PERMIT ATTACHMENT 8
GROUND WATER SAMPLING PLAN

I. CONTAINER PREPARATION

I.A. The containers will be constructed of a material compatible and non-reactive with the expected sample aliquots. Consult Appendix 1, Recommended Container-ization and Preservation of Samples, to determine the number, type and volume of containers needed. Metal lids should not be utilized. Plastic lids with polyethylene or Teflon liners are acceptable in most cases.

I.B. Individual aliquot containers are not required for each chemical determination or test. If two or more tests require the same container and preservation, and a container of sufficient size is available, the sample aliquots may be combined.

I.C. The sample containers will generally be supplied by the analytical laboratory. The containers will be cleaned by the laboratory before shipment to the Facility in accordance with the laboratory's quality assurance program. The Laboratory will provide documentation certifying the containers to be analyte-free. Alternatively, the laboratory may provide sample containers that have been purchased from a vendor, provided the vendor can provide documentation certifying the containers to be analyte-free. If sample containers are not supplied by the Laboratory and/or vendor the containers shall be cleaned in accordance with Section VI.

I.D. One set of trip blank sample aliquots for the parameters to be sampled and analyzed for (Tables VII-2, VII-3, and VII-4) shall be prepared for each sampling event. The trip blank sample aliquots will be prepared in the laboratory by filling the appropriate clean sample bottles, with "analyte-free" reagent-grade water adding the appropriate preservatives, as indicated in Appendix 1, for each type of sample. These bottles will be labeled "Trip Blank", the analyses to be performed indicated on each, and placed in the sample shuttle cooler(s) used for sample transport to the field and back to the Laboratory.

The Trip Blank will be used to document any contamination which may be attributable to the containers, the coolers, the cleaning operations, and the chemical preservatives.

I.E. If the sample locations and tests are known prior to collection, the container labels may be partially completed and the chemical preservatives added to the containers (where applicable) before sampling.

I.F. The Laboratory will generally supply sample shuttle kits (each) consisting of an insulated cooler, precleaned containers, labels, seals, and Chain-of-Custody, field

log, and shipping forms. Refrigerant will be supplied by the sampling crew at the time of sampling.

II. WELL INSPECTION

The monitoring wells shall be inspected prior to each groundwater sampling event. Immediately after removal of the well casing cap, and prior to taking water level measurements, an organic vapor reading will be taken from the air space within the well casing. The organic vapor reading will be taken using a properly calibrated Foxboro 108 Organic Vapor Analyzer or equivalent Organic Vapor Meter. These data from the well inspection shall be recorded on the form provided in Appendix 4. Should organic vapors be detected during the inspection, the headspace shall be re-tested for organic vapors during the sampling event. The depth to water, if any, and total well depth shall be measured during the inspection. Each well shall be checked to determine if water is present in the well. These data will be recorded on the form provided in Appendix 6. Personnel will also note well conditions, as appropriate, on this form.

III. WELL EVACUATION

Prior to purging the well in preparation for sampling, the groundwater personnel will perform the following tasks:

- On these wells in which organic vapors were detected during well inspection the headspace will be re-tested immediately prior to purging.

- A water-hydrocarbon interface probe will be employed to determine if an immiscible layer is present (see Section IV.H.). Sampling of immiscible layer(s) (if present) shall precede well evacuation procedures. Immiscible layers, if present, will be sampled using a device constructed of the same material as the well casing, stainless steel, or teflon. Care will be taken to gently lower the sampling device to avoid, as much as possible, disturbing the interface between the hydrocarbon layer and water.

- Measure depth to water and total well depth.

The procedures to perform these tasks are described in Section IV.

III.A. The requirements for purging a well are as follows:

6 CCR 1007-3 264.97 (a)(2) requires that groundwater samples must represent the quality of water passing the point of compliance to ensure that the water sampled is not stagnant and therefore representative of the surrounding groundwater conditions. To meet this requirement, the following protocol shall be followed for purging or evacuating wells:

III.A.1. Rapidly recovering wells are defined as those wells which recover at least 90% of one well volume in less than 12 hours.

- Rapidly recovering wells shall have approximately three well volumes removed prior to sampling.
- Sampling of these wells shall be completed within 24 hours from the time that the last well volume is purged.

III.A.2. Low yield or slowly recovering wells are those wells which take longer than 12 hours but less than 48 hours to recover at least 90% of one well volume of water. Sampling of low yield wells will be following the *Ground water Sampling Procedure for Low Stress (Low Flow) Purging and Sampling Procedure* contained in Appendix 11.

- Low yield wells shall be totaly evacuated (to the extent practicable) only one time prior to sampling.
- Low yield wells shall be inspected within 24 hours of the well evacuation. If a sufficient amount of water is available, a sample shall be collected at this time for analysis of volatiles if performing background sampling or semi-volatile organic compounds if performing detection monitoring sampling..
- Sampling of these wells shall be completed within 48 hours of the well evacuation.

III.A.3. Dry wells are defined as a well which has not recovered at least 90 percent of a well volume within 36 to 48 hours. These wells shall not be sampled.

III.A.4. During each sampling event each previously dry well shall have been checked during the well inspection procedure to determine if water is present in the well. If water is present it shall be purged as described above.

III.A.5. During the first sampling event all inspection and detection monitoring wells shall be classified as a rapidly recovering, low yield or no-yield well.

The first sampling event classifications and measurement of well recovery data shall be recorded on the form in Appendix 5. The Appendix 5 form presents a protocal for classifying the wells relative to recovery. The results of this well recovery classification shall be included in the Monitoring Report.

During the second sampling event each well will be evacuated and sampled in accordance with the procedures applicable to that well's recovery classification which was determined in the first sampling event. Well evacuation procedures and data for those quarterly events will be recorded on the form presented in Appendix 6.

III.B. In order to prevent well contamination, one of the following well purging procedures will be utilized:

III.B.1. A dedicated bailer, constructed of the same material as the well casing, Teflon7, or stainless steel, attached to the reel with a single strand of stainless steel wire or a monofilament line, shall be used. If necessary, the reel will be mounted on a tripod and set directly above the well opening. The bailer and cable should only contact the internal well casing. The reel's monofilament line will be wiped with a clean towel moistened with de-ionized water as the bailer line is retrieved. As the last bailer-full is pulled, the cable will be wiped away from the well casing opening with a freshly prepared reagent grade methanol/D.I. water saturated cloth. Care must be exercised not to permit excessive methanol/water to drop into the well, possibly resulting in contamination of the well. Well water will be evacuated from the uppermost part of the water column to assure that fresh water moves upward from the screen.

III.B.2. A dedicated system composed of either an electrically powered submersible pump, a gas operated positive displacement (bladder or piston) pump, or a gas lift purge pump may be used. The pump intake will be located approximately a foot above the bottom of the screened area to minimize the potential for electrically powered submersible pumps to burn-out upon total evacuation. Electrically powered submersible pumps will not be operated when the water level in the well drops below the pump intake.

III.C. If non-dedicated equipment is used in well purging, that equipment, will be cleaned before evacuating each well. The equipment shall be cleaned and stored per the procedures outline in Section VI. (Note: All groundwater wells at the Highway 36 Facility, except the dry wells, utilize dedicated purging and sampling equipment.)

III.D. All dedicated bailers will be inspected at the time of well purging for cleanliness and functionality.

III.E. All dedicated equipment temporarily removed from its well for repair (i.e. Maintenance Building or Off-site) shall be decontaminated as described in Section VI. Equipment blank samples shall be taken on all dedicated equipment that has been temporarily removed from the well for repairs in Maintenance Building or Off-site and after it has been decontaminated.

III.F. All purge water shall be collected in a calibrated container to determine evacuation rate and volume. Well water not used for sampling will be transferred to a central collection point (portable collection tanks), and evaluated for proper waste water management.

IV. FIELD RECORDS (Evacuation)

A separate evacuation field log for each well shall be maintained to record all pertinent information regarding the evacuation and sampling of monitor wells. Sample forms are presented as Appendices 5 and 6. The form in Appendix 5 will be utilized during the first sampling event for classifying wells according to their recovery characteristics. The form in Appendix 6 will be utilized for all other sampling events. This recorded information is necessary to maintain well sampling data and becomes part of the analytical report. The sample collector shall sign and date each page of the field log (see Section VII and Appendix 7). The following data shall be determined and recorded upon the evacuation of each well:

IV.A. Sample collector's name, date and time that evacuation was initiated and completed.

IV.B. Site and Location

IV.C. Event and Year

IV.D. Well Identification - i.e., monitor well number, code or name.

IV.E. If applicable, organic vapors measured in the well head in accordance with Section II or III.

IV.F. Well Depth - Measure from a marked reference point at the top of the casing to the bottom of the well to the nearest 0.01 foot with a clean weighted measuring tape or a calibrated water level indicator. The tape or water level indicator shall be wiped with a clean cloth saturated with reagent grade methanol and de-ionized water following each measurement of well depth.

Wells with dedicated pumps will be re-developed at a minimum once a year during the second quarter, or at any time should excessive silting occur. Well depth will be measured after re-development and recorded on the sampling log.

IV.G. Water Level Depth - Measure from the marked reference point at the top of the well casing to the water surface to the nearest 0.01 foot with a calibrated water level indicator. The water level indicator shall be calibrated and any correction factors noted on the meter, and the factor, if any, will be applied to the water level depth measurements. Each well shall have a marked measurement reference point at the top of the casing from which its water level is taken. An elevation/location reference point shall be established in relation to mean sea level by a licensed surveyor for each well, the marker is typically located on the concrete well pad. The reference point shall be established in relation to mean sea level and the survey shall also note the well location coordinates. Appendix 9 shows mean sea level elevations for the reference points at each well.

IV.H. Depth to any light or dense immiscible layer(s), and thickness of each layer - Measure from the marked measurement reference point at the top of the well casing to the immiscible layer(s) (to a maximum depth of 200 feet) utilizing a water-hydrocarbon interface probe. If immiscible layers are present, document the method of collection and identification of immiscible layer samples.

IV.I. Measure and record well casing inside diameter to the nearest 0.1 inch.

IV.J. The well volume - Calculate the amount of water in gallons occupying the well prior to purging as follows:

Volume (gallons) = (3.14) $r^2h/231$.
r = inside well casing radius in inches.
h = height of water in well in inches (well depth minus the water level depth).

Record the calculated well volume in the well sampling log.

IV.K. Record total gallons evacuated - Well yield

IV.L. Record water level (in feet) following evacuation.

IV.M. Record method of evacuation - type of bailer, pump, etc. including description.

IV.N. Comments - Any deviation from standard sampling procedures, unusual conditions, damage or problems encountered at each well should be recorded completely, clearly and concisely.

V. SAMPLING THE MONITOR WELLS

After the wells have been evacuated (Section III) , the containers and sampling equipment shall be prepared and the initial log data entered. Those wells which meet the recovery criteria specified in Section III.A. shall be sampled as follows:

V.A. Remeasure the water level depth to the nearest 0.01 foot and record on the field sampling log (Appendix 7).

V.B. All non-dedicated equipment used to sample the well (e.g., bailer, funnel, etc.) must be cleaned and stored per the procedures outlined in Section VI.

V.C. During the normal course of sampling equipment blanks will not be taken from wells utilizing dedicated sampling equimpent. If the dedicated equipment is removed from the well for any reason other than the normal course of sampling or well purging, then the equipment will be decontaminated and an equipment blank will be collected from the final rinse of the decontamination process which was performed in accordance with Section VI.

During sampling, an equipment blank(s) will be generated from the filtration equipment. If dedicated filtration equipment is used (e.g., disposable filter and tubing) then one equipment blank will be generated for each sampling event. If non-

dedicated filtration equipment is used (e.g., Buchner funnels, filter stand, etc.) then one equipment blank will be generated for each day of the sampling event. The filtration equipment blank(s) will be analyzed for dissolved metals only.

If an equipment blank is necessary then the equipment blank will be generated by passing laboratory supplied "analyte-free" reagent-grade water through the sampling equipment, and then into the appropriate prelabeled container for transport to the laboratory. This blank is to be prepared in the field, prior to the collection of samples. These containers are to be labeled "equipment blank" (see Section VII), and placed in the coolers utilized to ship the samples to the laboratory. If applicable, one equipment blank shall be prepared for each day that monitoring wells are sampled. Equipment blanks are not to be taken from wells utilizing dedicated sampling equipment. Dedicated equipment should not be removed and exposed to possible sources of contamination. A sampling scenario shall be employed, to ensure all non-dedicated sampling equipment is blank sampled each time that piece of equipment undergoes the decontamination procedure.

V.D. If the well is equipped with a dedicated submersible pump, it will be used to sample the well. Wells shall be sampled within the time periods specified in Section III.A. Samples will be collected in the order of volatility. When collecting samples for the analyses of volatile constituents, such as volatile organics, total organic carbon (TOC) or total organic halide (TOX), pumping rates shall be minimized within the limits of the pumping equipment available.

V.E. Wells not equipped with a pump system will be sampled utilizing a bailer. The bailers will be constructed of stainless steel, Teflon7 or of the same material as the well casing, attached to a reel with a clean single strand stainless steel wire or a monofilament line. The reel will be mounted on a tripod if necessary and set directly above the well opening. Except as specified in Section III.A.4. the first bailer-full collected shall be used to rinse the bailer and managed as described in paragraph III.F., if the well has recharged sufficiently to collect all samples required. If the well contains insufficient water to generate the necessary aliquots, then the first bailer-full may be used to collect the sample, rather than discarding it as rinse water. Samples will be transferred, with as little agitation as possible, from the bailer to the sample containers and immediately preserved according to the specific test requirements (see Appendix 1). Upon withdrawing the last bailer-full, the cable will be wiped away from the well casing opening with a fresh clean cloth saturated with deionized water and reagent grade methanol. Care must be taken not to allow any excess methanol/water mixture to enter the well.

V.F. All samples collected for transport to the Laboratory shall be chemically preserved (if applicable) and immediately placed on wet or blue ice. See Appendix 1, for specific requirements. Groundwater samples on which dissolved metals analysis will be conducted shall be filtered through a 0.45 micron filter (glass fiber or membrane), transferred to a bottle, and preserved with nitric acid to a pH less than 2. All filtering will be done at the Facility site prior to sample shipment.

All containers, especially those containing samples to be analyzed for volatile constituents, will be filled to the top, inverted and checked to ensure that no air bubbles are present. Records shall include notation of the presence of headspace at the time of collection and upon receipt at the laboratory. VOA septum vials shall be transported inverted.

V.G. The following determinations will be made in the field at the time of sampling and recorded on the field logs:

- pH
- Temperature
- Turbidity
- Specific Conductance
- Calibration checks

Field monitoring instruments including pH, specific conductance, and turbidity meters, shall be calibrated each day of sample collection prior to sampling. In addition, the calibration of these instruments shall be verified using certified standards prior to the sampling of each well. All calibration verifications will be recorded in the designated logbook. Wells will be monitored for organic vapors using a calibrated OVA/OVM instrument not more than three weeks prior to the overall sampling event. Organic vapor readings will be recorded in the designated logbook.

V.H. Sample Shipment - Samples will be shipped in sealed insulated shipping containers, ice chests or coolers supplied by the analytical laboratory conducting the analyses. Shipment and receipt of samples must be coordinated with the laboratory to minimize time in transit. All samples for organic analysis (and many other parameters) should arrive at the laboratory within one day after sampling and maintained at zero to 4^{o} C with wet ice or packaged refrigerant ("blue ice"). Wet ice should be replaced with frozen packaged refrigerant just prior to shipment. To insure arrival at the laboratory in good condition, the samples will be sent in sturdy insulated ice chests (coolers). An air courier or equivalent overnight courier service will be utilized, if necessary. The internal temperature of the shuttle at the time of shipment and at the time of receipt at the laboratory shall be recorded on the field logs.

V.I. One well field duplicate will be obtained for 20 wells (batch) in each scheduled sampling event. Duplicated sampling of wells will be determined by the random sampling method discussed in Appendix 8 of this plan. Only those wells that have traditionally produced a sufficient volume of water to fill a complete Background Parameters (Groundwater Protection Program Table 3) or Detection Monitoring (Groundwater Protection Program Table 4) bottle set will be included as potential duplicate well candidates. Duplicate sample aliquots (except for volatile analysis samples) will be collected in quarter-bottle increments to ensure inter-sample homogeneity.

VI. DECONTAMINATION OF NON-DEDICATED EVACUATION AND SAMPLING EQUIPMENT and NON-LABORATORY SUPPLIED SAMPLING EQUIPMENT

The cleanliness of the containers, evacuating and sampling equipment is most important.

VI.A. Bottles and lids to contain samples for metals or conventional analyses must be hand washed with a liquid hand dishwashing detergent, rinsed in hot tap water, rinsed with chemically pure or reagent grade nitric acid, rinsed at least four times with tap water and four times with distilled or deionized water and allowed to air dry.

VI.B. Glass bottles used to collect samples for the determination of organic compounds by GC, GC/MS, or HPLC analysis shall be washed with a liquid hand dishwashing detergent, rinsed with hot tap water, rinsed with reagent grade methanol, finished with D.I. water (at least six rinses), and kiln baked at 300^{o} C. Caps and teflon liners for these analyses, shall be prepared in the same manner, except without the kiln bake. When the bottles are cool and the caps and liners are completely dry, cap the bottles and store them in a clean and dry environment.

VI.C. All non-dedicated equipment used to bail or sample a well must be cleaned in the same manner prescribed for cleaning the bottles and lids for conventional analysis described in A. above, and stored in a clean and dry environment. Clean bailers must be wrapped in new aluminum foil with the bright side out, or high grade paper for storage.

VII. FIELD RECORDS (Sampling)

VII.A. It is most important to maintain an accurate and thorough field log in case one is required to recall particular detailed information concerning the evacuation and sampling of a monitor well. As mentioned earlier, these logs become part of the analytical report. In addition to the information recorded during the purging process (Section III), the following information will be also be recorded on the field log at the time of sampling (See Appendix 7):

VII.A.1. Sample collector's name, date and time of sampling.

VII.A.2. Water Level Depth - Measure from the reference point at the top of casing to the water surface to the nearest 0.01 foot with a calibrated water level indicator.

VII.A.3. Reason for sampling - e.g., semi-annual sampling, special problem (define), initiator requesting the well sampling.

VII.A.4. Sample identification number for each set of samples taken from a single sample source.

VII.A.5. Sample pH and specific conductance, temperature and turbidity, and calibration documentation (See Section IV.G.).

VII.A.6. Method of sample collection - type of bailer, pump, etc.

VII.A.7. Sample characteristics - color, odor, sediment, surface oil, etc.

VII.A.8. Sample volume, containers, preservatives.

VII.A.9. Test to be performed on each sample (if known).

VII.A.10. Weather conditions at the time of sampling.

VII.A.11. Sample sequence number - Order in which well was sampled with respect to other wells onsite. If more than one sampler or sampling team are participating in the sampling event, each sampler or team shall record the sequence or order in which each well was sampled with respect to the other wells they have sampled.

VII.A.12. Any additional field observations, comments or recommendations - e.g., split sampling (with whom), re-sampling, equipment failures, condition of the well, etc.

VII.A.13. Sample Custody Statement - If the samples are transferred to the receiving laboratory by the collector and are in his or her possession at all times, a statement to this effect shall be noted.

VII.B. The samples must be sealed to protect their value. If the sample shuttle kit (cooler) does not employ a tamper proof seal, the collector is to date, sign and identify each sample on a seal and attach it to each sample container and lid. A waterproof adhesive seal and pen must be used.

VII.C. Prepare a sample label for each sample container employing a waterproof pen and adhesive label. The following is to be indicated on the label -

VII.C.1. Collector's name, date and time of sampling.

VII.C.2. Sample source.

VII.C.3. Sample identification number.

VII.C.4. Sample preservatives.

VII.C.5. Test(s) to be performed on the sample, if known.

VIII. CHAIN-OF-CUSTODY

Chain-of-Custody records will be used to insure the integrity of the sampling event and the analyses.

VIII.A. A Chain-of-Custody record (Appendix 2 or equivalent) shall be completed by the sample collector for all monitoring well samples.

VIII.B. The sample collector will retain a copy of the Chain-of-Custody record, and forward the original with the sample to the laboratory performing the analyses.

VIII.C. Upon receipt of the samples, the laboratory manager or representative will complete the Chain-of-Custody record, make a copy for his or her files, and return the original with the analytical data.

IX. INSTRUCTIONS TO THE LABORATORY

The results of the analysis of the blanks should not be used to correct the ground water data. If contaminants are found in the blanks, the source of the contamination must be identified and corrective action, including re-sampling, must be initiated. Other quality control samples (e.g., standards, spikes, performance evaluation samples) must be prepared and analyzed as part of the laboratory operation.

X. LABORATORY REQUIREMENTS

The laboratory shall have the capabilities to analyze for most monitor well parameters. Some samples submitted to the laboratory for analysis may be subcontracted to another independent commercial laboratory. Any samples submitted to the Lab must be properly preserved, accompanied with completed Chain-of-Custody records (Appendix 2). If an independent, subcontracted laboratory is utilized, the procedures recommended for sample preservation will be followed, Chain-of-Custody records, and a completed Sample Analysis Request form will accompany the samples.

X.A. Laboratory: Laboratory QA/QC plan applicable to these Groundwater Analysis performed by Highway 36 will be in accordance with the QA/QC specified in Appendix 3. These standard operating procedures will include, but are not limited to, the following:

- The use of Standard Reference Materials, intra-laboratory samples, laboratory blanks, duplicate and spike samples for calibration and matrix interference identification.

- Statistical procedures and accuracy control charts to monitor and document laboratory performance and define analysis acceptance criteria.

- Programs for instrument calibration and maintenance control.

- Sample receipt and documentation.

X.B. Outside Laboratory - Highway 36 will submit to the Department a QA/QC plan for each outside laboratory contacted to perform groundwater analysis.

XI. ANALYTICAL PARAMETERS

The analytical parameters to be analyzed for in groundwater samples collected at the facility are given in Part VII - Groundwater Protection Program, Tables VII-2, VII-3 and VII-4. Listed are each parameter, their respective analytical methods and levels of Reporting Detection Limits and if they

are background or detection monitoring parameters, or both. The metals listed are dissolved metals; these aliquots will be filtered prior to preservation. The parameters pH, specific conductance and turbidity will be determined in the field on unfiltered samples.