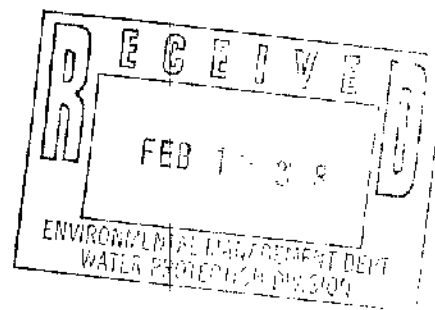


Sue



Remedial Action Plan

Oxbow Marina
100 Oxbow Marina Drive
Isleton, California

Prepared For:
Oxbow Marina
Mr. Joe Da Cruz
100 Oxbow Marina Drive
Isleton, CA 95641

Prepared By:
Apex Envirotech, Inc.

Apex Project No. OXB02.001

February 14, 2008



11244 Pyrites Way • Gold River, CA 95670
Phone 916.851.0171 • Fax 916.851.0177 • Toll Free 1.800.242.5249

February 14, 2008

Ms. Susan Erickson
County of Sacramento
Environmental Management Department
8475 Jackson Road, Suite 230
Sacramento, California 95826

Subject: **Remedial Action Plan**
 OxBow Marina, 100 Oxbow Marina Drive
 Isleton, California
 Apex Project No. OXB02.001

Dear Ms. Erickson:

Apex Envirotech, Inc. (Apex) has been authorized by OxBow Marina (OxBow) to provide this remedial action plan outlining the installation of an oxygen injection system at the subject site (Figures 1 & 2). This remedial action plan is in response to the County of Sacramento Environmental Management Department (SCEMD) letter dated December 26, 2007, approving the results of the oxygen injection pilot test (Appendix A). All field work and sampling shall be conducted in accordance with Apex's standard operating procedures included as Appendix B.

This workplan provides details about the installation of an oxygen injection system at the subject site. Also included is a full description of the equipment specifications (Appendix C) including a timeline to be utilized for the system start-up and operations and maintenance.

This report is based in part on information obtained by Apex from OxBow, and is subject to modification as newly acquired information may warrant.

BACKGROUND

The subject site is located one mile southeast of the town of Isleton in the Sacramento/San Joaquin Rivers Delta. The subject site is an operating marina facility. A recreational marina and trailer park occupy a majority of the site. The four former underground storage tanks (UST), consisting of two 6,000-gallon gasoline, one 6,000-gallon diesel, and one 2,000-gallon gasoline USTs were removed on April 14, 1999. The tank removal work and confirmation soil and groundwater sampling was documented in the Geotechnical Research and Development (GRD)

Remedial Action Plan

Oxbow Marina, 100 Oxbow Marina Drive, Isleton, California

Page 2

report entitled, *Underground Storage Tank Removal Report*, dated April 29, 1999, by Wallace-Kuhl & Associates (WKA).

Based on the GRD report, Ms. Sue Erickson, of the SCEMD, requested that a workplan for a limited subsurface investigation be submitted as a first phase for characterizing the vertical and lateral extent, if any, of contamination. In response to the County, WKA submitted a workplan entitled, *Site Investigation Workplan* dated September 17, 1999. The County approved the WKA workplan in a letter dated December 16, 1999.

August 18, 2000 - Apex implemented the WKA workplan. Apex personnel supervised the drilling of five geoprobe borings at the subject site. Apex collected soil and groundwater samples from each of the five geoprobe borings. Apex submitted the results in a report entitled, *Results Report for Limited Subsurface Investigation*, dated September 6, 2000.

January 25, 2001 - Apex supervised the installation of four 2-inch diameter groundwater monitoring wells (MW-1 through MW-4) and two extraction wells (EW-1 and EW-2) at the subject site. Results of the well installations were documented in the report titled, *Results Report for Limited Subsurface Investigation and First Quarter 2001 Groundwater Monitoring Report*, dated March 7, 2001.

September 5 and 6, 2001 - Apex supervised the installation of five additional groundwater monitoring wells MW-5 through MW-9, in an effort to define the lateral extent and mass of the petroleum contaminant plume at the site. Results of the well installations were documented in the report titled, *Results Report for Limited Subsurface Investigation and Fourth Quarter 2001 Groundwater Monitoring Report*, dated January 15, 2002.

March 22 through 25, 2002 - Apex personnel conducted a tidal study at the site to determine the influence tidal currents have on groundwater elevation. Results from the tidal study were documented in the report titled, *Tidal Study and First Quarter 2002 Groundwater Monitoring Report*, dated April 26, 2002.

June 11 through 14, 2002 - Apex conducted a 48-hour pumping test at extraction well EW-1. Groundwater extraction was not found to be an appropriate remedial method for the site. Results from the pumping test were documented in the report titled, *48-Hour Pumping Test Results Report*, dated October 24, 2002.

January 23, 2003 - The SCEMD responded in a letter to the Apex report titled, *Limited Interim Remedial Action Workplan*, concurring with the proposal to use a vacuum truck as a remedial alternative at wells MW-2 and MW-3.

March 28 and April 26, 2003 - Apex conducted two batch groundwater extraction events. A total of 9,600 gallons of groundwater was extracted with approximately 0.064 pounds of TPHg and 0.028 pounds of MTBE being removed. Given the low concentrations of hydrocarbons removed, Apex ceased further batch groundwater extraction events.

July 9, 2004 - Apex submitted the report titled, *Annual 2004 Groundwater Monitoring Report*, which noted that sampling for redox potential and dissolved oxygen readings during the first quarter 2004 sampling event were positive for anaerobic biodegradation, indicating that natural attenuation was occurring at the site.

September 22, 2004 - The SCEMD issued a letter requesting completion of a feasibility study and site conceptual model for the site.

May 16, 2007 – Apex submitted *Site Conceptual Model and Remedial Alteration Feasibility Study* to the county suggesting oxygen injection as the remediation recommendation.

June 22, 2007 – The SCEMD concurred with Apex's recommendation in the site conceptual model of oxygen injection as the remedial alternative at the site, and directed that Apex install piezometers prior to an oxygen injection pilot test.

July 20 and 25, 2007 - Apex personnel supervised the installation of six one-inch diameter piezometers, P-1 through P-6. The piezometers were installed to a depth of approximately 15 feet. A results report detailing the installation of the piezometer was submitted on August 29, 2007 is currently being prepared.

September 12 and September 26, 2007 – Apex personnel conducted an oxygen injection pilot test at the site. Two injection events were performed on September 12 and September 26, 2007. A results report was submitted on December 19, 2007 documenting the field activities. During the test, oxygen was injected into wells MW-1 and MW-3.

January 10 through 31, 2008 – Apex personnel supervised four weekly batch groundwater extractions as an interim measure to reduce hydrocarbon concentrations at the site. Samples were collected from each well that groundwater was extracted for. Results will be included in the next quarterly monitoring report.

OXYGEN SPARGING POINTS

During the pilot test, oxygen was injected into the subsurface through wells MW-1 and MW-3 from 10 to 33 pounds per square inch gauge (psig). Based on the pressures of oxygen injected during the pilot test and dissolved oxygen readings taken at wells in the vicinity of the injection wells, a radius of influence was observed at approximately 26 and 5 feet in wells MW-1 and MW-3, respectively.

Based on the radius of influence and current iso-concentrations maps on October 24 and 25, 2007, Apex recommends installing eight oxygen sparging points at the subject site shown in Figure 3. The proposed oxygen sparging points should provide adequate coverage of the source area (Figure 4). A map showing the ROI superimposed over the TPHg plume is shown as Figure 5. All proposed oxygen injection wells will be constructed as one inch schedule 40 PVC pipe to a depth of approximately 12 feet below ground surface (bgs). At the bottom of the PVC pipe an oxygen diffuser will be threaded onto the PVC casing with a filtration rating of 40 microns. The

Remedial Action Plan

Oxbow Marina, 100 Oxbow Marina Drive, Isleton, California

Page 4

annular space will be filled with #3 Monterey sand filter pack installed from two feet below the bottom of the diffuser (approximately 16 feet bgs) to 8 feet bgs followed by a two foot thick hydrated bentonite seal and neat Portland Type I-II cement on top of the bentonite seal to two feet bgs. At the top of the well casing the oxygen sparging points will be finished with a one inch tee connected from the well casings to the conveyance piping with a threaded plug on top for field measurements and traffic rated vault boxes to surface. Well construction details have been included as Figure 6.

Underground Service Alert will be contacted at least 48 hours prior to drilling activities to locate underground utilities in the vicinity and adjacent public right-of-ways. As a further precaution, the first five feet of each boring will be hand augured to avoid striking utilities and a private utility locator company will be hired to identify underground utilities.

Soil Sampling

Soil samples will be collected continuously to first groundwater. Depth to groundwater ranges from 4.50 to 7.25 feet bgs. All soil samples will be screened for volatile organics in the field with the use of a photo ionization detector (PID). The soil sample with the highest PID reading and the sample collected just above current groundwater levels will be submitted for analysis from each boring. Soil samples will be submitted under chain-of-custody (COC) documentation, to a state-certified laboratory for analysis for the following constituents:

| Analysis | Abbreviation | Designation | USEPA Method No. |
|--|--------------|----------------------------|------------------|
| Total Petroleum Hydrocarbons as Gasoline | TPHg | Gas Range Hydrocarbons | 8015 Modified |
| Benzene | BTEX | Aromatic Volatile Organics | 8021B |
| Toluene | | | |
| Ethylbenzene | | | |
| Xylenes (Total) | | | |

All drill cuttings will be temporarily stockpiled on site on and under visqueen, pending receipt of the analytical results. A composite soil sample will be collected from the drill cuttings and analyzed for the constituents listed above and for total lead by EPA Method 6010. Once the laboratory analytical data has been received and reviewed, soil disposal options will be considered.

OXYGEN SPARGING SYSTEM CONSTRUCTION

Apex has designed an oxygen injection system to utilize eight oxygen injection wells (AS-1 through AS-8) located on Figure 3. Conveyance piping will be installed from the oxygen sparging unit to each sparging point as one inch horizontal piping installed approximately 18 inches bgs in trenches located on Figure 6. A diagram of the oxygen injection well is shown on Figure 7. Oxygen will be transferred from the oxygen generator to the oxygen sparging points by the one inch conveyance piping.

Power for the remediation equipment will be supplied from the existing temporary power pole located on site. All construction will be completed in accordance with the rules and regulations set forth by the Isleton Building Codes.

OXYGEN SPARGING SYSTEM SPECIFICATIONS

Apex recommends an oxygen sparging system capable of a maximum of 1.14 cubic feet per minute (cfm) and 150 pounds per day (lbs/day) of oxygen injected into the subsurface for groundwater treatment. The oxidizer contains an oxygen concentrator that delivers 90% pure oxygen through a delivery pump capable of delivering 35 psig to up to ten sparging points (eight sparging points will be used onsite). An oxygen boost delivery compressor can also be used to create higher pressures (up to 80 psig at 1 cfm) if needed. The oxygen sparging system contains a programmable logic controller (PLC) and independent time duration control for each sparging port. The oxygen sparging system also contains a high limit pressure switch and pressure relief valve on the injection manifold and high flow cooling fan.

Initially oxygen (90% pure) will be injected into each sparging point at an effective rate of 7.5 standard cubic feet per hour (scfh). Full time operation of the oxygen injection system will consist of biweekly site visits to monitor oxygen injection rates and pressures, with dissolved oxygen (DO) readings collected from monitoring wells and piezometers as needed to monitor system progress and efficiency. Routine maintenance will also be performed to ensure full time operation.

OXYGEN SPARGING SYSTEM INSTALLATION TIMELINE

Once this workplan has been approved, Apex will begin to obtain the necessary drilling permits to install the oxygen injection points and begin construction on the oxygen sparging system as soon as possible. A tentative schedule has been presented below for clarification of significant events in the completion of the oxygen sparging system.

- RAP for oxygen injection system submitted
- RAP approved by SCEMD (1 month)
- Installation of oxygen sparging points (2 months)
- Construction of oxygen sparging system (3 months)

Based on the tentative schedule presented above, the injection system should be operational within six months from the submittal of the RAP.

REPORT DISTRIBUTION

A copy of this report was submitted to:

Regulatory Oversight: Ms. Susan Erickson
County of Sacramento, Environmental Management Department
8475 Jackson Road, Suite 230
Sacramento, California 95826
(916) 875-8550

Mr. Mike Smith
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive # 200
Rancho Cordova, California 95760
(916) 464-3291

Responsible Party: Mr. Joe DaCruz

ATTACHMENTS:

Figure 1: Site Vicinity Map
Figure 2: Site Plan Map
Figure 3: Proposed Oxygen Sparging Points
Figure 4: Proposed Oxygen Sparging Points Radius of Influence
Figure 5: TPHg Isoconcentration Map: October 24 and 25, 2007 with ROI
Figure 6: Proposed Oxygen Sparging Unit Location and Trenching Map
Figure 7: Proposed Oxygen Sparging Well Construction Detail

Appendix A: SCEMD Letter
Appendix B: Apex Standard Operating Procedures
Appendix C: Manufacturers specification sheets

REMARKS/SIGNATURES

The information contained within this plan reflects our professional opinions and was developed in accordance with currently available information, and accepted hydrogeologic and engineering practices

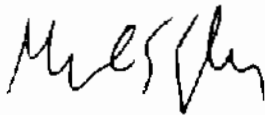
We appreciate the opportunity to provide to you geologic, engineering and environmental consulting services. If you have any questions or comments, please call at (916) 851-0174.

Sincerely,

APEX ENVIROTECH, INC



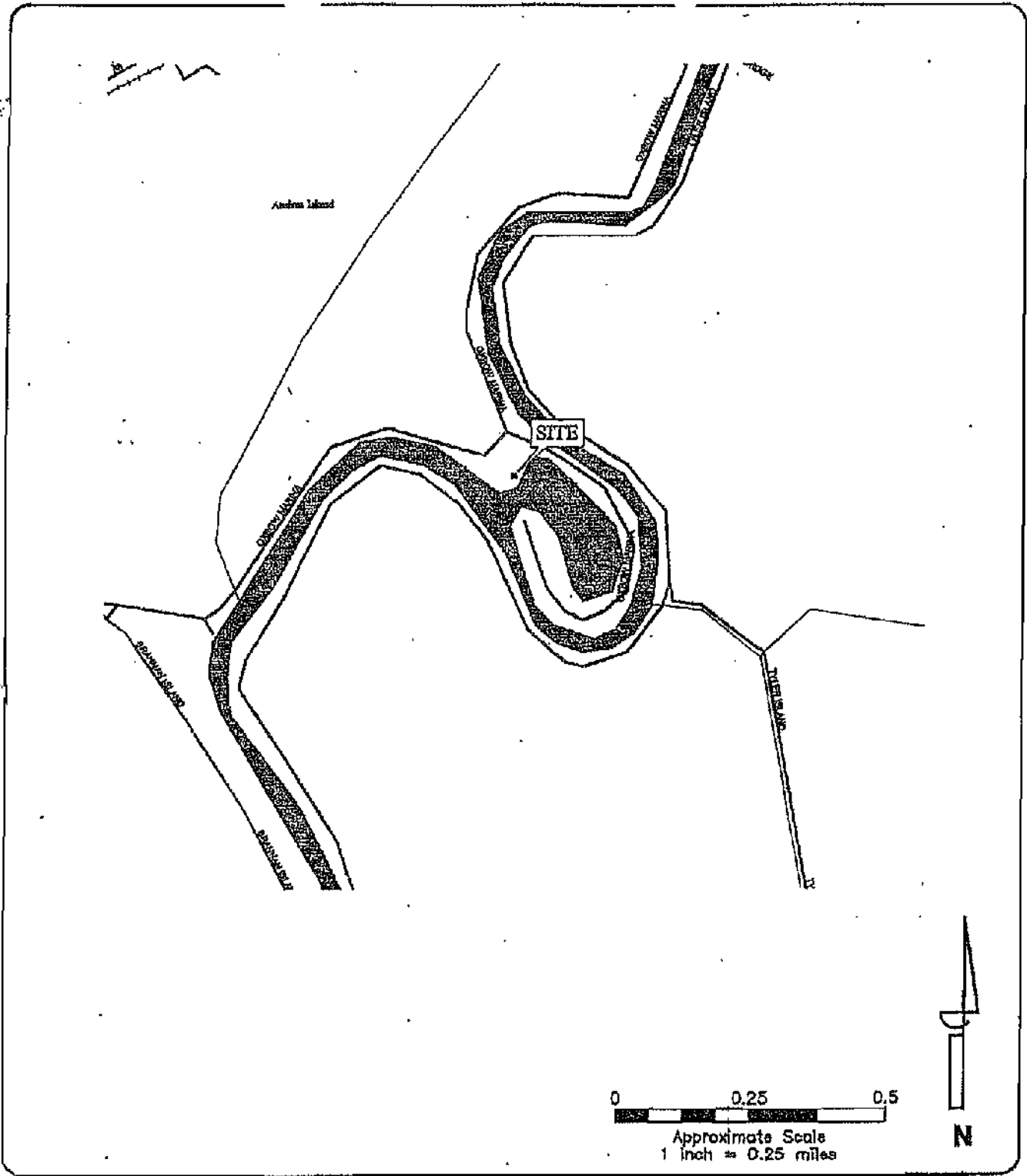
Dan Lafontaine, PE
California Registered Professional
Chemical Engineer, No. 6247




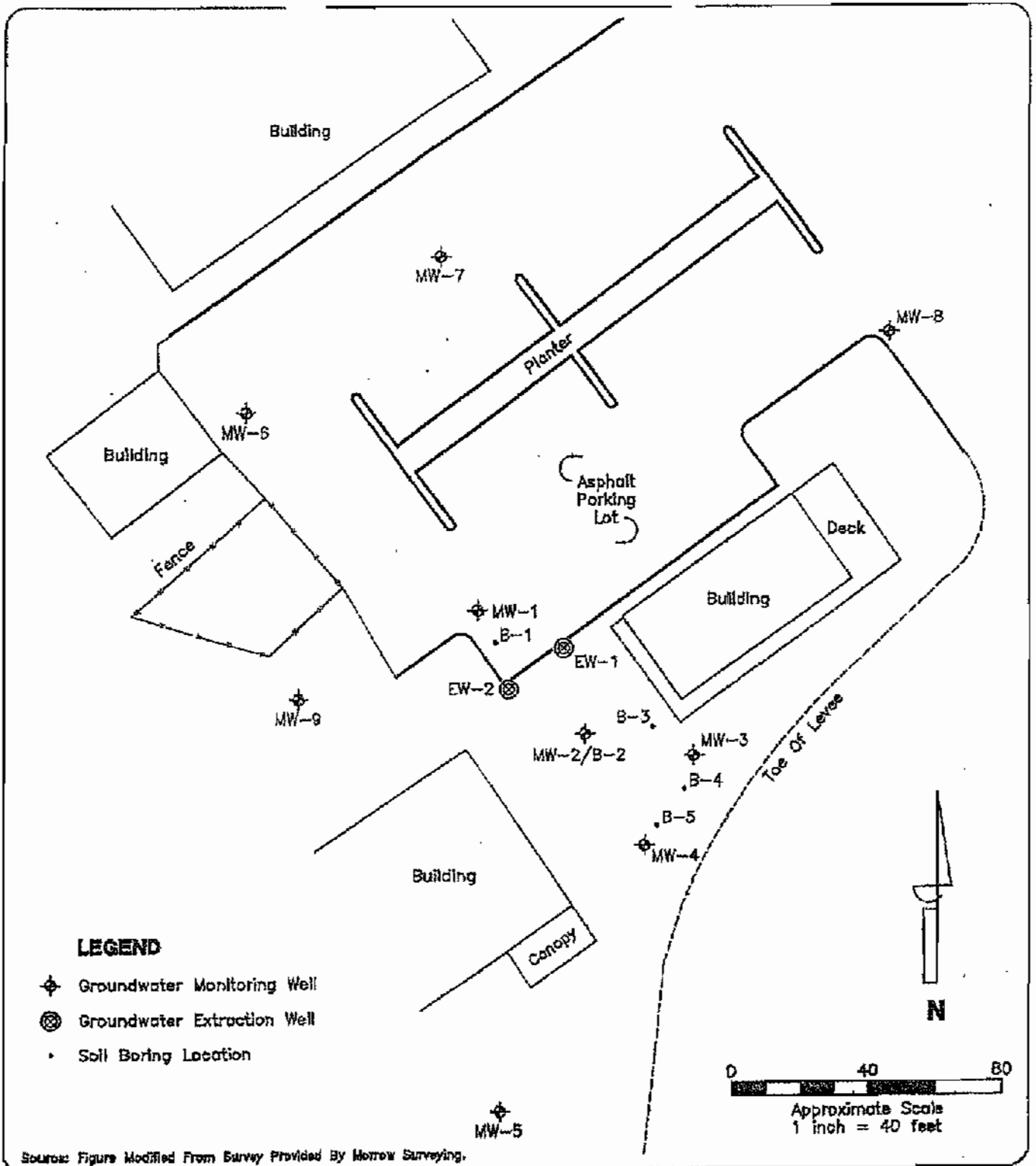
Michael S. Sgourakis, P.G.
Senior Geologist
CPG No. 7194




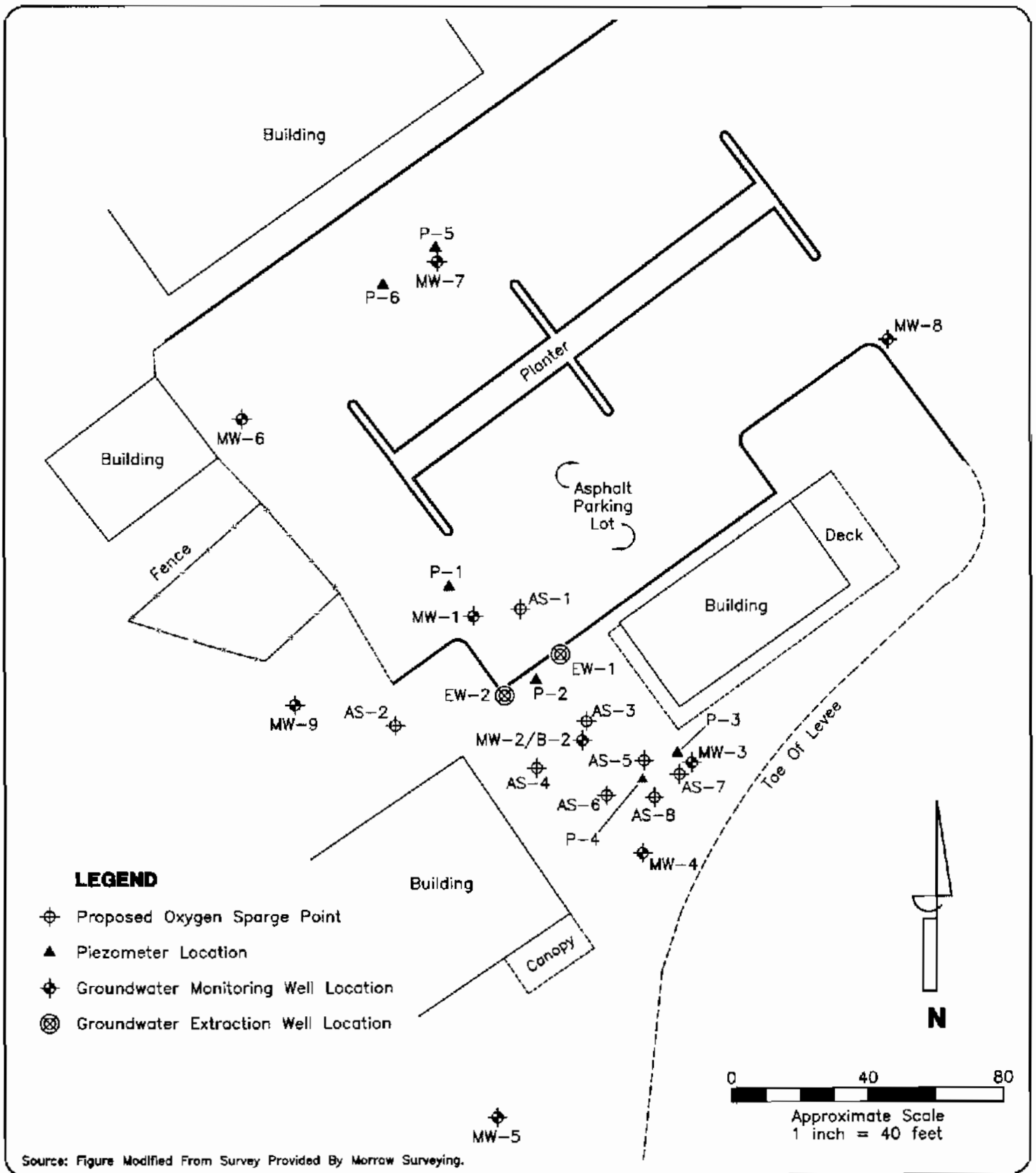
FIGURES



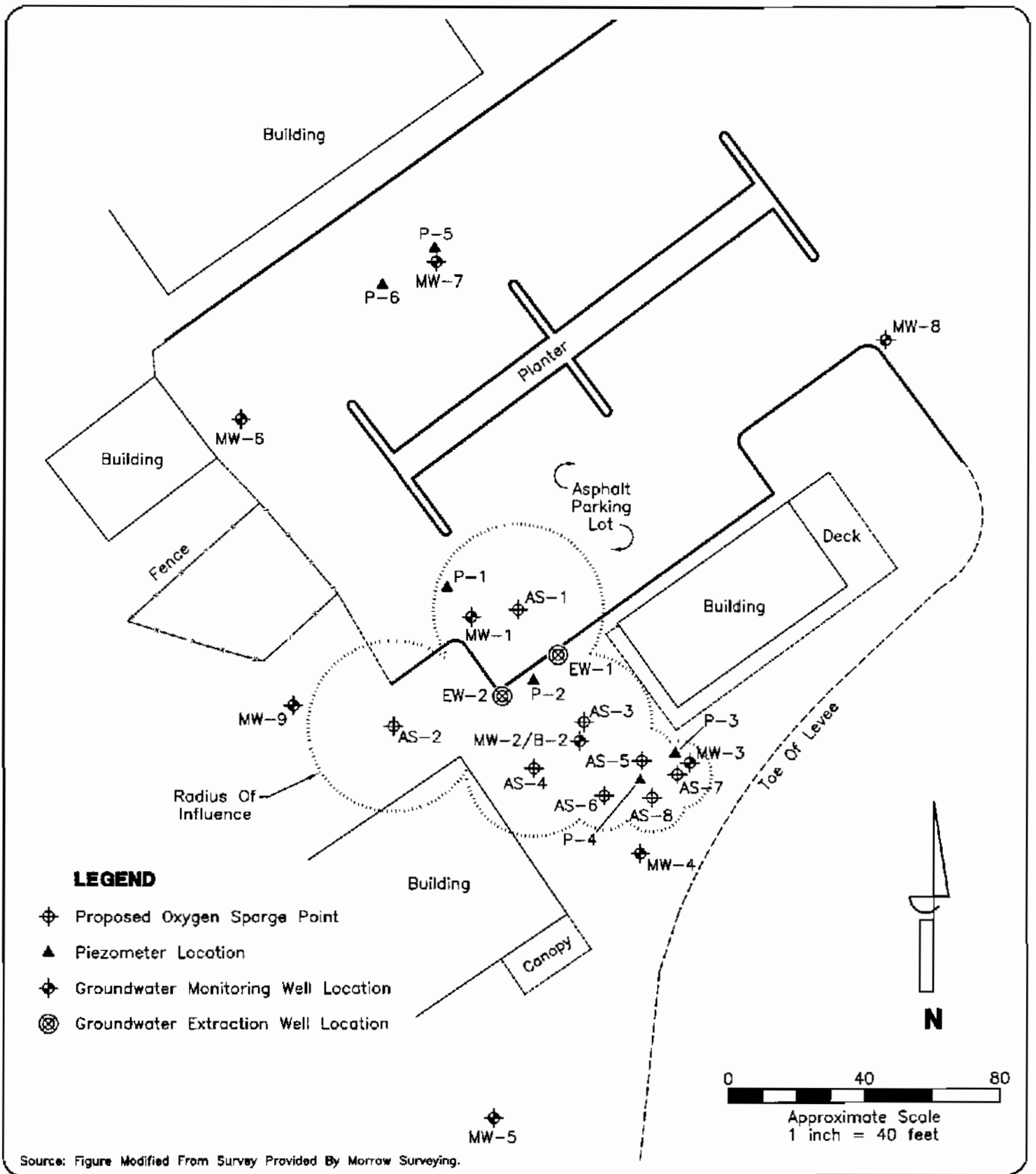
| | | | |
|---|---------------------------------------|------------------------------|-----------------|
|  | DRAWN BY: D. Alston DATE: 04/04/01 | SITE VICINITY MAP | FIGURE 1 |
| | REVISIONS | | |
| | | PROJECT NUMBER: OXB02.001 | |
| | | | |



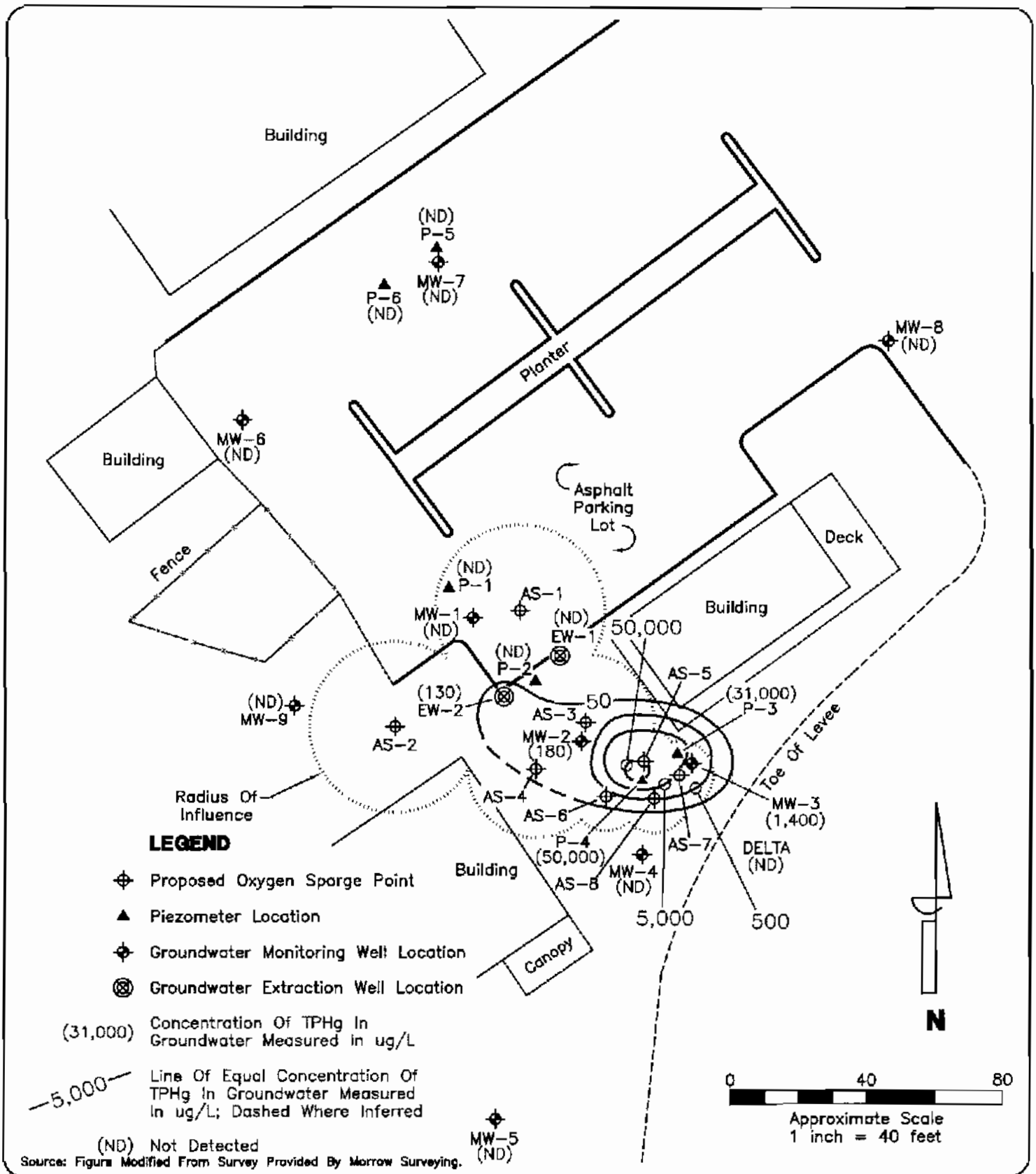
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|---|---------------------------------------|----------------------|-----------------|
|  | DRAWN BY: D. Alston DATE: 10/10/08 | SITE PLAN MAP | FIGURE 2 |
| | REVISIONS | | |
| | | OXB02.001 | |
| | | | |



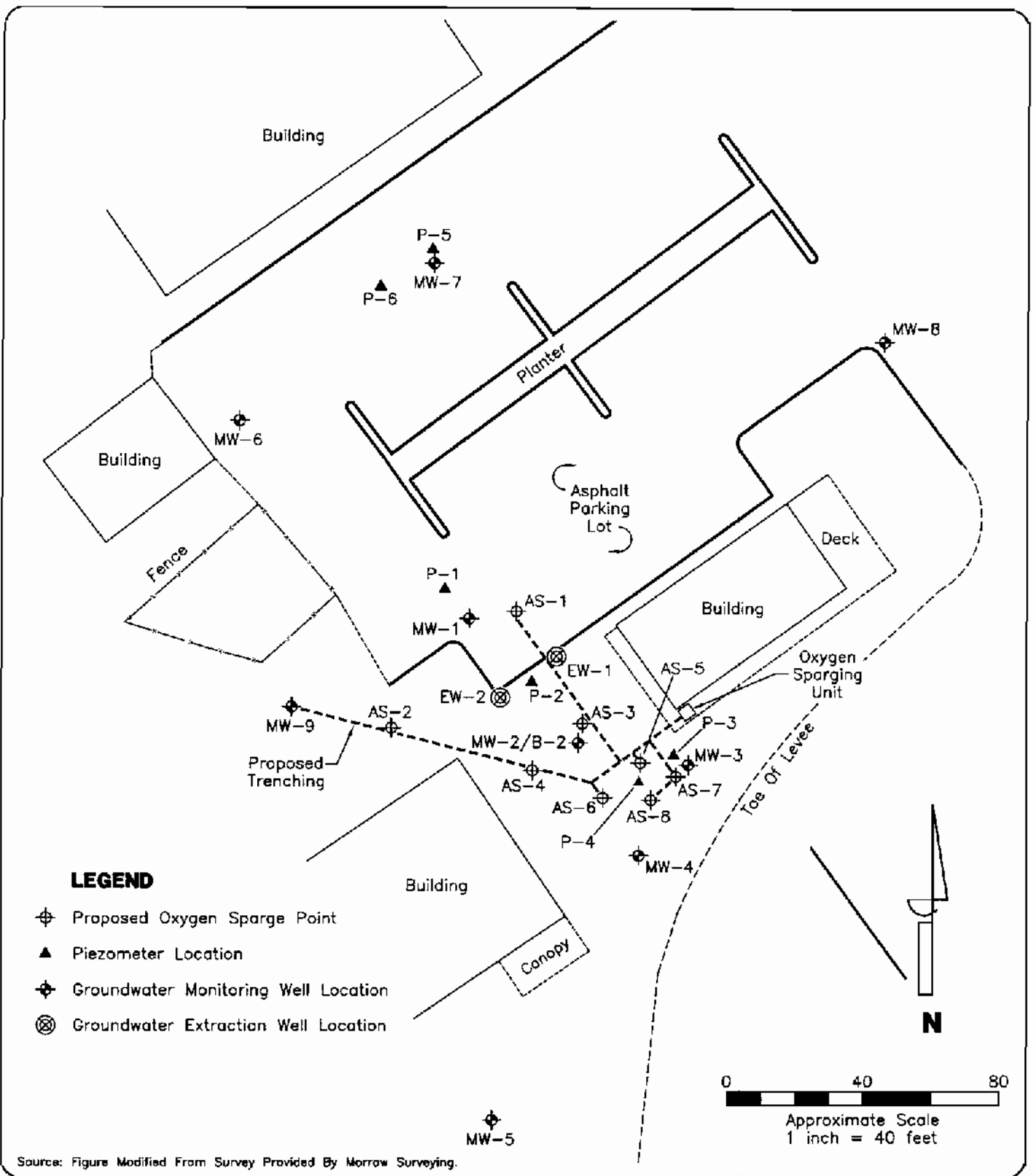
| | | | |
|--|-------------------------------------|--|-----------------|
| | DRAWN BY: D. Alston DATE: 2/7/08 | PROPOSED OXYGEN SPARGING POINTS | FIGURE 3 |
| | REVISIONS | | |
| | | | |
| | | | |




| | | | |
|--|---------------------|--|---------------------|
| | DRAWN BY: D. Alston | PROPOSED OXYGEN SPARGING POINTS RADIUS OF INFLUENCE | FIGURE 4 |
| | DATE: 2/7/08 | | |
| | REVISIONS | OxBow Marina 100 OxBow Marina Drive Isleton, California | PROJECT NUMBER: |
| | | | OXB02.001 |
| | | | |

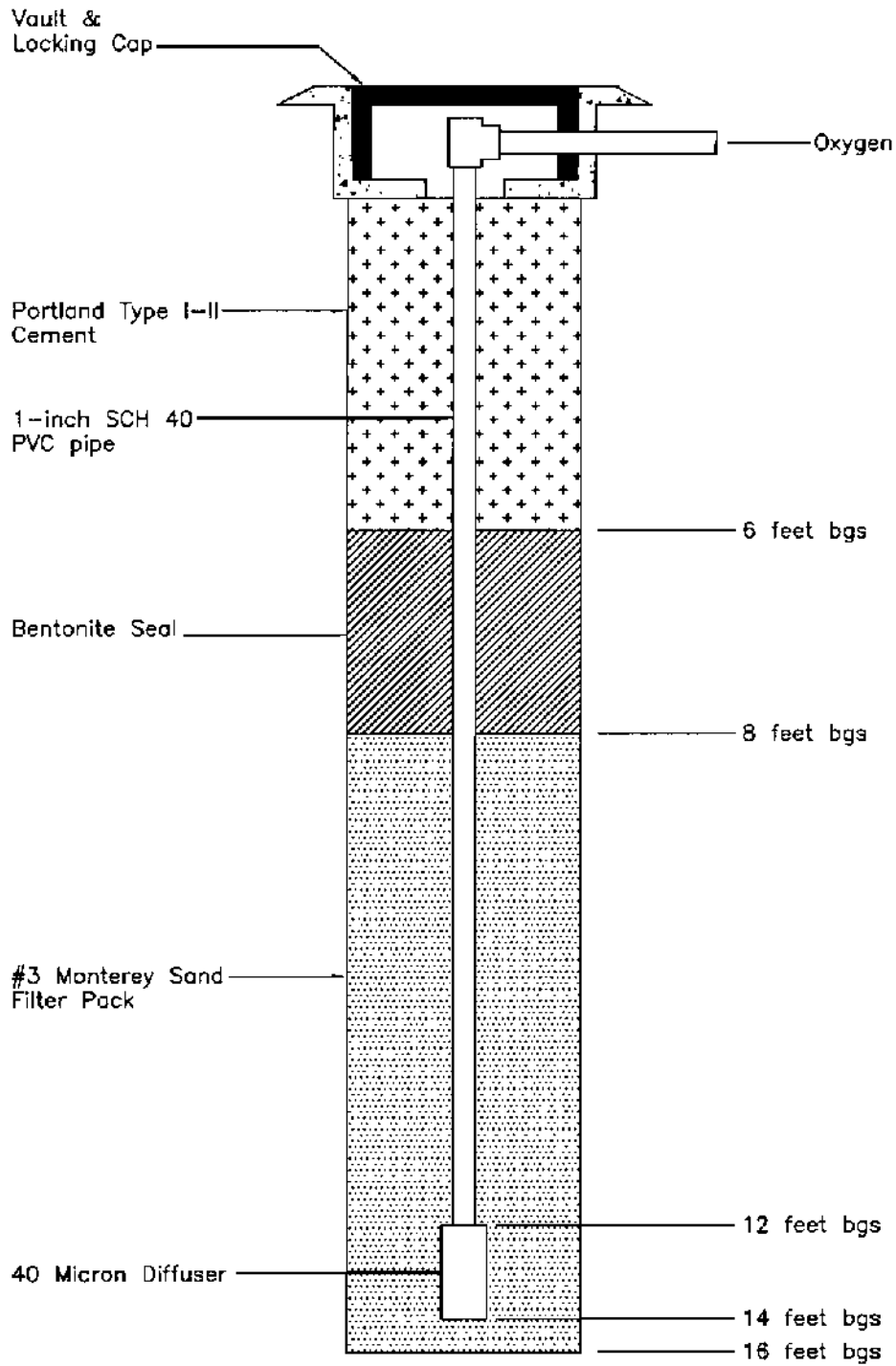


| | | | |
|--|---|---|-----------------|
| | DRAWN BY: D. Aiston DATE: 2/14/08 | TPHg IN GROUNDWATER ISOCONCENTRATION MAP, OCTOBER 24-25, 2007 WITH RADIUS OF INFLUENCE | FIGURE 5 |
| | REVISIONS | | |
| | OxBow Marina 100 OxBow Marina Drive Isleton, California | | |



Source: Figure Modified From Survey Provided By Morrow Surveying.

| | | | |
|---|--------------------------------------|---|---------------------|
|  | DRAWN BY: D. Alston DATE: 2/14/08 | PROPOSED OXYGEN SPARGING UNIT LOCATION AND TRENCHING MAP | FIGURE 6 |
| | REVISIONS | | |
| | (Empty table for revisions) | | |



DRAWN BY: D. Alston
 DATE: 2/14/08

| REVISIONS | |
|-----------|--|
| | |
| | |
| | |

**PROPOSED OXYGEN SPARGING WELL
 CONSTRUCTION DETAILS**

OxBow Marina
 100 OxBow Marina Drive
 Isleton, California

FIGURE
7

PROJECT NUMBER:
 OXB02.001

APPENDIX A
SCEMD LETTER



Countywide Services Agency

Environmental Management
Department

Water Protection Division

Cecilia Jensen, Chief

Terry Schutten, County Executive
Penelope Clarke, Agency Administrator
Val F. Siebal, Department Director

County of Sacramento

COPY

December 26, 2007

Joe DaCruz
Oxbow Marina
100 Oxbow Marina Drive
Isleton, CA 95641

Dear Mr. DaCruz:

**SUBJECT: LOCAL OVERSIGHT PROGRAM SITE NO. D532
OXBOW MARINA
100 OXBOW MARINA DRIVE,
ISLETON, SACRAMENTO, CALIFORNIA**

This Department has received and reviewed the *Oxygen Injection Pilot Test Results Report* prepared by APEX Envirotech. Your consultants recommend batch groundwater extraction events from MW-3 and MW-4 be performed as an initial measure to remove contamination in wells along the levee. In addition, permanent oxygen injection points should be installed in the area around the former USTs and in the distal portion of the plume. We concur. A remedial Action Plan shall be submitted to this Department by **February 1, 2008**.

If you have any questions, please call me at (916) 875-8433.

Sincerely,

Susan J. Erikson, MS
Environmental Specialist III
Site Assessment/Mitigation Group

SJE:lc

c: Vera Fischer, CVRWQCB
Dan LaFontaine, P.E., APEX Envirotech [FAX: (916) 851-0177]

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APPENDIX B

APEX STANDARD OPERATING PROCEDURES

APEX ENVIROTECH, INC.

STANDARD OPERATING PROCEDURES

SOP-1 SOIL BORING SAMPLING

During drilling, soil samples for chemical analysis are collected in thin-walled brass tubes, of varying diameters and lengths (e.g., four or six inches long by two inches outside diameter). Three or four of the selected tubes, plus a spacer tube, are set in an 18-inch long split-barrel sampler of the appropriate inside-diameter.

Where possible, the split-barrel sampler is driven its entire length either hydraulically or using a 140-pound drop hammer. The sampler is extracted from the borehole and the brass tubes, containing the soil samples, are removed. Upon removal from the sampler, the selected brass tubes are either immediately trimmed and capped with aluminum foil or "Teflon" sheets and plastic caps or the samples are extruded from the tubes and sealed within other appropriate, cleaned sample containers. The samples are then hermetically sealed, labeled, and refrigerated for delivery, under strict chain-of-custody, to the analytical laboratory. These procedures minimize the potential for cross-contamination and volatilization of volatile organic compounds (VOC) prior to chemical analysis.

One soil sample collected at each sampling interval is analyzed in the field using either a portable photo ionization detector (PID), flame ionization detector (FID), organic vapor analyzer, catalytic gas detector, or an explosimeter. The purpose of this field analysis is to qualitatively determine the presence or absence of hydrocarbons, and the samples to be analyzed at the laboratory. The soil sample is sealed in either a brass tube, glass jar, or plastic bag to allow for some volatilization of VOC. The PID is then used to measure the concentrations of hydrocarbons within the container's headspace. The data is recorded on both field notes and the boring logs at the depth corresponding to the sampling point.

Other soil samples are collected to document the soil and/or stratigraphic profile beneath the project site, and estimate the relative permeability of the subsurface materials. All drilling and sampling equipment are either steam cleaned or washed in solution and doubly rinsed in deionized water prior to use at each site and between boreholes to minimize the potential for cross-contamination.

In the event the soil samples cannot be submitted to the analytical laboratory on the same day they are collected (e.g., due to weekends or holidays), the samples are temporarily stored until the first opportunity for submittal either on ice in a cooler, such as when in the field, or in a refrigerator at Apex's office.

SOP-2 SOIL EXCAVATION AND SAMPLING

Excavation and subsequent soil sampling is performed under the direction of a registered geologist or civil engineer. To reduce the potential for cross-contamination, all excavation equipment is either steam cleaned or washed prior to use and between excavations. Soil samples for chemical analysis are collected in cleaned, thin-walled brass tubes of varying diameters and lengths (e.g., six inches long by two inches outside diameter) or other appropriate cleaned sample container. If used, one tube may be set in a two inch inside diameter, hand-driven sampler. To reduce the potential for cross-contamination between samples, the

sampler is washed in a solution and doubly rinsed between each sampling event.

Upon recovery, a portion of the soil sample is sealed for later screening with either a portable PID, FID, or an explosimeter. Another portion of the sample is used for description of the excavated materials. A third portion of the sample is hermetically sealed, labeled and refrigerated for delivery, under strict chain-of-custody, to the analytical laboratory. These procedures minimize the potential for cross-contamination and volatilization of volatile organic compounds prior to chemical analysis.

In the event the soil samples cannot be submitted to the analytical laboratory on the same day they are collected (e.g., due to weekends or holidays), the samples are temporarily stored until the first opportunity for submittal either on ice in a cooler, such as when in the field, or in a refrigerator at Apex's office.

SOP-3 SOIL CLASSIFICATION

Soil samples are classified according to the Unified Soil Classification System. Representative portions of the samples may be submitted, under strict chain-of-custody, to an analytical laboratory for further examination and verification of the in-field classification and analysis of soil mechanical and/or petrophysical properties. The soil types are indicated on logs of either excavations or borings together with depths corresponding to the sampling points and other pertinent information.

SOP-4 SAMPLE IDENTIFICATION AND CHAIN-OF-CUSTODY PROCEDURES

Sample identification and chain-of-custody procedures ensure sample integrity as well as document sample possession from the time of collection to ultimate disposal. Each sample container submitted for analysis is labeled to identify the job number, date, time of sample collection, a sample number unique to the sample, any in-field measurements made, sampling methodology, name(s) of on-site personnel, and any other pertinent field observations also recorded on the field excavation or boring log.

Chain-of-custody forms are used to record possession of the sample from time of collection to arrival at the laboratory. During shipment, the person with custody of the samples will relinquish them to the next person by signing the chain-of-custody form(s) and noting the date and time. The sample-control officer at the laboratory will verify sample integrity, correct preservation, confirm collection in the proper container(s), and ensure adequate volume for analysis.

If these conditions are met, the samples will be assigned unique laboratory log numbers for identification throughout analysis and reporting. The log numbers will be recorded on the chain-of-custody forms and in the legally-required log book maintained in the laboratory. The sample description, date received, client's name, and any other relevant information will also be recorded.

SOP-5 LABORATORY ANALYTICAL QUALITY ASSURANCE AND CONTROL

In addition to routine instrument calibration, replicates, spikes, blanks, spiked blanks, and certified reference materials are routinely analyzed at method-specific frequencies to monitor precision and bias. Additional components of the laboratory Quality Assurance/Quality Control program include:

1. Participation in state and federal laboratory accreditation/certification programs;
2. Participation in both U.S. EPA Performance Evaluation studies (WS and WP studies) and inter-laboratory performance evaluation programs;
3. Standard operating procedures describing routine and periodic instrument maintenance;
4. "Out-of-Control"/Corrective Action documentation procedures; and,
5. Multi-level review of raw data and client reports.

SOP-6 HOLLOW-STEM AUGER MONITORING WELL INSTALLATION AND DEVELOPMENT

Boreholes for monitoring wells are drilled using a truck-mounted, hollow-stem auger drill rig. The borehole diameter will be a minimum of four inches larger than the outside diameter of the casing when installing well screen. The hollow-stem auger provides minimal interruption of drilling while permitting soil sampling at desired intervals. Soil samples are collected by either hammering (with a 140-pound drop hammer) or hydraulically pushing a conventional split-barrel sampler containing pre-cleaned two inch-diameter brass tubes. A geologist or engineer from Apex Envirotech, Inc., continuously logs each borehole during drilling and constantly checks drill cuttings for indications of both the first recognizable occurrence of groundwater and volatile hydrocarbons using either a PID, FID, or an explosimeter. The sampler is rinsed between samples and either steam cleaned or washed with all other drilling equipment between borings to minimize the potential for cross-contamination.

Monitoring wells are cased with threaded, factory-perforated and blank Schedule 40 PVC. The perforated interval consists of slotted casing, generally with 0.020-inch wide by 1.5 inch long slots, with 42 slots per foot. A PVC cap may be secured to the bottom of the casing with stainless steel screws; no solvents or cements are used. Centering devices may be fastened to the casing to ensure even distribution of filter material and grout within the borehole annulus. The well casing is thoroughly washed and/or steam cleaned, or may be purchased as pre-cleaned, prior to installation.

After setting the casing inside the hollow-stem auger, sand or gravel filter material is poured into the annular space to fill from boring bottom to generally one foot above the perforated interval. A one to two foot thick bentonite plug is set above this filter material to prevent grout from infiltrating the filter pack. Either neat cement, containing about five percent bentonite or sand-cement grout is then tremied into the annular space from the top of the bentonite plug to near surface. A traffic-rated vault is installed around each wellhead for wells located in parking lots or driveways, while

steel "stovepipes" are usually set over wellheads in landscaped areas.

After installation, the wells are thoroughly developed to remove residual drilling materials from the wellbore, and to improve well performance by removing fine material from the filter pack that may pass into the well. Well development techniques used may include pumping, surging, bailing, swabbing, jetting, flushing, and air-lifting. All development water is collected either in drums or tanks for temporary storage, and properly disposed of depending on laboratory analytical results. To minimize the potential for cross-contamination between wells, all development equipment is either steam cleaned or properly washed prior to use. Following development, the well is allowed to stand undisturbed for a minimum of 24 hours before its first sampling.

SOP-7 ROTARY DRILLING MONITORING WELL INSTALLATION AND DEVELOPMENT

Boreholes for monitoring wells may be drilled using truck-mounted drill rigs capable of air- and mud-rotary drilling, and continuous coring and/or drilling with tri-cone roller or fixed-blade drag bits. Generally, rotary drilling is used when more conventional hollow-stem auger drilling either is or becomes infeasible. Various drilling fluids (mud or air), used to keep the borehole from caving and to remove drill cuttings, are chosen according to the nature of the soils and/or geologic formations expected to be encountered as well as the monitoring program. Samples may be collected directly from cores. A geologist or engineer from Apex Envirotech, Inc., continuously logs each boring during drilling and checks returned drill cuttings for indications of both the first recognizable occurrence of groundwater and volatile hydrocarbons, using either a portable PID, FID, or explosimeter. All drilling equipment is either steam cleaned or washed between borings to minimize the potential for cross-contamination.

Frequently, hollow-stem augers are used to drill and sample to either a minimum depth or auger refusal. In such cases, the augers may be left in place as temporary surface casing, with the center plug removed and drilling/coring carried out through the augers. Alternatively, a shallow conductor casing, or surface casing, may be set by drilling to a desired depth with a large-diameter bit, then setting the casing and proceeding with the drilling/coring. After total drill depth (TD) is reached, the borehole may be logged by geophysical means or hydraulically tested. If casing is not set to the bottom of the borehole, the lower portion of the hole may be grouted or backfilled accordingly. The borehole may be drilled out (reamed) as necessary with a large-diameter bit.

Upon reaching TD, drilling fluid is circulated to remove cuttings. Selected casing is then run into the borehole and set to the desired depth. Monitoring wells are cased with clean, threaded, factory-perforated and blank casing. The perforated interval consists of slotted casing, generally with 0.020-inch-wide by 1.5 inch-long slots, with 42 slots per foot. Centering devices may be fastened to the casing to ensure even distribution of filter material and grout within the borehole annulus. The well casing is thoroughly washed and/or steam cleaned, or may be purchased as pre-cleaned, prior to installation. All recoverable drilling fluid and/or cuttings are collected for temporary storage and disposed of properly pending analytical results.

After setting the casing, sand or gravel filter material is poured into the annular space to fill from boring bottom to generally 1 foot above the perforated interval. A one to two foot-thick bentonite plug is set above this filter material to prevent grout from infiltrating the filter pack. Either neat cement, containing about five percent bentonite, or sand-cement grout is then tremmed into the annular space from the top of the bentonite plug to near surface. A traffic-rated vault is installed around each wellhead for wells located in parking lots or driveways, while steel "stovepipes" are usually set over wellheads in landscaped areas.

After installation, the wells are thoroughly developed to remove residual drilling materials from the wellbore, and to improve well performance by removing fine material from the filter pack that may pass into the well. Well development techniques used may include pumping, surging, bailing, swabbing, jetting, flushing, and air-lifting. All development water is collected either in drums or tanks for temporary storage, and properly disposed of pending laboratory analytical results. To minimize the potential for cross-contamination between wells, all development equipment is either steam cleaned or properly washed prior to use. Following development, the well is allowed to stand undisturbed for a minimum of 24 hours before its first sampling.

SOP-8 GROUNDWATER PURGING AND SAMPLING

Prior to water sampling, each well is purged by evacuating a minimum of three wetted well-casing volumes of groundwater. When required, purging will continue until either the discharge water temperature, conductivity, or pH stabilize, a maximum of ten wetted-casing volumes of groundwater have been recovered, or the well is bailed dry. When practical, the groundwater sample should be collected when the water level in the well recovers to at least 80 percent of its static level.

The sampling equipment consists of either a "Teflon" bailer, PVC bailer, or stainless steel bladder pump with a "Teflon" bladder. If the sampling system is dedicated to the well, then the bailer is usually "Teflon," but the bladder pump is PVC with a polypropylene bladder. In general and depending on the intended laboratory analysis, 40-milliliter glass, volatile organic analysis (VOA) vials, with "Teflon" septa, are used as sample containers.

The groundwater sample is decanted into each VOA vial in such a manner that there is no meniscus at the top of the vial. A cap is quickly secured to the top of the vial. The vial is then inverted and gently tapped to see if air bubbles are present. If none are present, the vial is labeled and refrigerated for delivery, under strict chain-of-custody, to the analytical laboratory. Label information should include a unique sample identification number, job identification number, date, time, type of analysis requested, and the sampler's name.

For quality control purposes, a duplicate water sample is collected from each well. This sample may also be analyzed or put on hold at the laboratory. When required, a trip blank, prepared at the laboratory, is placed in the transport cooler. It is labeled similar to the well samples, remains in the cooler during transport, and is analyzed by the laboratory along with the groundwater samples. In addition, a field blank may be prepared in the field when sampling equipment is not dedicated. The field blank is prepared after a pump or bailer has been either steam cleaned or properly washed, prior to

use in the next well, and is analyzed along with the other samples. The field blank analysis demonstrates the effectiveness of the in-field cleaning procedures to prevent cross-contamination.

To minimize the potential for cross-contamination between wells, all well development and water sampling equipment not dedicated to a well is either steam cleaned or properly washed between uses. As a secondary precautionary measure, wells are sampled in order of least to highest concentrations as established by available previous analytical data.

In the event the water samples cannot be submitted to the analytical laboratory on the same day they are collected (e.g., due to weekends or holidays), the samples are temporarily stored until the first opportunity for submittal either on water ice in a cooler, such as when in the field, or in refrigerator at Apex's office.

SOP-9 MEASURING LIQUID LEVELS USING WATER LEVEL METER OR INTERFACE PROBE

Field equipment used for liquid-level gauging typically includes the measuring instrument (water-level meter or interface probe) and product bailer(s). The field kit also includes cleaning supplies (buckets, solution, spray bottles, and deionized water) to be used in cleaning the equipment between wells.

Prior to measurement, the instrument tip is lowered into the well until it touches bottom. Using the previously established top-of-casing or top-of-box (i.e., wellhead vault) point, the probe cord (or halyard) is marked and a measuring tape (graduated in hundredths of a foot) is used to determine the distance between the probe end and the marking on the cord. This measurement is then recorded on the liquid-level data sheet as the "Measured Total Depth" of the well.

When necessary in using the interface probe to measure liquid levels, the probe is first electrically grounded to either the metal stove pipe or another metal object nearby. When no ground is available, reproducible measurements can be obtained by clipping the ground lead to the handle of the interface probe case.

The probe tip is then lowered into the well and submerged in the groundwater. An oscillating (beeping) tone indicates the probe is in water. The probe is slowly raised until either the oscillating tone ceases or becomes a steady tone. In either case, this is the depth-to-water (DTW) indication and the DTW measurement is made accordingly. The steady tone indicates floating liquid hydrocarbons (FLH). In this case, the probe is slowly raised until the steady tone ceases. This is the depth-to-product (DTP) indication and the DTP measurement is made accordingly.

The process of lowering and raising the probe must be repeated several times to ensure accurate measurements. The DTW and DTP measurements are recorded on the liquid-level data sheet. When FLH are indicated by the probe's response, a product bailer is lowered partially through the FLH-water interface to confirm the FLH on the water surface and as further indication of the FLH thickness, particularly in cases where the FLH layer is quite thin. This measurement is recorded on the data sheet as "FLH thickness."

In order to avoid cross-contamination of wells during the liquid-level measurement process, wells are measured in the order of "clean" to "dirty" (where such information is available). In addition, all measurement equipment is cleaned with solution and thoroughly rinsed with deionized water before use, between measurements in respective wells, and at the completion of the day's use.

SOP-10

SOIL VAPOR SAMPLING: "TEDLAR" BAG SAMPLING TECHNIQUE / REMEDIATION SYSTEM SAMPLING

Prior to vapor sampling, the vacuum system must reach a stabilized air flow (cubic feet per minute) for approximately 15 minutes. Prior to the actual collection of the vapor sample, the following data is recorded: air flow, temperature, and pressure at collection ports and gauges.

The sampling equipment consists of a Tedlar™ bag (available in 1, 3, 5, and 10 liter sizes), a diaphragm pump, and 3/16-inch-diameter polyethylene tubing (approximately 1 foot long). The Tedlar™ bag should be fitted with an integral valve for filling and sealing the bag after sampling. The diaphragm pump inlet and outlet are fitted with 3/16-inch hose barbs for attaching the sample tubing. Prior to vapor sampling, the soil vapor source (vapor screen, vapor extraction well or manifold, etc.) must be isolated for sampling. A sample label with the sample number and date and time of sample collection is prepared and placed on the Tedlar™ bag.

If the sample is being collected from an operating vapor extraction system, the target vapor manifolds must be set up with sample ports that can be isolated without interrupting system operation. Prior to the actual collection of the vapor sample, source data is recorded: air flow, temperature, and pressure; or, well identification number and depth interval of screen.

Typical sampling ports consist of a 1/4 -inch ball valve fitted with a 3/16-inch hose barb to form a slip stream from the sample source.

The sampling procedure requires one end of the tubing be slipped over the sample port hose barb and the other end over the diaphragm pump inlet hose barb to form an air-tight connection. The sampling pump is then started and the pump is purged for one minute with the vapor to be sampled.

Following purging, the discharge of the pump is then connected to the "Tedlar" bag using a section of 3/16-inch tubing. The pump is restarted and the bag is opened and allowed to fill to approximately 3/4 of its capacity. Caution should be taken not to overfill the sampling bag. The sample is placed in a non-refrigerated dry cooler with sufficient packing to prevent damage during transport. Cooling samples will cause condensation of moisture within the sample, thereby distorting the laboratory analysis.

For quality control purposes, a duplicate vapor sample should be collected from each sampling port. This sample is then put on hold at the laboratory pending initial analysis. To ensure quality control and minimize the potential for cross-contamination prior to and during sampling, the diaphragm pump is thoroughly purged for approximately five minutes with nitrogen or clean air (i.e., compressed clean air). A "blank" sample of the discharged air is captured in a "Tedlar" bag at the end of the purging procedure and may be analyzed to ensure the purging was effective.

To minimize the potential for cross-contamination between air samples, the polyethylene tubing, if not sample dedicated, is thoroughly cleaned and rinsed.

Vapor samples are subject to very limited holding times, typically 48 hours. Thus, care must be taken to avoid delays in submittal of vapor samples to the laboratory. In the event the vapor samples cannot be submitted to the analytical laboratory on the same day they are collected, they are to be temporarily stored in the dry, non-refrigerated, packed cooler until the very first opportunity for submittal well within the required holding time, taking into account the time needed for shipment to and receipt by the laboratory.

SOP-11

VAPOR SAMPLING: SUMA CANISTER SAMPLING TECHNIQUE

Prior to vapor sampling, the vacuum system must reach a stabilized air flow (cubic feet per minute) for approximately 15 minutes. Prior to the actual collection of the vapor sample, the following data is recorded: air flow, temperature, and pressure at collection ports and gauges.

The sampling equipment consists of a sterilized, gas-tight, "Suma" stainless steel canister (available in one and six liter volumes), flow meter (if required, obtained and calibrated by the laboratory) and 1/4-inch-diameter polyethylene tubing approximately 2 feet in length.

The sampling ports are brass connections fitted with silicone septa and threaded into a tapped hole in the system piping. The sampling procedure requires one end of the tubing to be slipped over the sampling port and the other end over the canister nozzle or flow meter (if required) to acquire an air-tight connection. The valve should be opened at this time and the initial pressure should then be recorded to verify that the Suma canister is under vacuum. The Suma canister is allowed to collect the soil vapor sample at a predetermined duration. After the sample has been collected record the final vacuum reading (approximately five pounds per square inch gauge (psig)) to ensure that the flow meter was working properly, if applicable. Immediately following the sample collection, complete sampling information is recorded on the label on the air sampling canister (e.g., sample ID, date, time, location, and temperature). The sample is placed in a non-refrigerated, dry cooler with sufficient packing to ensure against damage during transport. Cooling samples will cause condensation of any moisture within the air sample, thereby distorting laboratory analysis.

Suma canister samples are subject to hold times of typically 30 days and with some compounds a more rigid hold time of 14 days is required.

SOP-12

SOIL VAPOR SAMPLING: SYRINGE SAMPLING TECHNIQUE

Prior to vapor sampling, the vacuum system must reach a stabilized air flow (cubic feet per minute) for approximately 15 minutes. Prior to the actual collection of the vapor sample, the following data is recorded: air flow, temperature, and pressure at collection ports and gauges.

The sampling equipment consists of a clean, 100cc, gas-tight syringe and silicone septa.

The sampling ports are brass connections, fitted with silicone septa, and threaded into a tapped hole in the system piping. Samples are collected by inserting a clean syringe into the septum and the plunger actuated several times. Each syringe should be purged of three syringe volumes before collecting the sample. On the fourth purge, the plunger is extracted slowly until the syringe is filled with a gas sample, then the syringe is withdrawn and the needle immediately plugged with a silicone stopper. The sample should be placed in a non-refrigerated, dry cooler with sufficient packing to eliminate breakage during transport. Cooling samples will cause condensation of moisture, thereby distorting laboratory analysis.

Duplicate air samples should be collected as in SOP-10. Vapor samples are also subject to the same hold times and must be stored as stated in SOP-10

SOP-13 SOIL VAPOR SURVEY SAMPLING: "TEDLAR" BAG SAMPLING TECHNIQUE

The sampling equipment consists of a "Tedlar" bag (available in 1, 3, 5, and 10 liter sizes), an SKC universal sample pump, soil vapor probe, and 1/4-inch-diameter polyethylene tubing (approximately three feet long).

A Roto-hammer or slam bar is used to obtain a three foot hole into the ground area, where the soil vapor sample will be collected. Once the hole has been formed the soil vapor probe will be inserted into the hole and advanced the remaining two feet, five feet total below ground surface (bgs), with the use of either a slide hammer, using a tee adapter and using physical force. Once the vapor probe has been inserted into the ground a bentonite seal must be formed between ambient air and the sample air. The bentonite must be hydrated and create an air tight seal around the probe. If required IPA can be placed on the joints of the vapor probe and analyzed for in the sample to ensure that ambient air is not diluting the soil vapor survey samples.

Once the sample apparatus has been set up, new tubing will be connected to the inlet of the SKC sample pump. The pump operates at a low flow purge rate of approximately 200 milliliters per minute to prevent air stripping of contaminants from the soil. Once three volumes have been evacuated (minimum 4.2 minutes of sample time) a sample can be collected. Verification with a PID will determine when the maximum concentration is obtained and a sample should be collected. If measurable concentrations are not obtained with the PID after 7 purge volumes (10 minutes) a sample should be collected. Once a sample has been determined to be collected new tubing will be placed on the effluent of the sample pump running to the Tedlar bag, which should be filled to 3/4 of volume capacity. Caution should be taken not to overfill the sampling bag. The sample is placed in a non-refrigerated dry cooler with sufficient packing to eliminate damage during transport. Cooling samples will cause condensation of moisture within the sample, thereby distorting laboratory analysis.

To minimize the potential for cross-contamination between air samples new polyethylene tubing will be used for every sample.

Vapor samples are also subject to the same hold times and must be stored as stated in SOP-10

SOP-14 SOIL VAPOR SURVEY SAMPLING: INDOOR AIR SAMPLING WITH SUMA CANISTERS

Indoor air sampling requires an eight hour air sample obtained with 6-liter Suma canisters equipped with flow controllers (calibrated by the laboratory) to a flow rate of 11.5 milliliters per minute (ml/min). Suma canisters are placed in each floor of the building at the center of the room being sampled at a height of approximately three to five feet above ground level, to simulate the typical breathing zone. More than one indoor air sample may be required to determine a representative sample of all occupants in the building.

Associated with each indoor air quality sample is an ambient air sample that is collected outside the subject building. The ambient air quality sample consists of one 6-liter Suma canister with a sample collection time of 8 hours at a flow rate of 11.5 ml/min. The ambient air Suma canister is placed approximately 5 to 15 feet upwind of the subject building and 5 feet above ground level. Due to most buildings having an air exchange ratio of 0.5 to 1.0 exchanges per hour, sampling of the ambient air quality will begin at least one hour prior to the indoor air sample.

With all Suma canister sampling the valve should be opened and the initial pressure should then be recorded to verify that the Suma canister is under vacuum. The Suma canister is allowed to collect the soil vapor sample at a predetermined duration (usually eight hours). After the sample has been collected record the final vacuum reading (approximately five pounds per square inch gauge (psig)) to ensure that the flow meter was working properly. Immediately following the sample collection, complete sampling information is recorded on the label on the air sampling canister (e.g., sample ID, date, time, location, and temperature). The sample is placed in a non-refrigerated, dry cooler with sufficient packing to ensure against damage during transport. Cooling samples will cause condensation of any moisture within the air sample, thereby distorting laboratory analysis.

Suma canister samples are subject to hold times of typically 30 days and with some compounds a more rigid hold time of 14 days is required.

APPENDIX C

MANUFACTURERS SPECIFICATION SHEETS



831 North K Street
Livermore, CA 94588
Ph. 925-895-9925
Fax 925-396-6084

February 4, 2008

Mr. Dan LaFontaine, P.E.
Apex Envirotech
11244 Pyrites Way
Gold River, CA 95670

RE: Proposal To Purchase a Mako Industries Cabinet Mounted Oxygen Injection Unit for Isleton, CA. Mako Industries Proposal Number MINC080204

Dear Mr. LaFontaine,

On Behalf of Mako Industries I am pleased to provide to you this quote for a Mako Industries cabinet mounted oxygen injection system capable of up to 150 lbs/day output of oxygen per day at 1 CFM discharge with a 10 port solenoid controlled manifold system. We are confident that you will find both the quality of our equipment and service to exceptional. Please review, sign, and return the proposal/contract provided to proceed with this project.

Cabinet Mounted Oxygen Injection System

- NEMA 4 cabinet enclosed system with mounting feet. Size of cabinet to not exceed 3' wide by 4' long
- Oxygen Generator Output: 1.14 CFM Max, Oxygen concentrator @ 90% purity, up to 150 lbs/day oxygen output
- Oxygen Concentrator output will be @ 90% purity or greater-Total of three included with system
- Oxygen delivery pump: up to 35 PSI, as specified by the oxygen generator to each oxygen generator-Total of three delivery compressors included with system
- Oxygen boost delivery compressor for final injection-2 CFM and up to 100 PSIG, 1 CFM @ 80 PSIG
- Filter/dryer on outlet of pressure delivery pump to ensure complete purity of air delivery to oxygen generator
- PLC Field programmable controller with human machine interface panel viewer to control all 10 solenoids, pressure switches and controls for complete oxygen injection system.
- Independent time duration control for each injection port(s) (1 to 99 minutes).
- Programmable cycle lag time between each oxygen injection cycles.
- Individual and total injection port cycle time accumulator.
- 10 Point manifold with oxygen compatible solenoid valves.
- Outlet injection port fittings are 1/2" kynar compression 90°.
- Built-in high-limit pressure switch and pressure relief valve on injection manifold.
- Built in pressure gage and flow meter on discharge of each oxygen generator, total of three plumbed in series to oxygen injection manifold

Exhaust Mufflers

For pipe size information, see pages 2-3.

About Exhaust Mufflers

Exhaust mufflers reduce noise while filtering your exhaust air. Ideal for use as air-line mufflers and exhaust diffusers, these units fit in the exhaust ports of valves and cylinders, impact wrenches, screwdrivers, and other air tools.

Noise reduction is measured in decibels (dB). Some example decibel levels are at right.

| | Decibels |
|---------------------|----------|
| Air-Powered Riveter | 125 |
| Air-Powered Drill | 120 |
| Impact Wrench | 103 |
| Hand saw | 85 |
| Normal Conversation | 60 |

Exhaust Mufflers



Hex Style
NPT Male



Slotted-Head Style

The most popular mufflers we sell, these reduce noise levels from air-powered tools, valves, and cylinders. They are available with a NPT male, NPT female, or BSPT male connection. Use with air and inert gases.

Hex-style mufflers have a porous bronze element bonded to a pipe fitting with hex wrench flats. They reduce noise by 15-20 decibels; filtration rating is 40 microns.

Slotted-head mufflers are made entirely of porous bronze. They're formed with a groove for a slotted-head screwdriver so they'll fit in tight spaces where a wrench can't go. They reduce noise by 10-20 decibels; filtration rating is 80 microns.

| Pipe Size | Max. scfm @ 100 psi | Max. Temp. | Max. psi | O'all Ht. | Hex Size | Each |
|--|---------------------|------------|----------|-----------|----------|----------------|
| Hex Style | | | | | | |
| NPT Male Connection—Nickel-Plated Steel Fitting | | | | | | |
| 10-32 | 1 | 300° F | 300 | 1 1/8" | 3/8" | 4450K31 \$1.55 |
| 1/8" | 25 | 400° F | 175 | 1 3/8" | 3/4" | 4450K15 1.68 |
| 1/4" | 11 | 300° F | 300 | 1 1/2" | 7/8" | 4450K1 1.67 |
| 3/8" | 21 | 300° F | 300 | 1 3/4" | 1 1/8" | 4450K2 1.87 |
| 1/2" | 24 | 300° F | 300 | 1 7/8" | 1 1/4" | 4450K3 2.52 |
| 5/8" | 57 | 300° F | 300 | 2 1/8" | 1 3/8" | 4450K4 3.38 |
| 3/4" | 112 | 300° F | 300 | 2 1/4" | 1 1/2" | 4450K5 5.10 |
| 1" | 154 | 300° F | 300 | 2 3/8" | 1 3/4" | 4450K6 8.15 |
| 1 1/4" | 154 | 300° F | 300 | 3 1/4" | 1 11/8" | 4450K8 14.57 |
| 1 1/2" | 162 | 300° F | 300 | 3 1/2" | 2" | 4450K9 19.43 |
| 2" | 2190 | 400° F | 175 | 4 3/4" | 2 3/4" | 4450K16 20.68 |
| NPT Female Connection—Zinc-Plated Steel Fitting | | | | | | |
| 1/8" | 53 | 400° F | 175 | 1 1/4" | 3/8" | 4450K91 1.80 |
| 1/4" | 70 | 400° F | 175 | 1 1/2" | 7/8" | 4450K92 2.49 |
| 3/8" | 175 | 400° F | 175 | 1 3/4" | 1 1/8" | 4450K93 3.14 |
| 1/2" | 263 | 400° F | 175 | 2 1/8" | 1 1/4" | 4450K94 6.14 |

• Body is zinc-plated steel.

| Pipe Size | Max. scfm @ 100 psi | Max. Temp. | Max. psi | O'all Ht. | Hex Size | Each |
|---|---------------------|------------|----------|-----------|----------|----------------|
| Hex Style (Cont.) | | | | | | |
| BSPT Male Connection—Zinc-Plated Steel Fitting | | | | | | |
| 1/8" | 53 | 400° F | 175 | 1 3/8" | 3/8" | 9836K21 \$1.46 |
| 1/4" | 70 | 400° F | 175 | 1 1/2" | 7/8" | 9836K22 1.73 |
| 3/8" | 175 | 400° F | 175 | 1 3/4" | 1 1/8" | 9836K23 2.39 |
| 1/2" | 263 | 400° F | 175 | 2 1/8" | 1 1/4" | 9836K24 3.02 |
| 5/8" | 438 | 400° F | 175 | 2 3/8" | 1 3/8" | 9836K25 5.91 |
| 3/4" | 613 | 400° F | 175 | 2 1/2" | 1 3/4" | 9836K26 8.11 |
| 1" | 700 | 400° F | 175 | 3 1/8" | 1 11/8" | 9836K27 14.37 |
| 1 1/4" | 1314 | 400° F | 175 | 4" | 2" | 9836K28 15.76 |
| 2" | 2190 | 400° F | 175 | 4 3/4" | 2 3/4" | 9836K29 22.06 |
| Slotted-Head Style | | | | | | |
| NPT Male Connection | | | | | | |
| 1/8" | 5 | 500° F | 170 | 1" | 7/16" | 8158T31 2.19 |
| 1/4" | 10 | 500° F | 170 | 1 1/8" | 9/16" | 8158T32 2.42 |
| 3/8" | 25 | 500° F | 170 | 1 1/4" | 1 1/16" | 8158T33 3.40 |
| 1/2" | 30 | 500° F | 170 | 1 3/8" | 1 1/8" | 8158T34 5.10 |
| 5/8" | 70 | 500° F | 170 | 2 1/8" | 1 1/4" | 8158T35 6.85 |
| 1" | 100 | 500° F | 170 | 3 3/8" | 1 3/8" | 8158T36 10.80 |

▲ Overall diameter for slotted-head style.

Sure-Seal Miniature Exhaust Mufflers



Brass

Small size and a rubber seal above the threads ensure a tight seal in tight spots. Use with air and inert gases. They can also be used in applications that require bubbling air or inert gas through a liquid (sparging). Connection is UNF male straight threads. All have a Buna-N seal, unless noted. Elements are porous metal; filtration rating is 40 microns. They reduce noise levels by 17-22 decibels.

| Thread Size | Max. scfm @ 60 psi | Max. Temp. | Max. psi | O'all Ht. | Hex Size | Each |
|---|--------------------|------------|----------|-----------|----------|----------------|
| Brass with Bronze Element | | | | | | |
| 10-32 | 1.7 | 200° F | 125 | 3/8" | 1/4" | B226T11 \$5.93 |
| 10-32 | 2.6 | 200° F | 125 | 1 1/8" | 3/8" | B226T13 4.43 |
| Type 303 Stainless Steel with Nickel-Plated Bronze Element | | | | | | |
| 10-32 | 2.7 | 200° F | 125 | 1 1/8" | 3/8" | B226T15 10.53 |
| Type 303 Stainless Steel with Type 316 Stainless Steel Element | | | | | | |
| 10-32 | 2.6 | 300° F | 300 | 1 1/8" | 3/8" | B226T16 14.27 |

* Seal is Viton.

Flow-Control Exhaust Mufflers



Control the rate at which air exhausts. These mufflers feature an adjusting screw that increases and decreases the orifice size; a locknut secures it in your desired position. Use with air; they're ideal for controlling the speed of air cylinders. They reduce noise levels by 17-20 decibels and have a porous bronze element and brass fitting. Filtration rating is 40 microns. Connections are NPT male.

| Pipe Size | Max. scfm @ 100 psi | Max. Temp. | Max. psi | O'all Ht. | Hex Size | Each |
|----------------------|---------------------|------------|----------|-----------|----------|----------------|
| Standard Flow | | | | | | |
| 1/8" | 20 | 300° F | 300 | 1 1/8" | 1/2" | 9834K31 \$3.69 |
| 1/4" | 30 | 300° F | 300 | 1 1/8" | 3/8" | 9834K32 4.05 |
| 3/8" | 40 | 300° F | 300 | 1 1/4" | 1 1/8" | 9834K33 5.05 |
| 1/2" | 60 | 300° F | 300 | 2" | 7/8" | 9834K34 6.45 |
| 3/4" | 70 | 300° F | 300 | 2 3/8" | 1 1/8" | 9834K35 11.64 |
| 1" | 100 | 300° F | 300 | 2 1/2" | 1 1/4" | 9834K36 15.93 |
| High Flow | | | | | | |
| 1/8" | 30 | 300° F | 300 | 1 1/8" | 3/8" | 9834K41 4.07 |
| 1/4" | 40 | 300° F | 300 | 1 1/4" | 1 1/8" | 9834K42 5.00 |
| 3/8" | 60 | 300° F | 300 | 2" | 7/8" | 9834K43 6.79 |
| 1/2" | 70 | 300° F | 300 | 2 1/4" | 1 1/4" | 9834K44 10.55 |

Corrosion-Resistant Exhaust Mufflers



For excellent corrosion resistance, these mufflers have a Type 304 stainless steel fitting. Element is porous Type 316 stainless steel. Use with air and gases compatible with Type 304 stainless steel. They reduce noise levels by 15-20 decibels. Filtration rating is 50 microns. Connections are NPT male.

| Pipe Size | Max. scfm @ 100 psi | Max. Temp. | Max. psi | O'all Ht. | Hex Size | Each |
|-----------|---------------------|------------|----------|-----------|----------|----------------|
| 1/8" | 53 | 400° F | 175 | 1 3/8" | 3/8" | 4402K51 \$8.87 |
| 1/4" | 70 | 400° F | 175 | 1 1/2" | 7/8" | 4402K52 9.24 |
| 3/8" | 175 | 400° F | 175 | 1 3/4" | 1 1/8" | 4402K53 11.15 |
| 1/2" | 263 | 400° F | 175 | 2" | 1 1/4" | 4402K54 15.25 |
| 5/8" | 438 | 400° F | 175 | 2 3/8" | 1 3/8" | 4402K55 44.06 |
| 1" | 613 | 400° F | 175 | 3 1/8" | 1 11/8" | 4402K56 62.15 |

Push-to-Connect Exhaust Mufflers



| Stem OD | Max. scfm @ 100 psi | Max. Temp. | Max. psi | O'all Ht. | Dia. | Each |
|---|---------------------|------------|----------|-----------|-------|----------------|
| (A) Nickel-Plated Brass | | | | | | |
| 4 mm | Not Rated | 300° F | 175 | 1 1/8" | 1/8" | B413T11 \$8.30 |
| 6 mm | Not Rated | 300° F | 175 | 1 1/8" | 3/16" | B413T12 11.50 |
| 8 mm | Not Rated | 300° F | 175 | 1 1/8" | 1/4" | B413T13 12.16 |
| 10 mm | Not Rated | 300° F | 175 | 2 1/8" | 3/8" | B413T14 12.27 |
| 12 mm | Not Rated | 300° F | 175 | 2 1/8" | 1/2" | B413T15 16.51 |
| (B) Glass-Filled Polypropylene | | | | | | |
| 1/4" | Not Rated | 175° F | 150 | 2 3/8" | 3/4" | B457T31 6.71 |
| 3/8" | Not Rated | 175° F | 150 | 3 1/8" | 3/4" | B457T32 9.46 |
| (B) PBT (Polybutylene Terephthalate) | | | | | | |
| 6 mm | 27 | 140° F | 145 | 2 1/8" | 3/8" | B457T51 7.51 |
| 8 mm | 42 | 140° F | 145 | 2 3/8" | 7/8" | B457T52 9.61 |
| 10 mm | 95 | 140° F | 145 | 3 1/8" | 1" | B457T53 11.96 |