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Environmental
Resources
Management

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14 November 2003

Mr. Dale Klettke
Port of Oakland
530 Water Street
Oakland, California 94607

Subject: Additional Investigation Workplan, Former UAL Oakland Maintenance Center, Oakland, California

Dear Mr. Klettke:

On behalf of United Airlines (UAL), Environmental Resources Management (ERM) is submitting this workplan to conduct additional investigation activities at the former UAL Oakland Maintenance Center (OMC) in Oakland, California (Figure 1). The primary objectives of the proposed work is to confirm the concentrations of chemicals detected in ground water at 2 of the 19 identified areas of concern (AOCs 1 – 2) during the initial Phase II investigation conducted in April and May 2003 and to further delineate their extents. In addition, the proposed investigation will involve collecting data to characterize ground water flow within the fill aquifer, as well as the aquifer's capacity for biodegradation of hydrocarbons. The primary tasks of this investigation include:

- Resampling the monitoring wells in the AOC 1 and 2 (small parts wash rack and aircraft wash rack) area to confirm the exceedances of regulatory screening criteria;
- Perform natural attenuation monitoring at AOC 1 to determine the fill zone aquifers intrinsic capacity for biodegradation of hydrocarbons and chlorinated hydrocarbons; ?
- Install additional monitoring wells within AOC 1 and 2 to delineate the extent of ground water impacts above regulatory screening criteria;
- Conduct a ground water flow assessment including slug testing to determine the hydraulic conductivity of the fill aquifer; and
- Complete a survey of underground utility corridors to determine if potential preferential chemical migration pathways exist at the OMC.

## Previous Investigation Results Summary

ERM conducted an initial soil and ground water investigation of the OMC during the week of 14 April 2003. Nineteen AOCs that were identified during an evaluation of past and then-current operations at the OMC were investigated to determine whether impacts to soil and/or ground water existed. The investigation consisted of the collection of grab soil and/or ground water samples from each AOC. Based on the results of the investigation, three of the AOCs, AOC 1 (small parts wash rack and former World Airways cleaning room), AOC 2 (aircraft wash rack), and AOC 3 (industrial wastewater sump) were determined to require additional investigation to confirm the initial analytical results.

Ten monitoring wells were installed in AOCs 1, 2, and 3 during the week of 5 May 2003 to evaluate the regulatory screening criteria exceedances during the initial investigation. Five monitoring wells (ERM-MW-01 through ERM-MW-05; Figure 2) were installed within AOC 1 to determine if volatile organic compounds (VOCs) and nickel detected within ground water samples collected from this area were representative of ground water conditions within this area. Figure 2 presents the results of ground water samples collected from AOC 1. As seen in Figure 2, ground water samples collected from all of the monitoring wells contained concentrations of VOCs above the regulatory screening criteria. 1,1-DCA was detected in all five of the new wells at concentrations ranging from 6.8 to 52 µg/L, which are above its maximum contaminant level (MCL) of 5 µg/L. In addition, cis-1,2-DCE was detected in two wells (ERM-MW-01 and ERM-MW-05) at concentrations of 19 and 46 µg/L, respectively, which is above its MCL of 6 µg/L. Vinyl chloride was also detected in ERM-MW-05 at a concentration of 0.89 µg/L, which is above its MCL of 0.5 µg/L. Nickel was detected in three of the five wells at concentrations ranging between 0.036 and 0.090 mg/L, which are below the nickel MCL of 0.1 mg/L.

Four monitoring wells (ERM-MW-06 through ERM-MW-9; Figure 3) were also installed within AOC 2 to confirm the concentrations of VOCs (dichloromethane [DCM]), total extractable petroleum hydrocarbons (TEPH), total purgeable hydrocarbons (TPPH), and metals (nickel, cadmium, and lead) that exceeded their regulatory screening criteria. Ground water samples collected from these wells did not contain concentrations of VOCs, TPPH, or TEPH in excess of their respective regulatory screening criteria. Cadmium and lead were not detected in any of the ground water samples collected from the monitoring wells installed within AOC 2. Nickel was detected in three of the four samples (ERM-MW-07, ERM-MW-08, ERM-and MW-09) collected from the monitoring wells at concentrations ranging between 0.082 and 0.23 mg/L. Two of the samples

(ERM-MW-08 and ERM-MW-09) contained concentrations in excess of the nickel MCL of 0.1 mg/L (0.110 and 0.230 mg/L, respectively).

One monitoring well was installed in AOC 3 (ERM-MW-10; Figure 3) to evaluate the concentrations of TEPH and cadmium, which were detected at concentrations exceeding their regulatory screening criteria in the initial grab samples. The ground water sample collected from this well did not contain concentrations of TEPH or cadmium above their respective regulatory screening criteria.

Based on the detection of chemicals at concentrations exceeding their regulatory screening criteria during the monitoring well sampling activities, further investigation activities are considered appropriate to confirm the results of the initial well sampling activities and further delineate the extent of chemicals in ground water.

## SCOPE OF WORK

The scope of work for this investigation involves the following five primary tasks:

- Resampling of the existing monitoring wells;
- Natural attenuation monitoring of the wells in AOC 1;
- Additional well installation to delineate the extent of chemicals in ground water at AOCs 1 and 2;
- Ground water flow evaluation including slug testing in AOCs 1 and 2; and
- An underground utility survey to determine if potential preferential chemical migration pathways exist at AOCs 1 and 2.

These proposed activities are described in the following paragraphs.

### Task 1 - Resampling of Existing Monitoring Wells

To confirm the results of the initial ground water samples collected and analyzed from the monitoring wells at AOC 1 and AOC 2, ERM will resample all of the existing monitoring wells within the two AOCs. For AOC 1, the five monitoring wells (ERM-MW-01 through ERM-MW-05) installed in May 2003 will be purged and sampled for VOCs by United States Environmental Protection Agency (USEPA) Method 8260. Samples will also be collected from monitoring wells UAL-MW-2, UAL-MW-3, and P2/UAL-MW-5 (Figure 2) and analyzed for VOCs to provide additional characterization for the AOC 1 VOC plume. For AOC 2,

ground water samples will be collected from the five wells in the AOC 2 area (ERM-MW-06 through ERM-MW-10) and will be analyzed for nickel. The samples collected for nickel analyses will be field filtered and preserved. In addition, a sample will be collected from UAL-MW-4 and analyzed for arsenic to determine if the concentration detected during the previous sampling in April 2003 is representative of aquifer conditions. As discussed above, the sample will be field filtered and preserved.

The results of this resampling of the existing wells will be used to determine if additional monitoring wells are needed to complete the characterization of the AOCs. If the results of the resampling also exceed applicable standards, confirming the results of the initial sampling, then additional wells will be installed as described in Task 3. If the results no longer exceed the screening levels used, the results will be summarized in the investigation report.

**Task 2 – Natural Attenuation Monitoring**

To determine the fill zone aquifer's intrinsic capacity for hydrocarbon biodegradation, ERM plans to sample three wells (UAL-MW-1 through 3) from the hydrocarbon-impacted former fuel UST area (AOC 17) for natural attenuation parameters. Natural attenuation sampling will be performed consistent with the protocols outlined in *Technical Protocol for Implementing Intrinsic Remediation with Long-Term Monitoring for Natural Attenuation of Fuel Contamination Dissolved in Ground Water* (Air Force Center for Environmental Excellence [AFCEE], June 1995). Natural attenuation sampling will consist of field measurements of dissolved oxygen, reduction/oxidation potential, and conductivity, and laboratory analyses for nitrate, sulfate, total alkalinity, dissolved iron, dissolved manganese, carbon dioxide, and methane. The results of the sampling will be evaluated and presented as an appendix to the investigation report to formally document the fill aquifer's capacity for hydrocarbon biodegradation.

In addition, natural attenuation sampling will be performed at AOC 1 to determine the fill zone aquifer's capacity for biodegradation of chlorinated solvents. Samples will be collected from four monitoring wells representing upgradient (UAL-MW-5), source area (ERM-MW-01), mid-plume (ERM-MW-04) and downgradient (UAL-MW-3) conditions. This natural attenuation sampling will also be performed consistent with the protocols outlined in AFCEE (November 1996). Sampling will consist of field measurements of dissolved oxygen, reduction/oxidation potential, and conductivity, and laboratory analyses for nitrate, sulfate, total alkalinity, dissolved iron, dissolved manganese, carbon dioxide, ethane, ethane, and methane. The results of the sampling will be

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evaluated and presented as an appendix to the investigation report to formally document the fill aquifer's capacity for biodegradation of chlorinated solvents.

**Task 3 - Well Installation**

If the monitoring well resampling results confirm exceedances of the screening levels detected in the initial sampling, additional monitoring wells will be installed in AOC 1 and AOC 2. For the purpose of this workplan, we have assumed that the initial results will be confirmed by the resampling. Based on this assumption, we propose the installation of four monitoring wells at AOC 1 and three monitoring wells at AOC 2. Figures 3 and 4 show the locations of the proposed new wells. The following paragraphs outline the field activities to be performed as part of this task.

Prior to the initiation of subsurface work at the OMC, ERM will obtain well installation permits from Alameda County Public Works Agency, Water Resources Section. In addition, ERM will obtain a right of entry and work authorization permit from the Port of Oakland to provide access to the OMC. ERM will mark the locations of the proposed borings on the pavement using white paint; borings on unpaved areas will be marked using wooden stakes. Underground Service Alert (USA) will be notified of the proposed work. ERM will also obtain underground utility maps from UAL and/or the Port of Oakland, if available, to ensure that the proposed borings are not placed on underground utilities. A private utility locating subcontractor will clear the proposed sampling locations.

Wells will be installed using direct push methodology. Soil samples will be collected continuously from just below the pavement to the water table, anticipated to be encountered between 10 and 15 feet below ground surface (bgs) in AOC 1 and 2 and 5 feet bgs in AOC 2. Soils will be logged by an ERM geologist and screened using an organic vapor analyzer with a photo ionization detector (PID). The results of the field screening will be recorded on the boring logs. If field screening indicates soil impact in the unsaturated zone, a soil sample will be collected and submitted to the laboratory for VOC analysis using USEPA Method 8260. In addition, four soil samples from four locations will be collected and submitted for total organic carbon (TOC) analyses by USEPA Method 415.1. Samples selected for analysis will be properly sealed and preserved. The samples will be labeled with relevant sampling information and a chain-of-custody (COC) form completed and maintained with the samples.

Once total depth has been attained, a one-inch diameter, Schedule 40 PVC casing with 10 feet of 0.010-inch machine slotted screen will be installed in each boring.

ERM assumes that the wells installed at AOC 1 will have a total depth of 20 feet bgs and the wells at AOC 2 will have total depths of 15 feet bgs. A sand filter pack will be used to fill each borehole annulus from the bottom of the hole to approximately 1 foot above the top of the screened interval. A minimum 2-foot bentonite seal will be emplaced above the filter pack and the remainder of each borehole will be backfilled with a bentonite cement grout. The wells will be completed with a flush-mount well box with the exception of the well installed within the unpaved area northwest of ERM-MW-9, which will be completed with an aboveground stovepipe well box. The well boxes will be set in cement and sloped to encourage surface flow away from the well. All wells will be outfitted with a lockable cap. The new wells will be surveyed to a site-specific reference datum to allow for the determination of ground water flow information.

Following installation, the new wells will be developed using swab (surge block) and bail (suction bailer) techniques and sampled. Ground water levels will be measured and recorded prior to development. All samples collected for metals analyses will be field filtered and preserved. Ground water samples collected from AOC 1 will be submitted to the laboratory and analyzed for VOCs by USEPA Method 8260. Ground water samples collected from AOC 2 will be analyzed for nickel by USEPA Method 6010.

Soil and ground water generated during well installation and sampling will be accumulated in properly labeled 55-gallon drums and temporarily stored on-site. Composite samples will be collected and analyzed for disposal purposes. Upon receipt of the analytical results, the wastes will be disposed of at a proper facility.

**Task 4 – Ground Water Flow Evaluation**

ERM will perform aquifer slug testing on six monitoring wells at the OMC to calculate the hydraulic conductivity of the fill zone above the Bay Mud. The six wells are shown on the attached Figure 4. Three of the wells (ERM-MW-3, ERM-MW-7, and ERM-MW-9) are 1-inch diameter wells, two wells (UAL-MW-1 and UAL-MW-3) are 4-inch diameter wells, and one well (P-2/UAL-MW-5) is a 2-inch diameter well. A known volume of water or a solid cylinder of a known volume will be removed from each of these wells and the change in water level will be monitored using pressure transducers with data loggers. Two tests will be conducted at each well. In addition, a data logger will be installed within monitoring well UAL-MW-02 prior to provide information on changes in water table elevation during the slug testing activities. The hydraulic conductivity values will be used to estimate ground water flow velocities within the fill zone. The data from each test will be analyzed using a curve matching evaluation to determine the range of hydraulic conductivity in the fill unit.

**Task 5 - Utility Evaluation**

ERM will conduct a utility evaluation to identify if the potential for preferential pathways for migration of impacted ground within utility corridors exists within AOCs 1 and 2. To accomplish this task, a private utility locating service will be used to identify and survey the location of underground utilities including storm drains, sanitary sewers, water, gas, communication, and electrical in relation to the AOCs with identified ground water impact. The proposed utility survey will be scheduled to occur in conjunction with utility clearance of the proposed well locations, as described in Task 3. In addition, existing as-built maps on file with UAL and the Port of Oakland will be evaluated. The results of this work will be used to determine if the presence of the utility corridors could serve as preferential pathways from the impacted AOCs to ecological or human receptors.

## SCHEDULE

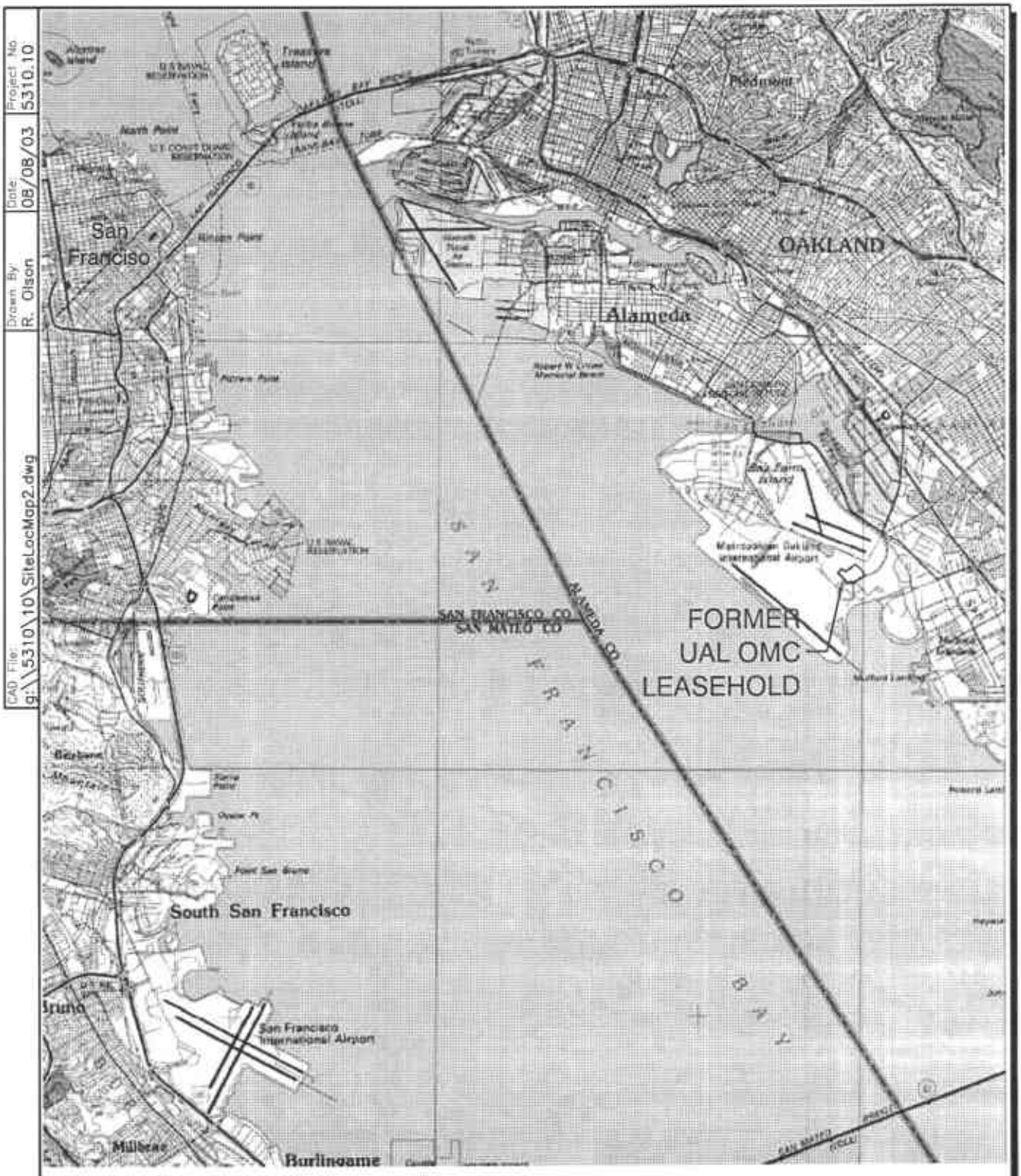
ERM will conduct the investigation described above upon obtaining approval of this workplan and access to the OMC from the Port of Oakland. It is anticipated that the field activities can be completed within a two-week period.

Please contact me at (925) 946-0455 if you have questions.

Sincerely,

John Lucio, R.G.
*Project Manager*

JAL/MXB/jal/ 5310.10
Attachments: Figures 1 through 4




References:
TOPO!® Version 2.6.8 (2001)

Figure 1
*Site Location Map*
*Former United Airlines Oakland Maintenance Center*
*Oakland International Airport, Oakland, California*

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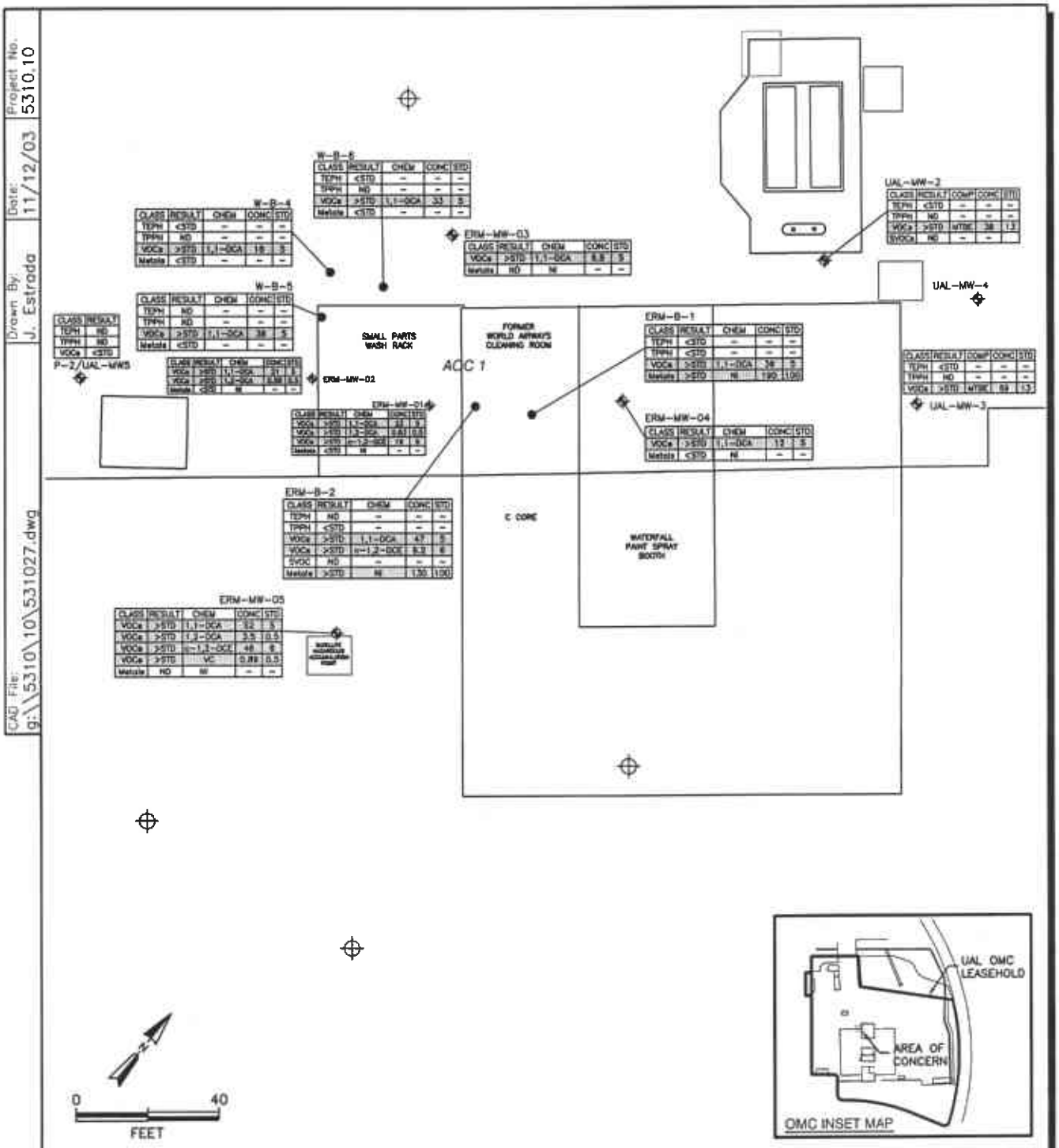


ABBREVIATIONS:

| | | | | | |
|---|---|---|---|---|---|
| CLASS | Chemical Class | TEPH | Total Extractable Petroleum Hydrocarbon | VC | Vinyl Chloride |
| CHEM | Chemical Constituent | TPPH | Total Purgeable Petroleum Hydrocarbon | c-1,2-DCE | cis-1,2-Dichloroethene |
| CONC | Concentration | VOCs | Volatile Organic Compounds | Ni | Nickel |
| STD | Standard | SVOC | Semi Volatile Organic Compounds | | |
| ND | Not Detected | 1,1-DCA | 1,1-Dichloroethane | | |

Notes:
Standards included RWQCB RBSL for Commercial Ground Water and USEPA MCLs for Ground Water.
Highlighted data indicates concentration greater then STD.
Normal Text=ERM data.
*Italic Text*=Weiss data.
Ground water concentration results are in µg/L.

- SAMPLE LOCATION
- MONITORING WELL LOCATION
- AOC 1 AREA OF CONCERN
- PROPOSED MONITORING WELL LOCATION

Figure 2

*Area of Concern 1*

*Ground Water Sample Results and Proposed Monitoring Well Locations*

*Former United Airlines Oakland Maintenance Center*

*Oakland International Airport, Oakland, California*

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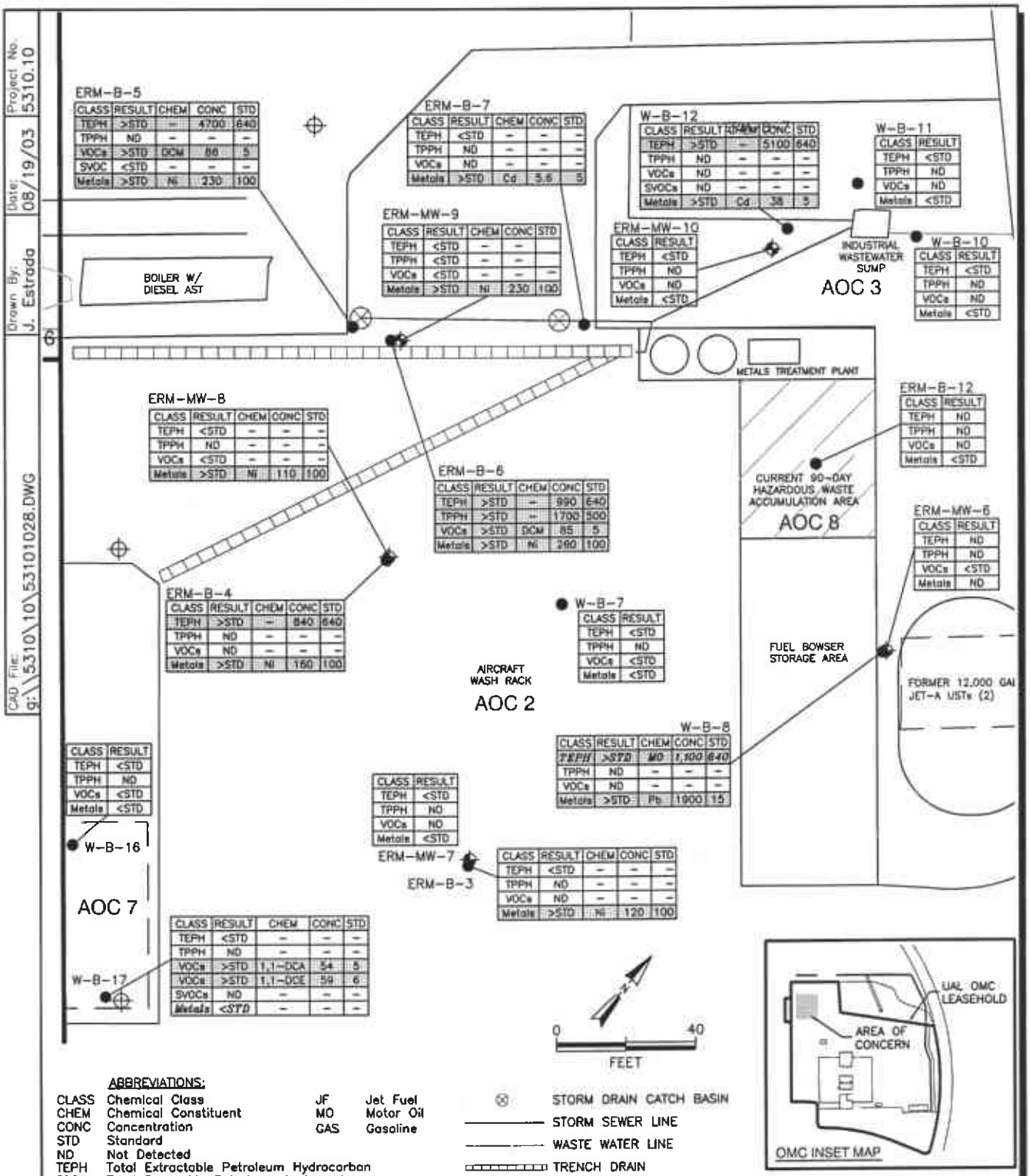


ABBREVIATIONS:

| | | | |
|---|---|---|---|
| CLASS | Chemical Class | JF | Jet Fuel |
| CHEM | Chemical Constituent | MO | Motor Oil |
| CONC | Concentration | GAS | Gasoline |
| STD | Standard | | |
| ND | Not Detected | | |
| TEPH | Total Extractable Petroleum Hydrocarbon | | |
| TPPH | Total Purgeable Petroleum Hydrocarbon | | |
| BTEX | Benzene, Toluene, Ethene, Xylenes | | |
| VOCs | Volatile Organic Carbons | | |
| SVOC | Semi Volatile Organic Carbon | | |
| DCM | Dichloromethane | | |
| Ni | Nickel | | |
| Pb | Lead | | |
| Cd | Cadmium | | |

Notes:
Standards included RWQCB RBSL for Commercial Ground Water and USEPA MCLs for Ground Water.
Highlighted data indicates concentration greater then STD.
Normal Text=ERM data.
*Italic Text*=Weiss data.
Grounw water concentration results are in µg/L.

Figure 3

*Areas of Concern 2, 3, and 7*
*Ground Water Sample Results and*
*Proposed Monitoring Well Locations*
*Former United Oakland Maintance Center*
*Oakland International Airport, Oakland, California*

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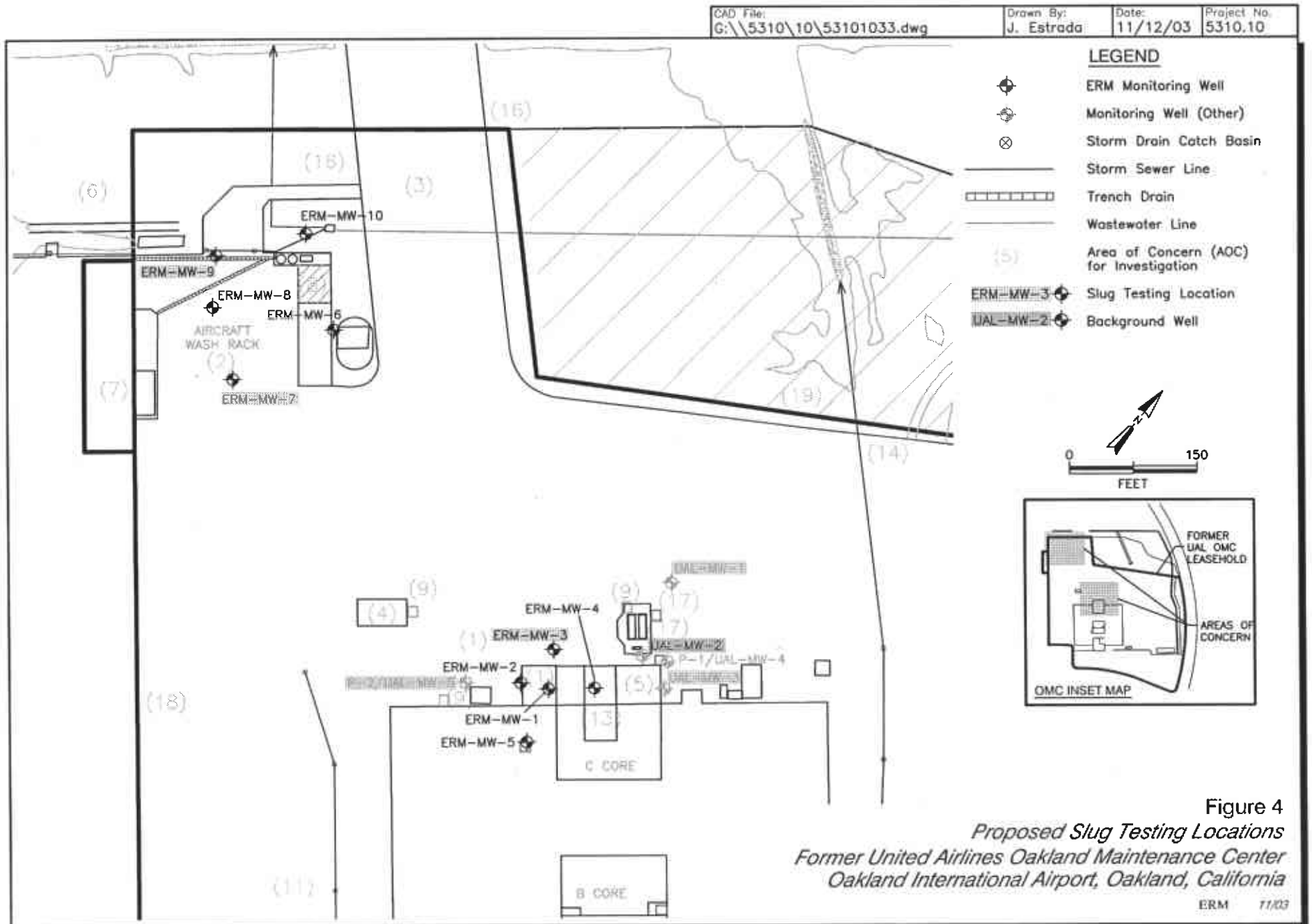


Figure 4

*Proposed Slug Testing Locations*

*Former United Airlines Oakland Maintenance Center*

*Oakland International Airport, Oakland, California*

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