CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. R5-2006-0087

WASTE DISCHARGE REQUIREMENTS
FOR
CHEVRON CORPORATION
AND
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
CHEVRON FORMER BAKERSFIELD REFINERY
AND
WAIT TANK YARD GROUNDWATER CLEANUP
KERN COUNTY

The California Regional Water Quality Control Board, Central Valley Region (hereafter the Central Valley Water Board) finds that:

1. Chevron Environmental Management Company (a California corporation), on behalf of Chevron Corporation (a Delaware corporation) [hereafter jointly referred to as Discharger], submitted a Report of Waste Discharge on 6 August 2002 for modification of an air sparging/soil vapor extraction remediation system at 2525 North Chester Avenue, Bakersfield. The property location is the northeast quarter of Section 7 and the west half of the northwest quarter of Section 8, Township 29S, Range 28E, MDB&M as shown on Attachment 1, which is incorporated herein and made part of this Order by reference.

2. The property is assigned Assessor's Parcel Numbers 118-010-24, 118-010-22, and 436-041-01 (hereafter referred to as the Site). The 200-acre facility consists of the former refinery on the eastern portion of the Site and a former tank yard (Wait Tank Yard) covering the majority of the western Site, as shown on Attachment 2, which is incorporated herein and made part of this Order by reference. The underlying dissolved-phase petroleum hydrocarbon groundwater plume extends off-site to the west of the Site, and is also shown on Attachment 2.

Background

3. Chevron Corporation owns the former Chevron Bakersfield Refinery and adjacent Wait Tank Yard. The Refinery and Wait Tank Yard were in operation from about 1912 to 1986, and manufactured or stored a variety of hydrocarbon products including crude oil, gasoline, diesel, stove oil, furnace oil, road asphalt, and jet fuel. Petroleum hydrocarbon constituents are found at the Site, which originate from spills and leaks from pipelines, tanks, and process units during the facility's operational phase.

4. The Discharger initiated subsurface investigations at the Site in 1984 with the investigation of a waste disposal site. In 1986, refinery product was discovered in two water supply wells in the former Wait Tank Yard. Eleven soil borings were advanced, of which five were converted to groundwater monitoring wells, during a 1986 Phase I investigation of the water supply well contamination. During a 1988 Phase II investigation, nine additional monitoring wells were installed. Sampling of the monitoring wells returned benzene, ethylbenzene, toluene, and total

xylenes (BTEX) results with select BTEX constituents present in groundwater at concentrations greater than 20 parts per million, or milligrams per liter (mg/L). Total Petroleum Hydrocarbons as gasoline (TPHg) were present at concentrations exceeding 100 mg/L. Two rounds of sampling through December 1989 determined that separate phase hydrocarbons (SPH), or free product, continued to be present in the water supply wells and was detected in four of the monitoring wells.

5. Additional subsurface investigations during 1990-1992 determined the presence of two SPH plumes — one at the center (west central source area) and one near the eastern edge of the former Wait Tank Yard near the former Refinery parcel (central source area). The investigations also determined the presence of perched groundwater zones within areas of SPH, assessed the downgradient extent of the dissolved phase plume in the shallow aquifer, assessed soil contamination throughout the former Tank Yard and the associated air emissions from that soil, and provided perimeter monitoring of the shallow aquifer. Concentrations of TPH were as high as 74,000 parts per million, or milligrams per kilogram (mg/kg), in soil to depths of 22 feet below ground surface (bgs). From depths of 22 feet to 200 feet bgs, TPH concentrations in soil were as high as 1,500 mg/kg. Below 200 feet bgs, the maximum TPH concentrations ranged from nondetect to 200 mg/kg.

6. Review of the data described in Finding No. 5 indicated that soil vapor extraction (SVE) technology might be appropriate for remediation of SPH and unsaturated soils at the Site. In 1996, remediation using product recovery and vapor extraction technologies commenced in the west central and central source areas.

7. By late 2000, over 3.3 million pounds of petroleum hydrocarbons had been removed from the unsaturated zone by vapor extraction activities, and had resulted in a large decrease in soil vapor concentrations. Despite these activities, no significant attenuation of the dissolved phase groundwater plume had been demonstrated, with the flux of hydrocarbons exceeding the biodegradation capacity of the aquifer. Dissolved plume chemistry showed that dissolved oxygen (DO), nitrate, and sulfate were reduced and dissolved iron and manganese were elevated, suggesting intrinsic biodegradation was occurring. In addition, with the installation of an additional off-site well, the dissolved groundwater plume was shown to exist at least 600 feet west of the Site.

8. The Discharger proposed to install air sparge wells in late 2000, due to the apparent exceedance of the biodegradation capacity of the aquifer. The purpose of the sparge wells was to reduce the concentrations of dissolved constituents in the plume, to reduce the source areas (including residual hydrocarbon in the saturated zone), and to increase DO levels in the regional aquifer to promote the biodegradation of hydrocarbons. The first phase of an air sparge remedial system was a proposed air sparge “curtain” across the dissolved plume at the western Site boundary to address the migration of dissolved-phase hydrocarbons off-site.

9. During 2001, air sparge, groundwater monitoring, and vapor extraction wells were installed at the western Site boundary. A pilot test of these wells showed that sparging at depths of 25 and 50 feet below the water table was effective at remediating residual hydrocarbons trapped at these levels by a 50-foot rise in the water table over the past 50 years. Discrete interval groundwater sampling also showed that the dissolved plume extended to depths of over 130 feet below the water table. As eighty percent of the dissolved phase plume mass was determined to exist in the upper 100 feet of the plume, a remedial option to initially treat only the top 100 feet of the aquifer was considered viable.

10. Long-term sparging at the test wells determined that oxygen conditions were suitable for biodegradation, but nutrient conditions were limiting bacterial growth within the saturated zone. Consequently, the Discharger has proposed that nutrient injections be considered part of the air sparging remedy.

11. As of the last half of 2003, approximately 31,000 gallons of product have been removed from the subsurface of the Site through dual-phase extraction by the SVE remediation system. Through the same period, a cumulative equivalent of 1.2 million gallons of free product petroleum hydrocarbons have been removed as vapor by the SVE system. Currently, 21 SVE system extraction wells and
19 air sparge wells are part of the remediation system.

Hydrology, Soils, and Land Use

12. The Site lies within the Tulare Lake Basin, specifically the Kern Delta Hydrologic Area (No. 557.10) of the South Valley Floor Hydrologic Unit, as depicted on interagency hydrologic maps prepared by the State Water Resources Control Board (SWRCB), revised 1986. Surface water drainage is to the Kern River. All storm water runoff within the Site property is contained onsite.

13. The depth to first encountered groundwater is quite variable at the Site, ranging between 200 feet bgs (eastern Site) and 260 feet bgs (western Site), except near the southern portion of the Site where it is encountered as shallow as 100 feet bgs. The groundwater is unconfined. The regional water table at the Site declined approximately 200 feet (from 60 feet bgs to 260 feet bgs) between the establishment of the former Chevron Refinery in 1912 and approximately 1975, after which time the regional water table has risen an estimated 50 feet.

14. Groundwater flow direction varies from north to west across the site, at a gradient of 0.004 in the northwest portion of the Site. Calculated groundwater flow velocities in and downgradient of the source area range from 1 to 91 feet per year.

15. The principal stratigraphic units are younger alluvium and the underlying Kern River Formation. The younger alluvium consists of silty sands and sands with interbedded gravel deposited as older

stream terrace deposits and recent flood plain deposits. The Kern River Formation consists of moderately indurated silts, silty sands, and sands with interbedded gravel and clay. The regional aquifer exists within the Kern River Formation.

16. Groundwater monitoring has been conducted at the Site since 1988. Water quality data show that groundwater contains petroleum hydrocarbon constituents at concentrations exceeding applicable water quality objectives.

17. Based on a well survey, the closest water supply well is approximately 3,000 feet northeast (sidegradient) of the proposed air sparge curtain. The closest downgradient water supply well is approximately 7,000 feet west of the sparge curtain.

18. The Discharger has sampled groundwater monitoring wells for indicators of intrinsic bioremediation of petroleum hydrocarbons. Such indicators include low values or concentrations of sulfate, nitrate, dissolved oxygen (DO), and oxidation/reduction potential (ORP); and increased dissolved iron and manganese concentrations in groundwater. The positive values of the above bioremediation indicator parameters are present within the dissolved hydrocarbon groundwater plume.

19. Surrounding land uses are industrial, commercial, and residential.

Proposed Remedial Technology

20. The Discharger proposes to conduct nutrient injection in conjunction with air sparging (biosparging) and soil vapor extraction for remediation of petroleum hydrocarbons in groundwater to reduce the anticipated cleanup time of the aquifer. The Discharger proposes to inject nitrogen and phosphorus to enhance biological degradation of petroleum hydrocarbons, as existing groundwater monitoring data suggest that nutrient conditions are limiting bacterial growth within the saturated zone. Nitrogen will be injected with sparge air in the form of ammonia, and phosphorus will be injected with sparge air in the form of triethyl phosphate (TEP).

21. Gaseous nutrients (ammonia and TEP) will be added to the injected air stream and regulated by programmable mass flow controllers, which will regulate gas flow to a predetermined rate. Nitrogen will be provided in the form of ammonia in standard storage cylinders. Liquid TEP will be pumped into a heated evaporation chamber and a slipstream of compressed air will be diverted to the evaporation chamber to transfer TEP vapor from the chamber into the main sparge air injection line. A nutrient injection system process diagram is shown in Attachment 3, which is incorporated herein and made part of this Order by reference.

22. The estimated cleanup time using biosparging for the off-site groundwater plume is seven years. During that time, groundwater monitoring will be conducted to determine nutrient dosing rates and biological uptake and to minimize residual nutrient concentrations in groundwater downgradient of

the treatment area. Bacterial uptake of nitrogen and phosphorous into cellular mass, and sorption and fixation with inorganic cations, will result in the reduction of nutrient concentrations in groundwater. Based on the responsiveness of the indigenous hydrocarbon degrading bacteria, both nutrient form and dosing rates may be modified.

23. Based on conservative groundwater flow rates for areas downgradient of the nutrient injection points, it will take at least four years for injected materials or their potential daughter/ byproducts to reach the downgradient end of the treatment area where compliance point wells MW-44, MW-51A/B/C, and MW-55AR/B are located.

24. The Discharger has conducted four sampling events for most baseline parameters from downgradient monitoring wells MW-44 and MW-51A/B/C and two baseline sampling event at downgradient well MW-55AR/B. The Discharger will collect additional baseline groundwater samples from downgradient monitoring wells prior to the injection of ammonia and TEP. The list of analytes required for the baseline sampling is listed in the attached MRP No. R5-2006-0087. The Discharger will submit a Baseline Summary Report containing proposed baseline concentrations following these additional groundwater sampling events.

25. In the event that ammonia, TEP, or any of their breakdown products, including nitrate, are detected at concentrations greater than 80 percent above approved baseline concentrations in compliance point wells MW-44, MW-51A/B/C, or MW-55AR/B during the treatment period, the Discharger will cease the discharge. In the event that ammonia, TEP, or any of their breakdown products, including nitrate, are non-detect in compliance point wells after four years of nutrient injection, the criterion to cease injection will be 80 percent of the respective constituent water quality objectives (WQOs) as measured at the compliance points. If ammonia, TEP, or any of their breakdown products, including nitrate, are detected at concentrations greater than their respective water quality objectives at the compliance points, the Discharger will then implement an investigation to verify and evaluate the extent of the exceedance, and based on the investigation results, a work plan for remedial actions developed specifically for the nature and extent of the exceedance identified. These remedial actions could include groundwater extraction and treatment.

26. The Discharger will monitor eight downgradient wells, two upgradient wells, and two wells in the treatment area as required in MRP No. R5-2006-0087. The three furthest downgradient monitoring wells MW-44, MW-51A/B/C or MW-55AR/B will be the compliance point wells for this Order at which groundwater concentrations must not exceed their respective water quality objectives.

Regulatory Considerations

27. The injection of chemicals into the waters of the State is subject to regulation under the California Water Code. This Order authorizes the Discharger to inject ammonia and triethyl phosphate into the groundwater subject to specific discharge requirements.

28. The *Water Quality Control Plan for the Tulare Lake Basin, Second Edition* (hereafter Basin Plan), designates beneficial uses, establishes narrative and numerical WQOs, and contains implementation plans and policies for protecting waters of the basin. The Basin Plan includes plans and policies of the SWRCB incorporated by reference. Pursuant to §13263(a) of the California Water Code, waste discharge requirements must implement the Basin Plan.

29. The beneficial uses of Kern River designated by the Basin Plan are municipal and domestic supply; agricultural, industrial service, and industrial process supply; water contact recreation; noncontact water recreation; warm freshwater habitat; wildlife habitat; rare, threatened, or endangered species; hydropower generation; and groundwater recharge.

30. The Site is in Detailed Analysis Unit (DAU) No. 254 of the Kern County Basin. The Basin Plan designates the beneficial uses of groundwater in this DAU as municipal and domestic supply; agricultural, industrial service, and industrial process supply; contact and non-contact water recreation; and wildlife habitat.

31. State Board Resolution No. 92-49 requires the Central Valley Water Board to require actions for cleanup and abatement of discharges that cause or threaten to cause pollution or nuisance to conform to the provisions of State Board Resolution No. 68-16 (hereafter Resolution 68-16) and the Basin Plan. Pursuant to Resolution No. 92-49, the Central Valley Water Board shall ensure that dischargers are required to cleanup and abate the effects of discharges in a manner that promotes attainment of either background water quality, or if background levels of water quality cannot be restored, the best water quality which is reasonable and which complies with the Basin Plan including applicable WQOs.

32. State Water Resources Control Board Resolution No. 68-16 (hereafter Resolution 68-16 or the "Antidegradation Policy") requires the Central Valley Water Board, in regulating the discharge of waste, to maintain high quality waters of the state until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect beneficial uses, and will not result in water quality less than that described in the Central Valley Water Board's policies (e.g., quality that exceeds WQOs). Spatially restricted and temporary degradation of groundwater by constituents in the discharge is determined consistent with maximum benefit to the people of California. This determination is based on considerations of reasonableness under the circumstances of the discharge. Factors considered include:

    a. past, present, and probable beneficial uses of the water (as specified in the Basin Plan);
    b. economic and social costs, tangible and intangible, of the discharge compared to the benefits;
    c. environmental aspects of the discharge; and
    d. implementation of feasible alternative treatment or control methods.

33. The Central Valley Water Board finds that some temporal degradation of groundwater may occur by injection of TEP and ammonia. Such degradation is consistent with Resolution 68-16 since: (1)

the purpose of the discharge of TEP and ammonia is to accelerate and enhance remediation of the groundwater pollution and such remediation will benefit the people of the state; (2) the discharge as allowed in this Order is limited in scope and duration; (3) this Order requires use of best practicable treatment, including adequate monitoring and contingency plans to assure protection of water quality; and (4) this Order does not allow discharges of waste to exceed water quality objectives other than those temporarily permitted by these WDRs. If the discharge causes or threatens to cause degradation of water quality (other than those temporarily permitted by these WDRs), then the Discharger will be required to cease the discharge, implement source control, change the method of discharge, or take other action.

34. Degradation of groundwater by constituents other than those specified in the groundwater limitations in this Order is inconsistent with Resolution 68-16. Some degradation of groundwater by the Discharger is consistent with Resolution 68-16 provided that the degradation is:

    a. limited in extent;
    b. restricted to the nutrients proposed for injection or their known breakdown products;
    c. minimized by fully implementing the remediation strategy, and regularly maintaining, and optimally operating remediation system equipment;
    d. demonstrated to be consistent with water quality objectives prescribed in the Basin Plan; and
    e. justified to be consistent with the maximum benefit to the people of California.

35. This discharge is exempt from the requirements of *Consolidated Regulations for Treatment, Storage, Processing, or Disposal of Solid Waste,* as set forth in Title 27, CCR, Division 2, Subdivision 1, Section 20005, et seq., (hereafter Title 27). The exemption pursuant to Section 20090(b), is based on the following:

    a. The Central Valley Water Board is issuing waste discharge requirements;
    b. The discharge complies with the Basin Plan, and;
    c. The wastewater does not need to be managed according to Title 22 CCR, Division 4.5, and Chapter 11, as a hazardous waste.

    In addition, the discharge is also exempt pursuant to Section 20090(d) of Title 27 regarding RWQCB cleanup actions, which states:

    d. Actions taken by or at the direction of public agencies to cleanup or abate conditions of pollution or nuisance resulting from unintentional or unauthorized releases of waste or pollutants to the environment; provided that wastes, pollutants, or contaminated materials removed from the immediate place of release shall be discharged according to the SWRCB-promulgated sections of Article 2, Subchapter 2, Chapter 3, Subdivision 1 of this division (§20200 et seq.); and further provided that remedial actions intended to contain such wastes at the place of release shall implement applicable SWRCB- promulgated provisions of this division to the extent feasible.

General Findings

36. The California Department of Water Resources sets standards for the construction and destruction of groundwater wells, as described in *California Well Standards Bulletin 74-90* (June 1991) and *Water Well Standards: State of California Bulletin 94-81* (December 1981). These standards, and any more stringent standards adopted by the Discharger or county pursuant to California Water Code Section 13801, apply to all monitoring wells.

37. Work plans and reports regarding the installation of groundwater monitoring wells must also adhere to the appropriate portions of Attachment 4 "Standard Monitoring Well Provisions for Waste Discharge Requirements," which is incorporated herein and made part of this Order by reference.

38. Pursuant to California Water Code §13263(g), discharge is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.

39. Section 13267(b) of the California Water Code states, in part, that:

> In conducting an investigation specified in [§13267] subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports.

40. The technical reports required by this Order and the monitoring and reporting program required by this Order and the attached Monitoring and Reporting Program No. R5-2006-0087 are necessary to assure compliance with these waste discharge requirements. The Discharger operates the remediation system that discharges the waste subject to this Order.

41. All the above and the supplemental information and details in the attached Information Sheet, which is incorporated by reference herein, were considered in establishing the following conditions of discharge.

42. The Discharger and interested agencies and persons were notified of the intent to prescribe waste discharge requirements for this discharge and provided an opportunity to submit written views and recommendations and to be heard in a public meeting.

43. All comments pertaining to the discharge were heard and considered in a public meeting.

44. Issuance of this Order is an action to assure the restoration of the environment and is, therefore, exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.), in accordance with Section 15308 and 15330, Title 14, California Code of Regulations (CCR).

IT IS HEREBY ORDERED that, pursuant to California Water Code §13263 and §13267, Chevron Corporation and Chevron Environmental Management Company, its agents, successors, and assigns, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted hereunder, shall comply with the following:

A. Discharge Prohibitions[1]

1. The discharge of ammonia or TEP, or any by-products, into any surface water or surface water drainage course is prohibited.

2. Discharge of waste classified as 'hazardous' under Section 2521, Chapter 15 of Title 23 is prohibited.

3. Discharge of ammonia or TEP at a location or in a manner different from that described in Finding No. 21 is prohibited at this site.

B. Discharge Specifications

1. The existing compliance point wells marking the downgradient end of the treatment area are monitoring wells MW-44, MW-51A/B/C, and MW-55AR/B.

2. No waste constituent shall be released, discharged, or placed where it will be released or discharged, in a concentration or in a mass that causes violation of the Groundwater Limitations, except as noted in Findings No. 33 and No. 34 above.

C. Groundwater Limitations

[1] Note: Other prohibitions, conditions, definitions, and some methods of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements" dated 1 March 1991.

1. The Discharger shall not cause the groundwater outside the treatment area to contain waste constituents in excess of their respective WQOs as measured in compliance point wells MW-44, MW-51A/B/C, or MW-55AR/B.

2. The Discharger shall not cause the groundwater to contain taste and odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses outside of the treatment area.

D. Provisions

1. The Discharger shall notify Central Valley Water Board staff a minimum of two weeks prior to the injection of TEP and ammonia.

2. All of the following reports shall be submitted pursuant to Section 13267 of the California Water Code. As required by the California Business and Professions Code, all reports shall be prepared by, or under the direction of an appropriate California Registered Professional Engineer or Geologist (unless a specific Provision requires a different type of professional registration). The registered professional shall certify each report. In addition, the Discharger shall certify all reports, as required by General Reporting Requirement B.3 of the Standard Provisions.

   a. No later than **60 days** after initiation of nutrient injection, the Discharger shall submit a data summary with the data for the first 30 days of injection, a description of the nutrient injection implementation phase, and any preliminary results from the first month of the nutrient injection.

   b. No later than **90 days** after initiation of nutrient injection, the Discharger shall submit a contingency workplan to investigate any byproducts of the nutrient injection process or nutrient or hydrocarbon breakdown products, in the event these constituents exceed their respective WQOs at monitoring wells MW-44, MW-51A/B/C, or MW-55AR/B. The investigation should be designed to verify and evaluate the extent of the exceedance, and based on the investigation results, a workplan for remedial actions shall be developed specifically for the nature and extent of the exceedance identified. These remedial actions could include groundwater extraction and treatment.

   c. No later than **12 months** after initiation of injection, the Discharger shall submit a report summarizing the results of the initial nine months of nutrient injection, including an evaluation of the effectiveness of using TEP and ammonia for remediation of hydrocarbon-contaminated groundwater at the Site, the effects of any byproducts on the receiving groundwater, the hydraulic properties on the aquifer, and any other effects of the in-situ treatment. Other effects include evaluation of any changes to the aquifer's transmissivity, hydraulic conductivity, and storativity inside the nutrient injection zone.

Groundwater monitoring data and mathematical or computer models should be used to analyze groundwater flow and contaminant movement. The report shall also contain both tabular and graphical summaries of all the monitoring data obtained during the initial nine months of nutrient injection. In addition, the Discharger shall discuss the compliance record and the corrective action taken or planned, which may be needed to bring the discharge into full compliance with the waste discharge requirements.

d. No later than **30 months** after initiation of injection, the Discharger shall submit a Baseline Summary Report after the collection of additional samples from downgradient monitoring wells to propose baseline values for ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate, their byproducts, and/or breakdown products. The Baseline Summary Report shall provide a table of proposed baseline concentrations developed using an EPA-approved statistical method, including the rationale used to develop the concentrations. The Discharger shall cease nutrient injections if the concurrence of Central Valley Water Board staff with the Baseline Sampling Report is not reached within 60 days of receipt of the Baseline Sampling Report by Central Valley Water Board staff.

3. The Discharger shall comply with the attached MRP No. R5-2006-0087, which is part of this Order, and any revisions thereto as ordered by the Executive Officer. Monitoring will continue quarterly until ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate are no longer present in the monitoring wells east of Manor Street at concentrations exceeding their respective WQOs (for four successive quarters). For monitoring wells west of Manor Street, monitoring will continue quarterly for ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate until these constituents are no longer present at concentrations exceeding 80 percent of their respective WQOs (for four successive quarters).

4. Should the evaluation of the monitoring data reveal adverse effects on groundwater quality due to discharging ammonia and TEP, then the Discharger shall notify the Central Valley Water Board within 24 hours, followed by a written summary within two weeks. Within six months of the initial notification, the Discharger shall clean up and abate these effects, including possible extraction of any byproducts or injectant breakdown products, by implementing the approved workplan, as described in Provision No. D.2.b. The Discharger shall provide a status summary report within two months detailing activities to implement the workplan.

5. The Discharger shall comply with applicable sections of the "Standard Provisions and Reporting Requirements for Waste Discharge Requirements," dated 1 March 1991, which are attached hereto and by reference a part of this Order. This attachment and its individual paragraphs are commonly referenced as "Standard Provision(s)."

6. The Discharger shall comply with all conditions of this Order, including timely submittal of technical and monitoring reports as directed by the Executive Officer. Violations may result in enforcement action, including Central Valley Water Board or court order requiring corrective action or imposing civil monetary liability, or in revision or rescission of this Order.

7. The Discharger shall provide an alternate water supply source for any municipal, domestic or other water use, if affected by the Discharger's wastes and if ordered by the Central Valley Water Board.

8. Prior to any modifications at the Site that would result in material change in the quality or quantity of ammonia or TEP discharge, or any material change in the character, location, or volume of the discharge, the Discharger shall report all pertinent information in writing to the Central Valley Water Board for review and approval. This Order may be revised prior to implementation of any modifications.

9. The Discharger shall maintain records of all monitoring information including all calibration and maintenance records, copies of all reports required by this Order, and records of all data used to complete the application for this Order. Records shall be maintained for a minimum of three years from the date of the sample, measurement, or report. This period may be extended during the course of any unresolved litigation regarding this discharge or when requested by the Executive Officer.

10. While this Order is in effect, and prior to any change in ownership of the Site or management of this operation, the Discharger shall transmit a copy of this Order to the succeeding Owner/Operator, and forward a copy of the transmittal letter and proof of transmittal to the Central Valley Water Board.

11. The Discharger shall allow the Central Valley Water Board, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

    a. Enter upon the premises regulated by the Central Valley Water Board, or the place where records must be kept under the conditions of this Order;

    b. Have access to and copy, at reasonable times, any records that shall be kept under the conditions of this Order;

    c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

    d. Sample or monitor, at reasonable times, for the purpose of assuring compliance with this Order or as otherwise authorized by the California Water Code, any substances or parameters at this Site.

12. A copy of this Order shall be kept at the discharge facility for reference by operating personnel. Key operating personnel shall be familiar with its contents.

13. The Central Valley Water Board will review this Order periodically and will revise requirements when necessary.

I, PAMELA C. CREEDON, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 4 August 2006.

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PAMELA C. CREEDON, Executive Officer

Order Attachments:

Monitoring and Reporting Program
1. Vicinity Map – Bakersfield Refinery Area
2. Site Map
3. Process Diagram – Nutrient Injection System
4. Standard Monitoring Well Provisions for Waste Discharge Requirements

Information Sheet
Standard Provisions (1 March 1991 version)

BEM: 8/4/06

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
MONITORING AND REPORTING PROGRAM NO. R5-2006-0087
FOR
CHEVRON CORPORATION AND
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
CHEVRON FORMER BAKERSFIELD REFINERY
AND WAIT TANK YARD GROUNDWATER CLEANUP
KERN COUNTY

This monitoring and reporting program (MRP) incorporates requirements for monitoring of the nutrient injection system process and groundwater. This MRP is issued by the Executive Officer of the California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) pursuant to California Water Code Section 13267. The Discharger is required to comply with this MRP and shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. Groundwater sampling and reporting associated with the existing monitoring well network at the Site is not currently regulated by an MRP. The existing groundwater monitoring schedule is incorporated into this MRP, modified as necessary to implement nutrient injection monitoring. Central Valley Water Board staff shall approve specific sample station locations prior to implementation of sampling activities.

Prior to construction of any new groundwater monitoring or extraction wells, the Discharger shall submit plans and specifications to the Central Valley Water Board for review and approval. Once installed, all new wells shall be added to the monitoring program and shall be sampled and analyzed according to the schedule below.

All samples shall be representative of the volume and the nature of the discharge and matrix of the sampled medium. The time, date, and location of each grab sample shall be recorded on the sample chain of custody form.

NUTRIENT INJECTION SYSTEM AND GROUNDWATER MONITORING

A. LABORATORY ANALYSES

Monitoring of the nutrient injection system shall consist of groundwater samples collected from the following well groups:

Upgradient Wells:	MW-16 and MW-29
Treatment Area Wells:	MW-21 and MW-34
Downgradient Wells:	MW-18, MW-31, MW-35, MW-42, MW-44, MW-51A/B/C, MW-52, and MW-55AR/B

Please note that well MW-31 is being monitored; however, the results from this well may be qualified, as previous analytical data from this well have shown it to return non-representative results for local groundwater quality conditions. These wells shall be monitored (at a minimum) for the following constituents at the schedule shown. These analyses shall be completed by a State certified laboratory.

Constituents	EPA Analytical Method	Reporting Limit	Sample Frequency[4]	Reporting Frequency
BTEX[1]	8021B	0.5 µg/l	Semi-Ann	Semi-Ann
TPH (gasoline)	8021B	50 µg/l	Semi-Ann	Semi-Ann
TPH (diesel)	8015B	50 µg/l	Semi-Ann	Semi-Ann
Nitrate (as N)	300.0	0.1 mg/l	Quarterly	Quarterly
Nitrite (as NO_2)	353.2	0.065 mg/l	Quarterly	Quarterly
Ammonia (as NH_3)	350.1	0.03 mg/l	Quarterly	Quarterly
Total Kjeldahl Nitrogen	351.2	0.2 mg/l	Quarterly	Quarterly
Total Phosphate	365.4	0.15 mg/l	Quarterly	Quarterly
Orthophosphate	365.1	0.02 mg/l	Quarterly	Quarterly
Hydrocarbon Degrading Bacteria	SM 9215	10 cfu/ml	Quarterly	Quarterly
Total Alkalinity (as $CaCO_3$)	310.1	20 mg/l	Semi-Ann	Semi-Ann
Total Organic Carbon	415.1	1 mg/l	Semi-Ann	Semi-Ann
Major Cations[2]	6010B	mg/l	Semi-Ann	Semi-Ann
Major Anions[3]	300.0	mg/l	Semi-Ann	Semi-Ann
Total Dissolved Solids	160.1	10 mg/l	Semi-Ann	Semi-Ann

[1] Benzene, toluene, ethylbenzene, and xylenes
[2] Including calcium, sodium, potassium, magnesium, iron, and manganese (standard reporting limit varies)
[3] Including bicarbonate, chloride and sulfate (standard reporting limit varies)
[4] For monitoring wells west of Manor Street, monitoring will continue quarterly for ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate until these constituents are no longer present at concentrations exceeding 80 percent of their respective WQOs (for four successive quarters). For monitoring wells east of Manor Street, monitoring will continue quarterly for ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate until these constituents are no longer present at concentrations exceeding their respective WQOs (for four successive quarters).

B. FIELD MEASURED PARAMETERS

Monitoring of the nutrient injection system shall include field-measured parameters taken from groundwater samples from:

Upgradient Wells:	MW-16 and MW-29
Treatment Area Wells:	MW-21 and MW-34
Downgradient Wells:	MW-18, MW-31, MW-35, MW-42, MW-44, MW-51A/B/C, MW-52, and MW-55AR/B

Field testing instruments (such as those used to test ORP and dissolved oxygen) may be used provided that:

1. The operator is trained in proper use and maintenance of the instruments;
2. The instruments are calibrated prior to each monitoring event;

3. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Field calibration reports are provided with the appropriate monitoring report.

These wells shall be monitored (at a minimum) for the following constituents at the schedule shown.

Constituents	Units	Type of Sample	Monitoring Frequency[1]	Reporting Frequency
Specific Conductivity	µmhos/cm	Grab	Quarterly	Quarterly
pH	pH units	Grab	Quarterly	Quarterly
Oxidation-reduction potential	millivolts	Grab	Quarterly	Quarterly
Dissolved Oxygen	mg/l	Grab	Quarterly	Quarterly
Temperature	ºF/ºC	Grab	Quarterly	Quarterly
Liquid Hydrocarbon Thickness	Feet	Grab	Quarterly	Quarterly
Ground Water Elevation[2]	Feet, MSL	Grab	Quarterly	Quarterly

[1] For monitoring wells west of Manor Street, monitoring will continue quarterly until ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate are no longer present at concentrations exceeding 80 percent of their respective WQOs (for four successive quarters). For monitoring wells east of Manor Street, monitoring will continue quarterly for ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate until these constituents are no longer present at concentrations exceeding their respective WQOs (for four successive quarters).

[2] Measured every time a well is sampled.

C. NUTRIENT INJECTION SYSTEM MONITORING

Monitoring of the nutrient injection system shall include the following parameters taken from sampling/monitoring points within the physical nutrient injection system:

Parameter	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Injected Air Flow Rate[1]	SCFM	Metered	Continuous	Quarterly
Ammonia Concentration[1]	ppmv	Grab	Semi-monthly	Quarterly
TEP Concentration[1,4]	ppmv	Grab	Semi-monthly[4]	Quarterly
Flow Rates (at sparge wells)	SCFM	Meter	Monthly	Quarterly
Injection Pressure (at sparge wells)	PSI	Meter	Monthly	Quarterly
Flow Rates (at ex. wells)[2]	SCFM	Meter	Monthly	Quarterly
Vacuum (at ex. wells)[2]	PSI	Meter	Monthly	Quarterly
Various Constituents[3] (at ex. wells)[2]	ppmv	Grab	Monthly	Quarterly

[1] Monitored at injected air header before air flow is split to individual wells.

[2] Measured at vapor extraction wells near air sparge wells used for nutrient injection.

[3] Vapor phase constituents should include BTEX, TPH(gasoline), oxygen, carbon dioxide, methane, TEP, and ammonia.

[4] TEP concentration monitoring frequency will revert to once per month after the initial three months of injection.

The remaining groundwater monitoring wells at the Site are not currently under a monitoring and reporting program. As such, the monitoring schedule outlined below has been developed to closely approximate the Discharger's existing voluntary monitoring program.

A. LABORATORY ANALYSES

Monitoring of the groundwater not directly involved in the nutrient injection system shall consist of groundwater samples collected from the following wells:

MW-7	MW-11	MW-13	MW-14	MW-17[1]
MW-19[1]	MW-20[1]	MW-25	MW-27	MW-30
MW-37[1]	MW-38	MW-48[1]	MW-53[1]	

[1] Sampled for groundwater intrinsic bioremediation parameters during the fourth quarter.

These wells shall be monitored (at a minimum) for the following constituents at the schedule shown. These analyses shall be completed by a State certified laboratory.

Constituents	EPA Analytical Method	Reporting Limit	Sample Frequency[2]	Reporting Frequency
BTEX[1]	8021B	0.5 µg/l	Semi-Ann.	Semi-Ann.
TPH (gasoline)	8021B	50 µg/l	Semi-Ann.	Semi-Ann.
TPH (diesel)	8015B	50 µg/l	Semi-Ann.	Semi-Ann.

[1] Benzene, toluene, ethylbenzene, and xylenes.
[2] Sampled during the second and fourth quarters.

When fourth quarter groundwater intrinsic bioremediation sampling of the wells designated above occurs, these additional parameters shall be monitored:

Constituents	EPA Analytical Method	Reporting Limit	Sample Frequency	Reporting Frequency
Nitrate (as N)	300.0	0.1 mg/l	Annually	Annually
Total Alkalinity (as $CaCO_3$)	310.1	20 mg/l	Annually	Annually
Total Organic Carbon	415.1	1 mg/l	Annually	Annually
Major Cations[3]	6010B	mg/l	Annually	Annually
Major Anions[4]	300.0	mg/l	Annually	Annually
Total Dissolved Solids	160.1	10 mg/l	Annually	Annually

[3] Including calcium, sodium, potassium, magnesium, iron, and manganese (standard reporting limit varies)
[4] Including chloride and sulfate (standard reporting limit varies)

B. FIELD MEASURED PARAMETERS

Monitoring of the groundwater not directly involved in the nutrient injection system shall consist of the following groundwater parameters measured at each well listed in Section A above:

Type of Constituents	Monitoring Units	Reporting Sample	Frequency	Frequency
Specific Conductivity	µmhos/cm	Grab	Semi-Ann.	Semi-Ann.
pH	pH units	Grab	Semi-Ann.	Semi-Ann.
Oxidation-reduction potential	millivolts	Grab	Semi-Ann.	Semi-Ann.
Dissolved Oxygen	mg/l	Grab	Semi-Ann.	Semi-Ann.
Temperature	ºF/ºC	Grab	Semi-Ann.	Semi-Ann.
Liquid Hydrocarbon Thickness	Feet	Grab	Semi-Ann.	Semi-Ann.
Ground Water Elevation[1]	Feet, MSL	Grab	Quarterly	Quarterly

[1] Measured every time a well is sampled.

REPORTING

In reporting monitoring data, the Discharger shall arrange the data in tabular form so that the date, sample type, and reported analytical result for each sample are readily discernible. The data shall be summarized in such a manner to clearly illustrate compliance with waste discharge requirements and spatial or temporal trends, as applicable. The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall be reported to the Central Valley Water Board.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all Groundwater Monitoring Reports shall be prepared under the direct supervision of a Registered Engineer or Geologist and signed by the registered professional.

A. Quarterly and Semi-Annual Monitoring Reports

Quarterly and semi-annual reports shall be submitted to the Central Valley Water Board by the **15th day of the second month following the end of each calendar quarter (i.e., by 15 February, 15 May, 15 August, and 15 November**). Quarterly reporting shall continue for Nutrient Injection System And Groundwater Monitoring until:

1. Ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate are no longer present at concentrations exceeding 80 percent of their respective WQOs (for four successive quarters) in wells west of Manor Street, or

2. Ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate are no longer present at concentrations exceeding their respective WQOs (for four successive quarters) in wells east of Manor Street.

At a minimum, the reports shall include:

1. A narrative description of all preparatory, monitoring, sampling, and analytical testing activities for the groundwater monitoring. The narrative shall be sufficiently detailed to verify compliance with the WDR, this MRP, and the Standard Provisions and Reporting Requirements. The narrative shall be supported by field logs for each well documenting depth to groundwater; parameters measured before, during, and after purging; calculation of casing volume; total volume of water purged, etc.;

2. An assessment of ammonia and TEP dosing, by-products, and results of all sampling;

3. Copies of all laboratory analytical report(s);

4. A calibration log verifying regular calibration of any field monitoring instruments (e.g., DO, pH, EC meters) used to obtain data;

5. Piezometric and contour maps for DO concentrations and Hydrocarbon Degrading Bacteria counts for each quarterly sampling event, for all areas potentially affected by the nutrient injection system;

6. Cumulative data tables containing the water quality analytical results and depth to groundwater.

7. An evaluation of the effectiveness of the nutrient injection in remediating petroleum hydrocarbons in groundwater.

B. Annual Report

An annual report shall be submitted to the Central Valley Water Board by **15 February** of each year. This report shall contain an evaluation of the effectiveness and progress of the investigation and remediation, and may be submitted with the fourth quarter monitoring report. The annual report shall contain the following minimum information:

1. Tabular and graphical summaries of all data collected during the previous year;

2. Groundwater contour maps and contaminant concentration maps containing all data obtained during the previous year;

3. Data for monitoring and analysis performed on an annual basis;

4. A discussion of the long-term trends in the concentrations of the pollutants in the groundwater monitoring wells;

5. An evaluation of the performance of the nutrient injection system, including a description of all remedial activities conducted during the year, an analysis of its effectiveness in destroying the contaminants and whether the contaminant plume is being destroyed or is continuing to spread;

6. A discussion of compliance and the corrective action taken, as well as any planned or proposed actions needed to bring the discharge into full compliance with the waste discharge requirements; and

7. A discussion of any data gaps, potential deficiencies/redundancies in the monitoring system or reporting program and the anticipated date for completion of cleanup activities.

A letter transmitting the self-monitoring reports shall accompany each report. Such a letter shall include a discussion of requirement violations found during the reporting period, and actions taken or planned for correcting noted violations, such as operation or facility modifications. If the Discharger has previously submitted a report describing corrective actions and/or a time schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. The transmittal letter shall contain the penalty of perjury statement by the Discharger, or the Discharger's authorized agent, as described in the Standard Provisions General Reporting Requirements Section B.3.

The Discharger shall implement the above monitoring program on the first day of the month following adoption of this Order.

Ordered by: _____
PAMELA C. CREEDON, Executive Officer

4 August 2006
(Date)

BEM: 8/04/06

INFORMATION SHEET

ORDER NO. R5-2006-0087
CHEVRON CORPORATION AND
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
CHEVRON BAKERSFIELD FORMER REFINERY
AND WAIT TANK YARD GROUNDWATER CLEANUP
KERN COUNTY

Chevron Corporation (the Discharger) owns the former Chevron Bakersfield Refinery and adjacent Wait Tank Yard in Oildale, in the northeastern portion of Bakersfield. The Refinery and Wait Tank Yard (the Site) were in operation from about 1912 to 1986, and manufactured or stored a variety of hydrocarbon products including crude oil, gasoline, diesel, stove oil, furnace oil, road asphalt, and jet fuel. These are the primary contaminants found at the Site, which originated from spills and leaks from pipelines, tanks, and process units during the facility's operational phase.

The Discharger decommissioned and dismantled the former Refinery and Wait Tank Yard between May 1990 and September 1991, removing the aboveground and belowground facilities. During decommissioning operations, approximately 11,000 tons of petroleum hydrocarbon impacted soil was removed from the Site.

The Discharger initiated subsurface investigations at the Site in 1984. In 1986, refinery product (separate phase hydrocarbons (SPH), or free product) was discovered in two water supply wells in the former Wait Tank Yard. Sampling of monitoring wells returned benzene, ethylbenzene, toluene and total xylenes (BTEX) results with select BTEX constituents present in groundwater at concentrations greater than 20 parts per million, or milligrams per liter (mg/L).

Additional subsurface investigations during 1990-1992 determined the presence of two SPH plumes, one at the center (west central source area) and one near the eastern edge of the former Wait Tank Yard near the former Refinery parcel (central source area). Soil investigations determined that from depths of 22 feet to 200 feet below ground surface (bgs), total petroleum hydrocarbon (TPH) concentrations in soil are as high as 1,500 milligrams per kilogram (mg/kg). Groundwater is present at depths of 200 to 260 feet bgs.

In 1996, site remediation using product recovery and vapor extraction technologies commenced in the west central and central source areas. Three soil vapor extraction (SVE) wells in the west central area and four SVE wells in the central area were initially installed, with some wells operating as dual-phase extraction wells for SPH removal. At that time, a treatment system was installed on the Site, which consists of a water/oil separator, water storage tank, air stripper, liquid phase carbon treatment vessels, and a large vapor extraction and thermal oxidizer system.

By late 2000, over 3.3 million pounds of petroleum hydrocarbons had been removed from the unsaturated zone by vapor extraction activities, and had resulted in a large decrease in soil vapor concentrations. Despite these activities, no significant attenuation of the dissolved phase groundwater plume had been demonstrated, with the flux of hydrocarbons exceeding the biodegradation capacity of the aquifer. Dissolved plume chemistry showed that dissolved oxygen (DO), nitrate, and sulfate were reduced and dissolved iron and manganese were elevated, suggesting intrinsic biodegradation was occurring. In addition, with the installation of an additional off-site well, the dissolved groundwater plume was shown to exist at least 600 feet west of the Site property boundary.

The Discharger proposed to install air sparge wells in late 2000, due to the apparent exceedance of the biodegradation capacity of the aquifer. The purpose of the sparge wells was to reduce the concentrations of dissolved constituents in the plume, to reduce the source areas (including residual hydrocarbon in the saturated zone), and to increase DO levels in the regional aquifer to promote the biodegradation of hydrocarbons. The first phase of an air sparge remedial system was a proposed air sparge "curtain" across the dissolved plume at the western Site boundary to address the migration of dissolved-phase hydrocarbons off-site.

A deep sparge well, with screens 100 and 150 feet below the water table, was installed and tested in late 2001 and early 2002. Test results showed sparging was effective at 100 feet below the water table but not at depths of 150 feet.

Long-term sparging at the test wells along the western Site boundary during 2002 suggested that the primary hydrocarbon removal mechanism in this area was through stripping from groundwater rather than through biodegradation. While oxygen conditions were determined suitable for biodegradation, it appeared that nutrient conditions were limiting bacterial growth within the saturated zone. Consequently, the Discharger has proposed that nutrient injections be considered part of the air sparging remedy.

The Discharger proposes to conduct nutrient injection in conjunction with air sparging (biosparging) and soil vapor extraction for remediation of petroleum hydrocarbons in groundwater to reduce the anticipated cleanup time of the aquifer. The proposed soil vapor extraction and biosparging remediation system is based on the results of literature research and review, groundwater modeling, extensive review of the groundwater geochemistry at the Site, and discussions with Board staff. The Discharger proposes to inject nitrogen and phosphorus to enhance biological degradation of petroleum hydrocarbons, as existing groundwater monitoring data suggest that nutrient conditions are limiting bacterial growth within the saturated zone. Nitrogen will be injected with sparge air in the form of ammonia, and phosphorus will be injected with sparge air in the form of triethyl phosphate (TEP).

Both ammonia and TEP are highly soluble, with solubility limits of 34 percent and 12 percent in water, respectively; therefore, the majority of injected nutrients will partition into groundwater. Bacterial uptake of nitrogen and phosphorous into cellular mass, and sorption and fixation with inorganic cations, will result in the reduction of nutrient concentrations in groundwater. For nutrient demand calculations, the "treatment area" was defined as that portion of the contaminant plume undergoing nutrient-enhanced sparging. This area includes the upper 100 feet of the aquifer, 600 feet wide (perpendicular to groundwater flow) and 200 feet long (parallel to flow), at the western Site boundary.

Nutrient dosage rates for biodegradation were calculated based on the mass on contaminants present in the treatment areas and the stoichiometric equations for biodegradation of the chemicals of concern. Nutrient dosage and demand will be balanced in an attempt to affect only a nominal increase in nitrate, ammonia, and phosphate concentrations in the aquifer.

Nitrogen and phosphate demand for bioremediation of non-strippable hydrocarbons will average approximately 4,900 pounds per year and 500 pounds per year, respectively. Inherent loss mechanisms in

the aquifer will require higher dosages than those given above. The required ammonia and TEP concentrations in the biosparge airstream are calculated at 400 parts per million as vapor (ppmv) and 30 ppmv, respectively.

The Discharger has estimated a "delivery efficiency" for both ammonia and TEP. The delivery efficiency equals the mass of nutrient (nitrogen or phosphorous) used by the target heterotrophic bacteria (responsible for hydrocarbon degradation) divided by the total mass of nutrient injected. For nitrogen, a delivery efficiency of 50 percent was adopted. Nitrogen loss occurs through volatilization, immobilization (incorporation into cellular mass), and migration outside the treatment area. Dissolved nitrogen that may migrate from the treatment area will be beneficial to biodegradation of hydrocarbons in the off-site plume that extends downgradient of the treatment area. The Discharger expects that all of the bioavailable nitrogen will be "scavenged' by the bacterial population, such that any increase in the dissolved inorganic nitrogen concentration in the aquifer will be minor and transient.

The delivery efficiency for phosphorous injection is expected to be low, as the majority of injected phosphate is expected to form inorganic complexes with iron and manganese within the formation and precipitate out of solution. The assumed delivery efficiency for phosphorous was therefore set at 10 percent for modeling purposes.

In practice and as modeled, a significant portion of the injected nitrogen will be utilized for the biodegradation of hydrocarbons. If 50 percent of the nitrogen is used for biodegradation, the correlative nitrogen concentration would be 17.3 mg/l. The Discharger anticipates other loss mechanisms would further reduce residual nitrogen concentrations to much less than the 10 mg/l drinking water standard for nitrate (measured as nitrogen). In practice and as modeled, with inorganic losses of 50 percent and biologic uptake of 10 percent, the resultant dissolved phosphorous concentration in groundwater would be 6.9 mg/l.

Based on the calculations performed as part of remediation system design, the estimated cleanup time using biosparging for off-site groundwater plume cleanup is seven years. During that time, groundwater monitoring will be conducted to determine nutrient dosing rates and biological uptake and to minimize residual nutrient concentrations in groundwater downgradient of the treatment area. Based on the responsiveness of the indigenous hydrocarbon degrading bacteria, both nutrient form and dosing rates may be modified.

The Discharger will monitor eight downgradient wells (MW-18, MW-31, MW-35, MW-42, MW-44, MW-51A/B/C, MW-52, and MW-55AR/B), two upgradient wells (MW-16 and MW-29), and two wells in the treatment area (MW-21 and MW-34) as required in MRP No. R5-2006-0087. These wells are screened between about 250 and 300 feet bgs, except MW-44 (285-325 feet bgs), MW-51A/B/C (a triple completion well with screens between 280-399 feet bgs), MW-52 (330-350 feet bgs), and MW-55AR/B (two screens between 340 and 400 feet bgs). These wells will be sampled according to the schedule in attached MRP No. R5-2006-0087. Monitoring wells MW-44, MW-51A/B/C and MW-55AR/B, the furthest downgradient monitoring wells, will be the compliance wells at which groundwater concentrations must not exceed WQOs.

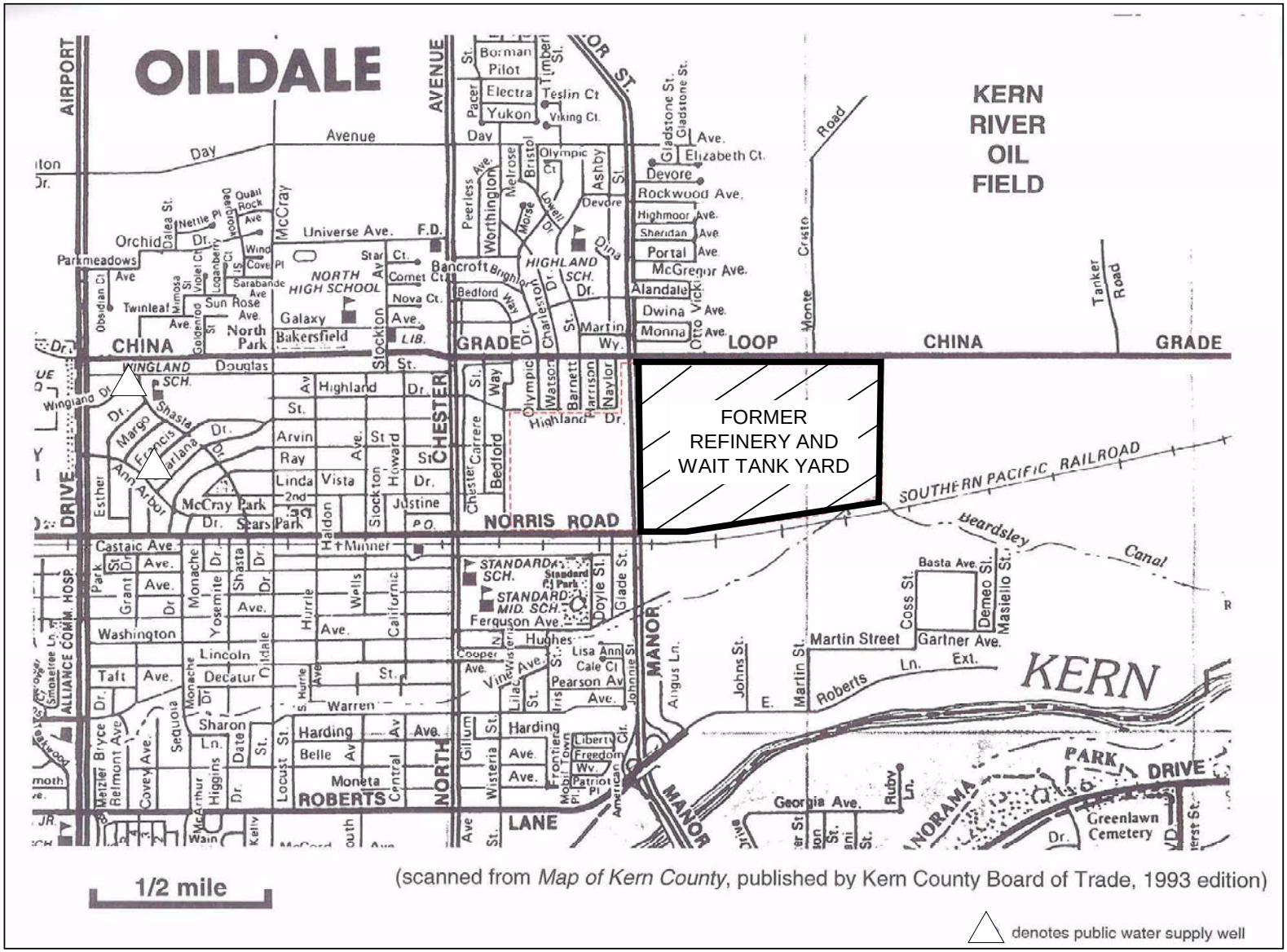
Monitoring will continue quarterly for ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate until these constituents are no longer present in the monitoring wells west of Manor Street at concentrations exceeding 80 percent of their respective WQOs (for four successive quarters). For monitoring wells east of Manor Street, monitoring will continue quarterly for ammonia, nitrate, nitrite, TKN, phosphate, and orthophosphate until these constituents are no longer present at concentrations exceeding their respective WQOs (for four successive quarters). Modifications to MRP No. R5-2006-0087 will be made at that time to continue process monitoring if any parameter does not return to pre-injection conditions.

The Discharger will submit a contingency workplan to investigate any byproducts of the nutrient injection process, or nutrient or hydrocarbon breakdown products, in the event these constituents exceed their respective WQOs at monitoring wells MW-44, MW-51A/B/C and MW-55AR/B. A workplan for remedial actions will be developed specifically for the nature and extent of the exceedance identified. These remedial actions could include groundwater extraction and treatment.

The permitted discharge is consistent with the anti-degradation provisions of 40 CFR 131.12 and State Water Resources Control Board Resolution No. 68-16. Some degradation of groundwater may occur from the injection of ammonia and TEP; however, the discharge will not cause an exceedance of water quality objectives or cause a significant impact on the beneficial uses of groundwater outside the treatment area. The continued remediation of polluted groundwater benefits the people of the state.

Issuance of this Order is an action to assure the restoration of the environment and is, therefore, exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.), in accordance with Section 15308 and 15330, Title 14, California Code of Regulations (CCR).

BEM:bem: 8/4/06



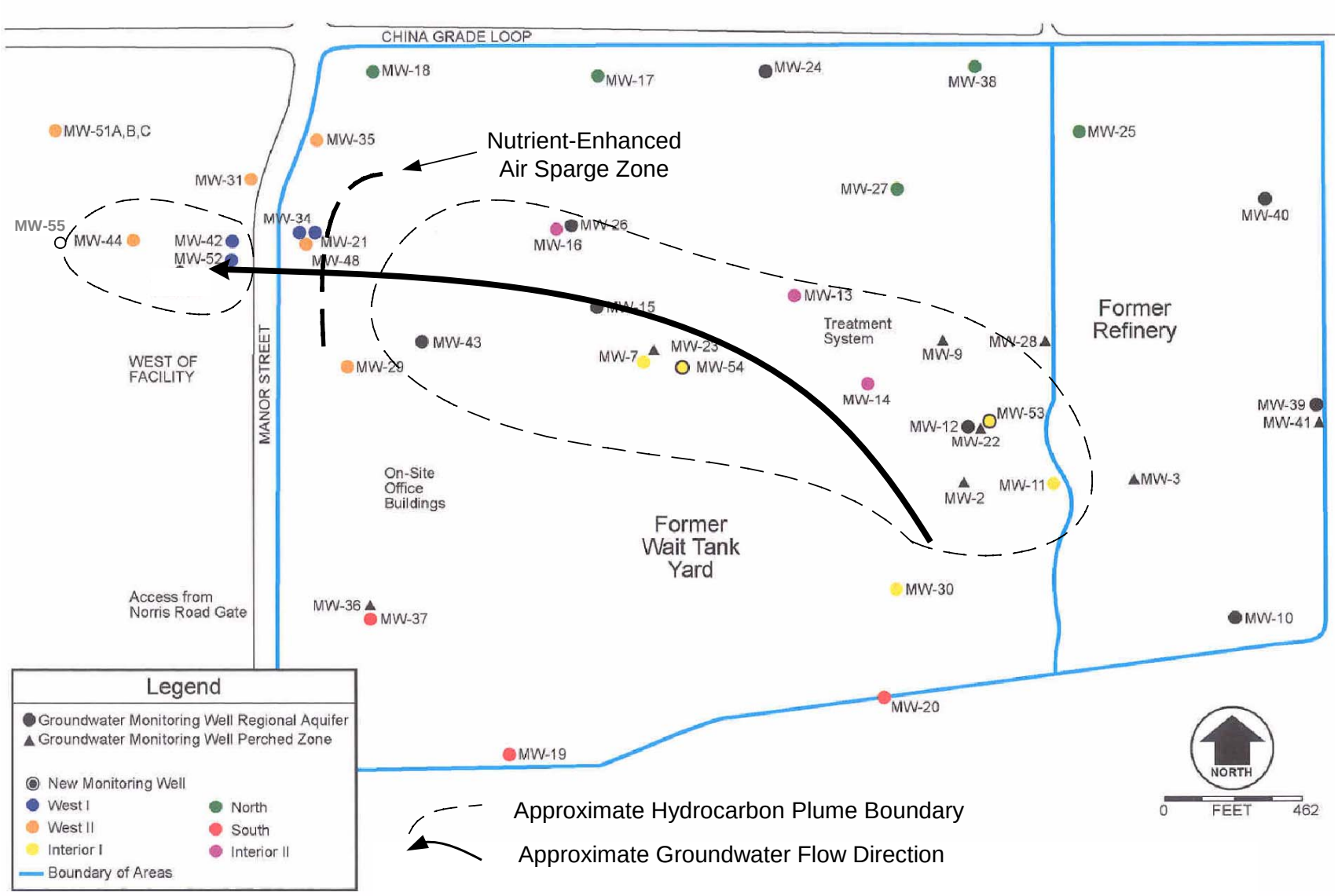
CHEVRON CORPORATION AND
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
CHEVRON FORMER BAKERSFIELD REFINERY AND
WAIT TANK YARD GROUNDWATER CLEANUP
KERN COUNTY

ATTACHMENT 1

WASTE DISHARGE REQUIREMENTS
ORDER NO. R5-2006-XXX

VICINITY MAP

(Modified from August 2002 URS report, "Deep Air Sparging Remedial Action Workplan for Impacted Groundwater")



CHEVRON CORPORATION AND
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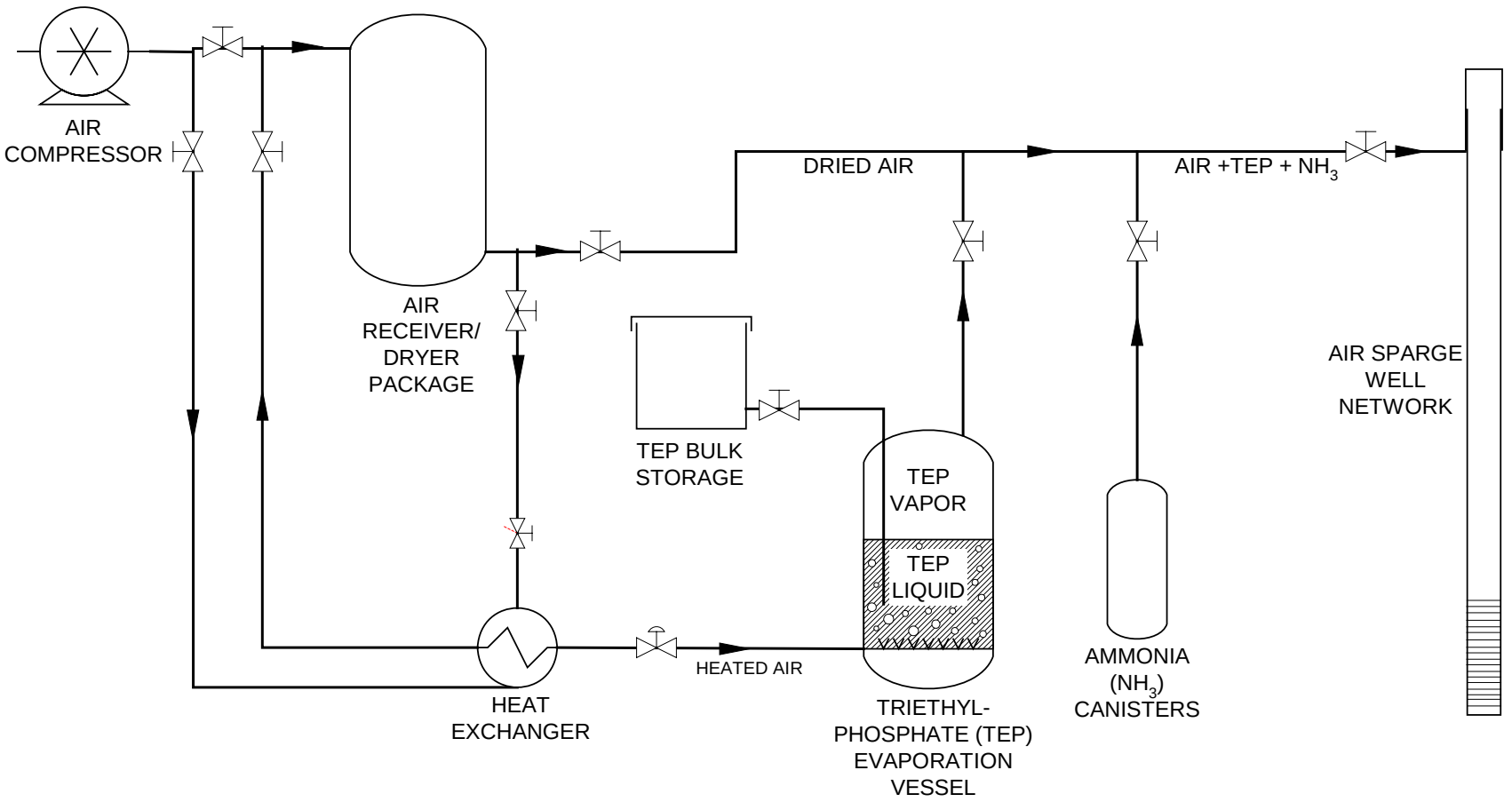
CHEVRON FORMER BAKERSFIELD REFINERY AND
WAIT TANK YARD GROUNDWATER CLEANUP
KERN COUNTY

ATTACHMENT 2

WASTE DISHARGE REQUIREMENTS
ORDER NO. R5-2006-XXX

SITE MAP

(Modified from July 2003 URS report, "Year 2003 1st Semiannual Well Gauging and Groundwater Monitoring Results")



CHEVRON CORPORATION AND
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CHEVRON FORMER BAKERSFIELD REFINERY AND
WAIT TANK YARD GROUNDWATER CLEANUP
KERN COUNTY

ATTACHMENT 3

WASTE DISHARGE REQUIREMENTS
ORDER NO. R5-2006-XXX

SIMPLIFIED PROCESS DIAGRAM - NUTRIENT INJECTION SYSTEM

WASTE DISCHARGE REQUIREMENTS ORDER NO. R5-2006-0087
CHEVRON CORPORATION
AND
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
CHEVRON FORMER BAKERSFIELD REFINERY
AND
WAIT TANK YARD GROUNDWATER CLEANUP
KERN COUNTY

ATTACHMENT 4
STANDARD MONITORING WELL PROVISIONS

Prior to installation of groundwater monitoring wells, the Discharger shall submit a workplan containing at least the information specified in this document. Wells may be installed after the Executive Officer's approval of the workplan. Upon installation of the monitoring wells, the Discharger shall submit a report of results, as described below. A registered geologist, certified engineering geologist, or civil engineer registered or certified by the State of California must sign all workplans and reports.

I. Monitoring Well Installation Workplan

A. General Information:
- Monitoring well locations and rationale
- Survey details
- Equipment decontamination procedures
- Health and safety plan
- Topographic map showing any existing monitoring wells, proposed wells, waste handling facilities, utilities, and other major physical and man-made features.

B. Drilling Details: describe drilling and logging methods

C. Monitoring Well Design:
- Casing diameter
- Borehole diameter
- Depth of surface seal
- Well construction materials
- Diagram of well construction
- Type of well cap
- Size of perforations and rationale
- Grain size of sand pack and rationale
- Thickness and position of bentonite seal and sand pack
- Depth of well, length and position of perforated interval

D. Well Development:
- Method of development to be used
- Method of determining when development is complete
- Method of development water disposal

E. Surveying Details: discuss how each well will be surveyed to a common reference point

F. Soil Sampling (if applicable):
- Cuttings disposal method
- Analyses to be run and methods
- Sample collection and preservation method
- Intervals at which soil samples are to be collected
- Number of soil samples to be analyzed and rationale
- Location of soil samples and rationale
- QA/QC procedures

G. Well Sampling:
- Minimum time after development before sampling (48 hours)
- Well purging method and amount of purge water
- Sample collection and preservation method
- QA/QC procedures

H. Water Level Measurement:

The elevation reference point at each monitoring well shall be within 0.01 foot. Ground surface elevation at each monitoring well shall be within 0.1 foot. Method and time of water level measurement shall be specified.

I. Proposed time schedule for work.

II. Monitoring Well Installation Report of Results

A. Well Construction:
- Boring diameter
- Casing diameter
- Casing material
- Size of perforations
- Number of bags of sand
- Well elevation at top of casing
- Depth to groundwater
- Date of water level measurement
- Monitoring well number
- Date drilled
- Location

B. Well Development:
   - Date(s) of development of each well
   - Method of development
   - Volume of water purged from well
   - How well development completion was determined
   - Method of effluent disposal
   - Field notes from well development should be included in report.

C. Well Surveying: provide reference elevations for each well and surveyor's notes

D. Water Sampling:
   - Date(s) of sampling
   - How well was purged
   - How many well volumes purged
   - Levels of temperature, EC, and pH at stabilization
   - Sample collection, handling, and preservation methods
   - Sample identification
   - Analytical methods used
   - Laboratory analytical data sheets
   - Water level elevation(s)
   - Groundwater contour map

E. Soil Sampling (if applicable):
   - Date(s) of sampling
   - Sample collection, handling, and preservation method
   - Sample identification
   - Analytical methods used
   - Laboratory analytical data sheets