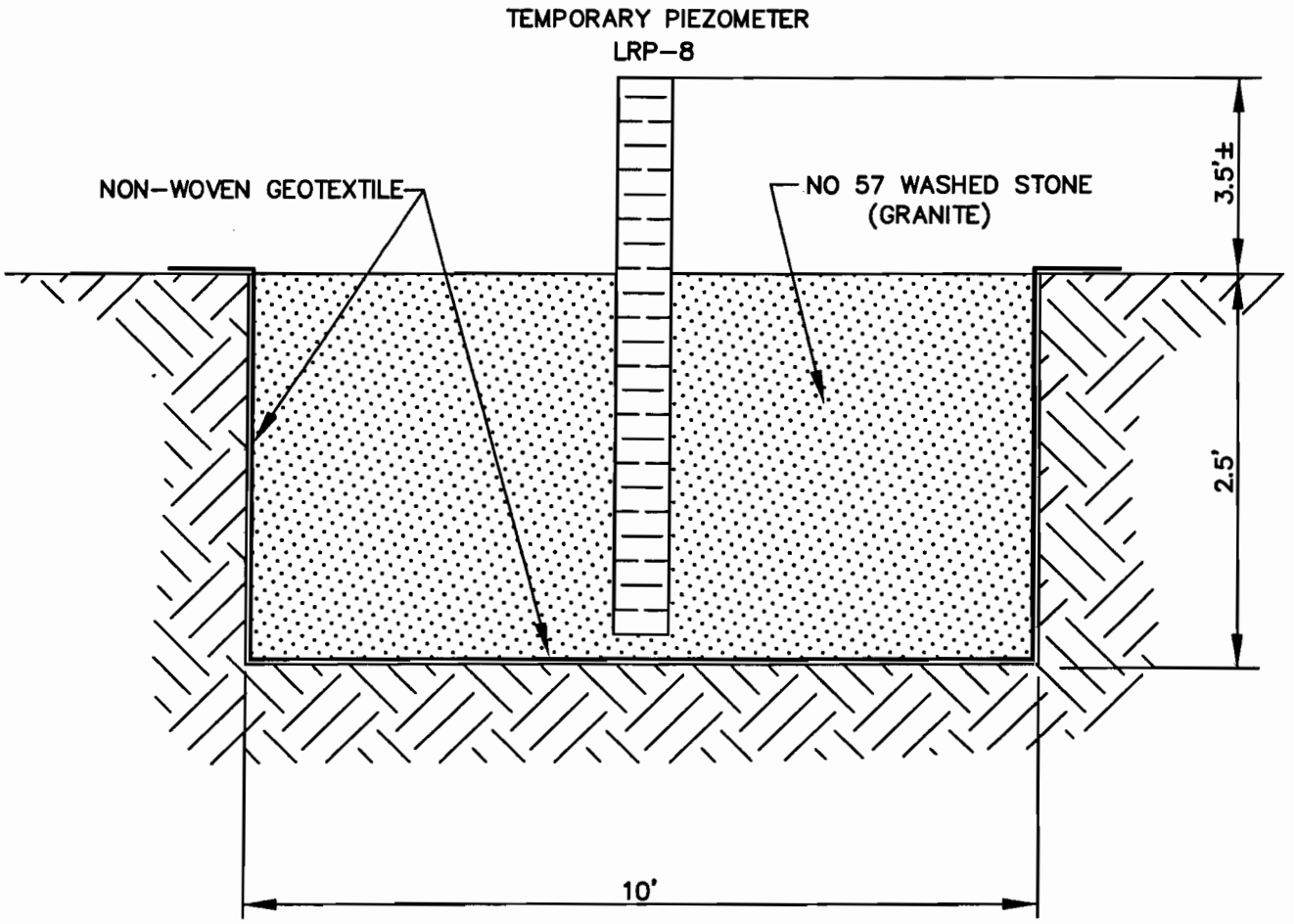
10 5 0 10
SCALE IN FEET

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

PROJECT	TITLE	FIGURE
FLINT HILLS RESOURCES, LP NORTH TERMINAL RIVER ROAD WILMINGTON, N.C.	PILOT TEST FOR INFILTRATION GALLERY AT LOADING RACK AREA	4

JOB NO: 201125-07	DATE: OCT 2002	SCALE: 1"=10'	DRAWN BY: HCS	CHECKED BY: JKB

201125-NOND-OCT2002-04



SECTION A-A
NOT TO SCALE

CATLIN ENGINEERS and SCIENTISTS, WILMINGTON, NORTH CAROLINA	PROJECT: FLINT HILLS RESOURCES, LP NORTH TERMINAL RIVER ROAD WILMINGTON, N.C.	TITLE: SECTION A-A THROUGH PILOT TEST GALLERY			FIGURE 5
	JOB NO: 201125-07	DATE: OCT 2002	SCALE: NTS	DRAWN BY: HCS	CHECKED BY: JKB

201125-NOND-OCT-05

CALCULATIONS

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT:
Flint Hills Resources, LP – North Terminal (Loading Rack Area)
CATLIN #: 201-125

Drawn/Calculated by: JKB
Date: 9/25/02
Reviewed by: MEM 9-27-02

Determine Size of Infiltration Gallery

Summary of Pilot Test Data

- Based on information provided in Table 2, approximate flow rates of 2, 3, 5 and 10 gal/min were used for this pilot test. The drawdown increased (groundwater elevation rose) in all of the temporary piezometer wells during the 10 gal/min. flow rate. The drawdown increased in temporary piezometers LRP-1, LRP-2, LRP-3, LRP-4, and LRP-7 and slightly decreased or remained the same in temporary piezometer wells LRP-5, LRP-6 and LRP-8 during the 5 gal/min flow rate. The drawdown slightly increased and/or decreased in temporary piezometers during first 2.5 min of pumping at the 3 gal/min flow rate, however, the water level generally stabilized after 25 min of pumping.

- The 2 gal/min flow rate was initially used during the pumping test. The drawdown increased (groundwater elevation rose) during the pumping at 2 gal/min in each temporary piezometer. Based on information provided above, it is our assumption that the groundwater elevation rose at 2 gal/min due to the soil not reaching the saturation point prior to completing pumping at this 2 gal/min flow rate and that if this flow rate was utilized after the 3 gal/min flow rate discussed above then the drawdown would have decreased (groundwater elevation fall) because soils were saturated at this point.

- Therefore, our conclusion is a flow rate of 3 gal/min would establish a stabilized water level. For purposes of this design a flow rate of 3 gal/min will be used.

- Refer to Figure 4 and 5 for location and size of pilot test trench.

- The head at 3 gal/min was increased approximately 1 to 2 feet above the initial head.

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT: Flint Hills Resources, LP - North Terminal (Loading Rack Area)
CATLIN #: 201-125

Drawn/Calculated by: JKB
Date: 9/25/02
Reviewed by: MEM 9-27-02

Determine Size of Infiltration Gallery

Determine Surface Area of Pilot Test Trench

- Based on Figure 4, trench is 10'x4'x2.5' deep

Surface Area = 10'x4' = 40 square feet (SF)

Determine Flow per Surface Area of Pilot Test Trench

= 3 gal/min / 40 SF

= 0.075 gal/min/SF

Determine Size of Infiltration Gallery

- Based on the Corrective Action Plan Addendum, 4 Recovery wells will be pumping into the groundwater pretreatment system at the loading rack area. Based on our experience w/ similar recovery wells on-site, we anticipate the maximum flow rate from each recovery well to be 10 gallons/minute. Therefore, the maximum discharge flow rate from the groundwater pretreatment system will be 40 gallons per minute

Assume
- Infiltration Gallery will be 10 feet wide*
- Safety Factor for Clogging = 2

$[(40\text{gpm})/(0.075\text{ gal/min/SF})] \times 2 = 1066\text{ SF}$

Infiltration Gallery = 10 feet x 107 feet

* Pending utilities encountered, infiltration gallery may be increased or decreased in width or multiple trenches may be used; however, total surface area is to be a minimum of 1,066 SF.

ATTACHMENT B

PROCESSING FEE

ATTACHMENT C

2 COPIES OF
CORRECTIVE ACTION PLAN ADDENDUM
AND
COMPREHENSIVE SITE ASSESMENT REPORTS

(SUBMITTED UNDER SEPARATE COVER)

ATTACHMENT D

EXISTING PERMIT

(NOT APPLICABLE)

ATTACHMENT E

CONSTRUCTION PLANS

4 SETS

ATTACHMENT F

SUMMARY OF REPRESENTATIVE MONITORING WELL NETWORK DATA

4 COPIES

PX FACILITY

SUMMARY OF REPRESENTATIVE MONITORING WELL NETWORK DATA

SUMMARY OF REPRESENTATIVE MONITORING WELL NETWORK DATA

Flint Hills Resources, LP
North Terminal
Paraxylene Facility
Wilmington, North Carolina

IDENTIFICATION NUMBER	WELL TYPE	DATE INSTALLED	DEPTH OF WELL (feet)
MW-3	Type II Monitoring	11/28/95	15
MW-4	Type II Monitoring	11/28/95	15
MW-9	Type II Monitoring	2/7/00	12
MW-10	Type II Monitoring	2/10/00	12
MW-11	Type II Monitoring	2/8/00	12
MW-12	Type II Monitoring	2/7/00	14
MW-13	Type II Monitoring	2/7/00	16.2
MW-14	Type II Monitoring	2/8/00	14
MW-15	Type II Monitoring	2/8/00	14
MW-16	Type II Monitoring	2/8/00	14
MW-17	Type II Monitoring	2/9/00	12
MW-18	Type II Monitoring	2/8/00	16
MW-19	Type II Monitoring	2/9/00	16
TMW-2	Type III Monitoring	2/17/00	38

LOADING RACK AREA

SUMMARY OF REPRESENTATIVE MONITORING WELL NETWORK DATA

SUMMARY OF REPRESENTATIVE MONITORING WELL NETWORK DATA

Flint Hills Resources, LP
North Terminal
Loading Rack Area
Wilmington, North Carolina

IDENTIFICATION NUMBER	WELL TYPE	DATE INSTALLED	DEPTH OF WELL (feet)
KMW-6	Type II Monitoring	9/13/01	12
KMW-7	Type II Monitoring	9/13/01	11
KMW-8	Type II Monitoring	9/12/01	12
KMW-9	Type II Monitoring	9/13/01	12
KMW-10	Type II Monitoring	9/13/01	12
KMW-11	Type II Monitoring	9/13/01	12
KMW-12	Type II Monitoring	12/21/01	15
KMW-13	Type II Monitoring	12/21/01	15
KMW-14	Type II Monitoring	12/21/01	15
TW-1	Type III Monitoring	11/30-12/1/95	45
TW-2	Type III Monitoring	2/17/00	38
LRRW-1	Recovery Well	12/23/03	20
LRRW-2	Recovery Well	12/23/03	20
LRRW-3	Recovery Well	12/30/03	20
LRRW-4	Recovery Well	12/23/03	20

ATTACHMENT G

SOIL SCIENTIST REPORT

(NOT APPLICABLE)

ATTACHMENT H

HYDROGEOLOGIC DESCRIPTION

ATTACHMENT H1

PX FACILITY

HYDROGEOLOGIC DESCRIPTION

HYDROGEOLOGIC DESCRIPTION FOR

PX FACILITY

New Hanover County Lithology

Shallow subsurface stratigraphic framework within New Hanover County was summarized by Larry Zarra in a 1991 reconnaissance study titled "Subsurface Stratigraphic Framework For Cenozoic Strata in Brunswick and New Hanover Counties, North Carolina". The predominant subsurface soil strata typically encountered at/around the subject site can be summarized as follows:

Surficial Sands - An unfossiliferous surficial unit which includes the modern surface and shallow subsurface sediments which overly the older fossiliferous units. The surficial sand unit is generally a light gray to light-yellow medium to fine grained sand with trace quantities of clay, opaque mineral grains, coarse-grained sand, pebbles, and feldspar. Peat is locally abundant (Zarra, 1991).

Pliocene/Pleistocene (Undifferentiated) - Available logs and data do not provide enough data to separate these strata into component formations. The Pliocene/Pleistocene strata are made up of shelly quartz sands and shelly carbonates. The quartz sands are typically unconsolidated, fine grained, and contain well-preserved whole shells to fragmental shell hash. In some localities the shells are stained black. The carbonates vary between loosely consolidated sandy shell hash and sand marl to indurated sand moldic limestone (Zarra, 1991).

Castle Hayne Formation - The Castle Hayne Formation is generally recognized as light gray or white moldic limestone or bryozoan-rich limestone. The limestone cuttings from the upper part of the Castle Hayne Formation often contain traces of finely disseminated phosphate or glauconite. In some wells, the limestone section grades downward to calcareous fine-grained sandstone, and the limestone section is overlain by thin silty fossiliferous clay.

Site Monitoring Well Network

Characterization of site soil/geology was interpreted from soil samples obtained during site Type II and Type III monitoring well installation. Since 1980 different consultants and/or personnel have installed sets of monitoring wells which make up the current monitoring well network. Information pertaining to construction details of the entire well network was not known by CATLIN at the time of this report. The Type II monitoring wells constructed by CATLIN in the area of concern (MW-3, MW-4, and MW-9 through MW-19) were constructed of two inch diameter, schedule 40 PVC. Depths of the Type II monitoring wells installed by CATLIN ranged from 12 to 18 feet BLS. The Type III monitoring well (TMW-2) installed at the subject site by CATLIN was constructed with two inch diameter PVC to a depth of 38 feet BLS and 30 feet of six inch diameter outer casing. North Carolina Well Construction Records and boring logs for the monitoring wells installed by CATLIN within the area of concern have been provided as part of this attachment. Seven six inch diameter stainless steel recovery wells (RW-2, and KRW-3 through KRW-8) have been constructed across the site. The recovery wells range in depth from approximately 20 to 30 feet BLS. Monitoring and recovery well locations are presented on Figure 1 of Attachment H1.

Site Subsurface Soils

Descriptions of soil samples collected during the installation of the monitoring wells indicates that the area of investigation is underlain primarily by fine to medium grained, poorly to well sorted sand with occasional plagioclase grains and 1 mm to 15 mm. The surficial sand unit is often interbedded with silty/clayey sand lenses. These materials appear to be similar to those described by Zarra (1991) as the Pliocene/Pleistocene undifferentiated unit. Fine to medium grained, poorly sorted clayey to silty sands with occasional shell fragments and black phosphatic sands were identified underlying the surficial unit at a depth of approximately twenty feet BLS. The silty/clayey sand unit was not identified consistently across the area of interest. Where present, the silty/clayey sand was typically five to ten feet thick. The description of this material closely resembles the "undifferentiated Pliocene/Pleistocene strata" as described by Zarra (1991). While installing the Type III monitoring well TMW-2, a sequence of fine grained clay (moderate plasticity) underlain by sand with shell fragments and glauconite were encountered at 28 feet below the ground surface. This material was in turn underlain by fossiliferous moldic limestone. This sequence is interpreted to be the upper limits of the Castle Hayne Formation. Total thickness of the Castle Hayne Formation within the subject site was not determined.

Subsurface Soil Cross Section

As part of the August 9, 2002 CAPA, a cross section of the area of interest was prepared illustrating the encountered subsurface soils and interpolated depth of contamination referred to as cross section A-A'. In addition to the layout of the proposed remediation system the cross section A-A' transect is also indicated in attached Figure 1 of Attachment H1. Refer to Figure 2 of Attachment H1 for the A-A' cross section details. Please note, this cross section detail has been modified to illustrate current conditions.

Hydrogeologic Description

Within this Coastal Plain physiographic province, groundwater systems consist of aquifers (saturated zones) in permeable sand, gravel, and limestone layer(s) often separated by confining layer(s) of less permeable sediments such as silt and clay. In assessing subsurface conditions at the North Terminal two aquifers have been identified. An unconfined surficial groundwater aquifer, and the confined Castle Hayne aquifer. The unconfined surficial aquifer has been interpreted to extend from the water table to the top of the underlying silty/clayey sand, where present, or the clay unit identified at a depth of approximately 25 to 30 feet BLS. The unconfined surficial aquifer has been impacted at the area of interest with dissolved petroleum constituents and has been the primary focus of site assessment and remediation efforts. As part of the August 7, 2000 CSA, CATLIN personnel evaluated the hydrogeologic characteristics of the site surficial groundwater aquifer. Those findings are summarized as follows:

Hydraulic Gradient

Strict interpolation of the surficial water table elevations revealed groundwater flow trend towards the west-northwest. The hydraulic gradient was calculated using water level measurement from two monitoring wells apparently not influenced by site surficial groundwater remediation efforts. The hydraulic gradient (dh/dl) calculated from water level measurements between wells MW-10 and 113 on March 23, 2000 was determined to be 0.02 feet per feet.

Hydraulic Conductivity

To estimate the hydraulic conductivity of the surficial aquifer, rising head/recovery tests were performed on shallow monitoring wells MW-9 and MW-15 on March 23, 2000. To perform the test, the static head of the groundwater was measured. A solid "slug" was introduced into the well and the water table was allowed to return to static levels. The slug was instantaneously removed and the recovery rate of the groundwater was measured utilizing a pressure transducer. Data was recorded with a Hermit 2000® data logger. The recovery data was processed by the AQTESOLV™ aquifer test solving software program which utilizes the Bouwer and Rice (1976) method. Program assumptions are as follows:

- Aquifer has infinite areal extent
- Aquifer is homogeneous and of uniform thickness
- Aquifer potentiometric surface is initially horizontal
- A known volume, V, is injected into or discharged from the well instantaneously
- Flow is steady
- Aquifer is confined or unconfined

The AQTESOLV program uses the following equation to derive the hydraulic conductivity:

$$\ln(s_0)-\ln(s_t) = \frac{2KLt}{r_{ce}^2 \ln(R_e/r_{we})}$$

where:

K = Hydraulic conductivity in feet per day

s_0 = initial displacement in well or slug due to instantaneous removal of slug from well

s_t = displacement in well at time t

r_{ce} = $[r_c^2 + n(r_w^2-r_c^2)]^{0.5}$

$\ln (R_e/r_{we})$ = empirical "shape factor" determined from graphs provided in Bouwer and Rice (1976)

r_{we} = $r_w [(K^2/K_r)]^{0.5}$

r_c = radius of well where water level is rising during the slug test

r_w = radius of the screened or open section of the well plus the thickness of a sand or gravel pack. Thus, r_w is the radial distance from the center of the well to the normal K of the aquifer.

R_e = effective radial distance over which head loss occurs

L = saturated length of screened, perforated, or otherwise open section of well

t = time interval

To solve for the hydraulic conductivity (K), the above equation yields K as follows:

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \quad \frac{1}{t} \quad \ln \quad \frac{s_0}{s_t}$$

Anomalies ("double straight line effect") sometimes observed in the measured rate of the rise of the water level in the well are attributed to drainage of a gravel pack or developed zone around the well following lowering of the water level. The effect of this drainage was eliminated by ignoring the early data points and matching a line through the second straight line portion in the data plot for calculation of hydraulic conductivity (Bouwer, 1989).

Based on the slug test data, hydraulic conductivity (K) values at MW-9 and MW-15 were determined to be 19.03 feet per day and 4.22 feet per day, respectively. These values yielded an average K value of 11.62 feet per day. The slug test calculations have been provided as part of this attachment.

Transmissivity

The transmissivity of an aquifer is equal to the hydraulic conductivity of the aquifer multiplied by the saturated thickness of the aquifer. Thus:

$$T=Kb$$

Where:

T = transmissivity
K = hydraulic Conductivity
b = aquifer thickness

For the past several years the site surficial aquifer thickness has varied with the seasons. In addition to the subsurface soil data, cross-section A-A' (Figure 2 of Attachment H1) illustrates the highest and lowest surficial water table level encountered at the site since 1997. Using this information the seasonal transmissivity within the area of interest can be determined as follows:

Seasonal High Water Table

During the seasonal high water table conditions the surficial aquifer thickness is approximately 25 feet thick within the area of interest. Therefore:

$$T = (11.62 \text{ feet per day})(25 \text{ feet})$$
$$T = 290.5 \text{ ft}^2 \text{ per day}$$

Seasonal Low Water Table

During the seasonal high water table conditions the surficial aquifer thickness is approximately 20 feet thick within the area of interest. Therefore:

$$T = (11.62 \text{ feet per day})(20 \text{ feet})$$
$$T = 232.4 \text{ ft}^2 \text{ per day}$$

Specific Yield

Aquifer specific yield values depend on factors such as stratum grain size, shape, distribution of pores, and time of drainage. For this site specific yield of the surficial aquifer has been determined by comparing the predominant type of subsurface material encountered while drilling to the representative specific yield values for various materials found in – Johnson, A. I., Specific Yield –compilation of specific yields for various materials, U. S. Geological Survey Water-Supply Paper 1662-D, 74 pp.

For a material consisting predominantly of medium grained sand a specific yield of 28% is estimated.

ATTACHMENT H1 - FIGURES FOR

PX FACILITY

STATE PORTS AUTHORITY EAST
EQUIPMENT STORAGE YARD

FLINT HILLS RESOURCES, LP
NORTH TERMINAL

LEGEND

EXISTING	DESCRIPTION
	BUILDING
⊕	TYPE II WELL
⊕	TYPE III WELL
▢	PUMPING WELL

N

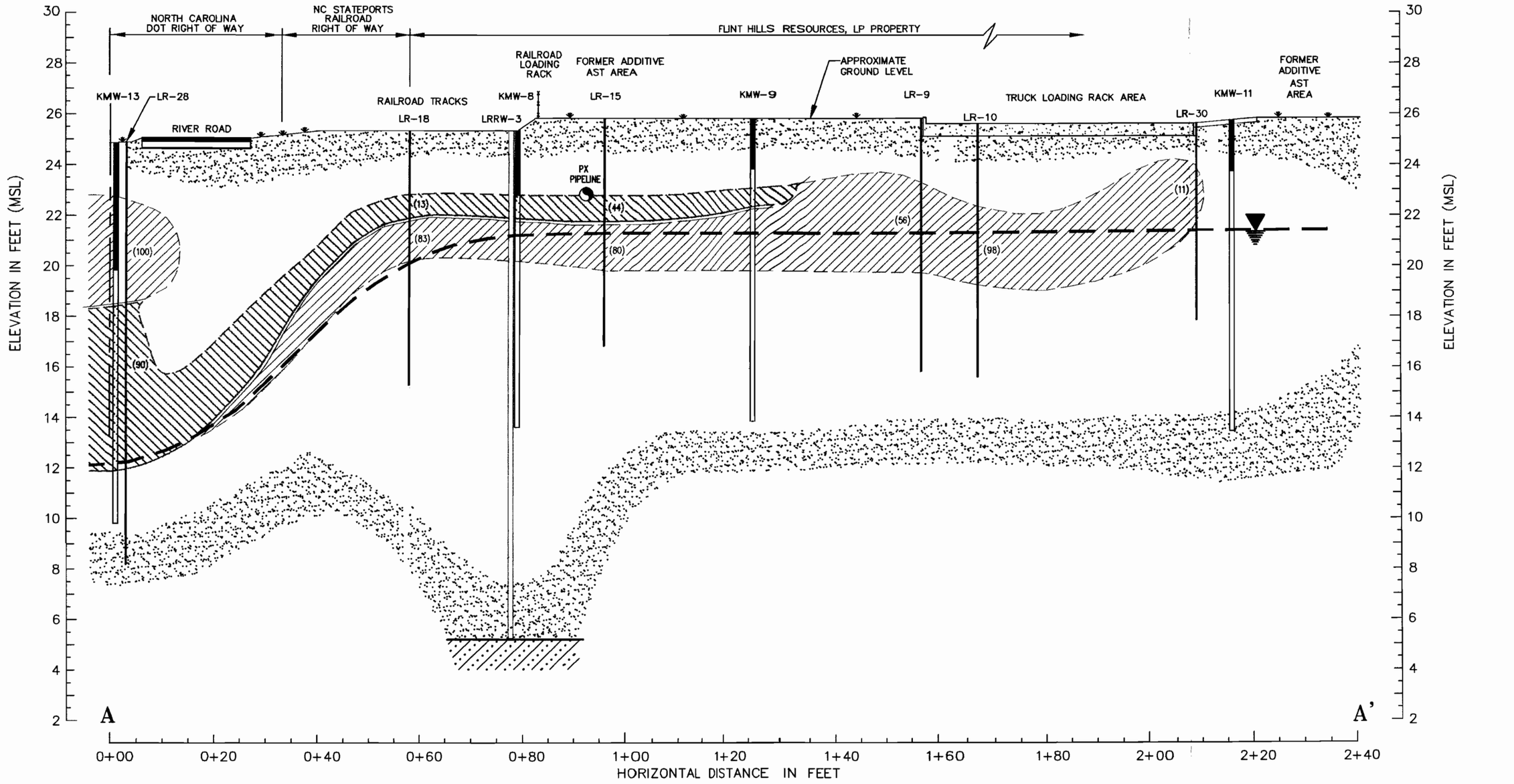
80 40 0 80
SCALE IN FEET

ESTIMATED LOCATION OF ABANDONED PARAXYLENE LINES
MW-29
LOADING RAMP
MW-30
MW-28
GATE
10' EASEMENT
MW-20
MW-19
116
117
KRW-6
MW-15
KRW-3
A
MW-18
PARKING
OFFICE
MW-14
MW-16
4" STORM DRAIN FORCE MAIN
113
114
BOILER HOUSE
KRW-5
MW-4
MW-13
MW-3
KRW-7
MW-17
109
120
107
121
108
TW-1
KRW-4
NORTH TRUCK LOADING DOCK
PROPOSED INFILTRATION GALLERY
119
106
104
105
MW-2
RW-2
3" RECOVERY WELL FORCE MAIN
4" TANK DRAIN FORCE MAIN
RAIL CAR LOADING RACK AREA
102
101
3" RECOVERY WELL FORCE MAIN
MH
SS
E. BOX
KRW-8
MW-12
MW-11
MW-7
TANK 801
T.D.I. #801
TANK 601
T.D.I. #601
MW-6
TMW-2
MW-10
MW-8
A'
4" TANK DRAIN FORCE MAIN
MW-5
TANK 301
T.D.I. #301
TANK 401
T.D.I. #401
MW-1
TANK 501
T.D.I. #501
TANK 402
T.D.I. #402
MW-9
TANK 1101
4" TANK DRAIN FORCE MAIN

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

PROJECT: FLINT HILLS RESOURCES, LP NORTH TERMINAL RIVER ROAD WILMINGTON, N.C.	TITLE: GEOLOGIC TRANSECT LOCATION		FIGURE: 1
JOB NO. 195033-07	DATE: OCT 2002	SCALE: 1"= 80'	DRAWN BY: HCS / CHECKED BY: ST

195033-WOND-OCT2002-01



SOILS LEGEND

- SAND
- SANDY CLAY

ROST LEGEND

- (162) PEAK FLUORESCENCE
- (162) PEAK FLUORESCENCE
- PREDOMINENTLY GAS/ PX WAVEFORM
- PREDOMINENTLY DIESEL WAVEFORM

MONITORING LEGEND

- CASING
- SCREENED INTERVAL
- SURFICIAL WATER TABLE LEVEL AS OF 3/14/01

20 10 0 20
SCALE IN FEET
1"=20' HORIZ.

4 2 0 4
SCALE IN FEET
1"=4' VERT.

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

PROJECT: FLINT HILLS RESOURCES, LP
NORTH TERMINAL
LOADING RACK AREA
RIVER ROAD
WILMINGTON, N.C.

JOB NO. 201125-07 | DATE: FEB 2003

TITLE: TRANSECT - A-A'

SCALE: AS SHOWN | DRAWN BY: WHW | CHECKED BY: JKB

FIGURE 2

201125-NDPERMIT-HYDRO-02

ATTACHMENT H1 - WELL CONSTRUCTION RECORD/BORING LOGS FOR

PX FACILITY

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY
Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-3

DRILLING CONTRACTOR Richard Catlin & Associates, Inc.

DRILLER REGISTRATION NUMBER 1142

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: New Hanover
Nearest Town: Wilmington

Koch North Terminal
(Road, Community, or Subdivision and Lot No.)

2. OWNER Koch Refining Company, L.P.

ADDRESS 3334 River Road
(Street or Route No.)
Wilmington NC 28412
City or Town State Zip Code

DRILLING LOG

Depth From	To	Formation Description

3. DATE DRILLED 11/28/95 USE OF WELL Monitoring

4. TOTAL DEPTH 17' CUTTINGS COLLECTED X YES _____ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES X NO

6. STATIC WATER LEVEL: ± 8 FT. ___ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): N/A METHOD OF TEST N/A

WATER ZONES (depth): Surficial Aquifer

9. CHLORINATION: Type: N/A Amount N/A

SEE ATTACHED

If additional space is needed use back of form.

10. CASING:

		Depth			Diameter	Wall Thickness or Weight/Ft.	Material
From	+2	To	5	Ft.	2 in.	SCH40	PVC
From		To		Ft.	in.	SCH40	PVC

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

		Depth			Material	Method
From	0	To	3	Ft.	CEMENT	TREMIE
From	3	To	4	Ft.	BENTONITE	CHIPS

12. SCREEN:

		Depth			Diameter	Slot Size	Material
From	5	To	15	Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

		Depth			Size	Material
From	4	To	15	Ft.	TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Amy L. Myers 4-18-96
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-3
TOTAL DEPTH 15.0

SITE LOCATION Koch North Terminal
Wilmington, North Carolina

DRILLED BY DS/GS
LOGGED BY S. HUDSON

DRILLING DATE 11/28/95

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
2.0	4.0	Light tan-brown, fine to medium grained, SAND, well sorted, very high permeability.	SP	Dry	Possible	7.8	Grab
5.0	7.0	Brown to very dark brown, medium grained, SAND, minor root fragments, well sorted, sub-rounded, possible hydrocarbon staining.	SP	Wet	Possible	29	12-12-12-12
10.0	12.0	Light brown, medium grained, SAND, well sorted, sub-rounded, possible hydrocarbon staining.	SP	Wet	Possible	32	10-14-11-12
.0	17.0	Light brown, medium grained, SAND, well sorted, sub-rounded, possible hydrocarbon staining.	SP	Wet	Possible	9.4	13-15-13-13

REMARKS Grab = Grab Sample

PAGE 1 OF 1

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY

Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-4

DRILLING CONTRACTOR Richard Catlin & Associates, Inc.

DRILLER REGISTRATION NUMBER 1142

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: New Hanover
   Nearest Town: Wilmington
   Koch North Terminal
   (Road, Community, or Subdivision and Lot No.)

2. OWNER Koch Refining Company, L.P.
   ADDRESS 3334 River Road
   (Street or Route No.)
   Wilmington NC 28412
   City or Town State Zip Code

Depth From	To	DRILLING LOG Formation Description

3. DATE DRILLED 11/28/95 USE OF WELL Monitoring
4. TOTAL DEPTH 17' CUTTINGS COLLECTED X YES _____ NO
5. DOES WELL REPLACE EXISTING WELL? _____ YES X NO
6. STATIC WATER LEVEL: ± 8 FT. ___ ABOVE/BELOW TOP OF CASING.
7. YIELD (gpm): N/A METHOD OF TEST N/A
8. WATER ZONES (depth): Surficial Aquifer

SEE ATTACHED

9. CHLORINATION: Type: N/A Amount N/A

If additional space is needed use back of form.

10. CASING:

	Depth			Diameter	Wall Thickness or Weight/Ft.	Material
From	+2	To	5 Ft.	2 in.	SCH40	PVC
From		To	Ft.	in.	SCH40	PVC

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth			Material	Method
From	0	To	3 Ft.	CEMENT	TREMIE
From	3	To	4 Ft.	BENTONITE	CHIPS

12. SCREEN:

	Depth			Diameter	Slot Size	Material
From	5	To	15 Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth			Size	Material
From	4	To	15 Ft.	TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Amy L. Myers 4-18-96
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-4
TOTAL DEPTH 15.0

SITE LOCATION Koch North Terminal
Wilmington, North Carolina

DRILLED BY DS/GS
LOGGED BY S. HUDSON

DRILLING DATE 11/28/95

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
2.0	4.0	Yellowish-orange, fine to medium grained, SAND, moderately well sorted, high permeability.	SP	Dry	Possible	190	Grab
5.0	7.0	Brown, medium fine to medium grained, SAND, well sorted, high permeability.	SP	Wet	Very Strong	>1000	11-11-15-16
10.0	12.0	Gray-brown, medium fine to medium grained, SAND, well sorted, high permeability.	SP	Wet	Strong	>1000	10-10-10-10
15.0	17.0	Gray-brown, medium fine to medium grained, SAND, well sorted, high permeability.	SP	Wet	Strong	>1000	13-10-8-11

REMARKS Grab = Grab Sample

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY

Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-9

DRILLING CONTRACTOR ___CATLIN ENGINEERS & SCIENTISTS_____

DRILLER REGISTRATION NUMBER ___1142_____ STATE WELL CONSTRUCTION PERMIT NUMBER: ___N/A_____

1. WELL LOCATION: (Show sketch of the location below) County: ___NEW HANOVER_____

   Nearest Town: ___Wilmington_____

   ___3325 RIVER ROAD, KOCH NORTH TERMINAL_____
   (Road, Community, or Subdivision and Lot No.)

2. OWNER ___KOCH REFINING COMPANY, LP_____

   ADDRESS ___3334 RIVER ROAD_____
   (Street or Route No.)
   ___WILMINGTON_____ ___NC_____ ___28412_____
   City or Town State Zip Code

3. DATE DRILLED ___2/07/00_____ USE OF WELL ___MONITORING_____

4. TOTAL DEPTH ___12.0'___ CUTTINGS COLLECTED ____YES ___X___ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO

6. STATIC WATER LEVEL: ___±3.5___ FT. ____ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): ___N/A_____ METHOD OF TEST ___N/A_____

   WATER ZONES (depth): ___SURFICIAL AQUIFER_____

   _____

9. CHLORINATION: Type: ___N/A_____ Amount ___N/A_____

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 5.0 Ft.		2 in.	SCH 40	PVC
From	To Ft				

11. GROUT:

	Depth		Material	Method
From 0	To 2.5 Ft.		CEMENT	TREMIE
From 2.5	To 3.0 Ft.		BENTONITE	CHIPS

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 5	To 12.0 Ft.		2 in.	.010 in.	PVC

13. GRAVEL PACK:

	Depth		Size	Material
From 3	To 12.0 Ft.		TORPEDO	SAND

14. REMARKS: _____

Depth From To — Formation Description

SEE ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

SEE ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

_____ 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well

BORING LOG

BORING NUMBER MW-9
TOTAL DEPTH 12.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/07/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	2.0	Tan/brown, fine to coarse grained SAND, poorly sorted.	SP	Dry	No	--	Grab
2.0	4.0	Dark brown, fine to coarse grained SAND, poorly sorted, few organic fines.	SP	Wet @ 3.5'	Slight	--	Grab
4.0	8.0	Tan/gray, fine to coarse grained SAND, poorly sorted, few fines.	SP	Wet	Slight	--	Grab
8.0	12.0	Dark brown, fine to coarse grained SAND, poorly sorted, few fines.	SP	Wet	No	--	Grab
		2/28/00 Depth to Ground Water Table = 3.24 Feet					

REMARKS Grab = Grab Sample

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY
Quad No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-10

DRILLING CONTRACTOR CATLIN ENGINEERS & SCIENTISTS
DRILLER REGISTRATION NUMBER 1142
STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: NEW HANOVER
Nearest Town: Wilmington
3325 RIVER ROAD, KOCH NORTH TERMINAL
(Road, Community, or Subdivision and Lot No.)

2. OWNER KOCH REFINING COMPANY, LP
ADDRESS 3334 RIVER ROAD
(Street or Route No.)
WILMINGTON NC 28412
City or Town State Zip Code

3. DATE DRILLED 2/10/00 USE OF WELL MONITORING

4. TOTAL DEPTH 12.0' CUTTINGS COLLECTED ____YES X NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES X NO

6. STATIC WATER LEVEL: ±4.0 FT. ___ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): N/A METHOD OF TEST N/A

WATER ZONES (depth): SURFICIAL AQUIFER

9. CHLORINATION: Type: N/A Amount N/A

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 2.0 Ft.		2 in.	SCH 40	PVC
From	To Ft				

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth		Material	Method
From 0	To 0.5 Ft.		CEMENT	TREMIE
From 0.5	To 1.0 Ft.		BENTONITE CHIPS	

12. SCREEN:

	Depth	Diameter	Slot Size	Material
From 2	To 12.0 Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth	Size	Material
From 1	To 12.0 Ft.	TORPEDO	SAND

4. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[signature] 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-10
TOTAL DEPTH 12.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/10/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	3.0	Tan, fine to coarse grained SAND, poorly sorted, some fill (gravel and shells).	SP	Dry	No	--	Grab
3.0	12.0	Dark brown to gray/black, fine to coarse grained sand, poorly sorted.	SP	Wet @ 4'	Strong @ 3'	--	Grab
		2/28/00 Depth to Surficial Water Table = 3.52 Feet					

REMARKS Grab = Grab Sample

PAGE 1 OF 1

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY

Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-11

DRILLING CONTRACTOR ___CATLIN ENGINEERS & SCIENTISTS_____

DRILLER REGISTRATION NUMBER ___1142_____ STATE WELL CONSTRUCTION PERMIT NUMBER: ___N/A_____

1. WELL LOCATION: (Show sketch of the location below) County: ___NEW HANOVER_____

   Nearest Town: ___Wilmington_____

   ___3325 RIVER ROAD, KOCH NORTH TERMINAL_____
   (Road, Community, or Subdivision and Lot No.)

2. OWNER ___KOCH REFINING COMPANY, LP_____

   ADDRESS ___3334 RIVER ROAD_____
   (Street or Route No.)
   _WILMINGTON_____NC_____28412_____
   City or Town State Zip Code

Depth From	Depth To	DRILLING LOG Formation Description
		SEE ATTACHED

3. DATE DRILLED ___2/08/00_____ USE OF WELL ___MONITORING_____

4. TOTAL DEPTH ___12.0'___ CUTTINGS COLLECTED ____YES _X__ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO

6. STATIC WATER LEVEL: ___±3.5___ FT. ____ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): ___N/A_____ METHOD OF TEST _____N/A_____

8. WATER ZONES (depth): ___SURFICIAL AQUIFER_____

   _____

9. CHLORINATION: Type: ___N/A_____ Amount ___N/A_____

   If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 2.0 Ft.		2 in.	SCH 40	PVC
From	To	Ft			

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth		Material	Method
From 0	To 0.5	Ft.	CEMENT	TREMIE
From 0.5	To 1.0	Ft.	BENTONITE CHIPS	

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 2	To 12.0	Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth		Size	Material
From 1	To 12.0	Ft.	TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

_____ 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-11
TOTAL DEPTH 12.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/08/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	12.0	Tan/brown, fine to coarse grained SAND, poorly sorted, well rounded grains.	SP	Wet @ 3.5'	Strong @ 3'	--	Grab
		2/28/00 Depth to Surficial Water Table = 3.91 Feet					

REMARKS Grab = Grab Sample

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY
Quad No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-12

DRILLING CONTRACTOR CATLIN ENGINEERS & SCIENTISTS
STATE WELL CONSTRUCTION
DRILLER REGISTRATION NUMBER 1142 PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: NEW HANOVER
Nearest Town: Wilmington
3325 RIVER ROAD, KOCH NORTH TERMINAL
(Road, Community, or Subdivision and Lot No.)

Depth — From / To — DRILLING LOG Formation Description

2. OWNER KOCH REFINING COMPANY, LP
ADDRESS 3334 RIVER ROAD
(Street or Route No.)
WILMINGTON NC 28412
City or Town State Zip Code

SEE ATTACHED

3. DATE DRILLED 2/0700 USE OF WELL MONITORING
4. TOTAL DEPTH 14.5' CUTTINGS COLLECTED ____YES X NO
5. DOES WELL REPLACE EXISTING WELL? _____ YES X NO
6. STATIC WATER LEVEL: ±6.0 FT. ___ ABOVE/BELOW TOP OF CASING.
7. YIELD (gpm): N/A METHOD OF TEST N/A
WATER ZONES (depth): SURFICIAL AQUIFER
9. CHLORINATION: Type: N/A Amount N/A

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 2.5	To 4.0 Ft.		2 in.	SCH 40	PVC
From	To Ft				

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth	Material	Method
From 0	To 2.0 Ft.	CEMENT	TREMIE
From 2	To 3.0 Ft.	BENTONITE CHIPS	

12. SCREEN:

	Depth	Diameter	Slot Size	Material
From 4	To 14.0 Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth	Size	Material
From 3	To 14.5 Ft.	TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

_____ 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-12
TOTAL DEPTH 14.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/07/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	8.0	Tan/brown, fine to medium grained SAND, with some black phosphatic sands.	SP	Wet @ 6'	Strong @ 5'	--	Grab
8.0	14.5	Brown to dark gray, fine to coarse grained SAND.	SP	Wet	Slight	--	Grab
		2/28/00 Depth to Surficial Water Table = 6.09 Feet					

REMARKS Grab = Grab Sample

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY
Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-13

DRILLING CONTRACTOR ___CATLIN ENGINEERS & SCIENTISTS_____
DRILLER REGISTRATION NUMBER ___1142_____ STATE WELL CONSTRUCTION PERMIT NUMBER: ___N/A_____

1. WELL LOCATION: (Show sketch of the location below) County: ___NEW HANOVER_____

Nearest Town: ___Wilmington_____

___3325 RIVER ROAD, KOCH NORTH TERMINAL_____
(Road, Community, or Subdivision and Lot No.)

2. OWNER ___KOCH REFINING COMPANY, LP_____

ADDRESS ___3334 RIVER ROAD_____
(Street or Route No.)
___WILMINGTON_____ ___NC_____ ___28412_____
City or Town State Zip Code

SEE ATTACHED

Depth From	Depth To	DRILLING LOG Formation Description

3. DATE DRILLED ___2/07/00_____ USE OF WELL ___MONITORING_____

4. TOTAL DEPTH ___18.0'___ CUTTINGS COLLECTED ____YES ___X___ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO

6. STATIC WATER LEVEL: ___±7.0___ FT. ___ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): ___N/A_____ METHOD OF TEST ___N/A_____

WATER ZONES (depth): ___SURFICIAL AQUIFER_____

9. CHLORINATION: Type: ___N/A_____ Amount ___N/A_____

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 6.2	Ft.	2 in.	SCH 40	PVC
From	To	Ft			

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth		Material	Method
From 0	To 2.0	Ft.	CEMENT	TREMIE
From 2	To 3.0	Ft.	BENTONITE CHIPS	

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 6	To 16.2	Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth		Size	Material
From 3	To 18.0	Ft.	TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

_____ 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-13
TOTAL DEPTH 18.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/07/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	12.0	Tan/brown, fine to coarse grained SAND, poorly sorted.	SP	Wet @ 7'	Slight	--	Grab
12.0	18.0	Tan/brown to dark brown, fine to coarse grained SAND, poorly sorted, some phosphatic sands.	SP	Wet	No	--	Grab
		2/28/00 Depth to Surficial Water Table = 5.89 Feet					

REMARKS Grab = Grab Sample

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY
Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-14

DRILLING CONTRACTOR CATLIN ENGINEERS & SCIENTISTS
DRILLER REGISTRATION NUMBER 1142
STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: NEW HANOVER
Nearest Town: Wilmington
3325 RIVER ROAD, KOCH NORTH TERMINAL
(Road, Community, or Subdivision and Lot No.)

2. OWNER KOCH REFINING COMPANY, LP
ADDRESS 3334 RIVER ROAD
(Street or Route No.)
WILMINGTON NC 28412
City or Town State Zip Code

Depth From	Depth To	DRILLING LOG Formation Description
		SEE ATTACHED

3. DATE DRILLED 2/08/00 USE OF WELL MONITORING
4. TOTAL DEPTH 14.0' CUTTINGS COLLECTED ____YES _X_ NO
5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO
6. STATIC WATER LEVEL: ±5.5 FT. ___ ABOVE/BELOW TOP OF CASING.
7. YIELD (gpm): N/A METHOD OF TEST N/A
8. WATER ZONES (depth): SURFICIAL AQUIFER

9. CHLORINATION: Type: N/A Amount N/A

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 4.0	Ft.	2 in.	SCH 40	PVC
From	To	Ft			

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth		Material	Method
From 0	To 2.0	Ft.	CEMENT	TREMIE
From 2	To 3.0	Ft.	BENTONITE CHIPS	

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 4	To 14.0	Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth		Size	Material
From 3	To 14.0	Ft.	TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stan A. [illegible] 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-14
TOTAL DEPTH 14.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/08/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	4.0	Tan/brown, fine to coarse grained SAND, poorly sorted.	SP	Moist	No	--	Grab
4.0	14.0	Brown, fine to coarse grained SAND, moderate to poorly sorted.	SP	Wet @ 5.5'	Strong @ 4'	--	Grab
		2/28/00 Depth to Surficial Water Table = 4.98 Feet					

REMARKS Grab = Grab Sample

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY

Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-15

DRILLING CONTRACTOR ___CATLIN ENGINEERS & SCIENTISTS_____

DRILLER REGISTRATION NUMBER ___1142_____ STATE WELL CONSTRUCTION PERMIT NUMBER: ___N/A_____

1. WELL LOCATION: (Show sketch of the location below) County: ___NEW HANOVER_____

   Nearest Town: ___Wilmington_____

   ___3325 RIVER ROAD, KOCH NORTH TERMINAL_____
   (Road, Community, or Subdivision and Lot No.)

2. OWNER ___KOCH REFINING COMPANY, LP_____

   ADDRESS ___3334 RIVER ROAD_____
   (Street or Route No.)
   ___WILMINGTON_____ ___NC_____ ___28412_____
   City or Town State Zip Code

3. DATE DRILLED ___2/08/00_____ USE OF WELL ___MONITORING_____

4. TOTAL DEPTH ___14.0'___ CUTTINGS COLLECTED ____YES ___X___ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO

6. STATIC WATER LEVEL: ___±6.0___ FT. ___ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): ___N/A_____ METHOD OF TEST ___N/A_____

8. WATER ZONES (depth): ___SURFICIAL AQUIFER_____

9. CHLORINATION: Type: ___N/A_____ Amount ___N/A_____

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 4.0 Ft.		2 in.	SCH 40	PVC
From	To Ft				

11. GROUT:

	Depth		Material	Method
From 0	To 1.0 Ft.		CEMENT	TREMIE
From 1	To 2.0 Ft.		BENTONITE	CHIPS

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 4	To 14.0 Ft.		2 in.	.010 in.	PVC

13. GRAVEL PACK:

	Depth		Size	Material
From 2	To 14.0 Ft.		TORPEDO	SAND

14. REMARKS: _____

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

SEE ATTACHED

SEE ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

_____ 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-15
TOTAL DEPTH 14.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/08/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	4.0	Brown/tan/orange, fine to coarse grained SAND, with some 3mm to 15mm gravel.	SP	Moist	No	--	Grab
4.0	7.0	Tan, fine to coarse grained SAND, moderately sorted, some 1mm to 8mm gravel.	SP	Wet @ 6'	Strong @ 5'	--	Grab
7.0	14.0	Dark brown/olive, fine to coarse grained SAND, poorly sorted, some gravel 1mm to 8mm.	SP	Wet	Slight	--	Grab
		2/28/00 Depth to Surficial Water Table = 5.86 Feet					

REMARKS Grab = Grab Sample

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY

Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-16

DRILLING CONTRACTOR ___CATLIN ENGINEERS & SCIENTISTS_____

DRILLER REGISTRATION NUMBER ___1142_____ STATE WELL CONSTRUCTION PERMIT NUMBER: ___N/A_____

1. WELL LOCATION: (Show sketch of the location below) County: ___NEW HANOVER_____

   Nearest Town: ___Wilmington_____

   ___3325 RIVER ROAD, KOCH NORTH TERMINAL_____
   (Road, Community, or Subdivision and Lot No.)

2. OWNER ___KOCH REFINING COMPANY, LP_____

   ADDRESS ___3334 RIVER ROAD_____
   (Street or Route No.)
   WILMINGTON NC 28412
   City or Town State Zip Code

3. DATE DRILLED ___2/08/00_____ USE OF WELL ___MONITORING_____

4. TOTAL DEPTH ___14.0'___ CUTTINGS COLLECTED ____YES __X__ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO

6. STATIC WATER LEVEL: ___±6.0___ FT. ___ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): ___N/A_____ METHOD OF TEST ___N/A_____

8. WATER ZONES (depth): ___SURFICIAL AQUIFER_____

9. CHLORINATION: Type: ___N/A_____ Amount ___N/A_____

10. CASING:

				Wall Thickness	
	Depth		Diameter	or Weight/Ft.	Material
From	0	To 4.0 Ft.	2 in.	SCH 40	PVC
From		To Ft			

11. GROUT:

	Depth		Material	Method
From	0	To 1.0 Ft.	CEMENT	TREMIE
From	1	To 2.0 Ft.	BENTONITE CHIPS	

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From	4	To 14.0 Ft.	2 in.	.010 in.	PVC

13. GRAVEL PACK:

	Depth		Size	Material
From	2	To 14.0 Ft.	TORPEDO	SAND

14. REMARKS: _____

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

SEE ATTACHED

SEE ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[signature] 2/15/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-16
TOTAL DEPTH 14.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/08/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	7.0	Tan/brown/orange, fine to coarse grained SAND, poorly sorted, some 1mm to 6mm gravel.	SP	Wet @ 6'	Strong @ 5'	--	Grab
7.0	14.0	Dark brown, fine to coarse grained SAND, poorly sorted, some 1mm to 6mm gravel, some black phosphatic sand.	SP	Wet	Slight	--	Grab
		2/28/00 Depth to Surficial Water Table = 5.82 Feet					

REMARKS Grab = Grab Sample

PAGE 1 OF 1

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY
Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-17

DRILLING CONTRACTOR CATLIN ENGINEERS & SCIENTISTS
DRILLER REGISTRATION NUMBER 1142
STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: NEW HANOVER
Nearest Town: Wilmington
3325 RIVER ROAD, KOCH NORTH TERMINAL
(Road, Community, or Subdivision and Lot No.)

2. OWNER KOCH REFINING COMPANY, LP
ADDRESS 3334 RIVER ROAD
(Street or Route No.)
WILMINGTON NC 28412
City or Town State Zip Code

3. DATE DRILLED 2/09/00 USE OF WELL MONITORING

4. TOTAL DEPTH 12.0' CUTTINGS COLLECTED ____YES _X_ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO

6. STATIC WATER LEVEL: ±4.0 FT. ____ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): N/A METHOD OF TEST N/A

WATER ZONES (depth): SURFICIAL AQUIFER

9. CHLORINATION: Type: N/A Amount N/A

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 2.0 Ft.		2 in.	SCH 40	PVC
From	To Ft				

11. GROUT:

	Depth		Material	Method
From 0	To 0.5 Ft.		CEMENT	TREMIE
From 0.5	To 1.0 Ft.		BENTONITE	CHIPS

12. SCREEN:

	Depth	Diameter	Slot Size	Material
From 2	To 12.0 Ft.	2 in.	.010 in.	PVC

13. GRAVEL PACK:

	Depth	Size	Material
From 1	To 12.0 Ft.	TORPEDO	SAND

14. REMARKS: _____

Depth From	Depth To	DRILLING LOG Formation Description
		SEE ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

SEE ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT 2/08/00 DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-17
TOTAL DEPTH 12.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/09/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	3.0	Dark brown, fine to medium grained SAND, some plant roots and rubble fill.	SP	Dry	No	--	Grab
3.0	12.0	Dark brown/tan, fine to coarse grained SAND, poorly sorted, some phosphatic sands.	SP	Wet @ 3'	Slight	--	Grab
		2/28/00 Depth to Surficial Water Table = 2.40 Feet					

REMARKS Grab = Grab Sample

PAGE 1 OF 1

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE: (910) 733-3221

FOR OFFICE USE ONLY
Quad No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-18

DRILLING CONTRACTOR CATLIN ENGINEERS & SCIENTISTS
DRILLER REGISTRATION NUMBER 1142
STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: NEW HANOVER
Nearest Town: Wilmington
3325 RIVER ROAD, KOCH NORTH TERMINAL
(Road, Community, or Subdivision and Lot No.)

2. OWNER KOCH REFINING COMPANY, LP
ADDRESS 3334 RIVER ROAD
(Street or Route No.)
WILMINGTON NC 28412
City or Town State Zip Code

Depth From | Depth To | DRILLING LOG Formation Description
SEE ATTACHED

3. DATE DRILLED 2/08/00 USE OF WELL MONITORING
4. TOTAL DEPTH 16.0' CUTTINGS COLLECTED ____YES X NO
5. DOES WELL REPLACE EXISTING WELL? _____ YES X NO
6. STATIC WATER LEVEL: ±9.0 FT. ____ ABOVE/BELOW TOP OF CASING.
7. YIELD (gpm): N/A METHOD OF TEST N/A
8. WATER ZONES (depth): SURFICIAL AQUIFER

9. CHLORINATION: Type: N/A Amount N/A

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 6.0 Ft.		2 in.	SCH 40	PVC
From	To	Ft			

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth		Material	Method
From 0	To 2.0	Ft.	CEMENT	TREMIE
From 2	To 3.0	Ft.	BENTONITE CHIPS	

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 6	To 16.0	Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth		Size	Material
From 3	To 16.0	Ft.	TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT — DATE 2/15/00

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-18
TOTAL DEPTH 16.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/08/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	5.0	Orange/tan, fine to coarse grained SAND, poorly sorted.	SP	Dry	No	--	Grab
5.0	10.0	Tan, fine to medium grained SAND, poorly sorted.	SP	Wet @ 10'	Slight	--	Grab
10.0	16.0	Light tan, fine to medium grained SAND, moderately sorted, some phosphatic sands, some 3mm to 14mm gravel.	SP	Wet	Slight	--	Grab
		2/28/00 Depth to Surficial Water Table = 9.44 Feet					

REMARKS Grab = Grab Sample

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Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc._____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR MW-19

DRILLING CONTRACTOR ___CATLIN ENGINEERS & SCIENTISTS_____
DRILLER REGISTRATION NUMBER ___1142_____ STATE WELL CONSTRUCTION PERMIT NUMBER: ___N/A_____

1. WELL LOCATION: (Show sketch of the location below) County: ___NEW HANOVER_____

Nearest Town: ___Wilmington_____

___3325 RIVER ROAD, KOCH NORTH TERMINAL_____
(Road, Community, or Subdivision and Lot No.)

2. OWNER ___KOCH REFINING COMPANY, LP_____

ADDRESS ___3334 RIVER ROAD_____
(Street or Route No.)
_WILMINGTON_____NC_____28412_____
City or Town State Zip Code

3. DATE DRILLED ___2/09/00_____ USE OF WELL ___MONITORING_____

4. TOTAL DEPTH ___16.0'___ CUTTINGS COLLECTED ____YES __X__ NO

5. DOES WELL REPLACE EXISTING WELL? _____ YES ___X___ NO

6. STATIC WATER LEVEL: ___±9.2___ FT. ____ ABOVE/BELOW TOP OF CASING.

7. YIELD (gpm): ___N/A_____ METHOD OF TEST _____N/A_____

WATER ZONES (depth): ___SURFICIAL AQUIFER_____

9. CHLORINATION: Type: ___N/A_____ Amount ___N/A_____

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 6.0	Ft.	2 in.	SCH 40	PVC
From	To	Ft			

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth		Material	Method
From 0	To 2.0	Ft.	CEMENT	TREMIE
From 2	To 3.0	Ft.	BENTONITE	CHIPS

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 6	To 16.0	Ft.	2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth		Size	Material
From 3	To 16.0	Ft.	TORPEDO	SAND

14. REMARKS: _____

SEE ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT — DATE 2/15/00

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER MW-19
TOTAL DEPTH 16.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/09/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	10.5	Tan/dark brown, fine to medium grained SAND, poorly sorted.	SP	Wet @ 9'	Strong @ 7'	--	Grab
10.5	16.0	Tan/dark brown, fine to medium grained SAND, poorly sorted, 1mm to 4mm gravel.	SP	Wet	Moderate	--	Grab
		2/28/00 Depth to Surficial Water Table = 9.82 Feet					

REMARKS Grab = Grab Sample

PAGE 1 OF 1

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Quad No. _____ Serial No._____
Lat. _____ Long._____ Pc_____
Minor Basin_____
Basin Code_____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD FOR TMW-2

DRILLING CONTRACTOR CATLIN ENGINEERS & SCIENTISTS
DRILLER REGISTRATION NUMBER 1142
STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below) County: NEW HANOVER
   Nearest Town: Wilmington
   3325 RIVER ROAD, KOCH NORTH TERMINAL
   (Road, Community, or Subdivision and Lot No.)

2. OWNER KOCH REFINING COMPANY, LP
   ADDRESS 3334 RIVER ROAD
   (Street or Route No.)
   WILMINGTON NC 28412
   City or Town State Zip Code

Depth From	Depth To	DRILLING LOG Formation Description
		SEE ATTACHED

3. DATE DRILLED 2/17/00 USE OF WELL MONITORING
4. TOTAL DEPTH 38.0' CUTTINGS COLLECTED ____YES _X_ NO
5. DOES WELL REPLACE EXISTING WELL? _____ YES _X_ NO
6. STATIC WATER LEVEL: ±5.5 FT. ____ ABOVE/BELOW TOP OF CASING.
7. YIELD (gpm): N/A METHOD OF TEST N/A
   WATER ZONES (depth): SURFICIAL AQUIFER
9. CHLORINATION: Type: N/A Amount N/A

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 36.0 Ft.		2 in.	SCH 40	PVC
From 0	To 30.0 Ft		6 in.		

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points.)

11. GROUT:

	Depth		Material	Method
From 0	To 29.0 Ft.		CEMENT	TREMIE
From 29	To 33.0 Ft.		BENTONITE CHIPS	

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 36	To 38.0 Ft.		2 in.	.010 in.	PVC

SEE ATTACHED

13. GRAVEL PACK:

	Depth		Size	Material
From 33	To 38.0 Ft.		TORPEDO	SAND

14. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

_____ 2/25/00
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REVISED 2/90

Submit original to Division of Environmental Management and copy to well owner.

BORING LOG

BORING NUMBER TMW-2
TOTAL DEPTH 38.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

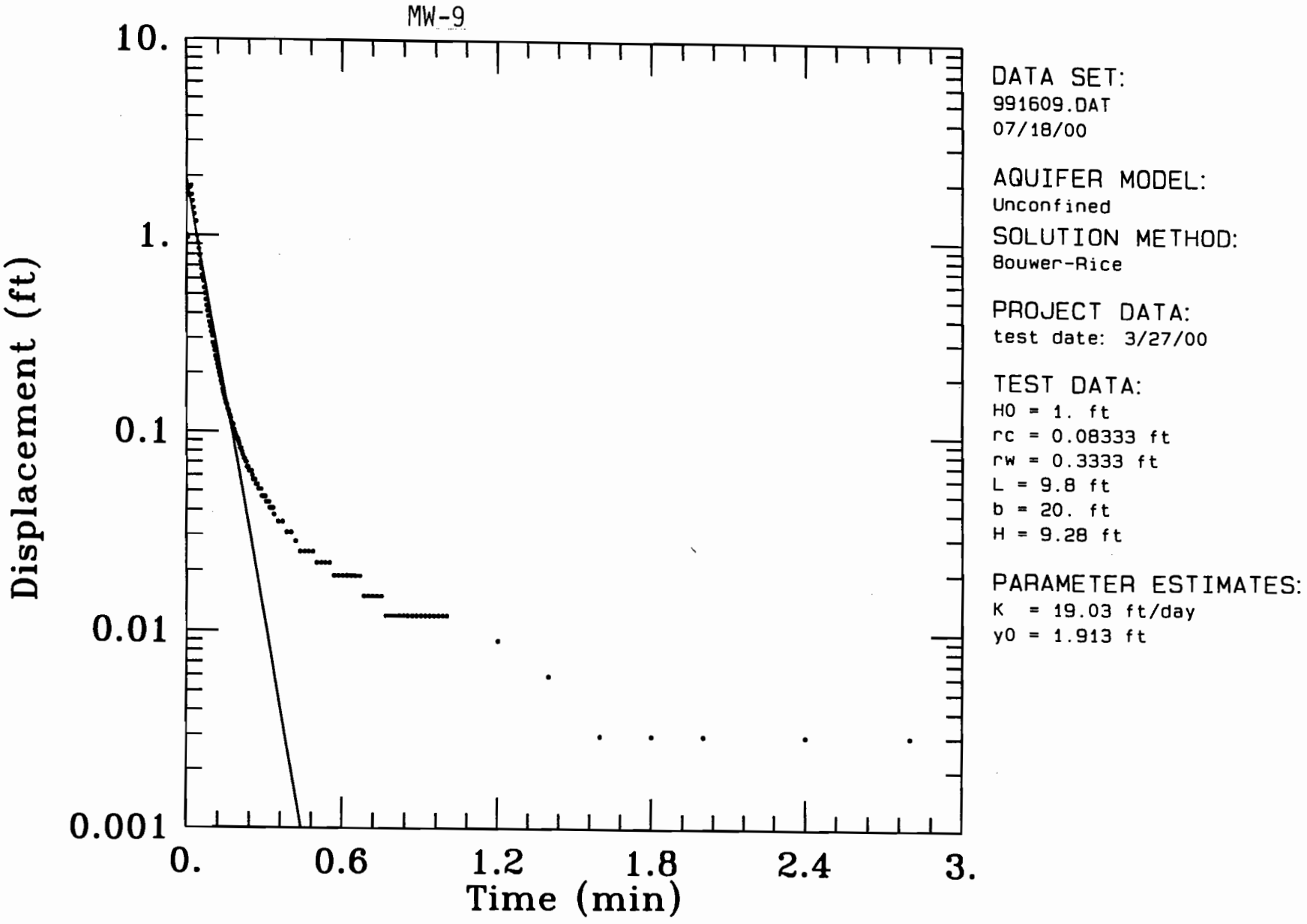
DRILLING DATE 2/17/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	3.0	Tan, fine to coarse grained SAND, poorly sorted, with shell fragments and gravel fill.	SP	Dry	No	--	Grab
3.0	15.0	Dark gray/brown, fine to coarse grained SAND, poorly sorted.	SP	Wet @ 6'	Strong @ 5'	--	Grab
15.0	20.0	Tan/white, fine to medium grained SAND, black phosphatic sands.	SP	Wet	Slight	--	Grab
20.0	28.0	Tan, fine to coarse grained SILTY SAND, poorly sorted, 1mm to 3mm well rounded gravel, some black phosphatic sand and shell fragments.	SM SP	Wet	Slight	--	Grab
28.0	31.0	Gray/olive, very fine to coarse grained SANDY CLAY, moderate plasticity.	SC	Moist	No	--	Grab
31.0	35.0	Tan, very fine to medium grained phosphatic SAND, some shell fragments.	SP	Wet	No	--	Grab
35.0	38.0	Limestone, hard.	LS	Wet	No	--	Grab
		2/28/00 Depth to Surficial Water Table = 5.66 Feet					

REMARKS Grab = Grab Sample

ATTACHMENT H1 - SLUG TEST DATA FOR

PX FACILITY


MW-9
10.
1.
0.1
0.01
0.001
Displacement (ft)
0.
0.6
1.2
1.8
2.4
3.
Time (min)
DATA SET:
991609.DAT
07/18/00
AQUIFER MODEL:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
PROJECT DATA:
test date: 3/27/00
TEST DATA:
H0 = 1. ft
rc = 0.08333 ft
rw = 0.3333 ft
L = 9.8 ft
b = 20. ft
H = 9.28 ft
PARAMETER ESTIMATES:
K = 19.03 ft/day
y0 = 1.913 ft

AQTESOLV

SE1000C
Environmental Logger
03/28 15:29

Unit# 30422 Test 0

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	00009
Reference	0.000
Linearity	0.040
Scale factor	10.070
Offset	0.040
Delay mSEC	50.000

Step 0 03/28 12:45:06

Elapsed Time	INPUT 1
0.0000	1.453
0.0033	0.966
0.0066	1.594
0.0100	1.753
0.0133	1.750
0.0166	1.785
0.0200	1.606
0.0233	1.492
0.0266	1.377
0.0300	1.284
0.0333	1.173
0.0366	1.176
0.0400	0.988
0.0433	0.911
0.0466	0.851
0.0500	0.784
0.0533	0.730
0.0566	0.672
0.0600	0.624
0.0633	0.580
0.0666	0.538
0.0700	0.503
0.0733	0.468
0.0766	0.436
0.0800	0.411
0.0833	0.385
0.0866	0.360
0.0900	0.341
0.0933	0.322

0.0966	0.306
0.1000	0.283
0.1033	0.271
0.1066	0.258
0.1100	0.242
0.1133	0.232
0.1166	0.220
0.1200	0.210
0.1233	0.200
0.1266	0.191
0.1300	0.181
0.1333	0.175
0.1366	0.165
0.1400	0.159
0.1433	0.153
0.1466	0.146
0.1500	0.140
0.1533	0.137
0.1566	0.130
0.1600	0.127
0.1633	0.121
0.1666	0.117
0.1700	0.111
0.1733	0.108
0.1766	0.108
0.1800	0.102
0.1833	0.098
0.1866	0.095
0.1900	0.092
0.1933	0.092
0.1966	0.089
0.2000	0.086
0.2033	0.082
0.2066	0.082
0.2100	0.079
0.2133	0.076
0.2166	0.073
0.2200	0.073
0.2233	0.070
0.2266	0.070
0.2300	0.066
0.2333	0.066
0.2366	0.063
0.2400	0.063
0.2433	0.063
0.2466	0.063
0.2500	0.060
0.2533	0.057
0.2566	0.057
0.2600	0.057
0.2633	0.054
0.2666	0.054

0.2700	0.054
0.2733	0.051
0.2766	0.051
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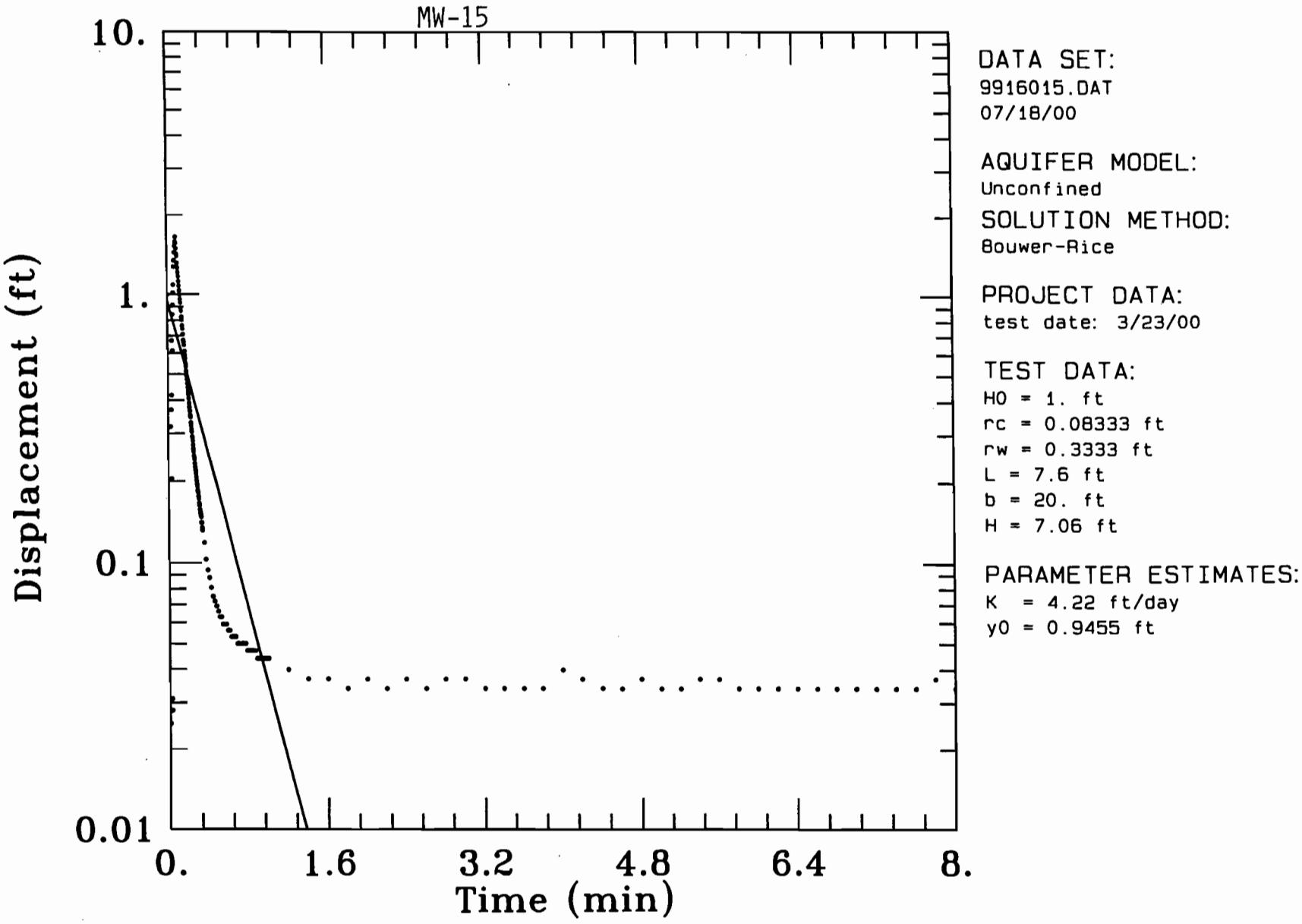
0.2833	0.051
0.2866	0.047
0.2900	0.047
0.2933	0.047
0.2966	0.047
0.3000	0.047
0.3033	0.044
0.3066	0.044
0.3100	0.044
0.3133	0.044
0.3166	0.041
0.3200	0.041
0.3233	0.041
0.3266	0.041
0.3300	0.041
0.3333	0.038
0.3500	0.035
0.3666	0.035
0.3833	0.031
0.4000	0.031
0.4166	0.028
0.4333	0.025
0.4500	0.025
0.4666	0.025
0.4833	0.025
0.5000	0.022
0.5166	0.022
0.5333	0.022
0.5500	0.022
0.5666	0.019
0.5833	0.019
0.6000	0.019
0.6166	0.019
0.6333	0.019
0.6500	0.019
0.6666	0.019
0.6833	0.015
0.7000	0.015
0.7166	0.015
0.7333	0.015
0.7500	0.015
0.7666	0.012
0.7833	0.012
0.8000	0.012
0.8166	0.012
0.8333	0.012
0.8500	0.012
0.8666	0.012

0.8833	0.012
0.9000	0.012
0.9166	0.012
0.9333	0.012
0.9500	0.012
0.9666	0.012
0.9833	0.012
1.0000	0.012
1.2000	0.009
1.4000	0.006
1.6000	0.003
1.8000	0.003
2.0000	0.003
2.2000	0.000
2.4000	0.003
2.6000	0.000
2.8000	0.003
3.0000	0.000
3.2000	0.000
3.4000	0.000
3.6000	0.000
3.8000	0.000
4.0000	-0.003
4.2000	0.000
4.4000	-0.003
4.6000	0.000
4.8000	-0.003
5.0000	0.000
5.2000	0.000
5.4000	0.000
5.6000	0.000
5.8000	0.000
6.0000	-0.003
6.2000	0.000
6.4000	-0.003
6.6000	0.000
6.8000	0.000
7.0000	0.000
7.2000	0.000
7.4000	0.000
7.6000	0.000
7.8000	0.000
8.0000	-0.003
8.2000	-0.003
8.4000	0.000
8.6000	0.000
8.8000	0.000
9.0000	0.000
9.2000	-0.003
9.4000	-0.003
9.6000	-0.003
9.8000	0.000

10.0000 0.000


MW-15
10.
1.
0.1
0.01
Displacement (ft)
0.
1.6
3.2
4.8
6.4
8.
Time (min)
DATA SET:
9916015.DAT
07/18/00
AQUIFER MODEL:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
PROJECT DATA:
test date: 3/23/00
TEST DATA:
H0 = 1. ft
rc = 0.08333 ft
rw = 0.3333 ft
L = 7.6 ft
b = 20. ft
H = 7.06 ft
PARAMETER ESTIMATES:
K = 4.22 ft/day
y0 = 0.9455 ft

AQTESOLV

KOCH NORTH
compny
CATLIN ENG. AND SCI.
projno
99160
client
KOCH
locsit
WILMINGTON, NC
tstdat
3/23/00
units
1
0
0
slugt5
1
0.08333
0.33333
20
7.6
7.06
0
1
173
0.0033 0.028 1
0.0066 0.025 1
0.01 0.028 1
0.0133 0.028 1
0.0166 0.028 1
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0.0233 0.028 1
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0.03 0.204 1
0.0333 0.368 1
0.0366 0.418 1
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0.0466 0.613 1
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0.0533 0.913 1
0.0566 1.013 1
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0.0633 1.268 1
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0.07 1.344 1
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0.0766 1.523 1
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0.0833 1.652 1
0.0866 1.564 1
0.09 1.492 1
0.0933 1.426 1
0.0966 1.396 1
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0.1033 1.259 1
0.1066 1.212 1
0.11 1.168 1

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0.1166   1.076   1
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0.1266   0.96   1
0.13   0.931   1
0.1333   0.891   1
0.1366   0.868   1
0.14   0.824   1
0.1433   0.802   1
0.1466   0.765   1
0.15   0.743   1
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0.1566   0.673   1
0.16   0.664   1
0.1633   0.645   1
0.1666   0.61   1
0.17   0.591   1
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0.1766   0.551   1
0.18   0.535   1
0.1833   0.513   1
0.1866   0.494   1
0.19   0.478   1
0.1933   0.462   1
0.1966   0.447   1
0.2   0.434   1
0.2033   0.421   1
0.2066   0.406   1
0.21   0.39   1
0.2133   0.377   1
0.2166   0.365   1
0.22   0.352   1
0.2233   0.346   1
0.2266   0.33   1
0.23   0.321   1
0.2333   0.311   1
0.2366   0.305   1
0.24   0.292   1
0.2433   0.283   1
0.2466   0.273   1
0.25   0.264   1
0.2533   0.258   1
0.2566   0.248   1
0.26   0.242   1
0.2633   0.233   1
0.2666   0.226   1
0.27   0.22   1
0.2733   0.214   1
0.2766   0.207   1
0.28   0.201   1
0.2833   0.195   1
0.2866   0.192   1
0.29   0.185   1
0.2933   0.182   1
0.2966   0.176   1
0.3   0.173   1
```

0.3033 0.166 1
0.3066 0.163 1
0.31 0.157 1
0.3133 0.154 1
0.3166 0.151 1
0.32 0.148 1
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0.3266 0.141 1
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0.3666 0.103 1
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0.45 0.072 1
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0.4833 0.066 1
0.5 0.063 1
0.5166 0.063 1
0.5333 0.059 1
0.5666 0.059 1
0.5833 0.056 1
0.6 0.056 1
0.6166 0.053 1
0.6333 0.053 1
0.65 0.053 1
0.6666 0.053 1
0.6833 0.05 1
0.7 0.05 1
0.7166 0.05 1
0.7333 0.05 1
0.75 0.05 1
0.7666 0.05 1
0.7833 0.047 1
0.8 0.047 1
0.8166 0.047 1
0.8333 0.047 1
0.85 0.047 1
0.8666 0.047 1
0.8833 0.044 1
0.9 0.044 1
0.9166 0.044 1
0.9333 0.044 1
0.95 0.044 1
0.9666 0.044 1
0.9833 0.044 1
1 0.044 1
1.2 0.04 1
1.4 0.037 1
1.6 0.037 1
1.8 0.034 1
2 0.037 1
2.2 0.034 1
2.4 0.037 1
2.6 0.034 1

```
2.8    0.037    1
3    0.037    1
3.2    0.034    1
3.4    0.034    1
3.6    0.034    1
3.8    0.034    1
4    0.04    1
4.2    0.037    1
4.4    0.034    1
4.6    0.034    1
4.8    0.037    1
5    0.034    1
5.2    0.034    1
5.4    0.037    1
5.6    0.037    1
5.8    0.034    1
6    0.034    1
6.2    0.034    1
6.4    0.034    1
6.6    0.034    1
6.8    0.034    1
7    0.034    1
7.2    0.034    1
7.4    0.034    1
7.6    0.034    1
7.8    0.037    1
8    0.034    1
<end>
```

ATTACHMENT H2

LOADING RACK AREA

HYDROGEOLOGIC DESCRIPTION

HYDROGEOLOGIC DESCRIPTION FOR

LOADING RACK AREA

New Hanover County Lithology

Shallow subsurface stratigraphic framework within New Hanover County was summarized by Larry Zarra in a 1991 reconnaissance study titled "Subsurface Stratigraphic Framework For Cenozoic Strata in Brunswick and New Hanover Counties, North Carolina". The predominant subsurface soil strata typically encountered at/around the subject site can be summarized as follows:

Surficial Sands - An unfossiliferous surficial unit which includes the modern surface and shallow subsurface sediments which overly the older fossiliferous units. The surficial sand unit is generally a light gray to light-yellow medium to fine grained sand with trace quantities of clay, opaque mineral grains, coarse-grained sand, pebbles, and feldspar. Peat is locally abundant (Zarra, 1991).

Pliocene/Pleistocene (Undifferentiated) - Available logs and data do not provide enough data to separate these strata into component formations. The Pliocene/Pleistocene strata are made up of shelly quartz sands and shelly carbonates. The quartz sands are typically unconsolidated, fine grained, and contain well-preserved whole shells to fragmental shell hash. In some localities the shells are stained black. The carbonates vary between loosely consolidated sandy shell hash and sand marl to indurated sand moldic limestone (Zarra, 1991).

Castle Hayne Formation - The Castle Hayne Formation is generally recognized as light gray or white moldic limestone or bryozoan-rich limestone. The limestone cuttings from the upper part of the Castle Hayne Formation often contain traces of finely disseminated phosphate or glauconite. In some wells, the limestone section grades downward to calcareous fine-grained sandstone, and the limestone section is overlain by thin silty fossiliferous clay (Zarra, 1991).

Site Monitoring Well Network

Characterization of subsurface soils was based on soil samples collected during the construction of nine Type II monitoring wells (KMW-6 through KMW-14), and four recovery wells (LRRW-1 through LRRW-4) installed at the subject site. Monitoring well depths ranged from 11 to 15 feet below land surface (BLS). Boreholes for all four-recovery wells were installed to a depth of 21 feet below the land surface. A site map depicting the location of the monitoring and recovery wells is presented on Figure 1 of Attachment H2.

Due to the relatively shallow depth of the area of interest monitoring wells, additional information relating to subsurface conditions was derived from additional on-site sources. Two Type III monitoring wells (TMW-1 and TMW-2) have been installed within the Paraxylene Facility of the North Terminal to access subsurface conditions relating to a separate incident. TMW-1 and TMW-2 were installed to depths of 45 and 38 feet respectively, and are located approximately 1,000 feet northeast of the loading rack area site.

Copies of North Carolina Well Construction records and boring logs for the monitoring and recovery wells installed within the loading rack area, and the two Type III monitoring wells outside of the area of interest have been attached to this document.

Site Subsurface Soils

Description of soil samples obtained during installation of the monitoring and recovery well indicates the area of investigation is underlain primarily by well-sorted, fine to medium grained, SAND with few fines from land surface to approximately 20 feet BLS. These sediments are similar to the surficial sand unit as described by Zarra (1991). A review of the data generated during the installation of the deeper Type III monitoring wells revealed similar subsurface soils to depths of roughly 15 to 20 feet BLS.

While installing recovery wells LRRW-2, LRRW-3, and LRRW-4 a light green CLAYEY SAND was encountered from 20 feet BLS until borings were terminated at 21 feet BLS. The SAND was fine to medium grained; the CLAY exhibited moderate plasticity. These materials appear to be similar to those described by Zarra (1991) as the Pliocene/Pleistocene undifferentiated unit. While installing the Type III monitoring wells TMW-1 and TMW-2, a sequence of CLAYEY (moderate plasticity) SAND (fine, and fine to medium grained) underlain by sand with shell fragments and glauconite were encountered at 30 feet and 28 feet below the ground surface, respectively. This material was in turn underlain by fossiliferous moldic limestone. This sequence is interpreted to be the upper limits of the Castle Hayne Formation.

Subsurface Soil Cross Section

As part of the site CAPA, a cross section of the area of interest was prepared illustrating the encountered subsurface soils and interpolated depth of contamination. The cross section A-A' transect location is indicated in attached Figure 1 of Attachment H2. Refer to attached Figure 2 of Attachment H2 for the A-A' cross section profile. Please note this cross-section has been modified to illustrate current conditions.

Hydrogeologic Description

Within this Coastal Plain physiographic province, groundwater systems consist of aquifers (saturated zones) in permeable sand, gravel, and limestone layer(s) often separated by confining layer(s) of less permeable sediments such as silt and clay. In assessing subsurface conditions at the North Terminal two aquifers have been identified. A unconfined surficial groundwater aquifer, and the confined Castle Hayne aquifer. The unconfined surficial aquifer has been interpreted to extend from the water table (1 to 4 feet BLS) to the top of the underlying silty/clayey sand, where present, or the clay unit identified at a depth of approximately 20 feet BLS. The unconfined surficial aquifer has been impacted at the area of interest with dissolved petroleum constituents and has been the primary focus of site assessment and remediation efforts.

To evaluate the hydrogeologic character of the site unconfined surficial aquifer Breen GeoScience Management, Inc. (BREEN) prepared an aquifer pump test plan-utilizing site Type II monitoring well KMW-8. CATLIN personnel conducted (November 1 to 2, 2002) a 24-hour pump test in general accordance with the BREEN plan and added three temporary observation wells (OB-2, OB-3, and OB-4) around KMW-8. During the pump test groundwater recovery rates from KMW-8 were recorded. Water level readings were obtained prior to, during, and following termination of the pump test. Resulting data was submitted to BREEN for Aquifer^{Win32} modeling analysis, which utilizes Theiss equations. A copy of the resulting BREEN report (Technical Memorandum) has been provided with this attachment. The resulting pump test data can be summarized as follows:

Well ID	Transmissivity (ft^2/day)	Specific Yield	Hydraulic Conductivity (ft/day)	Distance from Pumping Well (ft)	Test Type
OB-2	174	0.24	8.7	6	Drawdown/recovery
OB-3	201	0.11	10	12	Drawdown/recovery
OB-4	277	0.10	14	12	Drawdown/recovery

An assumed (seasonal high) surficial aquifer thickness of 20 feet was used for all calculations. Site surficial hydrogeologic characteristics regarding average hydraulic conductivity, transmissivity, and specific yield can be summarized as follows:

Transmissivity – The site surficial aquifer transmissivity is based on the observation well calculations, which ranged from 174 ft^2/day to 277 ft^2/day, resulting in an average of 217.3 ft^2/day.

Specific Yield - The site surficial aquifer specific yield is based on the observation well data, which ranged from 0.10 to 0.24 resulting in an average of 0.15.

Hydraulic Conductivity – Based on an assumed aquifer thickness of 20 feet, the hydraulic conductivity can be determined with the following calculation:

$$K=T/b$$

Where:
Transmissivity (T) and Aquifer Thickness (b) = 20 feet

OB-2 Hydraulic conductivity (K) = (174 ft^2/day)/(20 feet) = 8.7 ft/day
OB-3 Hydraulic conductivity (K) = (201 ft^2/day)/(20 feet) = 10 ft/day
OB-4 Hydraulic conductivity (K) = (277 ft^2/day)/(20 feet) = 14 ft/day

Seasonal High and Low Water Table

To determine the seasonal high water table level, depth to water data from selected site Type II monitoring wells for this past year has been summarized in the attached "Summary of Water Table Data at Loading Rack Area".

Historical groundwater table data has repeatedly shown a significant difference in surficial water table depths from the east to the West Side of River Road within this area of interest. The cause for this feature has not been determined. However, this permit application concerns a system which will influence the surficial groundwater on the East Side of River Road. Therefore, the seasonal high and low surficial water table depths have been evaluated for only the East Side of River Road.

Seasonal High Water Table – During the past year the average (9/27/02 data) depth to seasonal high water table level has been 1.37 feet below grade.

Seasonal Low Water Table – During the past year the average (5/7/02 data) depth to seasonal high water table level has been 7.42 feet below grade.

ATTACHMENT H2 – FIGURES FOR

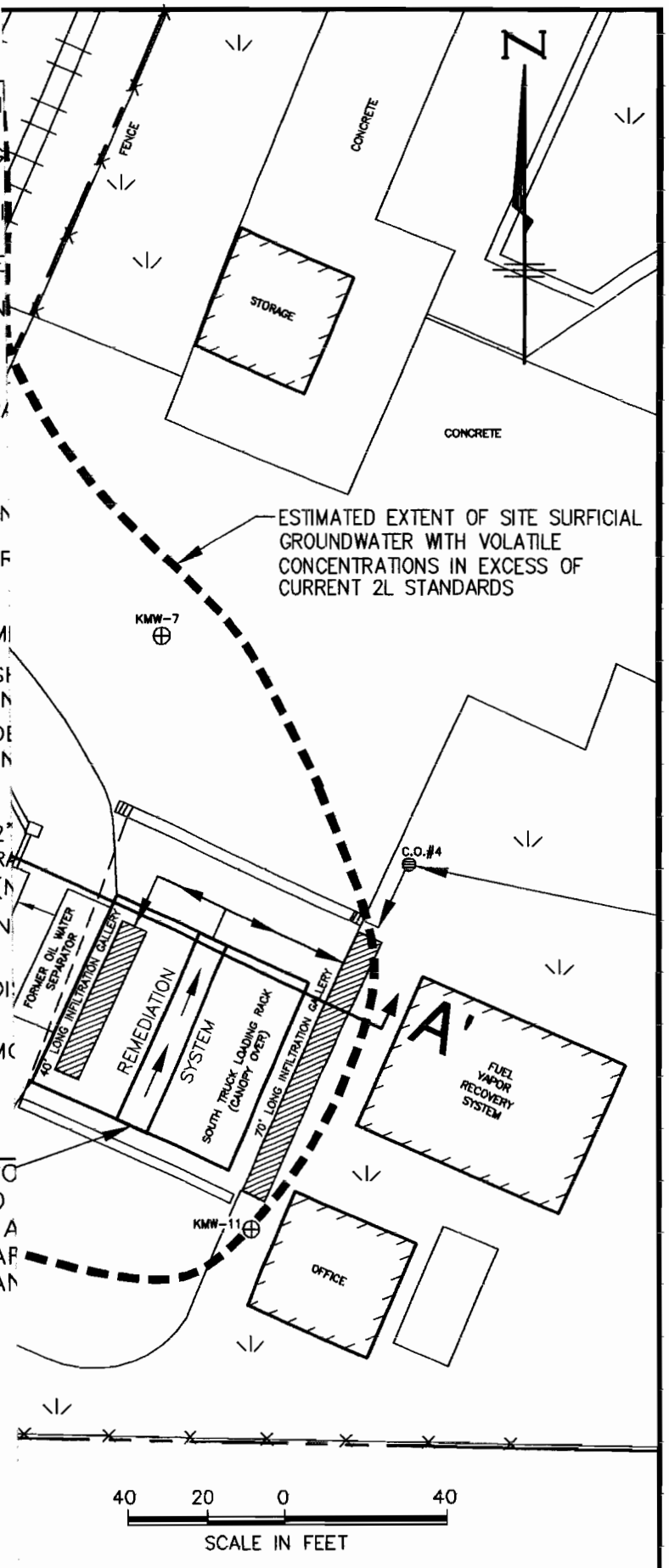
LOADING RACK AREA

LEGEND

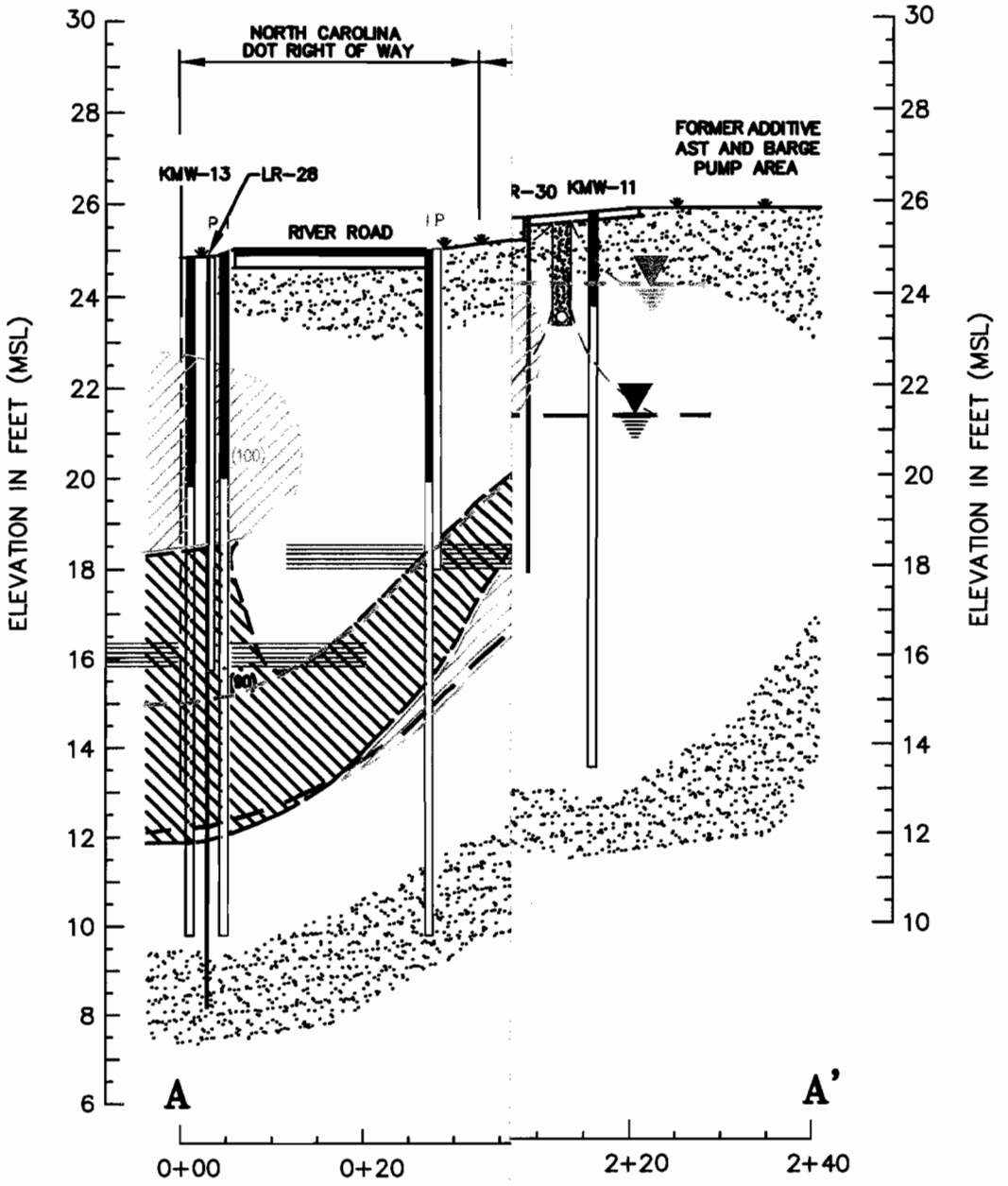
SYMBOL	DESCRI
—R—	HIGHWAY RIG
	PROPERTY LI
O PP	POWER POLE
FH	FIRE HYDRAN
X	TEMPORARY
	RAILROAD TRA
	CLEAN OUT
	EXISTING MON
	NEW MONITOR TO SHALLOW
	NEW 4" DIAM
	PROPOSED SI (N
	PROPOSED DE (N
	PROPOSED 2" RA (N
	PROPOSED IN
	PROPOSED DI
	PROPOSED MC

NOTES:

1. ALL EXISTING MONITORING AND RECO APPROXIMATE AND BASED ON FIELD
2. ESTIMATED EXTENT OF SITE SURFICIA IN EXCESS OF CURRENT 2L STANDAR IN CAPA DATED AUGUST 9, 2002 AN



TITLE	FIGURE
GEOLOGIC TRANSECT LOCATION	1
SCALE: 1"=40' | DRAWN BY: WHW | CHECKED BY: JKB	



SOILS LEGEND

SAND

ROST LEGEND

PEAK FLUO

PEAK FLUO

PREDOMINE
PX WAVEFO

PREDOMINE
WAVEFORM

TITLE	FIGURE
CROSS SECTION – A–A'	2
SCALE: AS SHOWN | DRAWN BY: WHW | CHECKED BY: JKB	

201125-07-INJ-06

ATTACHMENT H2 - WELL CONSTRUCTION RECORD/BORING LOGS FOR

LOADING RACK AREA

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) On-site Monitoring Well ASSOCIATED WQ PERMIT # (if applicable)

KMW-6

1. WELL USE (Check Applicable Box) Residential☐ Municipal/Public☐ Industrial☐ Agricultural☐
Monitoring☒ Recovery Heat Pump Water Injection☐ Other☐ If Other, List Use

2. WELL LOCATION: (Show scetch of the location below)
Nearest Town: Wilmington County: New Hanover
Koch North Terminal
(Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land Setting
☐Ridge ☐Slope ☐Valley ☒Flat
(check appropriate box)

Northing/Easting of well location
NCSP NAD 83 (ft.)
Latitude/longitude source☒GPS ☐Topo. map
(check box)

3. OWNER: Koch Petroleum Group, LP
Address: 3334 River Road
(Street or Route No.)
Wilmington (City or Town) NC (State) 28412 (Zip Code)
(910) 799-0180
Area code - Phone number

DEPTH From	To	DRILLING LOG Formation Description
0.0		

4. DATE DRILLED: 9/13/2001
5. TOTAL DEPTH: 12
6. CUTTINGS COLLECTED? YES X NO
7. DOES WELL REPLACE EXISTING WELL? YES NO X
8. STATIC WATER LEVEL Below Top of Casing 3 FT.
(Use "+" if Above Top of Casing)

Tan, well sorted, v.f. to f. SAND.
Moist to sat.

9. TOP OF CASING IS 0 FT. Above Land Surface*
* Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118

10. YIELD (gpm): N/A METHOD OF TEST N/A
11. WATER ZONES (depth): Surficial Aquifer

12.0

12. DISINFFECTION: Type N/A Amount N/A
13. CASING

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 2 ft.	2" in.	Sch. 40	PVC
From	To ft.	in.		
From	To ft.	in.		

14. GROUT:

	Depth	Material	Method
From 0	To 0.5 ft.	Portland Cement	Surface Pour
From 0.5	To 1.0 ft.	Bent. Pellets	Surface Pour

15. SCREEN:

	Depth	Diameter	Slot Size	Material
From 2	To 12 ft.	2" in.	Slot .010 in.	PVC
From	To ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth	Size	Material
From 1.0	To 12.0 ft.	#2 Medium	Torpedo Sand
From	To ft.		

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED FIGURE

17. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVVIDED TO THE WELL OWNER.

Bobbie Fowler 9-25-01

SIGNATURE OF PERSON CONSTRUCTION THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) On-site Monitoring Well ASSOCIATED WQ PERMIT # (if applicable)

KMW-7

1. WELL USE (Check Applicable Box) Residential☐ Municipal/Public☐ Industrial☐ Agricultural☐
   Monitoring☒ Recovery Heat Pump Water Injection☐ Other☐ If Other, List Use

2. WELL LOCATION: (Show scetch of the location below)
   Nearest Town: Wilmington County: New Hanover
   Koch North Terminal
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

   Topographic/Land Setting
   ☐Ridge ☐Slope ☐Valley ☒Flat
   (check appropriate box)
   Northing/Easting of well location
   NCSP NAD 83 (ft.)
   Latitude/longitude source☒GPS ☐Topo. map
   (check box)

3. OWNER: Koch Petroleum Group, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

DEPTH From	To	DRILLING LOG Formation Description
0.0		

4. DATE DRILLED: 9/13/2001
5. TOTAL DEPTH: 11
6. CUTTINGS COLLECTED? YES X NO
7. DOES WELL REPLACE EXISTING WELL? YES NO X
8. STATIC WATER LEVEL Below Top of Casing 2.5 FT.
   (Use "+" if Above Top of Casing)

Tan, well sorted, v.f. to f. SAND. Moist to sat.

9. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118

10. YIELD (gpm): N/A METHOD OF TEST N/A
11. WATER ZONES (depth): Surficial Aquifer 11.0
12. DISINFFECTION: Type N/A Amount N/A
13. CASING

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 1 ft.	2" in.	Sch. 40	PVC
From	To ft.	in.		
From	To ft.	in.		

14. GROUT:

	Depth	Material	Method
From 0	To 0.5 ft.	Portland Cement	Surface Pour
From 0.5	To 1.0 ft.	Bent. Pellets	Surface Pour

15. SCREEN:

	Depth	Diameter	Slot Size	Material
From 1	To 11 ft.	2" in.	Slot .010 in.	PVC
From	To ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth	Size	Material
From 1.0	To 12.0 ft.	#2 Medium	Torpedo Sand
From	To ft.		

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED FIGURE

17. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVVIDED TO THE WELL OWNER.

Bobbie Fowler 9-25-01

SIGNATURE OF PERSON CONSTRUCTION THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) On-site Monitoring Well ASSOCIATED WQ PERMIT # (if applicable)

KMW-8

1. WELL USE (Check Applicable Box) Residential☐ Municipal/Public☐ Industrial☐ Agricultural☐
   Monitoring☒ Recovery Heat Pump Water Injection☐ Other☐ If Other, List Use

2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Wilmington County: New Hanover
   Koch North Terminal
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

3. OWNER: Koch Petroleum Group, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

4. DATE DRILLED: 9/12/2001
5. TOTAL DEPTH: 12
6. CUTTINGS COLLECTED? YES X NO
7. DOES WELL REPLACE EXISTING WELL? YES NO X
8. STATIC WATER LEVEL Below Top of Casing 3.5 FT.
   (Use "+" if Above Top of Casing)
9. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118
10. YIELD (gpm): N/A METHOD OF TEST N/A
11. WATER ZONES (depth): Surficial Aquifer
12. DISINFFECTION: Type N/A Amount N/A
13. CASING

	Depth From	To		Diameter		Wall Thickness or Weight/Ft.	Material
	0	2	ft.	2"	in.	Sch. 40	PVC
			ft.		in.		
			ft.		in.		

14. GROUT:

	Depth From	To		Material	Method
	0	0.5	ft.	Portland Cement	Surface Pour
	0.5	1.0	ft.	Bent. Pellets	Surface Pour

15. SCREEN:

	Depth From	To		Diameter		Slot Size		Material
	2	12	ft.	2"	in.	Slot .010	in.	PVC
			ft.		in.		in.	

16. SAND/GRAVEL PACK:

	Depth From	To		Size	Material
	1.0	12.0	ft.	#2 Medium	Torpedo Sand
			ft.		

17. REMARKS:

Topographic/Land Setting
☐Ridge ☐Slope ☐Valley ☒Flat
(check appropriate box)
Northing/Easting of well location
NCSP NAD 83 (ft.)
Latitude/longitude source ☒GPS ☐Topo. map
(check box)

DEPTH From	To	DRILLING LOG Formation Description
0.0		
		Light gray, well sorted, v.f. to f. SAND. Moist
2.7		
		Tan, well sorted, v.f. to f. SAND. Sat.
12.0		

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED FIGURE

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVVIDED TO THE WELL OWNER.

Bobbi Fowler 9-25-01
SIGNATURE OF PERSON CONSTRUCTION THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636. Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) On-site Monitoring Well ASSOCIATED WQ PERMIT # (if applicable)

KMW-9

1. WELL USE (Check Applicable Box) Residential☐ Municipal/Public☐ Industrial☐ Agricultural☐
   Monitoring☒ Recovery Heat Pump Water Injection☐ Other☐ If Other, List Use

2. WELL LOCATION: (Show scetch of the location below)
   Nearest Town: Wilmington County: New Hanover
   Koch North Terminal
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

3. OWNER: Koch Petroleum Group, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

4. DATE DRILLED: 9/13/2001
5. TOTAL DEPTH: 12
6. CUTTINGS COLLECTED? YES X NO
7. DOES WELL REPLACE EXISTING WELL? YES NO X
8. STATIC WATER LEVEL Below Top of Casing 2.5 FT.
   (Use "+" if Above Top of Casing)
9. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118
10. YIELD (gpm): N/A METHOD OF TEST N/A
11. WATER ZONES (depth): Surficial Aquifer
12. DISINFFECTION: Type N/A Amount N/A
13. CASING

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From	0 To 2 ft.	4" in.	Sch. 40	PVC
From	To ft.	in.		
From	To ft.	in.		

14. GROUT:

	Depth	Material	Method
From	0 To 0.5 ft.	Portland Cement	Surface Pour
From	0.5 To 1.0 ft.	Bent. Pellets	Surface Pour

15. SCREEN:

	Depth	Diameter	Slot Size	Material
From	2 To 12 ft.	4" in.	Slot .010 in.	PVC
From	To ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth	Size	Material
From	1.0 To 12.0 ft.	#2 Medium	Torpedo Sand
From	To ft.		

17. REMARKS:

Topographic/Land Setting
☐Ridge ☐Slope ☐Valley ☒Flat
(check appropriate box)

Northing/Easting of well location
NCSP NAD 83 (ft.)

Latitude/longitude source ☒GPS ☐Topo. map
(check box)

DEPTH From	To	DRILLING LOG Formation Description
0.0		
0.5		Dark brown, SILTY, v.f. to f. SAND with roots and grass. moist
		Tan, well sorted, v.f. to f. SAND. Moist to sat.
	12.0	

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED FIGURE

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVVIDED TO THE WELL OWNER.

Bobbie Fowler 9-25-01

SIGNATURE OF PERSON CONSTRUCTION THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) On-site Monitoring Well ASSOCIATED WQ PERMIT # (if applicable)

KMW-10

1. WELL USE (Check Applicable Box) Residential☐ Municipal/Public☐ Industrial☐ Agricultural☐
   Monitoring☒ Recovery Heat Pump Water Injection☐ Other☐ If Other, List Use

2. WELL LOCATION: (Show scetch of the location below)
   Nearest Town: Wilmington County: New Hanover
   Koch North Terminal
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

   Topographic/Land Setting
   ☐Ridge ☐Slope ☐Valley ☒Flat
   (check appropriate box)
   Northing/Easting of well location
   NCSP NAD 83 (ft.)
   Latitude/longitude source☒GPS ☐Topo. map
   (check box)

3. OWNER: Koch Petroleum Group, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

4. DATE DRILLED: 9/13/2001
5. TOTAL DEPTH: 12
6. CUTTINGS COLLECTED? YES X NO
7. DOES WELL REPLACE EXISTING WELL? YES NO X
8. STATIC WATER LEVEL Below Top of Casing 3 FT.
   (Use "+" if Above Top of Casing)
9. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118
10. YIELD (gpm): N/A METHOD OF TEST N/A
11. WATER ZONES (depth): Surficial Aquifer
12. DISINFFECTION: Type N/A Amount N/A

DEPTH From	To	DRILLING LOG Formation Description
0.0	12.0	Tan, well sorted, v.f. to f. SAND. Moist to sat.

13. CASING

Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
0	2 ft.	2" in.	Sch. 40	PVC
	ft.	in.		
	ft.	in.		

14. GROUT:

Depth From	To	Material	Method
0	0.5 ft.	Portland Cement	Surface Pour
0.5	1.0 ft.	Bent. Pellets	Surface Pour

15. SCREEN:

Depth From	To	Diameter	Slot Size	Material
2	12 ft.	2" in.	Slot .010 in.	PVC
	ft.	in.	in.	

16. SAND/GRAVEL PACK:

Depth From	To	Size	Material
1.0	12.0 ft.	#2 Medium	Torpedo Sand
	ft.		

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED FIGURE

17. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTION THE WELL — DATE 9-25-01

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) On-site Monitoring Well ASSOCIATED WQ PERMIT # (if applicable)

KMW-11

1. WELL USE (Check Applicable Box) Residential☐ Municipal/Public☐ Industrial☐ Agricultural☐
   Monitoring☒ Recovery Heat Pump Water Injection☐ Other☐ If Other, List Use

2. WELL LOCATION: (Show scetch of the location below)
   Nearest Town: Wilmington County: New Hanover
   Koch North Terminal
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

3. OWNER: Koch Petroleum Group, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

4. DATE DRILLED: 9/13/2001
5. TOTAL DEPTH: 12
6. CUTTINGS COLLECTED? YES X NO
7. DOES WELL REPLACE EXISTING WELL? YES NO X
8. STATIC WATER LEVEL Below Top of Casing 3.5 FT.
   (Use "+" if Above Top of Casing)
9. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118
10. YIELD (gpm): N/A METHOD OF TEST N/A
11. WATER ZONES (depth): Surficial Aquifer
12. DISINFFECTION: Type N/A Amount N/A
13. CASING

	Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	2 ft.	2" in.	Sch. 40	PVC
		ft.	in.		
		ft.	in.		

14. GROUT:

	Depth From	To	Material	Method
	0	0.5 ft.	Portland Cement	Surface Pour
	0.5	1.0 ft.	Bent. Pellets	Surface Pour

15. SCREEN:

	Depth From	To	Diameter	Slot Size	Material
	2	12 ft.	2" in.	Slot .010 in.	PVC
		ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth From	To	Size	Material
	1.0	12.0 ft.	#2 Medium	Torpedo Sand
		ft.		

17. REMARKS:

Topographic/Land Setting
☐Ridge ☐Slope ☐Valley ☒Flat
(check appropriate box)

Northing/Easting of well location
NCSP NAD 83 (ft.)
Latitude/longitude source☒GPS ☐Topo. map
(check box)

DEPTH From	To	DRILLING LOG Formation Description
0.0		
	1.0	Dark brown, SILTY, v.f. to f. SAND with vegetation.
	2.0	moist
		Brown, well sorted, v.f. to f. SAND. Moist
		Tan, well sorted, v.f. to f. SAND. Moist to sat.
	12.0	

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED FIGURE

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVVIDED TO THE WELL OWNER.

Bobbi Fowler 9-25-01

SIGNATURE OF PERSON CONSTRUCTION THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

NORTH CAROLINA – DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
– DIVISION OF WATER QUALITY – GROUNDWATER SECTION
1636 MAIL SERVICE CENTER –
RALEIGH, N.C. 27699-1636 – PHONE (919) 733-3221

KW-12
KMW

WELL CONSTRUCTION RECORD

WELL CONTRACTOR: WILLIAM J. MILLER
WELL CONTRACTOR CERTIFICATION #: 2927
STATE WELL CONSTRUCTION PERMIT #: N/A

1. WELL USE (Check Applicable Box): Residential Municipal Industrial Agricultural Monitoring
   Recovery Heat Pump Water Injection Other If Other, list use: _____
2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Wilmington County: New Hanover
   River Road
   (Road Name and Numbers, Community, or Subdivision and Lot No.)
3. OWNER Koch Petroleum Group, LP
   Address 3325 River Rd
   (Street or Route No.)
   Wilmington NC 28406
   City or Town State Zip Code
4. DATE DRILLED 12/21/01
5. TOTAL DEPTH 15
6. CUTTINGS COLLECTED ____YES ___X___NO
7. DOES WELL REPLACE EXISTING WELL? ____YES ___X___NO
8. STATIC WATER LEVEL Below Top of Casing _____ Ft.
   (Use "+" if Above Top of Casing)
9. TOP OF CASING IS _____ Ft. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118
10. YIELD (gpm): _____ METHOD OF TEST _____
11. WATER ZONES (depth) _____
12. CHLORINATION: Type N/A Amount N/A
13. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 5	Ft.	2"	Sch 40	PVC
From	To	Ft.			
From	To	Ft.			

14. GROUT:

	Depth		Material	Method
From 0	To 2'	Ft.	Cement	SURFACE
From	To	Ft.		

15. SCREEN:

	Depth		Diameter	Slot Size	Material
From 5	To 15	Ft.	2" in.	.010 in.	PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth		Size	Material
From 3	To 15	Ft.	#2	Gravel Pack
From	To	Ft.		

17. REMARKS: _____

DRILLING LOG

From	To	Formation Description
		SEE BORING LOG
		TAN MED SORTED FINE TO MED. SAND
0.5	15'	

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

SEE FIGURE 1.2

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTIONN STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE 12/21/01

FOR OFFICE USE ONLY
Quad No: _____
Serial No: _____

Submit original to Division of Water Quality, Groundwater Section within 30 days

GW-1 REV.12/99

NORTH CAROLINA – DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
– DIVISION OF WATER QUALITY – GROUNDWATER SECTION
1636 MAIL SERVICE CENTER –
RALEIGH, N.C. 27699-1636 – PHONE (919) 733-3221

KMW-13

WELL CONSTRUCTION RECORD

WELL CONTRACTOR: WILLIAM J. MILLER
WELL CONTRACTOR CERTIFICATION #: 2927
STATE WELL CONSTRUCTION PERMIT #: N/A

1. WELL USE (Check Applicable Box): Residential Municipal Industrial Agricultural Monitoring
Recovery Heat Pump Water Injection Other If Other, list use: _____

2. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Wilmington County: New Hanover
River Road
(Road Name and Numbers, Community, or Subdivision and Lot No.)

3. OWNER Koch Petroleum Group, LP
Address 3325 River Road.
(Street or Route No.)
Wilmington NC 28406
City or Town State Zip Code

4. DATE DRILLED 12/21/01
5. TOTAL DEPTH 15
6. CUTTINGS COLLECTED ____YES ✓ NO
7. DOES WELL REPLACE EXISTING WELL? ____YES ✓ NO
8. STATIC WATER LEVEL Below Top of Casing _____ Ft.
(Use "+" if Above Top of Casing)
9. TOP OF CASING IS _____ Ft. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118
10. YIELD (gpm): _____ METHOD OF TEST _____
11. WATER ZONES (depth) _____

12. CHLORINATION: Type N/A Amount N/A
13. CASING:

	Depth From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
	0	5		2"	Sch 40	PVC

14. GROUT:

	Depth From	To	Ft.	Material	Method
	0	3		Grout	Pipe

15. SCREEN:

	Depth From	To	Ft.	Diameter	Slot Size	Material
	5	15		2" in.	.010 in.	PVC
				in.	in.	
				in.	in.	

16. SAND/GRAVEL PACK:

	Depth From	To	Ft.	Size	Material
	3	15		#2	Gravel Pack

17. REMARKS: _____

DRILLING LOG From	To	DEPTH Formation Description
SEE BORING LOG		
TAN WELL SORTED		0.5-15'
FINE TO MED.		
SAND		

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

SEE FIGURE 1.2

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTIONN STANDARDS. AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE 12/21/01

FOR OFFICE USE ONLY
Quad No: _____
Serial No: _____

Submit original to Division of Water Quality, Groundwater Section within 30 days

GW-1 REV.12/99

NORTH CAROLINA – DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
– DIVISION OF WATER QUALITY – GROUNDWATER SECTION
1636 MAIL SERVICE CENTER –
RALEIGH, N.C. 27699-1636 – PHONE (919) 733-3221

KMW - 14

WELL CONSTRUCTION RECORD

WELL CONTRACTOR: WILLIAM J. MILLER
WELL CONTRACTOR CERTIFICATION #: 2927
STATE WELL CONSTRUCTION PERMIT #: N/A

1. WELL USE (Check Applicable Box): Residential Municipal Industrial Agricultural Monitoring
Recovery Heat Pump Water Injection Other If Other, list use: _____

2. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Wilmington County: New Hanover
River Road
(Road Name and Numbers, Community, or Subdivision and Lot No.)

3. OWNER Koch Petroleum Group, LP
Address 3325 River Rd
(Street or Route No.)
Wilmington NC 28406
City or Town State Zip Code

4. DATE DRILLED 12/21/01
5. TOTAL DEPTH 15
6. CUTTINGS COLLECTED ____YES ✓NO
7. DOES WELL REPLACE EXISTING WELL? ____YES ✓NO
8. STATIC WATER LEVEL Below Top of Casing _____ Ft.
(Use "+" if Above Top of Casing)
9. TOP OF CASING IS _____ Ft. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118
10. YIELD (gpm): _____ METHOD OF TEST _____
11. WATER ZONES (depth) _____

12. CHLORINATION: Type N/A Amount N/A
13. CASING:

	Depth From	To	Ft.	Diameter or Wall Thickness	Weight/Ft.	Material
	0	5'		2"	sch 40	PVC
From		To	Ft.			
From		To	Ft.			

14. GROUT:

	Depth From	To	Ft.	Material	Method
	0	3		Cement	SURFACE
From		To	Ft.		

15. SCREEN:

	Depth From	To	Ft.	Diameter	Slot Size	Material
	5	15		2" in.	.010 in.	PVC
From		To	Ft.	in.	in.	
From		To	Ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth From	To	Ft.	Size	Material
	4	15		#2	Gravel Pack
From		To	Ft.		

17. REMARKS: _____

DRILLING LOG From	To	DEPTH Formation Description
		SEE BORING LOG
TAN FINE TO MED GRAINED SAND		0.5 – 15.0'

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

SEE FIGURE 1.2

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTIONN STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE 12/21/01

FOR OFFICE USE ONLY
Quad No: _____
Serial No: _____

Submit original to Division of Water Quality, Groundwater Section within 30 days

GW-1 REV.12/99

BORING LOG

BORING NUMBER TW-1
TOTAL DEPTH 45.0

SITE LOCATION Koch North Terminal
Wilmington, North Carolina

DRILLED BY AM/MM
LOGGED BY T. LANDIS

DRILLING DATE 11/30-12/1/95

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
2.0	4.0	Light olive-gray, fine grained, SAND, medium density.	SP	Low	Strong	--	Grab
5.0	7.0	Light brown-olive gray, fine to medium grained, SAND, medium dense to dense, well rounded, poorly graded.	SP	Moderate	Very Strong	--	HP-HP-HP-HP
10.0	12.0	Light brown, fine to medium grained, SAND, medium density to dense.	SP	High	Strong	--	HP-HP-HP-HP
15.0	17.0	Light olive-gray, very fine to fine grained, slightly silty SAND, dense.	SM/ SP	High	Strong	--	10-12-13-10
20.0	22.0	Light gray, fine grained, SAND, medium dense to dense.	SP	Moderate	Moderate	--	12-8-10-10
25.0	27.0	Light gray, fine grained, SAND, mediun density, poorly graded.	SP	Moderate	Strong	--	10-9-8-6
30.0	32.0	Greenish-gray, fine grained, SANDS grading to very fine grained SANDY CLAY at approximately 31.5' below land surface, medium density.	SP/ CL	Moderate/ High	Very Slight	--	15-10-10-10
32.5	35.0	Light greenish-gray, very fine grained, inorganic CLAY, medium stiffness to stiff.	CL	High	No	--	10-11-12-15
35.0	37.5	Light gray, very fine grained, SILTY CLAY, medium stiffness.	CL	High	No	10	WR-10-12-10

REMARKS Grab = Grab Sample; HP = Hydraulic Push; WR = Weight of Rods

BORING LOG

BORING NUMBER TW-1
TOTAL DEPTH 45.0

SITE LOCATION Koch North Terminal
Wilmington, North Carolina

DRILLED BY AM/MM
LOGGED BY T. LANDIS

DRILLING DATE 11/30-12/1/95

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
37.5	40.0	Light gray, fine to medium grained, SAND, medium dense to dense.	SP	High	Slight	5	WR-15-10-10
40.0	42.5	Light olive-gray, slightly CLAY LIMESTONE, dense.	GC	High	Slight	20	WR-10-20-10
42.5	45.0	Light olive-gray, slightly CLAY LIMESTONE, dense.	GC	High	Slight	14	WR-20-20-10

REMARKS WR = Weight of Rods

BORING LOG

BORING NUMBER TMW-2
TOTAL DEPTH 38.0'

SITE LOCATION KOCH NORTH TERMINAL
WILMINGTON, NORTH CAROLINA

DRILLED BY B. FOWLER
LOGGED BY N. YOUNGREN

DRILLING DATE 2/17/00

SAMPLE DEPTH (FT.)		SAMPLE DESCRIPTION	USCS	WATER CONTENT	HC ODOR	PID/ FID PPM	BLOW COUNT
0	3.0	Tan, fine to coarse grained SAND, poorly sorted, with shell fragments and gravel fill.	SP	Dry	No	--	Grab
3.0	15.0	Dark gray/brown, fine to coarse grained SAND, poorly sorted.	SP	Wet @ 6'	Strong @ 5'	--	Grab
15.0	20.0	Tan/white, fine to medium grained SAND, black phosphatic sands.	SP	Wet	Slight	--	Grab
20.0	28.0	Tan, fine to coarse grained SILTY SAND, poorly sorted, 1mm to 3mm well rounded gravel, some black phosphatic sand and shell fragments.	SM SP	Wet	Slight	--	Grab
28.0	31.0	Gray/olive, very fine to coarse grained SANDY CLAY, moderate plasticity.	SC	Moist	No	--	Grab
31.0	35.0	Tan, very fine to medium grained phosphatic SAND, some shell fragments.	SP	Wet	No	--	Grab
35.0	38.0	Limestone, hard.	LS	Wet	No	--	Grab
		2/28/00 Depth to Surficial Water Table = 5.66 Feet					

REMARKS Grab = Grab Sample

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler — CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists — PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) 2869 — ASSOCIATED WQ PERMIT # (if applicable) N/A

LRRW-1

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☐ Recovery ☒ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Wilmington County: New Hanover
   _____
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land Setting
☐ Ridge ☐ Slope ☐ Valley ☒ Flat
(check appropriate box)

Northing/Easting of well location
_____ / _____

3. OWNER: Flint Hills Resources, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

Latitude/longitude source: ☐ GPS ☐ Topo. map
(check box)

DEPTH From To — DRILLING LOG Formation Description

4. DATE DRILLED: 12/23/2002
5. TOTAL DEPTH: 20
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing 2.0 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118

SEE ATTACHED

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): Surficial Aquifer
    _____
12. DISINFECTION: Type N/A Amount N/A
13. CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From ___ To ___ ft.	___ in.	___	___
From ___ To ___ ft.	___ in.	___	___
From ___ To ___ ft.	___ in.	___	___

14. GROUT:

Depth	Material	Method
From ___ To ___ ft.	___	___
From ___ To ___ ft.	___	___

15. SCREEN:

Depth	Diameter	Slot Size	Material
From 0 To 20 ft.	4 in.	Slot .010 in.	SS
From ___ To ___ ft.	___ in.	___ in.	___

16. SAND/GRAVEL PACK:

Depth	Size	Material
From 0 To 21 ft.	#2 Medium	Torpedo Sand
From ___ To ___ ft.	___	___

SEE ATTACHED

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

17. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Bobbie Fowler — 1-3-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL CONSTRUCTION RECORD 201-125.GPJ CATLIN.GDT 01/03/03

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) 2869 ASSOCIATED WQ PERMIT # (if applicable) N/A

LRRW-2

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☐ Recovery ☒ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Wilmington County: New Hanover
   _____
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land Setting
☐ Ridge ☐ Slope ☐ Valley ☒ Flat
(check appropriate box)

Northing/Easting of well location
_____ / _____

3. OWNER: Flint Hills Resources, LP

   Address: 3334 River Road
   (Street or Route No.)

   Wilmington (City or Town) NC (State) 28412 (Zip Code)

   (910) 799-0180
   Area code - Phone number

Latitude/longitude source: ☐ GPS ☐ Topo. map
(check box)

DEPTH From To | DRILLING LOG Formation Description

4. DATE DRILLED: 12/23/2002
5. TOTAL DEPTH: 20
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing 2.0 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118

SEE ATTACHED

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): Surficial Aquifer
12. DISINFECTION: Type N/A Amount N/A
13. CASING:

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From	To ft.	in.		
From	To ft.	in.		
From	To ft.	in.		

14. GROUT:

	Depth	Material	Method
From	To ft.		
From	To ft.		

15. SCREEN:

	Depth	Diameter	Slot Size	Material
From 0	To 20 ft.	4 in.	Slot .010 in.	SS
From	To ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth	Size	Material
From 0	To 21 ft.	#2 Medium	Torpedo Sand
From	To ft.		

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED

17. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Bobbie Fowler 1-3-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) 2869 ASSOCIATED WQ PERMIT # (if applicable) N/A

LRRW-3

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☐ Recovery ☒ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Wilmington County: New Hanover
   _____
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land Setting
☐Ridge ☐Slope ☐Valley ☒Flat
(check appropriate box)
Northing/Easting of well location
_____ / _____

3. OWNER: Flint Hills Resources, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

Latitude/longitude source: ☐GPS ☐Topo. map
(check box)

DEPTH From To — DRILLING LOG Formation Description

4. DATE DRILLED: 12/30/2002
5. TOTAL DEPTH: 20
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing 2.0 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118

SEE ATTACHED

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): Surficial Aquifer
12. DISINFECTION: Type N/A Amount N/A
13. CASING:

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From	To ft.	in.		
From	To ft.	in.		
From	To ft.	in.		

14. GROUT:

	Depth	Material	Method
From	To ft.		
From	To ft.		

15. SCREEN:

	Depth	Diameter	Slot Size	Material
From	0 To 20 ft.	4 in.	Slot .010 in.	SS
From	To ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth	Size	Material
From	0 To 21 ft.	#2 Medium	Torpedo Sand
From	To ft.		

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

SEE ATTACHED

17. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Bobbie Fowler 1-3-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

YG WELL CONSTRUCTION RECORD 201-125.GPJ CATLIN.GDT 1/10/03

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Bobbie Fowler CERTIFICATION # 2869

WELL CONTRACTOR COMPANY NAME CATLIN Engineers & Scientists PHONE # (910) 452-5861

STATE WELL CONSTRUCTION PERMIT # (if applicable) 2869 ASSOCIATED WQ PERMIT # (if applicable) N/A

LRRW-4

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
   Monitoring ☐ Recovery ☒ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Wilmington County: New Hanover
   _____
   (Road Name and Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land Setting
☐ Ridge ☐ Slope ☐ Valley ☒ Flat
(check appropriate box)

Northing/Easting of well location
_____ / _____

3. OWNER: Flint Hills Resources, LP
   Address: 3334 River Road
   (Street or Route No.)
   Wilmington (City or Town) NC (State) 28412 (Zip Code)
   (910) 799-0180
   Area code - Phone number

Latitude/longitude source: ☐ GPS ☐ Topo. map
(check box)

DEPTH From To | DRILLING LOG Formation Description

4. DATE DRILLED: 12/23/2002
5. TOTAL DEPTH: 20
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing 2.0 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0 FT. Above Land Surface*
   * Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C.0118

SEE ATTACHED

9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): Surficial Aquifer
    _____
12. DISINFECTION: Type N/A Amount N/A
13. CASING:

	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From	To ft.	in.		
From	To ft.	in.		
From	To ft.	in.		

14. GROUT:

	Depth	Material	Method
From	To ft.		
From	To ft.		

15. SCREEN:

	Depth	Diameter	Slot Size	Material
From 0	To 20 ft.	4 in.	Slot .010 in.	SS
From	To ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth	Size	Material
From 0	To 21 ft.	#2 Medium	Torpedo Sand
From	To ft.		

SEE ATTACHED

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include road numbers and common road names.

17. REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[signature] 1-3-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

Modified from: GW-1 REV.07/2001

WELL LOG

CATLIN ENGINEERS and SCIENTISTS
Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 201-125	STATE: NC	COUNTY: New Hanover	LOCATION: Wilmington
PROJECT NAME: FHR North Terminal		LOGGED BY: STEVE TYLER	WELL ID: LRRW-1
		DRILLER: Bobbie Fowler	
NORTHING:	EASTING:	SYSTEM:	
BORING LOCATION:			T.O.C. ELEV.:
DRILL MACHINE: CME 45B ATV	METHOD: MR	0 HOUR DTW: 2.0	BORING DEPTH: 21.0
START DATE: 12/23/02	FINISH DATE: 12/23/02	24 HOUR DTW: 2.0	WELL DEPTH: 20.0

DEPTH	BLOW COUNT 6in	6in	6in	6in	OVA (ppm)	LAB.	USCS	LOG	SOIL AND ROCK DESCRIPTION	WELL DETAIL
									0.0 LAND SURFACE	0.0
							SP		Tan, poorly graded, fine to med. grained SAND with few fines. Slight HCO from 3.0' to 7.0' bls.	4" Slot .010 SS
									21.0 Boring Terminated at Depth 21.0 ft	20.0 21.0

CATLIN BORING LOG 201-125.GPJ CATLIN.GDT 01/03/03

HP = Hydraulic Push NM = Not Measured

#2 Medium Sand

WELL LOG

CATLIN ENGINEERS and SCIENTISTS
Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 201-125	STATE: NC	COUNTY: New Hanover	LOCATION: Wilmington
PROJECT NAME: FHR North Terminal		LOGGED BY: STEVE TYLER	WELL ID: LRRW-2
		DRILLER: Bobbie Fowler	
NORTHING:	EASTING:	SYSTEM:	T.O.C. ELEV.:
BORING LOCATION:			
DRILL MACHINE: CME 45B ATV	METHOD: MR	0 HOUR DTW: 2.0	BORING DEPTH: 21.0
START DATE: 12/23/02	FINISH DATE: 12/23/02	24 HOUR DTW: 2.0	WELL DEPTH: 20.0

DEPTH	BLOW COUNT 6in	6in	6in	6in	OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	WELL DETAIL
									0.0	LAND SURFACE	0.0
							SP			Tan, poorly graded, fine to med. SAND with few fines. Slight HCO from 2.5' to 8.5' bls.	4" Slot .010 SS
									20.0		20.0
							SC		21.0	Light green, fine to med., CLAYEY SAND with moderate plasticity.	21.0
										Boring Terminated at Depth 21.0 ft	

CATLIN BORING LOG 201-125.GPJ CATLIN.GDT 01/03/03

HP = Hydraulic Push NM = Not Measured

#2 Medium Sand

WELL LOG

CATLIN ENGINEERS and SCIENTISTS
Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 201-125	STATE: NC	COUNTY: New Hanover	LOCATION: Wilmington
PROJECT NAME: FHR North Terminal		LOGGED BY: STEVE TYLER	WELL ID: LRRW-3
		DRILLER: Bobbie Fowler	
NORTHING:	EASTING:	SYSTEM:	T.O.C. ELEV.:
BORING LOCATION:			
DRILL MACHINE: CME 45B ATV	METHOD: MR	0 HOUR DTW: 2.0	BORING DEPTH: 21.0
START DATE: 12/30/02	FINISH DATE: 12/30/02	24 HOUR DTW: 2.0	WELL DEPTH: 20.0

DEPTH	BLOW COUNT 6in	6in	6in	6in	OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	WELL DETAIL
									0.0	LAND SURFACE	0.0
							SP			Tan, poorly graded, fine to med. SAND with few fines. Moderate to slight HCO from 2.5' to 10.0' bls.	4" Slot .010 SS
									20.0		20.0
							SC		21.0	Light green, fine to med., CLAYEY SAND with moderate plasticity.	21.0
										Boring Terminated at Depth 21.0 ft	

CATLIN BORING LOG 201-125.GPJ CATLIN.GDT 01/03/03

HP = Hydraulic Push NM = Not Measured

#2 Medium Sand

WELL LOG

CATLIN ENGINEERS and SCIENTISTS
Wilmington, North Carolina

SHEET 1 OF 1

PROJECT NO.: 201-125	STATE: NC	COUNTY: New Hanover	LOCATION: Wilmington
PROJECT NAME: FHR North Terminal		LOGGED BY: STEVE TYLER	WELL ID: LRRW-4
		DRILLER: Bobbie Fowler	
NORTHING:	EASTING:	SYSTEM:	
BORING LOCATION:			T.O.C. ELEV.:
DRILL MACHINE: CME 45B ATV	METHOD: MR	0 HOUR DTW: 2.0	BORING DEPTH: 21.0
START DATE: 12/23/02	FINISH DATE: 12/23/02	24 HOUR DTW: 2.0	WELL DEPTH: 20.0

DEPTH	BLOW COUNT 6in	6in	6in	6in	OVA (ppm)	LAB.	USCS	LOG	DEPTH	SOIL AND ROCK DESCRIPTION	WELL DETAIL
									0.0	LAND SURFACE	0.0
							SP			Tan, poorly graded, fine to med. SAND with few fines. Slight HCO from 1.5' to 4.5' and 8.0' to 12.0' bls. Moderate HCO from 4.5' to 8.0' bls.	4" Slot .010 SS
									20.0		20.0
							SC		21.0	Light green, fine to med., CLAYEY SAND with moderate plasticity.	21.0
										Boring Terminated at Depth 21.0 ft	

CATLIN BORING LOG 201-125.GPJ CATLIN.GDT 01/03/03

HP = Hydraulic Push NM = Not Measured

#2 Medium Sand

ATTACHMENT H2 -

BREEN GEOSCIENCE MANAGEMENT, INC. (BREEN)

TECHNICAL MEMORANDUM
"RESULTS INITIAL AQUIFER TESTING, 2" MONITORING WELLS,
TRUCK LOADING RACK"

FOR

LOADING RACK AREA

Technical Memorandum No. 3

To: ***Steve Tyler, Catlin Engineers & Scientists***

cc: ***Frank Van Ryn, Reiss Remediation***

From: ***Frank Breen, PG, Breen GeoScience Management, Inc.***

Date: ***March 13, 2003***

Subject: ***Results Initial Aquifer Testing, 2" Monitoring Wells, Truck Loading Rack***

The following technical memorandum outlines the results of the initial aquifer testing on the 2" monitoring well (KMW-8) located at the Truck Loading Rack (TLR, Figure 1). The purpose of this testing was to develop initial estimates of the transmissivity and specific yield (storativity) of the shallow unconfined aquifer in this area and to conduct initial groundwater flow model simulations of the capture zone of the proposed remedial system. Additional detailed aquifer testing and groundwater flow modeling will be conducted at the TLR following installation of the proposed groundwater extraction system presently being developed.

Aquifer Testing Approach and Results

Groundwater is present beneath the TLR under unconfined conditions approximately 5 to 8 feet below the groundwater surface. The aquifer testing[1] for the TLR was conducted by pumping monitoring well KMW-8 for approximately 1 day. Water level monitoring was conducted in the surrounding temporary observations wells OB-2; located 6 feet east of the pumping well, and OB-3 and OB-4; located 12 feet east and north, respectively, from the pumping well. The field data from the test is presented in Attachment 1. An initial pumping rate of 2 gallons per minute (gpm) was used for the initial 100 minutes of the pumping test. The pumping rate was then increased to 3 gpm and maintained at a constant rate until the end of the pumping test after 1530 minutes. Therefore, the time weighted pumping rate used in the test analysis was 2.93 gpm.

[1] Breen GeoScience Management, Inc., Draft Technical Memorandum No. 2, Initial Aquifer Testing, 2" Monitoring Wells, Truck Loading Rack, October 30.2002.

The aquifer test data was analyzed assuming unconfined aquifer conditions[2,3] using the Theis method for confined aquifer conditions. An evaluation of the unconfined aquifer correction was evaluated using the following relation:

$$s' = s - (s^2 / 2D)$$

Where:

s' = corrected drawdown for unconfined conditions (feet)

s = observed drawdown (feet)

D = unstressed aquifer saturated thickness (feet).

Application of the unconfined aquifer correction resulted in a negligible effect of the test results. For example, the thickness of the shallow aquifer in the TLR area is 20 feet, therefore, based on a drawdown of 1 foot in an observed well, the corrected drawdown would be 0.975 feet (a difference of 0.025 feet). Therefore, use of the Theis method for the unconfined shallow aquifer is reasonable since the drawdown observed in the observation wells was small compared with the total saturated thickness of the shallow unconfined aquifer.

In addition, the aquifer testing methods assume the following:

- the aquifer has a seemingly infinite areal extent,
- the aquifer is homogeneous and of uniform thickness over the area influenced by the test,
- prior to pumping, the watertable is horizontal over the area that will be influence by the test,
- the pumping well penetrates the entire aquifer and thus receives groundwater from the entire saturated thickness of the aquifer,

---

[2] Theis, C.V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Trans. Amer Geophys. Union, Vol. 16, pp. 519-524.

[3] Jacob, C.E., 1944, Notes of determining permeability by pumping tests under watertable conditions, USGS Open File Report, In: USGS Water Supply Paper 1536-1, 1963, pp. 245-271.

- the groundwater flow to the well is in an unsteady state,
- the influence of the unsaturated zone upon the drawdown in the aquifer is negligible,
- the observation wells are screened across the entire thickness of the aquifer, and
- the diameter of the pumping well and observation wells are small, i.e. storage in them can be neglected.

The model used to conduct this analysis was Aquifer^{Win32}, developed by Environmental Simulations, Inc.[4] A summary of the analysis results is presented in the following table, drawdown curves and model analysis results area presented in Attachment 2.

Observation Well	*Transmissivity (ft^2/day)*	*Hydraulic Conductivity (ft/day)**	*Specific Yield*	*Distance from Pumping Well (ft)*	*Test Type*
OB-2	174	8.7	0.24	6	drawdown, Theis
OB-3	201	10	0.11	12	drawdown, Theis
OB-4	277	14	0.10	12	drawdown, Theis

* ***Based on a average aquifer thickness of 20 feet.***

The average transmissivity of the shallow aquifer in the TLR, based on the analysis of OB-2, 3, and 4 was 217 ft^2/day. Based on an average aquifer thickness of 20 feet, the resulting average hydraulic conductivity was calculated to be approximately 11 ft/day, which represents a reasonable hydraulic conductivity for a predominately sand aquifer[5]. The calculated specific yield values are also consistent with a fine to medium unconfined sand aquifer.

Comparison of the transmissivities between OB-3, located 12 feet east of KMW-8, and OB-4, located 12 feet north of KMW-8, indicate a slightly higher hydraulic conductivity to the north than the east. This suggests the possibility of some degree of anisotropy in the shallow aquifer. A closer evaluation of the anisotropy in the shallow aquifer will be evaluated in the detailed performance testing of the TLR groundwater extraction system.

[4] Reference URL for Aquifer ^{Win32}, developed by Environmental Simulations, Inc. www.groundwatermodels.com

Additional Aquifer / Hydraulic Performance Testing

Following the installation of the proposed groundwater extraction system wells, detailed hydraulic and performance testing will be conducted. This testing will be done in order to obtain specific detailed data regarding the performance of the groundwater extraction system, and to determine if any modifications to the system need to be made in order to maintain hydraulic containment in the TLR area. The proposed performance testing will included, but not be limited to, the following elements:

- step testing on each extraction well to determine individual well performance,
- long term aquifer testing on a single well to measure the hydraulic parameters of the shallow groundwater system, and,
- sequential testing on each extraction well, following by long-term testing of the entire groundwater extraction system.

The focus of this initial testing was solely to conduct a "first pass" evaluation of the shallow aquifer in order to prepare an initial design of the extraction well system. This limited testing, while sufficient for an initial design, was insufficient to demonstrate, with a high degree of confidence, the overall system performance, and did not sufficiently stress the shallow aquifer system in order to measure aquifer parameters for the entire TLR area. In addition, the potential influence of partial penetration of KMW-8 and the observation wells and the influence of the Apex Line Sink cannot be adequately evaluated without additional detailed testing and groundwater flow modeling.

Capture Zone Analysis

A capture zone analysis was conducted by developing an analytical groundwater flow model using the same analysis methods, previously presented, that were used to analyze the aquifer test. The shallow aquifer was assumed to have a uniform thickness of 20 feet with an average hydraulic conductivity of 11

[5] Freeze, RA, and J.A. Cherry, Groundwater, Prentice Hall, Inc. NJ, 1979, Table 2.2, pg 29

ft/day based on the aquifer testing results. Model simulations were assumed to be under steady state conditions. Groundwater extraction wells were placed on the downgradient side of the TLR, just east of the railroad tracks. The apparent groundwater sink was simulated using a hydraulic head linesink (Apex linesink) with an assumed hydraulic head of 11 feet msl. The addition of the Apex linesink was necessary to accurately simulate the relatively steep hydraulic gradients observed across River Road (Figure 2).

The proposed recovery well system included four wells (LRRW-1, 2, 3 and 4) with two re-circulation trenches present upgradient of the TLR (Figure 3). The proposed pumping rate for the wells was 4, 6, 6, and 7 gpm, respectively, with all of the water (23 gpm) injected into the upgradient trenches to form a continuous hydraulic re-circulation system. The upgradient trenches were simulated using a flux dependent linesink with a negative flux in order to simulate injection of groundwater. The objectives of this system are two-fold:

- first, to maintain hydraulic containment of groundwater containing petroleum hydrocarbons from migrating across River Road, and

- second, to establish a *"closed-loop"* re-circulation system beneath the TLR in order to facilitate the removal of both free phase and dissolved phase hydrocarbon constituents present in the shallow aquifer system.

Model simulations of the four-well system indicated that hydraulic containment of the shallow groundwater can be achieved (Figure 4). Model simulations conducted to evaluate a three-well system indicated that under the simulated conditions, three extraction wells were sufficient of accomplished to stated objectives. However, a four-well recovery system (Figure 4) is recommended based on the following rationale:

- the uncertainty as to the cause of the Apex linesink,

- the observed seasonal fluctuations in groundwater levels across the site,
- the relatively thin aquifer thickness (approx. 20 feet),
- and the need for a high level of confidence in the TLC recovery system performance.

In addition, the four well recovery system has a number of advantages over the three well system, which include:

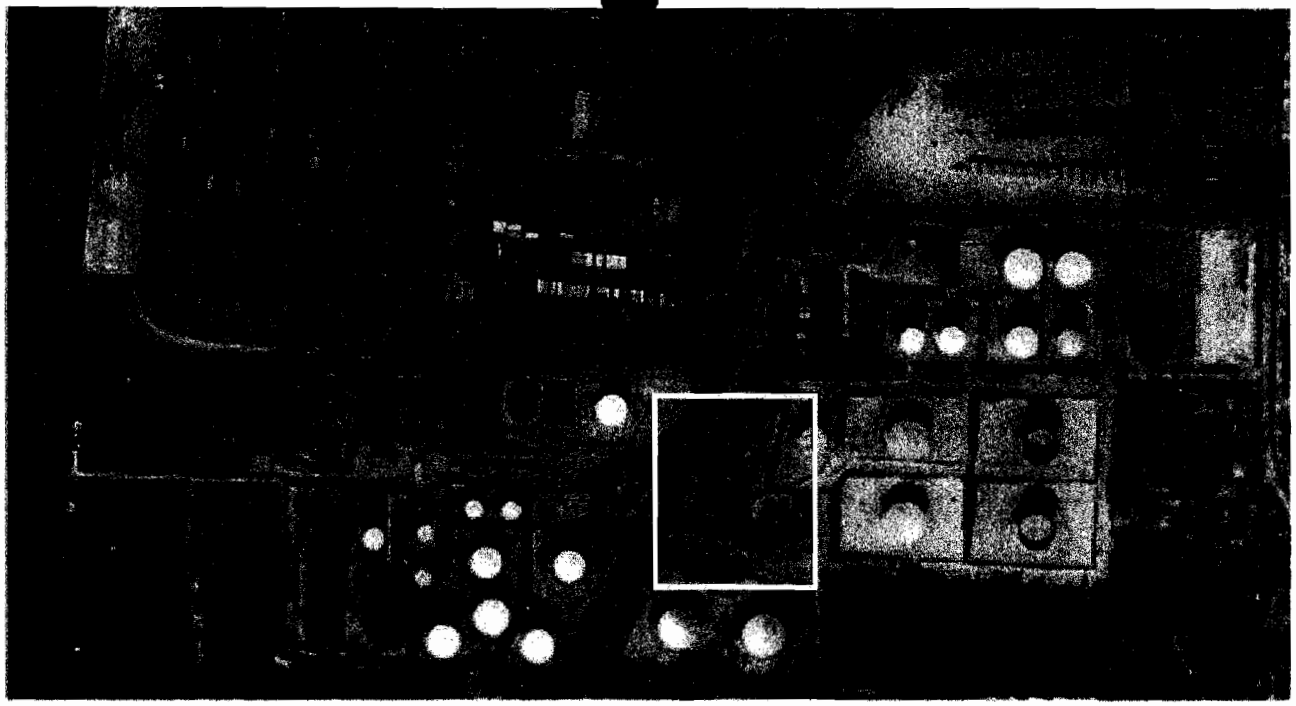
- a greater level of flexibility in modifying pumping rates and controlling groundwater flow,
- a higher level of confidence in maintaining hydraulic control along the down gradient portion of the TLR, and
- less pumping rate in each individual well resulting in less drawdown in each well and more available drawdown in the event that increased pumpage is required.

Based on the results of the initial 2" aquifer testing, the aquifer beneath the TLR can be characterized as a shallow unconfined aquifer with transmissivities ranging from 200 to 300 ft^2/day or a hydraulic conductivity of 11 ft/day, consistent with a fine to medium sand aquifer. Model simulations conducted to determine the best system for hydraulic containment of groundwater from the TLR indicated that a system containing four (4) extraction wells, screened across the entire thickness of the shallow aquifer, is the best method for preventing groundwater migration from the TLR from extending across River Road. Estimated pumping rates in each well ranged from 4 to 7 gpm, with a total estimated pumpage of approximately 23 gpm. Given the head drop across River road, the influence of the infiltration trench, and the need to maintain a high level of confidence in hydraulic containment with the minimum amount of pumpage and maximum amount of system flexibility, the 4 pumping well containment system is proposed.

Recommendations / Design Considerations

It is important to consider, however, that due to the uncertainties as to the cause of the Apex linesink, as well as the potential for seasonal fluctuations in groundwater levels or design changes to the infiltration trenches, additional pumping well (s) may be required. Detailed aquifer and system performance testing is recommended in order to obtain sufficient information to adequately evaluate possible alternatives and influences of these factors on the overall system performance. In addition, piezometers are recommended on the Apex property, down gradient of the TLR in order to determine the potential cause of the Apex linesink and to determine possible contingent actions.

FIGURES



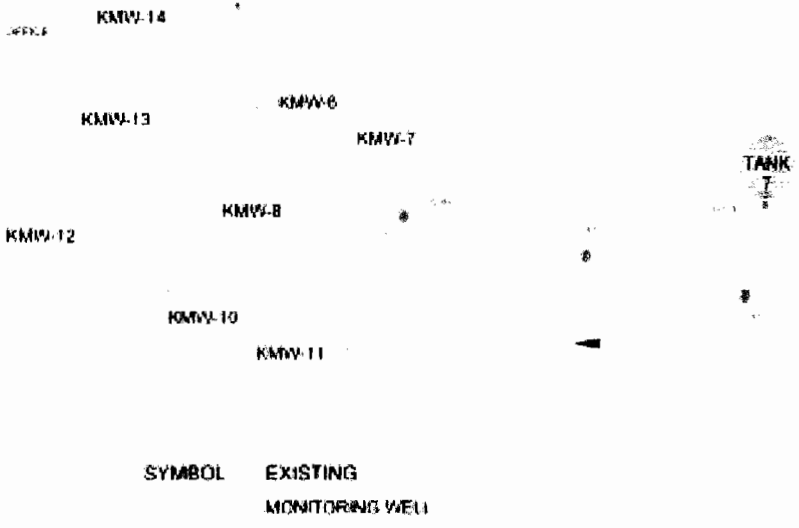


Figure 1
Truck Loading Rack, North Terminal
Flint Hills Resources, LP
Wilmington, NC

BREEN
GeoScience
Management, Inc.

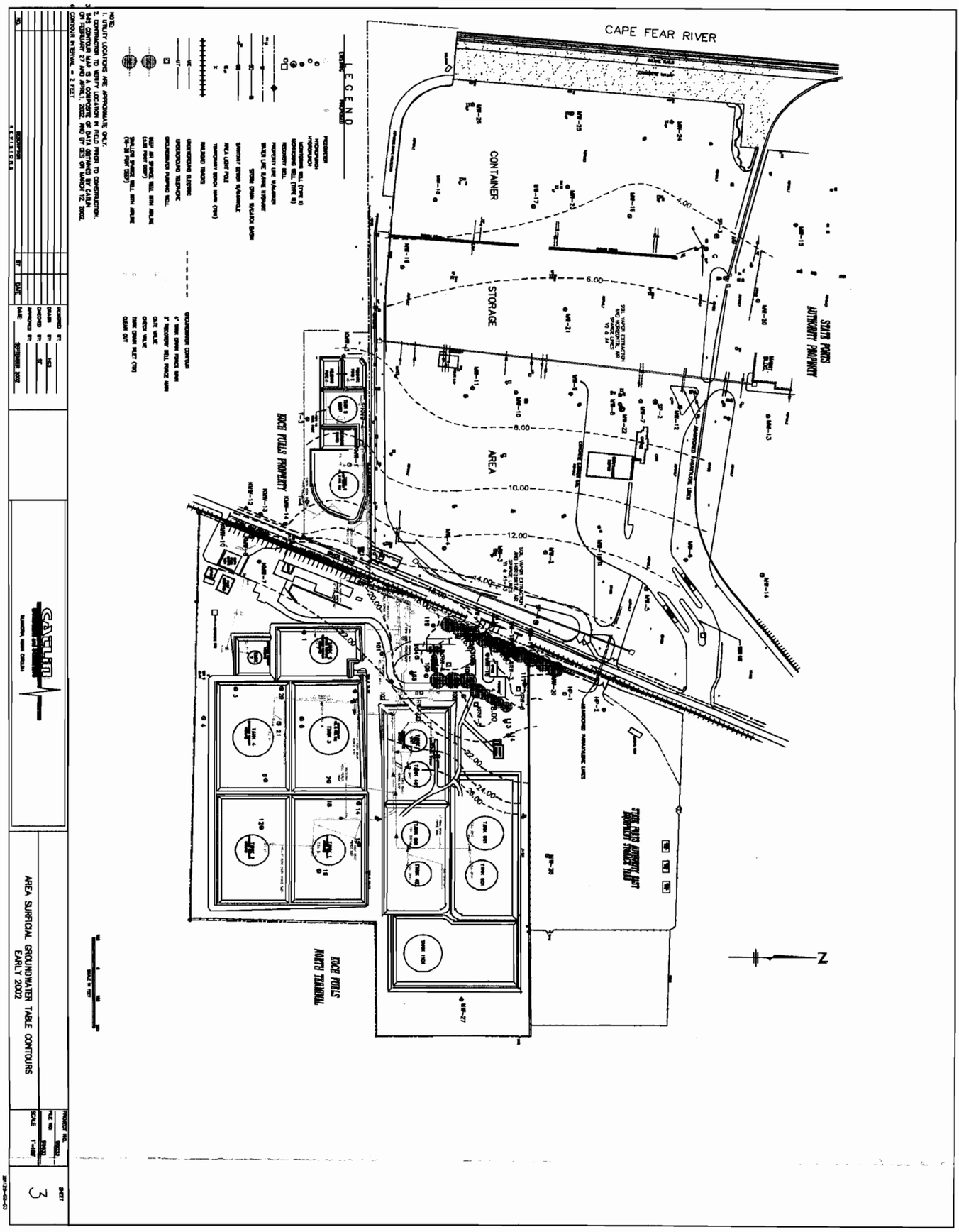
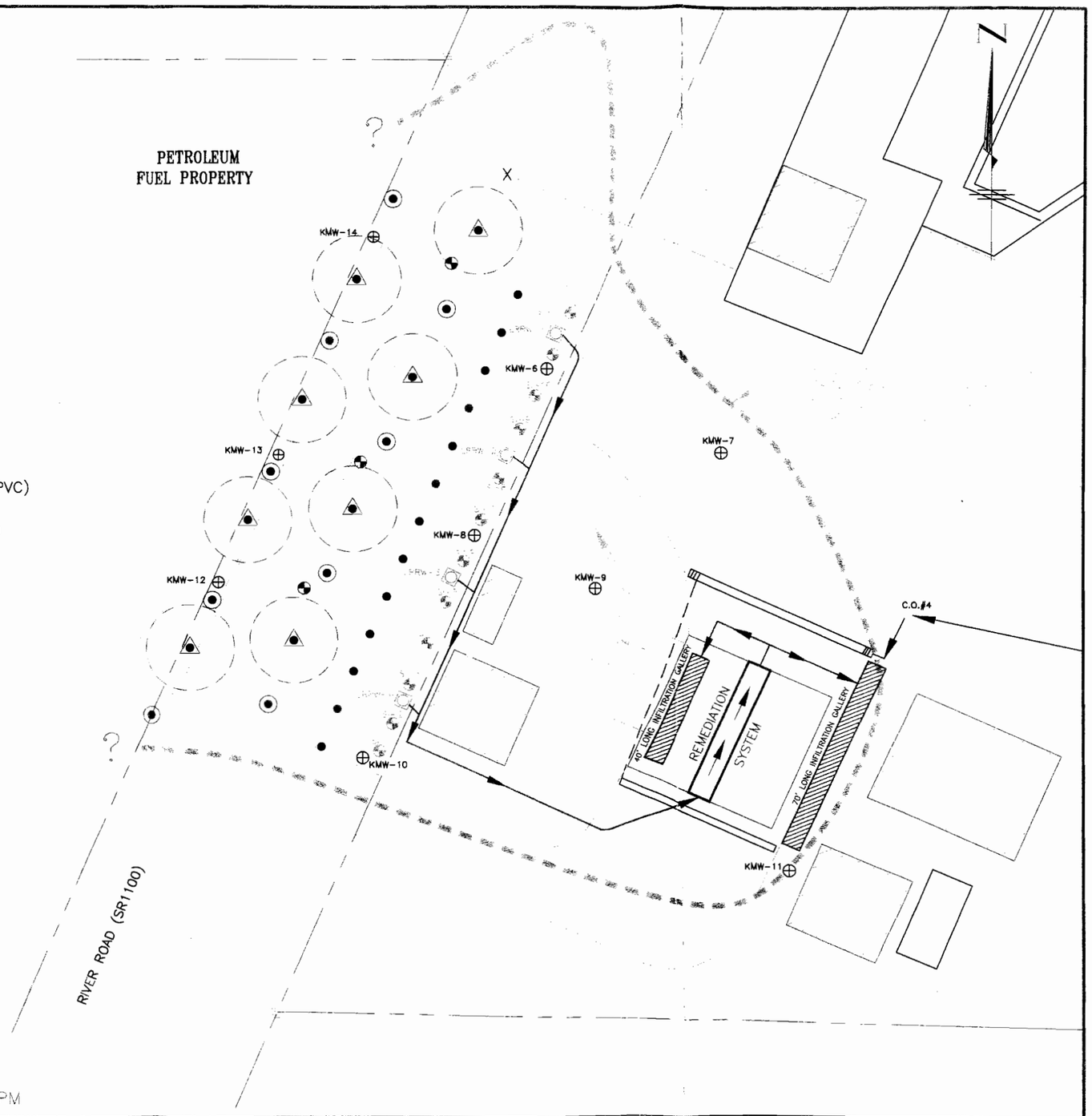


Figure 2
Area Surficial Groundwater Contours, Early 2002
Catlin Engineers and Scientists
Flint Hills Resources, LP, North Terminal
Wilmington, NC

BREEN GeoScience Management, Inc.

LEGEND

SYMBOL	DESCRIPTION
	HIGHWAY RIGHT OF WAY
	PROPERTY LINE W/MARKER
	POWER POLE
	FIRE HYDRANT
X	TEMPORARY BENCH MARK (TBM)
	RAILROAD TRACKS
	CLEAN OUT
⊕	EXISTING MONITORING WELL (TYPE II)
	NEW MONITORING WELL TO BE CONVERTED IN THE FUTURE TO SHALLOW 2" DIAMETER VERTICAL WELL (SCH. 40 PVC)
	NEW 4" DIAMETER RECOVERY WELL (STAINLESS STEEL)
●	PROPOSED SHALLOW 2" DIAMETER VERTICAL WELL (SCH. 40 PVC) (NOT PART OF THIS SCOPE)
◉	PROPOSED DEEP 2" DIAMETER VERTICAL WELL (SCH. 40 PVC) (NOT PART OF THIS SCOPE)
	PROPOSED 2" DIAMETER PROPAGATION POINT (STEEL) RADIUS OF PROPAGATION ESTIMATED AT 15 FEET (NOT PART OF THIS SCOPE)
	PROPOSED INFILTRATION GALLERY
	PROPOSED DISCHARGE PIPE LOCATION
	PROPOSED MONITORING WELL



NOTES:

1. ALL EXISTING MONITORING AND RECOVERY WELL LOCATIONS ARE APPROXIMATE AND BASED ON FIELD MEASUREMENTS.
2. ESTIMATED EXTENT OF SITE SURFICIAL GROUNDWATER CONCENTRATIONS IN EXCESS OF CURRENT 2L STANDARDS ARE BASED ON DATA PROVIDED IN CAPA DATED AUGUST 9, 2002 AND COLLECTED ON 2/27/02.
3. AREA OF TRENCHING MAY HAVE VARIOUS UNDERGROUND UTILITIES/PIPELINES IN THE VICINITY OF THE PROPOSED SYSTEM COMPONENTS. FIELD UTILITY LOCATION IS TO BE CONDUCTED PRIOR TO ANY EXCAVATION ACTIVITIES.

NOTE: FIGURE ADAPTED FROM CATLIN SHEET NO. 6
PARTICLE TRACKS BASED ON BGM GROUNDWATER FLOW MODEL.
TOTAL TRENCH INFILTRATION RATE = 24 GPM
PUMPING RATES FOR EXTRACTION WELLS:
LRRW-1 = 4 GPM, LRRW-2 = 6 GPM, LRRW-3 = 6 GPM, LRRW-4 = 7 GPM

NO.	DESCRIPTION	BY	DATE
	REVISIONS		

DESIGNED BY: JKB
DRAWN BY: WHW
CHECKED BY: SAT
APPROVED BY: JKB
DATE: MARCH 2003

DRAFT
NOT FOR CONSTRUCTION

BREEN GeoScience Management, Inc.

PROJECT
FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE
GROUNDWATER REMEDIATION SYSTEM
PROPOSED ACTIVE REMEDIATION SYSTEM LAYOUT AT LOADING DOCK

KochNT_TM3Fig2.dwg

JOB NO. 201125-NON DISCHARGE PERMIT

FIGURE
3

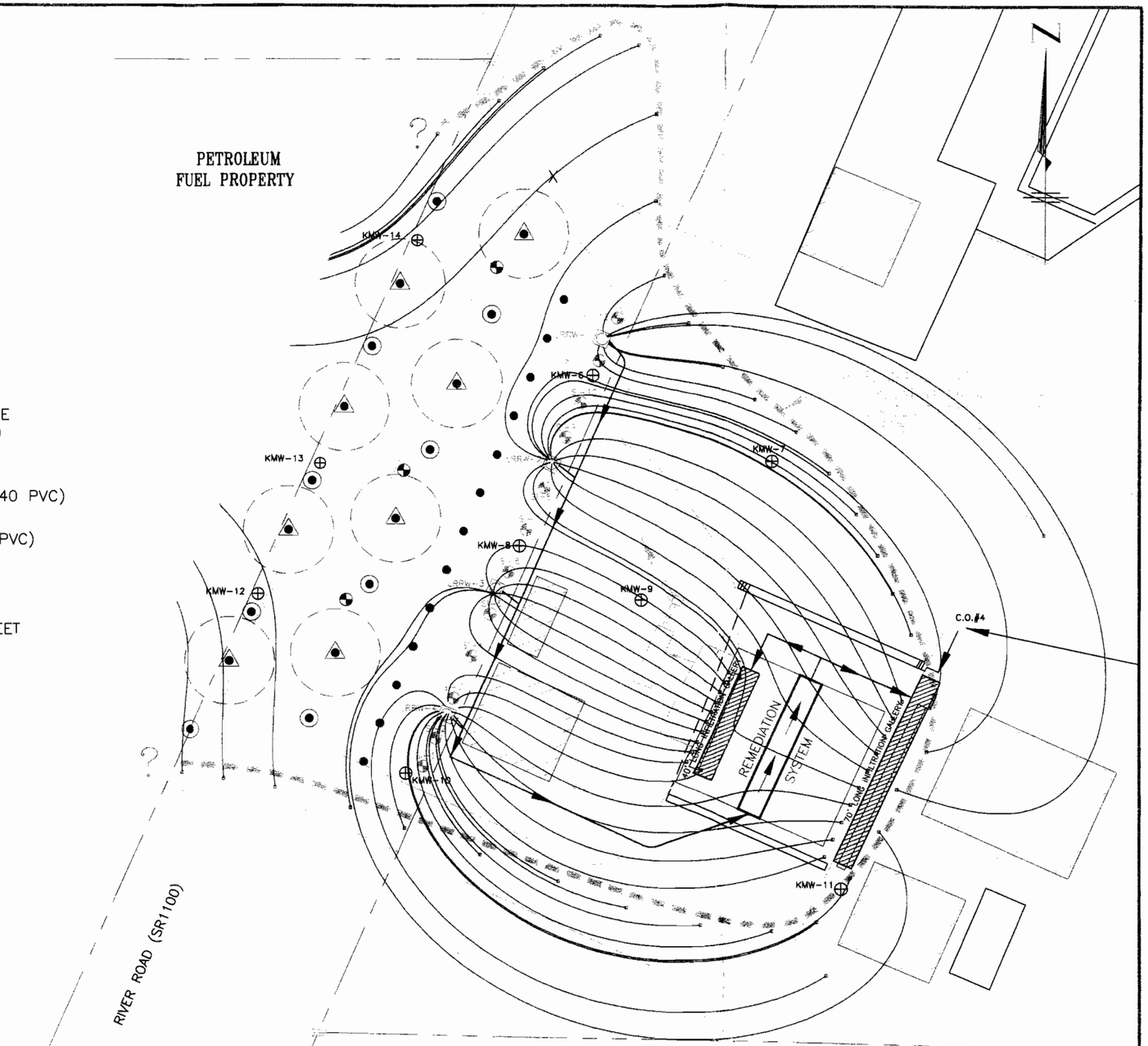
LEGEND

SYMBOL	DESCRIPTION
	HIGHWAY RIGHT OF WAY
	PROPERTY LINE W/MARKER
	POWER POLE
	FIRE HYDRANT
X	TEMPORARY BENCH MARK (TBM)
	RAILROAD TRACKS
	CLEAN OUT
⊕	EXISTING MONITORING WELL (TYPE II)
	NEW MONITORING WELL TO BE CONVERTED IN THE FUTURE TO SHALLOW 2" DIAMETER VERTICAL WELL (SCH. 40 PVC)
	NEW 4" DIAMETER RECOVERY WELL (STAINLESS STEEL)
●	PROPOSED SHALLOW 2" DIAMETER VERTICAL WELL (SCH. 40 PVC) (NOT PART OF THIS SCOPE)
◉	PROPOSED DEEP 2" DIAMETER VERTICAL WELL (SCH. 40 PVC) (NOT PART OF THIS SCOPE)
	PROPOSED 2" DIAMETER PROPAGATION POINT (STEEL) RADIUS OF PROPAGATION ESTIMATED AT 15 FEET (NOT PART OF THIS SCOPE)
	PROPOSED INFILTRATION GALLERY
	PROPOSED DISCHARGE PIPE LOCATION
	PROPOSED MONITORING WELL

NOTES:

1. ALL EXISTING MONITORING AND RECOVERY WELL LOCATIONS ARE APPROXIMATE AND BASED ON FIELD MEASUREMENTS.
2. ESTIMATED EXTENT OF SITE SURFICIAL GROUNDWATER CONCENTRATIONS IN EXCESS OF CURRENT 2L STANDARDS ARE BASED ON DATA PROVIDED IN CAPA DATED AUGUST 9, 2002 AND COLLECTED ON 2/27/02.
3. AREA OF TRENCHING MAY HAVE VARIOUS UNDERGROUND UTILITIES/PIPELINES IN THE VICINITY OF THE PROPOSED SYSTEM COMPONENTS. FIELD UTILITY LOCATION IS TO BE CONDUCTED PRIOR TO ANY EXCAVATION ACTIVITIES.

NOTE: FIGURE ADAPTED FROM CATLIN SHEET NO. 6
PARTICLE TRACKS BASED ON BGM GROUNDWATER FLOW MODEL.
TOTAL TRENCH INFILTRATION RATE = 24 GPM
PUMPING RATES FOR EXTRACTION WELLS:
LRRW--1 = 4 GPM, LRRW--2 = 6 GPM, LRRW--3 = 6 GPM, LRRW--4 = 7 GPM



NO.	DESCRIPTION	BY	DATE
	REVISIONS		

DESIGNED BY: JKB
DRAWN BY: WHW
CHECKED BY: SAT
APPROVED BY: JKB
DATE: MARCH 2003

DRAFT
NOT FOR CONSTRUCTION

BREEN GeoScience Management, Inc.

PROJECT
FLINT HILLS RESOURCES, LP
NORTH TERMINAL
RIVER ROAD
WILMINGTON, N.C.

TITLE
GROUNDWATER REMEDIATION SYSTEM
PROPOSED ACTIVE
REMEDIATION SYSTEM LAYOUT
AT LOADING DOCK

KochNT_TM3Fig2.dwg

JOB NO.
201125-NON DISCHARGE PERMIT

FIGURE
4

ATTACHEMENT 1

FAX Transmission from.....

CATLIN
ENGINEERS and SCIENTISTS

CATLIN Engineers and Scientists
P.O. Box 10279 • Wilmington, NC 28404-0279
220 Old Dairy Road • Wilmington, NC 28405
Phone (910) 452-5861
Fax (910) 452-7563

TO: FRANK **COMPANY:**

FROM: STEVE TYLER

DATE: 11-5-02 **CATLIN Project No.:**

SUBJECT: PUMP TEST

☐ Per Your Request ☑ For Your Review ☐ Please Comment ☐ Reply ASAP ☐ Urgent

TOTAL NUMBER OF PAGES, INCLUDING COVER: 7

COMMENTS: ANY QUESTIONS PLEASE CALL

DESTINATION FAX NO. 800-471-4853

"Virtually Anywhere"
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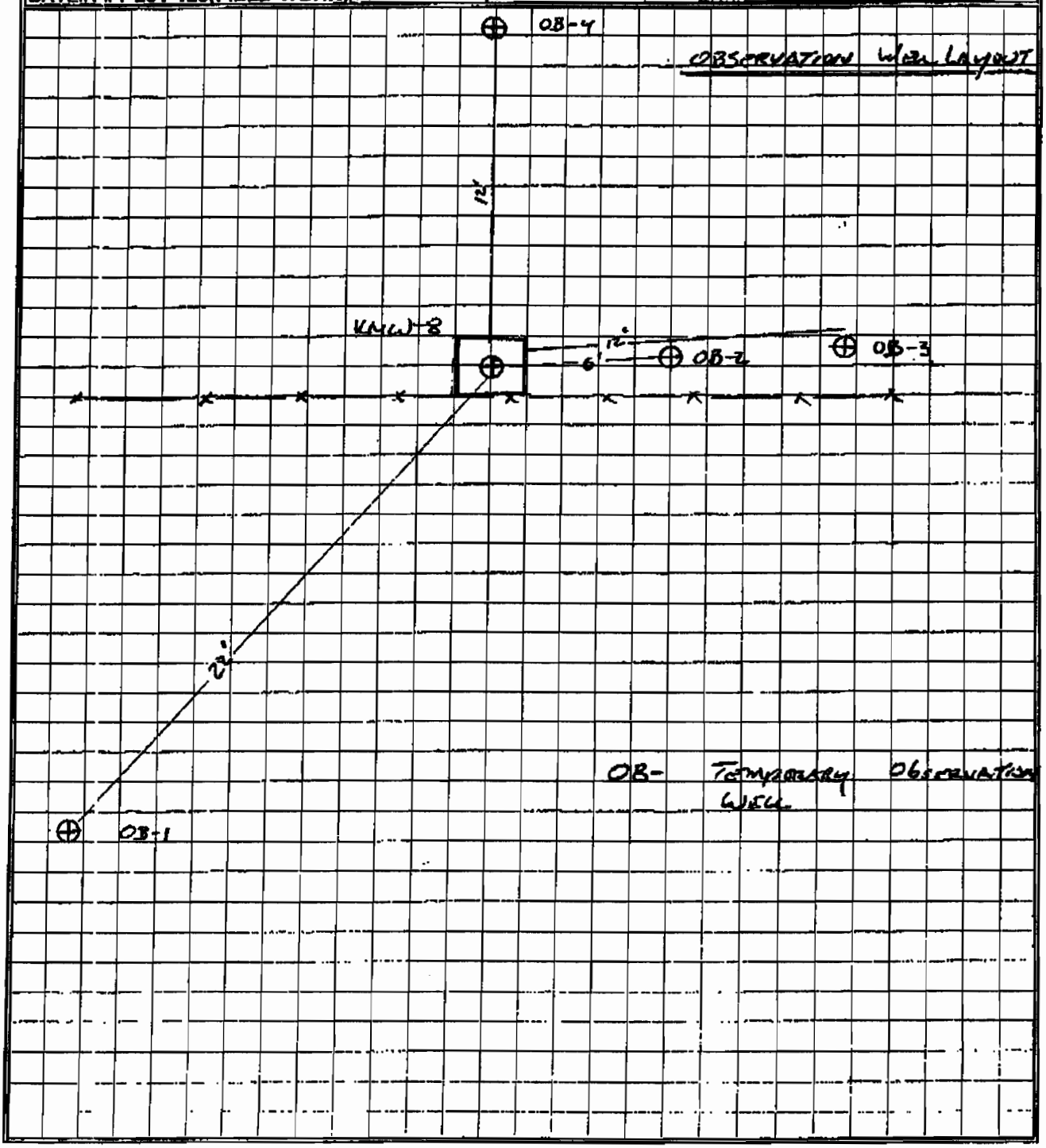
CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT:
FHR North Terminal
CATLIN # : 201-126(FIELD WORK)

Drawn/Calculated by: STAFF
Date: 11/1/02
Reviewed by:



CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT: FHR North Terminal
CATLIN #: 201-125(FIELD WORK)

Drawn/Calculated by: S.T.
Date: 10/1/02 CLEAR 60's FRIDAY
Reviewed by:

SURROUNDING GW DATA

Loading Rack Area Pump Test

Test Well KMW-8
2" Diameter 11.09' Total Well Depth
Using a REDI Flo 2 Electric submersible pump
Discharge pumped to site Groundwater Treatment Plant

	TIME	KMW-8	KMW-6	KMW-10	KMW-7	OB-1	OB-2	OB-3	OB-4	KMW-12	KMW-13
	Initial										
10/1/02	0630	1.96	1.90	1.82	1.54	2.52	3.24	3.23	2.29	10.69	10.30
	0700	Started pump Test @ 2 GPM									
	0900	5.42	1.90	1.81	1.55	2.72	3.41	3.50	2.54	10.68	10.30
		Changed pump rate to 3 GPM									
	1100	7.03	1.92	1.82	1.54	2.81	3.81	3.61	2.65	10.69	10.30
	1300	7.40	1.94	1.81	1.56	2.82	3.87	3.67	2.66	10.69	10.30
	1500	7.54	1.98	1.85	1.60	2.91	3.96	3.75	2.72	10.71	10.32
	1600	7.58	2.00	1.85	1.61	2.93	3.98	3.77	2.75	10.71	10.32
	1700	7.63	2.01	1.86	1.61	2.95	4.01	3.80	2.76	10.71	10.31
	1800	7.64	2.03	1.87	1.61	2.97	4.02	3.80	2.77	10.71	10.31
11/2/02	0830	8.01	2.15	1.96	1.71	3.16	4.25	4.02	2.95	10.76	10.37
50.6°	0900	8.02									
Clear	0930	8.02	2.15	1.97	1.71	3.16	4.25	4.02	2.95	10.77	10.36
		Turned off pump									
	0954		2.15	1.93					2.85		
	1000		2.13	1.93	1.70	2.92	3.95	3.86	2.82	10.74	10.35
	1030		2.12	1.94	1.70	2.87	3.86	3.77	2.75	10.75	10.36
	1100		2.12	1.95	1.70	2.84	3.82	3.74	2.73	10.76	10.36
	1500		2.04	1.94	1.70	2.76	3.59	3.55	2.58	10.76	10.36

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT:
FHR North Terminal
CATLIN # : 201-125(FIELD WORK)

Drawn/Calculated by: Steve T.
Date: 11/1/02 / 11/4/02
Reviewed by:

Start-up Pumping @ Rack-8

INTERVAL	READING (FEET)		INTERVAL	READING (FEET)
0 SEC.	1.96	26 GPM	7 MIN 0 SEC	5.17
5	2.40		7 20	5.18
10	2.85		7 40	5.18
15	4.00		8 00	5.18
20	4.50		8 20	5.19
25	4.34		8 40	5.19
30	4.58		9 00	5.20
35	4.75		9 20	5.21
40	4.84		9 40	5.21
45	4.87		10 00	5.22
50	4.90		10 30	5.23
55	4.91		11 00	5.23
60	4.92		11 30	5.24
1 MIN 20 SEC	4.95		12 00	5.25
1 40	5.00		12 30	5.25
2 00	5.01		13 00	5.26
2 20	5.03		13 30	5.26
2 40	5.06		14 00	5.26
3 00	5.08		14 30	5.27
3 20	5.10		15 00	5.27
3 40	5.10		15 30	5.28
4 00	5.11		16 00	5.29
4 20	5.13		16 30	5.29
4 40	5.14		17 00	5.29
5 00	5.14		17 30	5.30
5 20	5.15		18 00	5.30
5 40	5.15		18 30	5.30
6 00	5.16		19 00	5.31
6 20	5.16		19 30	5.31
6 40	5.17		20 00	5.31

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT: FHR North Terminal
CATLIN # : 201-125(FIELD WORK)

Drawn/Calculated by: STEVE TYLER
Date: 11/1/02 / 11/4/02
Reviewed by:

RECOVERY WELL MEASUREMENTS CONTINUED

INTERVAL	READING (FEET)	
22 MIN	5.31	NOTE: WE HAD A PROBLEM MONITORING THE BEGINNING TO 1 HOUR TIME FRAME DEPTH TO WATER @ MW-8. SO THE JUMP TEST WAS RESTART ON 11/4/02 FOR 2 HOURS. AFTER CORRECTING FOR THE DTW OF 1.96 (11/1/02) AS OPPOSED TO 2.21 OF (11/4/02) THE MEASURING DRAWDOWN NUMBERS WERE ALMOST THE SAME.
24	5.32	
26	5.32	
28	5.32	
30	5.33	
32	5.35	
34	5.37	
36	5.38	
38	5.39	
40	5.40	
42	5.41	
1 hr 10 min	5.41	
1 20	5.41	
1 30	5.42	
1 40	5.42	← RESET PUMP TO 3 GPM @ 2 hrs
2 hr 10 min	6.93	
2 40	7.03	
3 10	7.09	
3 40	7.15	
4 10	7.20	
4 40	7.26	
5 10	7.31	
5 40	7.36	
6 10	7.40	
6 40	7.44	
7 10	7.48	
8 10	7.52	11/2/02
9 10	7.58	
10 10	7.63	25 hr 30 min 8.01
11 10	7.64	26 hr 8.02
		26 hr 30 min 8.02

600 MIN.

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT: FHR North Terminal
CATLIN # : 201-125(Field Work)

Drawn/Calculated by: S.T. / J.B.
Date: 11/2/02
Reviewed by:

- Shut-down Pumping on KMW-B at 0930

The following are recovery measurement in KMW-B starting @ 2.91 GPM

Interval	Depth Reading
0	8.02
5 sec	7.60
10 sec	7.28
15 sec	6.95
20 sec	6.48
25 sec	6.08
30 "	5.68
35 "	5.30
40 "	4.92
45 "	4.55
50 "	4.21
55 "	3.83
60 "	3.62
1min 20sec	3.40
1-40	3.15
2-0	2.95
2-20	2.85
2-40	2.78
3-0	2.75
3-20	2.74
3-40	2.73
4-0	2.72
4-20	2.71
4-40	2.71
5-0	2.70
5-20	2.69
5-40	2.68
6-0	2.67
6-20	2.66
6-40	2.66

Interval	Reading
7min-0sec	2.66
7-20	2.66
7-40	2.65
8-0	2.64
8-20	2.63
8-40	2.63
9-0	2.62
9-20	2.61
9-40	2.61
10-0	2.60
10-30	2.59
11-0	2.59
11-30	2.59
12-0	2.58
12-30	2.58
13-0	2.57
13-30	2.57
14-0	2.57
14-30	2.57
15-0	2.57
15-30	2.56
16-0	2.56
16-30	2.56
17-0	2.56
17-30	2.56
18-0	2.55
18-30	2.55
19-0	2.55
19-30	2.54
20-0	2.54

CATLIN ENGINEERS and SCIENTISTS WILMINGTON, NORTH CAROLINA

SKETCH/COMPUTATION SHEET

CATLIN PROJECT: FHR North Terminal
CATLIN # : 201-125(Field Work)

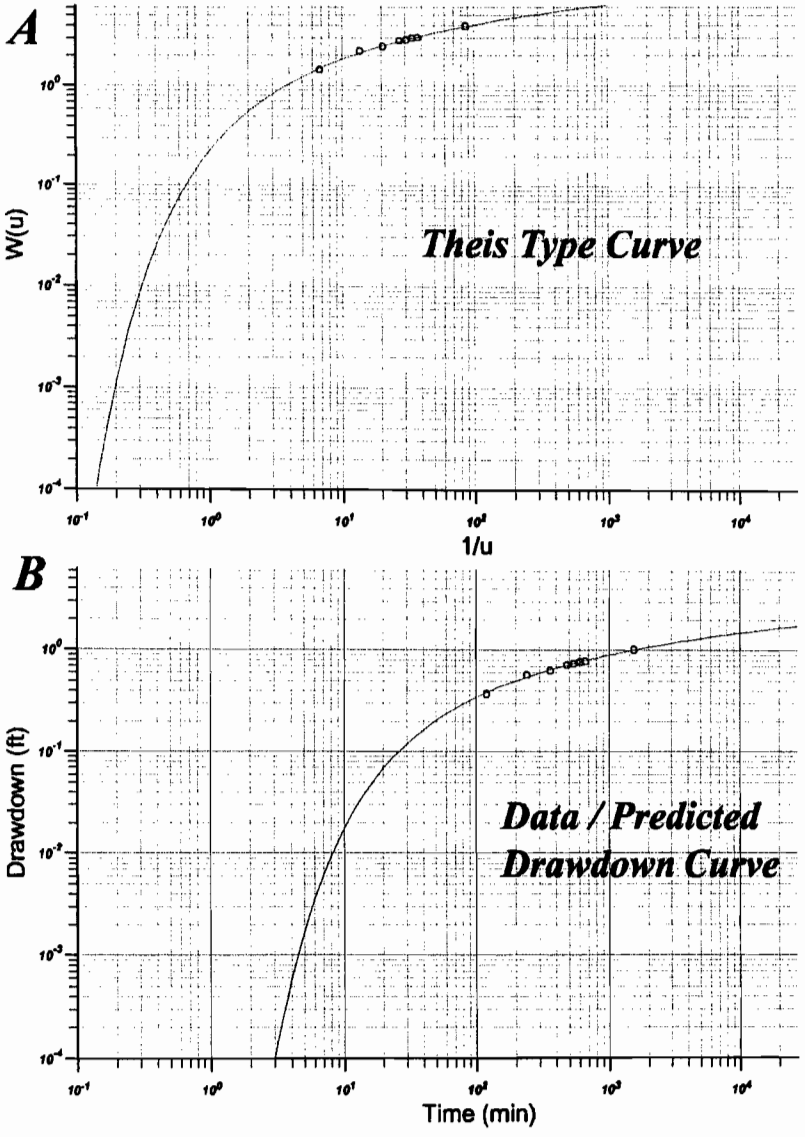
Drawn/Calculated by: ST
Date: 11/2/02
Reviewed by:

Recovery Measurements Continued

Interval	Reading
22 min	2.53
24	2.52
26	2.51
28	2.50
30	2.49
35	2.48
40	2.46
45	2.44
50	2.43
55	2.42
60	2.41
1:10	2.40
1:20	2.38
1:30	2.37
100 1:40	2.36
2:10	2.33
220 2:40	2.31
3:10	2.29
240 3:40	2.27
4:10	2.25
360 4:40	2.23
5:10	2.22
480 5:40	2.21
6:10	2.21
600 6:40	2.21

ATTACHEMENT 2

DRAWDOWN OB-2



Theis Equations

Transmissivity

$$T = \frac{Q}{4\pi(\Delta s)} W(u)$$

Storativity / Specific Yield

$$S = \frac{4Tut}{r^2}$$

where:

T = aquifer transmissivity (ft^2/day)
Q = pumping rate (ft^3/day)
Δs = drawdown at match point (ft)
W(u) = theis well function at match point on type curve
S = aquifer storativity (dimensionless)
t = elapsed time at match point (days)
r = radial distance to pumping well (ft)
u = well function constant

Match Point:

Type Curve
W(u) = 1.0 x 10^{-4}
1/u = 0.1; u = 10

Data Curve
t = 1.773649 min (0.0012317 days)
s = 2.5858 x 10^{-5} ft

Theis Calculations

Transmissivity

$$T = \frac{564.064\ ft^3/day}{4x3.14159(2.5858x10^{-5}\ ft)} 1.0x10^{-4}$$

$$T = 173.59\ ft^2/day$$

Storativity / Specific Yield

$$S = \frac{4x173.59\,ft^2/day\ x\ 10\ x\ 0.0012317\ days}{(6\ ft)^2}$$

$$S = 0.2376$$

Figure 1
Type Curve and Data (Predicted) Drawdown Curve
Observation Well OB-2
Truck Loading Rack, North Terminal
Flint Hills Resource, LP
Wilmington, NC

BREEN GeoScience Management, Inc.

AQUIFERWIN32 ANALYSIS SUMMARY FILE

Selected Analysis: Theis, 1935 (Confined)

Constant discharge from a fully penetrating well in a nonleaky aquifer

SITE INFORMATION

Site Designator: Flint Hill Resources, Truck Loading Rack Area
Job Number: BGM: Koch Regional Modeling
Client: Reiss Remediation
Site Name: Koch North Terminal, Wilmington, NC
Additional Info:
Aquifer test conducted at the Truck Loading Rack Area (TLR) located in the southern portion of the Flint Hills Terminal in Wilmington, North Carolina. The TRL is located along River Road immediately east (upgradient) of the Apex Terminal.

AQUIFER TEST INFORMATION

Test Designator: Truck Loading Rack 2" MW Aquifer Test
Job Number: BGM:Koch North Terminal Regional Model
Date: BGM Evaluation 10/02
Area Name: Truck Loading Area
Additional Info:
The aquifer testing was conducted by pumping the 2" monitoring well KMW-8 at a time weighted pumping rate of 2.9 gpm for a duration of 1530 minutes. Drawdown was recorded in observation well OB-2 located 6 feet east of KMW-8.

PUMP TEST DETAILS

Pumping Well KMW-8

Pumping Rates

Index	Time (min)	Rate (gal/min)
0	0.000000e+000	2.000000e+000
1	1.000000e+002	3.000000e+000

Monitored Wells

OB-2

ANALYSIS INFORMATION

Analysis Designator: Theis Analysis with Unconfined Aquifer Modification
Job Number: Breen GeoScience Management, Inc.
Date: December, 2002
Analyst Name: F.A. Breen, PG
Additional Info:
Analysis of drawdown in observation well OB-2.

ANALYSIS SUMMARY

Optimization Parameters

Convergence Criteria 0.000010
Maximum Iterations 100

Derivative Fraction	0.050000
Zero Derivative Value	0.000100
Derivative Type	Central
Lambda Value	0.001000

Number of Points = 8 Optimized Match

ANALYSIS PARAMETERS

Radial Distance
- Fixed Value = 6 ft

Pumping Rate
- Fixed Value = 2.93 gal/min

Transmissivity
- Calculated Value = 173.59 sq ft/d
  - Calculation Specifics:
    - Initial Guess = 173.59 sq ft/d
    - Enforced Minimum = 0.1 sq ft/d

Storage Coefficient
- Calculated Value = 0.237567
  - Calculation Specifics:
    - Initial Guess = 0.237567
    - Enforced Minimum = 0

ANALYSIS STATISTICS

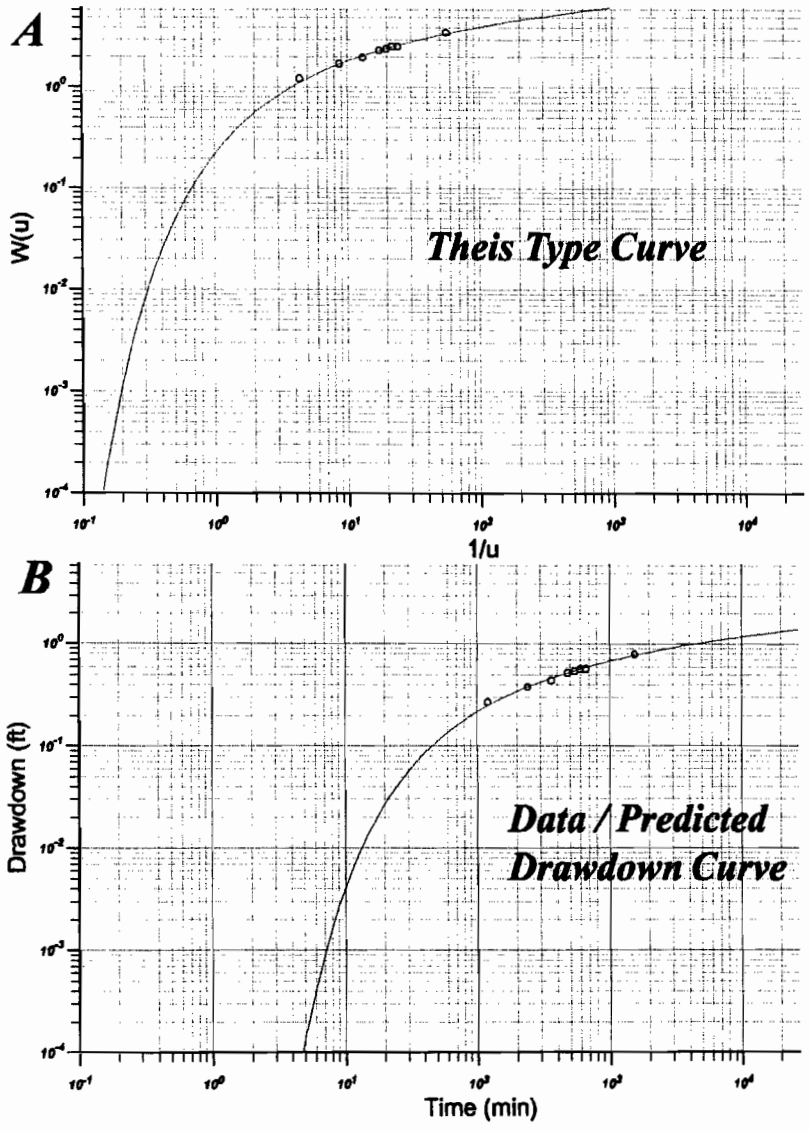
Match Point:
- Type Curve: (1.000000e-001, 1.000000e-004)
- Data Curve: (1.773649e+000, 2.585800e-005)

Residual Mean	= -0.000048
Residual Standard Dev.	= 0.012443
Residual Sum of Squares	= 0.001239
Absolute Residual Mean	= 0.009710
Minimum Residual	= -0.012830
Maximum Residual	= 0.026890

DATA DETAIL

Index	Time (min)	Obs. Drawdown (ft)	Calc. Drawdown (ft)	Residual
0	1.200000e+002	3.700000e-001	3.819654e-001	-1.196537e-002
1	2.400000e+002	5.700000e-001	5.431096e-001	2.689044e-002
2	3.600000e+002	6.300000e-001	6.417770e-001	-1.177701e-002
3	4.800000e+002	7.200000e-001	7.130486e-001	6.951415e-003
4	5.400000e+002	7.400000e-001	7.424616e-001	-2.461594e-003
5	6.000000e+002	7.700000e-001	7.688695e-001	1.130482e-003
6	6.600000e+002	7.800000e-001	7.928296e-001	-1.282965e-002
7	1.530000e+003	1.010000e+000	1.006326e+000	3.674229e-003

DRAWDOWN OB-3



Theis Equations

Transmissivity

$$T = \frac{Q}{4\pi(\Delta s)} W(u)$$

Storativity / Specific Yield

$$S = \frac{4Tut}{r^2}$$

where:

- T = aquifer transmissivity (ft^2/day)
- Q = pumping rate (ft^3/day)
- Δs = drawdown at match point (ft)
- W(u) = theis well function at match point on type curve
- S = aquifer storativity (dimensionless)
- t = elapsed time at match point (days)
- r = radial distance to pumping well (ft)
- u = well function constant

Match Point:

- Type Curve
  - $W(u) = 1.0 \times 10^{-4}$
  - 1/u = 0.1; u = 10
- Data Curve
  - t = 2.758413 min (0.001915565days)
  - $s = 2.227727 \times 10^{-5}$ ft

Theis Calculations

Transmissivity

$$T = \frac{564.064\ ft^3/day}{4x3.14159(2.227727x10^{-5}\ ft)} 1.0x10^{-4}$$

$$T = 201.49\ ft^2/day$$

Storativity / Specific Yield

$$S = \frac{4 \times 201.49\,ft^2/day \times 10 \times 0.0019156\ days}{(12\ ft)^2}$$

$$S = 0.1072$$

BREEN GeoScience Management, Inc.

Figure 2
Type Curve and Data (Predicted) Drawdown Curve
Observation Well OB-3
Truck Loading Rack, North Terminal
Flint Hills Resource, LP
Wilmington, NC

AQUIFERWIN32 ANALYSIS SUMMARY FILE
Observation Well OB-3

Selected Analysis: Theis, 1935 (Confined)

Constant discharge from a fully penetrating well in a nonleaky aquifer

SITE INFORMATION

Site Designator: Flint Hill Resources, Truck Loading Rack Area
Job Number: BGM: Koch Regional Modeling
Client: Reiss Remediation
Site Name: Koch North Terminal, Wilmington, NC
Additional Info:
Aquifer test conducted at the Truck Loading Rack Area (TLR) located in the southern portion of the Flint Hills Terminal in Wilmington, North Carolina. The TRL is located along River Road immediately east (upgradient) of the Apex Terminal.

AQUIFER TEST INFORMATION

Test Designator: Truck Loading Rack 2" MW Aquifer Test
Job Number: BGM:Koch North Terminal Regional Model
Date: BGM Evaluation 10/02
Area Name: Truck Loading Area
Additional Info:
The aquifer testing was conducted by pumping the 2" monitoring well KMW-8 at a time weighted pumping rate of 2.9 gpm for a duration of 1530 minutes. Drawdown was recorded in observation well OB-3 located 12 feet east of KMW-8.

PUMP TEST DETAILS

Pumping Well KMW-8

Pumping Rates

Index	Time (min)	Rate (gal/min)
0	0.000000e+000	2.000000e+000
1	1.000000e+002	3.000000e+000

Monitored Wells

OB-3

ANALYSIS INFORMATION

Analysis Designator: Theis Analysis with Unconfined Aquifer Modification
Job Number: Breen GeoScience Management, Inc.
Date: December, 2002
Analyst Name: F.A. Breen, PG
Additional Info:
Analysis of drawdown in observation well OB-3.

ANALYSIS SUMMARY

Optimization Parameters

Convergence Criteria 0.000010

Maximum Iterations	100
Derivative Fraction	0.050000
Zero Derivative Value	0.000100
Derivative Type	Central
Lambda Value	0.001000

Number of Points = 8 Optimized Match

ANALYSIS PARAMETERS

Radial Distance
- Fixed Value = 12 ft

Pumping Rate
- Fixed Value = 2.93 gal/min

Transmissivity
- Calculated Value = 201.491 sq ft/d
  - Calculation Specifics:
    - Initial Guess = 201.494 sq ft/d
    - Enforced Minimum = 0.1 sq ft/d

Storage Coefficient
- Calculated Value = 0.107214
  - Calculation Specifics:
    - Initial Guess = 0.107212
    - Enforced Minimum = 0

ANALYSIS STATISTICS

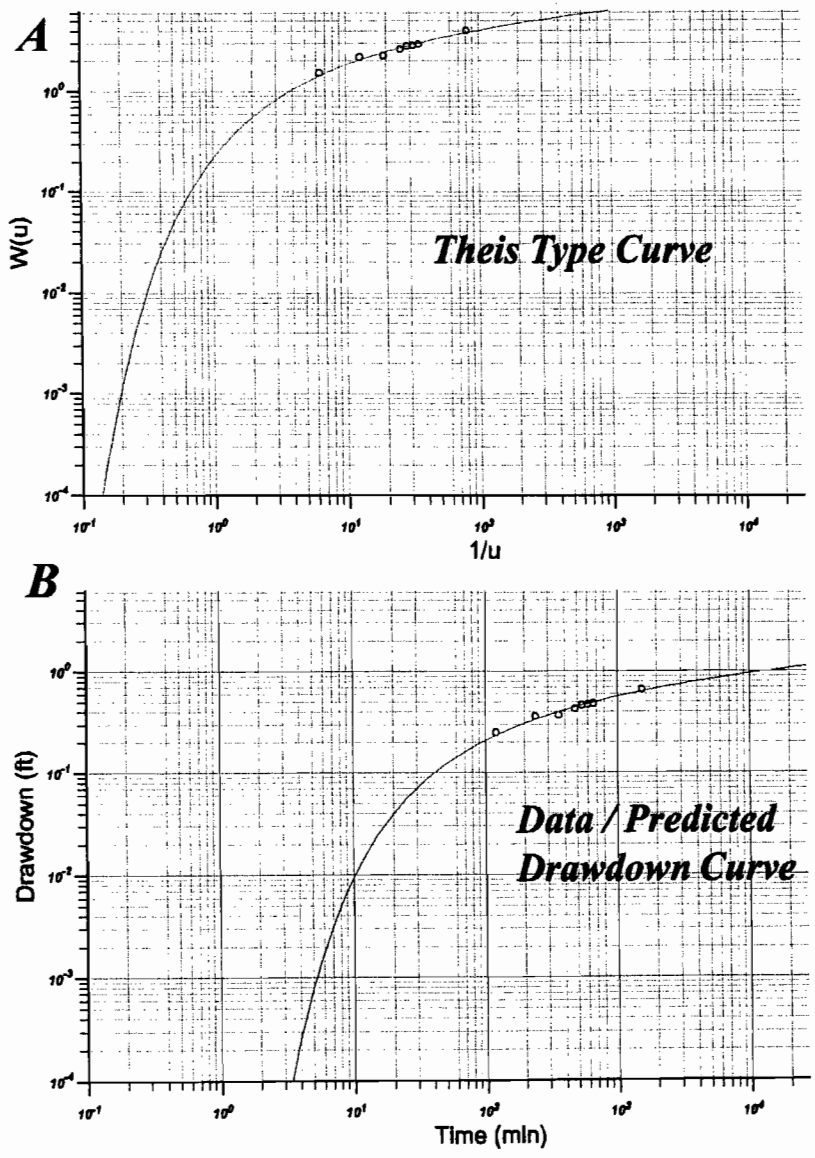
Match Point:
- Type Curve: (1.000000e-001, 1.000000e-004)
- Data Curve: (2.758413e+000, 2.227727e-005)

Residual Mean	= 0.000348
Residual Standard Dev.	= 0.014520
Residual Sum of Squares	= 0.001688
Absolute Residual Mean	= 0.011347
Minimum Residual	= -0.020432
Maximum Residual	= 0.022647

DATA DETAIL

Index	Time (min)	Obs. Drawdown (ft)	Calc. Drawdown (ft)	Residual
0	1.200000e+002	2.700000e-001	2.473526e-001	2.264744e-002
1	2.400000e+002	3.800000e-001	3.782441e-001	1.755890e-003
2	3.600000e+002	4.400000e-001	4.604318e-001	-2.043177e-002
3	4.800000e+002	5.200000e-001	5.203920e-001	-3.920184e-004
4	5.400000e+002	5.400000e-001	5.452463e-001	-5.246324e-003
5	6.000000e+002	5.700000e-001	5.676070e-001	2.393021e-003
6	6.600000e+002	5.700000e-001	5.879286e-001	-1.792856e-002
7	1.530000e+003	7.900000e-001	7.700162e-001	1.998380e-002

DRAWDOWN OB-4



Theis Equations

Transmissivity

$$T = \frac{Q}{4\pi(\Delta s)} W(u)$$

Storativity / Specific Yield

$$S = \frac{4Tut}{r^2}$$

where:

- T = aquifer transmissivity (ft^2/day)
- Q = pumping rate (ft^3/day)
- Δs = drawdown at match point (ft)
- W(u) = theis well function at match point on type curve
- S = aquifer storativity (dimensionless)
- t = elapsed time at match point (days)
- r = radial distance to pumping well (ft)
- u = well function constant

Match Point:

Type Curve

- W(u) = 1.0 x 10^{-4}
- 1/u = 0.1; u = 10

Data Curve

- t = 1.890939 min (0.001313152 days)
- s = 1.630543 x 10^{-5} ft

Theis Calculations

Transmissivity

$$T = \frac{564.064\ ft^3/day}{4x3.14159(1.623190x10^{-5}\ ft)} 1.0x10^{-4}$$

$$T = 276.53\ ft^2/day$$

Storativity / Specific Yield

$$S = \frac{4x276.53 ft^2/day \text{ x } 10 \text{ x } 0.001305215\ days}{(12\ ft)^2}$$

$$S = 0.1003$$

BREEN GeoScience Management, Inc.

Figure 3
Type Curve and Data (Predicted) Drawdown Curve
Observation Well OB-4
Truck Loading Rack, North Terminal
Flint Hills Resource, LP
Wilmington, NC

AQUIFERWIN32 ANALYSIS SUMMARY FILE

Selected Analysis: Theis, 1935 (Unconfined approximation)

Constant discharge from a fully penetrating well in a nonleaky aquifer

SITE INFORMATION

Site Designator: Flint Hill Resources, Truck Loading Rack Area
Job Number: BGM: Koch Regional Modeling
Client: Reiss Remediation
Site Name: Koch North Terminal, Wilmington, NC
Additional Info:
Aquifer test conducted at the Truck Loading Rack Area (TLR) located in the southern portion of the Flint Hills Terminal in Wilmington, North Carolina. The TRL is located along River Road immediately east (upgradient) of the Apex Terminal.

AQUIFER TEST INFORMATION

Test Designator: Truck Loading Rack 2" MW Aquifer Test
Job Number: BGM:Koch North Terminal Regional Model
Date: BGM Evaluation 10/02
Area Name: Truck Loading Area
Additional Info:
The aquifer testing was conducted by pumping the 2" monitoring well KMW-8 at a time weighted pumping rate of 2.9 gpm for a duration of 1530 minutes. Drawdown was recorded in observation well OB-4 located 6 feet north of KMW-8.

PUMP TEST DETAILS

Pumping Well KMW-8

Pumping Rates

Index	Time (min)	Rate (gal/min)
0	0.000000e+000	2.000000e+000
1	1.000000e+002	3.000000e+000

Monitored Wells

OB-4

ANALYSIS INFORMATION

Analysis Designator: Theis Analysis with Unconfined Aquifer Modification
Job Number: Breen GeoScience Management, Inc.
Date: December, 2002
Analyst Name: F.A. Breen, PG
Additional Info:
Analysis of drawdown in observation well OB-4.

ANALYSIS SUMMARY

Optimization Parameters

Convergence Criteria	0.000010
Maximum Iterations	100

```
            Derivative Fraction      0.050000
            Zero Derivative Value    0.000100
            Derivative Type          Central
            Lambda Value             0.001000


       Number of Points = 8                        Optimized Match


   ANALYSIS PARAMETERS

        Radial Distance
             Fixed Value                    = 12 ft

        Pumping Rate
             Fixed Value                    = 2.93 gal/min

        Transmissivity
             Calculated Value               = 276.534 sq ft/d
                  Calculation Specifics:
                       Initial Guess        = 276.533 sq ft/d
                       Enforced Minimum     = 0.1 sq ft/d

        Storage Coefficient
             Calculated Value               = 0.10026
                  Calculation Specifics:
                       Initial Guess        = 0.100261
                       Enforced Minimum     = 0

        Aquifer Thickness
             Fixed Value                    = 20 ft


   ANALYSIS STATISTICS

        Match Point:
                    Type Curve: (1.000000e-001, 1.000000e-004)
                    Data Curve: (1.879509e+000, 1.623190e-005)

        Residual Mean            =  0.000247
        Residual Standard Dev.   =  0.019160
        Residual Sum of Squares  =  0.002937
        Absolute Residual Mean   =  0.017137
        Minimum Residual         = -0.027877
        Maximum Residual         =  0.027597


   DATA DETAIL

  Index  Time              Obs. Drawdown       Calc. Drawdown      Residual
         (min)             (ft)                (ft)

    0    1.200000e+002     2.500000e-001       2.330482e-001        1.695177e-002
    1    2.400000e+002     3.600000e-001       3.350128e-001        2.498716e-002
    2    3.600000e+002     3.700000e-001       3.978774e-001       -2.787742e-002
    3    4.800000e+002     4.300000e-001       4.434615e-001       -1.346155e-002
    4    5.400000e+002     4.600000e-001       4.623136e-001       -2.313564e-003
    5    6.000000e+002     4.700000e-001       4.792587e-001       -9.258738e-003
    6    6.600000e+002     4.800000e-001       4.946487e-001       -1.464871e-002
    7    1.530000e+003     6.600000e-001       6.324034e-001        2.759658e-002
```

ATTACHMENT H2 - SUMMARY OF SURFICIAL WATER TABLE DATA

LOADING RACK AREA

SUMMARY OF WATER TABLE DATA
AT LOADING RACK AREA

FLINT HILLS RESOURCES, LP NORTH TERMINAL
LOADING RACK AREA
WILMINGTON, NORTH CAROLINA

WELL ID	DATE	DEPTH TO WATER TABLE (FT.)
EAST SIDE OF RIVER ROAD		
KMW-6	9/17/01	2.37
	2/27/02	4.82
	5/7/02	7.71
	9/27/02	1.47
	11/1/02	1.90
KMW-7	9/17/01	2.14
	2/27/02	4.63
	5/7/02	7.48
	9/27/02	1.21
	11/1/02	1.54
KMW-8	9/17/01	3.25
	2/27/02	5.56*
	5/7/02	7.85
	9/27/02	1.53
	11/1/02	1.96
KMW-9	9/17/01	2.54
	2/27/02	4.96*
	5/7/02	5.53*
	9/27/02	1.19
	11/1/02	Damaged during September oil/water separator removal

SUMMARY OF WATER TABLE DATA
AT LOADING RACK AREA

FLINT HILLS RESOURCES, LP NORTH TERMINAL
LOADING RACK AREA
WILMINGTON, NORTH CAROLINA

WELL ID	DATE	DEPTH TO WATER TABLE (FT.)*
KMW-10	9/17/01	2.75
	2/27/02	4.87
	5/7/02	7.60
	9/27/02	1.38
	11/1/02	1.82
KMW-11	9/17/01	3.74
	2/27/02	5.70
	5/7/02	8.34
	9/27/02	1.45
	11/1/02	1.99

* Depth to water table measurement has been corrected for specific gravity adjustment of free-phase product.

Note: All above monitoring well top of casing elevations are close to ground level.