Summary Report

Corrective Action
Boeing Developmental Center

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Prepared for

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Seattle, Washington

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1.0 INTRODUCTION

The Boeing Developmental Center (BDC) is a regulated facility under the Resource Conservation and Recovery Act (RCRA). The U.S. Environmental Protection Agency (EPA) identification number for the facility is WAD-09363-9946. Under its RCRA corrective action authority, EPA conducted a RCRA Facility Assessment (RFA) in 1994 to identify solid waste management units (SWMUs) and areas of concern (AOCs) at the site (SAIC 1994). The RFA identified 157 SWMUs and 5 AOCs and provided a preliminary assessment of the potential for release of hazardous constituents to the environment at each area (SAIC 1994). A summary of the SWMUs and AOCs is provided in Table 1.

The Washington State Department of Ecology (Ecology) has authority delegated from EPA to implement RCRA corrective action through the Model Toxics Control Act (MTCA) regulations (Washington Administrative Code [WAC] 173-340) and has assumed the oversight role of the corrective action activities at the BDC. The Boeing Company (Boeing) is addressing the SWMUs and AOCs through Ecology's voluntary cleanup program under MTCA.

1.1 STATEMENT OF PURPOSE

Corrective action investigation and remediation activities have been performed at a number of SWMUs and AOCs, primarily associated with former underground storage tanks (USTs) or sumps. In addition, several RCRA waste management areas have been clean-closed in accordance with RCRA requirements. The purpose of this document is to provide an overview of these activities and to document the current status of each SWMU and AOC.

1.2 REPORT ORGANIZATION

The remainder of this report consists of the following:

- Section 2.0 describes the physical characteristics of the facility, including the facility setting, facility background, and land use surrounding the site. Also included in this section is a discussion of geology and hydrogeology, both regional and site specific. Background water quality, surface water, and groundwater-surface water interaction are also described in this section.

- Section 3.0 presents a discussion of site screening standards. The selection of preliminary groundwater and soil screening levels and the points of compliance are described in this section.

- Section 4.0 is a summary of SWMUs and AOCs, including SWMUs-15, 16, 17, 20, 23-25, and 43 and AOCs-01 through 05. Within each summary of SWMU or AOC are a description of the SWMU or AOC, summary of corrective action, and current status.

- Section 5.0 – Summary of Corrective Action Status
- Section 6.0 – References
- Appendices
    - Appendix A contains summary tables of soil and groundwater data for the SWMUs and AOCs discussed in Section 4.0
    - Appendix B is a technical memorandum providing an evaluation of the pump and treat remedial system currently in operation at SWMU-20
    - Appendix C contains No Further Action notices from the Washington State Department of Ecology.

2.0 PHYSICAL CHARACTERISTICS OF THE FACILITY

2.1 FACILITY SETTING

The BDC is located at 9725 East Marginal Way South in Tukwila, Washington (Figure 1). The facility consists of approximately 60 buildings on 164.4 acres of property (Figure 2). Boeing owns 94.5 acres and leases the remaining 59.9 acres (SAIC 1994).

The BDC is primarily an aircraft and aerospace research and development complex with most of the work supporting U. S. Department of Defense projects. Past projects at the BDC have included research on supersonic transportation and development of military aircraft (SAIC 1994).

2.2 FACILITY BACKGROUND

Boeing has been operating on portions of this site continuously since 1956. Figure 1 presents the site location map and Figure 2 presents the current facility boundary map.

Prior to about 1918, when the U.S. Army Corps of Engineers (USACE) channelized the Duwamish Waterway, the site was farmland. The earliest known commercial operations at the site began in 1927, when Prankratz Lumber Company (a sawmill), Washington Compressed Gas Company (a welding supply company), and Associated Packing Company (a stockyard and meat-packing plant) occupied portions of the site. Washington Compressed Gas Company occupied the northern portion of the site (generally in the area of Building 9-04), Associated Packing Company was southwest of the welding company, and Prankratz Lumber Company was southwest of the stockyard and adjacent to the Duwamish Waterway. By 1947, a warehouse of modular home components and an office building occupied the location of Washington Compressed Gas Company. Associated Packing Company closed in 1956 and Prankratz Lumber Company closed between 1958 and 1963. The only known waste associated with these businesses was a scrap wood pile that was in the southwestern corner of Prankratz Lumber Company's property (SAIC 1994).

By 1938, Monsanto Fund purchased the northern 38 acres of the BDC site. Monsanto Fund leased the property to tenants of a warehouse and office buildings, American Winegrower's Association, Dallas-Mavis, a granary, and Slip No. 6. In 1938, a winery owned by the American Winegrower's Association occupied the property south of Washington Compressed Gas and adjacent to East Marginal Way. The winery expanded in 1946 and again in 1968 until it occupied 60,000 ft^2. The winery closed in the mid-1970s. There were two 1,000 gal underground concrete settling tanks associated with the winery that were removed from the site (SAIC 1994). Dallas-Mavis, a commercial trucking operation, occupied the location of the 9-04 building and the adjacent parking lot areas (part of the former winery) until 1989.

A 77,000 ft² granary was located north and west of the winery. It ceased storing grain in 1973 and functioned as a warehouse until 1985 (SAIC 1994).

The Port of Seattle purchased the Monsanto property and took over the leases in 1976. They leased the northeastern 5 acres in two 2.5 acre parcels to Transport Pool International and Kenworth Truck Company for parking and storage. Isaacson Steel leased the former granary for storage. Terminal 128 Corporation leased Slip No. 6 and intended to develop the slip as a marina. However, the development of the marina did not occur and the Port of Seattle sold the property to Boeing in 1985. The only known waste associated with these businesses was from the Terminal 128 lease. In February 1984, the Port of Seattle notified Terminal 128 Corporation that three transformer vaults had illegal hook-ups and that the associated sumps contained debris that was making them inoperable. There were also oil and chemical leaks and spills. Terminal 128 Corporation hired a contractor to remediate the leased property to the Port of Seattle's satisfaction (SAIC 1994).

In the mid-1930s, the southeastern portion of the property was occupied by a grocery store and a gasoline station. The gas station only operated for a short time period. A portion of the grocery store building was leased and occupied by a tavern and a warehouse. The building was destroyed by a fire in the 1940s (SAIC 1994).

Pamco construction company owned and operated a construction yard and commercial parking lot in the area of the BDC south parking lot. The Pamco construction yard closed in 1955. Boeing has a long-term lease on the parking lot. Between 1958 and 1963, Pro Gas, a propane distributor, was located adjacent to East Marginal Way in the south half of the site.

Due to the nature of the aerospace industry, the BDC facility is a large complex facility with activities changing over time. Activities that have occurred at the BDC facility include manufacturing of airplanes and missiles, which involves machining metal aircraft hardware, electroplating, chemical milling, conversion coating, painting, parts cleaning, and assembly. The machining, assembly, painting, and cleaning processes have taken place since 1957. However, they have declined since the 1980s when graphite composite fabrication began. The electroplating, chemical milling, and conversion coating processes were used primarily during the 1960s and 1970s (SAIC 1994).

Research and development activities have been a part of the BDC operations, with a substantial emphasis placed on these activities between 1957 and the early 1970s. Experimental manufacturing shops and research laboratories were used to investigate production aspects of materials and processes for manufacturing. There were also laboratories to investigate metals technology and electronics sciences (SAIC 1994).

2.3 LAND USE

The land use surrounding the BDC is primarily industrial and commercial. The BDC is located within a large contiguous industrial land use area which extends from Harbor Island to near the head of navigation of the Duwamish Waterway. This zone represents one of the largest contiguous industrial areas within Washington state. The Military Flight Center and Museum of Flight are east of the BDC, immediately across East Marginal Way South, with Boeing Field King County Airport further east. The Duwamish Waterway forms the southern and western boundaries of the site, and also forms part of the northern boundary where Slip No. 6 separates the site from the former Rhone Poulenc Company chemical manufacturing facility to the north (SAIC 1994) (Figure 3).

2.4 GEOLOGY

This section provides a description of the regional geology for the area and the local geology underlying the site. The regional geology is based on the regional conceptual model of the Puget Sound lowland as documented in Dragovitch et. al (1994) and Galaster and Laprade (1991), among others. The local geology has been interpreted from lithologic descriptions of subsurface soil collected from logs of soil borings and monitoring wells drilled at the BDC or at adjacent properties between the years of 1967 - 2001.

2.4.1 REGIONAL GEOLOGY

The BDC is located within the Duwamish Valley lowland along the floodplain of the Duwamish Waterway. The Duwamish/Green River Valley is a relict subglacial meltwater channel eroded during the retreat of the Puget lobe of the most recent glaciation (Vashon Stade of the Fraser Glaciation) about 14,000 years ago. With the retreat of the lobe, the Duwamish/Green River Valley was occupied by a deep embayment of Puget Sound that extended inland to near present day Sumner, Washington. Marine sedimentation occurred in the embayment until about 5,000 years ago when a large volcanic mudflow off of Mount Rainier, known as the Osceola Mudflow, swept down the Puyallup and Whiter River Valleys, partially spilling into the Duwamish/Green River valley and out into Puget Sound. The mudflow traveled northward down the ancestral Duwamish/Green River valley to near present day Tukwila and the location of the BDC. Subsequent channel incision and erosion resulted in increased sediment loads, river aggradation and delta progradation that eventually filled the valley with freshwater sediments. Within the last 100 years, the natural Duwamish Channel has been filled to create the present day morphology. The BDC is located adjacent to one of these channel fill structures (Bortleson et. al, 1980).

The general stratigraphic sequence within the Duwamish Valley lowland consists of recent Holocene (10,000 yrs to present) alluvial deposits overlying Pleistocene (10,000 to 2,000,000 years before present) glacial deposits. The Holocene alluvial deposits are typically over 250 ft thick in the valley; the thickness of the glacial deposits is unknown, but appears to be thin in places. Underlying the glacial deposits are deeper Tertiary sedimentary and volcanic rocks. In the vicinity of Tukwila and the BDC, Tertiary bedrock outcrops near the surface, associated with uplift along the Seattle fault (Yount et. al, 1985). In the vicinity of the BDC, the combined thickness of the marine sediments and freshwater Duwamish River alluvial sediments may be about 100 ft, but probably varies locally due to the buried bedrock topography.

2.4.2 SITE GEOLOGY

Prior to the construction of the Duwamish Waterway by the USACE in about 1918, the Duwamish River meandered through the site area. At that time, the BDC site was situated on the inner curve of an old meander loop of the Duwamish River. In about 1918, the loop was filled in with dredge spoils from the dredging of the current Duwamish Waterway (Bortleson et. al, 1980). The geologic units encountered beneath the site include fill, underlain by Duwamish River alluvium, underlain by marine sediment. Fill material has been encountered at the BDC in the upper 5 to 10 ft below ground surface (BGS) and generally consists of brown fine to medium sand with occasional gravel and silt.

Beneath the fill material is an approximately 30- to 40-ft thick layer of naturally deposited Duwamish River alluvium. The uppermost portion of this alluvium consists of brown and gray sand and silt with occasional red mottling. This portion of the alluvium is often difficult to distinguish from the overlying fill material. At approximately 10 to 20 ft BGS, the alluvium becomes a dark gray fine to medium sand characteristic of reworked Osceola Mudflow deposits. This sand becomes increasingly silty with depth. In the northern portion of the BDC (near Building 9-77) a 2- to 8-ft thick layer of black gravelly coarse sand is present beginning at approximately 20 ft BGS [about elevation –13 ft National Geodetic Vertical Datum (NGVD)]. At the northwest corner of Building 9-101 a 3 to 5 ft thick layer of silt and silty sand is present beginning at about 30 ft BGS (elevation –18 ft NGVD).

The freshwater (Duwamish River) alluvium is underlain by marine sediments consisting of a massive dark gray silt and silty clay overlying coarser sand deposits. The top of the silt/clay is generally encountered at approximately 50 ft BGS and is approximately 20- to 30-ft thick. The silt layer appears to be laterally contiguous across the site. The top of the marine sands is generally encountered at approximately 80 ft BGS. Underlying the sand deposit is a deeper marine layer of silty gravelly sand with shell fragments. A single onsite exploration (well MW-14E) penetrated through the silt/clay layer into the marine sand. No onsite explorations drilled into the deeper silty gravelly sand. Geologic cross

sections based on historical boring logs are provided on Figures 5 through 7. The location of each cross section is shown on Figure 4.

2.5 HYDROGEOLOGY

This section provides a description of the regional hydrogeology for the area and the local hydrogeology underlying the site. The site hydrogeology has been interpreted from monitoring wells drilled at the BDC or at adjacent properties between the years of 1967 – 2001.

2.5.1 REGIONAL HYDROGEOLOGY

The Duwamish River is a regional lowland stream that represents a regional groundwater discharge zone. In the vicinity of the BDC, the river is separated from Puget Sound to the west by the West Seattle and Des Moines Uplands, and from Lake Washington to the east by Beacon Hill and the Skyway Upland (Galaster and Laprade1991). Regional horizontal groundwater flow is from these upland areas towards the river and Elliot Bay. Regional vertical groundwater flow is upward from deep aquifers towards the river in the valley lowland reflecting groundwater discharge. However in the shallow aquifer, groundwater flow in the valley lowland is typically part of a local groundwater system with groundwater flow predominantly horizontal towards the river. The portion of the Duwamish River adjacent to the BDC is tidally influenced, which has a local, temporal effect on groundwater flow.

Two municipal supply wells are located approximately ¾ mile west and 1 mile south of the BDC, respectively, on the opposite side of the Duwamish River. Given their locations, neither well would be expected to be potentially impacted by any constituents in groundwater at the BDC. Water rights exist for domestic and/or irrigation wells in Sections east and south of the BDC; however, none of these are located within the two Sections occupied by the BDC (T23N, R4E, Section 4 and T24N, R4E, Section 33) and the locations are upgradient or cross-gradient from the BDC (groundwater from the BDC flows west and south to the Duwamish Waterway).

2.5.2 SITE HYDROGEOLOGY

Hydrogeology at the site consists of two identified aquifer units separated by an aquitard consisting of the silt/clay layer at the top of the marine sediment sequence. The shallow aquifer is typically characterized as unconfined saturated Duwamish alluvial sediments. Where Duwamish River alluvium grades silty, (i.e. the northwest corner of Building 9-101) the shallow aquifer exhibits more semiconfined characteristics. The deep confined aquifer consists of marine sand deposits beneath the silt/clay aquitard. The aquifer and aquitard units are discussed in greater detail below.

2.5.2.1 Shallow Unconfined Aquifer

A shallow unconfined aquifer is encountered beneath the site at a depth of approximately 10 to 12 ft BGS (approximately elevation 3 to 5 ft NGVD). The shallow unconfined aquifer is about 40 ft thick and is segregated into three depth intervals (A, B, and C horizons) (Landau Associates 1992) (Tetra Tech 1996). Groundwater level elevation contours, shown on Figure 8, indicate west to northwest horizontal groundwater flow toward the Duwamish Waterway in the shallow aquifer. The horizontal gradient is approximately 0.0004 to 0.0008 based on June 2001 water level data (Figure 8).

A distinct discontinuous silt layer is present at approximately 25 ft BGS in the vicinity of the northwest corner of Building 9-101. Underlying the silt layer is approximately 8 ft of Duwamish River alluvium. This specific area and depth interval was termed the D horizon of the shallow aquifer (Landau Associates 1992, Tetra Tech 1996). D horizon water levels have larger tidal fluctuations then other portions of the shallow aquifer indicating the presence of semi confined conditions.

Groundwater level elevations in the shallow aquifer appear to vary approximately 1 to 2 ft in response to tides and seasonal precipitation changes (Landau Associates 1987). Tidal influence on the groundwater levels (approximately 0.4 ft) was observed in the shallow unconfined aquifer (A through C horizon) in the area of Building 9-101 and SWMU-20 during a 45 hour period (Tetra Tech 1996). However only a minimal (up to 0.04 ft) groundwater level change was observed in wells at SWMU-17 during a 12-hour period (Landau Associates 1987). It appears that the tidal influence on groundwater levels does not extend appreciably east of SWMU-20 and AOC-03/04. At the north end of the site, tidally influenced groundwater level fluctuations have been observed in monitoring wells in the vicinity of Slip No. 6 but this affect does not appear to extend south to AOC-01/02 (Landau Associates 1986). In the D horizon, a tidally influenced groundwater elevation change of approximately 0.75 ft was observed in the vicinity of SWMU-20 during a 45 hour period (Tetra Tech 1996).

Water levels in adjacent wells, which are screened at different depths within the unconfined aquifer, show minor head differences with no consistent trend. This indicates there are no strong vertical gradients within the unconfined aquifer in the vicinity of the site and groundwater flow can be expected to be primarily horizontal. Aquifer transmissivity of 1.91 to 2.28 ft^2/min and hydraulic conductivity of 7.5×10^{-2} to 9.0×10^{-2} ft/min (110 to 130 ft/day) was calculated from pumping test data (Tetra Tech 1996).

Horizontal groundwater velocity measurements were calculated from hydraulic gradient, hydraulic conductivity and porosity estimates using Darcy's law. The hydraulic gradient at the site is approximately 0.0004 to 0.0008 ft/ft; the hydraulic conductivity has been estimated to be approximately

110 to 130 ft/day (Tetra Tech 1996). Based on these parameter values and an assumed effective porosity of 0.25, the average groundwater flow velocity would be approximately 65 to 150 ft per year.

2.5.2.2 Confining Unit

An approximately 20- to 30-ft thick massive marine silt to silty clay unit separates the shallow unconfined aquifer and the deeper aquifer. Because this silt unit appears to be laterally contiguous across the site, it is presumed that this unit acts as a confining layer for the deeper aquifer.

2.5.2.3 Deep Confined Aquifer

A deep aquifer is present in the marine sands that underlie the confining unit. Only well MW-14E is screened in the deep aquifer onsite. Water level comparisons between this well and adjacent wells in the shallow zone indicate a distinct upward gradient from the deep to the shallow aquifer. Offsite investigations indicate that groundwater flow is generally northward towards Elliot Bay and the permeability of the deep aquifer is relatively low based on the rate of recharge for well MW-14E.

2.5.3 Background Water Quality

The information available on groundwater chemistry from the unconfined aquifer indicates it is of marginal water quality. At BDC, specific conductance ranges from 324 to 1931 µS in the unconfined aquifer (measured in June 2001). The Washington State Board of Health secondary water quality criterion for specific conductance is 700 µS. The specific conductance of the groundwater obtained from Well MW-14E, screened in the confined aquifer beneath the marine silt, was 1166 µS (June 2001). A pH of 8.57 was measured in Well MW-14E in 2001.

2.6 SURFACE WATER

The BDC is located on the east bank of the Duwamish Waterway, approximately 4.5 miles upstream of its mouth on Elliott Bay. Surface drainage from the BDC is routed to the Duwamish Waterway through a storm water drainage system that consists of 16 separate lines with 11 oil/water separators (SAIC 1994). The Duwamish Waterway is a salt-wedge estuary, characterized by a mixed wedge of ocean water underlying a series of increasingly dilute (upstream) water layers introduced by fresh river water (USGS 1974). The location of the upstream end of the salt wedge is typically near the East Marginal Way Bridge at approximately river mile 7, and is a function of river discharge and tidal stage (Dawson and Tilley 1972). The BDC is slightly downstream of the East Marginal Way Bridge and

is typically in contact with the salt wedge except when very low tides and very high stream discharges co-occur. During these infrequent events of co-occurrence, the groundwater flow from BDC is expected to have minimal contribution to total Duwamish Waterway stream flow. The Duwamish Waterway water column adjacent to the BDC, at zero tide, consists of an approximately upper 10 ft of brackish water and a lower 20 ft of salt water (Landau Associates 1986). The Duwamish Waterway discharges at an annual average rate of 1660 ft^3 per second into Elliott Bay (SAIC 1994). The lowest flows typically occur in August and the highest flows in December and January.

2.7 GROUNDWATER-SURFACE WATER INTERACTION

The Duwamish Waterway is a point of discharge for groundwater from the unconfined aquifer. As discussed in Section 2.5, groundwater in the unconfined aquifer flows toward the waterway and groundwater levels are affected by tidal fluctuations in the surface water.

3.0 SITE SCREENING STANDARDS

This section presents the development of screening standards for groundwater and soil at the BDC, based on requirements under Ecology's revised MTCA regulations that became effective August 15, 2001. Preliminary screening levels are discussed in Section 3.1. Points of compliance for the preliminary screening levels are discussed in Section 3.2.

3.1 SELECTION OF PRELIMINARY SCREENING LEVELS

Preliminary groundwater screening levels were developed based on protection of surface water. Preliminary soil screening levels were developed for protection of human health assuming direct contact with the soil and protection of groundwater using the fixed parameter three-phase leaching model described in WAC 173-340-747(4) (Ecology 2001a).

3.1.1 PRELIMINARY GROUNDWATER SCREENING LEVELS

Groundwater at the BDC meets the criteria listed in WAC 173-340-720(2)(d) for classification as nonpotable water for purposes of preliminary screening level development. Each of the criteria is discussed below.

- **The groundwater does not serve as a current source of drinking water and it is unlikely that hazardous substances will be transported from the contaminated groundwater to groundwater that is a current or potential future source of drinking water.** As described in Section 2.5.1, there are no known municipal or domestic water wells either at or within at least ½ mile of the BDC. Two municipal supply wells are located approximately ¾ mile west and 1 mile south of the BDC, respectively, on the opposite side of the Duwamish River. Given their locations, neither well would be expected to be potentially impacted by any constituents in groundwater at the BDC. Water rights exist for domestic and/or irrigation wells in Sections east and south of the BDC; however, none of these are located within the two Sections occupied by the BDC (T23N, R4E, Section 4 and T24N, R4E, Section 33) and the locations are upgradient or cross-gradient from the BDC (groundwater from the BDC flows west and south to the Duwamish Waterway). As described in Section 4, areas of impacted groundwater are limited in areal extent, are decreasing over time through active remediation and natural attenuation, and are contained within the site boundaries.

- **There are known or projected points of entry of the groundwater into the surface water.** The BDC is adjacent to the Duwamish Waterway and shallow groundwater at the site flows southwest or west and discharges to the waterway.

- **The surface water is not classified as a suitable domestic water supply source.** The Duwamish Waterway adjacent to the site typically consists of brackish water overlying salt water. The Duwamish Waterway adjacent to the site and downstream of the site is not considered a suitable domestic water supply source due to the salinity of the water.

- **The groundwater is sufficiently hydraulically connected to the surface water that the groundwater is not practicable to use as a drinking water source.** The unconfined aquifer at the site is hydraulically connected to the Duwamish Waterway as evidenced by the tidal response observed in site monitoring wells.

The groundwater at the BDC meets the criteria for considering the groundwater to be nonpotable; therefore preliminary groundwater screening levels were developed that are protective of beneficial use of surface water. The MTCA Method B marine surface water and fresh water screening levels were selected as the preliminary groundwater screening levels for the site.

Preliminary screening levels for marine and fresh surface water were developed for detected constituents using standard Method B in accordance with WAC 173-340-730 (3)(b) (Ecology 2001a). Preliminary groundwater screening levels were based on the most stringent of federal and state water quality criteria for protection of marine and fresh water aquatic organisms and human health, if available. If no federal or state criteria were available, preliminary groundwater screening levels were determined using the equations in WAC 173-340-730 (3)(b)(iii). MTCA Method A groundwater levels were used for total petroleum hydrocarbon (TPH) diesel-range and gasoline-range petroleum hydrocarbons as there are no marine surface water values. Where analytical methods prevent the reliable detection of a constituent at the concentration defined as the preliminary screening level, the preliminary screening level was adjusted upward to the practical quantitation limit (PQL) in accordance with 173-340-730 (5)(c) (Ecology 1995). Preliminary groundwater screening levels protective of marine and fresh water surface water are shown in Table 2.

3.1.2 PRELIMINARY SOIL SCREENING LEVELS

Preliminary soil screening levels were developed using standard Method C for industrial properties in accordance with WAC 173-340-745. The BDC meets the industrial land use criteria in WAC 173-340-745 (1)(a). The BDC is zoned for industrial land use. The BDC has been used in the past and is currently used for industrial purposes. It is expected that the BDC will be used for industrial purposes in the future. The land use surrounding the BDC is primarily industrial and commercial. The BDC is located within a large contiguous industrial land use area which extends from Harbor Island to near the head of navigation of the Duwamish Waterway. This zone represents one of the largest contiguous industrial areas within Washington state.

The BDC meets the exclusion from a terrestrial ecological evaluation requirement based on WAC 173-340-7491(1). Impacted soil at the site is covered by buildings and pavement that prevent plants or wildlife from being exposed to the soil.

Soil screening levels protective of groundwater and direct contact were evaluated in the selection of preliminary soil screening levels. Preliminary soil screening levels protective of groundwater were calculated in accordance with Ecology's fixed parameter three-phase partitioning model, WAC 173-340-747(4). Preliminary soil screening levels protective of direct contact (MTCA Method C industrial soil screening levels) were also evaluated. The levels protective of groundwater and protective of direct human contact were compared and the more stringent values were selected as the preliminary soil screening levels. Where analytical methods prevent the reliable detection of a constituent at the concentration defined as the preliminary soil screening level, the preliminary screening level was adjusted upward to the PQL in accordance with WAC 173-340-745 (6)(c) (Ecology 1995). For metals, the Puget Sound Basin natural background 90th percentile values were compared to the preliminary soil screening levels (Ecology 1994). The preliminary soil screening levels were adjusted upward to the natural background values if the background value was greater than the Method C values. The MTCA Method A industrial soil cleanup level was used for arsenic, which includes an adjustment for natural background. The MTCA Method A industrial value was also used for "polychlorinated biphenyls (PCBs) and mixtures" and for TPH. The preliminary soil screening levels are shown on Table 3.

3.2 POINTS OF COMPLIANCE

The points of compliance for groundwater at the BDC are throughout groundwater at the site unless the groundwater screening levels cannot be met at these standard points of compliance within a reasonable restoration time frame. In the event that it is determined that the groundwater screening levels cannot be met at the standard points of compliance, Boeing reserves the right to use conditional points of compliance, in accordance with WAC-173-340-720(8). The point of compliance for soil at the BDC is established in soil throughout the site, in accordance with WAC 173-340-745 (7).

4.0 SUMMARY OF SWMUs/AOCs

4.1 OVERVIEW

In 1994, a RFA was performed to evaluate SWMUs and AOCs at the BDC. The RFA identified 157 SWMUs and 5 AOCs, which are described in detail in the RFA (SAIC 1994). The majority of the SWMUs have been excluded from further investigation based on a determination that they do not pose a threat to human health or the environment (Table 1). As shown in Table 1, all of the original 157 SWMUs and 5 AOCs except the following have been identified as requiring no further action:

- SWMU-15, paper shredder, Building 9-67
- SWMU-16, former regulated materials storage area, Buildings 9-69/70
- SWMU-17, former sump and USTs, Building 9-75
- SWMU-20, former degreaser pit, Building 9-101
- SWMUs-23 through 25, former waste water above ground storage tanks (ASTs), Building 9-101
- SWMU-43, storm water sewer system
- AOC-01/02, former unleaded gasoline USTs, Building 9-52
- AOC-03/04, former No. 5 fuel oil USTs, Buildings 9-50 and 9-72
- AOC-05, former unleaded gasoline UST, Buildings 9-60 and 9-61.

The locations of these SWMUs and AOCs are presented on Figure 9. Further detail of these SWMUs and AOCs, including description of SWMU or AOC, summary of corrective action, and current status of the SWMU or AOC, are presented below.

4.2 SWMU-15: PAPER SHREDDER (BLDG 9-67)

4.2.1 DESCRIPTION OF SWMU

SWMU-15, near Building 9-67, consists of two adjacent paper shredders used to destroy classified and "Boeing Limited" documents (Figure 9). Papers are ground into fine particles in one of two shredders that each have an associated baghouse (cyclone). The particles are then sent to another baghouse where water is added to produce a slurry. The paper slurry passes through a screw press where excess water is removed. The wetted paper is then loaded into a 13 yd^3 box and sent offsite to be blended

with compost. Approximately one box of paper is generated each day. The paper shredders have been in operation since 1984; the baghouses were added in 1988 (SAIC 1994).

There has been one documented release of paper slurry waste from SWMU-15. Approximately 200 gal of paper slurry wastewater were released to a storm drain in 1994. The material was captured in the oil/water separator (SAIC 1994).

4.2.2 Summary of Corrective Action

Since the release of process water in 1994, three boxes were purchased for use at Building 9-67. The BDC best management practices (BMPs), with respect to the paper shredder, have been modified as follows. The boxes are lined and covered when not in use to help prevent leakage of debris to pavement. In addition, the area around the paper shredder is swept nightly to remove any accumulated debris. Debris from Building 9-67 that cannot be removed by street sweeping, and which enters site catch basins, is captured by the storm sewer system oil/water separators. The site has several oil/water separators in the storm sewer system which are inspected quarterly and cleaned out at least annually.

4.2.3 Current Status

The release of paper slurry waste noted was a one-time release of a non-hazardous material. Modifications to the BMPs have been implemented to prevent future releases. No additional corrective actions are planned for this unit. No further action is recommended for SWMU-15.

4.3 SWMU-16: FORMER REGULATED MATERIALS STORAGE AREA

4.3.1 Description of SWMU

SWMU-16 is a former regulated materials storage area located in and adjacent to Building 9-69/70 (Figures 9 and 10). This unit was used to manage regulated waste generated throughout the BDC facility. The unit operated from 1979 to 1992. Building 9-69/70 consisted of six container storage bays that were used to segregate flammables, corrosives, and other wastes. Lead acid batteries were also stored in this area.

The six curb-enclosed container storage bays were each 18 ft wide by 16 ft deep with 6-inch to 8-inch high curbs on two sides, and walls on top of the curbs (Figure 11). The bays were enclosed with metal walls and a post-supported canopy roof. A strip drain ran across the front of each bay, and the inside wall of Building 9-69/70 formed the back side of the bays. The bays were arranged such that three bays faced each other with a 15-ft corridor down the center. The corridor sloped toward a catch basin in

the center. The strip drains emptied into a 1,000 gal oil/water separator (SWMU-35) with a shut-off valve. An asphalt paved container storage area behind the building was surrounded by a chainlink fence on three sides and the building on the fourth side. The area inside the fence did not have curbing or containment structures around its perimeter (SAIC 1994, Weston 1997).

4.3.2 SUMMARY OF CORRECTIVE ACTION

Ecology approved the RCRA Closure Plan for Building 9-69/70 Container Storage Area (Weston 1993 and Ecology 1993). During June 1996, the building structure was removed. Samples of the concrete slab and surface and subsurface soil beneath the concrete slab and asphalt area were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total PCBs, and priority pollutant metals. The soil samples contained VOCs, SVOCs, total PCBs, and metals. Soil underneath the concrete slab contained concentrations of total PCBs above the MTCA Method A industrial cleanup level. Soil underneath the asphalt contained elevated concentrations of lead. Approximately 800 yd^3 of soil were excavated from SWMU-16 and disposed of at an approved facility.

After excavation, 11 soil samples from the bottom of the excavation and 8 sidewall samples were collected and analyzed for VOCs, SVOCs, total PCBs, and priority pollutant metals. In accordance with the Closure Plan, the screening criteria for the soil samples was 100 times MTCA Method B groundwater criteria. Concentrations of VOCs in the soil samples did not exceed the screening criteria. One soil sample contained concentrations of carcinogenic polycyclic aromatic hydrocarbons (cPAHs) above the screening criteria but the elevated concentration appears to be residue from a buried treated wood bulkhead near the sampling location (Weston 1997). Concentrations of arsenic, beryllium, and chromium were above the screening criteria but within natural background concentrations for the area (Ecology 1994). The concentrations of these metals in the site soil appeared to result from natural background and not from contamination. Three soil samples contained concentrations of total PCBs above the screening criteria.

Additional soil was excavated from the three sample locations that contained total PCB exceedances. The locations were sampled after the excavation. One of the three locations did not contain detectable concentrations of total PCBs (0.036 mg/kg detection limit). The mean total PCB soil concentration in the remaining two locations (0.33 mg/kg) was below the screening criteria of 1 mg/kg established in the Closure Plan.

In summary, the Building 9-69/70 Container Storage Area was closed in accordance with the requirements of the Closure Plan. All concrete underlying the facility was removed and disposed of offsite. Residual PCB concentrations satisfied the Closure Plan requirements. Arsenic, beryllium, and chromium were not present in concentrations exceeding background concentrations (Weston 1997).

Ecology approved the closure of Building 9-69/70 (Ecology 1997). A copy of Ecology's approval letter is included in Appendix C.

During closure of the Building 9-69/70 Container Storage Area, soil was excavated beyond the boundaries of the storage unit. At the easternmost edge of the excavation, a sample was collected that contained 7.1 mg/kg PCB. Because this sample was collected beyond the boundaries of the container storage unit, the unit was certified clean-closed and Ecology approved the closure. The observed concentration of 7.1 mg/kg is below the MTCA Method A industrial cleanup level of 10 mg/kg; however, Ecology requested that additional investigation be performed to evaluate whether the PCB detected in soil was impacting groundwater. Boeing submitted a work plan on July 25, 2000 outlining a scope of work for the requested investigation (Boeing 2000). Ecology approved the plan on February 8, 2001.

The additional investigation of SWMU-16 included the drilling and sampling of six Geoprobe™ borings in January 2001. The soil boring locations are shown on Figure 12. Two groundwater samples were collected from each boring. The initial groundwater sample from each boring was collected from 0.5 to 3.5 ft below the top of the water table. The second groundwater sample from each boring was collected from a depth of 10.5 to 13.5 ft below the top of the water table (IT Corporation 2001).

The groundwater samples were analyzed for PCBs, which were not detected at the 1 to 2 μg/L method reporting limit (IT Corporation 2001). The results are summarized in Table 4. Based on the groundwater sample analytical results, it does not appear that PCBs previously detected in the soil have impacted the groundwater.

4.3.3 CURRENT STATUS

Ecology approved the RCRA closure of the former Building 9-69/70 Container Storage Area. Boeing performed a supplemental investigation to verify that residual PCB concentrations in soil in the area beyond the boundaries of the former storage area are protective of groundwater. PCBs were not detected in groundwater samples collected during this investigation. Based on these results, no further actions are recommended for SWMU-16.

4.4 SWMU-17: FORMER UNDERGROUND STORAGE TANK

4.4.1 DESCRIPTION OF SWMU

SWMU-17 consists of a former 67-gal sump and associated 4,000-gal steel UST, which were used to store waste hydraulic and engine oil. The sump/UST system is designated DC-05. It was installed in 1957 and was located east of the Building 9-75 water tank. The location of SWMU-17 is shown on Figures 9 and 10, and groundwater contours for SWMU-17 are presented on Figure 8. Waste oil

generated by hydraulic testing shops, automotive maintenance shops, and various other locations throughout the BDC was poured into the sump and then flowed into the UST. Periodically, the waste oil was pumped from the UST and shipped offsite for treatment and disposal (SAIC 1994). The sump and UST were closed and removed in late March or early April 1986 (Landau Associates 1987).

4.4.2 SUMMARY OF CORRECTIVE ACTION

Soil samples collected in 1985 in the vicinity of the UST indicated the soil was impacted with hydrocarbons (Norton Corrosion Limited, Inc. 1985). Visual contamination was not observed in the soil during the UST removal. Soil samples collected after the UST removal indicated minor amounts of hydrocarbon present in the soil (Landau Associates 1987).

As a result of identifying the presence of contaminated soil, three monitoring wells (BDC-05-1, BDC-05-2, and BDC-05-3) were installed in May or June 1986 (Figure 13) (Landau Associates 1987). One soil sample, from a depth of approximately 10 ft BGS in the boring for well BDC-05-2, was analyzed for VOCs and priority pollutant metals. Analytical results for detected constituents are presented in Table 5. The soil sample contained methylene chloride, acetone, toluene, total xylenes, and metals. However, the concentrations of all detected constituents were below the preliminary soil screening levels, with the exception of copper. The maximum concentration of copper (41 mg/kg) was above the preliminary soil screening level of 36 mg/kg, which is based on the 90th percentile concentration in soil for Puget Sound basin (Table 3). However, the measured concentration is less than two times the preliminary soil screening level and is also within the Puget Sound Basin natural background range of 4 to 243.5 mg/kg (Ecology 1994). Methylene chloride in the soil sample appears to be a result of laboratory contamination as it was detected in the lab blank at similar concentrations as the soil sample (Landau Associates 1987). The presence of trace levels of toluene and total xylenes with the absence of benzene and the detection of acetone may suggest low levels of non-chlorinated solvent contamination rather than hydrocarbon contamination (Landau Associates 1987).

Following installation of the groundwater monitoring wells, one groundwater sample was collected from each well and submitted for analysis of VOCs and priority pollutant metals. Additional groundwater samples were obtained from monitoring wells BDC-05-2 and BDC-05-3 in November 1986. Shortly thereafter, monitoring well BDC-05-2 was inadvertently destroyed during construction of Building 9-64. Boeing replaced the destroyed well and installed several additional monitoring wells to further define the extent and probable source of contamination associated with tank DC-05 (Landau Associates 1987). Monitoring wells BDC-05-2A, BDC-05-4, BDC-05-5, and BDC-05-6 (Figure 13) were installed in January 1987 and sampled in early February 1987. In March 1987 an additional monitoring well (BDC-05-7) was installed adjacent to and downgradient of the former tank

location (Figure 13). In December 1987, Ecology requested that additional groundwater sampling be conducted. Monitoring wells BDC-05-1, BDC-05-2A, BDC-05-3, and BDC-05-7 were sampled in February 1988 and the samples were analyzed for VOCs, bis(2-ethylhexyl)phthalate, and metals (chromium, copper, nickel, and zinc). In August 1988, Ecology stated that no further work was required at this site and that the monitoring wells could be abandoned (Ecology 1988). In January 1995, monitoring well BDC-05-01 was abandoned during a storm sewer relocation project. Monitoring well BDC-05-06 was abandoned prior to soil excavation activities related to closure of SWMU-16. From 1996 to 2001, groundwater samples from the five wells (BDC-05-2A, BDC-05-3, BDC-05-4, BDC-05-5, and BDC-05-7) were collected approximately annually and analyzed for VOCs, TPH, and metals.

Detected metals concentrations for groundwater samples collected since January 1998 are summarized in Table 6. Arsenic, cadmium, copper, and lead were detected at concentrations exceeding the preliminary screening levels. In general, the exceedances of preliminary screening levels for metals were infrequent with the exception of copper. Copper was detected at a maximum concentration of 44 µg/L, compared with the preliminary screening level of 3.4 µg/L for marine water and 8.9 µg/L for fresh water. TPH was not detected above the detection limit, 250 µg/L. Detected VOCs for samples collected since January 1998 are summarized in Table 7. Tetrachloroethene (PCE) is the only VOC detected at concentrations exceeding the preliminary screening level. During the most recent sampling event (December 2001), the maximum observed concentration of PCE was 8.2 µg/L, which is below the preliminary screening level of 9 µg/L. A complete summary of groundwater data for SWMU-17 is provided on digital media (compact disc) in Appendix A.

In the December 2001 groundwater monitoring event, split samples were sent to Analytical Resources, Inc. (ARI) of Seattle, Washington to confirm the concentrations of metals that had been observed in previous samples. Metals concentrations in the ARI samples were significantly lower, indicating that the elevated concentrations of metals in previous samples may be inaccurate. Semi-annual groundwater sampling will continue to monitor metals to confirm the lower concentrations. Analytical results for the original and split samples are presented in Appendix A.

4.4.3 CURRENT STATUS

Under the groundwater monitoring program, the monitoring wells (BDC-05-2A, BDC-05-3, BDC-05-4, BDC-05-5, and BDC-05-7) are currently sampled semi-annually for VOCs, diesel-range petroleum hydrocarbons, and metals (Boeing 2001).

4.5 SWMU-20: FORMER DEGREASER PIT (BLDG 9-101)

4.5.1 DESCRIPTION OF SWMU

SWMUs-20 through 22, the former degreaser pit (SWMU-20) and sumps [Sump No. 2 (SWMU-21) and Sump No. 3 (SWMU-22)] in the tank line, were associated with the vapor degreaser and the anodizing tank line, respectively, and were located in the northwest corner of Building 9-101 (Figure 14). Originally, there was an 8.5-ft deep degreaser pit that was 9 ft wide by 22.3 ft long with an adjacent plating line sump (Sump #1) that was 6.6 ft deep, 6.3 ft long, and 7.3 ft wide. The degreaser pit and sumps were used from about 1956 to 1984 (Landau 1990a). In 1967, a new sump pit was added that was 6.3 ft deep, 8 ft long, and 6 ft wide. The former degreaser pit and sumps were concrete lined. The degreaser pit was used as containment for solvents [reportedly PCE and trichloroethene (TCE)] used in the degreaser. The base of the degreaser pit was about 10 ft BGS and sloped toward Sump No. 2, which was about 13 ft BGS. Sump No. 2 drained into Sump No. 3. The two sumps were used to contain and accumulate wastewater contaminated with acid, alkaline, and metals from the anodizing plating line. After chemical testing, liquid waste was pumped from Sump No. 3 to either a tank truck for disposal by a waste hauler or to the METRO Sewer System. Elementary neutralization was performed on the wastewater prior to discharge to the sanitary sewer (SAIC 1994).

The degreaser pit and sumps were closed in 1984. All tanks, piping, and other equipment were removed. The degreaser pit and sumps were backfilled with compacted sand backfill material and capped with a 10-inch thick concrete slab. All openings through the walls and floor were plugged (Landau Associates 1990a).

4.5.2 SUMMARY OF CORRECTIVE ACTION

In 1989, approximately 1,400 tons of soil contaminated with PCE and TCE were removed from the area of the former degreaser pit and sump area during a structural upgrade project of Building 9-101. Six soil samples were collected from test pits in a Phase I investigation during June 1989. Water was observed at the base of the excavation, in two test pits 2 to 29 inches above the depth of the concrete floor of the degreaser pit. Soil and water samples were analyzed for VOCs, SVOCs, metals, and cyanide. Soil samples were collected from the area of subsequent excavation and therefore analytical results for VOCs and SVOCs are not presented in this report. The soil metals results from Phase I are presented in Table 8a. Although most or all of the soil represented by these samples was excavated, the results are included to document that metals were not present at concentrations above preliminary screening levels. A Phase II investigation was performed in August 1989; 65 soil samples were collected from borings and 24 monitoring wells were installed in the vicinity of the former degreaser pit/sump area. Soil samples

were submitted for analysis of VOCs, SVOCs, TPH, and PCBs. Groundwater samples were collected and analyzed for VOCs and TPH. A Phase III investigation was completed in February 1991, which included soil sampling and installation of 13 monitoring wells. Soil samples were analyzed for VOCs. Groundwater samples from the 24 existing monitoring wells and 13 additional monitoring wells were collected and analyzed for VOCs. Subsequent investigations confirmed the presence of chlorinated VOCs in the groundwater (Boeing 2001). The solvent release was interpreted to be from the former degreaser pit (SAIC 1994).

The detected analytical results for soil samples collected from the monitoring well borings during the Phases II and III investigations are presented in Table 8b. The most frequently detected constituents were chlorinated VOCs: PCE, TCE, cis-1,2-dichloroethene (DCE), and vinyl chloride (VC). Concentrations of PCE and TCE were above the preliminary soil screening levels at two depth intervals. The shallowest interval included soil from the vadose zone, from approximately 0 to 10 ft BGS. This zone contained the highest concentration of chlorinated VOCs. The deeper zone was observed from approximately 32 to 40 ft BGS (Landau Associates, 1992). Soil sample 8C-12 contained polycyclic aromatic hydrocarbons (PAHs) and other creosote-associated compounds at concentrations below the preliminary screening levels. These compounds appear to be associated with treated timber piles used to support Building 9-101 (Landau Associates 1990a). TPH was also detected at concentrations below the preliminary soil screening level in some of the samples.

The groundwater monitoring wells installed at the facility were constructed to allow evaluation of layers (horizons) of the aquifer system beneath the site. The range of depths of the monitoring well screens relative to the horizon of groundwater targeted for assessment were as follows:

A Horizon Wells – screen depths ranging from 6.5 to 21.5 ft BGS
B Horizon Wells – screen depths ranging from 22.0 to 27.5 ft BGS
C Horizon Wells – screen depths ranging from 23.5 to 40.5 ft BGS
D Horizon Wells – screen depths ranging from 40.0 to 56.0 ft BGS
E Horizon Wells – screen depths ranging from 77.0 to 82.0 ft BGS

As described in Section 2.5.2, the A, B, and C Horizon wells were intended to monitor three distinct layers of groundwater located in the shallow, unconfined aquifer located beneath the site. The D Horizon wells were intended to evaluate the semi-confined layer of groundwater present beneath a discontinuous silt aquitard underlying the unconfined aquifer. The E Horizon well (MW-14E) was intended to monitor the water quality in the fully confined aquifer present beneath a massive marine silt deposit located beneath the site.

SVOCs were not detected above EPA Contract Laboratory Program (CLP) quantitation limits in groundwater samples and were dropped from the testing program after the August 1989 sampling program (Landau Associates 1992). The SVOCs in groundwater were primarily PAHs and are assumed to be associated with the creosote-treated timber piles beneath Building 9-101 (Landau Associates 1990a).

Frequently detected VOCs in groundwater were benzene, PCE, TCE, DCE, VC, and naphthalene. A summary of concentrations for these constituents for monitoring events since January 1998 is presented in Tables 9 through 14. A complete summary of groundwater analytical data for SWMU-20 is provided on digital media in Appendix A.

The distributions of the chlorinated VOCs PCE, TCE, DCE, and VC in groundwater follow a similar pattern. Concentrations of PCE, TCE, and DCE in groundwater are greatest in the A Horizon near monitoring well MW-9A (i.e., near the former degreaser pit). Concentrations decrease in the downgradient groundwater flow direction from monitoring well MW-9A and generally show a decreasing trend with depth. A trend plot showing VOC concentrations over time for the influent to the groundwater pump and treat system (indicative of dissolved concentrations in the plume area) are presented in Appendix B. Since June 1998, only PCE has been detected in sample from the monitoring wells at concentrations exceeding the preliminary screening level (Table 11). Table 15 presents a summary of infrequently detected VOCs; none of these constituents has been detected at concentrations exceeding the preliminary screening levels. The E Horizon well has not exhibited impact by chlorinated hydrocarbons in excess of laboratory detection limits since August 1997. The only constituents detected in samples collected from Well MW-14E prior to 1997 were acetone (5.9 µg/L in October 1998), cis-1,2-DCE (1.1 µg/L in January 1994), and VC (detected at 10 µg/L, 1.43 µg/L, 1.3 µg/L, 1.3 µg/L, in January 1994, May 1995, August 1995, and May 1996, respectively). No constituents have been detected in samples from well MW-14E at concentrations exceeding the preliminary screening levels.

4.5.2.1 Overview of Remediation System

During the fall of 1993, a pump and treat system was installed to remove the chlorinated VOCs from the groundwater and preclude migration of chlorinated VOCs in groundwater. The pump and treat system consists of two extraction wells (E-1 and E-2), and a sieve tray aerating treatment system. Initially, the remediation system utilized one extraction well (E-1) to extract groundwater. E-1 was installed with a screened interval extending from approximately 23 to 38.3 ft BGS, which indicates that E-1 was capable of collecting groundwater from the A, B, and C horizons of the shallow groundwater present beneath the site. E-1 remained in use as the sole recovery well at the site from March 4, 1994 to December 13, 1995. A second groundwater extraction well (E-2) was utilized for groundwater extraction beginning in July 1996. E-2 was constructed with well screen extending from approximately 22 to

32 ft BGS, so that extraction of water from E-2 would also be within the A, B, and C horizons of the groundwater beneath the site. Since July 1996, the extraction wells have been used alternately for extraction, with E-2 being operated for a majority of the time. The pump and treat system produces approximately 25,000 gal per day of treated water, which is discharged to an national pollution discharge elimination system (NPDES) permitted stormwater outfall (Boeing 2001).

4.5.2.2 Remediation System Evaluation

A complete evaluation of the pump and treat remedial system at SWMU-20 is included in Appendix B. This remedial system evaluation examined the following information:

- Current and historical contaminant distribution (lateral and vertical) to evaluate system effectiveness in plume control and aquifer restoration
- Capture zone of each extraction well within each of four depth intervals (i.e., A, B, C, and D zones) at current pumping rates
- Appropriateness of current extraction well locations and screen depths
- Appropriateness of alternate pumping rates or alternate pumping scenarios (e.g., cyclic pumping, or concurrent extraction from both wells) with respect to plume containment and aquifer restoration
- Current mass removal rates, trends in mass removal, and total VOC mass removed to date
- Natural attenuation mechanisms and effectiveness, including a comparison of current mass removal rates to potential natural biodegradation rates.

A brief review of the findings are summarized below. Refer to Appendix B for further details. The remediation system evaluation focuses on the chlorinated VOCs: PCE, TCE, DCE, and VC. These constituents are considered the primary constituents of interest based on their concentration and frequency of detection in site monitoring wells. The evaluation considered the data collected for the site under two distinct scenarios: prior to the activation of the remediation system (August 1989 to January 1994) and following the activation of the remediation system (January 1994 to December 2000).

The implementation of the groundwater pump and treat system in March 1994 has increased the removal rate of PCE, TCE, DCE, and VC from the groundwater at the site. The influent concentration of the groundwater recovered by the pump and treat system has been declining significantly over the past two years (Figure 8 of Appendix B). The capture zone of the current pump and treat system indicates that it has effectively controlled plume migration (Landau Associates 2001).

4.5.3 CURRENT STATUS

The pump and treat remedial system evaluation (Appendix B) also includes a recommended course of action to continue groundwater remediation and to obtain regulatory closure for the site. This recommended course of action involves temporarily shutting down the remediation system and allowing the groundwater to equilibrate for a period of 6 months. In accordance with this recommendation and with Ecology concurrence (Ecology 2001b), the remediation system was temporarily shut down starting December 14, 2001. Following shutdown of the remediation system, sampling will be conducted, and the results will be evaluated to determine if natural attenuation appears to be a viable remedial alternative to reach site clean-up concentrations. The groundwater monitoring wells associated with SWMU-20 will be sampled for VOCs biannually, typically during summer and winter (Boeing 2001). Beginning with the December 2001 sampling event, the scope of groundwater monitoring was reduced as approved by Ecology and sampling of monitoring wells MW-17C, MW-17D, MW-18A, MW-18D, MW-19A, MW-19D, MW-20A, and MW-20D was discontinued.

4.6 SWMU-23 THROUGH SWMU-25: ABOVEGROUND STORAGE TANKS (BLDG 9-101)

4.6.1 DESCRIPTION OF SWMUS

SWMUs 23 through 25, three former ASTs, (designated A, B, and C), were located near the northwest corner of Building 9-101 (Figure 9). AST A was a 3,000-gal waste alkaline holding tank. It held waste sodium hydroxide and various other alkaline solutions used for chemically milling, stripping, and cleaning. AST B was a 2,000-gal waste acid holding tank which held waste nitric acid, hydrochloric acid, chromic acid, and other acid solutions used for chemically milling, etching, and plating operations. AST C was a 10,000-gal wastewater tank, which held wastewater contaminated with metals that exceeded METRO permit discharge limits. AST C wastewater included process rinse water, general cleaning wash water, and rain water. The rainwater initially accumulated in a sump in the tank line containment area for ASTs A, B, and C. When the sump was full, the water would be analyzed and either discharged to METRO Sewer System, if results met METRO's permit limits, or AST C. The ASTs were in use from 1957 through 1984. In 1982, ASTs A and B were moved to a nearby location to accommodate installation of a new scrubber. All three ASTs were decontaminated, closed, removed, and disposed of in 1985 (SAIC 1994). ASTs A and B were designated as RCRA-regulated tanks. AST C was not a RCRA-regulated storage tank, and therefore did not require RCRA closure.

There were no reported releases from ASTs A, B, and C.

4.6.2 SUMMARY OF CORRECTIVE ACTION

A soil and groundwater investigation was performed in 1993 at the former locations of ASTs A and B as a closure requirement (Landau Associates 1993a). Soil samples were collected at the pre- and post-1982 locations of ASTs A and B (Figure 15), and were analyzed for total and toxicity characteristic leaching procedure (TCLP) extractable priority pollutant metals. Groundwater samples were collected from existing monitoring wells MW-7A, MW-13A, and MW-16A (Figure 15) and were analyzed for total and dissolved priority pollutant metals. The performance closure standards were based on MTCA Method A and C cleanup levels for industrial sites. Chemical concentrations in the soil samples and the groundwater samples did not exceed the MTCA cleanup criteria. The soil and groundwater investigation therefore concluded that there were no significant soil or groundwater impacts from metals that may have been associated with the operation of ASTs A or B (Landau Associates 1993a). On September 3, 1997, Ecology accepted the final facility closure certification for the Building 9-101 dangerous waste ASTs (Ecology 1997) (Appendix C).

4.6.3 CURRENT STATUS

No further action is required for these SWMUs as Ecology accepted the final facility closure certification for the Building 9-101 dangerous waste ASTs (Ecology 1997).

4.7 SWMU-43: STORMWATER SEWER SYSTEM

4.7.1 DESCRIPTION OF SWMU

SWMU-43 is the storm water sewer system used to control surface water runoff throughout the BDC facility. There are also floor drains from some of the buildings that enter the stormwater sewer system. Although many of these floor drains have been sealed, some are still in use. Stormwater from areas expected to contain oil passes through oil/water separators (SWMUs-30 through 40) prior to discharge to the stormwater sewer system. There are 16 lines in the stormwater sewer system that discharge to the Duwamish Waterway. There are eleven oil/water separators associated with the stormwater sewer system lines. The stormwater sewer system has been operating since 1956. The sewer system has been modified over the life of the facility (SAIC 1994).

Historically, there have been periodic releases to the stormwater sewer system. In 1986, there were two spills of PS 300 fuel oil that reached the Duwamish Waterway. The first spill occurred in September 1986, when a steam to oil heat exchanger burst, causing oil to spill and enter the stormwater sewer that drained into the Duwamish Waterway. Up to 20 to 30 gal of oil reached the river. Following

cleanup of this spill, the heat exchanger was repaired and its discharge was routed away from the storm sewer. A second spill of 80 gal of PS 300 fuel oil occurred on December 24, 1986. The spill occurred when fuel oil was being transferred from a tank truck to an UST at Building 9-72. The spilled oil entered a storm drain catch basin, which discharged to the river. Contractors cleaned up both of these spills. To contain future spills, Boeing installed curbing around the fill pipes to the tanks and installed oil/water separators on the main stormwater sewer lines. In 1987, there was a 10-gal spill of heat transfer oil from an unspecified location. Approximately 10 percent of this spill reached the storm water sewer system. A spill occurred in 1989 at Building 9-120 of 15,000 gal of 15 percent alkyl trimethylene diamine, a biocide. Most of this spill was recovered; it is unclear if any of it reached the river. In 1992, there was a release of approximately 1 quart of diesel from the diesel tank at Building 9-102, and two releases of water (90 gal in January, and an unknown volume in April) with Dearborn 547 and Steamate from autoclave #4 at Building 9-101. In 1993, there was a spill containing 30 gal of ethylene glycol at Building 9-101, as well as a spill of 4,500 gal of cooling water at Building 9-101. One spill occurred in 1994, when a portion of 75 gal of spilled diesel fuel at Building 9-08 entered a catch basin (SAIC 1994). No information is available regarding any spills since 1994.

4.7.2 Summary Of Corrective Action

Boeing is continuously upgrading its training with regards to spill prevention. BMPs have been implemented to prevent future spills. Boeing installed curbing around the fill pipes to the tanks and installed oil/water separators on the main stormwater sewer lines. Boeing produced a video demonstrating practices to protect water quality and the video is used in training on a company-wide basis. Boeing has also marked all storm water catch basins with the phrase "dump no chemicals drains to stream". The signs are black with white lettering and include a fish symbol for added emphasis (Boeing 1998).

4.7.3 Current Status

No additional actions are planned with regard to this unit (Boeing 1998). No further action is recommended for SWMU-43.

4.8 AOC-01/02: FORMER UNDERGROUND STORAGE TANKS (BLDG 9-52)

4.8.1 DESCRIPTION OF AOCS

AOC-01/02 is the location of two former steel USTs (DC-14 and DC-13, respectively) located near Building 9-52, as shown on Figures 9 and 16. The USTs were installed in 1985 and used to store unleaded gasoline in a 500-gal tank (DC-14), and diesel fuel in a 300-gal tank (DC-13). The tanks were part of a fueling station that serviced Boeing vehicles and other motorized equipment (Landau Associates 1993b). A tank tightness test was performed in April 1990 and UST DC-14 (the gasoline tank) was discovered to be leaking, probably as a result of an improperly attached fill pipe. The two USTs were decontaminated, closed, and removed to the ChemPro facility in Tacoma, Washington. After the removal of the USTs, soil was excavated until soil at the base of the excavation met MTCA Method A cleanup criteria. Excavated soil was disposed of at Chem Securities Systems, Inc., Arlington, Oregon. The two USTs were replaced in June 1990 with a 550 gal (DC-18) and 1,100 gal (DC-19) USTs for diesel and unleaded gasoline, respectively (SAIC 1994).

4.8.2 SUMMARY OF CORRECTIVE ACTION

Twenty-four soil samples were collected and analyzed for TPH and benzene, toluene, ethylbenzene, and xylenes (BTEX) during and after soil excavation. Soil was removed to a depth of 2 ft below the water table during excavation. Soil concentrations of BTEX at the base of the excavation were below the preliminary soil screening levels. TPH was not detected in the soil samples. Soil analytical results are presented in Table 16.

One groundwater sample was collected from the base of the excavation (Landau 1990b). Free product was not observed on the groundwater but foam was present. The groundwater sample was analyzed for TPH and BTEX. Concentrations of TPH and BTEX in the groundwater sample were below the preliminary groundwater screening levels.

Three groundwater monitoring wells DC-9-52-1 (upgradient) and DC-9-52-2 and DC-9-52-3 (downgradient) were installed up-gradient and down-gradient from the source of the former fuel USTs (Figure 16) (Landau 1993b). A groundwater contour map of the site is presented on Figure 8. The wells were placed in the shallow groundwater depths to evaluate the potential presence of floating product.

The monitoring wells were sampled periodically between February 1991 and November 1995 and approximately annually from May 1997 to June 2001. The samples were analyzed for BTEX, diesel-range petroleum hydrocarbons and gasoline, PCBs, and metals. A summary of groundwater sample results for detected constituents in samples collected since 1998 are presented in Table 17. A complete analytical data summary is provided on the compact disc in Appendix A. Of the detected compounds

(metals, diesel-range petroleum hydrocarbons, toluene, and xylene), only diesel-range petroleum hydrocarbons (in wells DC-9-52-1 and DC-9-52-3) and cadmium and copper (in well DC-9-52-2) have been detected since 1998 at concentrations above the preliminary groundwater screening levels.

Diesel-range petroleum hydrocarbons was detected in wells DC-9-52-1 (2970 µg/L) and DC-9-52-3 (840 µg/L) at concentrations above the preliminary groundwater screening level (500 µg/L) in December 2000. Concentrations of diesel-range petroleum hydrocarbons in these wells decreased to non-detect in December 2001. Detected diesel-range petroleum hydrocarbons concentrations in well DC-9-52-2 have been below the preliminary groundwater screening levels.

Cadmium and copper were detected in one groundwater sample from November 1999 at concentrations (12 and 24 µg/L, respectively). The concentrations of cadmium and copper in this sample were less than two times the marine water preliminary screening level (9 µg/L) and twelve times the fresh water preliminary screening level (1 µg/L). The concentration of copper in this sample was seven times the marine water preliminary screening level (3.4 µg/L) and 2.7 times the fresh water preliminary screening level (8.9 µg/L).

4.8.3 CURRENT STATUS

The three monitoring wells will be sampled biannually (during wet and dry seasons) until two consecutive monitoring events are obtained without detections of gasoline-range petroleum hydrocarbons, diesel-range petroleum hydrocarbons, and BTEX (Boeing 2001).

4.9 AOC-03/04: FORMER UNDERGROUND STORAGE TANKS (BLDG 9-50)

4.9.1 DESCRIPTION OF AOCS

AOC-03/04 is the location of two 20,000-gal double wall composite USTs (DC-20 and DC-21), located near Buildings 9-50 and 9-72 (Figures 9 and 14). The original USTs, both 20,000-gal, (DC-03 and DC-04) were installed in 1957 and were used to store No. 5 fuel oil used by a steam plant in Building 9-50. A 1985 evaluation of soil conditions outside of the two original USTs did not provide any evidence of a release of petroleum hydrocarbons (Norton Corrosion Limited, Inc. 1985). However, in 1991 when tank tightness testing was conducted, the westernmost UST was discovered to be leaking. Both USTs were removed and replaced with two new 20,000-gal tanks in 1992 (Landau Associates 1993c).

4.9.2 SUMMARY OF CORRECTIVE ACTION

After removal of USTs DC-03 and DC-04, several holes were noted near the bottom of both former USTs. During the USTs removal, approximately 250 yd^3 of petroleum hydrocarbon contaminated soil and 200 to 500 gal of free phase hydrocarbon product were removed from the excavation. The soil was shipped to Woodworth & Company, Inc., Tacoma, Washington for thermal desorption treatment. The free hydrocarbon product was sent offsite to a licensed facility for proper treatment/disposal/recycling. Approximately 80,000 gal of water were generated during remediation. Excess water was pumped to a temporary onsite holding tank, then trucked either to Burlington Environmental's treatment facility at Pier 91 and/or Boeing's wastewater treatment plant in Auburn.

After excavation, a small area of soil (approximately 10 by 20 ft and unknown depth) remained at the base of the excavation with concentrations of petroleum hydrocarbon above the preliminary soil screening level. The soil was not excavated because it was beyond the reach of the excavating equipment, it was beneath the water table, and the affected area was relatively small (Landau Associates 1993c). No further soil removal was necessary due to the relative immobility of the fuel oil (Boeing 2001). Detected analytical results for soil samples are presented in Table 18.

In 1992, a monitoring well (MW-21A) was installed nearby the two former USTs, and the soil and groundwater were sampled for TPH. No TPH was detected in the soil or groundwater at that time (Landau Associates 1993c). The well has been sampled approximately biannually since 1997 and the groundwater samples analyzed for VOCs and diesel-range petroleum hydrocarbons. In June 2001, monitoring well MW-21C was installed within the C-Zone interval to evaluate benzene concentrations that have been detected at this depth interval in nearby SWMU-20 wells. MW-21C was sampled in June 2001 and analyzed for VOCs and diesel-range petroleum hydrocarbons. Analytical results for detected constituents in groundwater samples are presented in Table 19. A complete analytical data summary is provided on the compact disc in Appendix A.

Of the detected analytes (acetone, DCE, and diesel-range petroleum hydrocarbons), only diesel-range petroleum hydrocarbons was detected above the preliminary groundwater screening levels. Acetone (October 1998) and cis-1,2-DCE (June 2001) were detected at low levels in MW-21A and MW-21C, respectively. These analytes have not been detected during the remainder of the monitoring period. Diesel-range petroleum hydrocarbon was detected at a concentration above the preliminary groundwater screening level in MW-21A in December 2000. Concentrations of diesel-range petroleum hydrocarbons were non-detect in MW-21A and MW-21C in December 2001.

4.9.3 CURRENT STATUS

The two monitoring wells will be sampled semi-annually until four consecutive groundwater samples are obtained that are non-detect for diesel-range petroleum hydrocarbons (Boeing 2001).

4.10 AOC-05: FORMER UNDERGROUND STORAGE TANK

4.10.1 DESCRIPTION OF AOC

AOC-05 was a 1,000 gal unleaded gasoline steel UST (DC-01) located south of Buildings 9-60 and 9-61 (Figures 9 and 10). The UST was removed in 1985 after approximately 830 gal of unleaded gasoline leaked out of a puncture in the UST. The leak resulted from damage to the tank bottom from the practice of measuring product volume with a steel rod.

4.10.2 SUMMARY OF CORRECTIVE ACTION

During the UST removal, 500 to 600 gal of floating product was removed from the excavation. Additional gasoline contamination was removed within the excavated soils (Boeing 2001). Two monitoring wells (BDC-01-1 and BDC-01-2) were installed in early September 1985. Groundwater samples were collected from the two monitoring wells in July 1986. Benzene was detected in BDC-01-1, located west of the former UST.

Ecology requested Boeing to further investigate this area for gasoline-range petroleum hydrocarbons and BTEX (Ecology 2000). During January 2001, limited push-probe sampling was performed around AOC-05. Six borings were advanced in the vicinity of the former UST DC-01 (Figure 17) (IT Corporation 2001). Two groundwater samples were collected from each boring. One groundwater sample from each boring was collected from 0.5 to 3.5 ft below the top of the water table. The other groundwater sample from each boring was collected from 10.5 to 13.5 ft below the top of the water table. Groundwater samples were analyzed for gasoline-range petroleum hydrocarbons and BTEX. Analytical results are presented in Table 20. Of the detected compounds (gasoline-range petroleum hydrocarbons and BTEX), only gasoline-range petroleum hydrocarbons and benzene were detected at concentrations above the preliminary groundwater screening levels. Samples SB-9 upper and SB-10 upper contained concentrations of gasoline-range petroleum hydrocarbons above the preliminary groundwater screening level. Sample SB-9 upper also contained benzene at a concentration above the preliminary groundwater screening level.

Three monitoring wells were installed in June 2001. One well was upgradient of SB-9 and SB-10 (BDC-103) and two wells were downgradient (BDC-101 and BDC-102). The wells were sampled and

analyzed for gasoline-range petroleum hydrocarbons and BTEX in June 2001. BTEX results for BDC-102 and BDC-103 are presented in Table 21. Benzene was detected at a concentration above the preliminary groundwater screening level in well BDC-103. Gasoline-range petroleum hydrocarbon was detected above the preliminary groundwater screening level in BDC-101 and BDC-103.

4.10.3 CURRENT STATUS

The groundwater at AOC-05 will be injected with oxygen releasing compound (ORC®) to promote aerobic biodegradation or the residual petroleum hydrocarbon constituents in the groundwater. Up to 10 borings will be installed to a total depth of approximately 20 ft BGS for injection of ORC® into the groundwater in the vicinity of the former UST. ORC® will be injected in a slurry form into the portion of the boring intersecting the groundwater table.

Following the injection event, the effect of the ORC® in the groundwater will be monitored on a monthly basis for the following 3 months. Groundwater samples will be collected from BDC-102 and BDC-103 for analysis of dissolved oxygen (DO), oxidation-reduction potential (ORP), conductivity, and pH in the field. The groundwater samples will also be submitted to a laboratory for analysis of BTEX and gasoline-range petroleum hydrocarbons.

Following the ORC® evaluation, the three wells will be monitored quarterly for BTEX and gasoline-range petroleum hydrocarbons for one year. Then the wells will be monitored semi-annually for BTEX and gasoline-range petroleum hydrocarbons.

5.0 SUMMARY OF CORRECTIVE ACTIONS

The RFA of the BDC identified 157 SWMUs and 5 AOCs. The majority of the SWMUs were excluded from further investigation based on a determination that they do not pose a threat to human health or the environment (Table 1). The remaining eight SWMUs and five AOCs through Ecology's voluntary cleanup program under MTCA. The status of these SWMUs/AOCs is summarized below:

SWMU/AOC	Status	Rationale
SWMU-15, paper shredder, Building 9-67	No Further Action Recommended	The release of paper slurry waste noted was a one-time release of a non-hazardous material. Modifications to the BMPs have been implemented to prevent future releases.
SWMU-16, former regulated materials storage area, Buildings 9-69/70	No Further Actions Recommended	Ecology approved the RCRA closure of the former Building 9-69/70 Container Storage Area. Boeing performed a supplemental investigation to verify that residual PCB concentrations in soil in the area beyond the boundaries for the former storage area are protective of groundwater. PCBs were not detected in groundwater samples collected during this investigation.
SWMU-17, former sump and USTs, Building 9-75	Groundwater Monitoring	No current observed constituent concentrations in soil or groundwater exceed preliminary screening levels (VOCs) or apparent background levels (metals). Monitoring wells (BDC-05-2A, BDC-05-3, BDC-05-4, BDC-05-5, and BDC-05-7) are currently sampled semi-annually for VOCs, diesel-range petroleum hydrocarbons, and metals as specified in the Developmental Center Groundwater Monitoring Plan (Boeing 2001).
SWMU-20, former degreaser pit, Building 9-101	Evaluating pump and treat system shutdown with ongoing monitoring	The remediation system has been temporarily shut down for a period of six months. Following shutdown of the remediation system, sampling will be conducted, and the results will be evaluated to determine if natural attenuation appears to be a viable remedial alternative to reach site screening levels. The groundwater monitoring wells associated with SWMU-20 will be sampled for VOCs biannually, typically during summer and winter (Boeing 2001).
SWMUs-23 through 25, former waste water ASTs, Building 9-101	No Further Actions Recommended	Ecology has accepted the final facility closure certification for these former dangerous waste ASTs (Ecology 1997).

SWMU/AOC	Status	Rationale
SWMU-43, storm water sewer system	No Further Actions Recommended	BMPs have been implemented to prevent future spills.
AOC-01/02, former unleaded gasoline USTs, Building 9-52	Groundwater Monitoring	Three monitoring wells will be sampled biannually (during wet and dry seasons) until two consecutive monitoring events are obtained without detections of gasoline-range petroleum hydrocarbons, diesel-range petroleum hydrocarbons, and BTEX (Boeing 2001).
AOC-03/04, former No. 5 fuel oil USTs, Buildings 9-50 and 9-72	Groundwater Monitoring	Two monitoring wells will be sampled semi-annually until four consecutive groundwater samples are obtained that are non-detect for diesel-range petroleum hydrocarbons (Boeing 2001).
AOC-05, former unleaded gasoline UST, Buildings 9-60 and 9-61	Groundwater Monitoring	ORC® will be injected into groundwater to promote aerobic biodegradation of residual petroleum hydrocarbon constituents in groundwater. Groundwater samples will be collected monthly for three months following ORC® injection for BTEX and gas-range petroleum hydrocarbons.

6.0 USE OF THIS REPORT

This investigation summary report has been prepared for the exclusive use of The Boeing Company for specific application to the Boeing Developmental Center. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level and care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

LANDAU ASSOCIATES, INC.

By:

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Principal

and

Shannon M. Dunn
Senior Staff Environmental Scientist

JPB/ SMD/jzs

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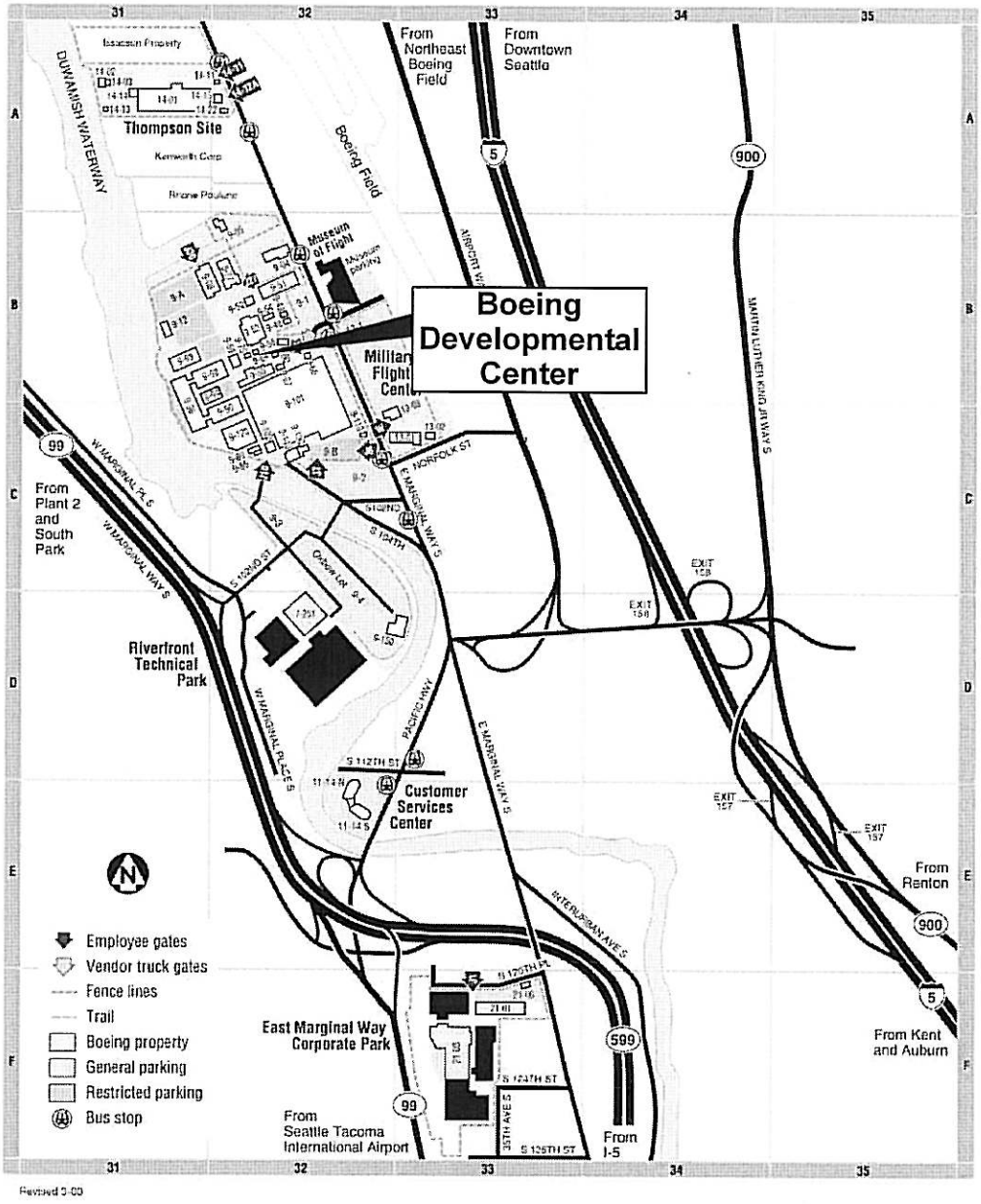


Revised 5-00

Map provided by Boeing, March 2000

Not To Scale

Boeing Developmental Center/GW Report | T:\025\093041/GW Report\Fig1.cdr (C) 8/24/2001

Landau Associates	Boeing Developmental Center Seattle, Washington	**Location Map**

Figure
1

N

SLIP NO. 6

EAST MARGINAL WAY SOUTH

DUWAMISH WATERWAY

DUWAMISH RIVER

Facility Boundary

Military Flight Center

9-04
9-08
9-12
9-51
9-52
9-53
9-55
9-77
9-90
9-91
9-93
9-94
9-96
9-98
9-99
9-101
9-110
9-120
9-140
7-444
13-01
13-02
13-03
13-07

Legend

- Monitoring Well Location
- Facility Boundary

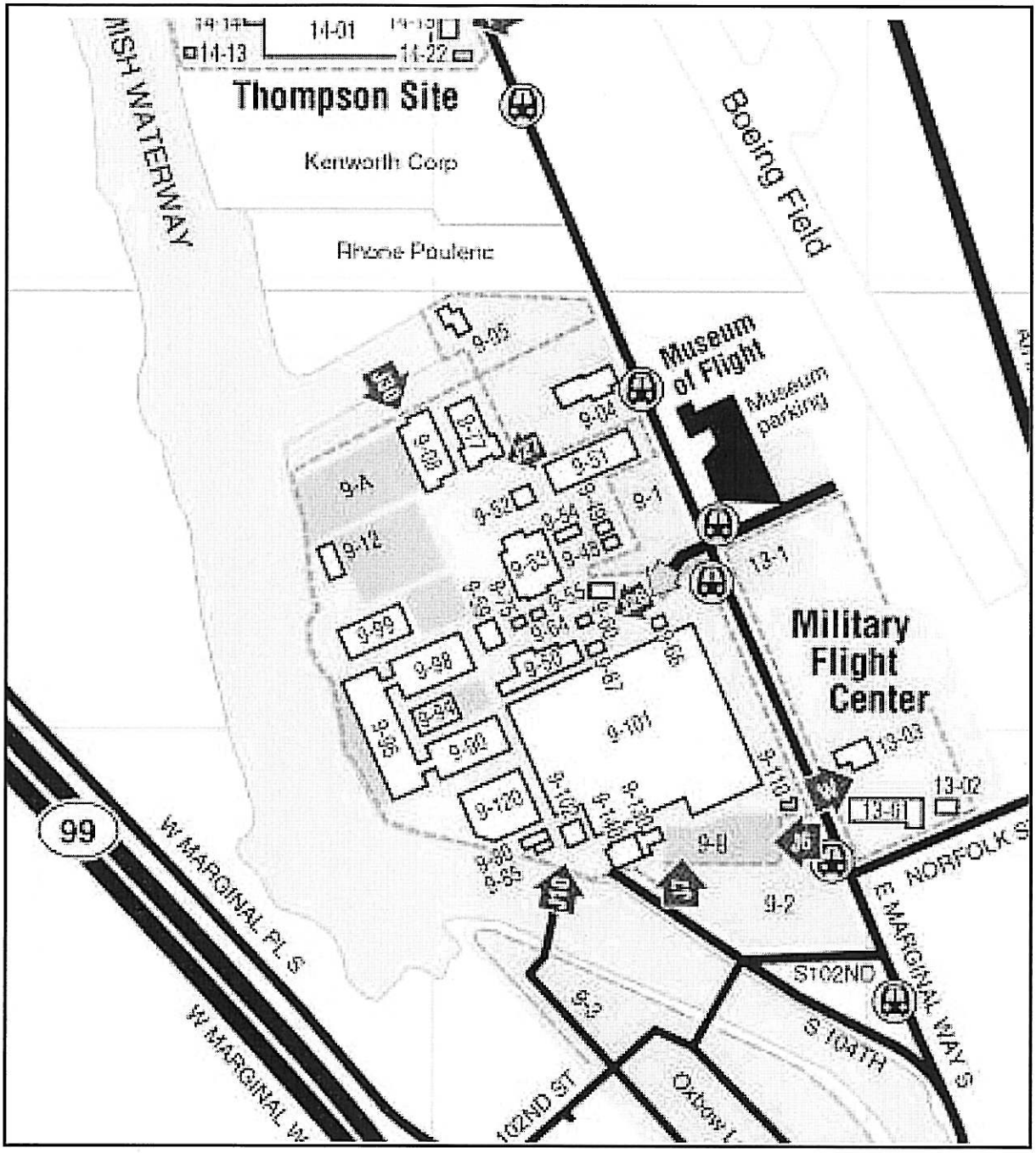
0 400 800

Approximate Scale in Feet

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Facility Boundary**	Figure 2

Boeing\Developmental Center\GW Report | T:\025\093\0411\GW Report\Fig2_8_9.dwg (A) "Figure 2" 8/24/2001



Map provided by Boeing, March 2000

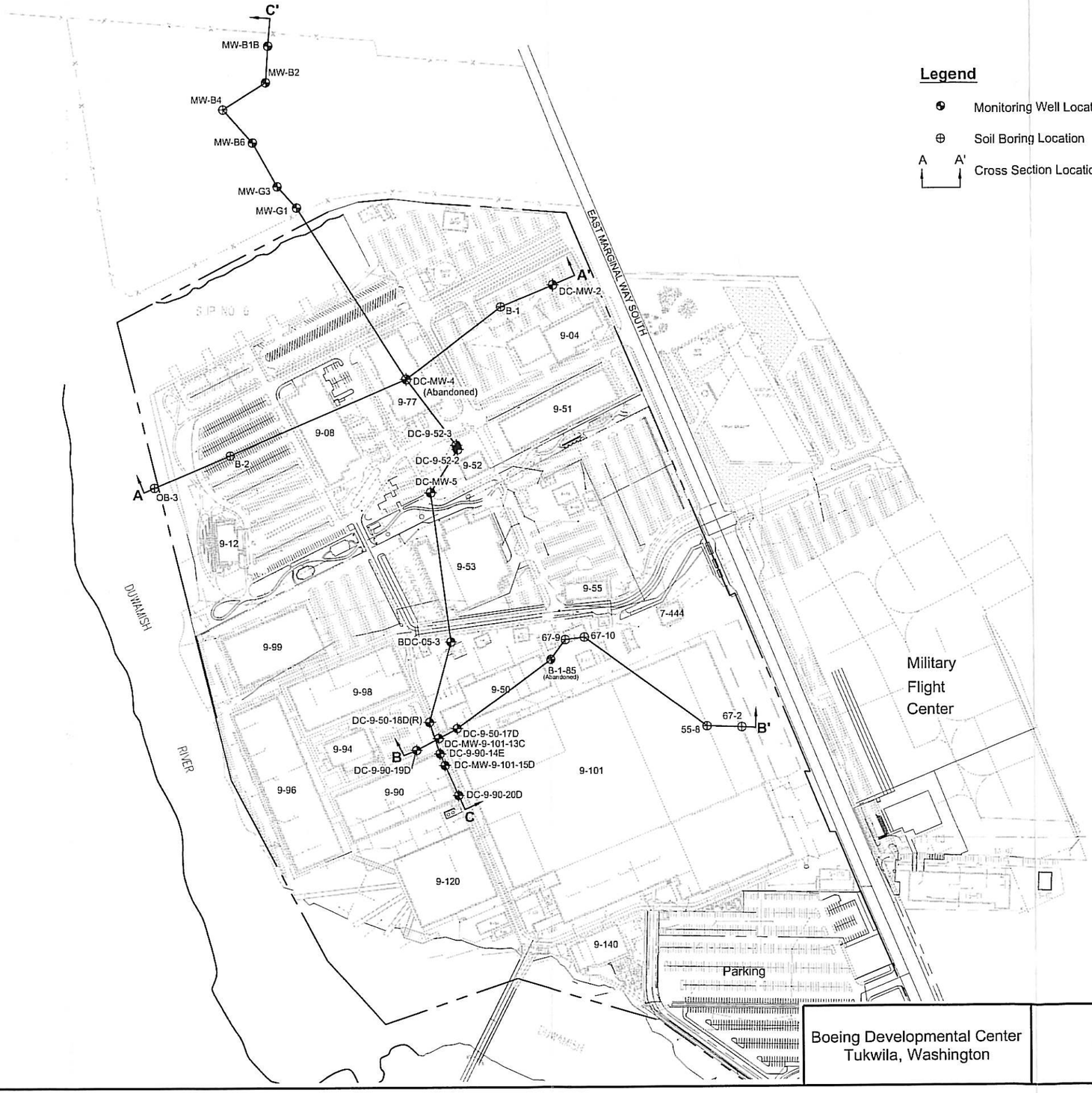
Not To Scale

Boeing Developmental Center/GW Report | T:\025/093/041/GW Report/Fig3.cdr (C) 8/24/2001

Landau Associates	Boeing Developmental Center Seattle, Washington	**Adjacent Land Use**

Figure
3

N



Legend

- Monitoring Well Location
- Soil Boring Location
- A A' Cross Section Location

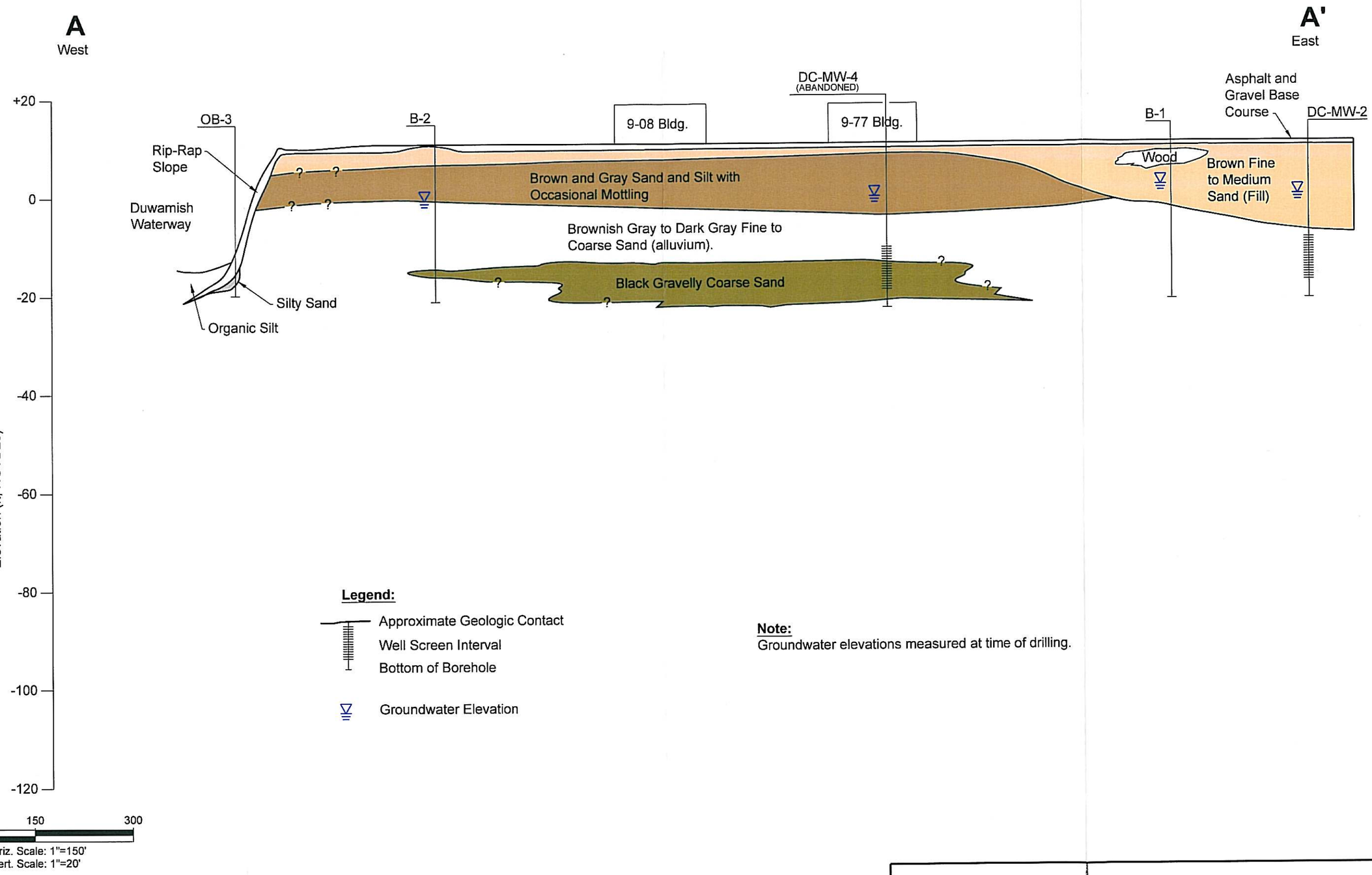
0 400 800

Approximate Scale in Feet

Boeing/Developmental Center/GW Report | T:\025\09310411\GW Report\Fig4.dwg (A) "Figure 4" 8/24/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Cross Section Locations**	Figure 4



Legend:

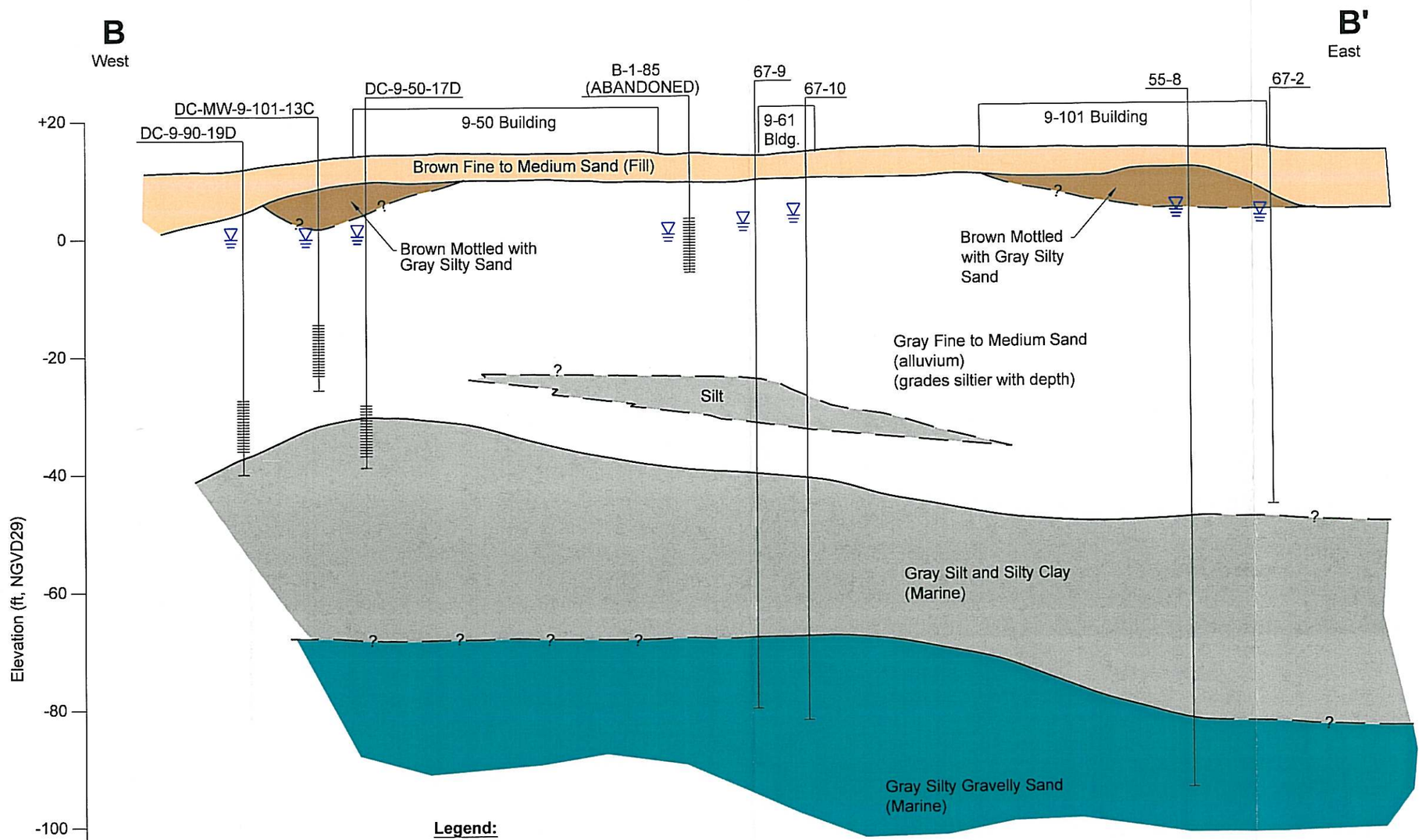
- Approximate Geologic Contact
- Well Screen Interval
- Bottom of Borehole
- Groundwater Elevation

Note:
Groundwater elevations measured at time of drilling.

Boeing/Developmental Center/GW Report | T:\025\093\041\GW Report\Fig5_6_7.DWG (A) "Figure 5" 8/24/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Cross Section A-A'**	Figure 5



Legend:

- Approximate Geologic Contact
- Well Screen Interval
- Bottom of Borehole
- Approximate Groundwater Elevation

Note:
Groundwater elevations at wells MW-13C, MW-17D, and MW-19D measured in December 2000. Groundwater elevations at all other locations measured at time of drilling.

0 150 300

Horiz. Scale: 1"=150'
Vert. Scale: 1"=20'

Boeing/Developmental Center/GW Report | T:\025\093\041\GW Report\Fig5_6_7.DWG (A) "Figure 6" 8/24/2001

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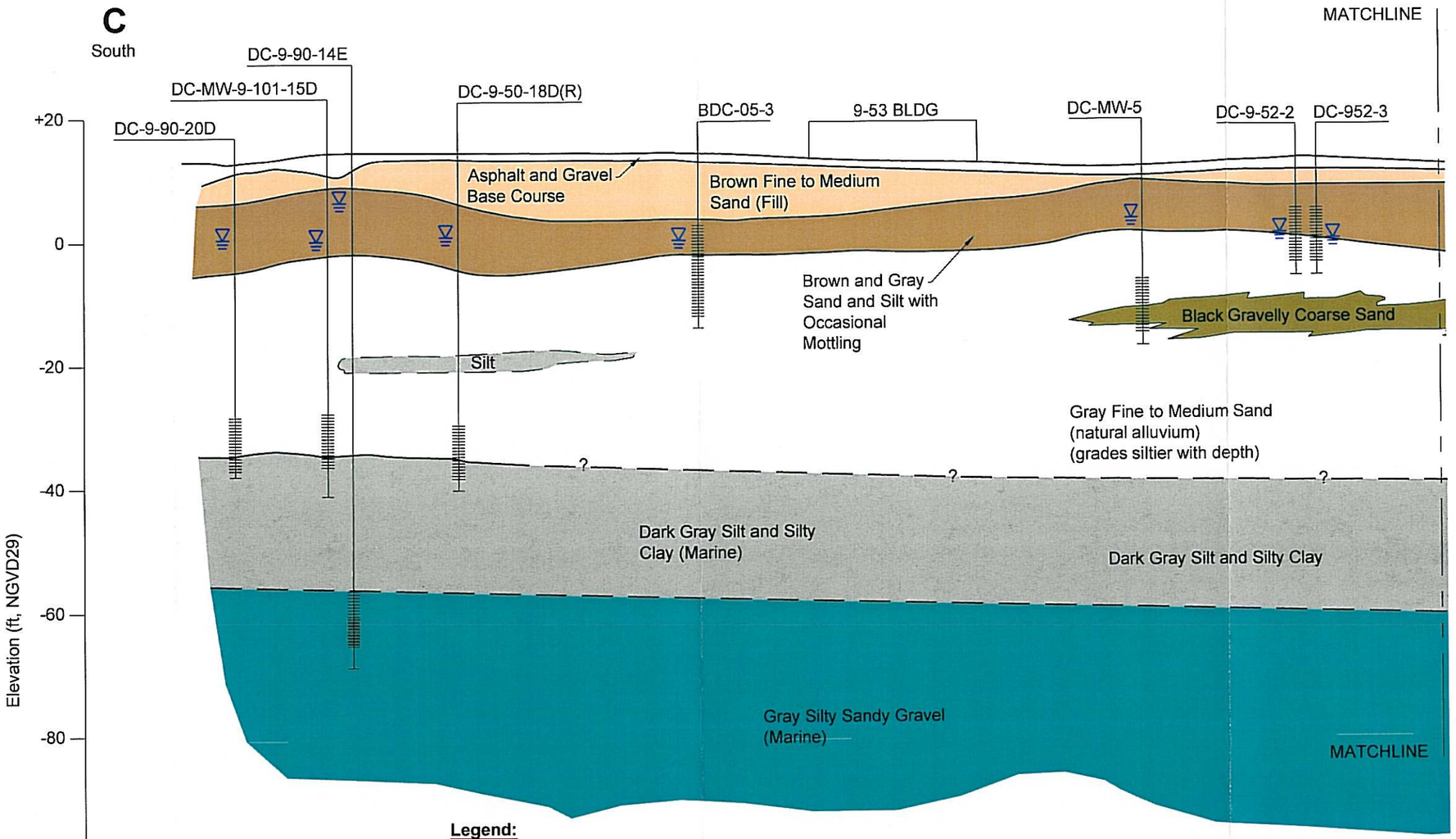
Boeing Developmental Center Tukwila, Washington	**Cross Section B-B'**	Figure 6



Legend:

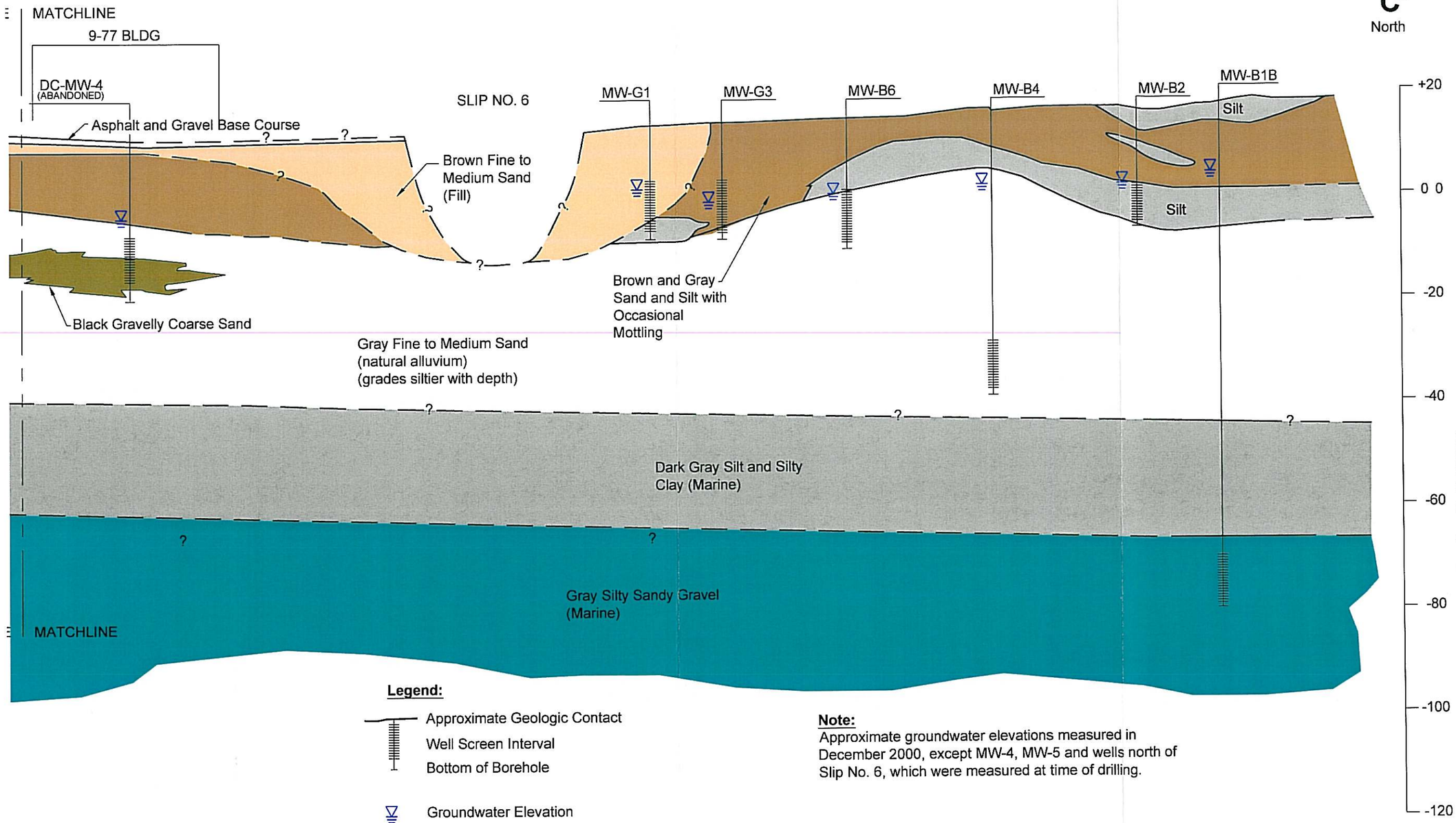
- Approximate Geologic Contact
- Well Screen Interval
- Bottom of Borehole
- Groundwater Elevation

Note:
Groundwater elevations measured in December 2000, except at wells MW-4, MW-5 and wells north of Slip No. 6, which were measured at time of drilling.

Boeing/Developmental Center/GW Report | T:\025\093\041\GW Report\Fig5_6_7.DWG (A) "Figure 7a" 8/24/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Cross Section C-C' (South End)**	Figure 7a



Legend:

- Approximate Geologic Contact
- Well Screen Interval
- Bottom of Borehole
- Groundwater Elevation

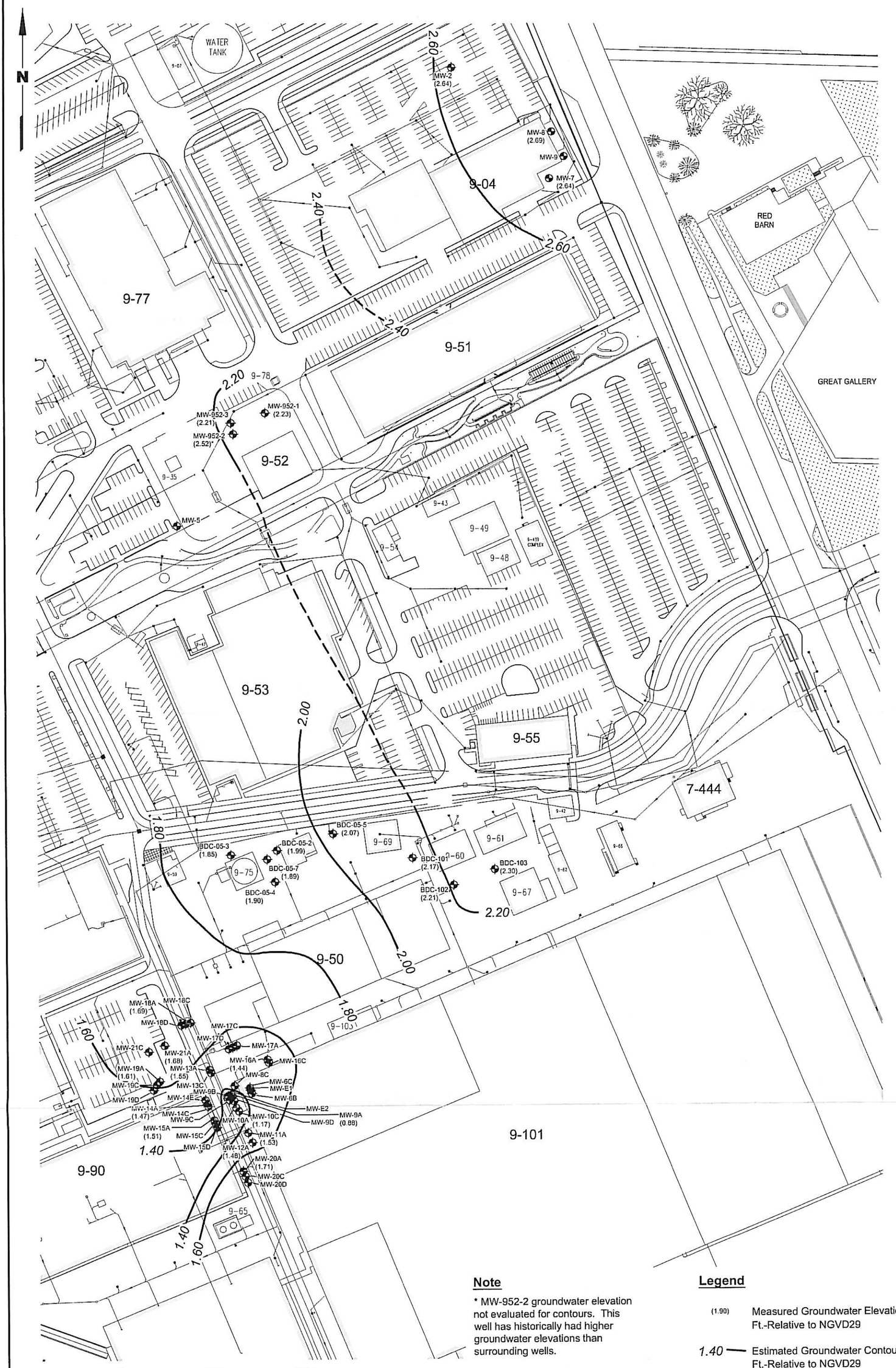
Note:
Approximate groundwater elevations measured in December 2000, except MW-4, MW-5 and wells north of Slip No. 6, which were measured at time of drilling.

0 150 300
Horiz. Scale: 1"=150'
Vert. Scale: 1"=20'

Boeing/Developmental Center/GW Report | T:\025\093\041\GW Report\Figs_6_7.DWG (A) "Figure 7b" 8/24/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Cross Section C-C' (North End)**	Figure 7b



Note

* MW-952-2 groundwater elevation not evaluated for contours. This well has historically had higher groundwater elevations than surrounding wells.

Legend

(1.90) Measured Groundwater Elevation, Ft.-Relative to NGVD29

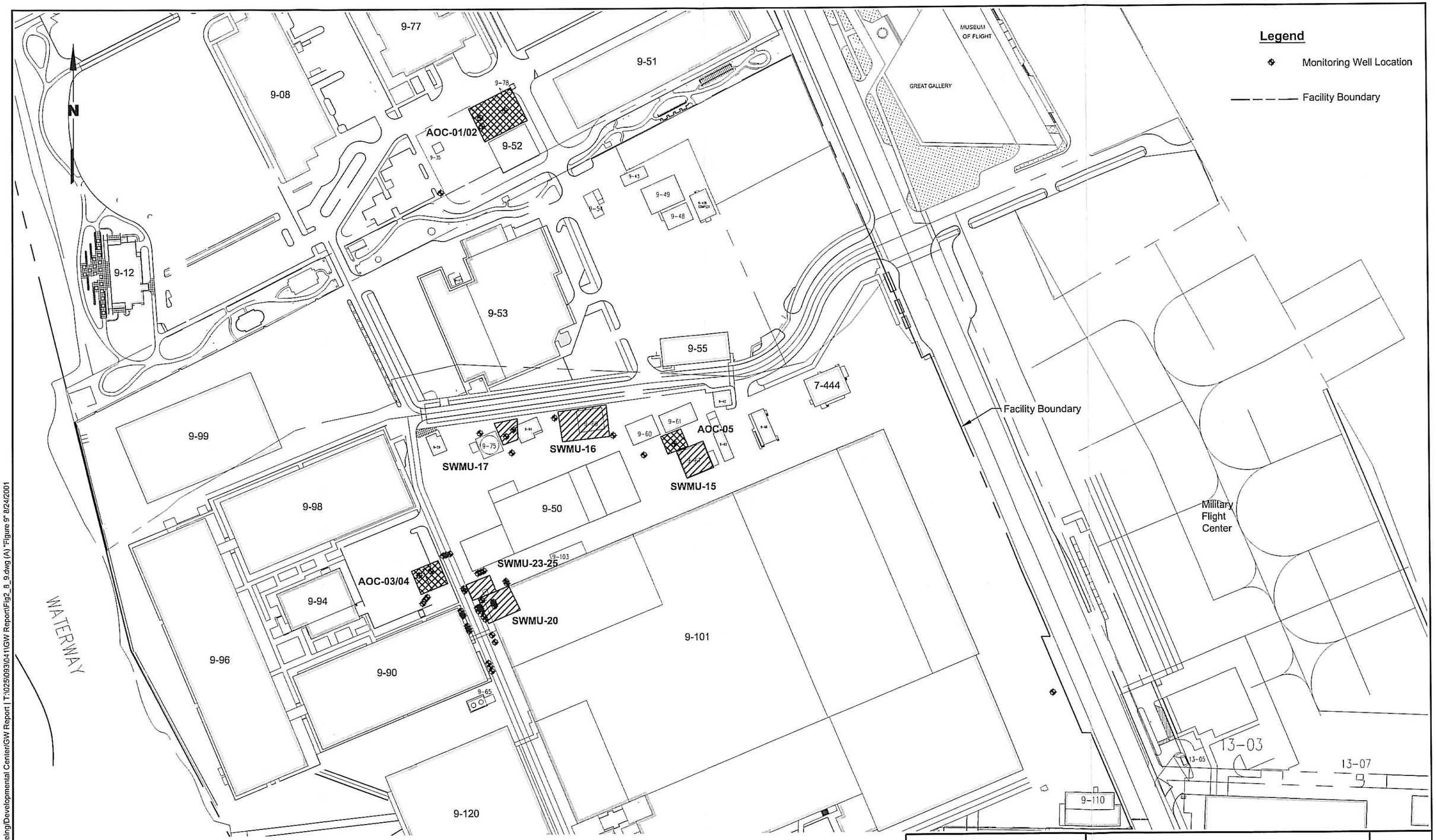
1.40 — Estimated Groundwater Contour, Ft.-Relative to NGVD29

Landau Associates

Boeing Developmental Center
Tukwila, Washington

Facility-Wide Groundwater Elevation Contours-June 2001

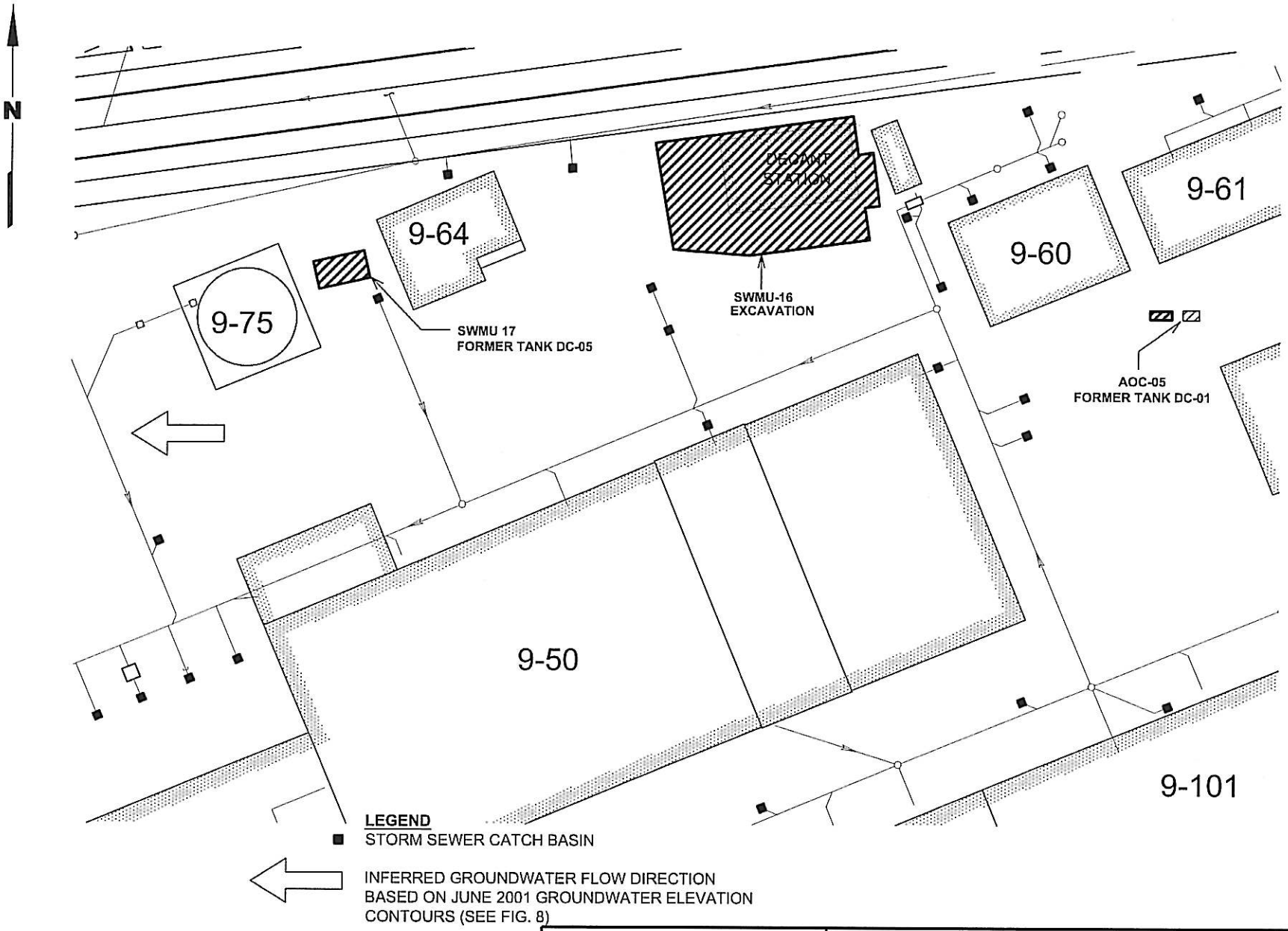
Figure 8



Boeing/Developmental Center/GW Report | T:\025\093\041\GW Report\Fig2_8_9.dwg (A) "Figure 9" 8/24/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**SWMU & AOC Locations**	Figure 9

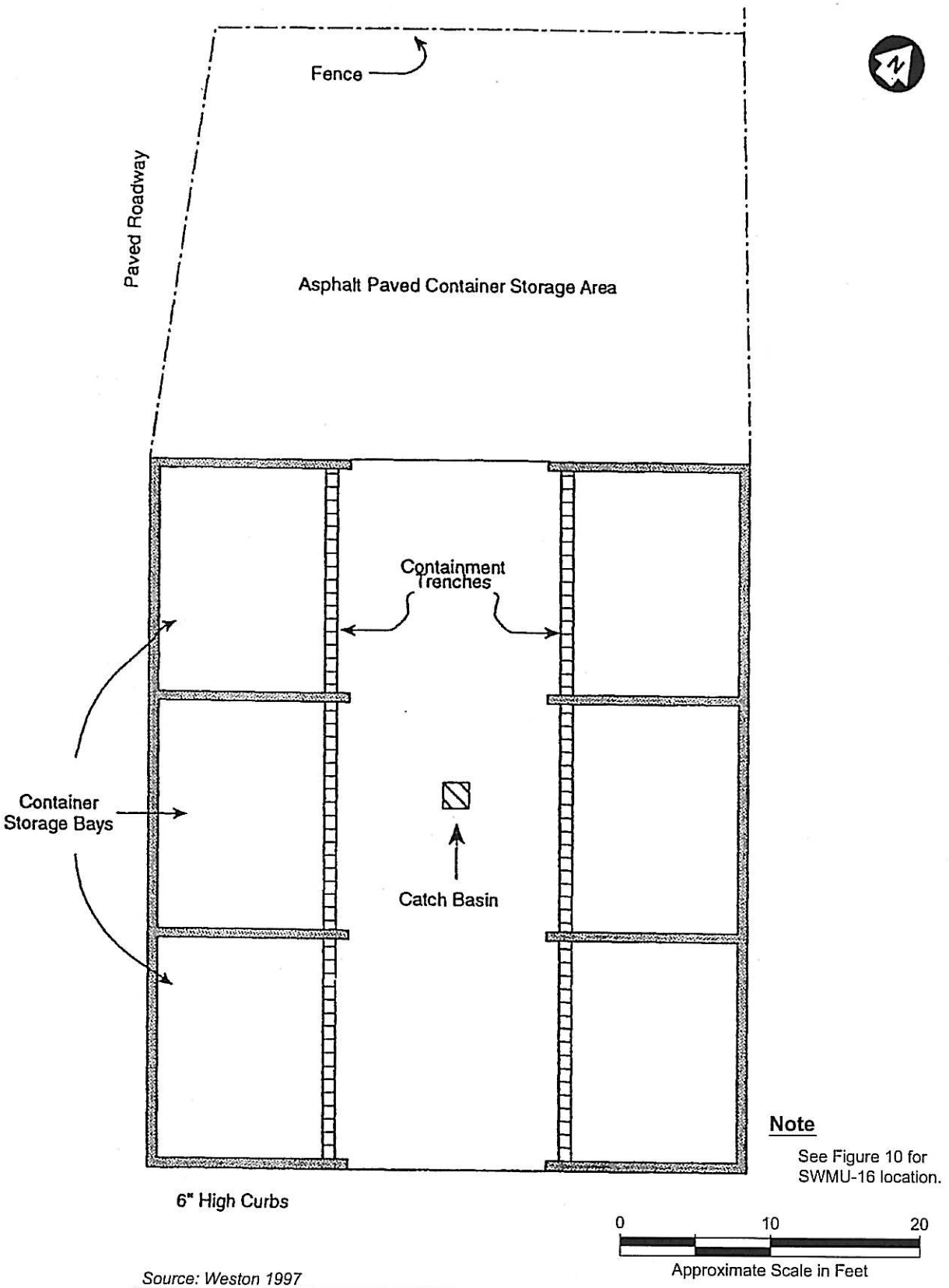


Landau Associates

Boeing Developmental Center
Tukwila, Washington

SWMU-16, SWMU-17, and AOC-05 Location Map

Figure 10



Source: Weston 1997

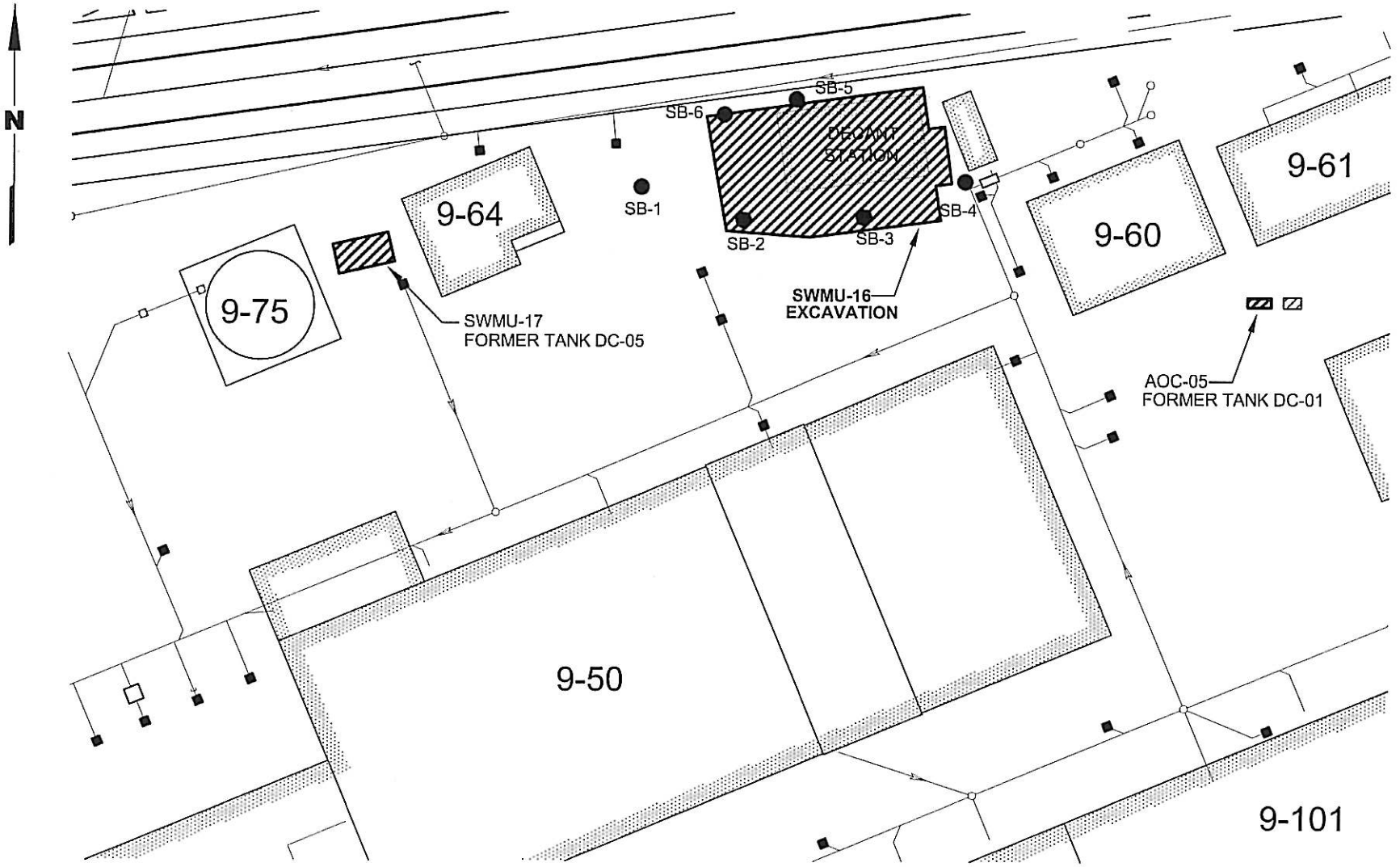
Boeing/Developmental Center/GW Report | T:\025\093\0411\GW Report\Fig11.dwg (A) "Figure 11" 8/30/2001

Landau Associates

Boeing Developmental Center
Tukwila, Washington

SWMU-16 Former Container Storage Area Layout

Figure 11

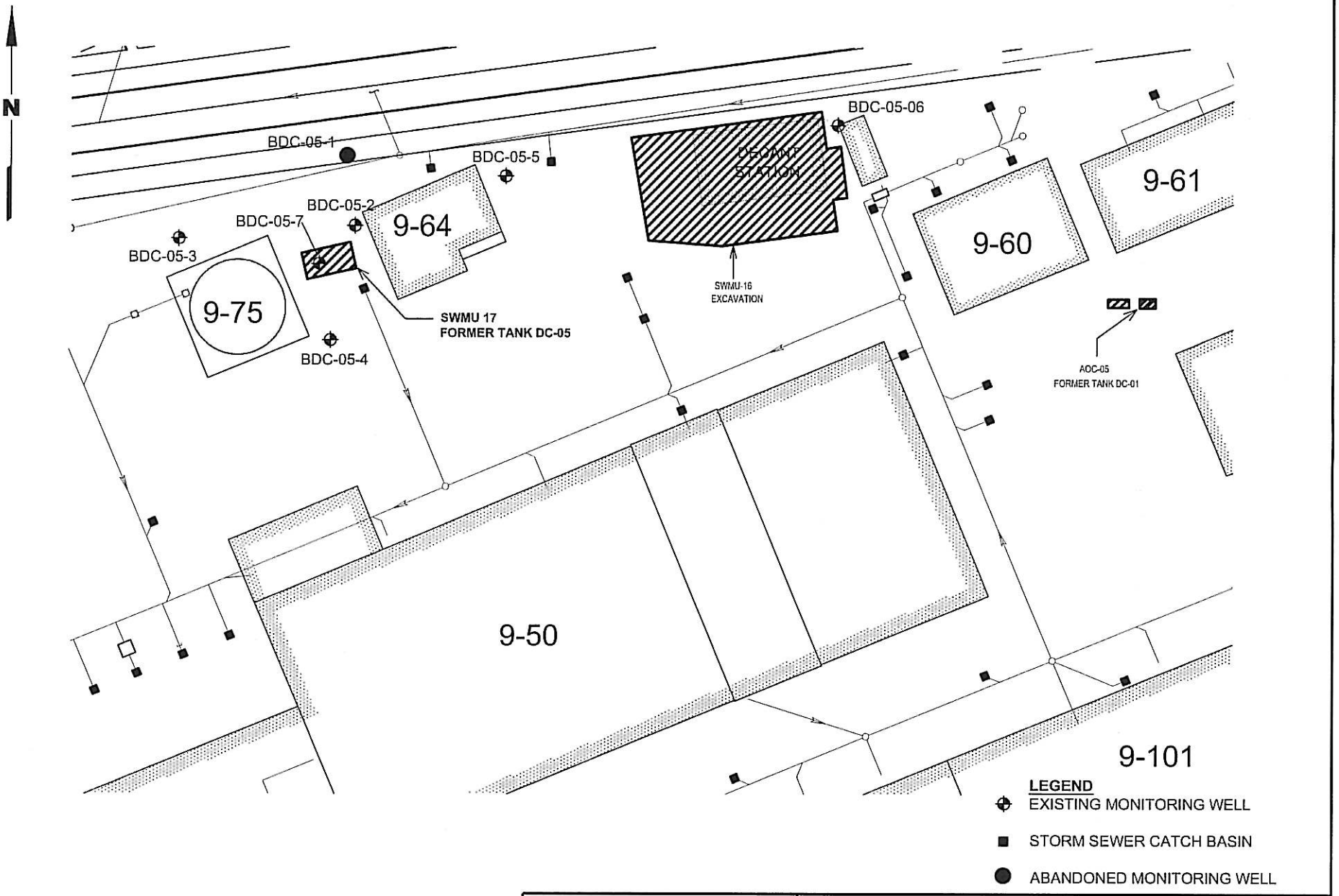


Landau Associates

Boeing Developmental Center
Tukwila, Washington

SWMU-16 Details

Figure
12

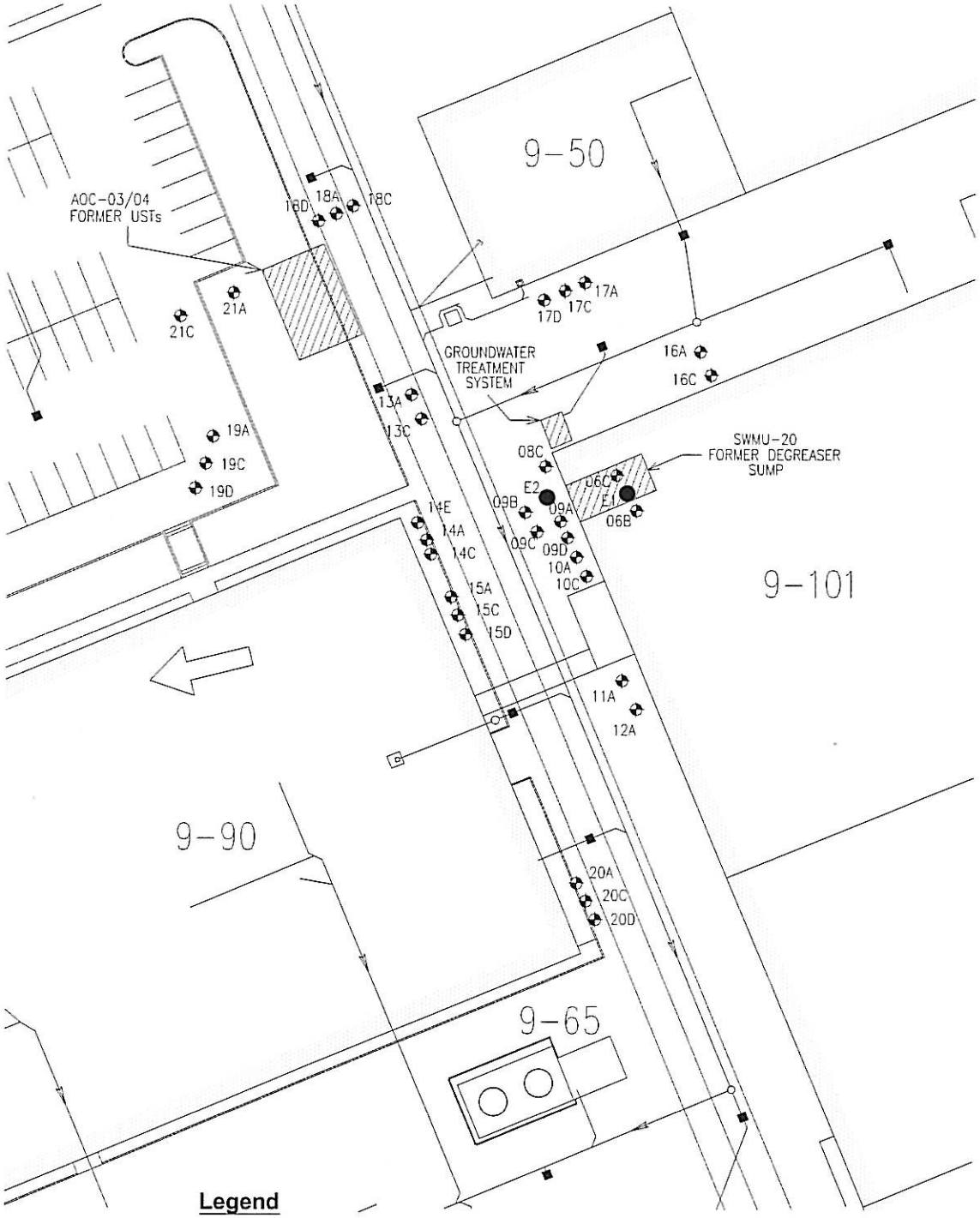


Landau Associates

Boeing Developmental Center
Tukwila, Washington

SWMU-17 DETAILS

Figure
13



Legend

- Monitoring Well
- Extraction Well
- Inferred Groundwater Flow Direction Based on June 2001 Groundwater Elevation Contours (See Figure 8)

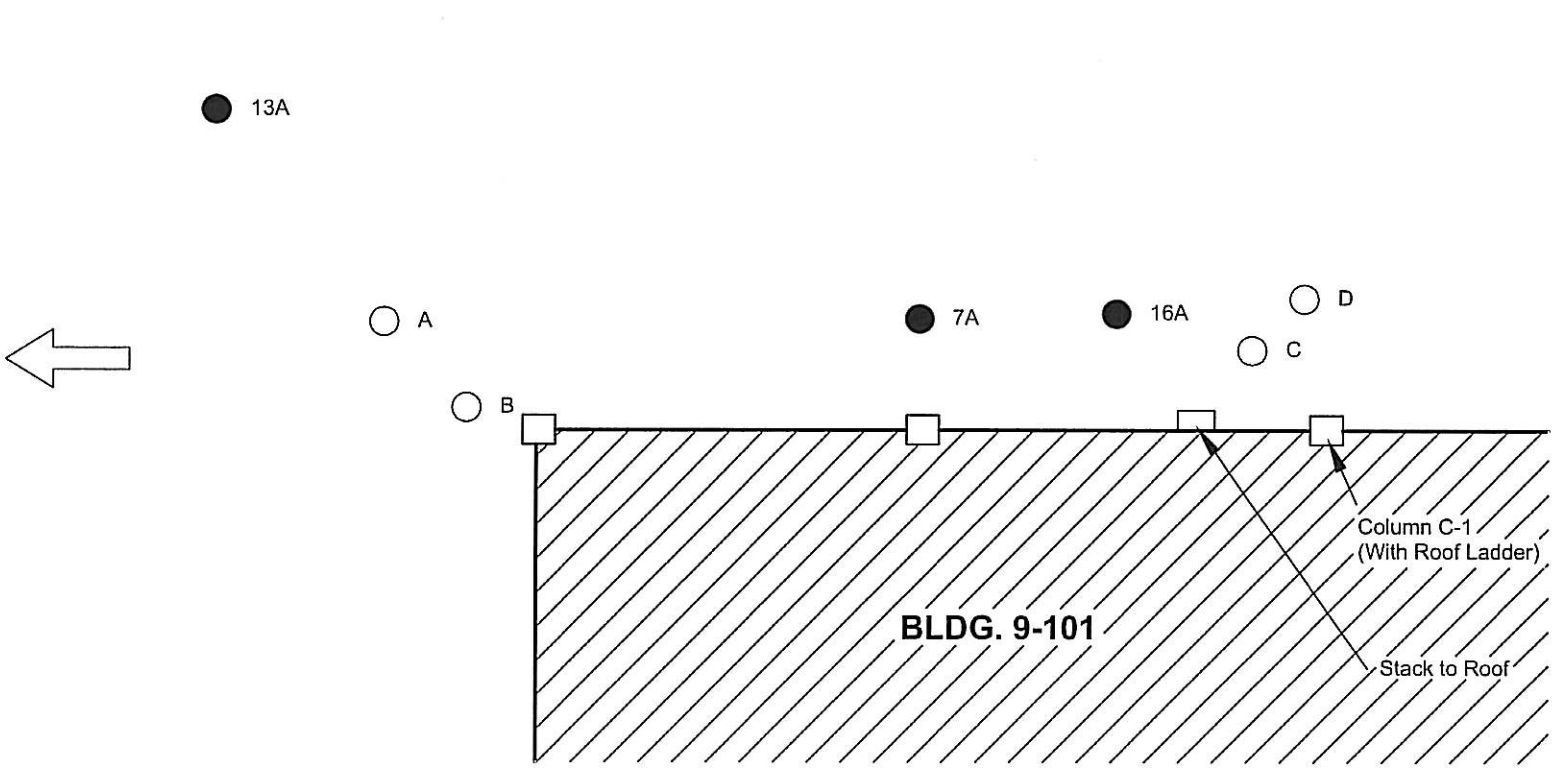
0 60 120

Scale in Feet

Boeing/Developmental Center/GW Report | T:\025\093\0411\GW Report\Fig14.dwg (A) "Figure 14" 8/24/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**SWMU-20 and AOC-03/04 Location & Details Map**	Figure 14



Legend

- Abandoned Monitoring Well
- Hand Auger Boring
- Building Column
- Inferred Groundwater Flow Direction Based on June 2001 Groundwater Elevation Contours (See Figure 8)

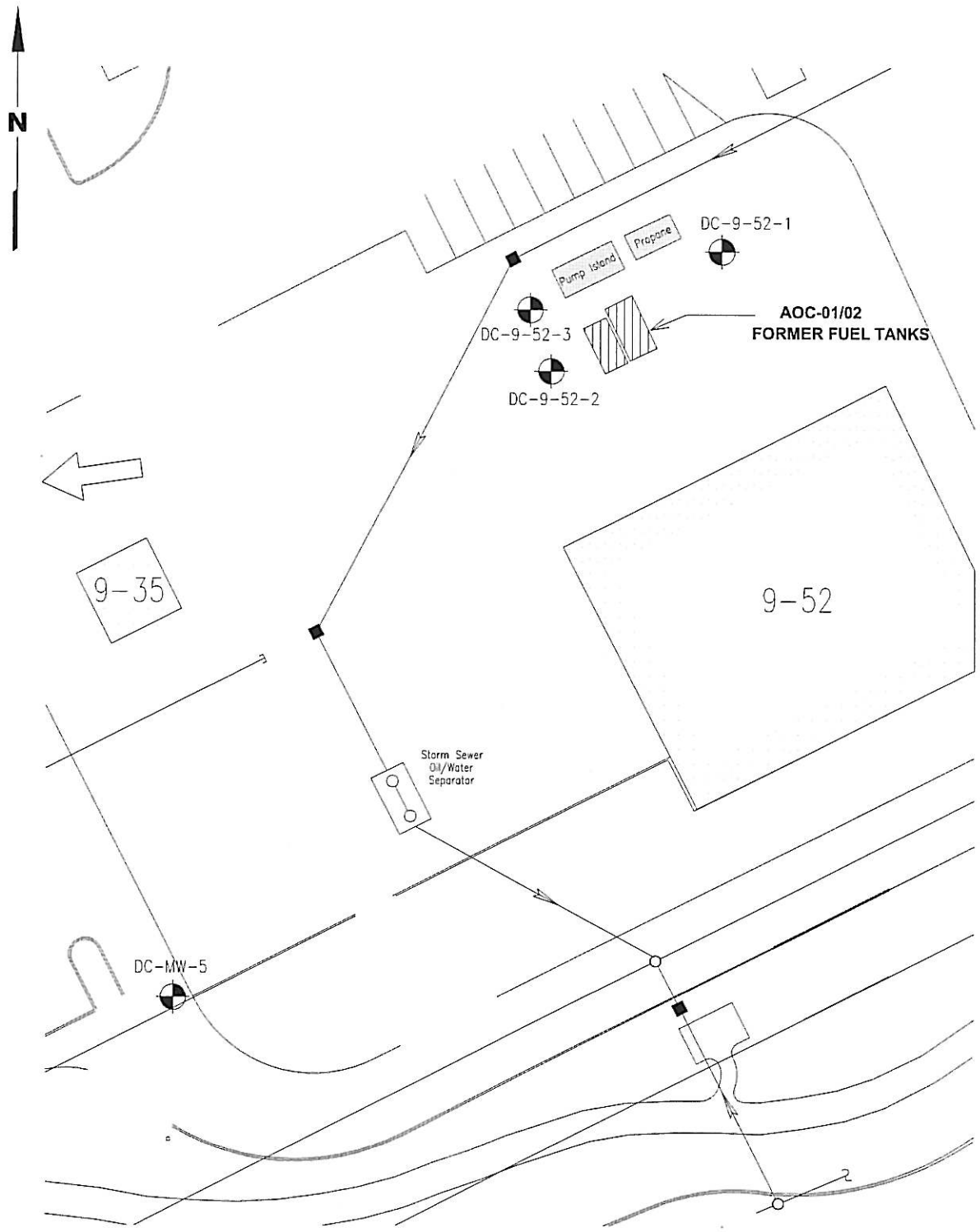
0 20 40
Scale in Feet

Landau Associates

Boeing Developmental Center
Tukwila, Washington

SWMU-23 & 25 Details

Figure
15



Legend

Groundwater Monitoring Well

Inferred Groundwater Flow Direction
Based on June 2001 Ground Water Elevation
Contours (See Figure 8)

Boeing/Developmental Center/GW Report | T:\025\093\0411\GW Report\Fig16.dwg (A) "Figure 16" 8/24/2001

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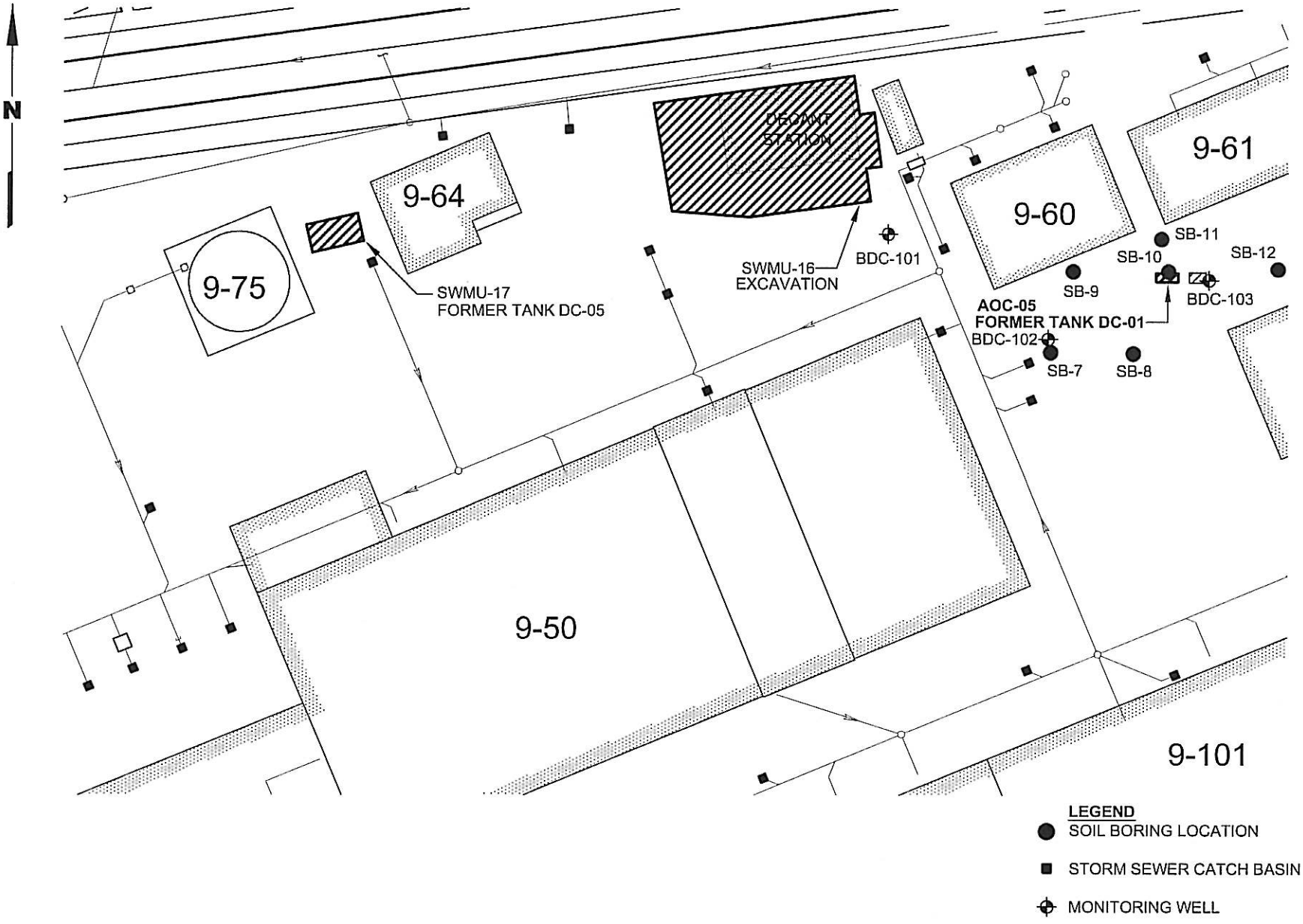
Boeing Developmental Center
Tukwila, Washington

AOC-01/02 Location & Details Map

Figure
16



0 60 120
Scale in Feet

Landau Associates

Boeing Developmental Center Tukwila, Washington	**AOC-05 Details**	Figure 17

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-1	Bldg 9-04, Final Accumulation Area	SWMU-1 was the final accumulation point for drums of hazardous waste from BDC prior to being shipped offsite for disposal. Wastes were removed every other week for offsite disposal. SWMU-1 had secondary containment with a sealed concrete floor that drained to blind trenches or containment vaults. SWMU-1 operated from March 1992 to July 2001. The final accumulation point was moved to Building 9-60 in July 2001.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-2	Bldg 9-04, Consolidation Room	SWMU-2 was the accumulation and consolidation area for solid wastes, including rags, spent aerosol cans, and used batteries. Wastes were placed in plastic bag lined-drums. Once filled, drums were transported to SWMU-1 for offsite disposal. SWMU-2 had secondary containment with a floor that drains to a containment vault. SWMU-2 operated from March 1992 to July 2001. The consolidation area was moved to Building 9-60 in July 2001.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-3	Bldg 9-04, Loading Dock	SWMU-3 is a loading dock that was used to ship off containerized waste from SWMU-1. SWMU-3 operated from March 1992 to July 2001.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-4	Bldg 9-04, Bulk Waste Oil Recycling Tank	SWMU-4 is a 500 gal AST for storing waste oil prior to removal offsite for recycling. The AST has secondary containment with blind trenches with closed sumps located beneath it. SWMU-4 has been in operation from February 1994 to July 2001 at this location. The tank was moved to Building 9-60 in July 2001.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-5	Bldg 9-08, Former Temporary Incinerator	SWMU-5 was an incinerator used to destroy classified microfilm and mylar prints. The non-hazardous ash was disposed of at an off site landfill. SWMU-5 operated from 1986 to 1988.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-6	Bldg 9-50, Former Container Storage Area	SWMU-6 was the final accumulation point for hazardous wastes from BDC prior to being shipped offsite for disposal. SWMU-6 operated from 1988 to 1992 and has been closed.	No further action required based closure in accordance with RCRA closure requirements and Ecology's approval of closure in a 1997 letter from Ecology (Appendix C).
SWMU-7	Bldg 9-50, Former Steam Cleaning Area	SWMU-7 was a 5 to 7 gal sludge trap. The sludge trap removed grease from the steam cleaning waste water. SWMU-7 operated prior to 1985.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-8	Bldg 9-50, Solid Waste Collection Area	SWMU-8 is the accumulation and consolidation area for non-hazardous solid wastes prior to being shipped offsite for recyling or disposal. SWMU-8 had been in operation from 1957 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-9	Bldg 9-51, Steam Cleaning Tank	SWMU-9 is a 3000 gal AST for steam cleaning waste water. Steam cleaning waste water is pumped from SWMU-10 to SWMU-9, where it is stored prior to disposal. The AST has diked steel secondary containment. SWMU-9 has been in operation from 1987 to present.	No further action recommended based on low potential for future releases (SAIC 1994 and EPA 1994).
SWMU-10	Bldg 9-51, Steam Cleaning Sump	SWMU-10 is a sump used to collect steam cleaning waste water prior to pumping it to SWMU-9. The sump has secondary containment with a leak detection system. SWMU-10 has been in operation from 1985 to present.	No further action recommended based on low potential for future releases (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-11	Bldg 9-51, Former Steam Cleaning Tank	SWMU-11 was a 300 gal UST used for storing steam cleaning waste water prior to offsite disposal. SWMU-11 operated from 1985 to 1987.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-12	Bldg 9-52, Former Wash Water Paint Booth	SWMU-12 was a water wash paint booth used to remove paint overspray from the air. SWMU-12 operated from 1985 to 1990 or 1991.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-13	Bldg 9-60, Former Container Storage Area	SWMU-13 was an accumulation area for hazardous waste prior to being shipped offsite for disposal. SWMU-13 operated from 1961 to 1992 and has been closed.	No further action required based closure in accordance with RCRA closure requirements and Ecology's approval of closure in a 1997 letter from Ecology (Appendix D).
SWMU-14	Bldg 9-67, Incinerator	SWMU-14 is an incinerator used to destroy classified microfilm, mylar, and computer disks. Non-hazardous ash is disposed of offsite. SWMU-14 has been in operation from 1988 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-15	Bldg 9-67, Paper Shredder	SWMU-15 is two adjacent paper shredders used to destroy classified documents. The shredded paper is slurried with water to facilitate the management and consolidation of the shredded paper. SWMU-15 has been in operation from 1984 to present. A release of paper slurry waste water (a non-hazardous solid waste) occurred on June 30, 1994. More information on SWMU-15 is presented in Section 4.2.	Best management practices (BMPs) have been implemented at SWMU-15 to prevent future releases. No additional actions are planned. No further action is recommended.
SWMU-16	Bldg 9-69/9-70, Former Regulated Materials Storage Area	SWMU-16 was an accumulation point for hazardous waste. SWMU-16 operated from 1979 to 1992 and has been closed. More information on SWMU-16 is presented in Section 4.3.	No further action required based closure in accordance with RCRA closure requirements and Ecology's approval of closure in a 1997 letter from Ecology (Appendix D).
SWMU-17	Bldg 9-75, Former UST Waste Storage Tank	SWMU-17 was a 65 gal sump and associated 4000 gal UST used to store waste oil. SWMU-17 operated from 1958 to 1986 and has been closed. The UST was closed and removed in 1986. During closure it was observed that the UST had leaked. More information on SWMU-17 is presented in Section 4.4.	The 5 monitoring wells around SWMU-17 will be sampled biannually for VOCs, metals, and TPH biannually (Boeing 2001).
SWMU-18	Bldg 9-101, Former Wash Water Paint Booth	SWMU-18 was a water wash paint booth used to remove paint overspray from the air. SWMU-18 operated from 1984 to 1990 or 1991.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-19	Bldg 9-101, Waste Hydraulic Oil Tank	SWMU-19 is a 250 gal AST used to store waste hydraulic oil prior to being transported to SWMU-4. SWMU-19 has been in operation from 1980 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-20	Bldg 9-101, Former Degreaser Pit	SWMU-20 was a degreaser pit used to accumulate solvents from the vapor degreaser. SWMU-20 operated from 1958 to 1984 and is currently undergoing closure. The degreaser pit apparently leaked. During closure 1400 tons of soil was excavated and disposed of from SWMU-20. A pump and treat system was installed to remove chlorinated VOCs from the groundwater. More information on SWMU-20 is presented in Section 4.5.	The remediation system has been temporarily shut down for six months (Ecology 2001b). Following shutdown of the remediation system, sampling will be conducted, and the results will be evaluated to determine if natural attenuation appears to be a viable remedial alternative to reach site screening levels. The groundwater monitoring wells associated with SWMU-20 will be sampled for VOCs biannually, typically during summer and winter (Boeing 2001).
SWMU-21	Bldg 9-101, Former First Sump	SWMU-21 was a sump used to accumulate waste water from the anodizing tank line prior to discharge to the sanitary sewer or SWMUs-23 through 25. SWMU-21 operated from 1958 to 1984.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-22	Bldg 9-101, Former Second Sump	SWMU-22 was a sump used to accumulate waste water from the anodizing tank line prior to discharge to the sanitary sewer or SWMUs-23 through 25. SWMU-22 operated from 1967 to 1984.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-23	Bldg 9-101, Former Tank A Waste Alkaline	SWMU-23 was a 3000 gal AST used to store waste alkaline water prior to disposal. SWMU-23 operated from 1957 to 1984. The AST was closed and removed from the site in 1985. Chemical concentrations in soil and groundwater samples collected in 1993 were below the MTCA Method A and C cleanup criteria. More information on SWMU-23 is presented in Section 4.6.	No further action required based closure in accordance with RCRA closure requirements and Ecology's approval of closure in a 1997 letter from Ecology (Appendix C).
SWMU-24	Bldg 9-101, Former Tank B Waste Acid	SWMU-24 was a 2000 gal AST used to store waste acid water prior to disposal. SWMU-24 operated from 1957 to 1984. The AST was closed and removed from the site in 1985. Chemical concentrations in soil and groundwater samples collected in 1993 were below the MTCA Method A and C cleanup criteria. More information on SWMU-24 is presented in Section 4.6.	No further action required based closure in accordance with RCRA closure requirements and Ecology's approval of closure in a 1997 letter from Ecology (Appendix C).
SWMU-25	Bldg 9-101, Former Tank C Waste Water	SWMU-25 was a 10,000 gal AST used to store water water prior to disposal. SWMU-25 operated from 1957 to 1984. The AST was closed and removed from the site in 1985. Chemical concentrations in soil and groundwater samples collected in 1993 were below the MTCA Method A and C cleanup criteria. More information on SWMU-25 is presented in Section 4.6.	No further action required based closure in accordance with RCRA closure requirements and Ecology's approval of closure in a 1997 letter from Ecology (Appendix C).
SWMU-26	Bldg 9-101, Former Pilot Plating Sump	SWMU-26 was a 3000 gal UST used for storage of waste water from the titanium chem mill and metal plating line prior to pumping to SWMU-28. SWMU-26 operated from 1966 to the early 1970s.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-27	Bldg 9-101, Former Maskant Dump Tank and Control Pit	SWMU-27 was the sumps associated with SWMU-26 and the chem mill and metal plating line. SWMU-27 operated from 1966 to the early 1970s.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-28	Bldg 9-101, Former Waste Water Treatment Plant	SWMU-28 was the waste water treatment plant for the chem mill and plating lines. SWMU-28 operated from 1966 to the early 1970s.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-29	Bldg 9-99, Oil/ Water Separator	SWMU-29 is the oil/water separator for potential spills from Building 9-99. Once a year, the oil/water separator is cleaned out and the wastes are disposed of off site. SWMU-29 has been in operation from 1968 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-30	Bldg 9-007, Oil/ Water Separator 3	SWMU-30 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-30 has been in operation from 1987 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-31	Bldg 9-08, Oil/ Water Separator 2	SWMU-31 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-31 has been in operation from 1987 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-32	Bldg 9-12, Oil/ Water Separator 1	SWMU-32 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-32 has been in operation from 1987 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-33	Bldg 9-51, Oil/ Water Separator 951	SWMU-33 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-33 has been in operation from 1985 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-34	Bldg 9-52, Oil/ Water Separator DM	SWMU-34 is an oil/water separator used to collect fuel station spills and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-34 has been in operation from 1985 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-35	Bldg 9-60, Oil/ Water Separator BMA003	SWMU-35 is an oil/water separator used to collect storm water from the storage yard at the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-35 has been in operation from 1961 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-36	Bldg 9-96, Oil/ Water Separator C	SWMU-36 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-36 has been in operation from 1987 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-37	Bldg 9-99, Oil/ Water Separator A	SWMU-37 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-37 has been in operation from 1987 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-38	Bldg 9-99, Oil/ Water Separator B	SWMU-38 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-38 has been in operation from 1987 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-39	Bldg 9-101, Oil/ Water Separator SDC	SWMU-39 is an oil/water separator used to collect storm water from a parking lot in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-39 has been in operation from 1987 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-40	Bldg 9-120, Oil/ Water Separator G	SWMU-40 is an oil/water separator used to collect storm water from a parking lot and an autoclave in the BDC and remove oil from the water prior to discharge to the Duwamish Waterway. SWMU-40 has been in operation from 1990 to present.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-41	Bldg 9-64, Former Oil/ Water Separator	SWMU-41 was a 500 gal oil/water separator used to collect steam cleaning waste water and remove oil prior to discharge to the sanitary sewer. The oil/water separator was periodically cleaned and the waste was disposed of off site. SWMU-41 operated from 1979 to 1987.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-42	Bldg 9-101, Former Oil/ Water Separator	SWMU-42 was a 500 gal oil/water separator used to collect process water from Building 9-101 and remove oil from the water prior to discharge. The oil/water separator was periodically cleaned and the waste was disposed of offsite. SWMU-42 operated from an unknown time to 1987.	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-43	Storm Water Sewer System	SWMU-43 is the storm water sewer system. It is used to control surface water runoff and some building drains throughout the BDC. SWMUs 30 through 40 discharge into SWMU-43. Sixteen lines in the storm water sewer system discharge into the Duwamish Waterway. SWMU-43 has been in operation from 1956 to present. More information on SWMU-43 is presented in Section 4.7.	BMPs have been implemented to reduce the potential for future release. No further action recommended based on low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-44	Bldg 9-49, Accumulation Area D003	SWMU-44 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and batteries. The waste is sent to SWMU-2 for consolidation. SWMU-44 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-45	Bldg 9-51, Accumulation Area D004	SWMU-45 is an accumulation station for hazardous or dangerous waste including oily rags, aerosol cans, and oil for recycling. The waste is sent to SWMU-2 or SWMU-4 for consolidation. SWMU-45 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-46	Bldg 9-52, Accumulation Area D005	SWMU-46 is an accumulation station for hazardous or dangerous waste including solvent rags, aerosol cans, paints, and inks. The waste is sent to SWMU-2 for consolidation. SWMU-46 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-47	Bldg 9-99, Accumulation Area D007	SWMU-47 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, paints, inks, and oil for recycling. The waste is sent to SWMU-2 or SWMU-4 for consolidation. SWMU-47 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-48	Bldg 9-99, Accumulation Area D008	SWMU-48 is an accumulation station for hazardous or dangerous waste including oily rags. The waste is sent to SWMU-2 for consolidation. SWMU-48 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-49	Bldg 9-101, Accumulation Area D009	SWMU-49 is an accumulation station for hazardous or dangerous waste including solvent rags, aerosol cans, paints, and inks. The waste is sent to SWMU-2 for consolidation. SWMU-49 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-50	Bldg 9-101, Accumulation Area D010	SWMU-50 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and oil for recycling. The waste is sent to SWMU-2 or SWMU-4 for consolidation. SWMU-50 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-51	Bldg 9-101, Accumulation Area D011	SWMU-51 is an accumulation station for hazardous or dangerous waste including oil for recycling. The waste is sent to SWMU-4 for consolidation. SWMU-51 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-52	Bldg 9-101, Accumulation Area D012	SWMU-52 is an accumulation station for hazardous or dangerous waste including oily rags and solvent rags. The waste is sent to SWMU-2 for consolidation. SWMU-52 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-53	Bldg 9-101, Accumulation Area D013	SWMU-53 is an accumulation station for hazardous or dangerous waste including oily rags. The waste is sent to SWMU-2 for consolidation. SWMU-53 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-54	Bldg 9-101, Accumulation Area D014	SWMU-54 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and alodine rags. The waste is sent to SWMU-2 for consolidation. SWMU-54 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-55	Bldg 9-101, Accumulation Area D016	SWMU-55 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, and aerosol cans. The waste is sent to SWMU-2 for consolidation. SWMU-55 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-56	Bldg 9-101, Accumulation Area D017	SWMU-56 is an accumulation station for hazardous or dangerous waste including solvent rags. The waste is sent to SWMU-2 for consolidation. SWMU-56 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-57	Bldg 9-101, Accumulation Area D019	SWMU-57 is an accumulation station for hazardous or dangerous waste including solvent rags. The waste is sent to SWMU-2 for consolidation. SWMU-57 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-58	Bldg 9-101, Accumulation Area D020	SWMU-58 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, and aerosol cans. The waste is sent to SWMU-2 for consolidation. SWMU-58 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-59	Bldg 9-101, Accumulation Area D021	SWMU-59 is an accumulation station for hazardous or dangerous waste including solvent rags, aerosol cans, paints, and inks. The waste is sent to SWMU-2 for consolidation. SWMU-59 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-60	Bldg 9-101.2, Accumulation Area D024	SWMU-60 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, batteries, paints, inks, and alodine rags. The waste is sent to SWMU-2 for consolidation. SWMU-60 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-61	Bldg 9-101.2, Accumulation Area D025	SWMU-61 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and oil for recycling. The waste is sent to SWMU-2 or SWMU-4 for consolidation. SWMU-61 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-62	Bldg 9-102, Accumulation Area D027	SWMU-62 is an accumulation station for hazardous or dangerous waste including oil for recycling. The waste is sent to SWMU-4 for consolidation. SWMU-62 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-63	Bldg 9-120, Accumulation Area D028	SWMU-63 is an accumulation station for hazardous or dangerous waste including oily rags. The waste is sent to SWMU-2 for consolidation. SWMU-63 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-64	Bldg 9-120.1, Accumulation Area D029	SWMU-64 is an accumulation station for hazardous or dangerous waste including oil for recycling. The waste is sent to SWMU-4 for consolidation. SWMU-64 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-65	Bldg 9-120, Accumulation Area D031	SWMU-65 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and batteries. The waste is sent to SWMU-1 for consolidation. SWMU-65 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-66	Bldg 9-120, Accumulation Area D032	SWMU-66 is an accumulation station for hazardous or dangerous waste including solvent rags, paints, and inks. The waste is sent to SWMU-2 for consolidation. SWMU-66 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-67	Bldg 9-51, Accumulation Area D033	SWMU-67 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and batteries. The waste is sent to SWMU-2 for consolidation. SWMU-67 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-68	Bldg 9-120, Accumulation Area D034	SWMU-68 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, paints, inks, and containers with paints and inks. The waste is sent to SWMU-2 for consolidation. SWMU-68 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-69	Bldg 9-120.3, Accumulation Area D036	SWMU-69 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and batteries. The waste is sent to SWMU-2 for consolidation. SWMU-69 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-70	Bldg 9-140, Accumulation Area D037	SWMU-70 is an accumulation station for hazardous or dangerous waste including photographic developer and photographic fluids. The waste is sent to SWMU-2 for consolidation. SWMU-70 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-71	Bldg 9-102, Accumulation Area D039	SWMU-71 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and oil for recycling. The waste is sent to SWMU-2 or SWMU-4 for consolidation. SWMU-71 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-72	Bldg 9-08.4, Accumulation Area D042	SWMU-72 is an accumulation station for hazardous or dangerous waste including aerosol cans and toner. The waste is sent to SWMU-2 for consolidation. SWMU-72 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-73	Bldg 9-101, Accumulation Area D043	SWMU-73 is an accumulation station for hazardous or dangerous waste including oily rags and solvent rags. The waste is sent to SWMU-2 for consolidation. SWMU-73 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-74	Bldg 9-51, Accumulation Area D047	SWMU-74 is an accumulation station for hazardous or dangerous waste. The waste is sent to SWMU-2 for consolidation. SWMU-74 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-75	Bldg 9-51, Accumulation Area D048	SWMU-75 is an accumulation station for hazardous or dangerous waste. The waste is sent to SWMU-2 for consolidation. SWMU-75 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-76	Bldg 9-101, Accumulation Area D051	SWMU-76 is an accumulation station for hazardous or dangerous waste including batteries. The waste is sent to SWMU-2 for consolidation. SWMU-76 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-77	Bldg 9-101.1, Accumulation Area D053	SWMU-77 is an accumulation station for hazardous or dangerous waste including oily rags and solvent rags. The waste is sent to SWMU-2 for consolidation. SWMU-77 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-78	Bldg 9-101, Accumulation Area D054	SWMU-78 is an accumulation station for hazardous or dangerous waste including solvent rags. The waste is sent to SWMU-2 for consolidation. SWMU-78 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-79	Bldg 9-53, Accumulation Area D058	SWMU-79 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, and batteries. The waste is sent to SWMU-2 for consolidation. SWMU-79 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-80	Bldg 9-101.1, Accumulation Area D061	SWMU-80 is an accumulation station for hazardous or dangerous waste including oily rags, solvent rags, aerosol cans, and oil for recycling. The waste is sent to SWMU-2 or SWMU-4 for consolidation. SWMU-80 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-81	Bldg 9-96.2, Accumulation Area, D062	SWMU-81 is an accumulation station for hazardous or dangerous waste including oil for recycling. The waste is sent to SWMU-4 for consolidation. SWMU-81 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-82	Bldg 9-101.1, Accumulation Area D063	SWMU-82 is an accumulation station for hazardous or dangerous waste including oily rags. The waste is sent to SWMU-2 for consolidation. SWMU-82 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-83	Bldg 9-101.2, Accumulation Area D064	SWMU-83 is an accumulation station for hazardous or dangerous waste including waste hydrofluoric acid. The waste is sent to SWMU-2 for consolidation. SWMU-83 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-84	Bldg 9-98.2, Accumulation Area D065	SWMU-84 is an accumulation station for hazardous or dangerous waste including aerosol cans and batteries. The waste is sent to SWMU-2 for consolidation. SWMU-84 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-85	Bldg 9-101.1, Accumulation Area D066	SWMU-85 is an accumulation station for hazardous or dangerous waste including paints, inks, and solvents. The waste is sent to SWMU-2 for consolidation. SWMU-85 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-86	Bldg 9-101, Accumulation Area D071	SWMU-86 is an accumulation station for hazardous or dangerous waste including paper filters with composite sludge/coolant. The waste is sent to SWMU-2 for consolidation. SWMU-86 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-87	Bldg 9-61, Accumulation Area D072	SWMU-87 is an accumulation station for hazardous or dangerous waste including oily rags. The waste is sent to SWMU-2 for consolidation. SWMU-87 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-88	Bldg 9-101, Accumulation Area D074	SWMU-88 is an accumulation station for hazardous or dangerous waste including mixed acid plating solutinos and sodium hydroxide/chromium wastes. The waste is sent to SWMU-2 for consolidation. SWMU-88 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-89	Bldg 9-08, Accumulation Area D075	SWMU-89 is an accumulation station for hazardous or dangerous waste including oily rags, aerosol cans, batteries, and spent toner cartridges. The waste is sent to SWMU-2 for consolidation. SWMU 89 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-90	Bldg 9-60, Accumulation Area D076	SWMU-90 is an accumulation station for hazardous or dangerous waste including oily rags, paint and ink contaminated debris, and alodine contaminated rags. The waste is sent to SWMU-2 for consolidation. SWMU-90 operated from unknown date to at least 1994 (a).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-91	Bldg 9-08.3, Former Accumulation Area D001	SWMU-91 was an accumulation station for hazardous or dangerous waste. SWMU-91 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-92	Bldg 9-48, Former Accumulation Area D002	SWMU-92 was an accumulation station for hazardous or dangerous waste. SWMU-92 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-93	Bldg 9-99, Former Accumulation Area D006	SWMU-93 was an accumulation station for hazardous or dangerous waste. SWMU-93 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-94	Bldg 9-101, Former Accumulation Area D015	SWMU-94 was an accumulation station for hazardous or dangerous waste. SWMU-94 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-95	Bldg 9-101, Former Accumulation Area D018	SWMU-95 was an accumulation station for hazardous or dangerous waste. SWMU-95 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-96	Bldg 9-101.1, Former Accumulaiton Area D022	SWMU-96 was an accumulation station for hazardous or dangerous waste. SWMU-96 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-97	Bldg 9-101, Former Accumulation Area D023	SWMU-97 was an accumulation station for hazardous or dangerous waste. SWMU-97 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-98	Bldg 9-101.2, Former Accumulation Area D026	SWMU-98 was an accumulation station for hazardous or dangerous waste. SWMU-98 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-99	Bldg 9-101.1, Former Accumulation Area D030	SWMU-99 was an accumulation station for hazardous or dangerous waste. SWMU-99 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-100	Bldg 9-120, Former Accumulation Area D035	SWMU-100 was an accumulation station for hazardous or dangerous waste. SWMU-100 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-101	Bldg 9-101, Former Accumulation Area D038	SWMU-101 was an accumulation station for hazardous or dangerous waste. SWMU-101 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-102	Bldg 9-70, Former Accumulation Area D040	SWMU-102 was an accumulation station for hazardous or dangerous waste. SWMU-102 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-103	Bldg 9-50, Former Accumulation Area D041	SWMU-103 was an accumulation station for hazardous or dangerous waste. SWMU-103 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-104	Bldg 9-101, Former Accumulation Area D044	SWMU-104 was an accumulation station for hazardous or dangerous waste. SWMU-104 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-105	Bldg 9-90.2, Former Accumulation Area D045	SWMU-105 was an accumulation station for hazardous or dangerous waste. SWMU-105 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-106	Bldg 9-101, Former Accumulation Area D046	SWMU-106 was an accumulation station for hazardous or dangerous waste. SWMU-106 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-107	Bldg 9-101.1, Former Accumulation Area D049	SWMU-107 was an accumulation station for hazardous or dangerous waste. SWMU-107 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-108	Bldg 9-101, Former Accumulation Area D050	SWMU-108 was an accumulation station for hazardous or dangerous waste. SWMU-108 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-109	Bldg 9-52, Former Accumulation Area D052	SWMU-109 was an accumulation station for hazardous or dangerous waste. SWMU-109 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-110	Bldg 9-101, Former Accumulation Area D055	SWMU-110 was an accumulation station for hazardous or dangerous waste. SWMU-110 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-111	Bldg 9-101.2, Former Accumulation Area D056	SWMU-111 was an accumulation station for hazardous or dangerous waste. SWMU-111 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-112	Bldg 9-101.2, Former Accumulation Area D057	SWMU-112 was an accumulation station for hazardous or dangerous waste. SWMU-112 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-113	Bldg 9-77.3, Former Accumulation Area D059	SWMU-113 was an accumulation station for hazardous or dangerous waste. SWMU-113 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-114	Bldg 9-101.1, Former Accumulation Area D060	SWMU-114 was an accumulation station for hazardous or dangerous waste. SWMU-114 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-115	Bldg 9-101.1, Former Accumulation Area D067	SWMU-115 was an accumulation station for hazardous or dangerous waste. SWMU-115 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-116	Bldg 9-140, Former Accumulation Area D068	SWMU-116 was an accumulation station for hazardous or dangerous waste. SWMU-116 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-117	Bldg 9-140, Former Accumulation Area D069	SWMU-117 was an accumulation station for hazardous or dangerous waste. SWMU-117 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-118	Bldg 9-120, Former Accumulation Area D070	SWMU-118 was an accumulation station for hazardous or dangerous waste. SWMU-118 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-119	Bldg 9-101.2, Former Accumulation Area D073	SWMU-119 was an accumulation station for hazardous or dangerous waste. SWMU-119 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-120	Bldg 9-102, Former Accumulation Area D077	SWMU-120 was an accumulation station for hazardous or dangerous waste. SWMU-120 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-121	Bldg 9-43, Former Accumulation Area D078	SWMU-121 was an accumulation station for hazardous or dangerous waste. SWMU-121 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-122	Former Accumulation Area DT01	SWMU-122 was an accumulation station for hazardous or dangerous waste. SWMU-122 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-123	Bldg 9-90, Former Accumulation Area Photographic Waste	SWMU-123 was an accumulation station for hazardous or dangerous waste. SWMU-123 operated from an unknown time and ceased operation prior to 1991 (b).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-124	Bldg 9-51, Newyork Blower Baghouse	SWMU-124 is a wood dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-125	Bldg 9-51, Spencer Baghouse	SWMU-125 is a wood dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-126	Bldg 9-53, Delta Filter/ Pack Box	SWMU-126 is a metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-127	Bldg 9-53, Kei Filter Bag	SWMU-127 is a metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-128	Bldg 9-77, Sternvent Filter/ Pack Box	SWMU-128 is a wood and metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-129	Bldg 9-77, Sternvent Filter/ Pack Box	SWMU-129 is a wood and metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-130	Bldg 9-77, Sternvent Filter/ Pack Box	SWMU-130 is a wood and metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-131	Bldg 9-99, Aget Filter/ Pack Box	SWMU-131 is a metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-132	Bldg 9-101, Donaldson Torit Bag/ Filter	SWMU-132 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-133	Bldg 9-101, Donaldson Torit Bag/ Filter	SWMU-133 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-134	Bldg 9-101, Donaldson Torit Bag/ Filter	SWMU-134 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-135	Bldg 9-101, Clemco industries Sand Blaster with a Drum/ Filter	SWMU-135 is a metal, sand, and phenolic dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-136	Bldg 9-101, Empire Abrasive Sand Blaster with a Drum/ Filter	SWMU-136 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-137	Bldg 9-101, Agent Manufacturing Filter/ Pack Box	SWMU-137 is a metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-138	Bldg 9-101, Delta Filter/ Pack Box	SWMU-138 is a wood and metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-139	Bldg 9-101, Aget Dustkop Filter/ Pack Box	SWMU-139 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-140	Bldg 9-101, Rockwell Filter/ Pack Box	SWMU-140 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-141	Bldg 9-101, Micropulse Baghouse	SWMU-141 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-142	Bldg 9-101, Spencer Baghouse	SWMU-142 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-143	Bldg 9-101, Spencer Baghouse	SWMU-143 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-144	Bldg 9-101, Donaldson Torit Bag/ Filter	SWMU-144 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-145	Bldg 9-101, Donaldson Industries Baghouse	SWMU-145 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-146	Bldg 9-101, Donaldson Torit Bag/ Filter	SWMU-146 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-147	Bldg 9-101, Donaldson Torit Bag/ Filter	SWMU-147 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-148	Bldg 9-101, Hoffman	SWMU-148 is a composite dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-149	Bldg 9-101, Torit Corp. Filter/ Pack Box	SWMU-149 is a metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-150	Bldg 9-101, Rockwell Filter/ Pack Box	SWMU-150 is a wood and metal dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).

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SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
SWMU-151	Bldg 9-120, Torit Filter/ Pack Box	SWMU-151 is a wood dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-152	Bldg 9-120, Torit Filter/ Pack Box	SWMU-152 is a wood dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-153	Bldg 9-120, Torit Filter/ Pack Bags	SWMU-153 is a plastic dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-154	Bldg 9-120, Spencer Baghouse	SWMU-154 is a wood dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-155	Bldg 9-120, Spencer Baghouse	SWMU-155 is a wood dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-156	Bldg 9-120, Donaldson Torit Baghouse	SWMU-156 is a wood, metal, and plastic dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
SWMU-157	Bldg 9-120, Torit Baghouse	SWMU-157 is a plastic dust collector. The dust collector is used as containment for air releases of dust as a result of manufacturing processes (c).	No further action recommended based on no indication of past releases and low potential for future release (SAIC 1994 and EPA 1994).
AOC-01	Underground Storage Tank DC 14	AOC-01 is the location of a 1100 gal UST used to store gasoline. The 1100 gal UST replaced a leaking 500 gal gasoline UST in 1990. After the removal of the older UST, soil was excavated until soil at the base of the excavation met MTCA Method A cleanup levels. AOC-01 has been in operation from 1985 to present. More information on AOC-01 is presented in Section 4.8.	The three monitoring wells will be sampled biannually until two consecutive monitoring events are obtained without detections of TPH gasoline, TPH diesel, and BTEX (Boeing 2001).
AOC-02	Underground Storage Tank DC 13	AOC-02 is the location of a 550 gal UST used to store diesel. The 550 gal UST replaced a 300 gal diesel UST in 1990. After the removal of the older UST, soil was excavated until soil at the base of the excavation met MTCA Method A cleanup levels. AOC-02 has been in operation from 1985 to present. More information on AOC-02 is presented in Section 4.8.	The three monitoring wells will be sampled biannually until two consecutive monitoring events are obtained without detections of TPH gasoline, TPH diesel, and BTEX (Boeing 2001).
AOC-03	Underground Storage Tank DC 20	AOC-03 is the location of a 20,000 gal UST used to store No. 5 fuel oil used by the steam plant in Building 9-50. The UST replaced a similar UST when a leak was discovered in 1991. During the UST removal, approximately 250 yd^3 of TPH contaminated soil and 200-500 gals of free phase hydrocarbon product were removed from the excavation. AOC-03 has been in operation from 1957 to present. More information on AOC-03 is presented in Section 4.9.	The two monitoring wells will be sampled biannually until four consecutive groundwater samples are obtained that are non-detect for TPH diesel (Boeing 2001).
AOC-04	Underground Storage Tank DC 21	AOC-04 is the location of a 20,000 gal UST used to store No. 5 fuel oil used by the steam plant in Building 9-50. The UST replaced a similar UST when a leak was discovered in 1991. During the UST removal, approximately 250 yd^3 of TPH contaminated soil and 200-500 gal of free phase hydrocarbon product were removed from the excavation. AOC-04 has been in operation from 1957 to present. More information on AOC-04 is presented in Section 4.9.	The two monitoring wells will be sampled biannually until four consecutive groundwater samples are obtained that are non-detect for TPH diesel (Boeing 2001).

TABLE 1
BOEING DEVELOPMENTAL CENTER
DESCRIPTION OF SWMUs AND AOCs

SWMU/AOC-ID	LOCATION	DESCRIPTION	STATUS
AOC-05	Underground Storage Tank DC 01	AOC-05 was the location of a 1000 gal UST used to store gasoline. A leak of gasoline occurred in 1985. The UST was closed and removed after the leak occurred. During the UST removal, 500-600 gals of floating product was removed from the excavation. Additional gasoline contamination was removed within the excavated soils (Boeing 2001). AOC-05 operated from an unknown time to 1985. More information on AOC-05 is presented in Section 4.10.	ORC will be injected into groundwater to promote aerobic biodegradation of residual petroleum hydrocarbon constituents in groundwater. Groundwater samples will be collected monthly for three months following ORC injection for BTEX and gas-range petroleum hydrocarbons.

Notes:

(a) Waste accumulation areas are designed to be self-contained. Small quantity waste collection areas are moved around to accommodate manufacturing operations. SWMU-51 to 90 were observed in 1994 and may not currently exist.

(b) Waste accumulation areas are designed to be self-contained. Small quantity waste collection areas are moved around to accommodate manufacturing operations. SWMU-91 to 123 were observed in 1991 but were not present in 1994.

(c) Filtering systems are designed to be self-contained. Filtering systems are moved around to accommodate manufacturing operations. SWMU-124 to 157 were observed in 1994 and may not currently exist.

TABLE 2
PRELIMINARY GROUNDWATER SCREENING LEVELS
in µg/L

	Ambient Water Quality Criteria					MTCA Method B		Method B Preliminary	Method B Preliminary
	Aquatic Life - Marine		Aquatic Life - Fresh Water		Human Health	Surface Water Equation		Screening Level	Screening Level
Constituent	State - Chronic	Federal - Chronic	State - Chronic	Federal - Chronic	Federal - Ing. of Org.	for Human Health (a)(b)	PQL	Marine Surface Water	Fresh Surface Water
Volatile Organics									
acetone	NA	NA	NA	NA	NA	NA	10 (c)	NA	NA
benzene	NA	NA	NA	NA	71	22	5 (d)	71	71
carbon disulfide	NA	NA	NA	NA	NA	NA	100 (c)	NA	NA
2-chloroethyl vinyl ether	NA	NA	NA	NA	NA	NA	10 (c)	NA	NA
chloroform	NA	NA	NA	NA	470	280	5 (c)	470	470
1,2-dichloro-1,1,2-trifluoroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-dichloroethane	NA	NA	NA	NA	NA	NA	5 (c)	NA	NA
1,2-dichloroethane	NA	NA	NA	NA	99	59	5 (c)	99	99
1,1-dichloroethene	NA	NA	NA	NA	3.2	1.9	4 (l)	4	4
cis-1,2-dichloroethene	NA	NA	NA	NA	NA	NA	5 (d)	NA	NA
trans-1,2-dichloroethene	NA	NA	NA	NA	NA	32,800	5 (c)	32,800	32,800
ethylbenzene	NA	NA	NA	NA	29,000	6910	5 (d)	29,000	29,000
Freon	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	1,600	960	5 (c)	1,600	1,600
methyl ethyl ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA
styrene	NA	NA	NA	NA	NA	NA	5 (c)	NA	NA
tetrachloroethene	NA	NA	NA	NA	8.85	4.2	5 (d)	9	9
toluene	NA	NA	NA	NA	200,000	48,500	5 (d)	200,000	200,000
Trichloroethane	NA	NA	NA	NA	NA	417000 (j)	NA	417,000	417,000
1,1,1-trichloroethane	NA	NA	NA	NA	NA	417,000	5 (c)	417,000	417,000
1,1,2-Trichloroethane	NA	NA	NA	NA	42	25	5 (c)	42	42
trichloroethene	NA	NA	NA	NA	81	56	5 (d)	81	81
1,2,4-trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	525	3.7	5 (d)	525	525
m-xylene	NA	NA	NA	NA	NA	NA	5 (c,e)	NA	NA
o-xylene	NA	NA	NA	NA	NA	NA	5 (c,e)	NA	NA
p-Xylene	NA	NA	NA	NA	NA	NA	5 (c,e)	NA	NA
Semivolatile Organics									
bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	5.9	3.6	3 (l)	3.6	3.6
di-butyl phthalate	NA	NA	NA	NA	12,000	2,900	NA	12,000	12,000
diethyl phthalate	NA	NA	NA	NA	120,000	28,000	10 (c)	120,000	120,000
naphthalene	NA	NA	NA	NA	NA	4,940	10 (c)	4,940	4,940
Benz(a)anthracene	NA	NA	NA	NA	0.031	0.0296	0.1 (l)	0.1	0.1
Chrysene	NA	NA	NA	NA	0.031	0.0296	0.1 (l)	0.1	0.1
Acenaphthene	NA	NA	NA	NA	NA	640.0	10 (c)	640.0	640.0
Anthracene	NA	NA	NA	NA	110,000	26,000	10 (c)	110,000	26,000
Fluoranthene	NA	NA	NA	NA	370	90	10 (c)	370	90
Fluorene	NA	NA	NA	NA	14,000	3,500	10 (c)	14,000	3,500
Phenanthrene	NA	NA	NA	NA	NA	NA	10 (c)	NA	NA
Pyrene	NA	NA	NA	NA	11,000	2,600	10 (c)	11,000	2,600
Dibenzofuran	NA	NA	NA	NA	NA	NA	10 (c)	NA	NA
Total PCBs									
Total PCBs	NA	0.03	NA	0.014	0.00017	0.00166	3.7 (i, l)	3.7	3.7
Total Petroleum Hydrocarbons									
TPH-diesel	NA	NA	NA	NA	NA	500 (f)	1.25 (d)	500	500
TPH-gasoline	NA	NA	NA	NA	NA	800 (f)	1.25 (d)	800	800
Metals									
aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA
arsenic, inorganic	36	36	190	190	0.14	0.098	5 (l)	5	5
barium	NA	NA	NA	NA	NA	NA	NA	NA	NA
beryllium	NA	NA	NA	NA	NA	273	2 (c)	273	273
cadmium	9.3	9.3	0.84 (g)	1 (h)	NA	20.3	0.2 (l)	9	1 (h)
calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA
chromium (III)	NA	NA	141 (g)	180 (h)	NA	243,000	10 (c)	243,000	180 (h)

TABLE 2
PRELIMINARY GROUNDWATER SCREENING LEVELS
In µg/L

		Ambient Water Quality Criteria					MTCA Method B		Method B Preliminary	Method B Preliminary
		Aquatic Life - Marine		Aquatic Life - Fresh Water		Human Health	Surface Water Equation		Screening Level	Screening Level
	Constituent	State - Chronic	Federal - Chronic	State - Chronic	Federal - Chronic	Federal - Ing. of Org.	for Human Health (a)(b)	PQL	Marine Surface Water	Fresh Surface Water
	chromium (VI)	50	50	10	10	NA	490	50 (c)	50	50
	cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
	copper	3.1	3.1	8.9 (g)	11 (h)	NA	2,660	3.4 (l)	3.4	8.9 (g)
	iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
	lead	8.1	8.1	1.85 (g)	2.5 (h)	NA	NA	8 (l)	8.1	8
	magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA
	manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
	mercury	0.025	0.025	0.012	0.012	0.15	NA	0.3 (l)	0.3	0.3
	molybdenum	NA	NA	NA	NA	NA	NA	NA	NA	NA
	nickel	8.2	8.2	124 (g)	160 (h)	4,600	1100	34 (l)	34	160 (h)
	silver	NA	NA	NA	NA	NA	26,000	70 (c)	26,000	26,000
	zinc	81	81	82.3 (g)	100 (h)	NA	16,500	45 (d)	81	100 (h)

(a) Equation values listed only for constituents for which sufficiently protective human-health based criteria have not been established under applicable state and federal laws.
(b) Ecology 2001.
(c) Practical quantitation limit from Ecology 1995.
(d) Practical quantitation limit from Developmental Center Groundwater Monitoring Plan, Boeing 2001.
(e) PQL for total xylene.
(f) MTCA Method A groundwater screening level for drinking water, Ecology 2001.
(g) Hardness dependent, hardness assumed to be 75.4 mg/L.
(h) Hardness and water effect ratio dependent, hardness assumed to be 100 mg/L, water effect ratio assumed to be 1.0.
(i) PQL for individual Aroclor with highest MDL.
(j) Criteria for 1,1,1-trichloroethane
(l) Ten times ARI method detection limit
NA = water screening level not available.
compounds detected in soil but not in water

TABLE 3
PRELIMINARY SOIL SCREENING LEVELS

	BDC PSL (a) mg/kg	Protection of groundwater based on marine surface water PSL mg/kg	Protection of groundwater based on fresh surface water PSL mg/kg	PQL (b) mg/kg	Background from Ecology (c) mg/kg
Volatile organics					
acetone	NA	NA	NA	0.01	
benzene	220	216	216	0.005	
carbon disulfide	NA	NA	NA	0.1	
2-chloroethyl vinyl ether	NA	NA	NA	NA	
chloroform	2.5	2.5	2.5	0.005	
1,1-dichloroethane	NA	NA	NA	0.005	
1,2-dichloroethane	0.48	0.48	0.48	0.005	
1,1-dichloroethene	0.02	0.02	0.02	0.005	
cis-1,2-,dichloroethene	NA	NA	NA	0.005	
trans-1,2-dichloroethene	180	178	178	0.005	
1,2-dichloro-1,1,2-trichoroethene	NA	NA	NA	NA	
ethylbenzene	250	251	251	0.005	
freon	NA	NA	NA	NA	
methyl ethyl ketone	NA	NA	NA	0.01	
methylene chloride	7	7.0	7.0	0.005	
naphthalene	140	138	138	0.66	
styrene	NA	NA	NA	0.005	
tetrachloroethene	0.1	0.10	0.10	0.005	
toluene	1450	145	145	0.005	
1,1,1-trichloroethane	3300	330	330	0.005	
1,1,2-trichloroethane	0.23	0.23	0.23	0.005	
trichloroethylene	0.54	0.54	0.54	0.001	
1,2,4-trimethylbenzene	NA	NA	NA	NA	
1,3,5-trimethylbenzene	NA	NA	NA	NA	
vinyl chloride	3.3	3.3	3.3	0.02	
m-xylene	NA	NA	NA	0.005	
o-xylene	NA	NA	NA	0.005	
p-xylene	NA	NA	NA	0.005	
Semivolatile organics					
bis(2-ethylhexyl) phthalate	13	13	13	0.66	
di-butyl phthalate	420	424	424	NA	
diethyl phthalate	680	677	677	0.66	
PAHs					
acenaphthene	70	70	70	0.66	
anthracene	52,000	52,100	52,100	0.66	
benzo[a]anthracene	0.22	0.22	0.22	0.008 (d)	
chrysene	0.25	0.25	0.25	0.01 (d)	
dibenzofuran	NA	NA	NA	0.33	
fluoranthene	370	365	365	0.66	
fluorene	2200	2210	2210	0.66	
phenanthrene	NA	NA	NA	0.66	
pyrene	15,000	15,000	15,000	0.66	
Total PCBs					
PCBs	0.33	0.01	0.01	0.33 (d)	
TPH					
diesel	2000 (e)				
gasoline	100 (e)				
Metals					
aluminum	NA	NA	NA	NA	32,600
arsenic, inorganic	7	0.08	0.08	0.5	7
barium and compounds	NA	NA	NA	NA	NA
beryllium	4300	4310	4310	NA	0.6
cadmium	1	1.2	0.14	0.05	1

TABLE 3
PRELIMINARY SOIL SCREENING LEVELS

	BDC PSL (a) mg/kg	Protection of groundwater based on marine surface water PSL mg/kg	Protection of groundwater based on fresh surface water PSL mg/kg	PQL (b) mg/kg	Background from Ecology (c) mg/kg
calcium	NA	NA	NA	NA	NA
chromium(III)	6,500,000	8,748,000,000	6,480,000	0.5	NA
chromium(VI)	3.8	19	3.8	NA	NA
cobalt	NA	NA	NA	NA	NA
copper	36	1.4	4.9	0.5	36
iron	NA	NA	NA	NA	36,100
lead	500	1620	500	0.5	24
magnesium	NA	NA	NA	NA	NA
manganese	NA	NA	NA	NA	NA
mercury	0.07	0.03	0.01	0.002	0.07
molybdenum	NA	NA	NA	NA	NA
nickel	20	11	209	20	48
silver	4400	4420	4420	5	NA
zinc	100	101	124	1	85

(a) Most stringent SSL selected. SSL replace with PQL or background concentration if SSL less than either of these values.
(b) Practical quantitation limit from Ecology 1995.
(c) Puget sound basin 90th percentile value from Ecology 1994.
(d) Ten times ARI method detection limit.
(e) MTCA Method A industrial value.

TABLE 4
SWMU 16: PCB CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Sample ID	SB-1	SB-1	SB-2	SB-2	SB-3	SB-3	SB-4	SB-4	SB-5	SB-5	SB-6	SB-6
Date Collected	1/23/01	1/23/01	1/23/01	1/23/01	1/23/01	1/23/01	1/24/01	1/24/01	1/24/01	1/24/01	1/24/01	1/24/01
Depth below Water Table in ft.	0-3.5	10-13.5	0-3.5	10-13.5	0-3.5	10-13.5	0-3.5	10-13.5	0-3.5	10-13.5	0-3.5	10-13.5
Aroclor 1016	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1242	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1248	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1254	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1260	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1221	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Aroclor 1232	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

U = Analyte not detected at indicated detection limit
Data from IT 2001.

TABLE 5
SWMU 17: DETECTED ANALYTES IN SOIL SAMPLE BDC-05-2

Analyte	Concentration	PSL (a)
Metals in mg/kg		
Arsenic	2.8	7
Beryllium	0.5	4300
Chromium	11	6,500,000
Copper	41	36
Lead	1.2	500
Nickel	9	20
Silver	0.4	4400
Zinc	36	100
Volatile Organics in ug/kg		
Methylene Chloride	trace	7000
Acetone	460	NA
Toluene	trace	1,400,000
Total Xylenes	trace	NA

trace Analyte detected between 5-25 ug/kg

Analyte detected at concentration above the screening level

(a) Preliminary screening level, see table 3

TABLE 6
SWMU 17: METALS DETECTED IN GROUNDWATER SAMPLES

Analyte	Maximum Detection (ug/L) [a]	PSL Marine (ug/L)	PSL Fresh (ug/L)	Number of Samples	Number of Marine PSL Exceedances	Number of Fresh PSL Exceedances	Frequency of Marine PSL Exceedance	Frequency of Fresh PSL Exceedance
Aluminum	3000	na	na	23	-	-	-	-
Arsenic	47	5	5	18	3	3	17%	17%
Barium	63	na	na	23	-	-	-	-
Cadmium	28	9	1	27	6	13	-	48%
Calcium	39000	na	na	23	-	-	-	-
Chromium	3.6	243000	180	27	-	-	-	-
Cobalt	48	na	na	23	-	-	-	-
Copper	44	3.4	8.9	27	26	24	96%	89%
Iron	73000	na	na	27	-	-	-	-
Lead	42	8.1	8	28	3	3	11%	11%
Magnesium	15000	na	na	23	-	-	-	-
Molybdenum	130	na	na	23	-	-	-	-
Nickel	19	34	160	27	-	-	-	-
Silver	ND	26000	26000	4	-	-	-	-
Zinc	42	81	100	27	-	-	-	-

(a) data collected since January 1998
PSL preliminary screning level, see Table 2
na not available
ND non-detect

TABLE 7
SWMU 17: DETECTED VOC CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Well	Jun-98	Nov-99	May-00	Dec-00	Jun-01	Dec-01	PSL
1,1-dichloroethane							na
BDC-05-02A	-	1.1	1.2	-	1.22 J	1.4	
BDC-05-03	nt	1.8	2.5	1.46	2.7	-	
BDC-05-04	3.7	3.7	-	3.2	2.45	4.8	
BDC-05-05	-	-	-	-	-	-	
BDC-05-07	1.4	1.6	1.5	1.67	1.41	3.3	
1,1,1-trichloroethane							417,000
BDC-05-02A	4	6.5	7.4	1.73	7.29 J	8.8	
BDC-05-03	-	1.7	2.2	1.57	1.77 J	3.5	
BDC-05-04	-	-	-	-	-	-	
BDC-05-05	-	-	-	-	-	-	
BDC-05-07	8.5	8.6	7.2	11.49	5.88 J	8.4	
cis-1,2-dichloroethene							na
BDC-05-02A	2	1.4	1.6	1.48	2.9 J	4.8	
BDC-05-03		3.1	8.7	4.7	11.62	1.1	
BDC-05-04	10.3	6.2	5.9	7.9	7.79 J	11	
BDC-05-05	-	-	-	-	-	-	
BDC-05-07	2.9	2.2	3.4	4.3	4.79 J	9.9	
tetrachloroethene							9
BDC-05-02A	6.7	15.8	19.8	8.67	9.82 J	8.2	
BDC-05-03	nt	6	5.4	4.49	2.6 J	1.7	
BDC-05-04	-	-	-	-	-	1.4	
BDC-05-05	-	-	-	-	-	-	
BDC-05-07	5.9	10.1	9.3	16.26	4.91 J	5.6	
trichloroethene							81
BDC-05-02A	12.4	30.2	39.5	12.64	38.94	37	
BDC-05-03	nt	12.2	18	13.4	17.59	3.6	
BDC-05-04	1.5	1.6	1.5	1.96	1.26 J	1.4	
BDC-05-05	1.4	1	1.33	2.01	1.87 J	1	
BDC-05-07	15.2	27.1	26.7	37.95	25.82	30	

- not detected
nt not tested
J estimated value
PSL preliminary screening level
na not available
[ ] analyte detected at concentration above preliminary screening level

TABLE 8a
SWMU 20: METALS AND CYANIDE RESULTS FOR PHASE I SOIL SAMPLES
in mg/kg

Analyte	PSL	Sample ID (a,b):	1-12.0		2-14.0		2-15.5		4-11.5		5-12.5	
Antimony	-		0.5	UR	0.5	UR	0.5	UR	0.5	UR	0.5	UR
Arsenic	7		3.2		2.7		3		7.8		4.1	
Barium	NA		44		37		48		53		54	
Beryllium	4300		0.1		0.1		0.2		0.3		0.3	
Cadmium	1		0.5	U	0.5	U	0.5		0.5	U	0.7	
Chromium	6,500,000		14		14		16		15		16	
Cobalt	NA		5		5		5		4		6	
Copper	36		16		10		17		21		16	
Lead	500		5	U	5	U	5	U	5	U	5	U
Mercury	0.07		0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Molybdenum	NA		5	U	5	U	5	U	5	U	5	U
Nickel	20		8		6		8		6		11	
Silver	4400		1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Selenium	-		0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Strontium	-		68		42		56		83		58	
Thallium	-		0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Vanadium	-		44		42		50		64		54	
Zinc	100		32		34		31		32		38	
Cyanide	-		0.5	UJ	0.5	UJ	0.5	UJ			0.5	UJ

(a) Sample ID indicates location and depth in ft BGS.
(b) These samples were collected in the area of the degreaser. The soil was subsequently excavated in 1989.
U = Element not detected at listed instrument detection limit.
R = Data unusable because of low spike recovery caused by matrix interferences.
J = Concentration estimated; low surrogate recovery.
NA = soil screening level not available
- = soil screening level not determined

TABLE 8b
SWMU 20: DETECTED ANALYTES FOR PHASE II SOIL SAMPLES
in ug/kg

Analyte	PSL		Boring ID:	6C	6C	6C	6C	6C	6C	6C	7C	7C	7C	7C	7C
			Sample ID (a):	6C-10.5	6C-12.0	6C-13.5	6C-15	6C-33.5	6C-35.0	6C-39	7C-10.5	7C-12.5	7C-15	7C-35	7C-39
			Date Collected:	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89
Volatile Organics in ug/kg															
Acetone	NA			-	-	-	-	10	-	-	-	-	-	47	18
Carbon Disulfide	NA			-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	2.00E+01			-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethene (b)	1.78E+05	(c)		35	710	81	71	24	18	1300		350	120	2300	47
Ethylbenzene	2.51E+05			-	-	-	-	-	-	-	-	-	-	-	-
Methylethyl Ketone	NA			-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	100			790	10000	450	280	-	-	-	27	1300	18	550	110
Trichloroethene	540			130	1300	100	74	-	-	-		320	21	830	110
Toluene	1.40E+06			-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	3300000			-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	230			-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	3300			-	-	-	-	-	19	-	-	-	40	690	26
Xylenes (d)	NA	(e)		-	-	-	-	-	-	-	-	-	-	-	-
Semivolatile Organics in ug/kg															
Benz(a)anthracene	220			-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	250			-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	7.00E+04			-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	5.20E+07			-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	3.70E+05			-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2.20E+06			-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	NA			-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1.50E+07			-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	NA			-	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons in mg/kg															
TPH (f)	2000	(g)		-	-	-	-	-	-	-	-	-	-	-	-

TABLE 8b
SWMU 20: DETECTED ANALYTES FOR PHASE II SOIL SAMPLES
in ug/kg

Analyte	PSL		Boring ID:	8C	8C	8C	8C	8C	8C	9D	9D	9D	9D	9D	9D
			Sample ID (a):	8C-12	8C-15.5	8C-17	8C-32.5	8C-40.5S	8C-40.5C	9D-11	9D-12.5	9D-15.5	9D-18.5	9D-27.5	9D-37.5
			Date Collected:	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89
Volatile Organics in ug/kg															
Acetone	NA			16	-	-	11	-	-	-	-	-	-	-	13
Carbon Disulfide	NA			-	-	-	7.4	-	-	-	-	-	-	-	-
1,1-Dichloroethene	2.00E+01			-	-	-		25	-	-	-	6.4	-	-	-
1,2-Dichloroethene (b)	1.78E+05	(c)		520	5500	670	1900	1900	4900	320	1400	8500	3200	-	-
Ethylbenzene	2.51E+05			-	-	-	-	-	-	-	-	-	-	-	-
Methylethyl Ketone	NA			-	-	-	-	-							
Tetrachloroethene	100			2100	8700	5300	17000	2.4		810	490	3900	320	1.7	-
Trichloroethene	540			680	9900	2000	6200	1100	4700	640	1400	3700	980	-	-
Toluene	1.40E+06			-	-	-	-	-	420	10	-	-	-	-	-
1,1,1-Trichloroethane	3300000			-	-	-	-	-	80	-	-	-	-	-	-
1,1,2-Trichloroethane	230			-	-	-	-	-	-	5.6	7.3	-	-	-	-
Vinyl Chloride	3300			30	-	38	57	110	-	-	14	160	-	-	-
Xylenes (d)	NA	(e)		-	-	-	-	-	240	-	-	-	-	-	-
Semivolatile Organics in ug/kg															
Benz(a)anthracene	220			360	-	-	-	-	-	-	-	-	-	-	-
Chrysene	250			420	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	7.00E+04			820	-	-	-	-	-	-	-	-	-	-	-
Anthracene	5.20E+07			1100	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	3.70E+05			3100	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2.20E+06			1000	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	NA			370	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1.50E+07			1600	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	NA			800	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons in mg/kg															
TPH (f)	2000	(g)		163	26	26	-	-	-	-	-	-	-	-	-

TABLE 8b
SWMU 20: DETECTED ANALYTES FOR PHASE II SOIL SAMPLES
in ug/kg

Analyte	PSL		Boring ID:	10C	10C	10C	10C	10C	12A	13C	13C	14C	14C	14C	14C
			Sample ID (a):	10C-3	10C-12	10C-15	10C-15dup	10C-22.5	12A-35	13C-30	13C-35	14C-12.5	14C-18.5	14C-27.5	14C-34
			Date Collected:	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89
Volatile Organics in ug/kg															
Acetone	NA			-	-	-	-	-	24	-	17	-	-	-	52
Carbon Disulfide	NA			-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	2.00E+01			-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethene (b)	1.78E+05	(c)		11	200	1300	1300	51			21	160	410	610	-
Ethylbenzene	2.51E+05			-	-	-	-	-	-	-	-	430	-	-	-
Methylethyl Ketone	NA								11	-	-	-	-	-	14
Tetrachloroethene	100			120	290	640	1100	230	-	-	-	88	1400	1500	-
Trichloroethene	540			110	220	260	420	43	-	-	-	120	890	520	-
Toluene	1.40E+06			-	-	-	-	-	-	-	-	2500	9.6	-	-
1,1,1-Trichloroethane	3300000			-	-	-	-	-	-	-	-	490	-	-	-
1,1,2-Trichloroethane	230			-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	3300			-	-	39	35	-	-	18	41	-	-	230	67
Xylenes (d)	NA	(e)		-	-			-	-	-	-	2200	-	-	-
Semivolatile Organics in ug/kg															
Benz(a)anthracene	220			-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	250			-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	7.00E+04			-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	5.20E+07			-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	3.70E+05			-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2.20E+06			-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	NA			-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1.50E+07			-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	NA			-	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons in mg/kg															
TPH (f)	2000	(g)		-	-	-	-	-	-	-	-	-	-	-	-

TABLE 8b
SWMU 20: DETECTED ANALYTES FOR PHASE II SOIL SAMPLES
in ug/kg

Analyte	PSL		Boring ID:	15C	15D	15D	15D	15D	15D	15D	16C	16C	16C	16C
			Sample ID (a):	15C-5	15D-5	15D-8	15D-18.5	15D-30	15D-36	15D-50dup	16C-3	16C-4.5	16C-13.5	16C-35
			Date Collected:	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89	Aug-89
Volatile Organics in ug/kg														
Acetone	NA			-	15	39	-	-	9.5	8.6	-	-	-	8.1
Carbon Disulfide	NA			-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	2.00E+01			-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethene (b)	1.78E+05	(c)		-	-	-	390	770	-	-	-	-	-	-
Ethylbenzene	2.51E+05			-	-	-	-	-	-	-	-	-	-	-
Methylethyl Ketone	NA			-	-	12	-	-	-	-	-	-	-	-
Tetrachloroethene	100			-	-	-	-	-	-	-	-	26	12	-
Trichloroethene	540			-	-	-	140	6.9	-	-	5.8	18	20	-
Toluene	1.40E+06			-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	3300000			-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	230			-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	3300			-	-	-	-	49	-	-	-	-	-	-
Xylenes (d)	NA	(e)		-	-	-	-	-	-	-	-	-	-	-
Semivolatile Organics in ug/kg														
Benz(a)anthracene	220			-	-	-	-	-	-	-	-	-	-	-
Chrysene	250			-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	7.00E+04			-	-	-	-	-	-	-	-	-	-	-
Anthracene	5.20E+07			-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	3.70E+05			-	-	-	-	-	-	-	-	-	-	-
Fluorene	2.20E+06			-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	NA			-	-	-	-	-	-	-	-	-	-	-
Pyrene	1.50E+07			-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	NA			-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons in mg/kg														
TPH (f)	2000	(g)		22	-	-	-	-	-	-	-	-	-	-

TABLE 8b
SWMU 20: DETECTED ANALYTES FOR PHASE II SOIL SAMPLES
in ug/kg

Analyte	PSL		Boring ID: / Sample ID (a): / Date Collected:
Volatile Organics in ug/kg			
Acetone	NA		
Carbon Disulfide	NA		
1,1-Dichloroethene	2.00E+01		
1,2-Dichloroethene (b)	1.78E+05	(c)	
Ethylbenzene	2.51E+05		
Methylethyl Ketone	NA		
Tetrachloroethene	100		
Trichloroethene	540		
Toluene	1.40E+06		
1,1,1-Trichloroethane	3300000		
1,1,2-Trichloroethane	230		
Vinyl Chloride	3300		
Xylenes (d)	NA	(e)	
Semivolatile Organics in ug/kg			
Benz(a)anthracene	220		
Chrysene	250		
Acenaphthene	7.00E+04		
Anthracene	5.20E+07		
Fluoranthene	3.70E+05		
Fluorene	2.20E+06		
Phenanthrene	NA		
Pyrene	1.50E+07		
Dibenzofuran	NA		
Total Petroleum Hydrocarbons in mg/kg			
TPH (f)	2000	(g)	

Footnotes:

[ ] Analyte detected at concentration above the preliminary screening level

"-" indicates analyte not detected above contract laboratory program quantitation limit

PSL = preliminary screening level, see Table 3

(a) sample ID indicates location and depth in ft

(b) Undifferentiated 1,2-dichloroethene

(c) Screening level for trans-1,2-dichloroethene, no surface water protection value available for cis-1,2-dichloroethene

(d) Undifferentiated xylene

(e) Screening level for m-xylene and o-xylene

(f) Undifferentiated TPH measured by EPA Method 418.1

(g) Screening level for diesel-range petroleum hydrocarbons

NA = soil screening level not available

TABLE 9
SWMU 20: BENZENE CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Well	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00	Jun-01	Dec-01
MW-6B	-	1.3	-	-	-	-	-	-
MW-6C	4.2	5.7	2.8	2.7	-	2.76	1.9 J	1.7
MW-8C	14	-	-	-	15.8	-	-	-
MW-9A	-	-	-	-	-	-	-	-
MW-9B	-	-	-	-	-	-	-	1.2
MW-9C	1.7	2.5	1.7	-	1.5	1.4	-	-
MW-9D	-	-	-	-	-	-	-	-
MW-10A	-	-	-	-	-	-	-	-
MW-10C	1.3	1.1	1.1	-	1.4	1.2	-	1.3
MW-11A	-	-	-	-	-	-	-	-
MW-12A	-	-	-	-	-	-	-	-
MW-13A	-	-	-	-	-	-	-	-
MW-13C	3.9	3.3	3	-	2	2.3	1.2	-
MW-14A	-	-	-	-	-	-	-	-
MW-14C	2.8	4.6	2.5	1.2	1.4	1.3	-	-
MW-14E	-	-	-	-	-	-	-	-
MW-15A	-	-	-	-	-	-	-	-
MW-15C	-	5.2	5.2	5.4	-	4.3	2.9 J	3.2
MW-15D	-	-	-	-	-	-	-	-
MW-16A	2	-	11	50	1.6	46	34	15
MW-16C	15	8.3	10	6.4	7.8	4.3	5.0	4.5
MW-17A	11	-	-	-	1.5	-	nt	-
MW-17C	5.6	2.7	3.7	2.4	2.1	nt	-	nt
MW-17D	-	-	-	-	-	-	-	nt
MW-18A	-	-	-	-	-	-	-	nt
MW-18C	1.5	1.4	1.5	-	1.1	1.3	-	-
MW-18D	-	-	-	-	-	-	-	nt
MW-19A	-	-	-	-	-	-	-	nt
MW-19C	2.2	1.8	1.8	1.3	1.2	1.4	1.3	-
MW-19D	-	-	-	-	-	-	-	nt
MW-20A	-	-	-	-	-	-	-	nt
MW-20C	-	-	-	-	-	-	-	-
MW-20D	-	-	-	-	-	-	-	nt

- not detected
nt not tested
J estimated value
analyte detected at concentration above preliminary screening level

TABLE 10
SWMU 20: cis-1,2-DCE CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Well	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00	Jun-01	Dec-01
MW-6B	67	9.9	70	50	72	92	64	27
MW-6C	1.1	180 J	-	-	-	-	-	-
MW-8C	38	-	1.1	-	3.2	-	-	-
MW-9A	94	680	15.5	190	420	61	270 J	100
MW-9B	940 J	178	122	41	102	135	110 J	100
MW-9C	-	-	-	-	-	-	-	1.1
MW-9D	-	-	-	-	-	-	-	-
MW-10A	29	6.9	33	21	11	14	14	36
MW-10C	-	-	-	-	-	-	-	-
MW-11A	2.8	2.3	2.1	1.1	1.5	1.6	1.3 J	2.1
MW-12A	1.7	1.7	1.8	1.0	1.9	2.1	1.5 J	2.2
MW-13A	-	1.2	1.3	1.2	1.2	-	-	-
MW-13C	-	-	-	-	-	-	-	-
MW-14A	4.9	3.7	7	3.2	3.8	-	-	-
MW-14C	26	22	6.2	-	1.2	2.8	1.6	-
MW-14E	-	-	-	-	-	-	-	-
MW-15A	16	6.4	-	-	-	-	5.0 J	4.9
MW-15C	790 J	91	53	28	1.0	2.5	-	1.1
MW-15D	1	1	1	1	1	1	1	-
MW-16A	1	1	1	1	1	1.8	1.8 J	2.6
MW-16C	-	-	-	-	-	-	-	-
MW-17A	2.3	3.8	4.1	4.3	2.3	2.1	nt	2
MW-17C	-	-	-	-	-	nt	-	nt
MW-17D	-	-	-	-	-	nt	-	nt
MW-18A	-	-	-	-	-	-	-	nt
MW-18C	1.8	2.8	1.9	2.1	1.3	1.6	1.4 J	-
MW-18D	1.8	-	-	-	-	-	-	nt
MW-19A	-	-	-	-	-	-	-	nt
MW-19C	2.0	1.2	1.4	-	1.0	-	1.0 J	-
MW-19D	-	-	-	-	-	-	-	nt
MW-20A	-	-	-	-	-	-	-	nt
MW-20C	-	1.5	-	-	1.3	-	1.1 J	1.1
MW-20D	-	-	-	-	-	-	-	nt

-	not detected
nt	not tested
J	estimated value
cis-1,2-DCE	cis-1,2-dichloroethene

No preliminary screening level available for DCE.

TABLE 11
SWMU 20: PCE CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Well	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00	Jun-01	Dec-01
MW-6B	18.9	16.3	22.6	2.3	6	10.19	2.6 J	2.4
MW-6C	-	-	-	-	-	-	-	-
MW-8C	7.8	-	-	-	-	-	-	-
MW-9A	39.4	121	5.1	38	40	36.6	12.65	16
MW-9B	31.3	-	6.74	3.6	-	6.62	1.18	2.1
MW-9C	-	-	-	-	-	-	-	-
MW-9D	-	-	-	-	-	-	-	-
MW-10A	72.5	86.4	38	21.5	16.6	21.63	30.3	11
MW-10C	-	-	-	-	-	-	-	-
MW-11A	-	-	-	-	-	-	-	-
MW-12A	-	-	-	-	-	-	-	-
MW-13A	1.6	1.3	-	-	1.2	-	-	1.6
MW-13C	-	-	-	-	-	-	-	-
MW-14A	-	-	-	-	-	-	-	-
MW-14C	-	-	-	-	-	-	-	-
MW-14E	-	-	-	-	-	-	-	-
MW-15A	-	-	-	-	-	-	-	-
MW-15C	-	-	-	-	-	-	-	-
MW-15D	-	-	-	-	-	-	-	-
MW-16A	1.64	1.03	1.3	2.3	2.2	-	-	-
MW-16C	-	-	-	-	-	-	-	-
MW-17A	2.6	2.4	2.5	2.1	2.6	4.15		-
MW-17C	-	-	-	-	-	nt	-	nt
MW-17D	-	-	-	-	-	-	-	nt
MW-18A	-	-	-	-	-	-	-	nt
MW-18C	-	-	-	-	-	-	-	-
MW-18D	-	-	-	-	-	-	-	nt
MW-19A	-	-	-	-	-	-	-	nt
MW-19C	-	-	-	-	-	-	-	-
MW-19D	-	-	-	-	-	-	-	nt
MW-20A	-	-	-	-	-	-	-	nt
MW-20C	-	-	-	-	-	-	-	-
MW-20D	-	-	-	-	-	-	-	nt

-	not detected
nt	not tested
J	estimated value
PCE	tetrachloroethene
	analyte detected at concentration above preliminary screening level

TABLE 12
SWMU 20: TCE CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Well	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00	Jun-01	Dec-01
MW-6B	3.5	2.6	4.54	2.2	4.7	8.71	5.83 J	4.7
MW-6C	-	91.6	-	-	-	-	-	-
MW-8C	26.6	-	-	-	-	-	-	-
MW-9A	15.4	98.4	3.5	35	23	24.3	25.21	32
MW-9B	20.65	-	7.5	4.8	2.6	11.2	5.79 J	4.8
MW-9C	-	-	-	-	-	-	-	-
MW-9D	-	-	-	-	-	-	-	-
MW-10A	23.8	33.9	19.2	14	8.3	13.11	17.02	18
MW-10C	-	-	-	-	-	-	-	-
MW-11A	nt	1.03	-	-	-	-	-	-
MW-12A	-	-	-	-	-	-	-	-
MW-13A	1.1	1.7	1.8	2.3	2.4	2.12	1.28 J	-
MW-13C	-	-	-	-	-	-	-	-
MW-14A	-	-	-	-	-	-	-	-
MW-14C	-	-	-	-	-	-	-	-
MW-14E	-	-	-	-	-	-	-	-
MW-15A	-	-	-	-	-	-	-	-
MW-15C	3.33	-	-	-	-	-	-	-
MW-15D	-	-	-	-	-	-	-	-
MW-16A	-	-	1.01	1.4	1.2	1.08	-	-
MW-16C	-	-	-	-	-	-	-	-
MW-17A	-	12.4	11.1	11.5	6.6	13.99	nt	5.9
MW-17C	-	-	-	-	nt	-	-	nt
MW-17D	-	-	-	-	nt	-	-	nt
MW-18A	-	-	-	-	-	-	-	nt
MW-18C	-	-	-	-	-	-	-	-
MW-18D	-	-	-	-	-	-	-	nt
MW-19A	-	-	-	-	-	-	-	nt
MW-19C	-	-	-	-	-	-	-	-
MW-19D	-	-	-	-	-	-	-	nt
MW-20A	-	-	-	-	-	-	-	nt
MW-20C	-	-	-	-	-	-	-	-
MW-20D	-	-	-	-	-	-	-	nt

-	not detected
nt	not tested
J	estimated value
TCE	trichloroethene
	analyte detected at concentration above preliminary screening level

TABLE 13
SWMU 20: VINYL CHLORIDE CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Well	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00	Jun-01	Dec-01
MW-6B	46.3	4.2	48.4	25.9	8	21.58	10.62	8.9
MW-6C	6	54.6	4.4	-	-	-	-	-
MW-8C	20.6	-	49.7	21.4	2.4	-	-	-
MW-9A	83.8	425	14	278	499	17.95	86.44	7.8
MW-9B	439.56	132	152.36	66.6	82.6	146.7	78.9	110
MW-9C	1.1	-	59	16.4	-	-	-	-
MW-9D	-	-	-	-	-	-	-	-
MW-10A	8.7	1.3	12.1	3.5	3	3.32	3.32 J	2.9
MW-10C	1.7	1.6	2.8	1.4	2.1	-	-	-
MW-11A	-	-	1.1	-	-	-	-	-
MW-12A	1.3	-	2.7	1.06	-	-	-	-
MW-13A	-	-	-	-	-	-	-	-
MW-13C	1	1.6	1.8	-	-	-	-	-
MW-14A	29.1	13.74	58.2	20.9	19.7	-	-	-
MW-14C	39.4	56.4	30.2	-	-	4.67	1.21 J	-
MW-14E	-	-	-	-	-	-	-	-
MW-15A	61.61	22.7	2.9	37	16	-	3.86 J	1.8
MW-15C	772 J	194 J	121.2	49.2	1.4	21.32	1.0	1.5
MW-15D	8.6	5.2	-	-	-	-	-	-
MW-16A	-	-	-	-	-	-	-	-
MW-16C	1.4	-	1.9	-	-	-	-	-
MW-17A	-	-	-	-	-	-	-	-
MW-17C	-	-	-	-	-	-	-	nt
MW-17D	-	-	-	-	-	-	-	nt
MW-18A	-	-	-	-	-	-	-	nt
MW-18C	-	-	-	-	-	-	-	-
MW-18D	-	-	-	-	-	-	-	nt
MW-19A	-	-	-	-	-	-	-	nt
MW-19C	-	-	-	-	-	-	-	-
MW-19D	-	-	-	-	-	-	-	nt
MW-20A	-	-	-	-	-	-	-	nt
MW-20C	1.6	1.8	-	1.9	-	1.06	-	-
MW-20D	-	-	-	-	-	-	-	nt

- not detected
nt not tested
J estimated value
analyte detected at concentration above preliminary screening level

TABLE 14
SWMU 20: NAPHTHALENE CONCENTRATIONS IN GROUNDWATER SAMPLES
in ug/L

Well	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00	Jun-01	Dec-01
MW-6B	-	1.4	-	-	-	nt	4.5 J	1.8
MW-6C	3	25.1	3.4	-	7.7	nt	9.73 J	2.8
MW-8C	600 J	38.6	230	137	109.2	174.1	125 J	210
MW-9A	-	-	-	-	-	8.65	3.63 J	-
MW-9B	-	-	3.4	4.6	-	11.2	2.24 J	3.1
MW-9C	-	-	9.9	6.8	-	1.67	1.8 J	1.3
MW-9D	-	-	-	-	-	-	-	-
MW-10A	-	-	-	-	-	-	-	-
MW-10C	2.8	-	3.8	4.7	2.7	5.77	-	36
MW-11A	-	-	-	-	5.1	-	-	-
MW-12A	-	-	-	-	-	-	-	-
MW-13A	-	-	-	-	-	-	-	-
MW-13C	-	-	-	-	-	-	-	-
MW-14A	-	-	150	4.8	235	113.23	84.7	35
MW-14C	7.2	6.5	6.3	7.3	17.2	8.7	6.79 J	3.5
MW-14E	-	-	-	-	-	-	-	-
MW-15A	1721 J	916	58.9	561	797	695.6	985.5 J	1100
MW-15C	-	4.8	-	-	29.8	-	-	-
MW-15D	-	-	-	-	-	-	-	7.4
MW-16A	-	-	-	-	-	-	-	3.1
MW-16C	-	-	-	-	-	-	-	-
MW-17A	-	-	-	-	-	-	-	-
MW-17C	1	1	31.9	16.6	13.7	nt	12.12	nt
MW-17D	-	-	-	-	-	nt	-	nt
MW-18A	-	-	-	-	-	-	-	nt
MW-18C	-	-	-	-	1.1	-	-	-
MW-18D	-	-	-	-	-	-	-	nt
MW-19A	-	-	-	-	1.54 J	-	-	nt
MW-19C	-	-	-	-	-	-	-	-
MW-19D	-	-	-	-	-	-	-	nt
MW-20A	-	-	-	-	5.48 J	-	-	nt
MW-20C	-	-	-	-	1.81 J	-	-	-
MW-20D	-	-	-	-	-	-	-	nt

- not detected
nt not tested
J estimated value
[ ] analyte detected at concentration above preliminary screening level

TABLE 15
SWMU 20: INFREQUENTLY DETECTED VOCS IN GROUNDWATER SAMPLES

Analyte	Number of Detections	Detection Frequency	Maximum Detection (ug/L)	PSL
1,1-dichloroethane	4	1.5%	2.4	na
1,1-dichloroethene	1	0.4%	1	3
1,3,5-trimethylbenzene	1	0.4%	3.6	na
2-butanone	1	0.4%	1	na
2-chloro vinyl ether	1	0.4%	17.66	na
carbon disulfide	3	1.2%	6.76	na
styrene	1	0.4%	2.16	na
toluene	4	1.5%	1.7	48500
trans-1,2-dichloroethene	8	3.1%	4.2	32800
xylene	6	2.3%	6.32	na

PSL preliminary screening level, see Table 2
na not available

TABLE 16
AOC-01/02: VOC CONCENTRATIONS IN SOIL SAMPLES
in ug/kg

Sample ID:	BE (a)	SLABSW (a)	DG952W (a)	
Date Collected:	Oct-90	Oct-90	Oct-90	PSL
Benzene	130	-	22	220,000
Ethylbenzene	-	-	4	250,000
Toluene	-	-	20	1,400,000
Xylenes [b]	110	380	32	NA

(a) Soil samples collected from remaining soil at base of UST excavation (Landau 1990b)
(b) Undifferentiated xylene
PSL = preliminary screening level, see Table 3

TABLE 17
AOC-01/02: DETECTED ANALYTES IN GROUNDWATER SAMPLES
in ug/L

Analyte	Maximum Concentration (a)	Marine Water PSL	Fresh Water PSL
Metals			
Aluminum	170	na	na
Arsenic	1.6	5	5
Barium	16	na	na
Cadmium	12	9	1
Calcium	17000	na	na
Copper	24	3.4	8.9
Iron	17000	na	na
Magnesium	9600	na	na
Volatile Organics			
Toluene	1.17 J	200,000	200,000
Xylenes (total)	1.47 J	na	na
Total Petroleum Hydrocarbons			
Diesel-range	2970	500	500

PSL = preliminary cleanup level, see Table 2

J = estimated value

na = not available

☐ analyte detected at concentration above preliminary screening level

(a) Maximum concentration for groundwater sampling from 1998 to present

TABLE 18
AOC-03/04: TPH CONCENTRATIONS IN SOIL SAMPLES
in mg/kg

Sample Identification	Date Collected	TPH [a] Concentration
SW-N-3	Aug-92	16 [b]
SW-N-16	Aug-92	65 [b]
SW-E-5	Aug-92	29 [b]
SW-E-31	Aug-92	75 [b]
SW-S-5	Aug-92	36 [b]
SW-W-9	Aug-92	20 [b]
SW-W-25	Aug-92	42 [b]
BS-W-3	Aug-92	13000 [b]
BS-W-4	Aug-92	18 [b]
BS-W-5	Aug-92	12000 [b]
BS-W-6	Aug-92	6200 [b]
21A-16	Oct-92	17 [c]

(a) Undifferentiated TPH measured by EPA Method 418.1
(b) Soil samples collected from remaining soil at base of UST excavation (Landau Associates 1993c)
(c) Soil sample collected from monitoring well borehole

[ ] analyte detected at concentration above preliminary screening level of 2000 mg/kg for TPH-diesel

TABLE 19
AOC-03/04: DETECTED ANALYTES IN GROUNDWATER SAMPLES
in ug/L

Analyte	Maximum Concentration	PSL
Volatile Organics		
Acetone	3.5	na
cis-1,2-dichloroethene	1.24	na
Total Petroleum Hydrocarbons		
Diesel-range	2010	500

PSL = preliminary screening level, see Table 2

J = estimated value

na = not available

☐ analyte detected at concentration above preliminary screening level

TABLE 20
AOC-05: GROUNDWATER RESULTS FROM GEOPROBE SAMPLING

	Gasoline-range Petroleum Hydrocarbons (mg/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
PSL [a]	0.8 (b)	71	200,000	29,000	na
SB-7 Upper	0.25 U	5.9	1.0 U	1.0 U	7.3
SB-7 Lower	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U
SB-8 Upper	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U
SB-8 Lower	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U
SB-9 Upper	5.3	99	1.0 U	33	153
SB-9 Lower	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U
SB-10 Upper	250	23	18000	4600	25000
SB-10 Lower	0.30	1.0 U	7.9	4.4	26
SB-11 Upper	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U
SB-11 Lower	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U
SB-12 Upper	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U
SB-12 Lower	0.25 U	1.0 U	1.0 U	1.0 U	1.0 U

na = groundwater screening level not available
PSL = preliminary screening level, see Table 2
Analyte detected at concentration above the preliminary screening level
Groundwater samples collected in January 2001 from Geoprobe exploration, IT 2001

TABLE 21
AOC-05: GROUNDWATER MONITORING RESULTS FOR JUNE 2001 SAMPLING EVENT
in ug/L

Well	Benzene	Toluene	Ethylbenzene	Xylenes (total)
PSL	71	200,000	29,000	na
BDC-102	5.33 J	1 U	1 U	1.87 J
BDC-103	875 J	12010	1985 J	11430

PSL = preliminary screening level, see Table 2

J = estimated value

Analyte detected at concentration above the preliminary screening level

APPENDIX A

Summary of Soil and Groundwater Data for SWMUs and AOCs (Digital Format)

APPENDIX B

Pump and Treat Remedial System Evaluation – SWMU 20, Landau Associates 2001

Landau Associates
Environmental and Geotechnical Services

TECHNICAL MEMORANDUM

TO: Jim Bet & Carl Bach
The Boeing Company

FROM: Martin Powers and Jerry Ninteman

DATE June 11, 2001

RE: PUMP AND TREAT REMEDIAL SYSTEM EVALUATION – SWMU 20
BOEING DEVELOPMENTAL CENTER
TUKWILA, WASHINGTON

In accordance with our letter proposal dated January 5, 2001 we have completed Task 3 – Pump and Treat Remediation System Evaluation at the referenced site. In completing the task authorized, we examined the following information relative to the groundwater pump and treat system:

- Current and historical contaminant distribution (lateral and vertical) to evaluate system effectiveness in plume control and aquifer restoration. This task included preparation of volatile organic compound (VOC) concentration isopleth maps for perchloroethylene (PCE), trichloroethylene (TCE), cis-1,-2 dichloroethylene (cis-1,2-DCE), and vinyl chloride for A, B, C, and D zone monitoring wells for three different monitoring events (August 1989, January 1994, and December 2000).

- Capture zone of each extraction well within each of three depth intervals (i.e., A, B, and C Horizons) at current pumping rates. This task included preparation of one groundwater elevation contour map for the A, B, and C Horizons using data representative of non-pumping conditions and steady state pumping conditions in E-1 and E-2, and estimating the capture zone from these maps. The capture zone was compared to plume maps to evaluate plume containment.

- Appropriateness of current extraction well locations and screen depths.

- Appropriateness of alternate pumping rates or alternate pumping scenarios (e.g., cyclic pumping, or concurrent extraction from both wells) with respect to plume containment and aquifer restoration.

- Current mass removal rates, trends in mass removal, and total VOC mass removed to date.

- Natural attenuation mechanisms and effectiveness, including a comparison of current mass removal rates to potential natural attenuation rates.

In developing our conclusions for the evaluation, we reviewed data for dissolved-phase concentrations in groundwater monitoring wells located at the site (Table 1); groundwater elevation data based on historical groundwater level measurements and an elevation survey of the monitoring and extraction wells completed in February 2001 (Table 2); groundwater monitoring and extraction well construction details, as previously provided in the document entitled Groundwater Extraction and

Treatment System Assessment (Tetra Tech, August 1996) (Table 3); and VOC mass removal rates exhibited by the pump and treat system as reported by The Boeing Company (Boeing) (Table 4).

BACKGROUND INFORMATION

Our review of the data indicates that a release of chlorinated hydrocarbons to the subsurface was initially discovered in 1989. The apparent source of the chlorinated hydrocarbons was the vapor degreaser sumps, which were in use at the facility from 1958 until 1984 and contained PCE and TCE. The presence of chlorinated hydrocarbons in the subsurface was detected during the implementation of structural improvements at the DC 9-101 building. In the spring of 1990, approximately 1,398 tons of impacted soil was removed and disposed at licensed disposal facilities. The initial groundwater sampling event was completed at the site in August 1989, after groundwater monitoring wells were installed to determine the extent of impact to the groundwater from the chlorinated hydrocarbons. Twenty-one (21) of the current groundwater monitoring wells (MW-6B, 6C, 7C, 8C, 9A, 9B, 9C, 9D, 10A, 10C, 11A, 12A, 13A, 13C, 14A, 14C, 15A, 15C, 15D, 16A, and 16C) were used for the collection of groundwater samples from 1989 to 1991. Thirteen additional groundwater monitoring wells (MW-14E, 17A, 17C, 17D, 18A, 18C, 18D, 19A, 19C, 19D, 20A, 20C, and 20D) were installed in February 1991 and one additional groundwater monitoring well (MW-21A) was installed in October 1992. The groundwater monitoring wells installed at the facility were constructed to permit evaluation of distinct layers (horizons) of the groundwater present beneath the site. The range of depths of the monitoring well screens relative to the horizon of groundwater targeted for assessment were as follows:

A Horizon Wells – Screen Depths Ranging from 6.5 to 21.5 ft below the ground surface (BGS).

B Horizon Wells – Screen Depths Ranging from 22.0 to 27.5 ft BGS.

C Horizon Wells – Screen Depths Ranging from 23.5 to 40.5 ft BGS.

D Horizon Wells – Screen Depths Ranging from 40.0 to 56.0 ft BGS.

E Horizon Well – Screen Depth Ranging from 77.0 to 82.0 ft BGS.

A, B, and C Horizon wells were intended to monitor three distinct layers of groundwater located in the shallow, unconfined aquifer beneath the site. The D Horizon wells were intended to evaluate the semi-confined layer of groundwater present beneath a discontinuous silt aquitard underlying the unconfined aquifer. The E Horizon well (MW-14E) was intended to monitor the water quality in a fully confined aquifer present beneath a massive marine silt deposit underlying the semi-confined aquifer. The

E Horizon well has not exhibited impact by chlorinated hydrocarbons in excess of laboratory detection limits since August 1997, therefore the E Horizon is not included in the evaluation contained herein.

Our assessment of the pump and treat system focuses on the chlorinated hydrocarbons PCE, TCE, cis-1,2-DCE, and vinyl chloride. These constituents are considered the primary constituents of interest (CoI) based on their concentration and frequency of detection in site monitoring wells. Data provided by Boeing indicate that two other constituents, benzene and naphthalene, are present in site groundwater at concentrations that exceed either Model Toxics Control Act (MTCA) Method A or Method B groundwater cleanup levels. However, these constituents are not considered CoI because, as of December 2000, the concentration of benzene and naphthalene exceed cleanup levels at only one well each. The December 2000 exceedances are limited to monitoring well MW-16A, which yielded a benzene concentration of 46 micrograms per liter (µg/L) compared to a Method A cleanup level of 5 µg/L, and MW-15A, which yielded a naphthalene concentration of 696 µg/L compared to a Method B cleanup level of 320 µg/L. (Comparison with MTCA cleanup levels is for screening purposes only; site-specific cleanup levels are being developed and will be included in the Site Summary Report.)

The groundwater pump and treat remediation system was installed in the fall of 1993 and began operation on March 7, 1994. The remediation system utilizes two wells (E-1 and E-2) for the extraction of impacted groundwater. E-1 was installed with a screened interval extending from approximately 23 to 38.3 ft BGS, which indicates that E-1 was capable of collecting groundwater from the A, B, and C Horizons of the shallow groundwater present beneath the site. E-1 remained in use as the sole recovery well at the site from March 4, 1994 to December 13, 1995. The second groundwater extraction well (E-2) was utilized for groundwater extraction beginning in July 1996. E-2 was constructed with well screen extending from approximately 22 to 32 ft BGS, which indicates that extraction of water from E-2 would also be within the A, B, and C Horizons of the groundwater beneath the site. Since July 1996, the extraction wells have been used alternately for extraction, with E-2 being operated for a majority of the time.

For the purpose of our evaluation, the data collected for the site was considered under two distinct scenarios prior to the activation of the remediation system and following the activation of the remediation system. Our evaluation of the data compiled for the site follows.

CONTAMINANT DISTRIBUTION EVALUATION

Groundwater analytical data have been compiled at the site since 1989. Table 1 provides a summary of the analytical data for the primary CoI at the site. For the purpose of evaluating the distribution of chlorinated hydrocarbons over time, we have utilized the dissolved phase concentrations reported for August 1989, January 1994, and December 2000 to develop site maps showing CoI data for

the A Horizon (inclusive of the two B Horizon wells), C Horizon, and D Horizon groundwater. These site maps are presented on Figures 1A, 1-C, and 1-D through 4-A, 4-C, and 4D. The A, C, and D designation refers to the A (and B), C, and D Horizons, respectively. Figures were not prepared for the B Horizon because this horizon only contained two data points. Analytical data for PCE, TCE, cis-1,2-DCE, and vinyl chloride Figures 1 through 4, respectively.

Since the groundwater pump and treat system was not activated until March 1994, expansion or contraction of the dissolved phase plumes of CoI from August 1989 to January 1994 would be attributed to the natural attenuation of the chlorinated hydrocarbons. Natural attenuation includes non-destructive processes (adsorption, dispersion, advection, and volatilization) and destructive processes (biodegradation) to reduce the concentration and/or mass of contaminants in the groundwater. Expansion or contraction of the CoI plumes between January 1994 and December 2000 can be attributed to both natural attenuation processes and the mass removal of chlorinated hydrocarbons caused by the pump and treat system. It should be noted that the overall extent of the dissolved phase plumes (i.e., the 1 µg/L contour area) appears to increase significantly between 1989 and 1994. However, the increase in the estimated size of the plumes can be at least partially attributed to the fact that 14 groundwater monitoring wells were installed after August 1989, thus providing additional data points to more clearly estimate the plume's fringe areas.

Data Evaluation - August 1989 to January 1994

The evaluation of data for the period from August 1989 to January 1994 was completed based on the information provided on Figures 1 through 4. A comparison of August 1989 and January 1994 isopleth maps for the same constituent indicates that the lateral extent of dissolved phase PCE, TCE, and cis-1,2-DCE in excess of 100 µg/L decreased or did not change during this period in the A and C Horizons (the arbitrary cutoff concentration of 100 µg/L was used in this analysis as a representative indicator of the plume extent). None of the CoI exceeded 100 µg/L in the D Horizon in either 1989 or 1994. The extent of the 100 µg/L isopleth of dissolved phase vinyl chloride increased during this period. To quantify the change in area of the groundwater impacted by the CoI in excess of 100 µg/L, we estimated the area of the plumes with concentrations of CoI greater than 100 µg/L for the A and C Horizons. The estimated percentage of variation in the area of groundwater impacted by each CoI in excess of 100 µg/L from August 1989 to January 1994 was then quantified as shown in Table 5. As indicated in Table 5, the area of groundwater impacted by 100 µg/L of the CoI appeared to change from August 1989 to January 1994 as follows:

- PCE impact greater than 100 µg/L decreased by 12 percent in the A Horizon and 100 percent (to less than 100 µg/L) in the C Horizon

- TCE impact greater than 100 µg/L decreased by 8 percent in the A Horizon and 100 percent in the C Horizon

- cis-1,2-DCE impact greater than 100 µg/L decreased by 33 percent in the A Horizon and 79 percent in the C Horizon

- Vinyl chloride impact greater than 100 µg/L increased by 121 percent in the C Horizon; the area of the A Horizon containing vinyl chloride concentrations above 100 µg/L went from 0 square feet (ft^2) in 1989 to approximately 3100 ft^2 in 1994.

The data indicates that the effects of natural attenuation processes had a positive impact on the reduction of concentrations of CoI in the saturated zone, especially in the C Horizon. The increase of vinyl chloride concentrations and decrease in PCE and TCE concentrations is often observed in plumes in which reductive dechlorination processes are active. Reductive dechlorination is the primary biodegradation pathway for the more highly chlorinated hydrocarbons (e.g., PCE and TCE). After the PCE and TCE are sufficiently reduced, the biodegradation process often shifts to an alternative mechanism such as aerobic oxidation, iron reduction, methanogenesis, or cometabolism to continue the destruction of the less chlorinated compounds (e.g., cis-1,2-DCE and vinyl chloride).

Data Evaluation - January 1994 to December 2000

The evaluation of data for the period from January 1994 to December 2000 was completed based on the information provided on Figures 1 through 4. A comparison of January 1994 and December 2000 isopleth maps for the same constituent indicates that the lateral and vertical extent of dissolved phase PCE, TCE, cis-1,2 DCE, and vinyl chloride in excess of 100 µg/L decreased significantly during this period. To quantify the change in area of the groundwater impacted by the CoI in excess of 100 µg/L, we estimated the area of the plumes with concentrations of CoI greater than 100 µg/L for the A and C Horizons. The estimated percentage of variation in the area of groundwater impacted by each CoI in excess of 100 µg/L from January 1994 to December 2000 was then quantified as shown in Table 5. As indicated in Table 5, the area of groundwater impacted by 100 µg/L of the CoI appeared to change from January 1994 to December 2000 as follows:

- PCE impact greater than 100 ppb decreased by 100 percent in the A Horizon; PCE concentrations equal to or greater than 100 µg/L were not detected in the C Horizon in 1994 or 2000

- TCE impact greater than 100 ppb decreased by 100 percent in the A Horizon; TCE concentrations equal to or greater than 100 µg/L were not detected in the C Horizon in 1994 or 2000

- cis-1,2 DCE impact greater than 100 ppb decreased by 100 percent in the A Horizon and 100 percent in the C Horizon
- Vinyl chloride impact greater than 100 ppb decreased by 95 percent in the A Horizon and 100 percent in the C Horizon.

The data indicate that the effects of groundwater pump and treat and natural attenuation processes had a positive impact on the reduction of concentrations of CoI in the saturated zone and resulted in a greater reduction in plume extent, as defined by the 100 µg/L isopleth, as compared to the non-pumping period from 1989 to 1994. The long-term reduction of CoI concentrations could be verified by discontinuing pumping activities for at least 6 months and allowing the VOCs in the groundwater and soil system to equilibrate. At some sites, allowing the VOC distribution to return to equilibrium following interruption of pumping has caused a rebound in the VOC concentrations. This is especially true where a non-aqueous phase liquid (NAPL) source area is present.

CAPTURE ZONE ANALYSIS

Capture zones for groundwater in the A, B, and C Horizons were estimated for the groundwater pump and treat system by preparing groundwater elevation contour maps under various pumping conditions. A groundwater elevation contour map representative of non-pumping conditions was also prepared to evaluate natural groundwater flow gradients and flow directions. A summary of the groundwater elevation data used in this analysis is provided in Table 2. The A, B, and C Horizon groundwater monitoring wells are screened within the same surficial aquifer and the groundwater extraction wells are screened in the A, B, and C Horizons. Where available, groundwater elevation data collected from the A Horizon wells was considered preferentially over B and C Horizon data in developing the groundwater elevation maps utilized for capture zone analysis, in order to minimize the effects of vertical gradients.

The entire groundwater extraction system was reported to be inactive from December 1995 until July 1996. The groundwater elevation data from the A, B, and C Horizons in February 1996 is presented on Figure 5 to represent the groundwater elevation (potentiometric) surface for the surficial aquifer beneath the site under non-pumping conditions. As shown on Figure 5, the natural (i.e., non-pumping) groundwater flow gradient and direction is non-uniform within the study area. Groundwater generally exhibits an overall west, southwesterly flow direction across the study area with the exception of the area to the northwest of extraction wells E1 and E2 which appears to exhibit an easterly flow direction. This flow reversal is caused by an anomalously high groundwater level in MW-19A and MW-19C. An overall west, southwesterly flow direction would be expected given that this is the direction toward the Duwamish Waterway.

Groundwater extraction well E-1 was used exclusively for groundwater extraction from March 1994 to December 1995. The groundwater elevation data from the A, B, and C Horizons in October 1995 is provided on Figure 6 to represent the potentiometric surface for the surficial aquifer under the influence of groundwater extraction from E-1 alone. Groundwater extraction well E-2 was used exclusively for groundwater extraction from March 1999 to December 2000. The groundwater elevation data from the A, B, and C Horizons in December 2000 is provided on Figure 7 to represent the potentiometric surface for the surficial aquifer under the influence of groundwater extraction from E-2 alone. The apparent effect on the groundwater flow direction created by the operation of the groundwater extraction wells is exhibited on Figures 6 and 7. Based on the altered groundwater flow direction caused by the operation of the extraction wells, the independent operation of each of the groundwater extraction wells is sufficient to limit plume migration. Each of the groundwater extraction wells appears to create a capture zone that encompasses the full extent of groundwater impacted by CoI in excess of 1 µg/L in the A, B, and C Horizons. The D Horizon groundwater was not evaluated because the extraction wells are not screened within the D Horizon and the data do not indicate that the groundwater is significantly impacted in the D Horizon.

MASS REMOVAL RATE EVALUATION FOR PUMP AND TREAT SYSTEM

Boeing provided data related to the mass of contaminants removed by the groundwater pump and treat system. The mass removal data is summarized in Table 4. As indicated in Table 4, the pump and treat remediation system has removed approximately 80 lbs of total chlorinated hydrocarbons from the subsurface of the site from March 7, 1994 to September 21, 2000. The average daily mass removal rate for the groundwater pump and treat system was approximately 0.05 lbs per day (22 grams per day) during the period analyzed. The average daily mass removal rate does not take into consideration periods of time when the pump and treat system was offline (i.e., the average daily mass removal rate would be slightly higher if the total mass removed was divided only by the number of days in which the system was online). Of the 80 lbs of chlorinated hydrocarbons estimated to have been removed by the pump and treat system, approximately 70 lbs (88 percent of the total mass removed) were removed prior to 1999. During the past two years (January 1999 through September 2000) approximately 10 lbs (12 percent of the total mass removed) has been extracted by the pump and treat system. The total mass of chlorinated hydrocarbons extracted by the pump and treat system has been steadily declining since 1997 due to a decline in the concentration of CoI present in the groundwater recovered by the pump and treat remediation system (Figure 8).

The data observed relevant to mass removal is typical for groundwater pump and treat systems. During the initial stages of operation of a groundwater pump and treat system, the groundwater being

recovered for treatment has a relatively high concentration of dissolved phase CoI. However, as the operation of the groundwater pump and treat system continues, the concentration of dissolved phase CoI is limited by the rate at which the CoI become "desorbed" from the saturated zone soil particles. The concentration of dissolved phase CoI in the recovered groundwater is related to the amount of contact time between the soil particles and the groundwater to be recovered. The groundwater pump and treat system limits the contact time between the soil particles and the groundwater and reduces the mass of CoI that can transferred from the soil particles to the groundwater, thus resulting in lower dissolved phase contaminant concentrations. In an effort to increase the mass removal efficiency, the operation of pump and treat systems is often cycled to allow the groundwater to periodically equilibrate and cause "washing" of CoI from the soil matrix within the groundwater table. If the operation of the groundwater pump and treat remediation system is to continue, cyclic operation of the pumps on a weekly basis may improve the mass removal efficiency.

NATURAL ATTENUATION EVALUATION

According to the United States Environmental Protection Agency (USEPA) – Office of Solid Waste and Emergency Response (OSWER), three lines of evidence can be used to verify natural attenuation of chlorinated hydrocarbons. The lines of evidence identified by OSWER Directive 9200.4-17 (1997) are as follows:

1. *Historical groundwater and/or soil chemistry data that demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentration over time at appropriate monitoring or sampling points. (In the case of a ground water plume, decreasing concentrations should not be solely the result of plume migration.)*

2. *Hydrogeologic and geochemical data that can be used to demonstrate indirectly the type(s) of natural attenuation processes active at the site, and the rate at which such processes will reduce contaminant concentrations to required levels. For example, characterization data may be used to quantify the rates of contaminant sorption, dilution, or volatilization, or to demonstrate and quantify the rates of biological degradation processes occurring at the site.*

3. *Data from field or microcosm studies (conducted in or with actual contaminated site media) which directly demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the contaminants of concern (typically used to demonstrate biological degradation processes only).*

The OSWER directive also states that "*Unless EPA or the implementing state agency determines that historical data (Number 1 above) are of sufficient quality and duration to support a decision to use monitored natural attenuation, EPA expects that data characterizing the nature and rates of natural attenuation processes at the site (Number 2 above) should be provided. Where the latter are also inadequate or inconclusive, data from microcosm studies (Number 3 above) may also be necessary.*

In general, more supporting information may be required to demonstrate the efficacy of monitored natural attenuation ... at sites with contaminants that transform into more toxic and/or mobile forms than the parent contaminant." This final statement is applicable to PCE, TCE, and cis-1,2 DCE ultimately degrading to vinyl chloride.

In consideration of the need to verify the first two lines of evidence listed above, the occurrence of natural attenuation may be evaluated at a site by performing the following steps:

Step 1 – Evaluate the potential for natural attenuation to be effective at a site

This step requires an evaluation of several data sets. The initial data set to be evaluated is the concentration of the CoI over time. If natural attenuation processes are to be considered as a viable remediation alternative, the concentration of the CoI should be decreasing over time primarily as a result of natural biodegradation processes. In sites impacted with PCE or TCE, the production of biodegradation breakdown products (cis-1,2-DCE and vinyl chloride) provide the most reliable indication that natural biodegradation processes are active at the site. A second set of data that must be considered in this step is the presence of potential receptors (e.g., potable water wells, surface water bodies, subsurface structures, etc.) located within the plume area. A third data set to be considered is the natural groundwater gradient and velocity exhibited by the impacted groundwater to assist in predicting if a potential receptor could be impacted in the future by the plume as it migrates before natural attenuation processes can effectively reduce concentrations to protect the receptor.

Sufficient CoI data have been collected at the site to indicate that the transformation of parent compounds PCE and TCE to breakdown products of cis-1,2-DCE and vinyl chloride occurs and that this attenuation process has resulted in a reduction in the concentration and extent of the CoI plumes at the site. In relation to the presence of potential receptors at the site and potential impact to potential receptors within the extent of the plume area and downgradient, the following conclusions have been derived:

- No potential receptors were identified within the plume area.
- The nearest downgradient potential receptor (The Duwamish Waterway) was identified to be approximately 500 ft west of the former source area of the plume. Groundwater analyses for CoI indicate that the dissolved-phase plume has not extended beyond 200 ft downgradient (west-southwest) from the source area.

It is likely that the reduction of the CoI plumes is due to a combination of the effects of natural attenuation and the groundwater pump and treat system. This decline can be qualitatively evaluated by comparing the plume maps presented on Figures 1 through 4.

Step 2 –Identify the natural attenuation mechanisms at the site

This step is completed after it has been determined that there is evidence that natural attenuation processes are likely having a positive impact on the reduction of the CoI plume. The key data to be evaluated during this step are geochemical parameters that may indicate the driving force behind biodegradation activity at the site. As stated earlier, reductive dechlorination processes appear to be ongoing at the site based on the reduction of PCE and TCE concentrations and the presence of cis-1,2-DCE and vinyl chloride. However, sufficient geochemical data has not been collected for the site to conclusively determine the actual mechanism(s) responsible for the reductive dechlorination processes. Reductive dechlorination has been demonstrated at other sites under nitrate and iron reducing conditions, but the most rapid biodegradation rates, affecting the widest range of chlorinated aliphatic hydrocarbons, occur under sulfate-reducing and methanogenic conditions (Bouwer, 1994).

In our experience, it is likely that reductive dechlorination at the site is occurring under methanogenic conditions because of the presence of vinyl chloride. Sites undergoing reductive dechlorination under sulfate-reducing conditions often do not progress beyond the degradation of TCE and subsequent formation of cis-1,2-DCE and therefore lack significant concentrations of vinyl chloride. Additional site geochemical data would be needed to demonstrate the actual reductive dechlorination process. Geochemical parameters that would be indicative of reductive dechlorination include a reduction in the concentration of sulfate or nitrate within the impacted area or an increase in the concentration of ferrous iron (iron II), methane, ethane/ethene or chloride ion in the impacted area.

Following the reduction of PCE and TCE, the continued biodegradation of the remaining CoI (cis-1,2-DCE and vinyl chloride) often is continued by oxidation-reduction mechanisms which are typically aerobic respiration, iron reduction, or methanogenesis. Evidence of these biodegradation processes would typically be confirmed by a depletion of dissolved oxygen within the impacted area or an increase of ferrous iron, methane, ethane/ethene or chloride ion within the impacted area.

In addition to the specific evidence referenced for biodegradation of PCE, TCE, cis-1,2-DCE, and vinyl chloride, there are conventional parameters that can indicate microbiological activity. These parameters include oxidation-reduction potential, alkalinity, conductivity, carbon dioxide concentration, temperature, and pH in groundwater. In addition, a sufficient carbon source must be present to continue the biodegradation process. The availability of carbon can be determined by analyzing the groundwater for total organic carbon (TOC) content.

Step 3 –Estimate the attenuation rate of CoI for the site

Following the completion of the initial two steps involved with the natural attenuation evaluation, it is often necessary to estimate the rate of attenuation of the CoI present in the subsurface. Estimating the

rate of attenuation may be simplistic (e.g., regression analysis to determine the attenuation rate observed due to natural processes) or more sophisticated (e.g., implementation of a three-dimensional groundwater model for the site). The goal of estimating the rate of attenuation is to predict whether cleanup level goals can be obtained within a reasonable timeframe and within an acceptable distance downgradient of the release area at identified "sentinel" wells. Accurate predictions of CoI concentrations in sentinel wells that are also protective of human health and the environment are key to gaining regulatory approval for the use of natural attenuation as a remediation method for the site.

Attenuation rates are typically calculated by observing the rate at which a contaminant concentration decreases with distance downgradient along a groundwater migration pathway. The data are typically fitted to a first order exponential decay equation and a regression analysis is performed to obtain the rate constant (for example, see USEPA 1998). Methods are available to separate the affects of non-biological processes (e.g., adsorption, dispersion, advection, and volatilization) from biological processes. Such an evaluation requires knowledge of the groundwater flow velocity and direction and contaminant concentration data from several monitoring points located along a common migration pathway. Because knowledge of these conditions does not exist for this site to the level needed to conduct such an evaluation, a modified evaluation was conducted with the objective of comparing the relative rate of contaminant concentration reduction for the non-pumping period (i.e., 1989 to 1994) to the relative rate of contaminant concentration reduction for the pumping period (i.e., 1994 to 2000). The evaluation consisted of calculating the rate at which CoI concentrations decreased with time at site monitoring wells during the non-pumping and pumping periods. The rate was obtained by plotting the natural logarithm of the concentration of specific contaminants (normalized to the starting concentration) versus time.

Separate graphs were prepared for select groundwater monitoring wells for the active pumping and non-pumping scenarios. Following the graphing of the contaminant concentration as described, a linear regression analysis was performed on each graph to determine the rate of contaminant reduction exhibited in each of the wells for the specific CoI. These graphs are presented in Attachment 1. A summary of the CoI reduction rate estimates is presented in Table 6. The calculated contaminant reduction rates consider the reduction in contaminant concentrations due to the combined affect of the non-destructive (advection, dispersion, etc.) and destructive (biodegradation) components of natural attenuation and, for the 1994 to 2000 period, the reduction caused by the operation of the pump and treat system.

The following conclusions were derived from information presented in Table 6, based on comparisons of the rate of contaminant reduction under non-pumping and pumping scenarios:

- The rate of PCE concentration reduction was greater in the non-pumping scenario in 6 out of 8 wells that could be compared
- The rate of TCE concentration reduction was greater in the non-pumping scenario in 6 out of 9 wells that could be compared
- The rate of cis-1,2 DCE concentration reduction was greater in the non-pumping scenario in 5 out of 10 wells that could be compared
- The rate of vinyl chloride concentration reduction was greater in the pumping scenario in 10 out of 10 wells that could be compared.

These results indicate that, with the exception of vinyl chloride, the rate of concentration reduction during non-pumping conditions was at least as great as the rate of concentration reduction during pumping conditions and in fact was significantly higher during non-pumping conditions for PCE and TCE. This trend is consistent with the expected trend given that the more highly oxidized chlorinated compounds (e.g., PCE and TCE) are more readily degraded under reductive dechlorination conditions.

The calculation of average concentration reduction rates for each CoI (see Table 6) allows an average half-life value to be calculated for each CoI. The half life is a term used to represent the amount of time necessary for the concentration of a compound to reach a concentration equal to one-half the concentrations measured at time zero. Therefore, the half life can be used to estimate how long it will take for the concentrations of CoI in the plume measured in December 2000 to decrease to concentrations equal to approximately one-half of the December 2000 concentrations, assuming the reduction rate does not change and CoI concentrations do not rebound after the pump and treat system is turned off. Based on this evaluation, natural attenuation processes (without the assistance of the pump and treat system) could remove 50 percent of the remaining PCE, TCE, and cis-1,2-DCE mass present in the saturated zone within the next 2 to 3 years. The production of vinyl chloride will continue to decline as concentrations of the parent compounds decline.

Step 4 – Monitor site and validate attenuation rate estimates

After an estimated attenuation rate for CoI is developed for a site, the predicted sentinel well concentrations must be validated by continuing to collect groundwater analytical data. Typically, the attenuation rate predictions are validated by collecting groundwater samples at sentinel wells to compare actual CoI concentrations to predicted CoI concentrations. In the event that a significant discrepancy is observed between the predicted and the actual CoI concentrations, it may be necessary to re-evaluate the attenuation rate at the site and collect additional biodegradation parameters. In the event that the predicted sentinel well concentrations are proven to be accurate over a period of time, typically 1 to 2 years, and it appears that potential receptors will not be impacted by the plume, closure may be

requested from the regulatory agency. The closure approval from the regulatory agency is often contingent upon the completion of an extended monitoring program that will provide additional data relevant to the effectiveness of natural attenuation in achieving site specific clean-up criteria. The length and frequency of the long term monitoring can often be negotiated with the regulatory agency.

CONCLUSIONS AND RECOMMENDATIONS

The data presented and discussed herein lead to the following conclusions:

- Concentrations of PCE, TCE, and cis-1,2-DCE in groundwater steadily declined since groundwater monitoring began in August 1989 until January 1994, apparently due to the effects of natural attenuation.

- The production of breakdown products (cis-1,2-DCE and vinyl chloride) in conjunction with the decline in PCE and TCE concentrations under non-pumping conditions indicate that natural biodegradation processes (i.e., reductive dechlorination) are active at the site.

- The capture zone evaluation of the current pump and treat system indicates that it is effectively controlling plume migration.

- The influent concentration of the groundwater recovered by the pump and treat system has been declining significantly over the past 2 years. As of September 2000, approximately 88 percent of the total mass of CoI removed by the pump and treat remediation system was removed prior to 1999.

- The extent of the PCE, TCE, and cis-1,2-DCE plumes (as measured by the 100 µg/L isopleth) decreased more rapidly under pumping conditions in comparison to non-pumping conditions, however, the rate of PCE and TCE concentration reduction appeared to be greater under non-pumping conditions.

- During both pumping and non-pumping periods, the lateral extent of CoI greater than 1 µg/L was fully contained within site boundaries.

Based on the evidence provided in this memorandum documenting the effectiveness of natural attenuation at this site, combined with previous source control measures (soil excavation and pump and treat operation), lack of potential receptors, and historical data indicating a downgradient plume of limited extent, we recommend requesting approval from Ecology to shut down the pump and treat system and monitor groundwater over a minimum six month period to evaluate whether VOC concentrations rebound in site groundwater. Discontinuation of the groundwater pump and treat system is further supported by considering the significant amount of energy resources expended to operate the system (approximately 130 kilowatt-hours per day) for a minimal amount of VOCs currently being removed by the system (approximately 0.3 pounds per day based on January 2000 through September 2000). A technical memorandum outlining the proposed discontinuation of the pump and treat system and the subsequent groundwater monitoring schedule should be prepared and submitted to Ecology for approval. The pump

and treat system should remain at the site in a standby mode. The technical memorandum outlining the steps to be completed for shut down of the system should include a contingency plan for restarting the pump and treat system in the event that monitoring indicates that natural attenuation processes are not effective in maintaining acceptable concentrations within the site boundary. Following the six month period after system shut down, groundwater data should be evaluated to develop a final remedy for the site.

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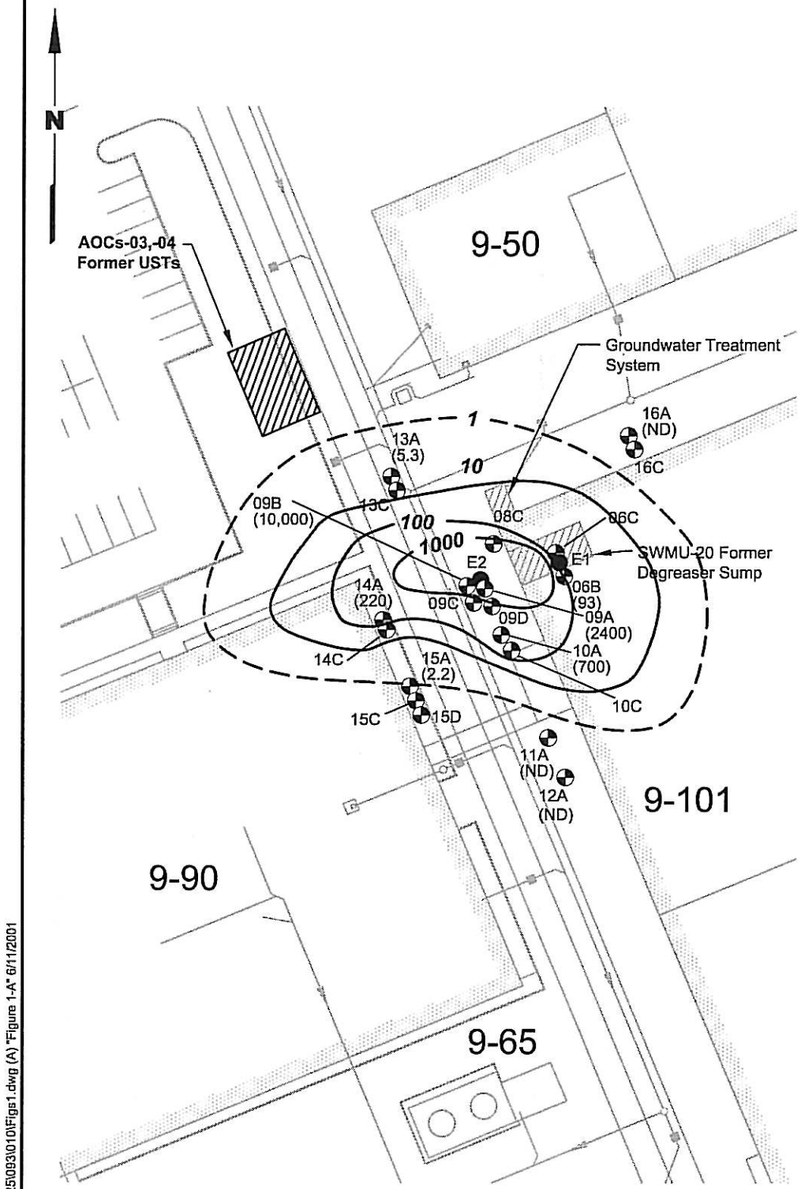
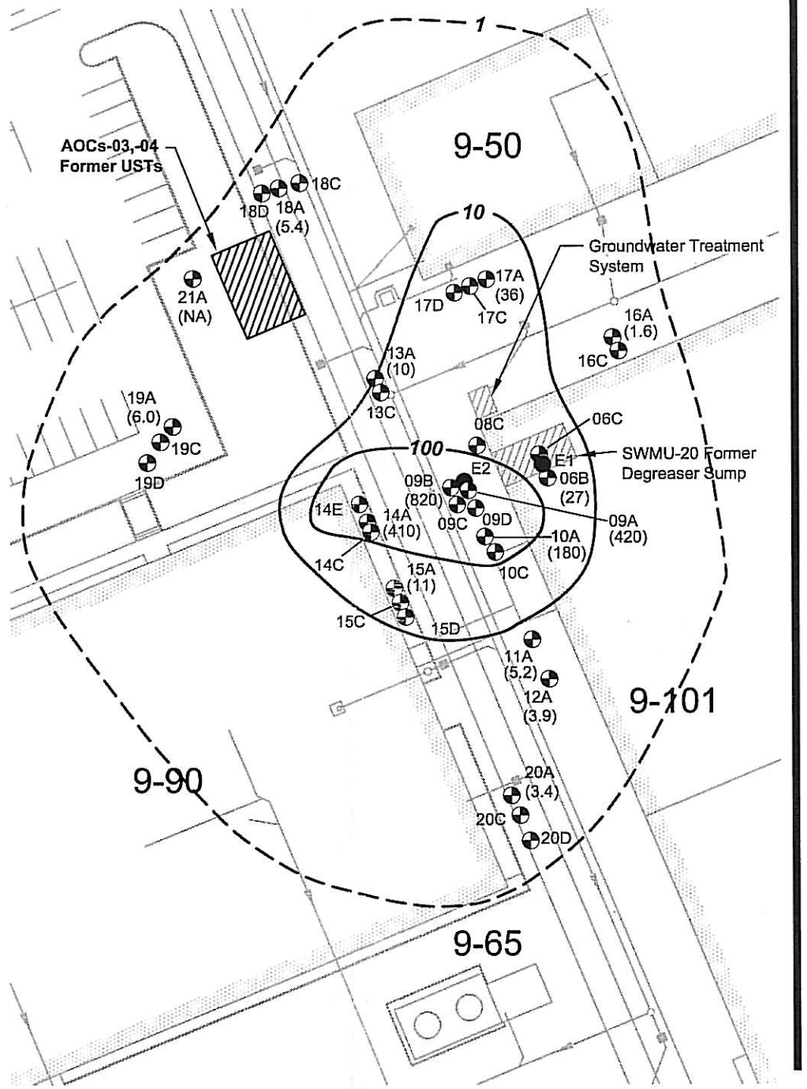
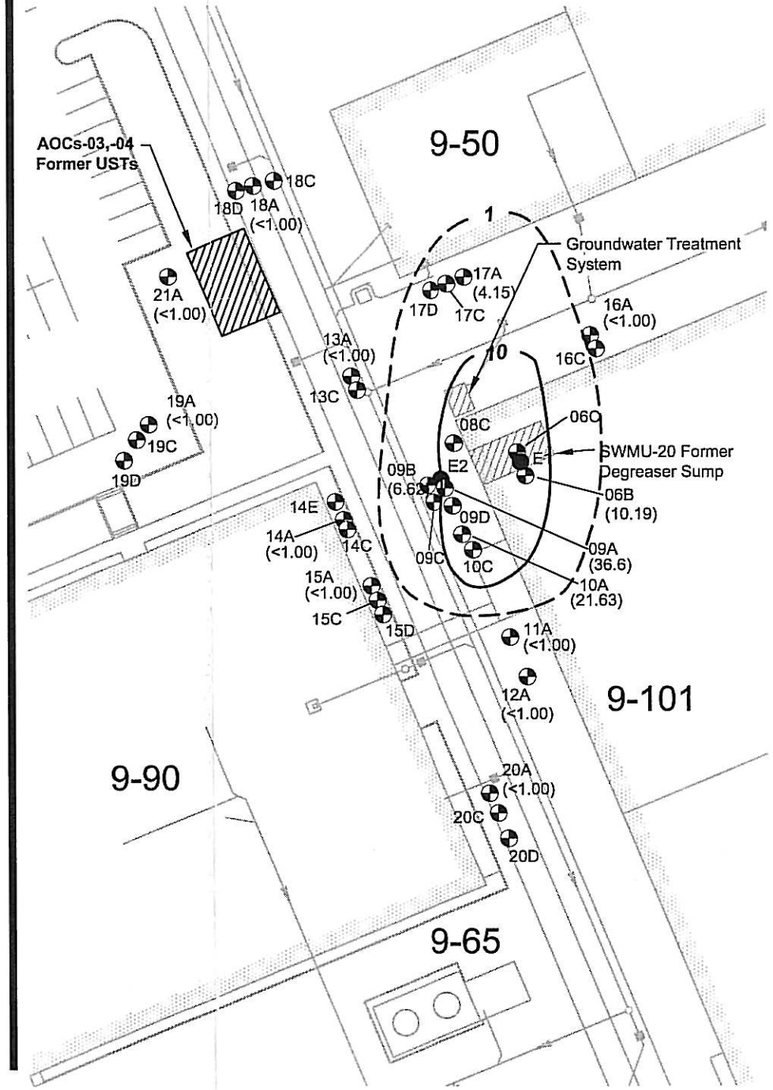


August 1989



January 1994



December 2000

Notes

1. (µg/L) = micrograms per liter.
2. "A" horizon extends from 6.5 to 21.5 ft. below ground surface.
3. ND = not detected
4. NA = not analyzed
5. Isopleths are representative of the A Horizon with consideration of the concentration reported in the two B Horizon wells

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported PCE Concentrations (µg/L)
- —10— Estimated PCE Concentration Isopleth (µg/L)

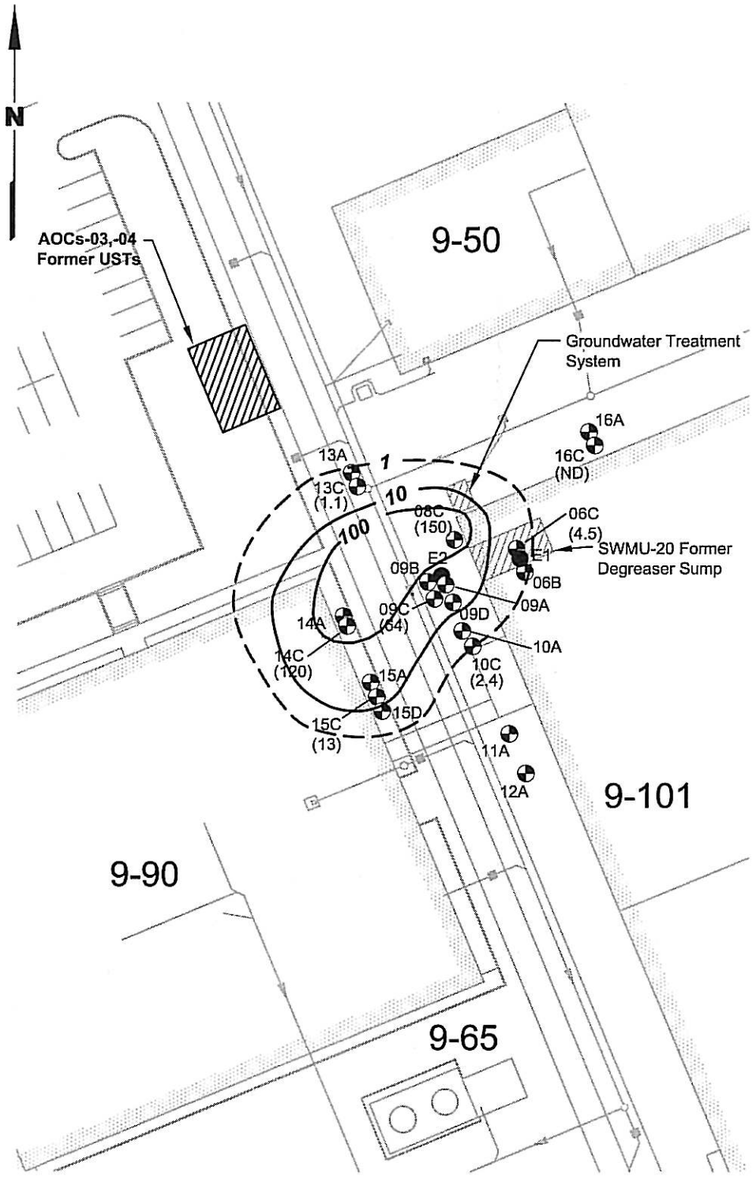
0 60 120
Scale in Feet

Landau Associates

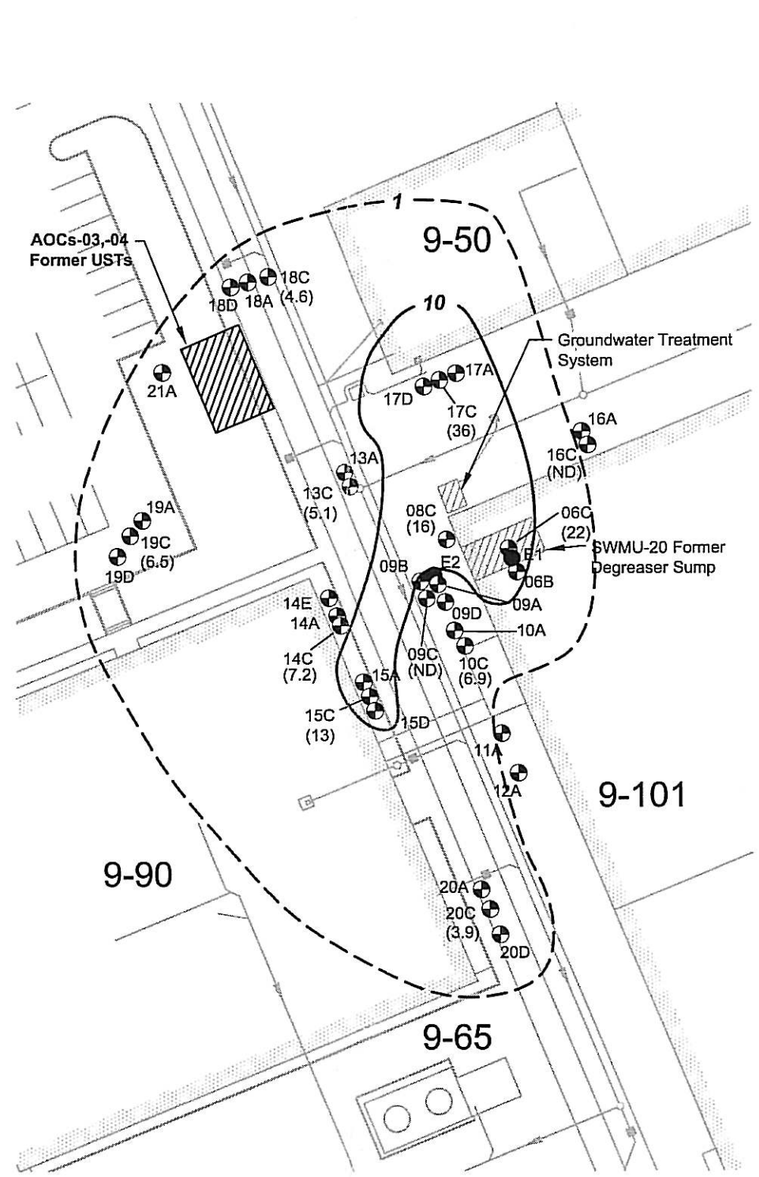
Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - PCE A Horizon Groundwater**	Figure 1-A

Boeing/Developmental Center | T:\025\093\010\Figs\1.dwg (A) "Figure 1-A" 6/11/2001



August 1989



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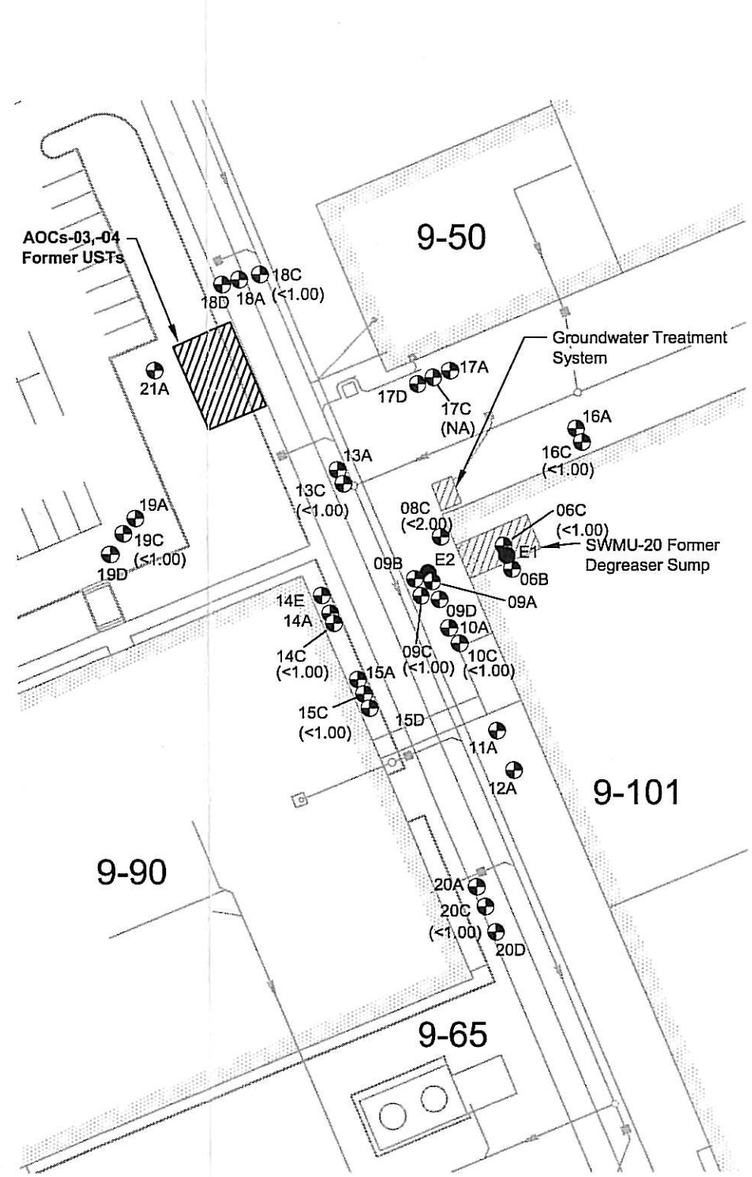


December 2000

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported PCE Concentrations (µg/L)
- —10— Estimated PCE Concentration Isopleth (µg/L)

Notes

1. (µg/L) = micrograms per liter.
2. "C" horizon extends from 23.5 to 40.5 ft. below ground surface.
3. ND = not detected

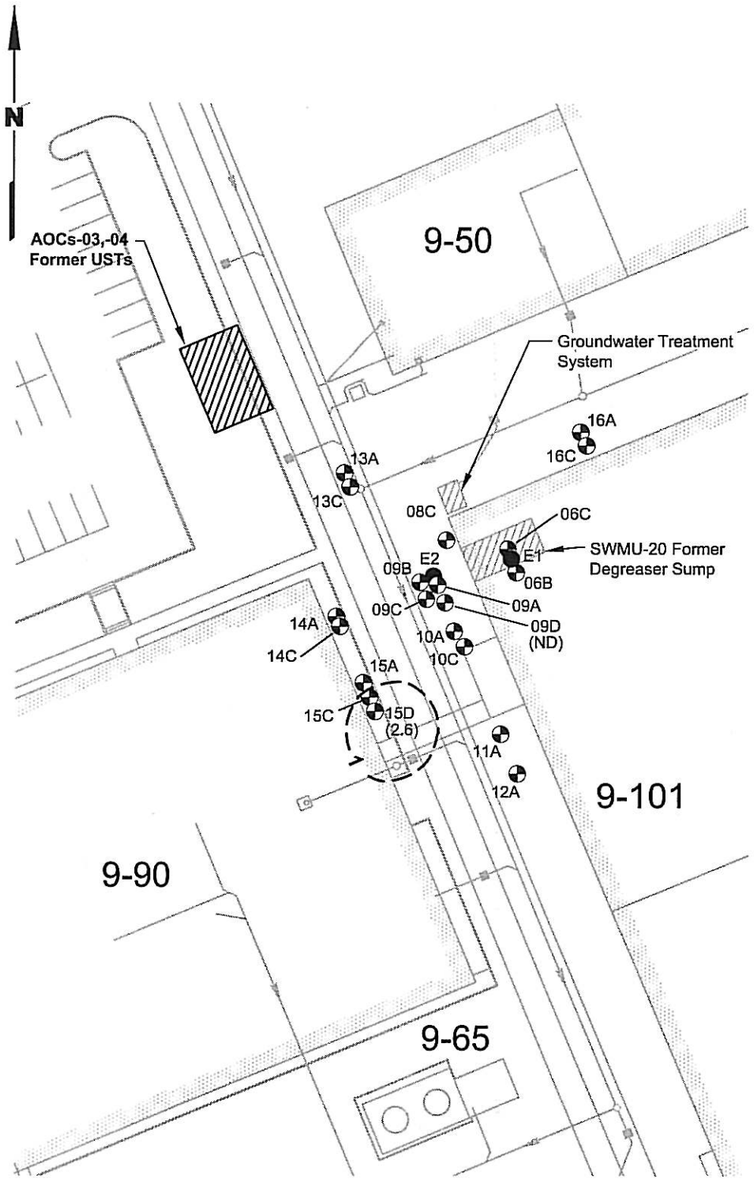
0 60 120
Scale in Feet

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - PCE C Horizon Groundwater**	Figure 1-C

Boeing/Developmental Center | T:\025\009\010\Figs1.dwg (A) "Figure 1-C" 6/11/2001



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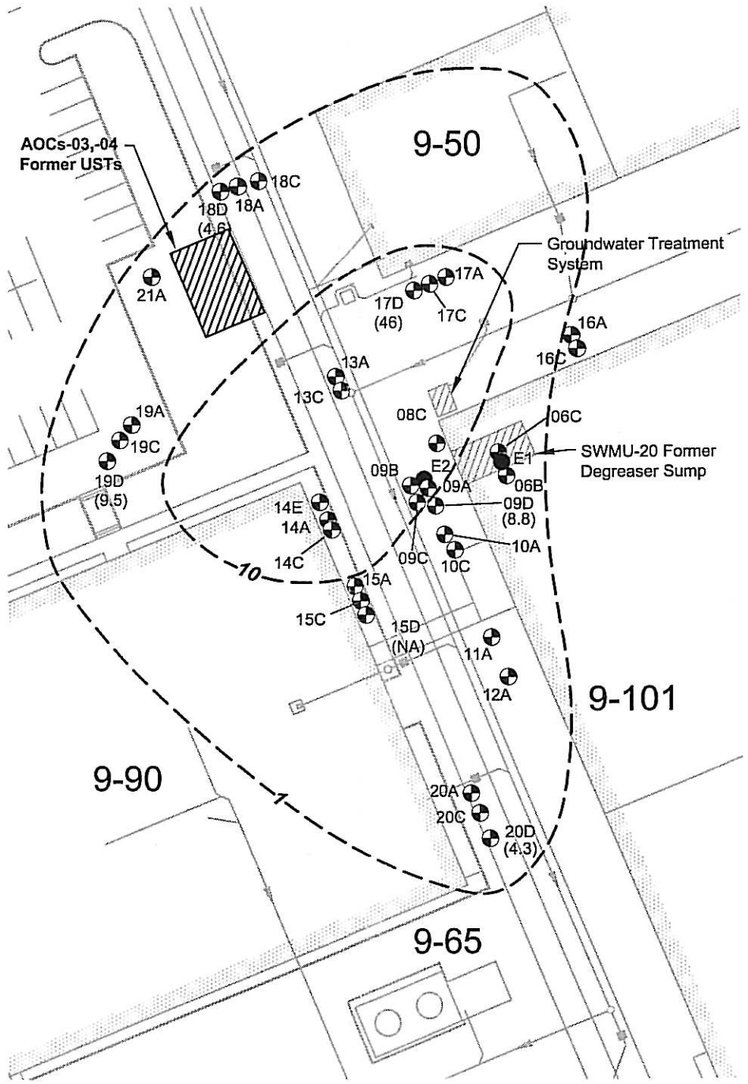
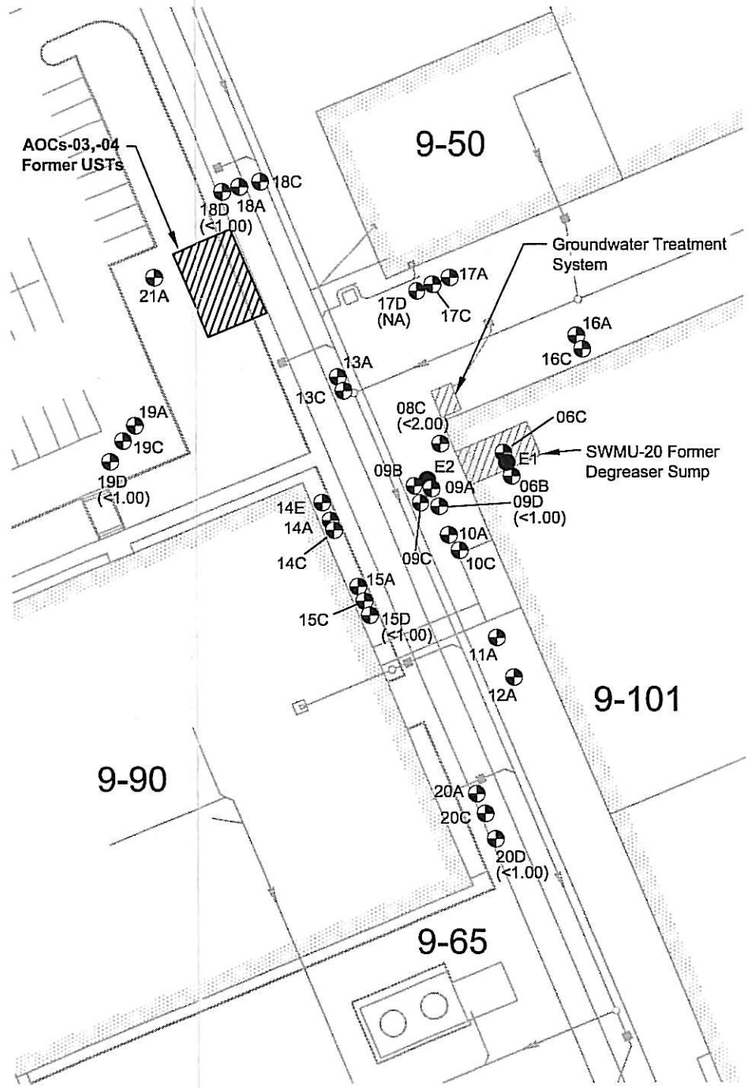


January 1994



December 2000

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported PCE Concentrations (µg/L)
- —10— Estimated PCE Concentration Isopleth (µg/L)

Notes

1. (µg/L) = micrograms per liter.
2. "D" horizon extends from 40.5 to 56.0 ft. below ground surface.
3. ND = not detected

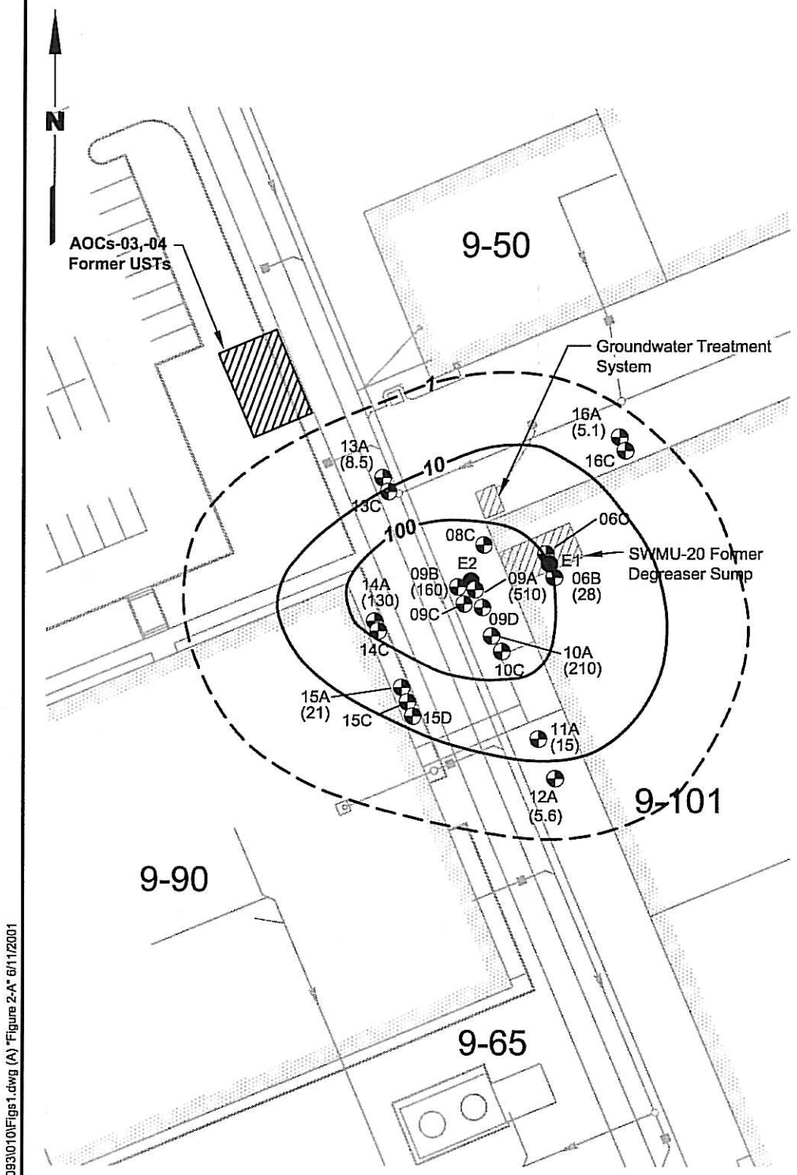
0 60 120
Scale in Feet

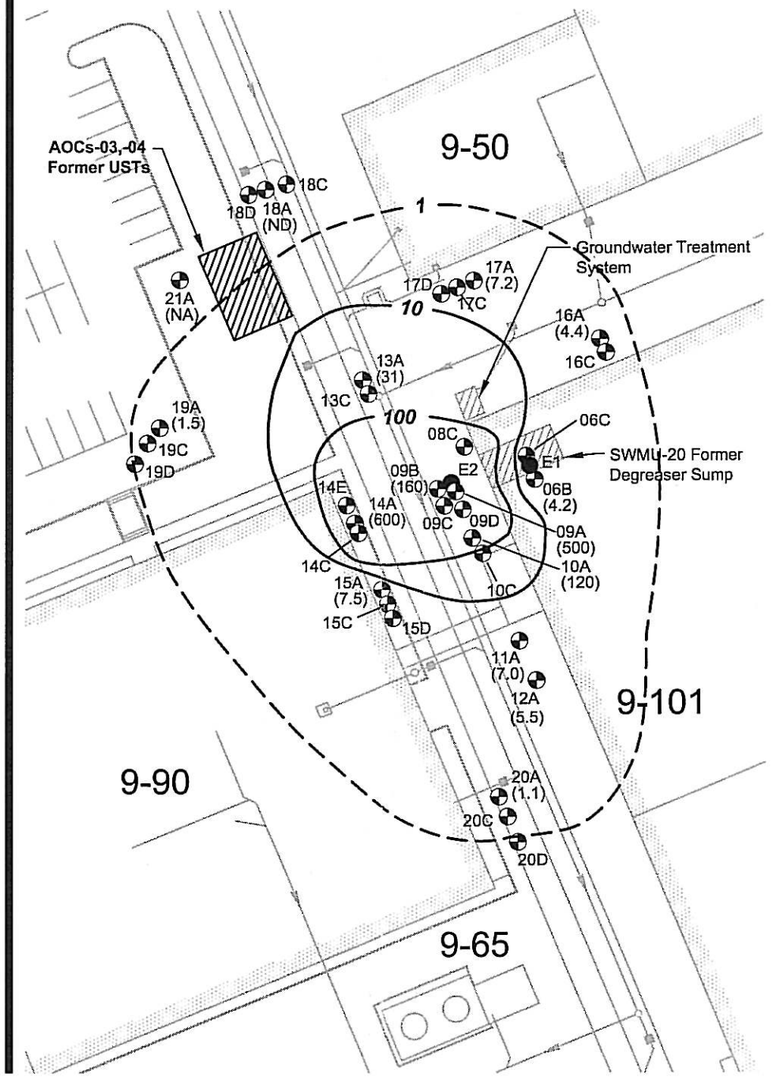
Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

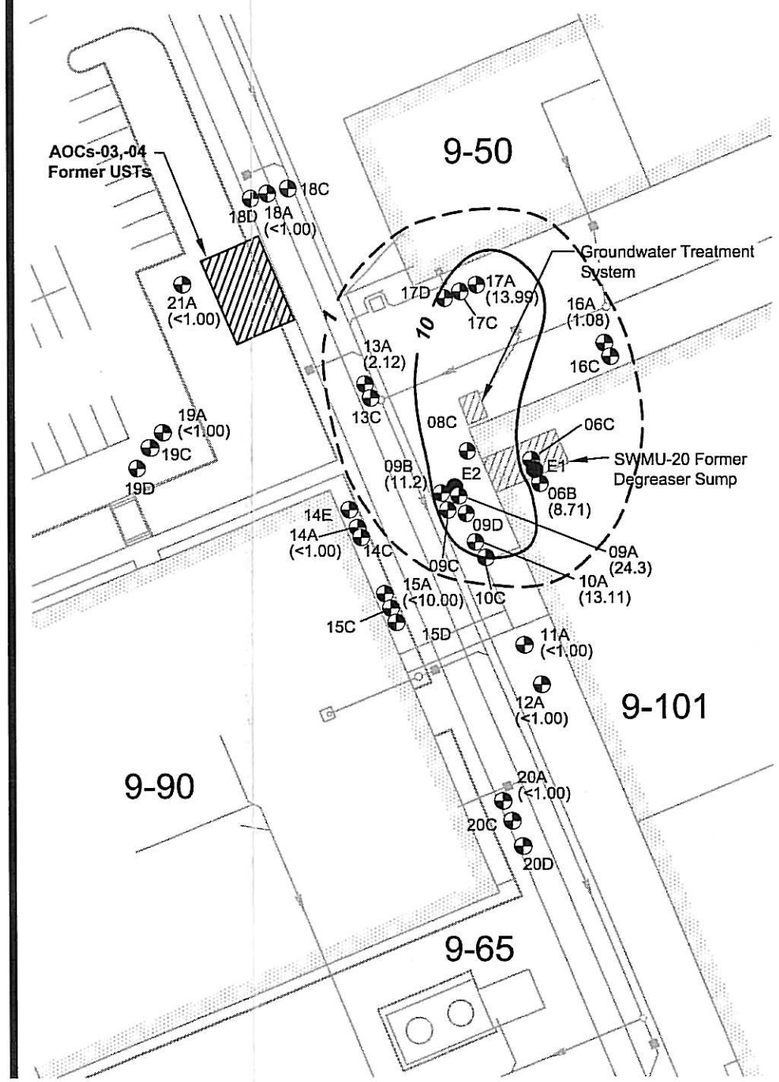
Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - PCE D Horizon Groundwater**	Figure 1-D

Boeing/Developmental Center | T:\025\093\010\Fig\a1.dwg (A) "Figure 1-D" 6/11/2001







August 1989

January 1994

December 2000

Notes

1. (µg/L) = micrograms per liter.
2. "A" horizon extends from 6.5 to 21.5 ft. below ground surface.
3. ND = not detected
4. NA = not analyzed
5. Isopleths are representative of the A Horizon with consideration of the concentration reported in the two B Horizon wells

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported TCE Concentrations (µg/L)
- —10— Estimated TCE Concentration Isopleth (µg/L)

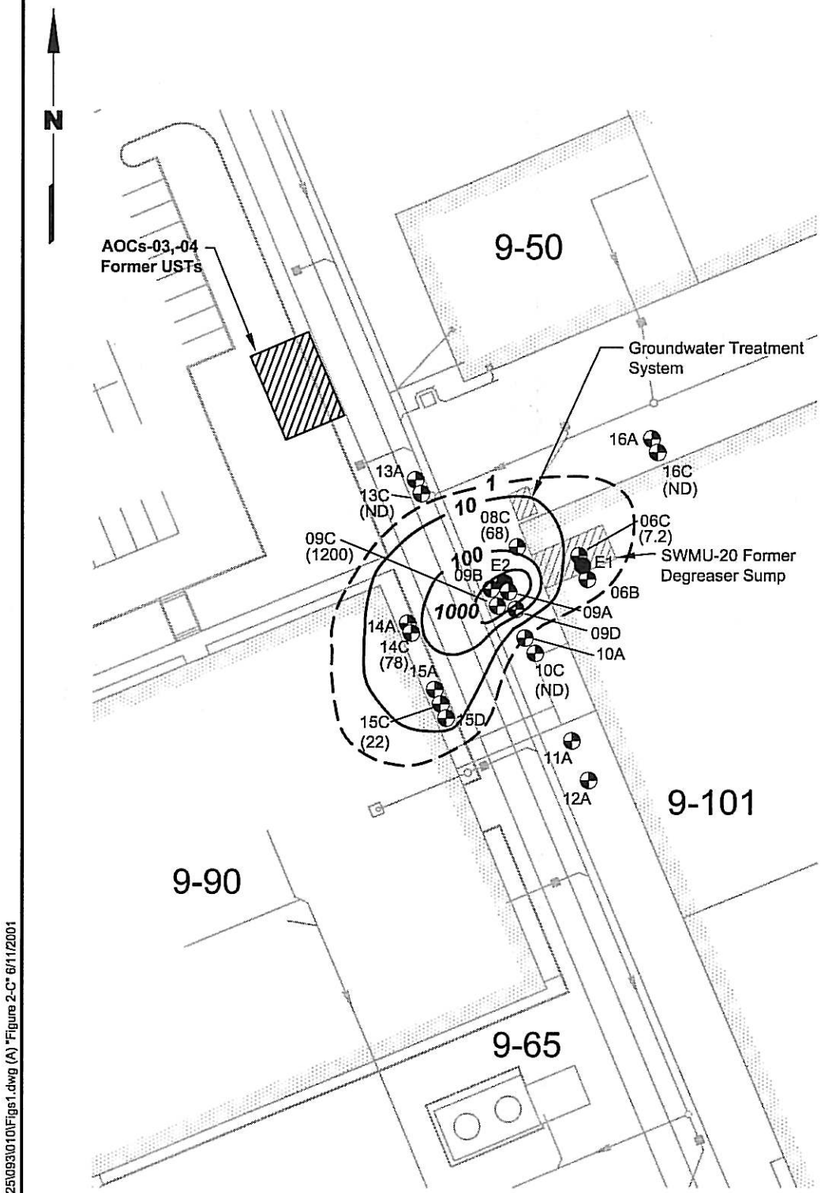
0 60 120
Scale in Feet

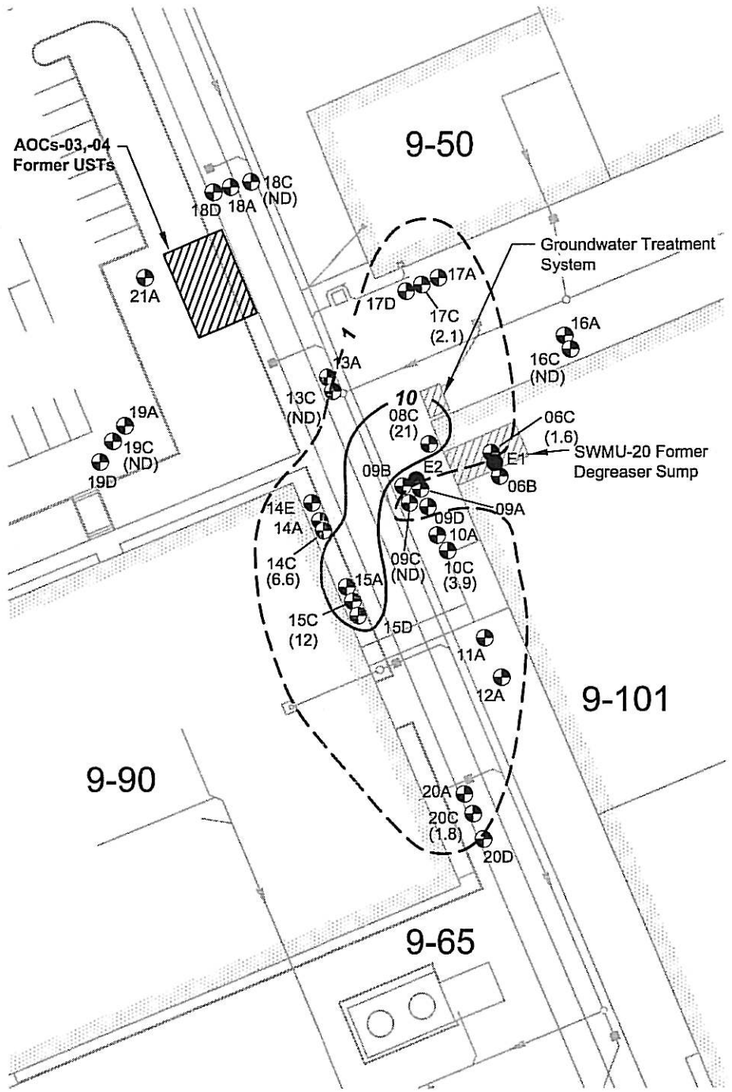
Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

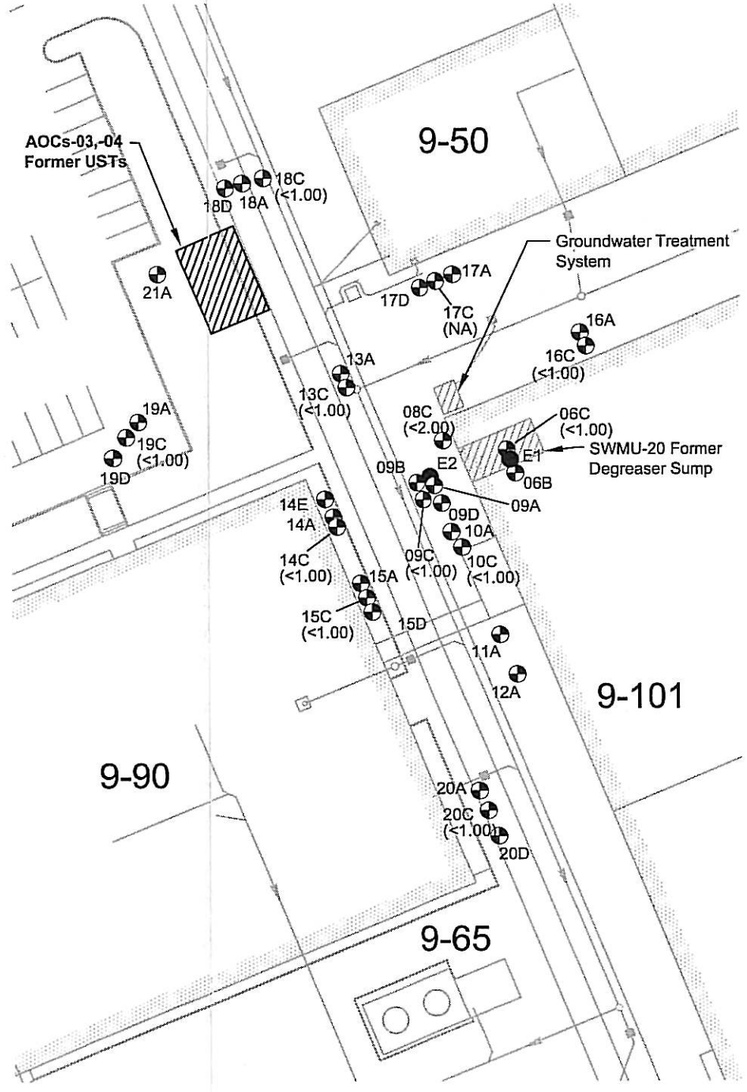
Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - TCE A Horizon Groundwater**	Figure 2-A

Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 2-A" 6/11/2001







August 1989

January 1994

December 2000

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported TCE Concentrations (µg/L)
- —10— Estimated TCE Concentration Isopleth (µg/L)

Notes

1. (µg/L) = micrograms per liter.
2. "C" horizon extends from 23.5 to 40.5 ft. below ground surface.
3. ND = not detected

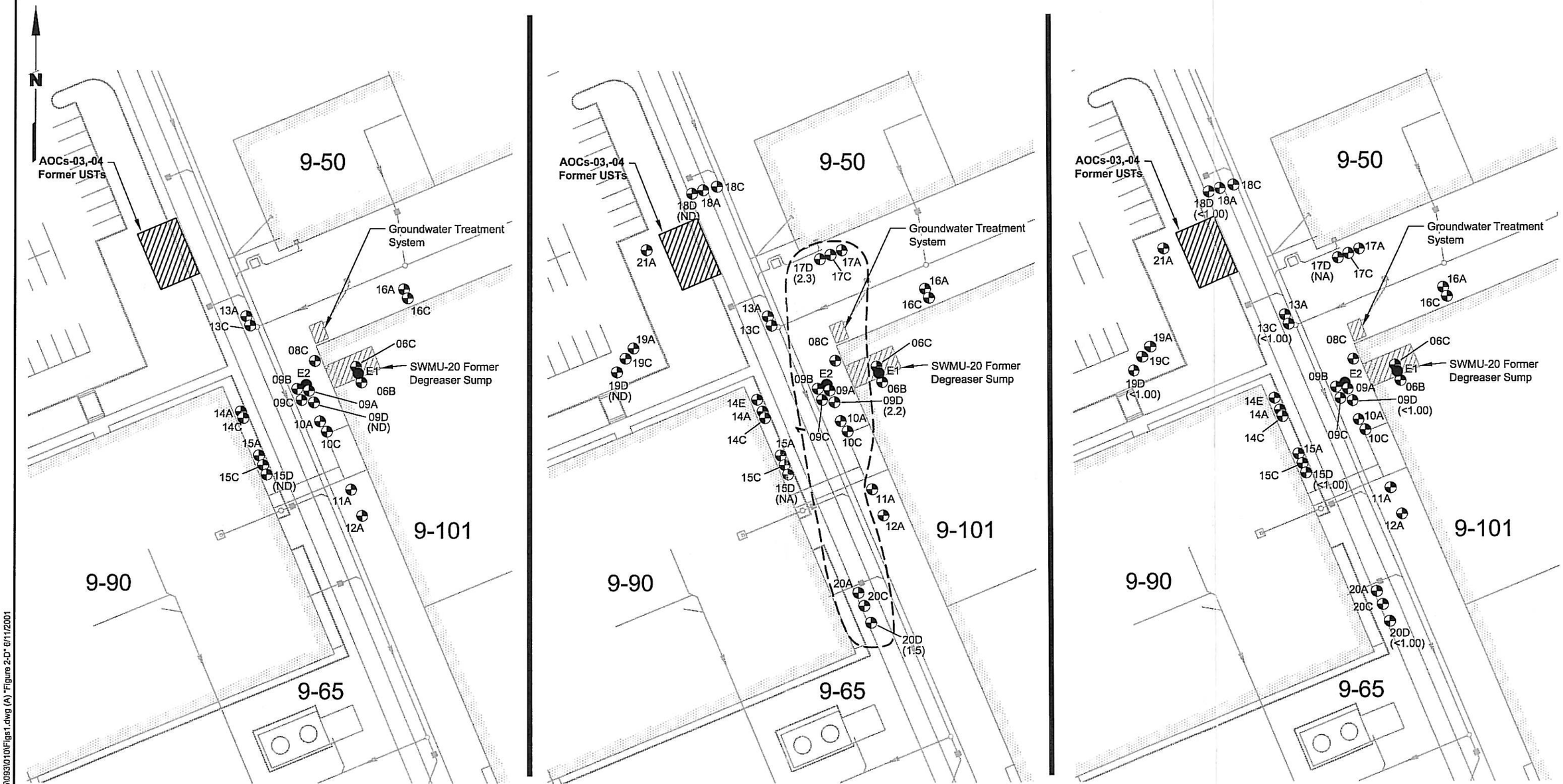
0 60 120
Scale in Feet

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 TCE C Horizon Groundwater**	Figure 2-C

Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 2-C" 6/11/2001

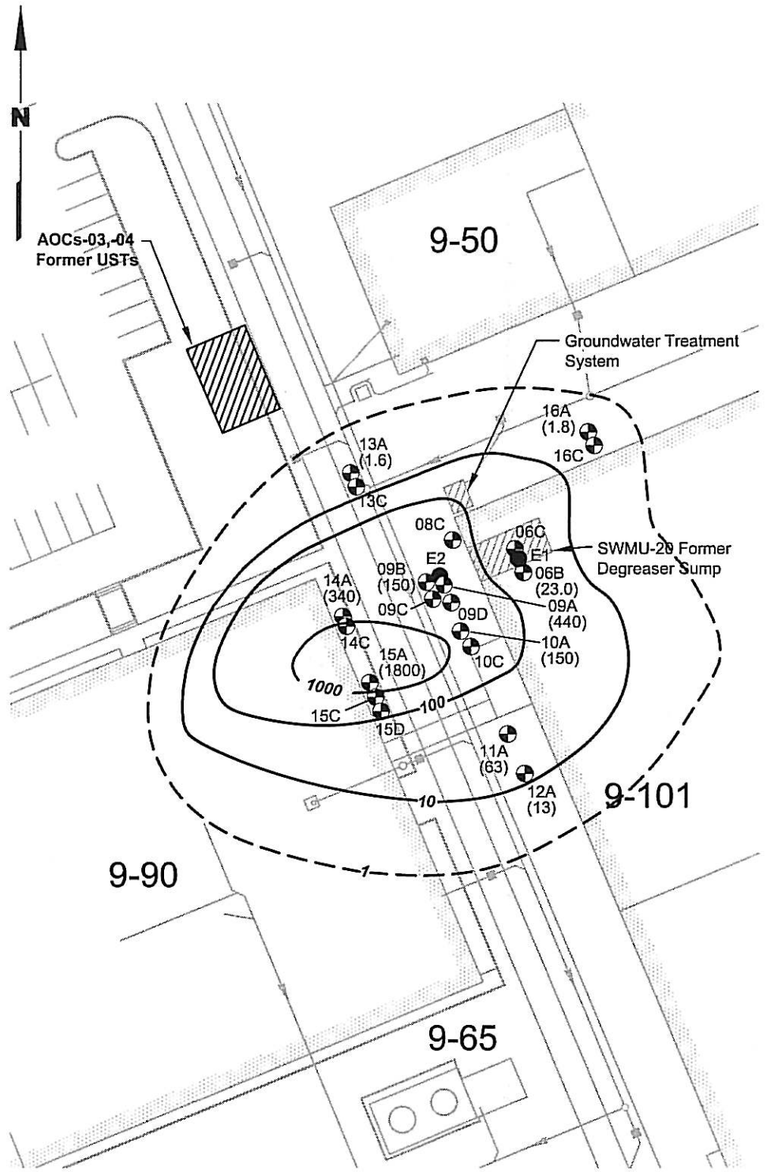


Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 2-D" 6/11/2001

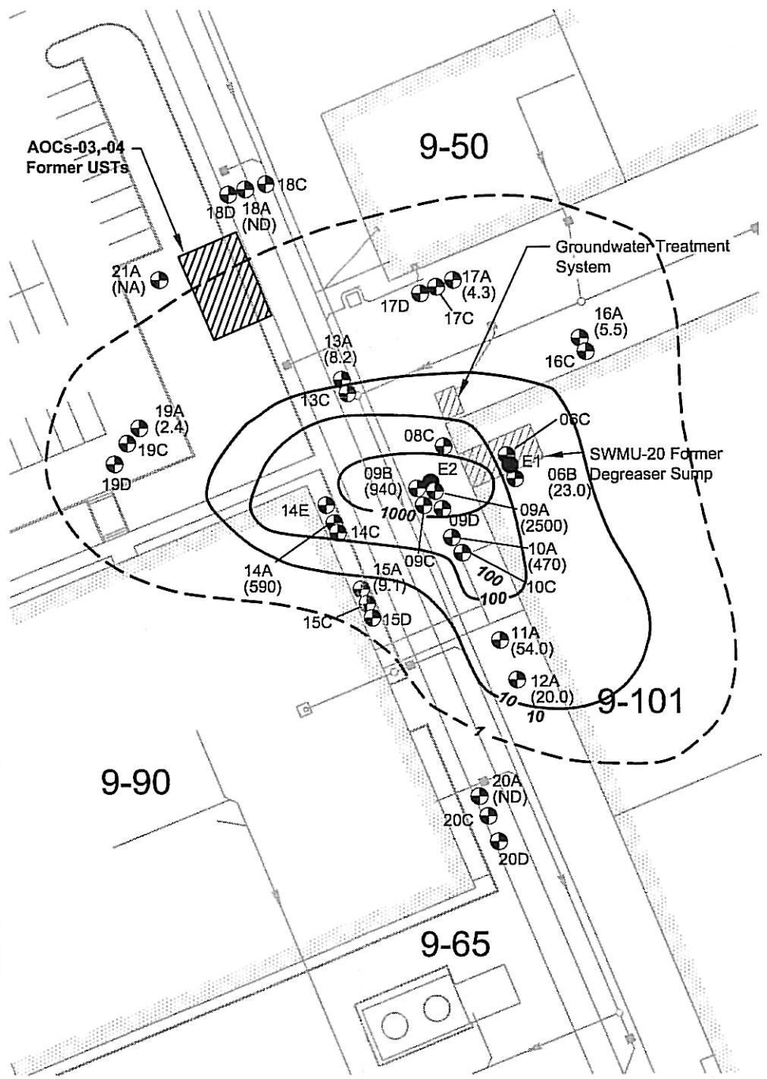
Landau Associates

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - TCE D Horizon Groundwater**	Figure 2-D



August 1989



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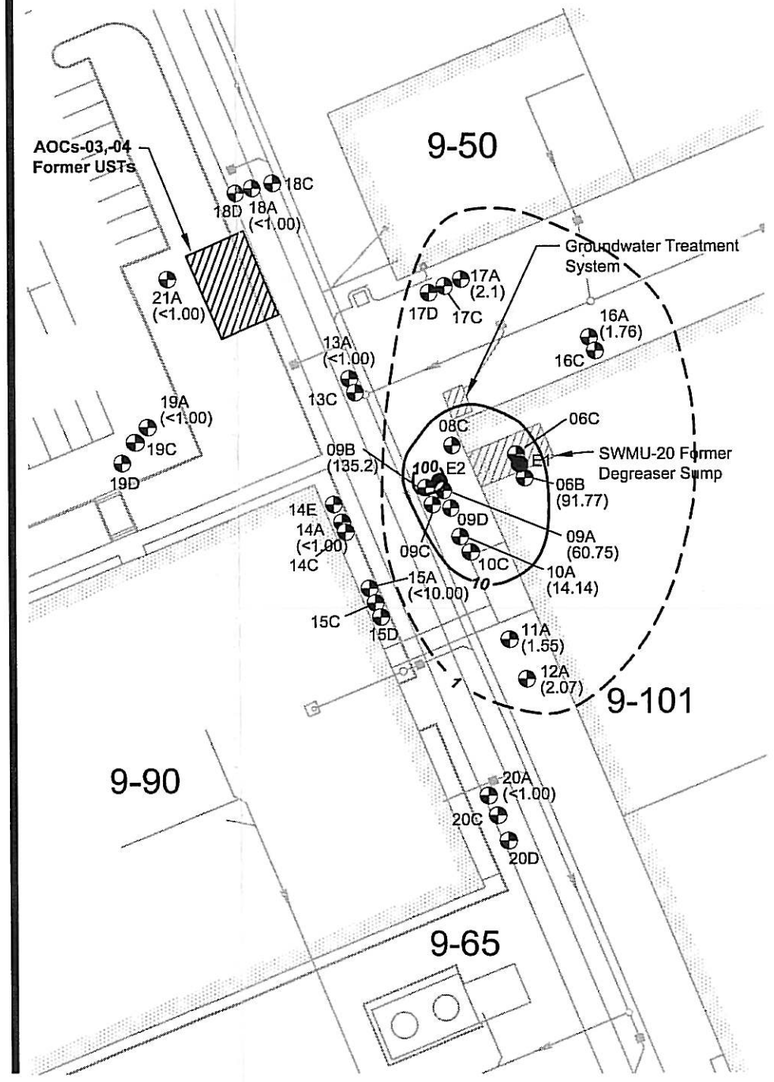


December 2000

Notes

1. (µg/L) = micrograms per liter.
2. "A" horizon extends from 6.5 to 21.5 ft. below ground surface.
3. ND = not detected
4. NA = not analyzed
5. Isopleths are representative of the A Horizon with consideration of the concentration reported in the two B Horizon wells

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported CIS-1,2-DCE Concentrations (µg/L)
- —10— Estimated CIS-1,2-DCE Concentration Isopleth (µg/L)

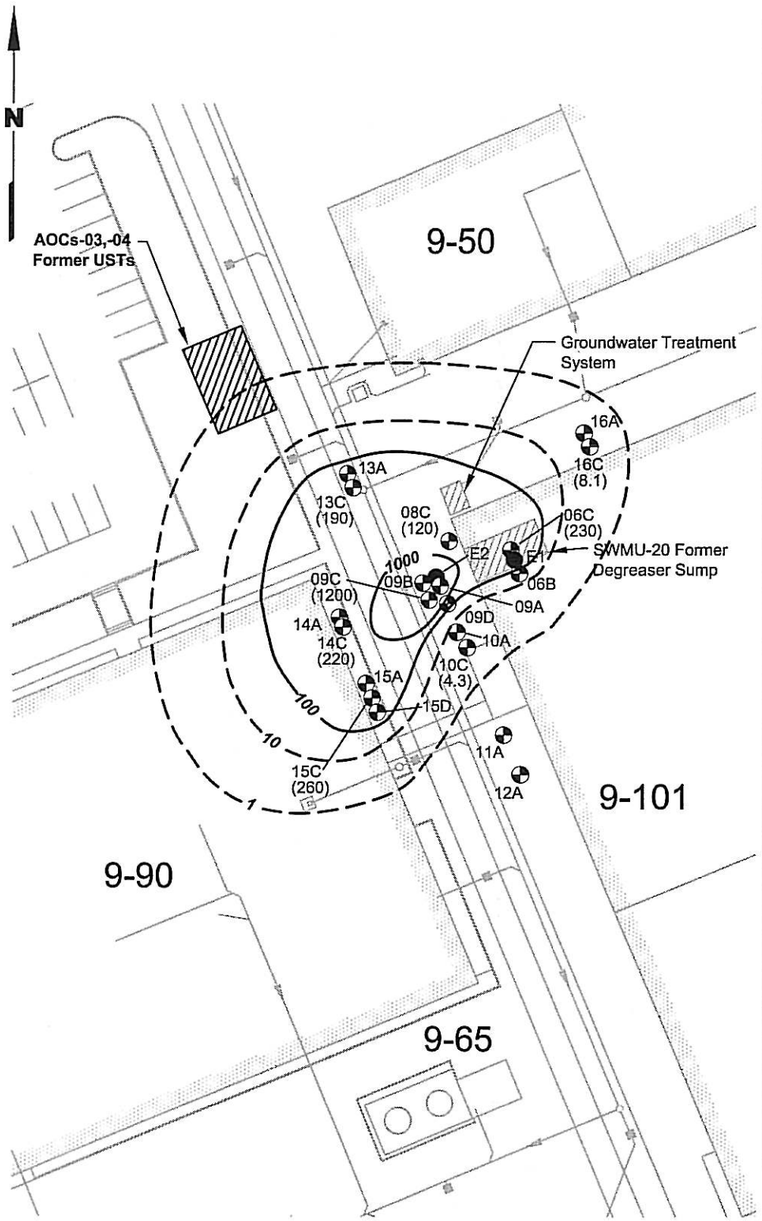
0 60 120
Scale in Feet

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

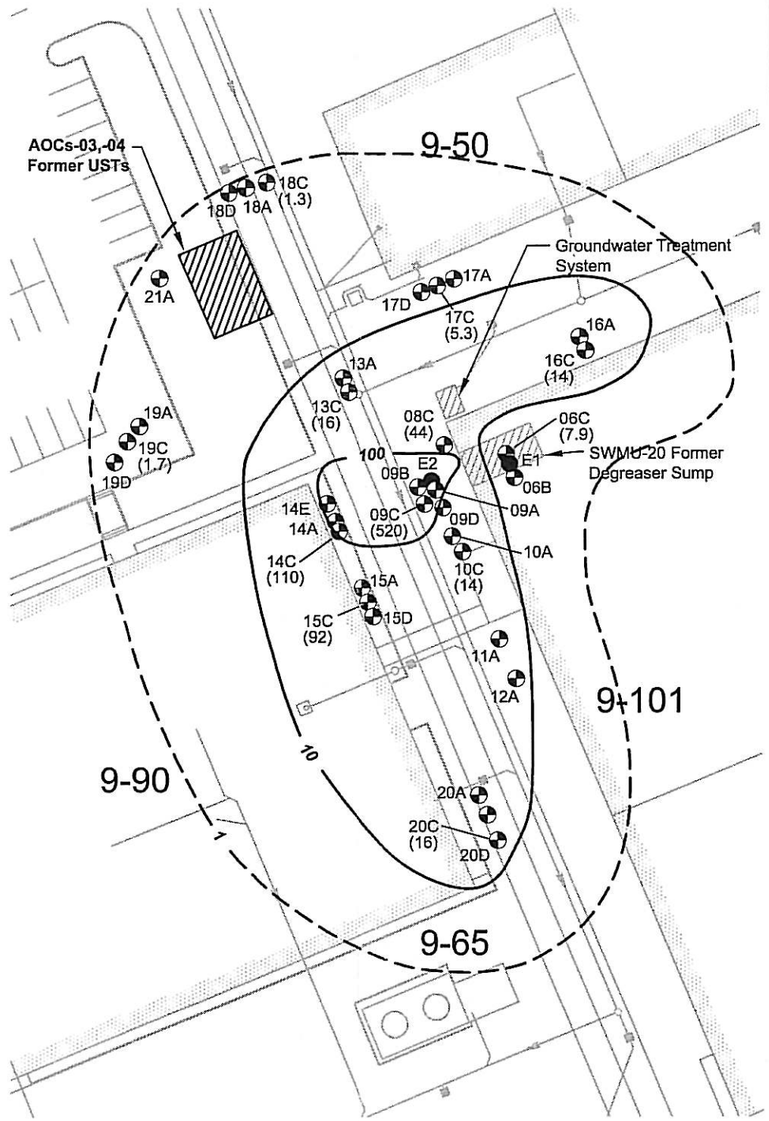
Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - cis-1,2-DCE A Horizon Groundwater**	Figure 3-A

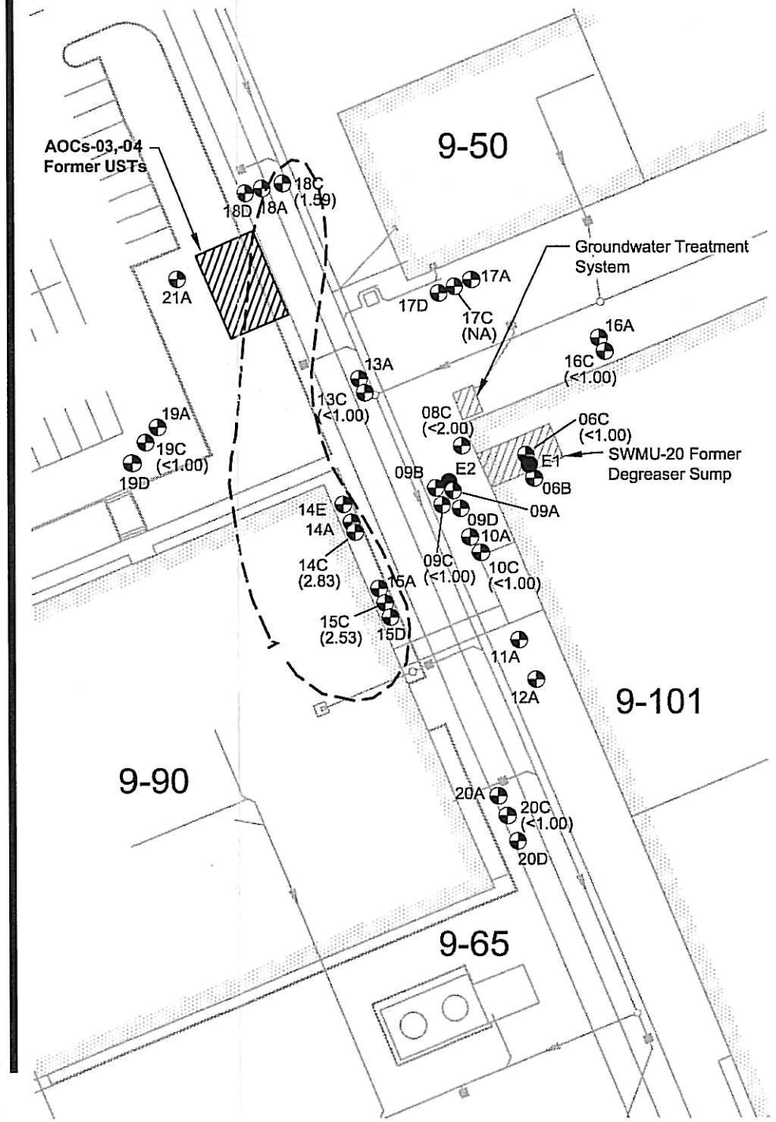
Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 3-A" 6/11/2001



August 1989



January 1994



December 2000

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported CIS-1,2-DCE Concentrations (µg/L)
- —10— Estimated CIS-1,2-DCE Concentration Isopleth (µg/L)

Notes

1. (µg/L) = micrograms per liter.
2. "C" horizon extends from 23.5 to 40.5 ft. below ground surface.
3. ND = not detected

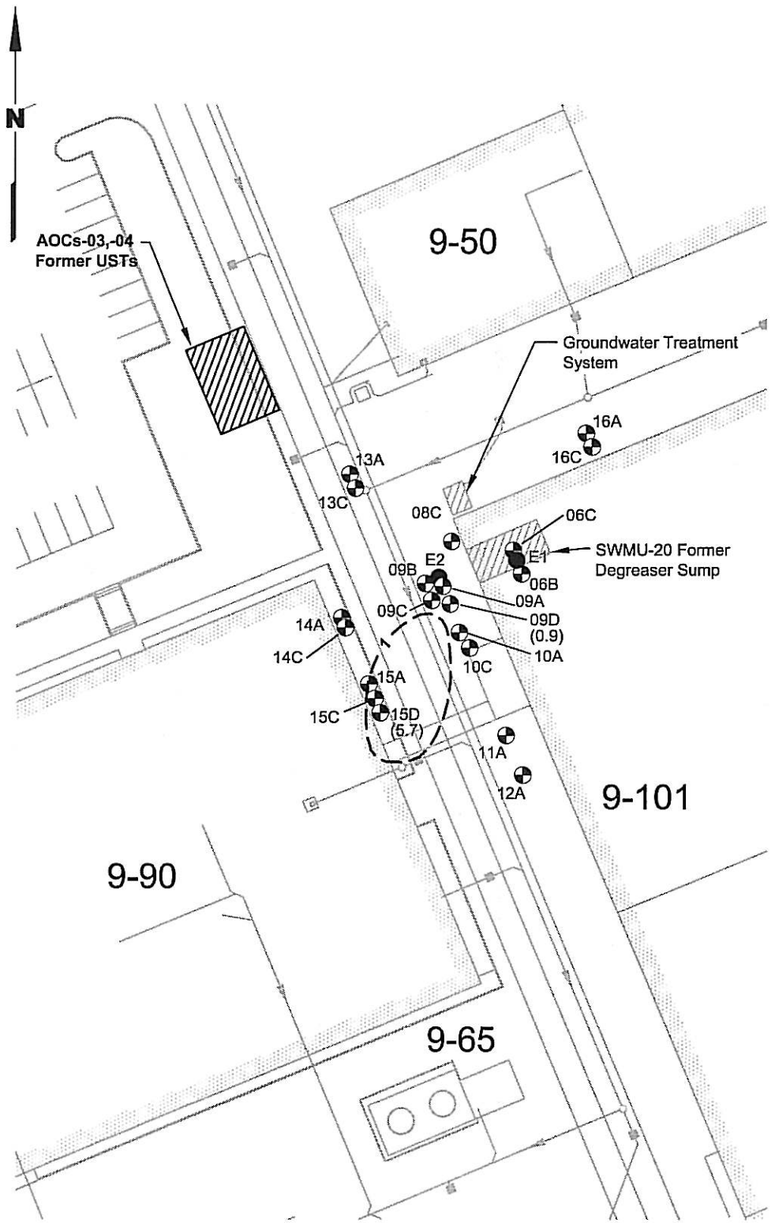
0 60 120
Scale in Feet

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

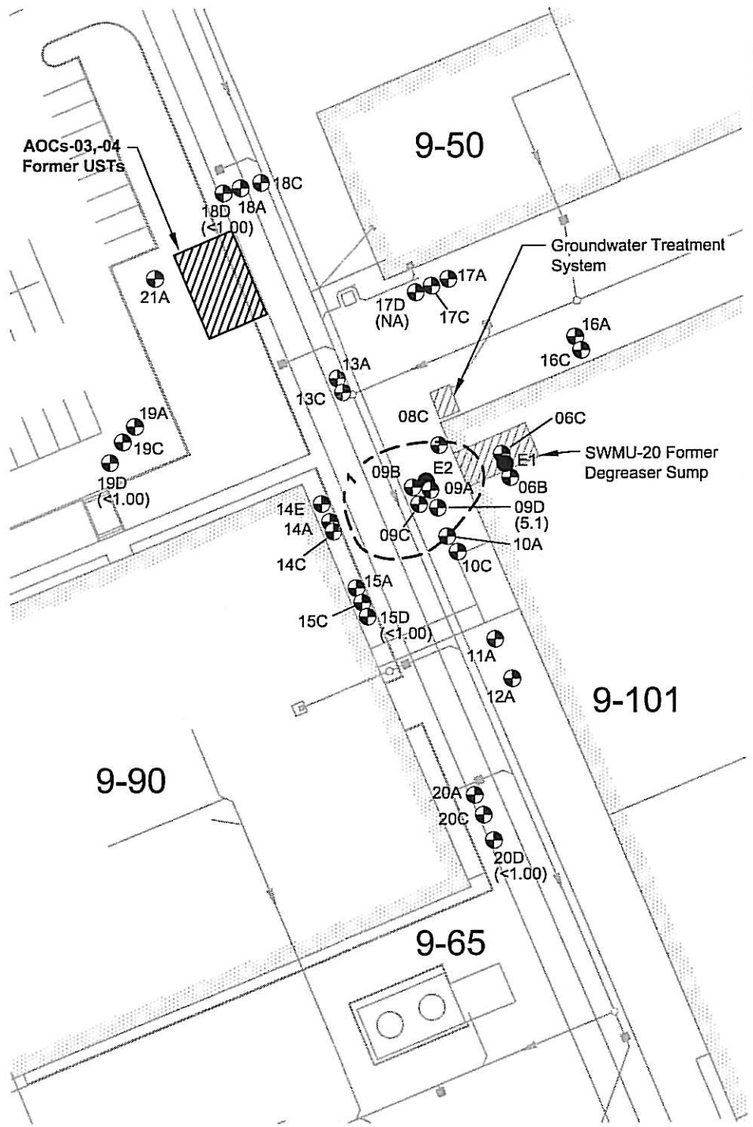
Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - cis-1,2-DCE C Horizon Groundwater**	Figure 3-C

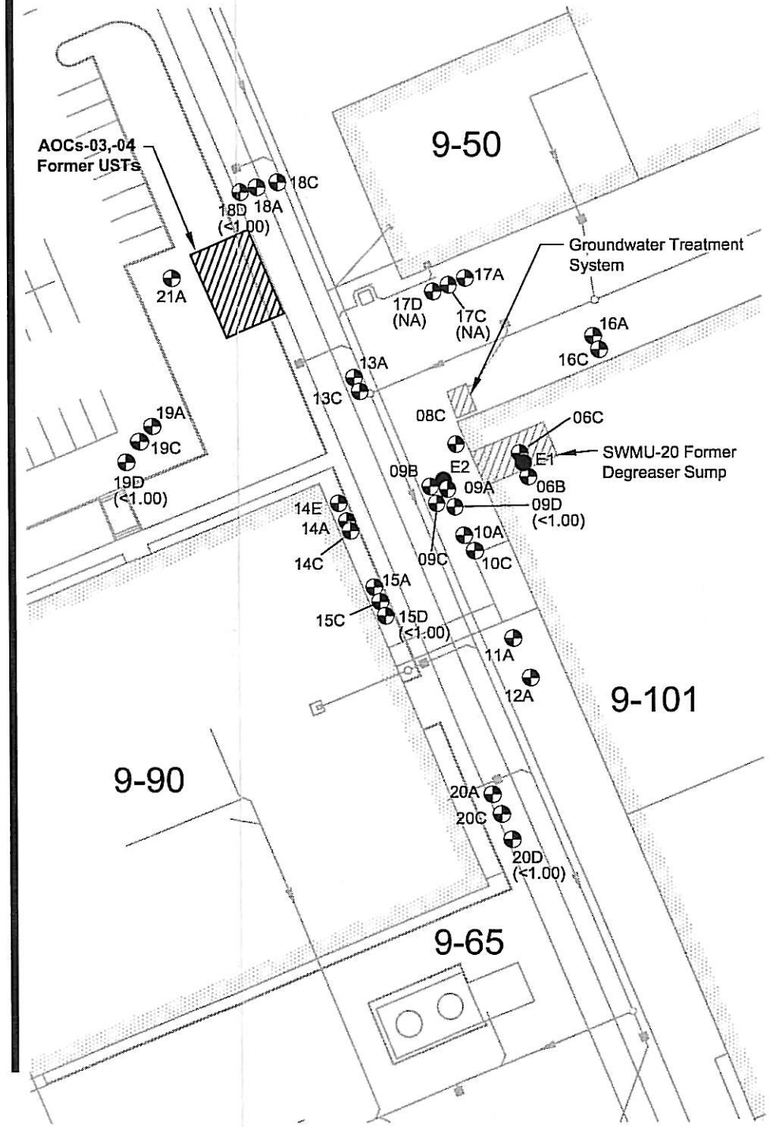
Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 3-C" 6/11/2001



August 1989



January 1994



December 2000

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported CIS-1,2-DCE Concentrations (µg/L)
- —10— Estimated CIS-1,2-DCE Concentration Isopleth (µg/L)

0 60 120
Scale in Feet

Notes

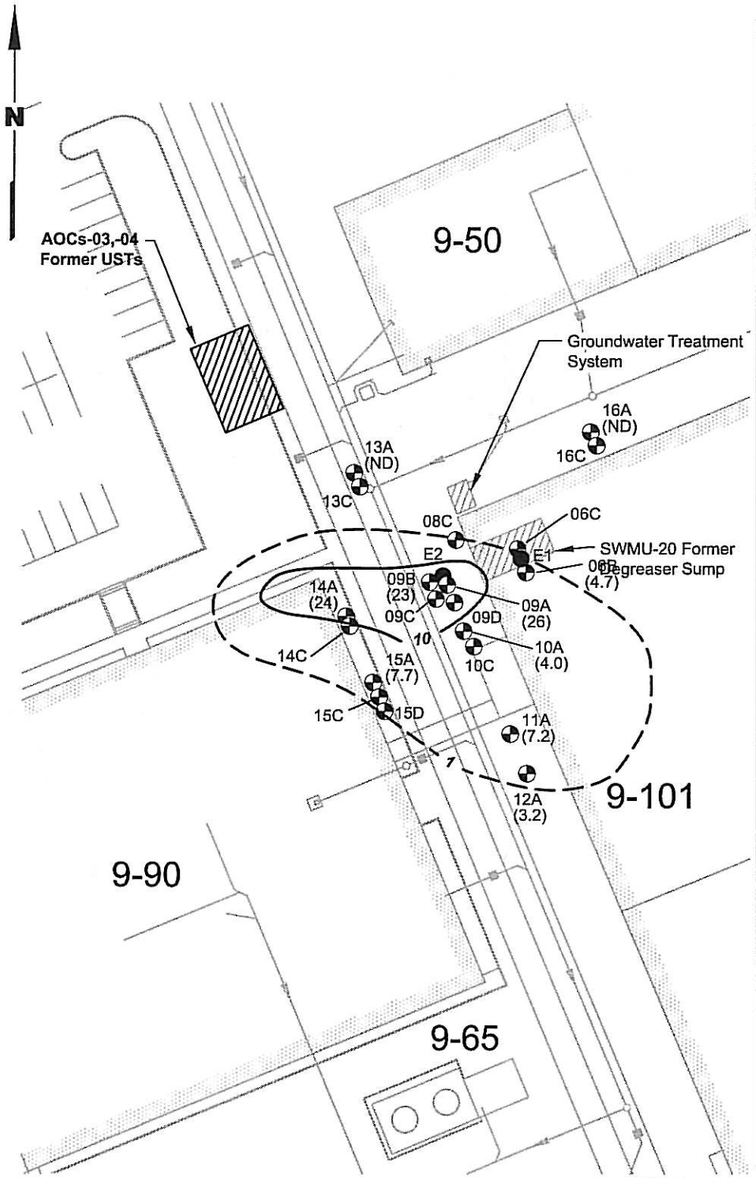
1. (µg/L) = micrograms per liter.
2. "D" horizon extends from 40.0 to 56.0 ft. below ground surface.
3. ND = not detected
4. NA = not analyzed

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

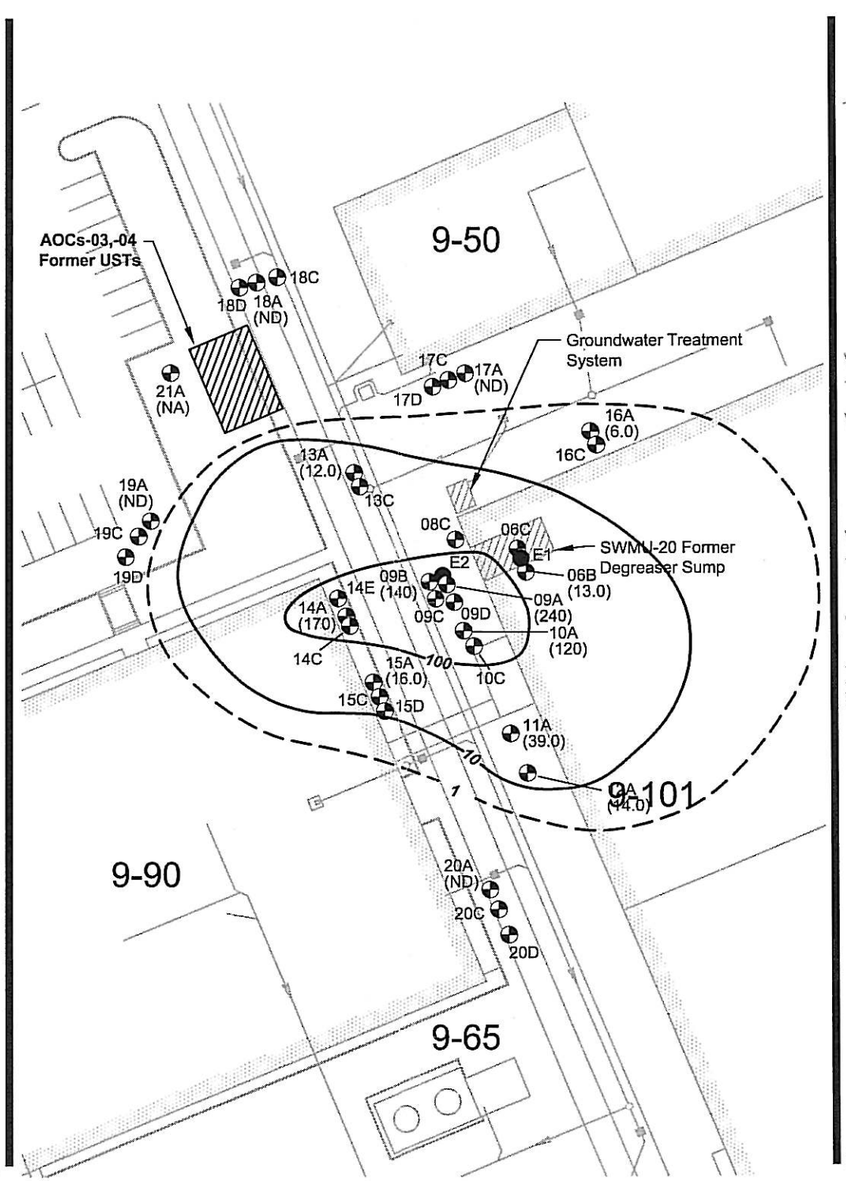
Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - cis-1,2-DCE D Horizon Groundwater**	Figure 3-D

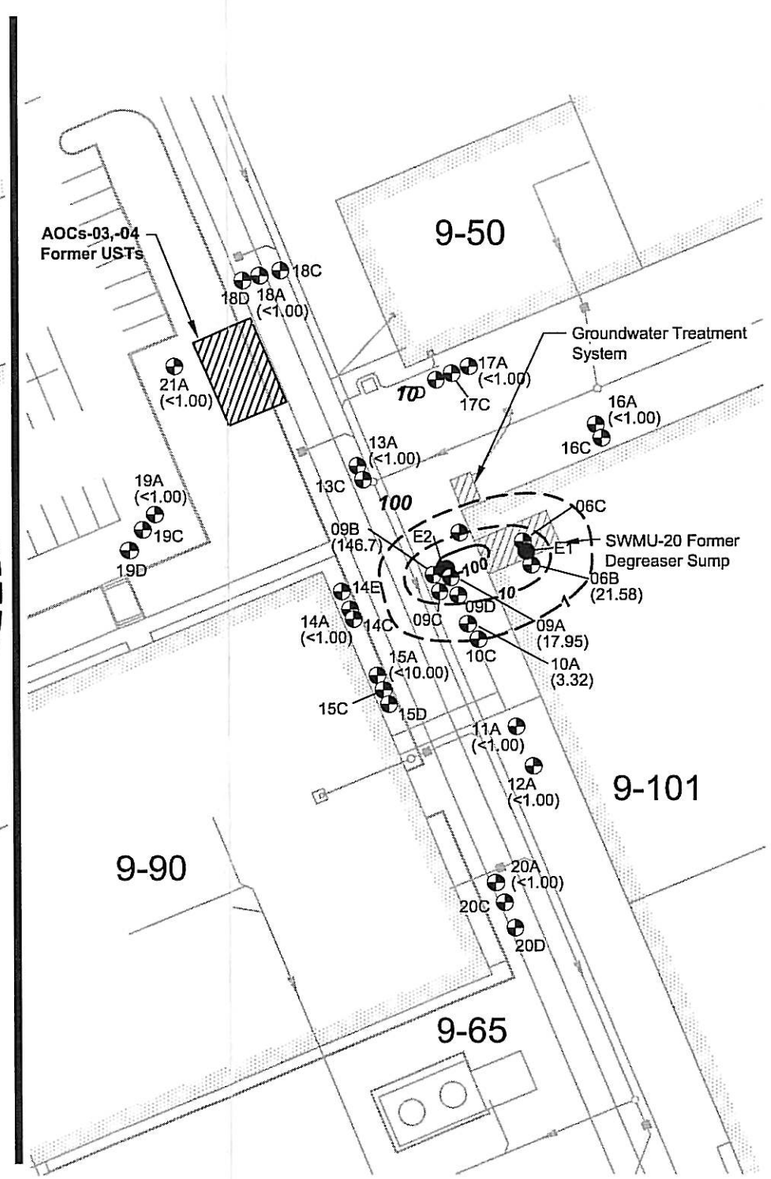
Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 3-D" 6/11/2001



August 1989



January 1994



December 2000

Notes

1. (µg/L) = micrograms per liter.
2. "A" horizon extends from 6.5 to 21.5 ft. below ground surface.
3. "B" horizon extends from 22.0 to 27.0 ft. below ground surface.
4. ND = not detected
5. NA = not analyzed
6. Isopleths are representative of the A Horizon with consideration of the concentration reported in the two B Horizon wells

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported Vinyl Chloride Concentrations (µg/L)
- —10— Estimated Vinyl Chloride Concentration Isopleth (µg/L)

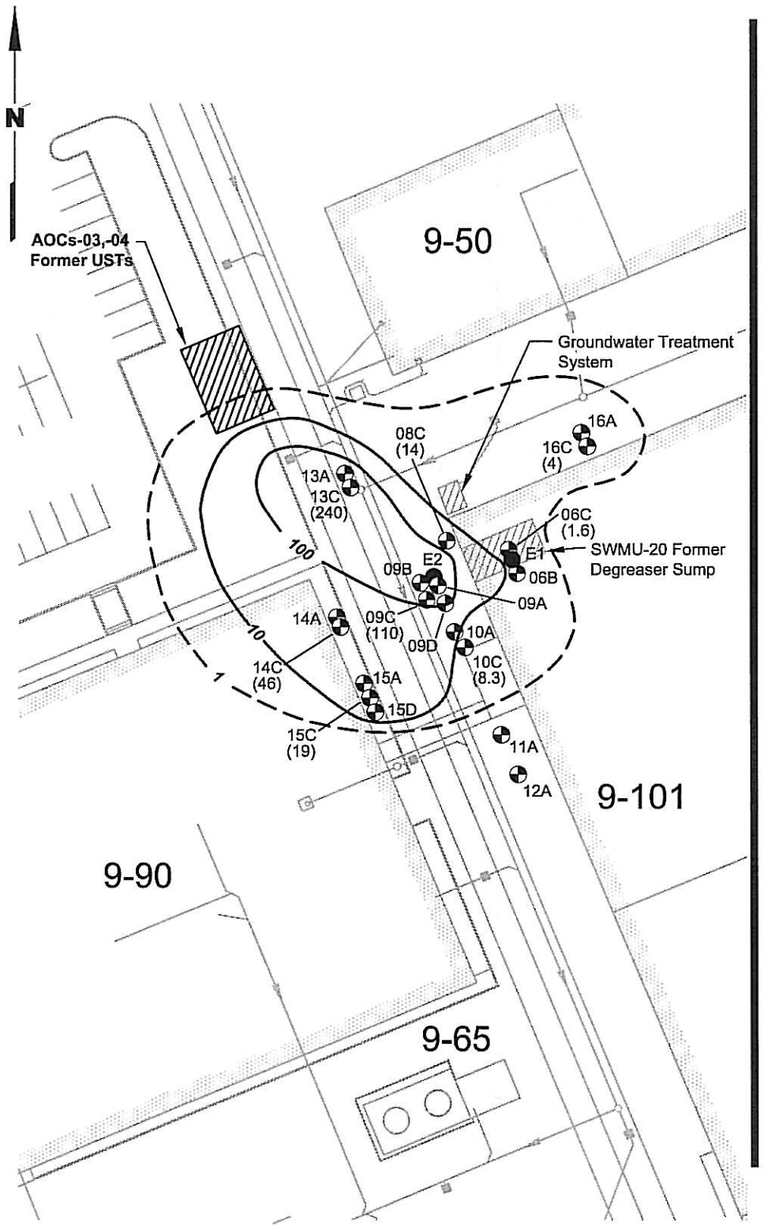
0 60 120
Scale in Feet

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

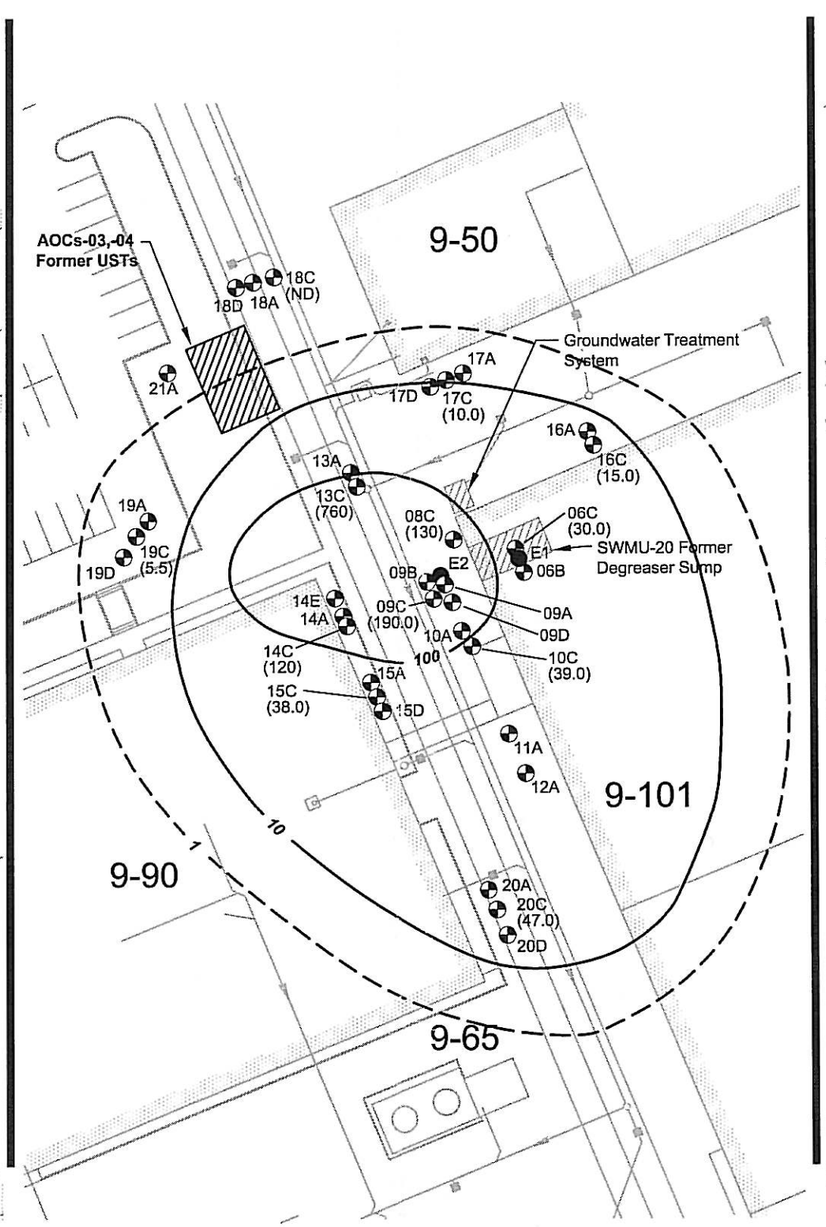
Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - Vinyl Chloride A Horizon Groundwater**	Figure 4-A

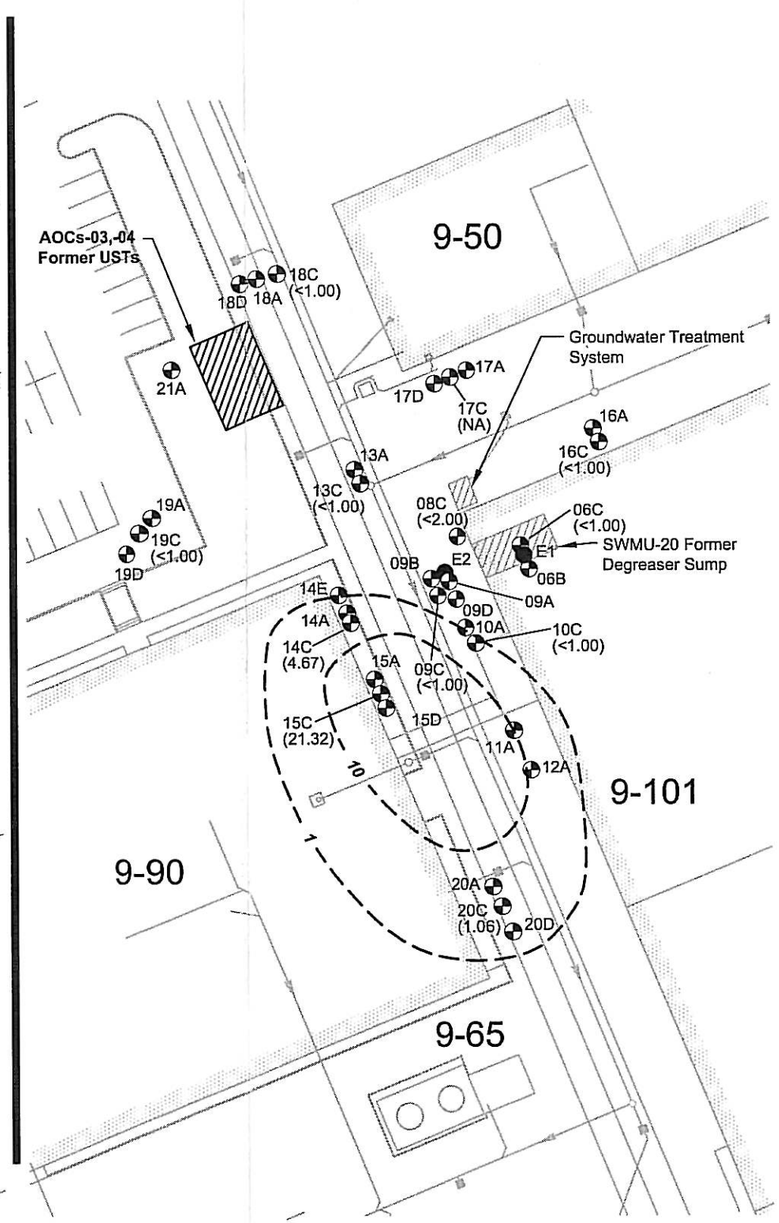
Boeing/Developmental Center | T:\0225\093\010\Figs1.dwg (A) "Figure 4-A" 6/11/2001



August 1989



January 1994



December 2000

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported Vinyl Chloride Concentrations (µg/L)
- —10— Estimated Vinyl Chloride Concentration Isopleth (µg/L)

Notes

1. (µg/L) = micrograms per liter.
2. "C" horizon extends from 23.5 to 40.5 ft. below ground surface.
3. ND = not detected

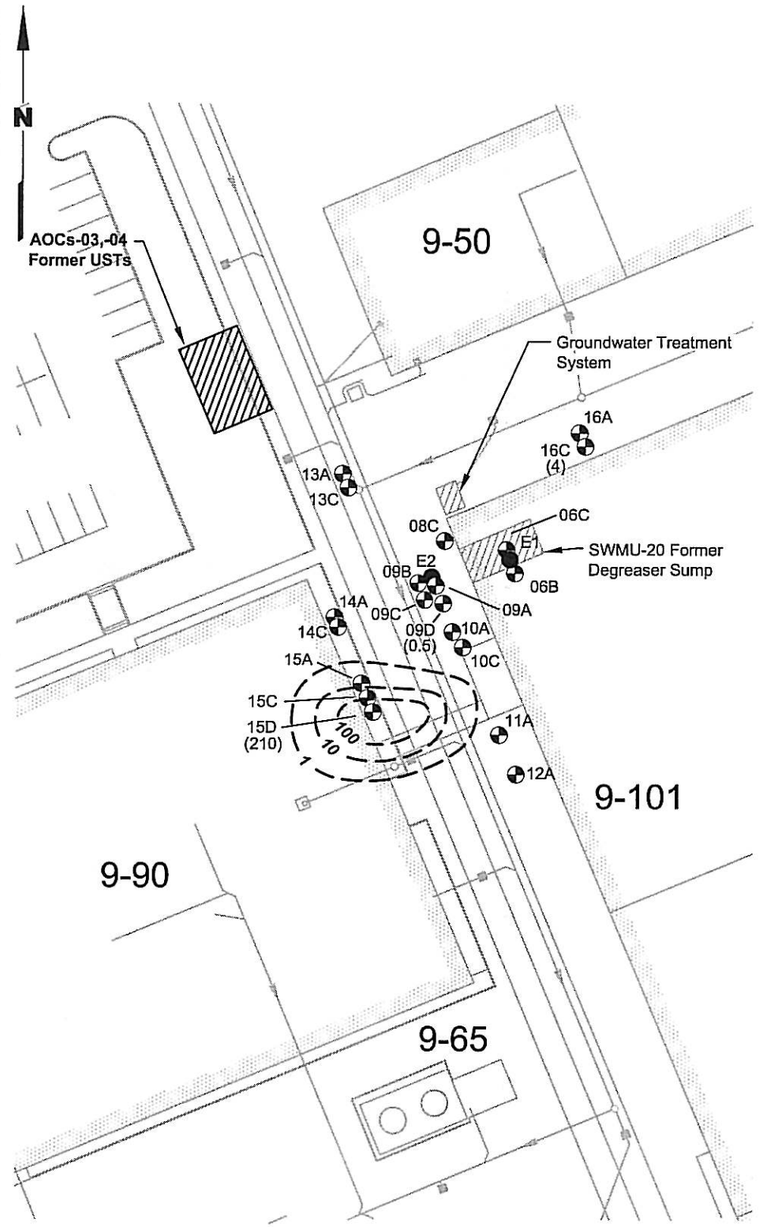
0 60 120
Scale in Feet

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

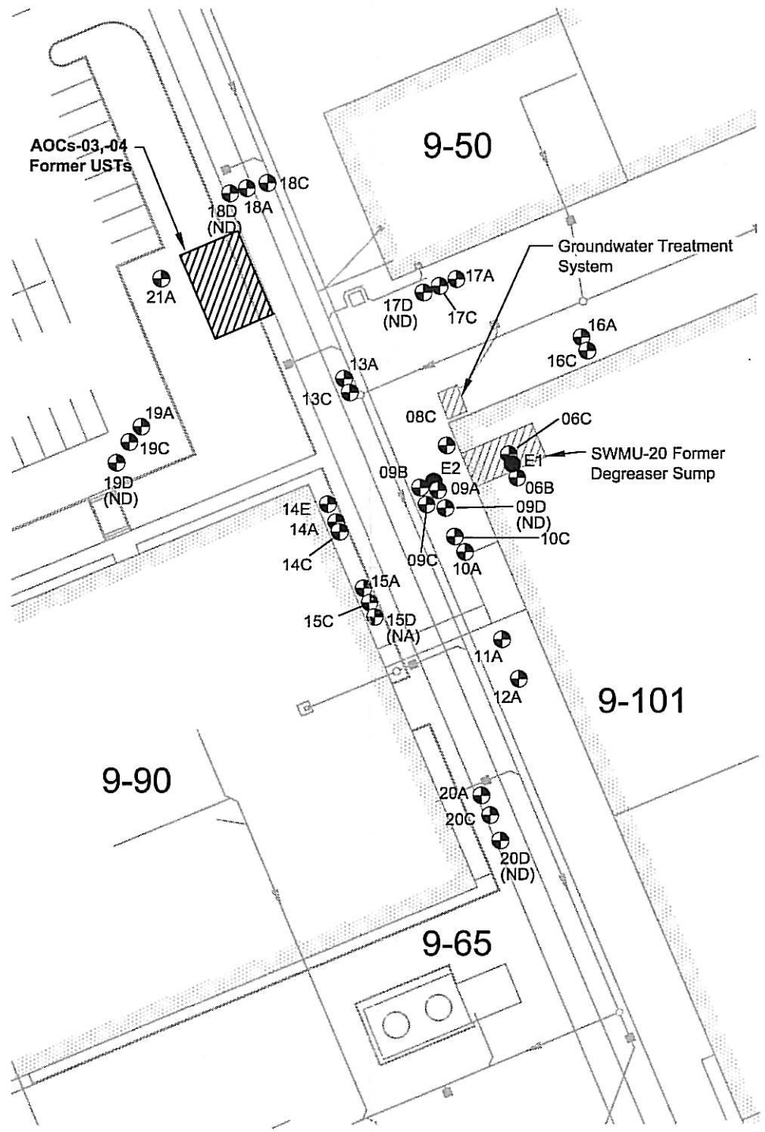
Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - Vinyl Chloride C Horizon Groundwater**	Figure 4-C

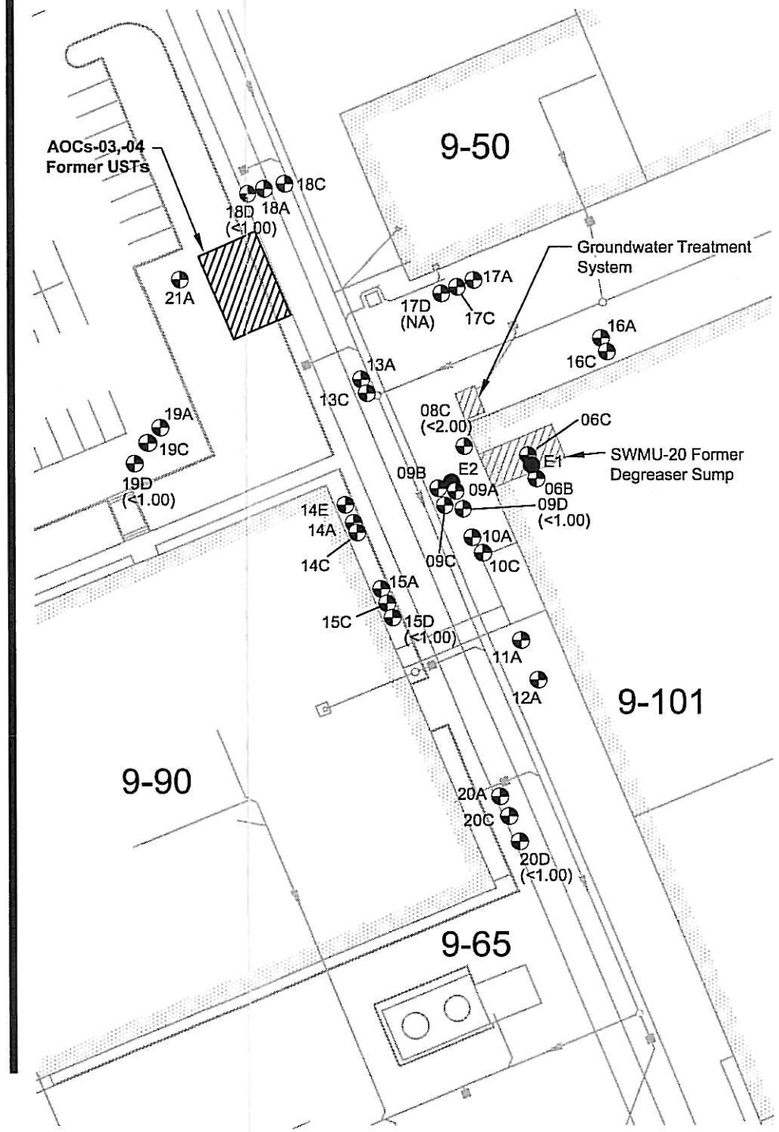
Boeing/Developmental Center I T:\025\093\010\Figs1.dwg (A) *Figure 4-C* 6/11/2001



August 1989



January 1994



December 2000

Legend

- Monitoring Well Locations
- Groundwater Extraction Well Locations
- (1.06) Reported Vinyl Chloride Concentrations (µg/L)
- —10— Estimated Vinyl Chloride Concentration Isopleth (µg/L)

Notes

1. (µg/L) = micrograms per liter.
2. "D" horizon extends from 40.5 to 56.0 ft. below ground surface.
3. ND = not detected
4. NA = not analyzed

0 60 120
Scale in Feet

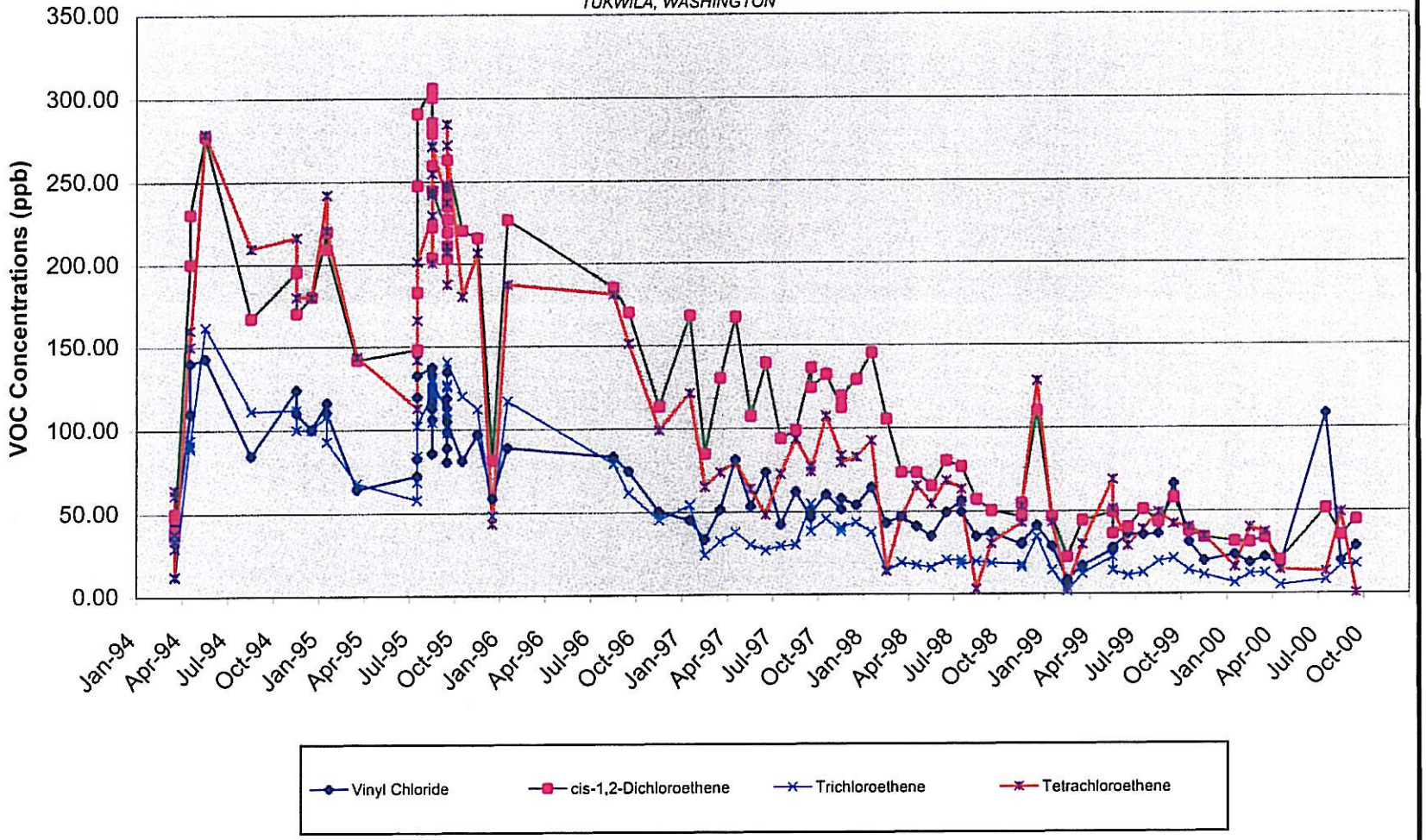
Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**August 1989, January 1994, and December 2000 - Vinyl Chloride D Horizon Groundwater**	Figure 4-D

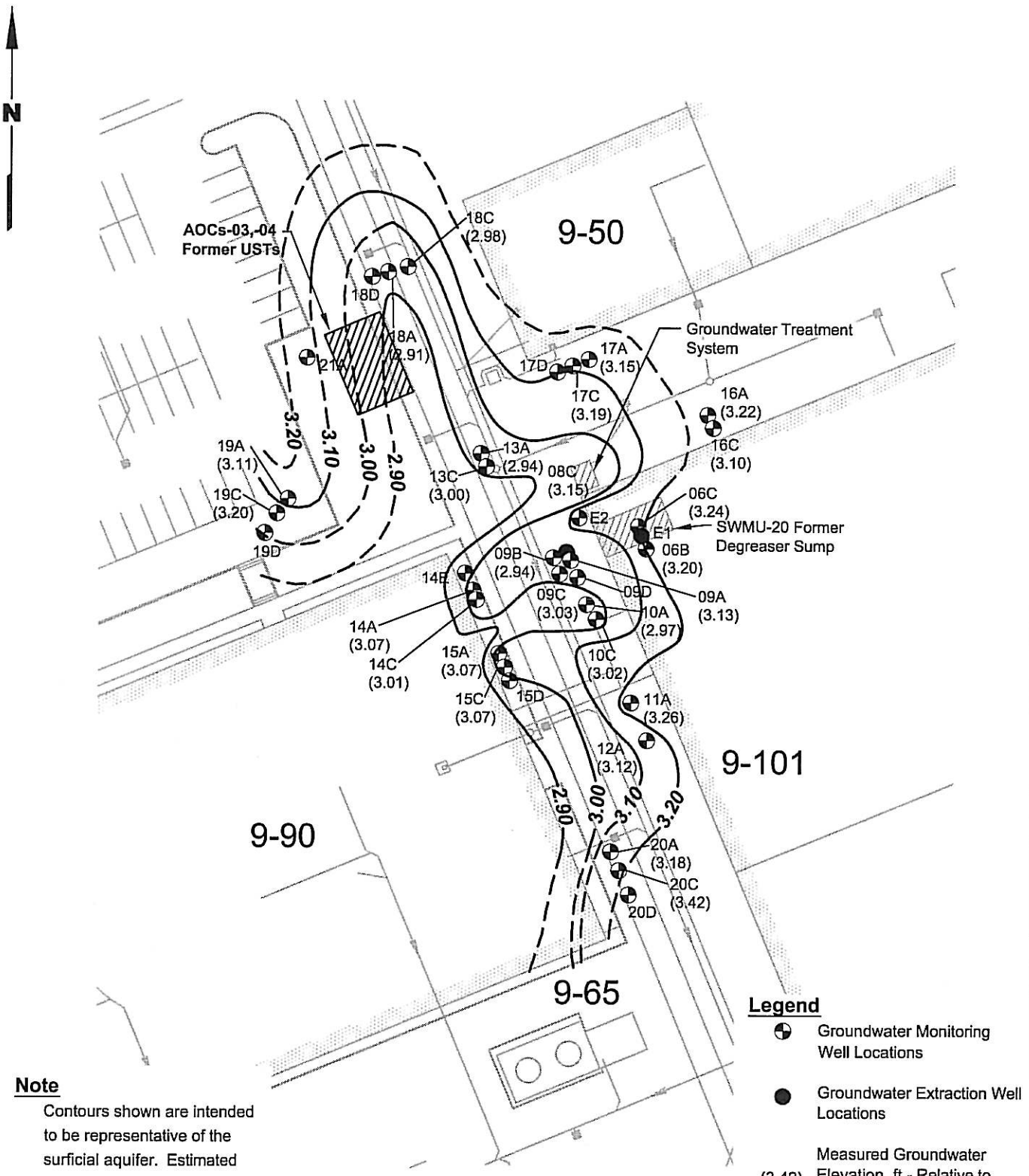
Boeing/Developmental Center I T:\025\093\010\Figs1.dwg (A) "Figure 4-D" 6/11/2001

FIGURE 8
VOC INLET CONCENTRATIONS MARCH 1996 - SEPTEMBER 2000
BOEING DEVELOPMENTAL CENTER SWMU 20
PUMP AND TREAT SYSTEM EVALUATION
TUKWILA, WASHINGTON



Landau Associates

Boeing Developmental Center Tukwila, Washington	**VOC Inlet Concentrations**	Figure 8



Note

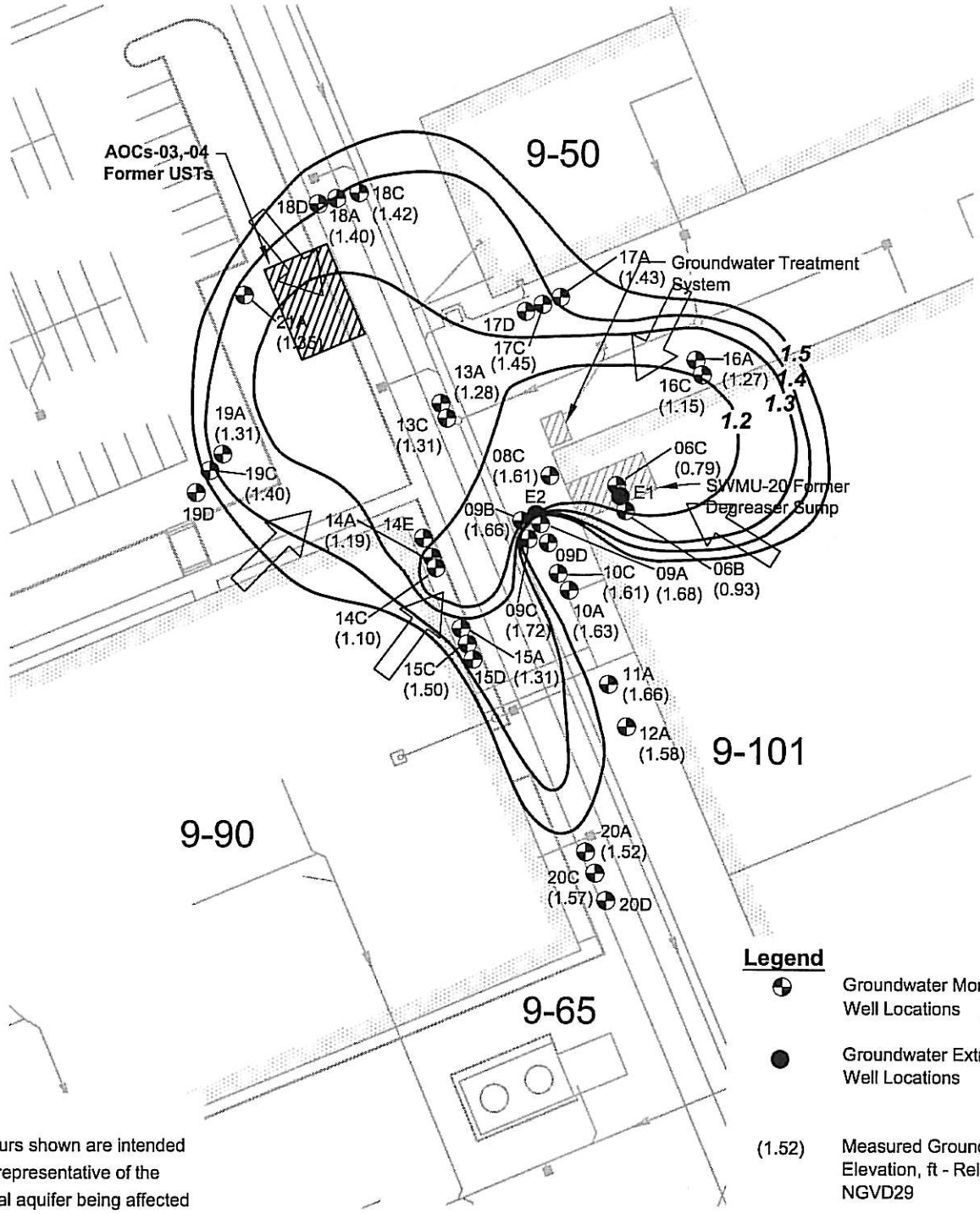
Contours shown are intended to be representative of the surficial aquifer. Estimated contour locations are weighted toward data collected in "A Horizon" wells.

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 5" 6/11/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Groundwater Potentiometric Map Non-Pumping Scenario**	Figure 5



Note

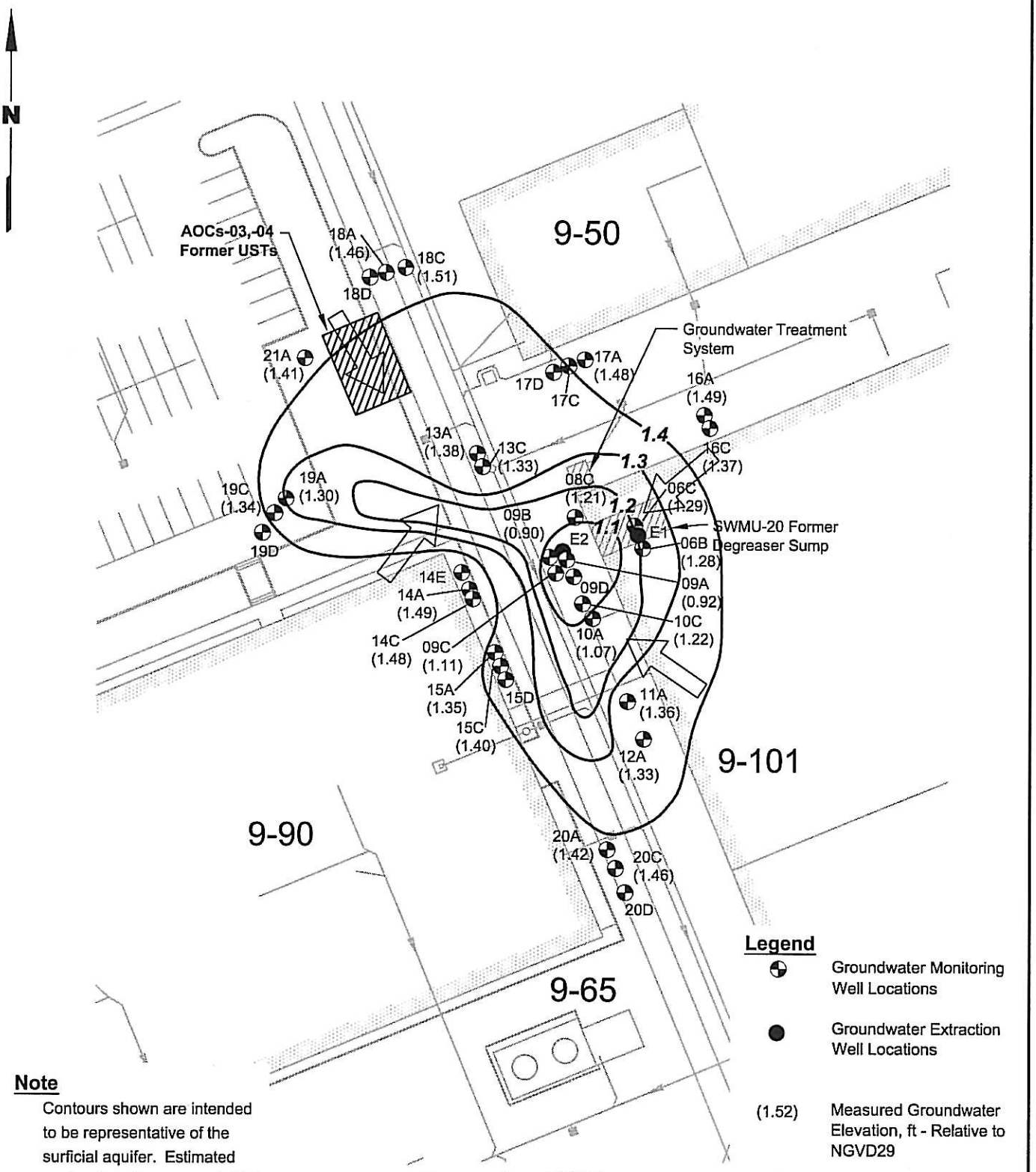
Contours shown are intended to be representative of the surficial aquifer being affected by the remedial system. Contours are weighted toward data collected in "A Horizon" wells.

Adapted from: Boeing Facilities; Duane Hartman and Associates, 2001

Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 6" 6/11/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Groundwater Potentiometric Map Active Pumping - E-1**	Figure 6



Boeing/Developmental Center | T:\025\093\010\Figs1.dwg (A) "Figure 7" 6/11/2001

Landau Associates

Boeing Developmental Center Tukwila, Washington	**Groundwater Potentiometric Map Active Pumping - E-2**	Figure 7

TABLE 1 SUMMARY OF GROUNDWATER ANALYTICAL DATA
BOEING DEVELOPMENTAL CENTER
DC 9-101 SWMU 20
PUMP AND TREAT EVALUATION
TUKWILA, WASHINGTON

Tetrachloroethene *ug/l*

	Aug-89	Feb-91	Jun-93	Jan-94	May-95	Oct-95	Feb-96	May-96	Aug-96	Nov-96	Feb-97	May-97	Aug-97	Nov-97	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00
06B	93	2000	48	27	5.87	14.4	9.62 J	26.18	13.7	14.3	21.5	21.3	17	16.9	18.9	16.3	22.6	2.3	6	10.19
06C	4.5	54	ND	22	<1.00	<10.00	<10.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<1.00	<1.00
08C	150	95	8	16	<1.00	<5.00	<5.00	<3.33	<10.00	13.5	<5.00	<4.00	<4.00	<4.00	7.8	<5.00	<1.00	<2.00	<2.00	<2.00
09A	2400	1200	370	420	2568.3	1589	1970	785.7	114	272	98	76	96.9	56.6	39.4	94	5.1	38	40	36.6
09B	10000	670	300	820	1972.7	668.1	1266	934.6	78.9	75.9	44.3	35	10.9	21.5	31.3	<10.00	6.74	3.6	<2.00	6.62
09C	64	18	ND	ND	11.32	<5.00	<10.00	1.24	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
09D	ND	ND	ND	8.8	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10A	700	550		180	635.8	754 E	468.85	242.1	114	342	67.5	77.8	76.5	70.3	72.5	86.4	38	21.5	16.6	21.63
10C	2.4	12		6.9	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
11A	ND	ND		5.2	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
12A	ND	ND		3.9	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
13A	5.3	ND		10	4.17	<5.00	<5.00	6.82	3	2.1	3.2	2.1	1.7	1.5	1.6	1.3	<1.00	<1.00	1.2	<1.00
13C	1.1	5.1		5.1	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14A	220	74		410	4.42	<5.00	133.57	96.06	11.2	<5.00	<4.00	<2.00	<2.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14C	120	1.2		7.2	9.02	10.53	8.64 J	5.44	6.1	<1.00	<10.00	<10.00	<10.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14E		0.5		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
15A	2.2	ND		11	<1.00	<5.00	<5.00	<5.00	<2.00	<1.00	<4.00	<2.00	<1.00	<2.00	<3.33	<10.00	<1.00	<10.00	<10.00	<10.00
15C	13	1.1		13	<1.00	<33.30	<5.00	<1.00	1.1	<1.00	<2.00	<10.00	<10.00	<10.00	<3.33	<1.00	<2.00	<2.00	<1.00	<1.00
15D	2.6	ND		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
16A	ND	1.8		1.6	1.10	<5.00	<5.00	<1.00	1.7	<1.00	1.1	<1.00	<1.00	<1.00	1.64	1.03	1.3	2.3	2.2	<1.00
16C	ND	ND		ND	<1.00	<5.00	<10.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
17A	ND			36	1.39	<5.00	<5.00	1.55	<1.00	1.3	2.7	1.90 J	2.2	<1.00	2.6	2.4	2.5	2.1	2.6	4.15
17C	ND			36	<1.00	<5.00	<5.00	<1.00	1.6	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
17D	ND			46	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
18A		ND		5.4	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18C		ND		4.6	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18D		ND		4.6	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19A		0.5		6	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19C		ND		6.5	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19D		ND		9.5	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20A		ND	ND	3.4	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20C		ND	ND	3.9	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20D		ND	ND	4.3	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
21A			4.6	NA	NA	NA	NA	<1.00		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

TABLE 1 SUMMARY OF GROUNDWATER ANALYTICAL DATA
BOEING DEVELOPMENTAL CENTER
DC 9-101 SWMU 20
PUMP AND TREAT EVALUATION
TUKWILA, WASHINGTON

Trichloroethene ***ug/l***

	Aug-89	Feb-91	Jun-93	Jan-94	May-95	Oct-95	Feb-96	May-96	Aug-96	Nov-96	Feb-97	May-97	Aug-97	Nov-97	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00
06B	28	810	10	4.2	3.57	6.00 J	<5.00	7.37	3.5	2.5	4.9	4.7	4.6	6.5	3.5	2.6	4.54	2.2	4.7	8.71
06C	7.2	21	ND	1.6	<1.00	31.36	<10.00	<1.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	91.6	<2.00	<1.00	<1.00	<1.00
08C	68	36	13	21	3.16	<5.00	<5.00	<3.33	<10.00	26.2	<5.00	<4.00	<4.00	<4.00	26.6	<5.00	<1.00	<2.00	<2.00	<2.00
09A	510	7400	1200	500	1796.5	1507	2318	1160	90.8	191	49.3	51.1	69.2	56.4	15.4	77	3.5	35	23	24.3
09B	160	720	140	160	1463	524.7	1206	554	58.6	35.2	28.7	31.5	4.9	15.4	20.65	<10.00	7.5	4.8	2.6	11.2
09C	1200	97	70	ND	19.41	<5.00	<10.00	3.54	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
09D	ND	ND	ND	2.2	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10A	210	270		120	333.23	411 E	268.41	115.3	56.7	128	28.4	38.2	36.6	48.8	23.8	33.9	19.2	14	8.3	13.11
10C	ND	13		3.9	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
11A	15	13		7	2.41	<5.00	<5.00	2.54	1.9	1	<1.00	<1.00	1.2	1.6	<1.00	1.03	<1.00	<1.00	<1.00	<1.00
12A	5.6	2.5		5.5	1.13	<5.00	<5.00	<1.00	1.7	1.2	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
13A	8.5	5.4		31	12.23	<5.00	9.57 J	16.52	3.4	3.4	2	1.5	2.9	3	1.1	1.7	1.8	2.3	2.4	2.12
13C	ND	9.2		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14A	130	66		600	6.25	<5.00	151.58	146.72	84.1	2.8	<4.00	<2.00	<2.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14C	78	2.3		6.6	14.41	21.93	13.33	7.61	12.5	<1.00	<10.00	<10.00	<10.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14E		4.3		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
15A	21	ND		7.5	<1.00	<5.00	<5.00	<5.00	<2.00	<1.00	<4.00	<2.00	<1.00	<2.00	<3.33	<10.00	<1.00	<10.00	<10.00	<10.00
15C	22	4.7		12	<1.00	<33.30	<5.00	<1.00	7.5	<1.00	<2.00	12	<10.00	<10.00	<3.33	<1.00	<2.00	<2.00	<1.00	<1.00
15D	ND	ND		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
16A	5.1	5.8		4.4	5.02	<5.00	<5.00	2.57	4	2.1	2.6	2	1.9	<1.00	<1.00	<1.00	1.01	1.4	1.2	1.08
16C	ND	1.3		ND	<1.00	<5.00	<10.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
17A		3.7		7.2	17.42	17.04	<5.00	7.28	<1.00	9.8	17.5	4.9	18	2	<1.00	12.4	11.1	11.5	6.6	13.99
17C		ND		2.1	<1.00	<5.00	<5.00	<1.00	14.1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
17D		ND		2.3	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
18A		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18C		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19A		1.5		1.5	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19C		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20A		1.9	0.8	1.1	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20C		3.1	1.7	1.8	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20D		ND	ND	1.5	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
21A				NA	NA	NA	NA	<1.00		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

TABLE 1 SUMMARY OF GROUNDWATER ANALYTICAL DATA
BOEING DEVELOPMENTAL CENTER
DC 9-101 SWMU 20
PUMP AND TREAT EVALUATION
TUKWILA, WASHINGTON

cis-1,2-Dichloroethene *ug/l*

	Aug-89	Feb-91	Jun-93	Jan-94	May-95	Oct-95	Feb-96	May-96	Aug-96	Nov-96	Feb-97	May-97	Aug-97	Nov-97	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00
06B	23	710	25	23	43.71	53.75	29.45	58.31	46.3	30.5	37.4	60.9	61.8	76.4	66.7	9.9	70.1	49.7	71.5	91.77
06C	230	28	6.7	7.9	14.57	99.09	<10.00	1.01	107	1.9	3.1	22.1	28.3	12.3	1.1	181 E	<2.00	<1.00	<1.00	<1.00
08C	120	38	1.9	44	14.95	<5.00	5.55 J	8	1.1	37.6	<5.00	37.3	46.1	42.3	38.4	<5.00	1.1	<2.00	3.2	<2.00
09A	440	15000	620	2500	5790.9	3286	7484	6143	443	816	520	258	206.E	199	94.3	680	15.5	187	421	60.75
09B	150	2100	210	940	5010.35	1307 E	3407 E	1521	207	142	164 E	510	35.1	111	939 E	178	122.04	41.2	102.4	135.2
09C	1200	360	680	520	431.66	159.69	70	33.67	29.8	1.6	4.6	2.6	2	1.7	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
09D	0.9	2.1	ND	5.1	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10A	150	228		470	421.26	297 E	249.16	159.2	90.1	17.8	29	66.1	58.5	74.1	29.3	6.9	33.3	20.6	10.6	14.14
10C	4.3	ND		14	1.93	<5.00	<5.00	1.01	<1.00	<1.00	f	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
11A	63	43		54	15.86	10.82	7.17 J	10.27	9.3	6.4	4.9	6.6	6.1	4.2	2.8	2.3	2.1	1.1	1.5	1.55
12A	13	4.2		20	2.30	17.5	<5.00	1.09	9.5	6.6	<1.00	6.1	3.7	3	1.7	1.7	1.8	1.03	1.9	2.07
13A	1.6	ND		8.2	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.6	<1.00	<1.00	1.2	1.3	1.2	1.2	<1.00
13C	190	40		16	1.14	<5.00	<5.00	<1.00	1.3	<1.00	1.3	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14A	340	92		590	15.50	9.83 J	294.36	115.94	249	114	6.4	24.2	18.3	9.5	4.9	3.7	7	3.2	3.8	<1.00
14C	220	9.0		110	187.91	1017.82	237.4	70.06	326	211	183	163	136	82.7	25.6	21.7	6.2	<1.00	1.2	2.83
14E		9.3		1.1	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
15A	1800	6.8		9.1	3.29	<5.00	<5.00	<5.00	3.6	3.5	4.5	5	5.5	5.5	15.65	<10.00	<1.00	<10.00	<10.00	<10.00
15C	260	69		92	69.14	640.52	93.62	1.47	463	532	187	1470	1100	719	785 E	90.5	53.2	28.4	1.01	2.53
15D	5.7	ND		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
16A	1.8	5.6		5.5	12.63	5.38 J	<5.00	25.39	12	3.2	6.2	2.4	1.7	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.76
16C	8.1	3.2		14	11.83	6.24 J	<10.00	5.66	2.6	1.6	1.6	1.13	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
17A		2.8		4.3	1.38	<5.00	<5.00	1.09	<1.00	1.4	1.2	2.90 J	4.13	<1.00	2.3	3.8	4.1	4.3	2.3	2.1
17C		ND		5.3	<1.00	<5.00	<5.00	1.19	1.6	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
17D		ND		1.8	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
18A		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18C		ND		1.3	2.02	<5.00	<5.00	<1.00	1	<1.00	<1.00	<1.00	<1.00	1.1	1.8	2.8	1.9	2.1	1.3	1.59
18D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19A		1.4		2.4	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19C		ND		1.7	1.17	<5.00	<5.00	1.37	1.3	<1.00	<1.00	1.2	1.2	1.2	2	1.2	1.4	<1.00	1.03	<1.00
19D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20A		ND	ND	ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20C		3.9	20	16	7.34	6.06 J	<5.00	2.46	2.5	2.1	1.9	1.6	<1.00	<1.00	<1.00	1.5	<1.00	<1.00	1.3	<1.00
20D		ND	ND	1.8	2.22	<5.00	<5.00	46.38	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
21A				NA	NA	NA	NA	<1.00		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

TABLE 1 SUMMARY OF GROUNDWATER ANALYTICAL DATA
BOEING DEVELOPMENTAL CENTER
DC 9-101 SWMU 20
PUMP AND TREAT EVALUATION
TUKWILA, WASHINGTON

Vinyl Chloride *ug/l*

	Aug-89	Feb-91	Jun-93	Jan-94	May-95	Oct-95	Feb-96	May-96	Aug-96	Nov-96	Feb-97	May-97	Aug-97	Nov-97	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00
06B	4.7	ND	74	13	36.53	31.8	52.29	44.78	54.5	49.4	63.7	88.7	55	62.7	46.3	4.2	48.4	25.9	8	21.58
06C	1.6	ND	26	30	20.89	34.09	38.34	22.06	164	12	18.3	50.3	39.5	26.1	6	54.6	4.4	<1.00	<1.00	<1.00
08C	14	25	ND	130	42.13	32.69	35.33	35.96	129	41.2	201	488	256	210	20.6	<5.00	49.7	21.4	2.4	<2.00
09A	26	2000	350	240	917.05	449	1385	844.9	124	228	80.9	185	127	135	83.8	425	14	278	499	17.95
09B	23	830	87	140	648.6	175.6	836	228.2	104	62.6	41.7	270	20.9	50.7	439.56	132	152.36	66.6	82.6	146.7
09C	110	130	82	190	233.79	185 E	71.74	50.13	106	19.4	59.8	147	102.5	87.8	1.1	<1.00	59	16.4	<1.00	<1.00
09D	0.5	ND	ND	ND	1.37	<5.00	<5.00	<1.00	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10A	4.0	54		120	116.25	16.12	31.6	651.2	80.9	16.7	48.2	33.4	9.8	8.8	8.7	1.3	12.1	3.5	3	3.32
10C	8.3	ND		39	28.29	33.16	40.41	18.69	11.6	10.1	9	<1.00	4.3	3.8	1.7	1.6	2.8	1.4	2.1	<1.00
11A	7.2	13		39	26.80	8.37 J	12.14	14.04	3.8	1.8	<1.00	<1.00	<1.00	3.4	<1.00	<1.00	1.1	<1.00	<1.00	<1.00
12A	3.2	ND		14	<1.00	17.16	<5.00	<1.00	2.9	8.6	<1.00	9.4	6.7	1.1	1.3	<1.00	2.7	1.06	<1.00	<1.00
13A	ND	ND		12	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
13C	240	220		760	3.03	<5.00	15.24	11.48	3.6	1.9	2.5	2.2	<1.00	<1.00	1	1.6	1.8	<1.00	<1.00	<1.00
14A	24	28		170	11.38	30.32	44.4	36.4	339	232	162	270	158	70	29.1	13.74	58.2	20.9	19.7	<1.00
14C	46	98		120	103.49	1587.3	1477	134.78	414	175	1296	307	148	144	39.4	56.4	30.2	<1.00	<1.00	4.67
14E		ND		10	1.43	<5.00	<5.00	<1.00	1.3	<1.00	<1.00	1.3	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
15A	7.7	12		16	13.84	31.2	54.62	19.45	19.4	23	20.4	23.5	17.4	18.6	61.61	17.2	2.9	37	16	<10.00
15C	19	16		38	38.79	142.38	69.81	5.12	104	220	69	598	519	500	772 E	194 E	121.2	49.2	1.4	21.32
15D	210	190		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.6	5.2	<1.00	<1.00	<1.00	<1.00
16A	ND	8.9		6	9.18	<5.00	<5.00	8.42	4.4	<1.00	<1.00	2.2	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
16C	4	3.4		15	23.46	38.59	45.16	31.71	20.8	11.8	11.3	9.1	3	<1.00	1.4	<1.00	1.9	<1.00	<1.00	<1.00
17A		ND		ND	<1.00	<5.00	<5.00	<1.00	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
17C		ND		10	2.32	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
17D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
18A		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18C		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19A		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19C		ND		5.5	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20A		ND	ND	ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20C		ND	28	47	20.12	12.63	13.77	8.32	6.7	3.4	3.3	3.4	<1.00	<1.00	1.6	1.8	<1.00	1.9	<1.00	1.06
20D		ND	ND	ND	6.98	<5.00	<5.00	31.12	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
21A				NA	NA	NA	NA	<1.00		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

TABLE 1 SUMMARY OF GROUNDWATER ANALYTICAL DATA
BOEING DEVELOPMENTAL CENTER
DC 9-101 SWMU 20
PUMP AND TREAT EVALUATION
TUKWILA, WASHINGTON

Benzene ***ug/l***

	Aug-89	Feb-91	Jun-93	Jan-94	May-95	Oct-95	Feb-96	May-96	Aug-96	Nov-96	Feb-97	May-97	Aug-97	Nov-97	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00
06B	ND	ND	ND	ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.3	<1.00	<1.00	<1.00	<1.00
06C	0.4	ND	ND	ND	8.64	230.09	29.96	13.7	5.6	2.9	3.4	4.6	4.1	4.2	4.2	5.7	2.8	2.7	<1.00	2.76
08C	ND	ND	ND	ND	225.74	135.58	104.73	104.6	31.8	121	27.5	6.1	<4.00	<4.00	13.6	<5.00	<1.00	<2.00	15.8	<2.00
09A	0.5	ND	ND	ND	<1.00	<5.00	<500.00	<50.00	<3.33	<10.00	<4.00	<5.00	<1.00	<4.00	<1.00	<10.00	<1.00	<10.00	<10.00	<5.00
09B	ND	ND	ND	ND	19.76	<33.30	<50.00	<10.00	2.5	<1.00	<1.00	7.5	3.1	3.3	<3.33	<10.00	<2.00	<2.00	<2.00	<2.00
09C	0.5	ND	ND	ND	<1.00	<5.00	<10.00	<1.00	9.6	2.4	6.3	9.3	4.8	3.6	1.7	2.5	1.7	<1.00	1.5	1.36
09D	ND	ND	ND	ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10A	ND	3.5		ND	<1.00	<5.00	<50.00	<10.00	<1.00	<3.33	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10C	0.8	ND		ND	1.15	<5.00	<5.00	1.33	1.4	1.4	1.5	1.4	1.2	1.3	1.3	1.1	1.1	<1.00	1.4	1.23
11A	ND	ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
12A	ND	ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
13A	ND	ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
13C	ND	0.6		ND	4.88	69.66	33.56	25.76	75	34.1	36.5	20.5	7.6	6.8	3.9	3.3	3	<1.00	2	2.31
14A	ND	ND		ND	<1.00	<5.00	<20.00	<1.00	<10.00	<5.00	<4.00	<2.00	<2.00	<2.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14C	13	ND		ND	<1.00	<5.00	<5.00	26.44	22	11.7	<10.00	<10.00	<10.00	4.3	2.8	4.64	2.5	1.2	1.4	1.33
14E		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
15A	ND	ND		ND	<1.00	<5.00	<5.00	<5.00	<2.00	<1.00	<4.00	<2.00	<1.00	<2.00	<3.33	<10.00	<1.00	<10.00	<10.00	<10.00
15C	ND	ND		ND	<1.00	<33.30	<5.00	<1.00	<3.33	<1.00	<2.00	<10.00	<10.00	<10.00	<3.33	5.2	5.2	5.4	<1.00	4.28
15D	ND	ND		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
16A	ND	ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	2	<1.00	10.9	49.8	1.6	46.03
16C	ND	ND		ND	<1.00	<5.00	<10.00	<1.00	3.3	31.2	11.3	14.4	18.8	1.7	15	8.3	10	6.4	7.8	4.33
17A		ND		ND	<1.00	<5.00	<5.00	<1.00	78.8	2.7	<1.00	<1.00	<1.00	<1.00	11.2	<1.00	<1.00	<1.00	1.5	<1.00
17C		ND		ND	142.64	73.23	34.26	92.46	40.6	22.5	36.6	4.7	21.8	8.53	5.6	2.7	3.7	2.4	2.1	NA
17D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
18A		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18C		18		14	8.77	5.28 J	<5.00	5.79	5.4	3.1	3.6	4	2.9	2.7	1.5	1.4	1.5	<1.00	1.1	1.26
18D		ND		ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19A		ND		1.1	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19C		ND		61	17.57	13.44	7.14 J	10.46	6.8	5.6	6.8	6.2	3.4	2.9	2.2	1.8	1.8	1.3	1.2	1.43
19D		ND		3.9	3.60	<5.00	<5.00	2.42	2.2	1.6	1.9	1.7	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20A		ND	ND	ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20C		0.7	ND	ND	<1.00	<5.00	<5.00	<1.00	1.1	<1.00	1.1	1.1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20D		ND	ND	ND	<1.00	<5.00	<5.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
21A				NA	NA	NA	NA	<1.00		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

TABLE 1 SUMMARY OF GROUNDWATER ANALYTICAL DATA
BOEING DEVELOPMENTAL CENTER
DC 9-101 SWMU 20
PUMP AND TREAT EVALUATION
TUKWILA, WASHINGTON

Naphthalene ***ug/l***

	Aug-89	Feb-91	Jun-93	May-95	Oct-95	Feb-96	May-96	Aug-96	Nov-96	Feb-97	May-97	Aug-97	Nov-97	Jun-98	Oct-98	Jun-99	Nov-99	Jun-00	Dec-00
06B	NA	NA	NA	NA	NA	NA	<1.00	2.8	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.4	<1.00	<1.00	<1.00	<1.00
06C	NA	NA	NA	NA	NA	NA	29.26	10.4	9.1	8.8	7.2	<1.00	18.4	3	25.1	3.4	<1.00	7.7	44.97
08C	NA	NA	NA	NA	NA	NA	351.9	401	155	370	234	118	292	600 E	38.6	230	137	109.2	174.1
09A	NA	NA	NA	NA	NA	NA	<50.00	<3.33	<10.00	<4.00	<5.00	<1.00	7	<1.00	<10.00	<1.00	<10.00	<10.00	8.65
09B	NA	NA	NA	NA	NA	NA	<10.00	<2.00	<1.00	<1.00	13.8	22.4	<2.00	<3.33	<10.00	3.4	4.6	<2.00	11.2
09C	NA	NA	NA	NA	NA	NA	<1.00	1.2	<1.00	8.8	6.5	<1.00	25	<1.00	<1.00	9.9	6.8	<1.00	1.67
09D	NA	NA	NA	NA	NA	NA	<1.00	1.3	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10A	NA	NA	NA	NA	NA	NA	<10.00	4.2	<3.33	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
10C	NA	NA	NA	NA	NA	NA	14.27	30.5	6.3	56.1	6.4	7.6	5.8	2.8	<1.00	3.8	4.7	2.7	5.77
11A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	5.1	<1.00
12A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
13A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
13C	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
14A	NA	NA	NA	NA	NA	NA	<1.00	<10.00	<5.00	<4.00	<2.00	<2.00	<2.00	<1.00	<1.00	150	4.8	235	113.23
14C	NA	NA	NA	NA	NA	NA	<2.00	<10.00	<1.00	<10.00	<10.00	<10.00	11.8	7.2	6.5	6.3	7.3	17.2	8.7
14E	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
15A	NA	NA	NA	NA	NA	NA	423.67	239	152	247	136	67.3	465 E	1721 E	916	58.9	561	797	695.6
15C	NA	NA	NA	NA	NA	NA	<1.00	1	<1.00	4.4	<10.00	<10.00	<10.00	<3.33	4.8	<2.00	<2.00	29.8	<1.00
15D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
16A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
16C	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
17A	NA	NA	NA	NA	NA	NA	<1.00	62	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
17C	NA	NA	NA	NA	NA	NA	<1.00	<1.00	26.6	<1.00	0.6	37.3	106	<1.00	<1.00	31.9	16.6	13.7	NA
17D	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NA
18A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
18C	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	1.7	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.1	<1.00
18D	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19C	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
19D	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20C	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
20D	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
21A	NA	NA	NA	NA	NA	NA	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

NA = Constituent was not analyzed.

ND = Constituent was not detected in laboratory analysis.

Table 2
Groundwater Elevation Data
Boeing Developmental Center
DC 9-101 Building SWMU 20
Pump and Treat Evaluation
Tukwila, Washington

DEVELOPMENTAL CENTER WATER LEVEL MEASUREMENTS

				December 2000 (2)		October 1995 (3)		February 1996 (4)	
Well Location / Bldg.	Well ID No.	Well Depth	Top of Well Casing Elev. (1) (NGVD29)	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation
9-101-bldg.	MW-6B	27.2	14.83	13.55	1.28	13.90	0.93	11.63	3.20
9-101-bldg.	MW-6C	40.55	14.99	13.7	1.29	14.20	0.79	11.75	3.24
9-101-bldg.	MW-8C	40.2	14.92	13.71	1.21	13.31	1.61	11.77	3.15
9-101-bldg.	MW-9A	21.3	14.64	13.72	0.92	12.96	1.68	11.51	3.13
9-101-bldg.	MW-9B	26.9	14.72	13.82	0.90	13.06	1.66	11.78	2.94
9-101-bldg.	MW-9C	38.8	14.68	13.57	1.11	12.96	1.72	11.65	3.03
9-101-bldg.	MW-9D	56	14.66	13.03	1.63	13.03	1.63	11.60	3.06
9-101-bldg.	MW-10A	20.2	14.69	13.62	1.07	13.08	1.61	11.72	2.97
9-101-bldg.	MW-10C	40.4	14.62	13.4	1.22	12.99	1.63	11.60	3.02
9-101-bldg.	MW-11A	19.9	14.88	13.52	1.36	13.22	1.66	11.62	3.26
9-101-bldg.	MW-12A	20.2	14.83	13.5	1.33	13.25	1.58	11.71	3.12
9-101-bldg.	MW-13A	19.37	14.14	12.76	1.38	12.86	1.28	11.20	2.94
9-101-bldg.	MW-13C	35.62	14.02	12.69	1.33	12.71	1.31	11.02	3.00
9-101-bldg.	MW-14A	19	14.47	12.98	1.49	13.28	1.19	11.40	3.07
9-101-bldg.	MW-14C	33.3	13.97	12.49	1.48	12.87	1.10	10.96	3.01
9-101-bldg.	MW-14E	82.1	14.18	7.44	6.74	8.36	5.82	7.25	6.93
9-101-bldg.	MW-15A	20.7	14.17	12.82	1.35	12.86	1.31	11.10	3.07
9-101-bldg.	MW-15C	34.35	14.17	12.77	1.40	12.67	1.50	11.10	3.07
9-101-bldg.	MW-15D	51.8	14.41	12.9	1.51	nm	nm	nm	nm
9-101-bldg.	MW-16A	20.55	14.99	13.5	1.49	13.72	1.27	11.77	3.22
9-101-bldg.	MW-16C	38.3	15.04	13.67	1.37	13.89	1.15	11.94	3.10
9-101-bldg.	MW-17A	19	14.8	13.32	1.48	13.37	1.43	11.65	3.15
9-101-bldg.	MW-17C	35	14.85	nm	nm	13.40	1.45	11.66	3.19
9-101-bldg.	MW-17D	52.5	14.87	nm	nm	13.44	1.43	11.81	3.06
9-101-bldg.	MW-18A	20.02	14.3	12.84	1.46	12.90	1.40	11.39	2.91
9-101-bldg.	MW-18C	34.55	14.63	13.12	1.51	13.21	1.42	11.65	2.98
9-101-bldg.	MW-18D	52.85	14.26	12.85	1.41	12.87	1.39	11.39	2.87
9-101-bldg.	MW-19A	16.86	12.23	10.93	1.30	10.92	1.31	9.12	3.11
9-101-bldg.	MW-19C	33.92	12.23	10.89	1.34	10.83	1.40	9.03	3.20
9-101-bldg.	MW-19D	51.86	12.23	10.9	1.33	10.96	1.27	9.38	2.85
9-101-bldg.	MW-20A	19.34	14.31	12.89	1.42	12.79	1.52	11.13	3.18
9-101-bldg.	MW-20C	35.32	14.15	12.69	1.46	12.58	1.57	10.73	3.42
9-101-bldg.	MW-20D	50.15	14.43	12.87	1.56	12.98	1.45	11.05	3.38
9-101/9-50 bldg.	MW-21A	19.9	14.45	13.04	1.41	13.10	1.35	nm	nm

na - not available
nm - not measured
* Surface Elevation
Depth to Water measurements taken from top of well casing

1) Elevations from February 2001 survey
2) Data collected during period when extraction well E-2 was operating alone.
3) Data collected during period when extraction well E-1 was operating alone.
4) Data collected during non-pumping conditions.

Table 3
Monitoring Well Construction Details
Boeing Developmental Center
DC 9-101 Building SWMU 20
Pump and Treat Evaluation
Tukwila, Washington

Monitoring Well Number	*Well Diameter & Const.*	*Top of Well Screen (Feet BGS)*	*Bottom of Well Screen (Feet BGS)*
MW-6B	2" FGRP	22.0	27.5
MW-6C	2" FGRP	30.0	40.5
MW-8C	2" FGRP	30.0	40.5
MW-9A	2" FGRP	11.0	21.5
MW-9B	2" FGRP	22.0	27.0
MW-9C	2" FGRP	29.0	39.5
MW-9D	2" FGRP	41.0	56.0
MW-10A	2" PVC-40	15.0	20.0
MW-10C	2" PVC-40	30.0	40.5
MW-11A	2" PVC-40	9.5	20.0
MW-12A	2" PVC-40	10.0	20.5
MW-13A	2" PVC-40	9.5	20.0
MW-13C	2" PVC-40	25.5	36.0
MW-14A	2" PVC-40	9.0	19.5
MW-14C	2" PVC-40	23.5	34.0
MW-14E	2" PVC-40	77.0	82.0
MW-15A	2" PVC-40	11.0	21.5
MW-15C	2" PVC-40	24.5	35.0
MW-15D	2" PVC-40	41.5	52.0
MW-16A	2" PVC-40	10.0	20.5
MW-16C	2" PVC-40	28.0	38.5
MW-17A	2" PVC-40	9.5	19.5
MW-17C	2" PVC-40	24.4	34.4
MW-17D	2" PVC-40	42.0	52.0
MW-18A	2" PVC-40	11.5	21.5
MW-18C	2" PVC-40	26.0	36.0
MW-18D	2" PVC-40	46.5	56.5
MW-19A	2" PVC-40	6.5	16.5
MW-19C	2" PVC-40	24.5	34.5
MW-19D	2" PVC-40	41.5	51.5
MW-20A	2" PVC-40	8.5	18.5
MW-20C	2" PVC-40	24.5	34.5
MW-20D	2" PVC-40	40.0	50.0
MW-21A	2" PVC-40	10.0	20.0
E-1		23.0	38.3
E-2		22.0	32.0

PVC = polyvinyl chloride

FGRP = fiberglass reinforced plastic

DEVELOPMENTAL CENTER 9-101 PUMP TREAT SYSTEM
EXTRACTION SAMPLING SUMMARY

Table 4
Mass Removal Rate Summary
March 1994 to September 2000
Boeing Developmental Center
DC 9-101 Building SWMU 20
Pump and Treat Evaluation
Tukwila, Washington

Year - 1994	Total Gallons Removed During Year	Total Liters Removed During Year				
	2,804,508	10616218.24				
Extraction Well E-1	Average Concentration of Groundwater Extracted, ug/L	Mass of Constituent Removed During Year, grams	Mass of Constituent Removed During Year, Pounds	Cumulative Mass Removed, Pounds	Percentage of Total Mass Removed through 9/00	Cumulative Percentage of Total Mass Removed through 9/00
Vinyl Chloride	103.02	1093.63	2.4	2.4		
cis-1,2-Dichloroethene	177.45	1883.86	4.2	4.2		
Trichloroethene	99.74	1058.88	2.3	2.3		
Tetrachloroethene	179.00	1900.29	4.2	4.2		
Total VOCs			13.1	13.1	16.33%	16.33%
Year - 1995	Total Gallons Removed During Year	Total Liters Removed During Year				
	3,463,865	13112156.14				
Extraction Well E-1	Average Concentration of Groundwater Extracted, ug/L	Mass of Constituent Removed During Year, grams	Mass of Constituent Removed During Year, Pounds	Cumulative Mass Removed, Pounds	Percentage of Total Mass Removed	Cumulative Percentage of Total Mass Removed
Vinyl Chloride	94.65	1241.07	2.7	5.1		
cis-1,2-Dichloroethene	199.58	2616.97	5.8	9.9		
Trichloroethene	96.45	1264.71	2.8	5.1		
Tetrachloroethene	185.62	2433.93	5.4	9.6		
Total VOCs			16.7	29.7	20.79%	37.12%
Year - 1996	Total Gallons Removed During Year	Total Liters Removed During Year				
	3,197,278	12103014.51				
Extraction Well E-1 (1/96-2/96) E-2 (7/96-12/96)	Average Concentration of Groundwater Extracted, ug/L	Mass of Constituent Removed During Year, grams	Mass of Constituent Removed During Year, Pounds	Cumulative Mass Removed, Pounds	Percentage of Total Mass Removed	Cumulative Percentage of Total Mass Removed
Vinyl Chloride	71.04	859.77	1.9	7.0		
cis-1,2-Dichloroethene	155.17	1878.05	4.1	14.1		
Trichloroethene	70.17	849.22	1.9	7.0		
Tetrachloroethene	132.24	1600.48	3.5	13.1		
Total VOCs			11.4	41.2	14.27%	51.39%

DEVELOPMENTAL CENTER 9-101 PUMP TREAT SYSTEM
EXTRACTION SAMPLING SUMMARY

Year - 1997	Total Gallons Removed During Year	Total Liters Removed During Year				
	6,957,692	26337730.79				
Extraction Well E-2	Average Concentration of Groundwater Extracted, ug/L	Mass of Constituent Removed During Year, grams	Mass of Constituent Removed During Year, Pounds	Cumulative Mass Removed, Pounds	Percentage of Total Mass Removed	Cumulative Percentage of Total Mass Removed
Vinyl Chloride	54.72	1441.11	3.2	10.2		
cis-1,2-Dichloroethene	124.53	3279.71	7.2	21.3		
Trichloroethene	36.65	965.28	2.1	9.1		
Tetrachloroethene	80.18	2111.63	4.7	17.7		
Total VOCs			17.2	58.4	21.45%	72.84%

Year - 1998	Total Gallons Removed During Year	Total Liters Removed During Year				
	7,249,888	27443813.03				
Extraction Well E-2 (1/98-7/98, 12/98) E-1 (8/98-11/98)	Average Concentration of Groundwater Extracted, ug/L	Mass of Constituent Removed During Year, grams	Mass of Constituent Removed During Year, Pounds	Cumulative Mass Removed, Pounds	Percentage of Total Mass Removed	Cumulative Percentage of Total Mass Removed
Vinyl Chloride	42.05	1154.13	2.5	12.8		
cis-1,2-Dichloroethene	77.99	2140.27	4.7	26.0		
Trichloroethene	21.00	576.43	1.3	10.4		
Tetrachloroethene	54.72	1501.75	3.3	21.1		
Total VOCs			11.8	70.2	14.78%	87.63%

Year - 1999	Total Gallons Removed During Year	Total Liters Removed During Year				
	6,441,513	24383780.61				
Extraction Well E-1 (1/99-3/99) E-2 (4/99-12/99)	Average Concentration of Groundwater Extracted, ug/L	Mass of Constituent Removed During Year, grams	Mass of Constituent Removed During Year, Pounds	Cumulative Mass Removed, Pounds	Percentage of Total Mass Removed through 9/00	Cumulative Percentage of Total Mass Removed through 9/00
Vinyl Chloride	30.56	745.19	1.6	14.4		
cis-1,2-Dichloroethene	41.93	1022.46	2.3	28.3		
Trichloroethene	13.64	332.55	0.7	11.1		
Tetrachloroethene	37.06	903.66	2.0	23.0		
Total VOCs			6.6	76.8	8.26%	95.89%

Year - 2000	Total Gallons Removed During Year	Total Liters Removed During Year				
	3,782,562	14318555.59				
Extraction Well E-2 (1/00-9/00)	Average Concentration of Groundwater Extracted, ug/L	Mass of Constituent Removed During Year, grams	Mass of Constituent Removed During Year, Pounds	Cumulative Mass Removed, Pounds	Percentage of Total Mass Removed	Cumulative Percentage of Total Mass Removed
Vinyl Chloride	33.84	484.58	1.1	15.5		
cis-1,2-Dichloroethene	35.24	504.63	1.1	29.4		
Trichloroethene	11.16	159.75	0.4	11.5		
Tetrachloroethene	24.09	344.87	0.8	23.8		
Total VOCs			3.3	80.1	4.11%	100.00%

Table 5
Estimated Change of Plume Area (100 ppb isopleth)
Boeing Developmental Center
DC9-101 Building SWMU

Groundwater Horizon	COI	Area of 100 ug/L Isopleth (1) (ft^2) 1989	Area of 100 ug/L Isopleth (1) (ft^2) 1994	1989-1994 Percent Change	Area of 100 ug/L Isopleth (1) (ft^2) 1994	Area of 100 ug/L Isopleth (1) (ft^2) 2000	1994-2000 Percent Change
A	Vinyl Chloride	0	3131	NA	3131	161	-95%
A	cis-1,2- DCE	7766	5173	-33%	5173	0	-100%
A	TCE	4195	3864	-8%	3864	0	-100%
A	PCE	3767	3306	-12%	3306	0	-100%
C	Vinyl Chloride	2754	6078	121%	6078	0	-100%
C	cis-1,2- DCE	7968	1647	-79%	1647	0	-100%
C	TCE	1349	0	-100%	0	0	NA
C	PCE	1976	0	-100%	0	0	NA

(1) See Figures 1 through 8

Table 6
Contaminant Reduction Estimates Using Linear Regression Analysis
Boeing Developmental Center SWMU 20

PCE Data

Well ID	Active Pumping Reduction Rate (1/year)	Inactive Pumping Reduction Rate (1/year)
MW-6B	-0.0373	-0.744
MW-8C	-0.3592	-0.9189
MW-9A	-0.2835	-0.6405
MW-9B	-0.4479	-0.8307
MW-9C	NA	-1.2685
MW-10A	-0.2049	-0.6791
MW-14A	-0.4122	0.3113
MW-14C	-0.0837	-1.4067
MW-15A	NA	1.6094
MW-15C	-2.4696	0
Mean	-0.5373	-0.4568
Median	-0.3592	-0.7116

TCE Data

Well ID	Active Pumping Reduction Rate (1/year)	Inactive Pumping Reduction Rate (1/year)
MW-6B	0.0054	-1.0086
MW-8C	0.2824	-0.4544
MW-9A	-0.3138	-0.1879
MW-9B	-0.3752	-0.1638
MW-9C	-0.0012	-1.4208
MW-10A	-0.2063	-0.2798
MW-14A	-0.5449	0.7647
MW-14C	0.0223	-1.2348
MW-15A	NA	-0.3089
MW-15C	0	-0.3031
Mean	-0.1257	-0.4597
Median	-0.0012	-0.3060

Table 6
Concentration Reduction Rate Estimates Using Linear Regression Analysis
Boeing Developmental Center SWMU 20

DCE Data

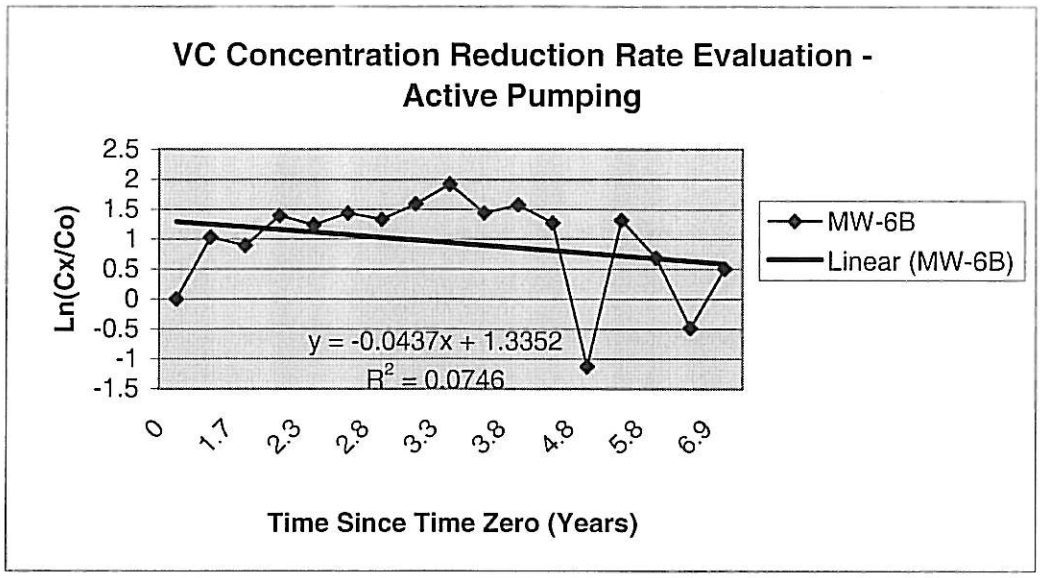
Well ID	Active Pumping Reduction Rate (1/year)	Inactive Pumping Reduction Rate (1/year)
MW-6B	0.0361	-0.3346
MW-8C	-0.103	-0.6006
MW-9A	-0.016	0.2026
MW-9B	-0.2647	0.3203
MW-9C	-0.6451	-0.1873
MW-10A	-0.2275	0.571
MW-14A	-0.332	0.2756
MW-14C	-0.3141	-0.3466
MW-15A	0.0819	-2.6436
MW-15C	-0.1661	-0.5194
Mean	**-0.1951**	**-0.3263**
Median	**-0.1968**	**-0.2610**

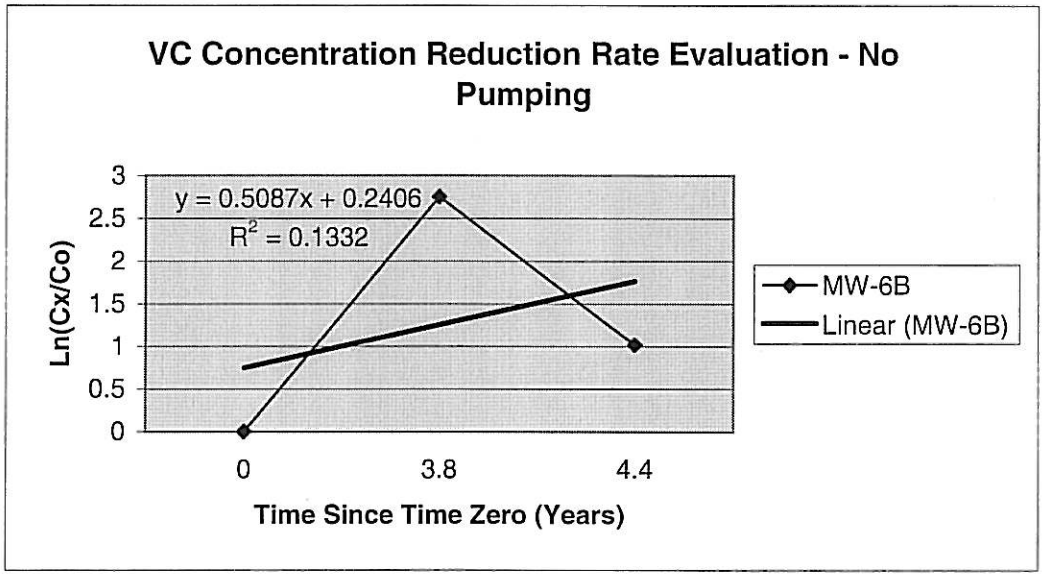
Vinyl Chloride Data

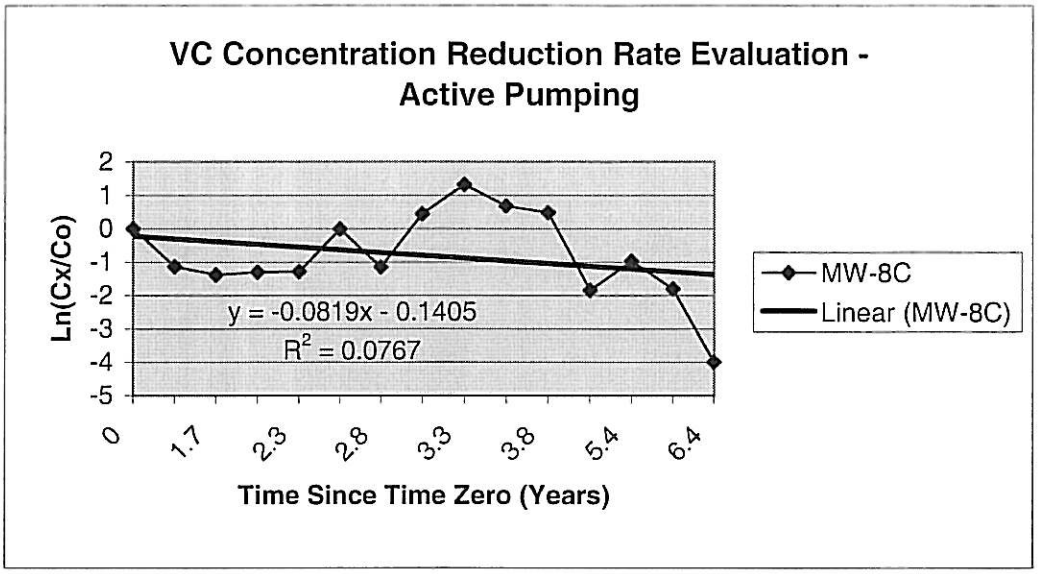
Well ID	Active Pumping Reduction Rate (1/year)	Inactive Pumping Reduction Rate (1/year)
MW-6B	-0.0437	0.5087
MW-8C	-0.0819	1.1142
MW-9A	-0.1357	0.4925
MW-9B	-0.0671	0.3163
MW-9C	-0.1904	0.1179
MW-10A	-0.2517	1.7006
MW-14A	-0.0557	0.9789
MW-14C	-0.2235	0.4794
MW-15A	-0.0244	0.3657
MW-15C	-0.0326	0.3466
Mean	**-0.1107**	**0.6421**
Median	**-0.0745**	**0.4860**

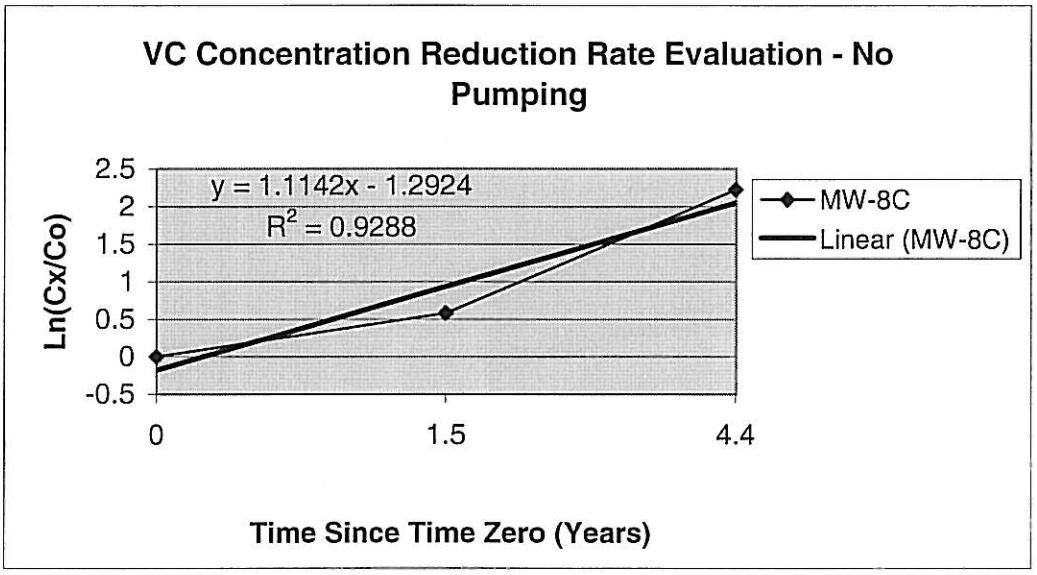
ATTACHMENT 1

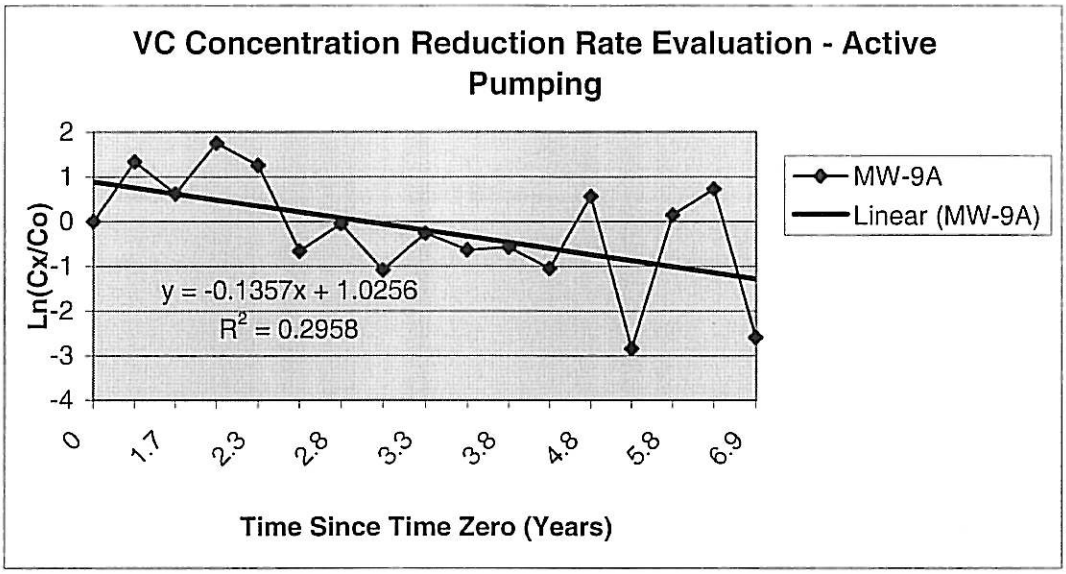
Concentration Reduction Rate Evaluations

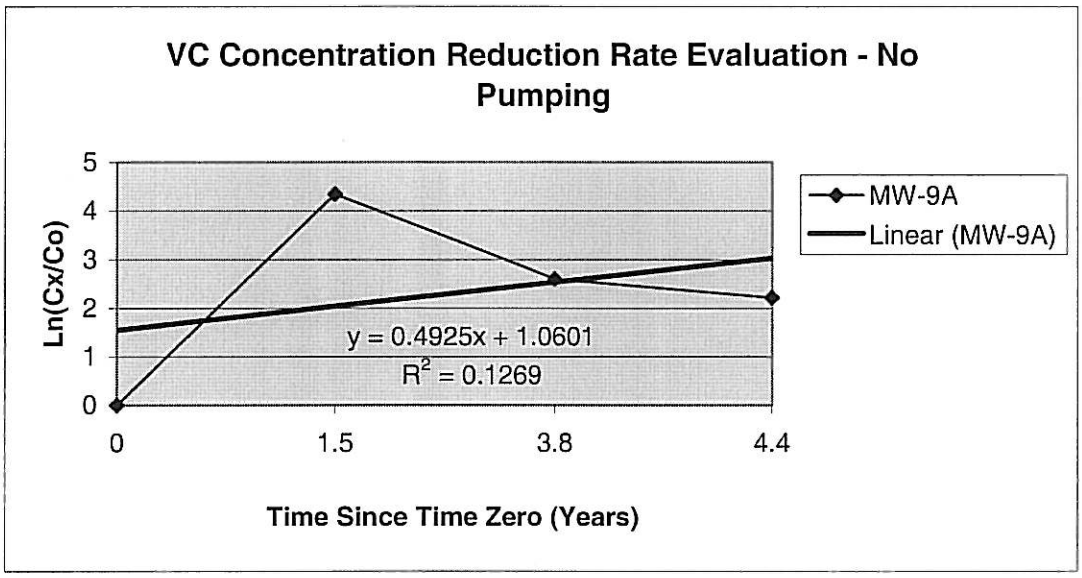

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
y = -0.0437x + 1.3352
R2 = 0.0746
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
6.9
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

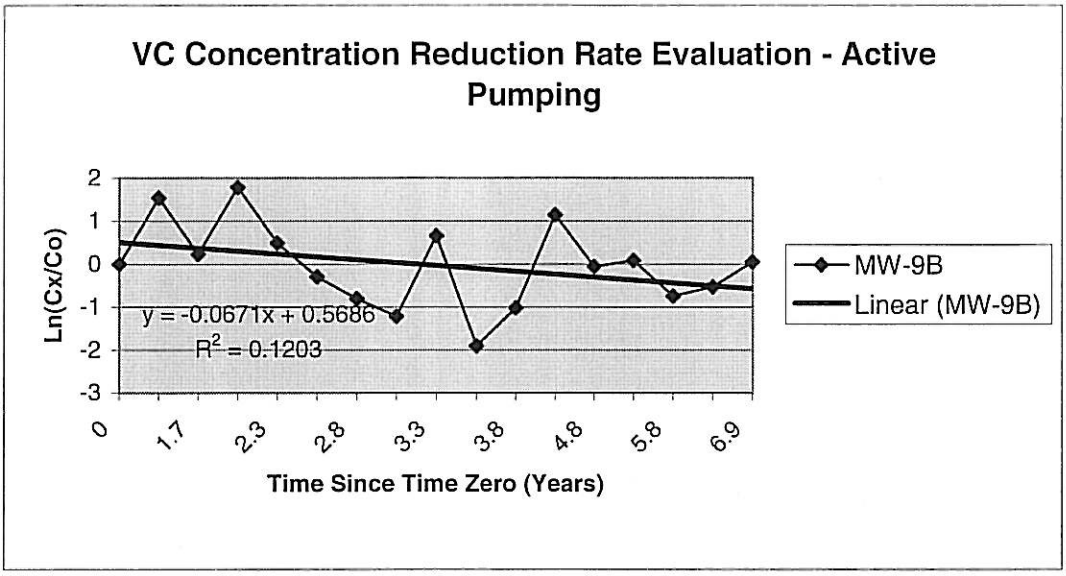

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
3
2.5
2
1.5
1
0.5
0
y = 0.5087x + 0.2406
R2 = 0.1332
0
3.8
4.4
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

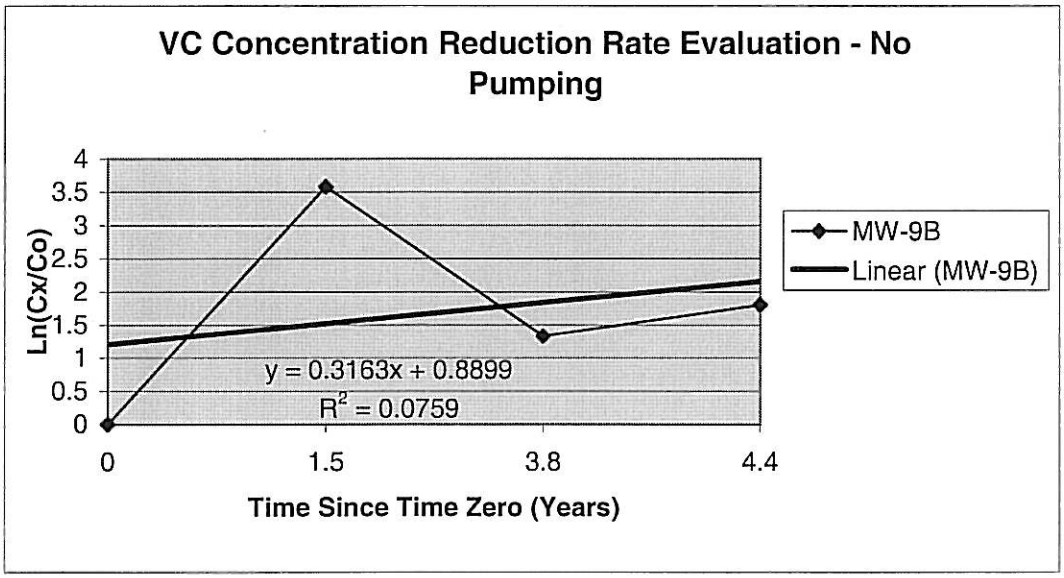

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
1
0
-1
-2
-3
-4
-5
y = -0.0819x - 0.1405
R2 = 0.0767
0
1.7
2.3
2.8
3.3
3.8
5.4
6.4
Time Since Time Zero (Years)
MW-8C
Linear (MW-8C)

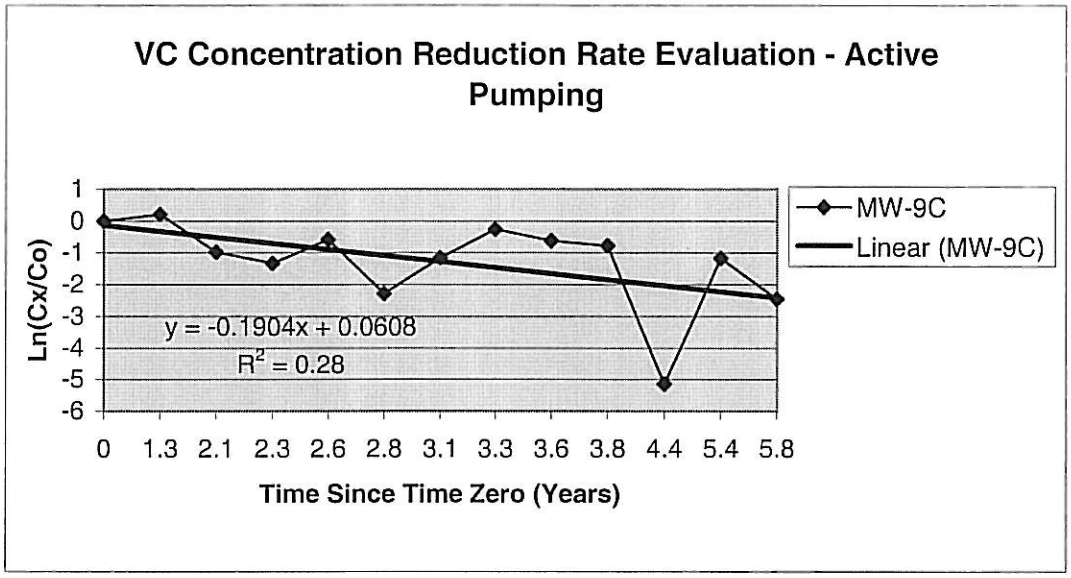

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
2.5
2
1.5
1
0.5
0
-0.5
y = 1.1142x - 1.2924
R2 = 0.9288
0
1.5
4.4
Time Since Time Zero (Years)
MW-8C
Linear (MW-8C)

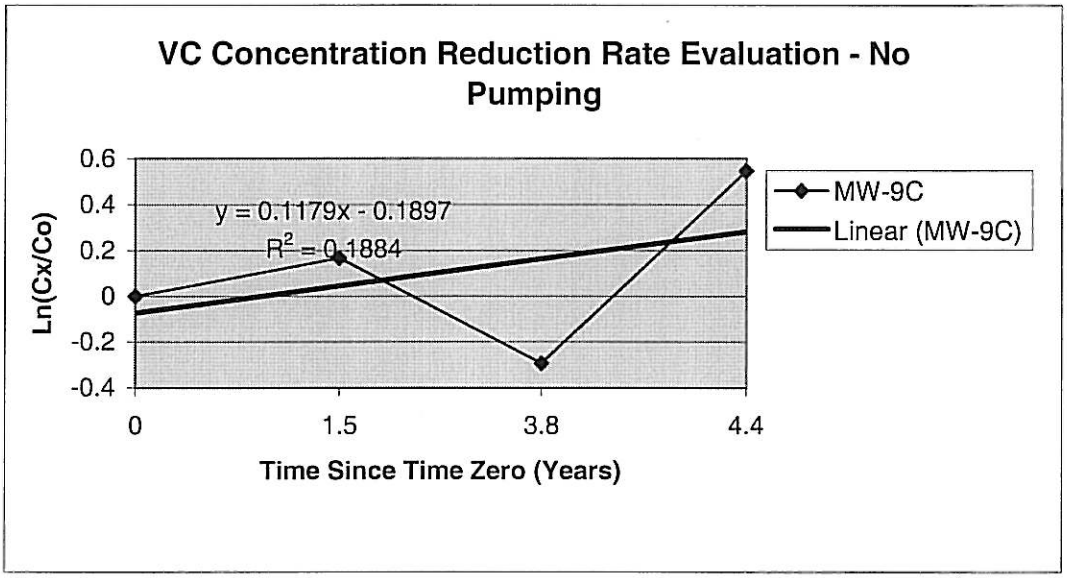

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
1
0
-1
-2
-3
-4
y = -0.1357x + 1.0256
R2 = 0.2958
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
6.9
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)

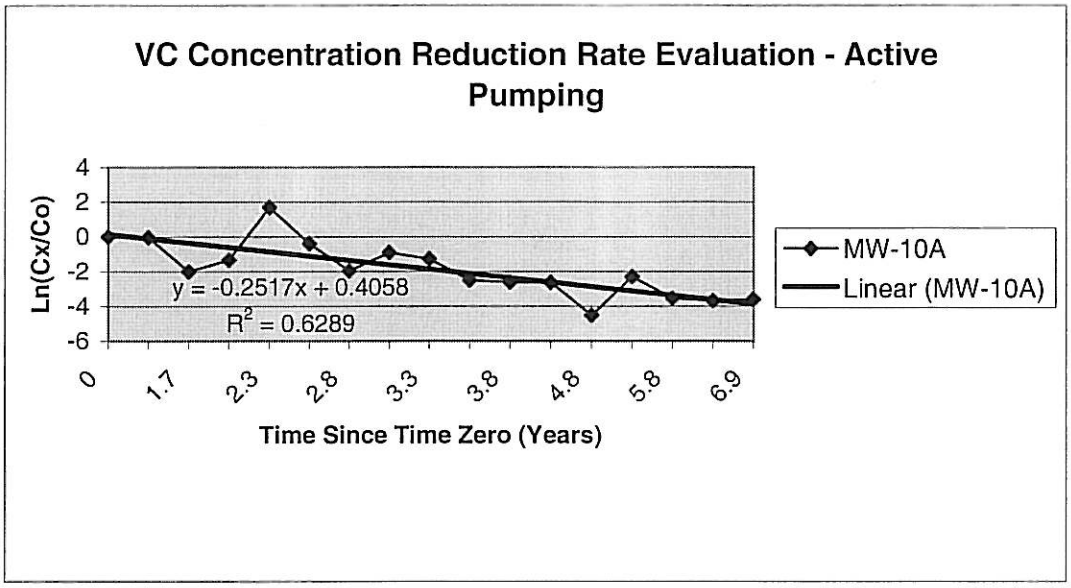

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
5
4
3
2
1
0
y = 0.4925x + 1.0601
R2 = 0.1269
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)

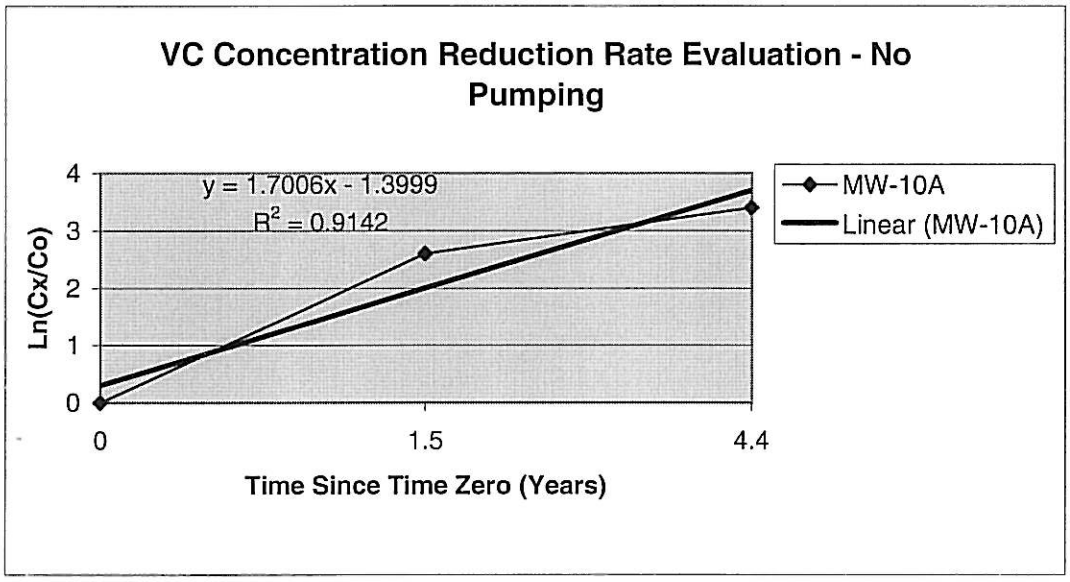

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
1
0
-1
-2
-3
y = -0.0671x + 0.5686
R2 = 0.1203
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
6.9
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

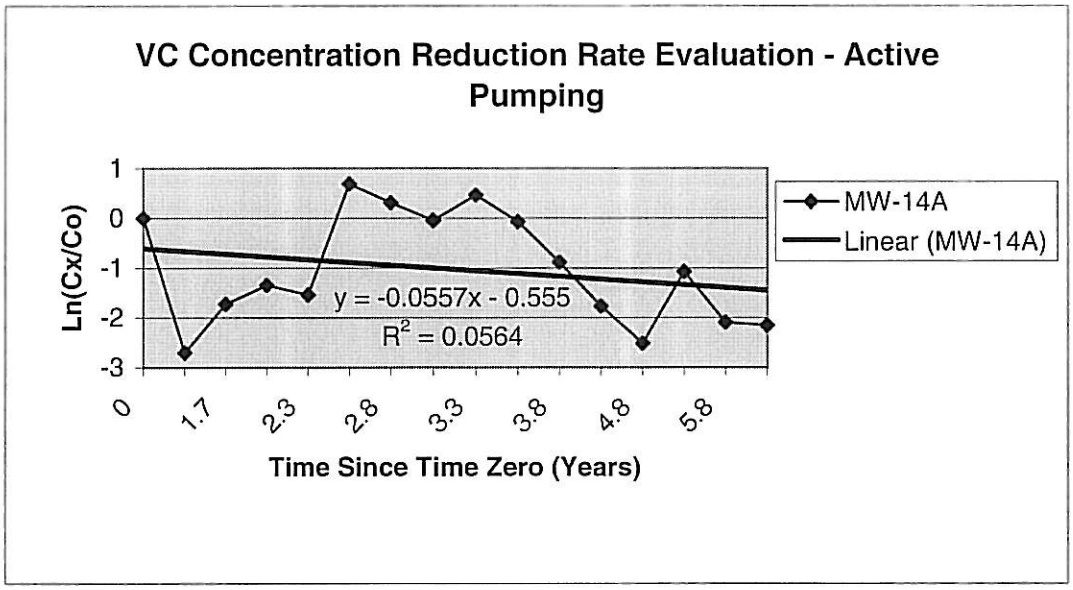

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
4
3.5
3
2.5
2
1.5
1
0.5
0
y = 0.3163x + 0.8899
R2 = 0.0759
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

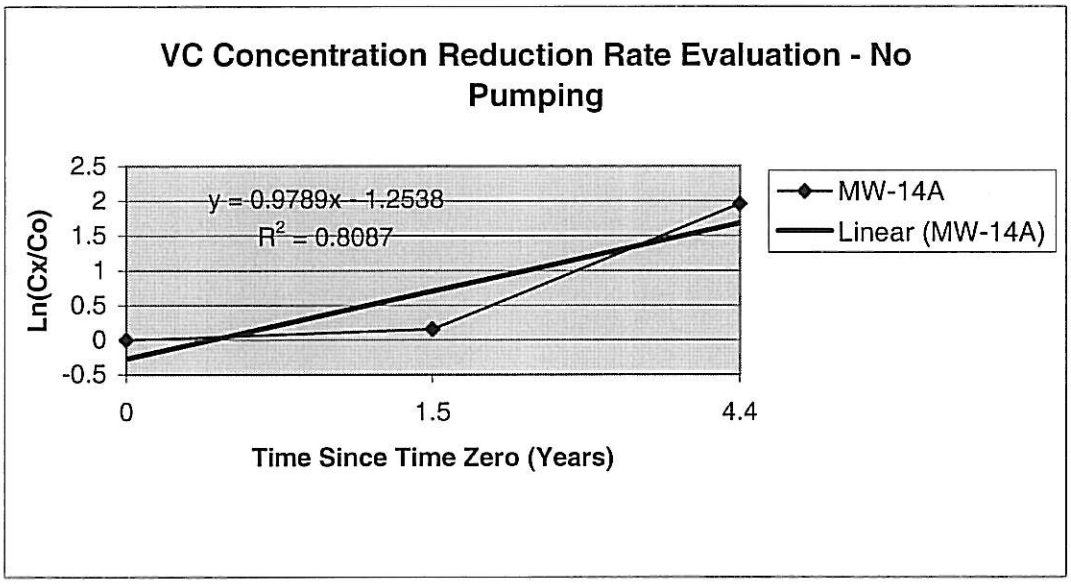

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
1
0
-1
-2
-3
-4
-5
-6
y = -0.1904x + 0.0608
R2 = 0.28
0 1.3 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 5.4 5.8
Time Since Time Zero (Years)
MW-9C
Linear (MW-9C)

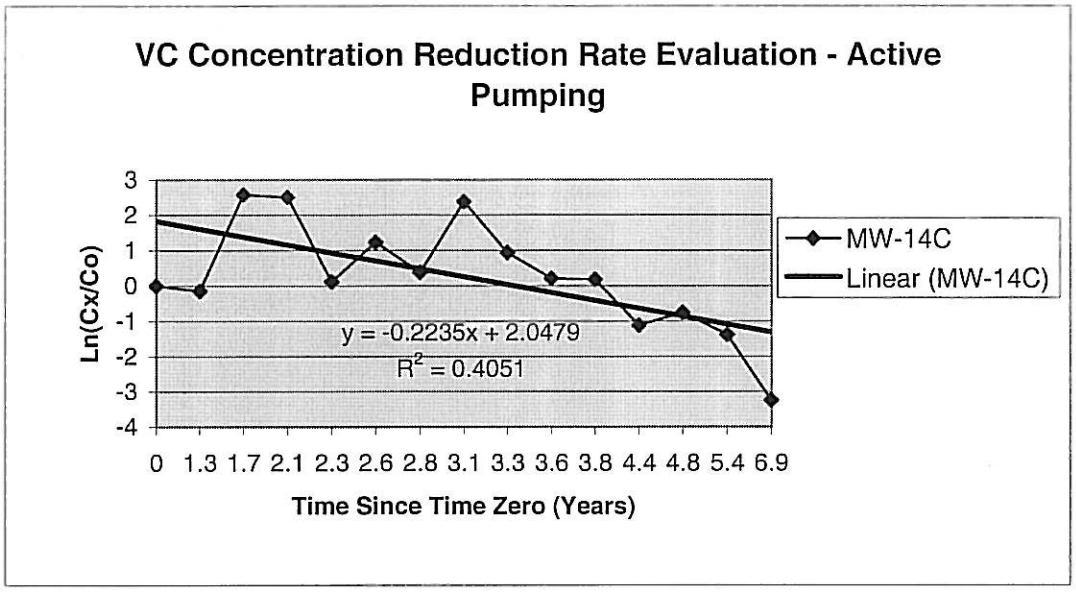

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0.6
0.4
0.2
0
-0.2
-0.4
y = 0.1179x - 0.1897
R2 = 0.1884
0 1.5 3.8 4.4
Time Since Time Zero (Years)
MW-9C
Linear (MW-9C)

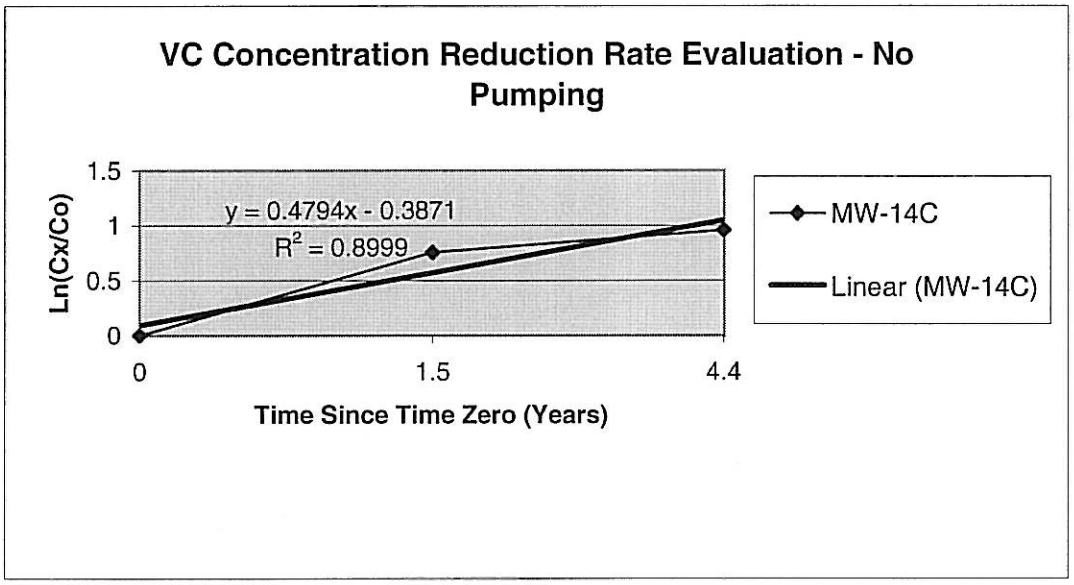

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
4
2
0
-2
-4
-6
y = -0.2517x + 0.4058
R2 = 0.6289
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
6.9
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)

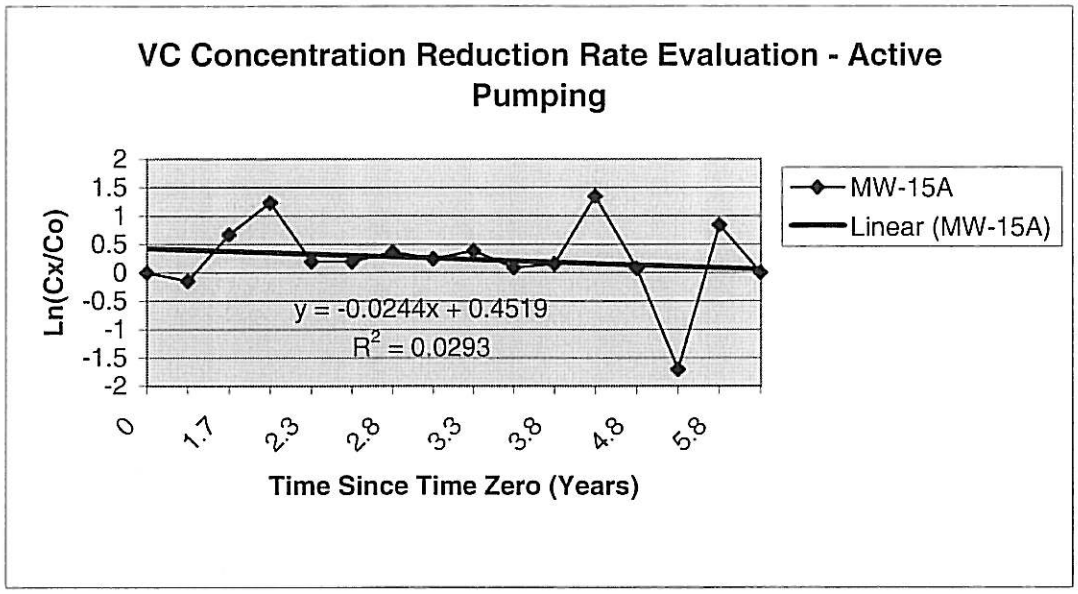

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
4
3
2
1
0
y = 1.7006x - 1.3999
R2 = 0.9142
0
1.5
4.4
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)

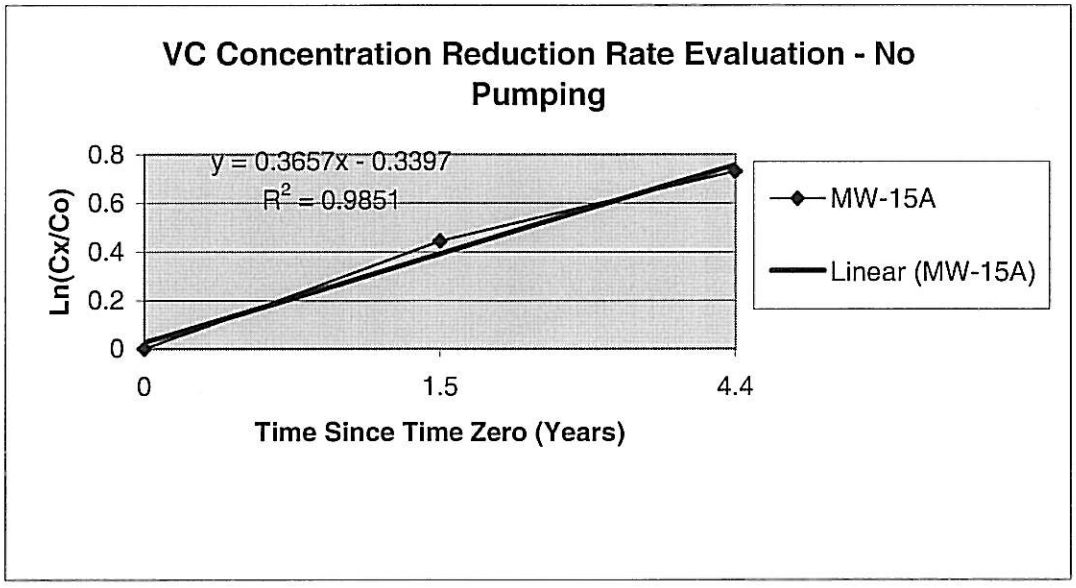

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
1
0
-1
-2
-3
y = -0.0557x - 0.555
R2 = 0.0564
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)

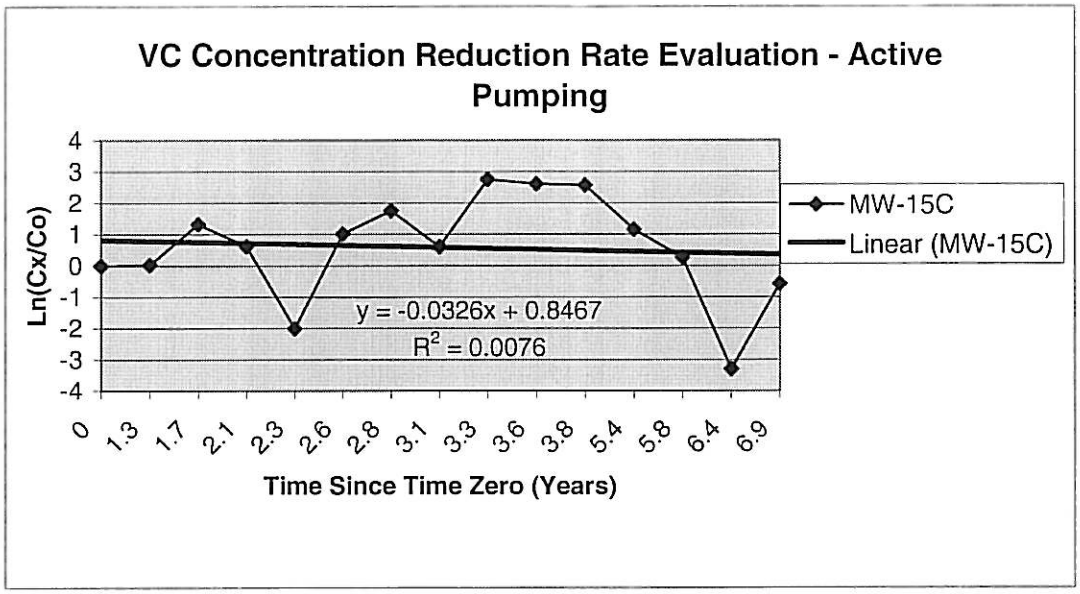

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
2.5
2
1.5
1
0.5
0
-0.5
y = 0.9789x - 1.2538
R2 = 0.8087
0
1.5
4.4
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)

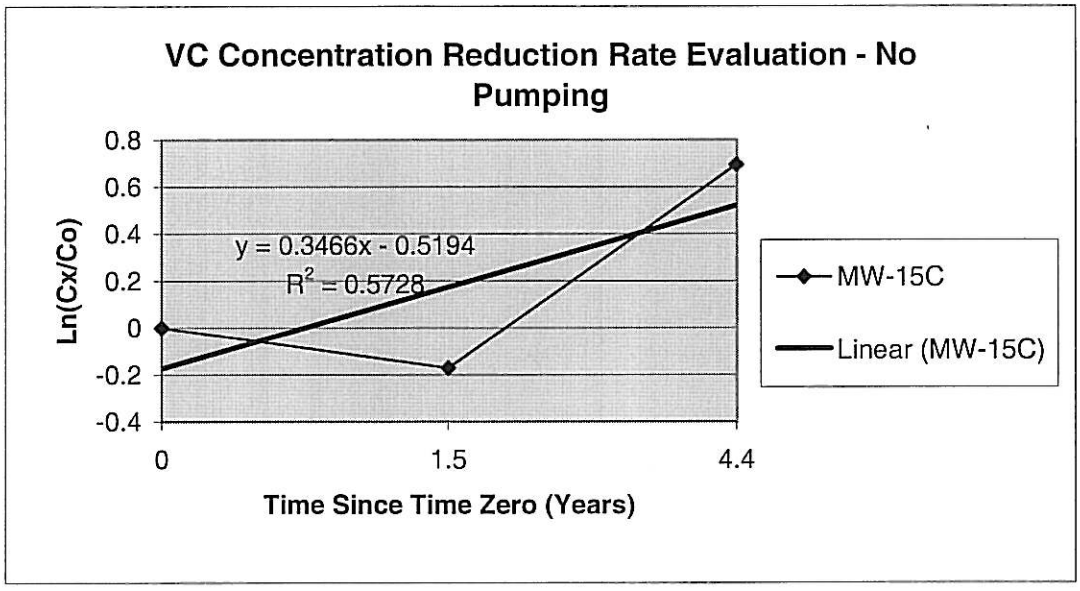

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
3
2
1
0
-1
-2
-3
-4
y = -0.2235x + 2.0479
R2 = 0.4051
0 1.3 1.7 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 4.8 5.4 6.9
Time Since Time Zero (Years)
MW-14C
Linear (MW-14C)

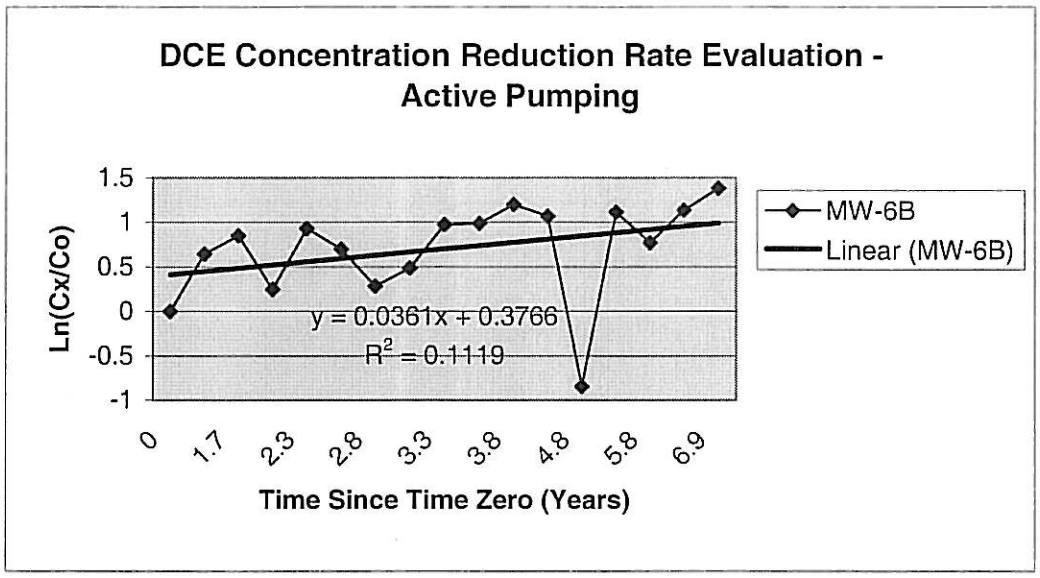

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
1.5
1
0.5
0
y = 0.4794x - 0.3871
R2 = 0.8999
0
1.5
4.4
Time Since Time Zero (Years)
MW-14C
Linear (MW-14C)

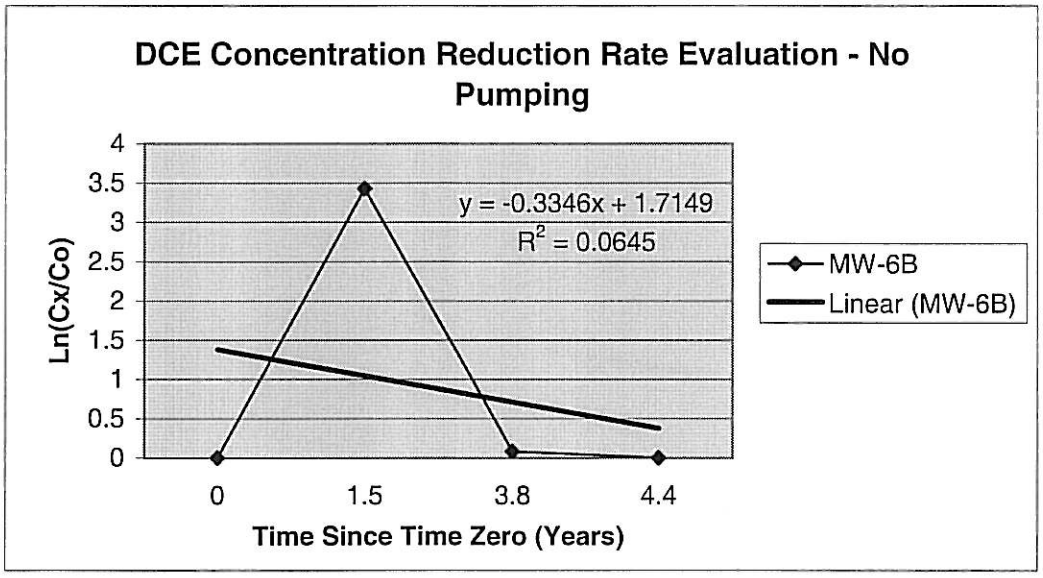

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
y = -0.0244x + 0.4519
R2 = 0.0293
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
Time Since Time Zero (Years)
MW-15A
Linear (MW-15A)

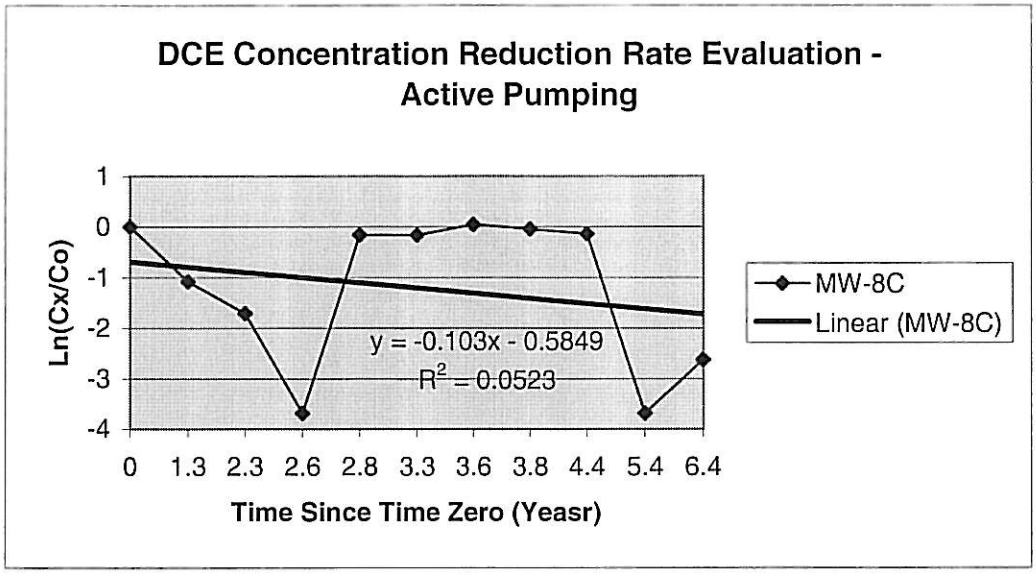

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0.8
0.6
0.4
0.2
0
y = 0.3657x - 0.3397
R2 = 0.9851
0
1.5
4.4
Time Since Time Zero (Years)
MW-15A
Linear (MW-15A)

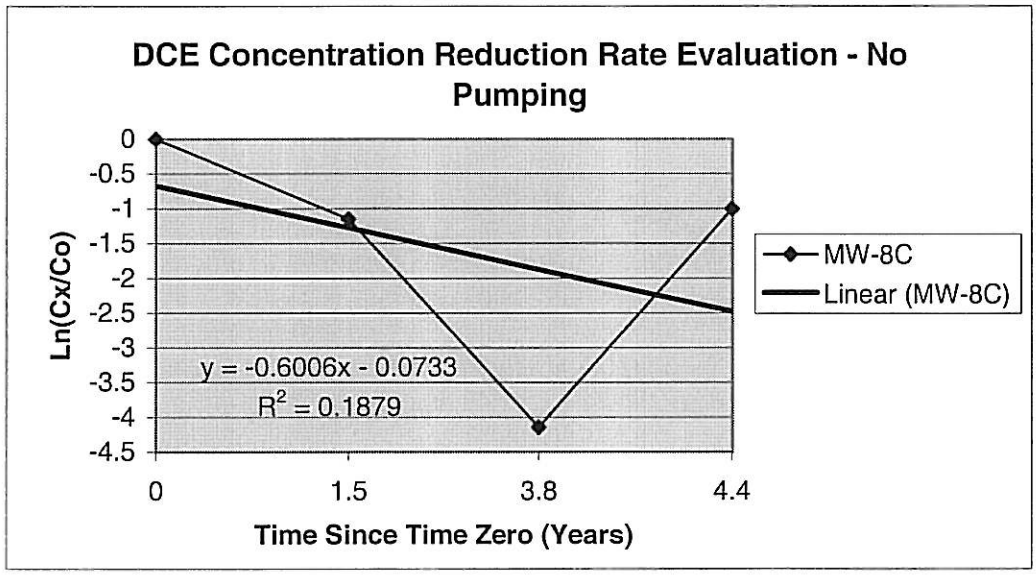

VC Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
4
3
2
1
0
-1
-2
-3
-4
y = -0.0326x + 0.8467
R2 = 0.0076
0
1.3
1.7
2.1
2.3
2.6
2.8
3.1
3.3
3.6
3.8
5.4
5.8
6.4
6.9
Time Since Time Zero (Years)
MW-15C
Linear (MW-15C)

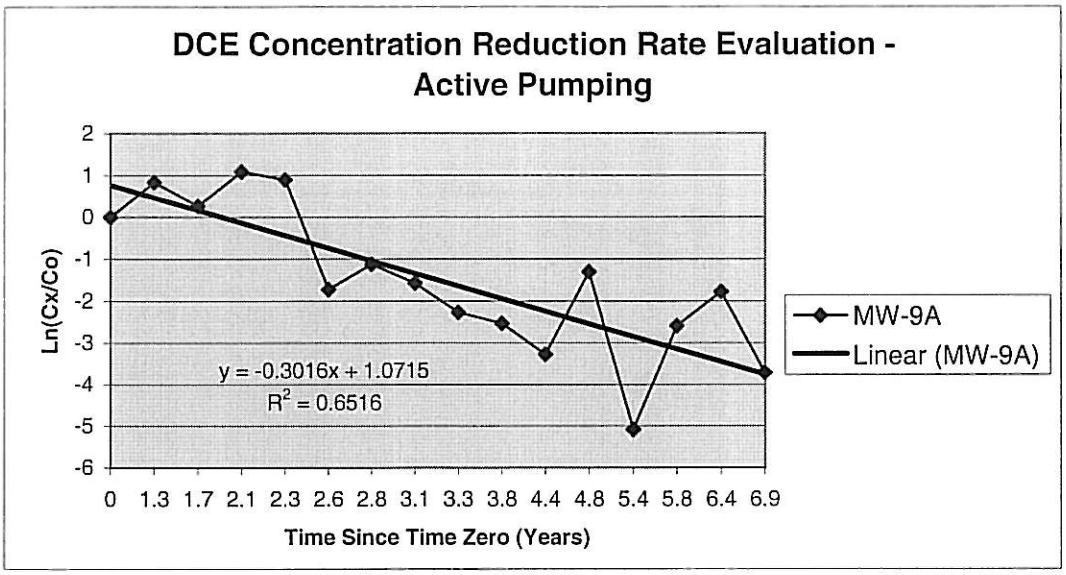

VC Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
y = 0.3466x - 0.5194
R2 = 0.5728
0
1.5
4.4
Time Since Time Zero (Years)
MW-15C
Linear (MW-15C)

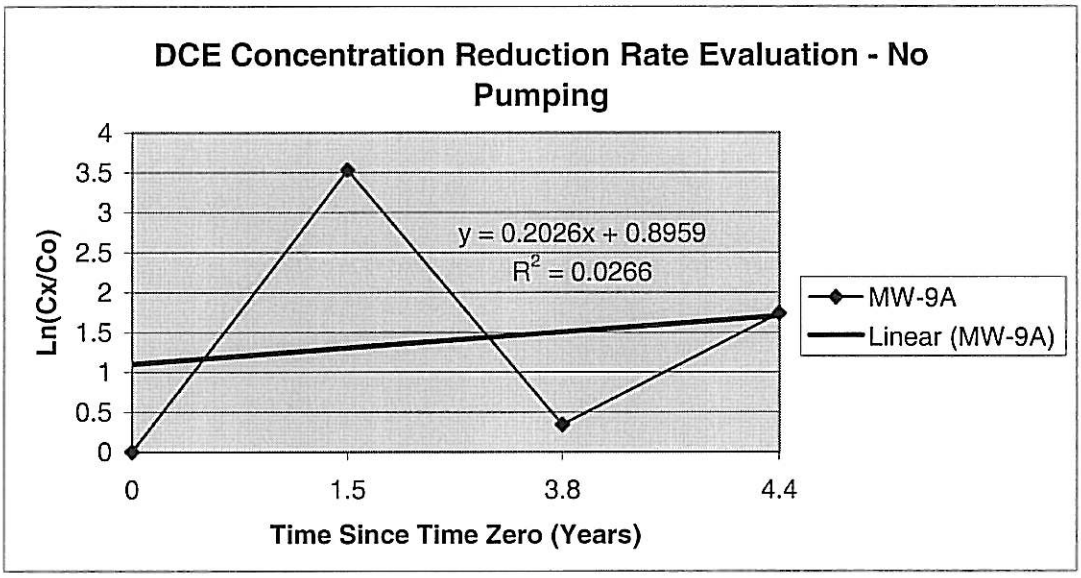

DCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
1.5
1
0.5
0
-0.5
-1
y = 0.0361x + 0.3766
R2 = 0.1119
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
6.9
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

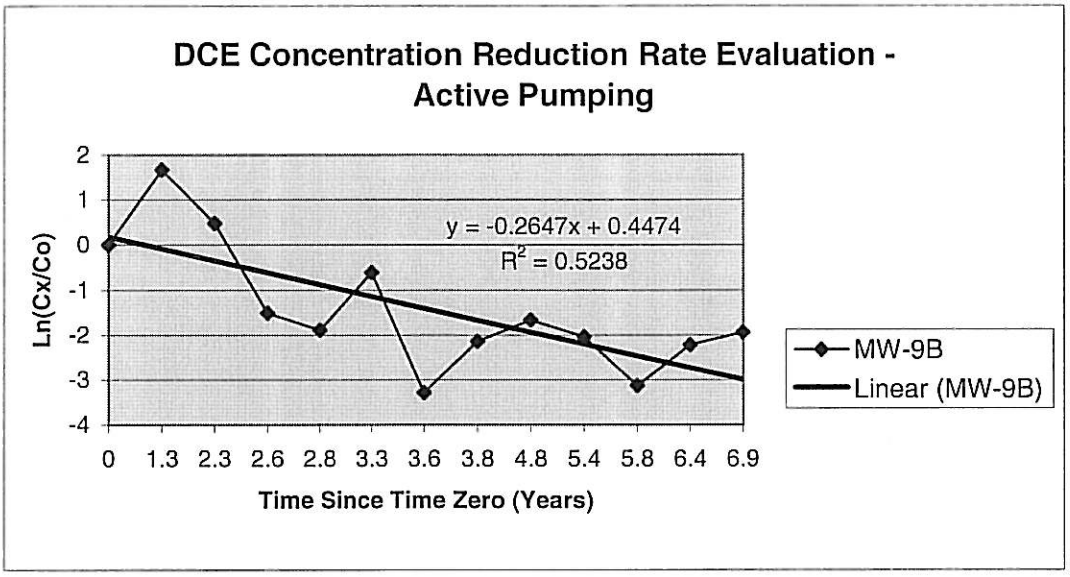

DCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
4
3.5
3
2.5
2
1.5
1
0.5
0
y = -0.3346x + 1.7149
R2 = 0.0645
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

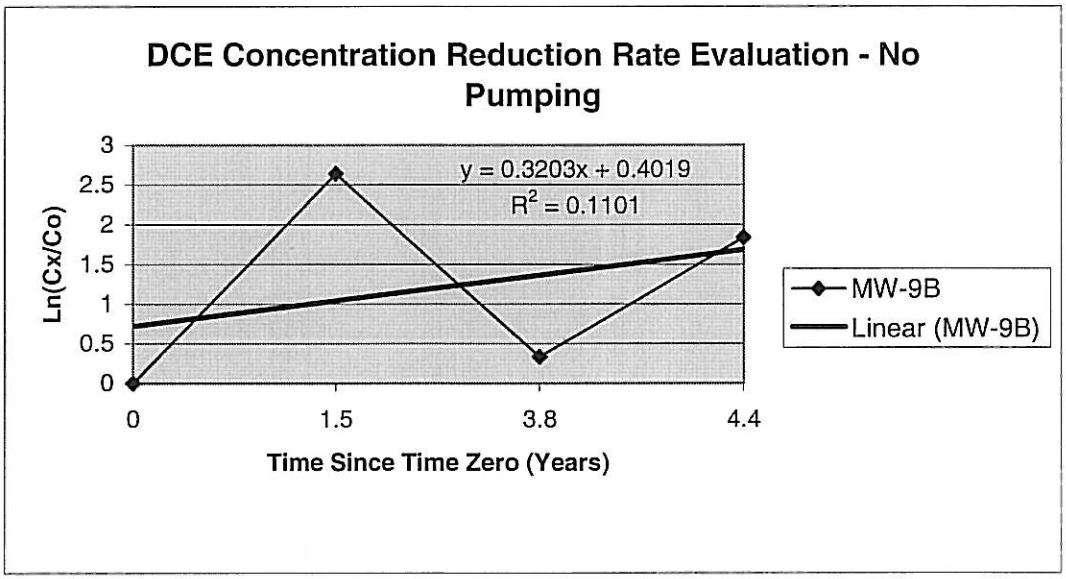

DCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
1
0
-1
-2
-3
-4
y = -0.103x - 0.5849
R2 = 0.0523
0 1.3 2.3 2.6 2.8 3.3 3.6 3.8 4.4 5.4 6.4
Time Since Time Zero (Yeasr)
MW-8C
Linear (MW-8C)

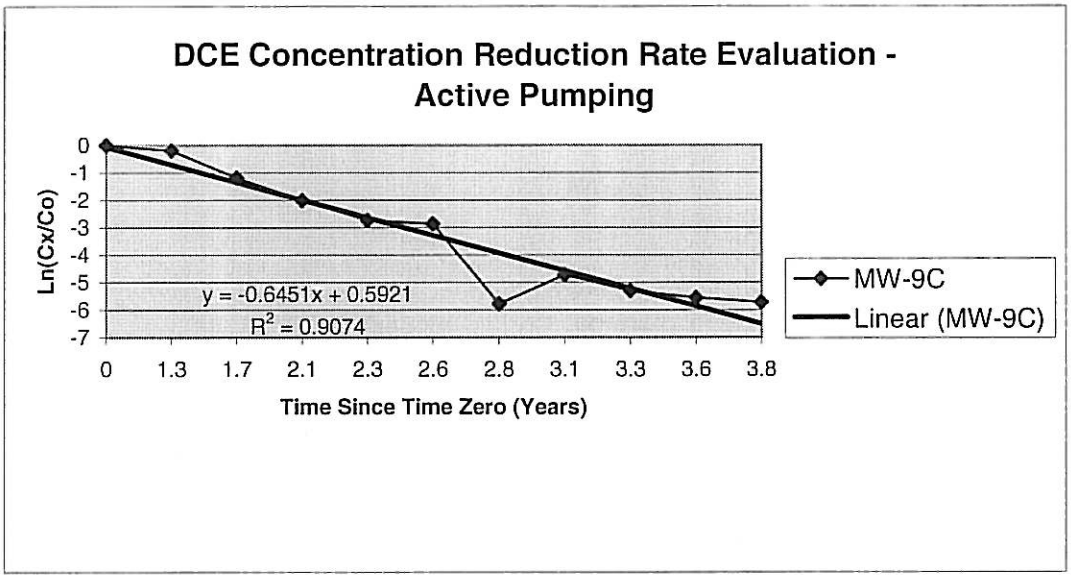

DCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
y = -0.6006x - 0.0733
R2 = 0.1879
0 1.5 3.8 4.4
Time Since Time Zero (Years)
MW-8C
Linear (MW-8C)

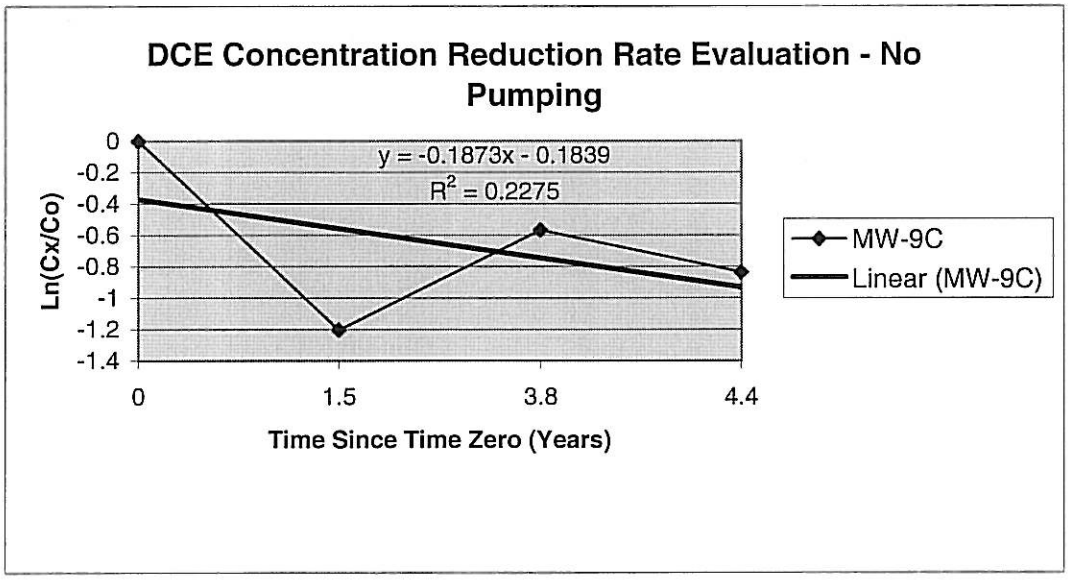

DCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
1
0
-1
-2
-3
-4
-5
-6
y = -0.3016x + 1.0715
R2 = 0.6516
0 1.3 1.7 2.1 2.3 2.6 2.8 3.1 3.3 3.8 4.4 4.8 5.4 5.8 6.4 6.9
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)

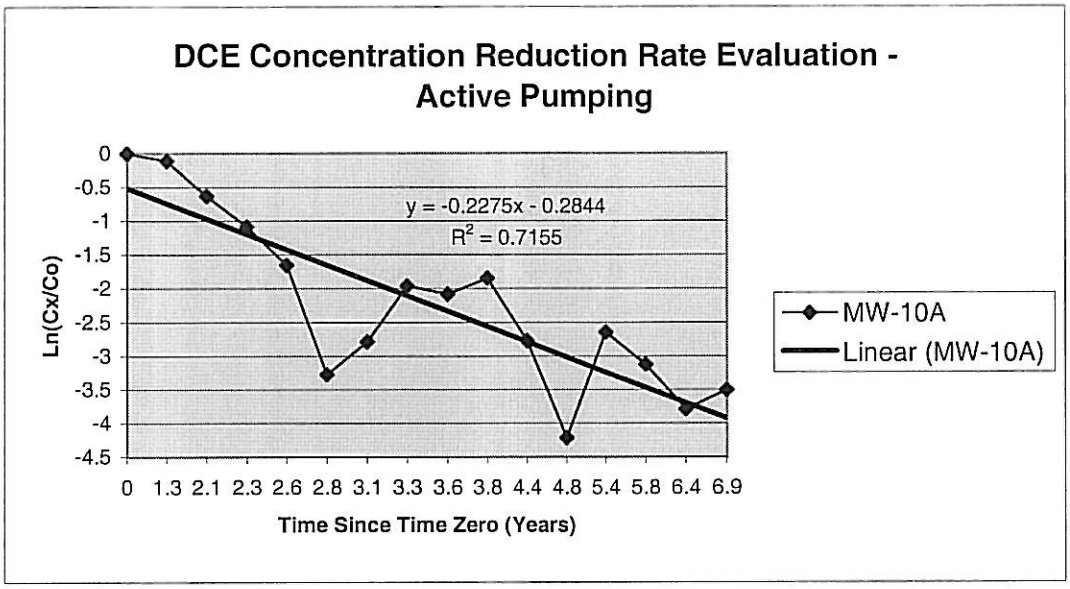

DCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
4
3.5
3
2.5
2
1.5
1
0.5
0
y = 0.2026x + 0.8959
R2 = 0.0266
0 1.5 3.8 4.4
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)

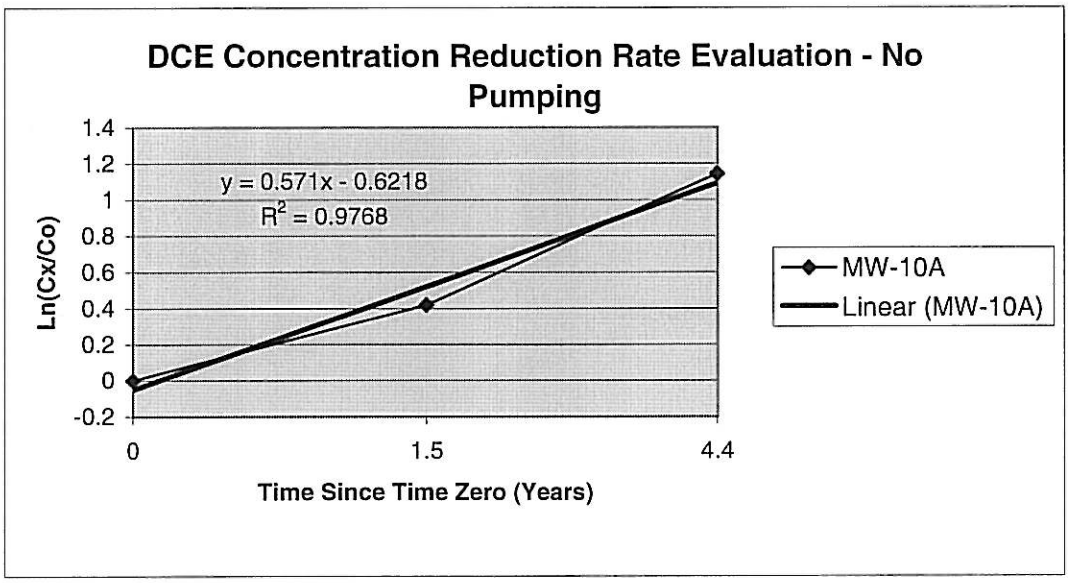

DCE Concentration Reduction Rate Evaluation - Active Pumping
y = -0.2647x + 0.4474
R2 = 0.5238
Ln(Cx/Co)
2
1
0
-1
-2
-3
-4
0 1.3 2.3 2.6 2.8 3.3 3.6 3.8 4.8 5.4 5.8 6.4 6.9
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

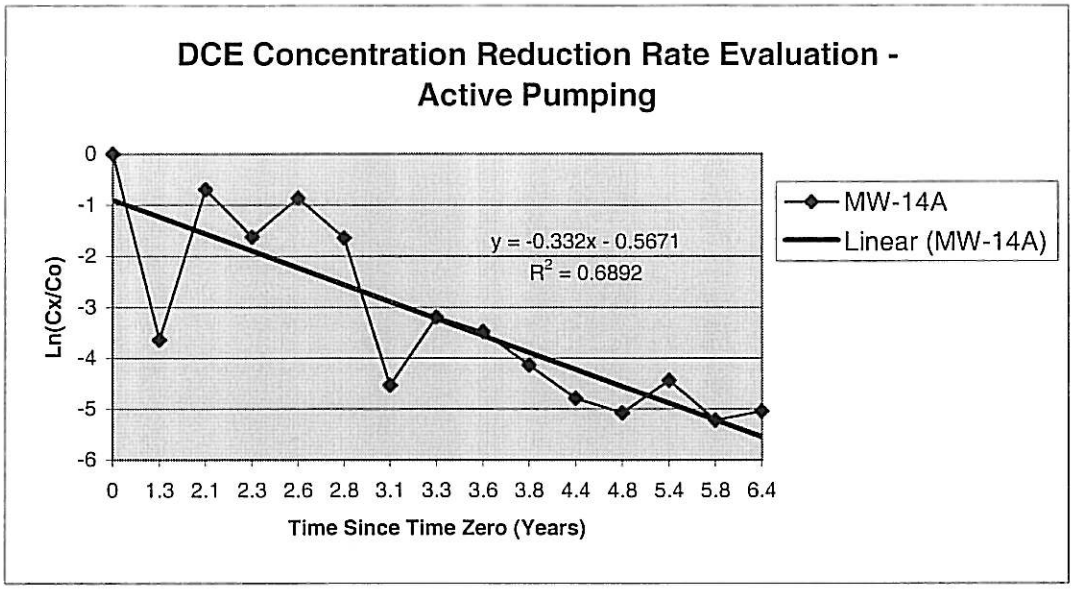

DCE Concentration Reduction Rate Evaluation - No Pumping
y = 0.3203x + 0.4019
R2 = 0.1101
Ln(Cx/Co)
3
2.5
2
1.5
1
0.5
0
0 1.5 3.8 4.4
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

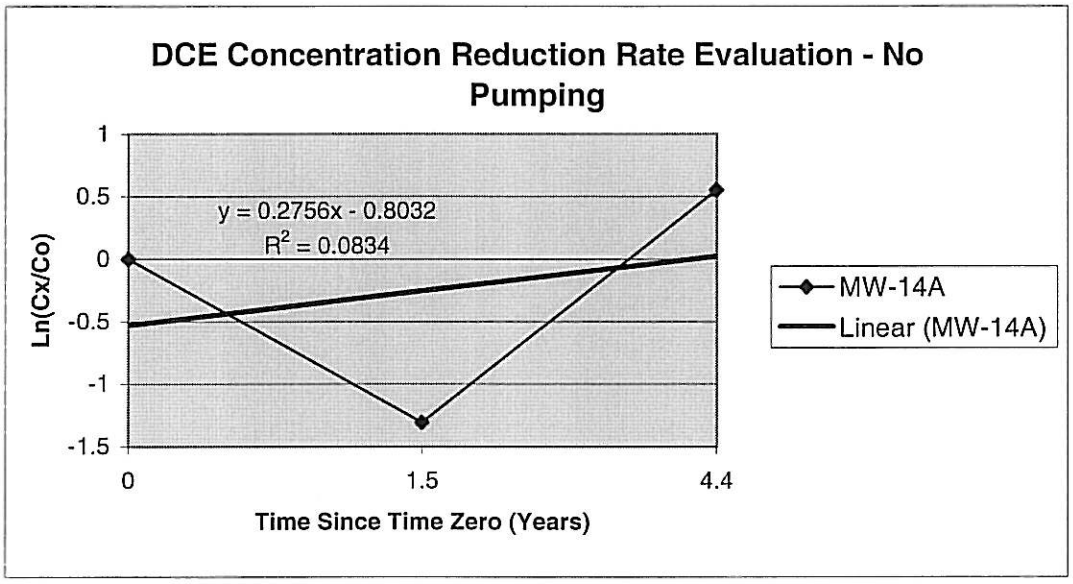

DCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0
-1
-2
-3
-4
-5
-6
-7
y = -0.6451x + 0.5921
R2 = 0.9074
0
1.3
1.7
2.1
2.3
2.6
2.8
3.1
3.3
3.6
3.8
Time Since Time Zero (Years)
MW-9C
Linear (MW-9C)

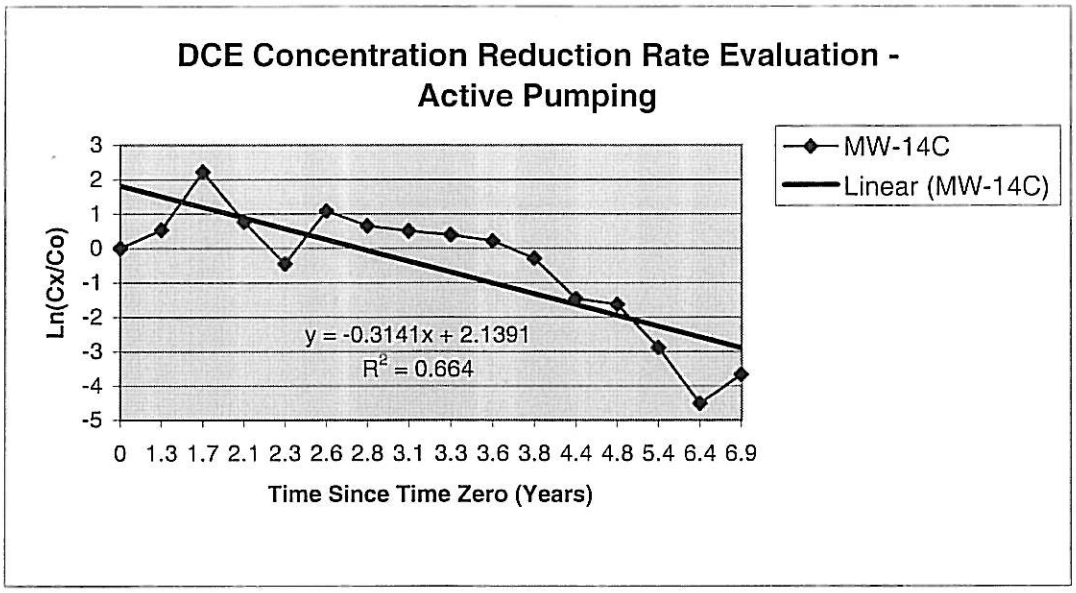

DCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
y = -0.1873x - 0.1839
R2 = 0.2275
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-9C
Linear (MW-9C)

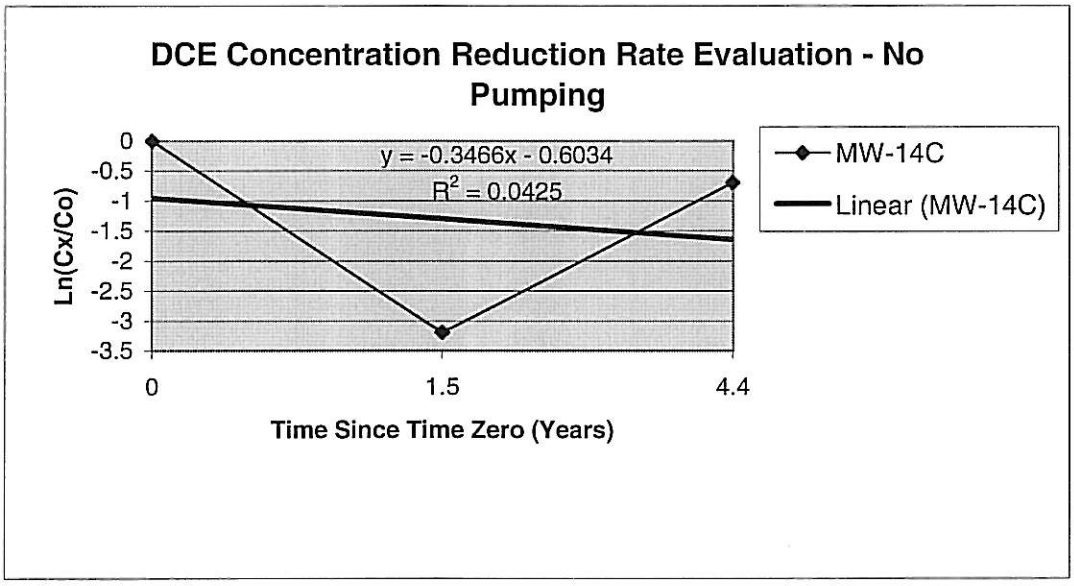

DCE Concentration Reduction Rate Evaluation - Active Pumping
y = -0.2275x - 0.2844
R2 = 0.7155
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
0 1.3 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 4.8 5.4 5.8 6.4 6.9
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)

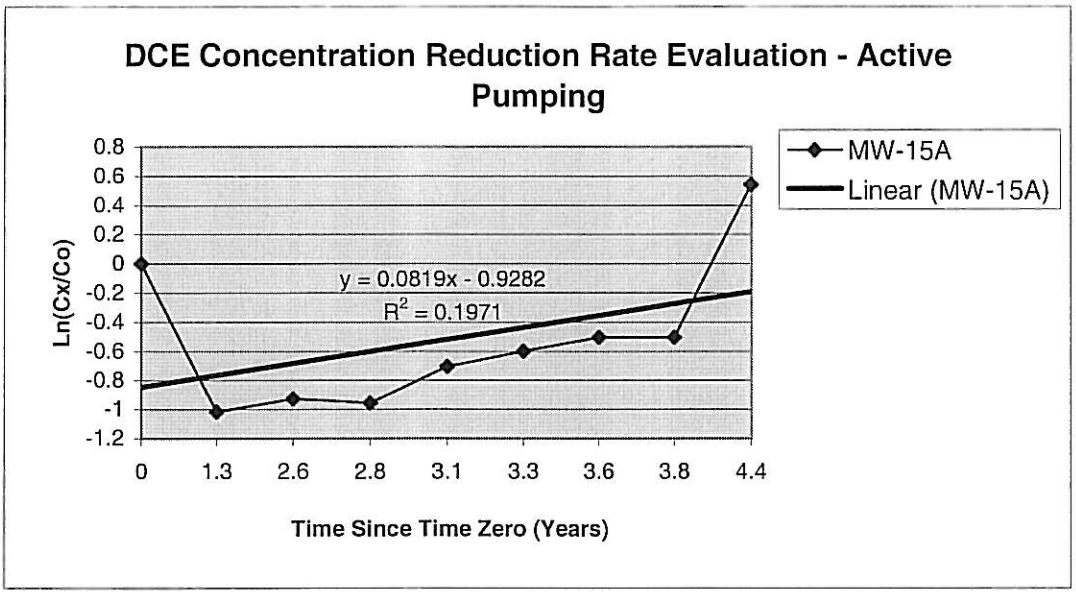

DCE Concentration Reduction Rate Evaluation - No Pumping
y = 0.571x - 0.6218
R2 = 0.9768
Ln(Cx/Co)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
0
1.5
4.4
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)

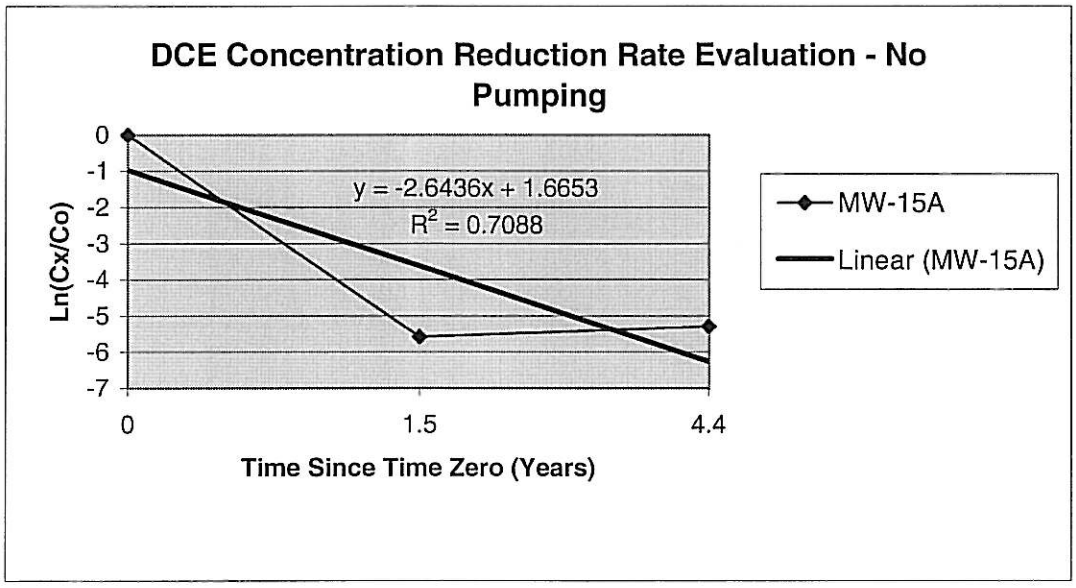

DCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0
-1
-2
-3
-4
-5
-6
y = -0.332x - 0.5671
R2 = 0.6892
0 1.3 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 4.8 5.4 5.8 6.4
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)

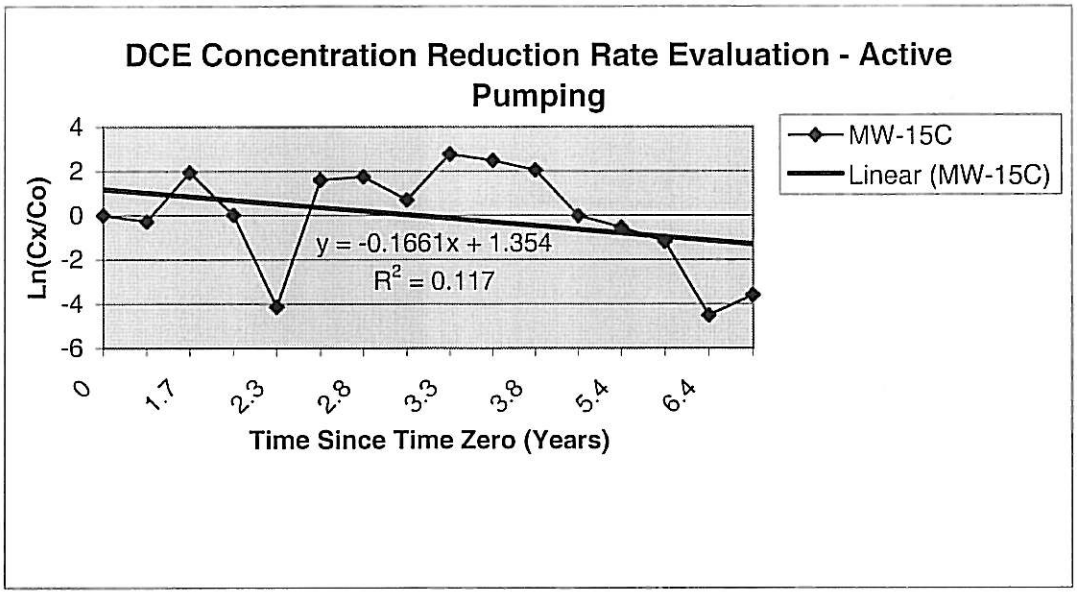

DCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
1
0.5
0
-0.5
-1
-1.5
y = 0.2756x - 0.8032
R2 = 0.0834
0 1.5 4.4
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)

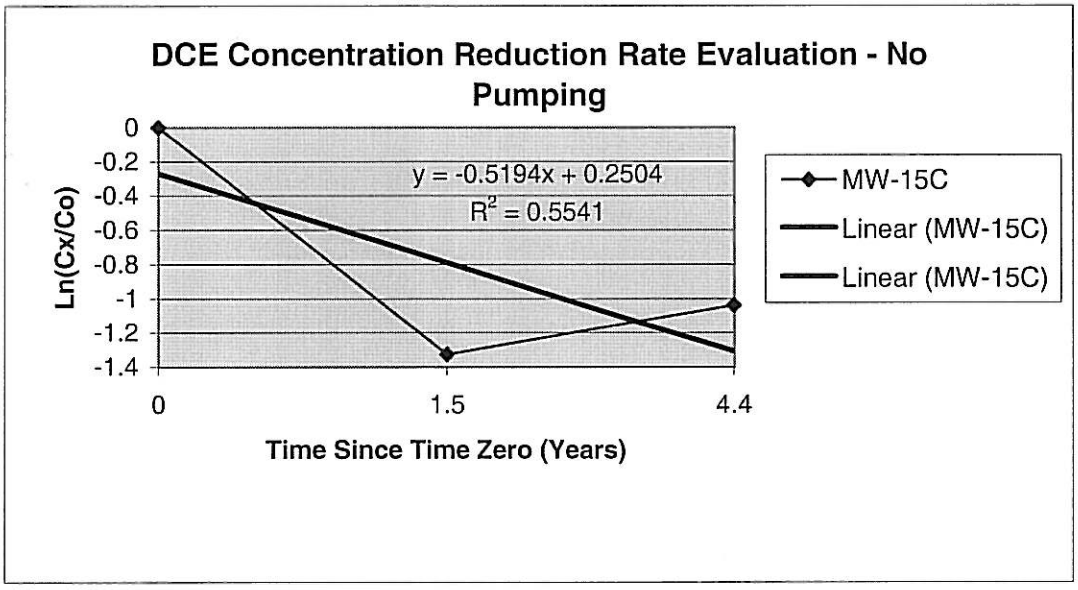

DCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
3
2
1
0
-1
-2
-3
-4
-5
y = -0.3141x + 2.1391
R2 = 0.664
0 1.3 1.7 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 4.8 5.4 6.4 6.9
Time Since Time Zero (Years)
MW-14C
Linear (MW-14C)

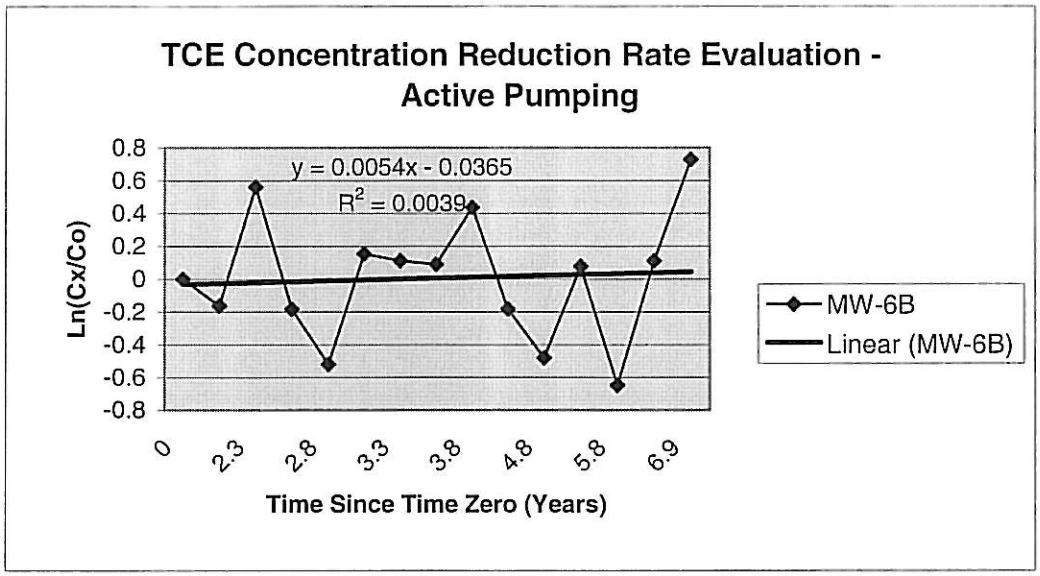

DCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
y = -0.3466x - 0.6034
R2 = 0.0425
0
1.5
4.4
Time Since Time Zero (Years)
MW-14C
Linear (MW-14C)

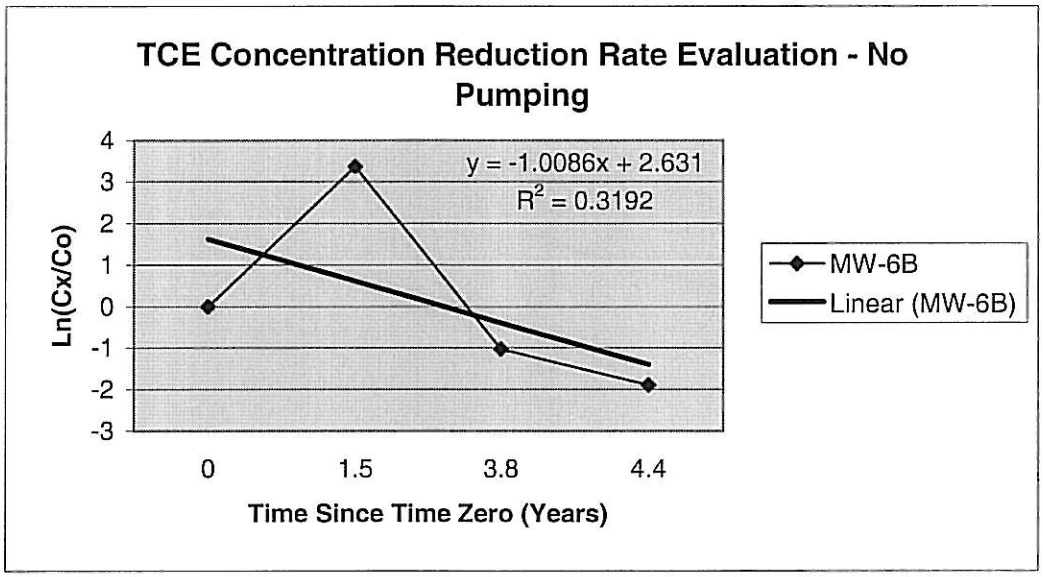

DCE Concentration Reduction Rate Evaluation - Active Pumping
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
Ln(Cx/Co)
y = 0.0819x - 0.9282
R2 = 0.1971
0
1.3
2.6
2.8
3.1
3.3
3.6
3.8
4.4
Time Since Time Zero (Years)
MW-15A
Linear (MW-15A)

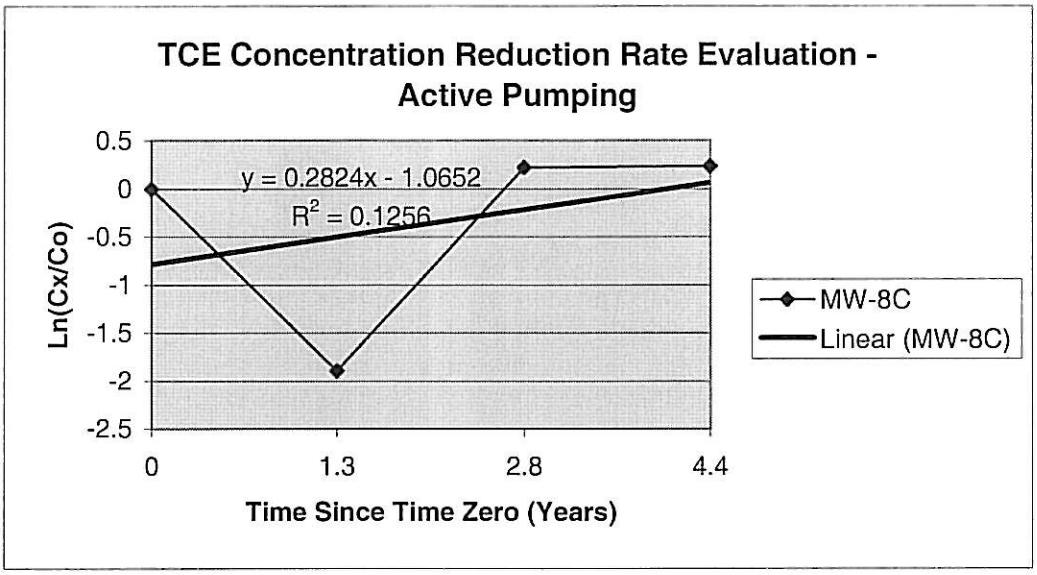

DCE Concentration Reduction Rate Evaluation - No Pumping
0
-1
-2
-3
-4
-5
-6
-7
Ln(Cx/Co)
y = -2.6436x + 1.6653
R2 = 0.7088
0
1.5
4.4
Time Since Time Zero (Years)
MW-15A
Linear (MW-15A)

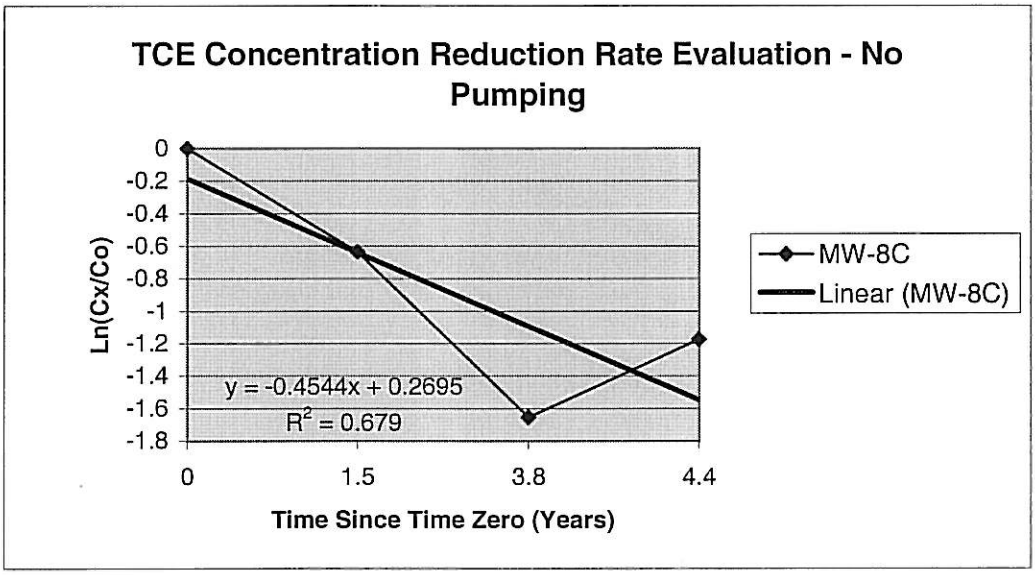

DCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
4
2
0
-2
-4
-6
y = -0.1661x + 1.354
R2 = 0.117
0
1.7
2.3
2.8
3.3
3.8
5.4
6.4
Time Since Time Zero (Years)
MW-15C
Linear (MW-15C)

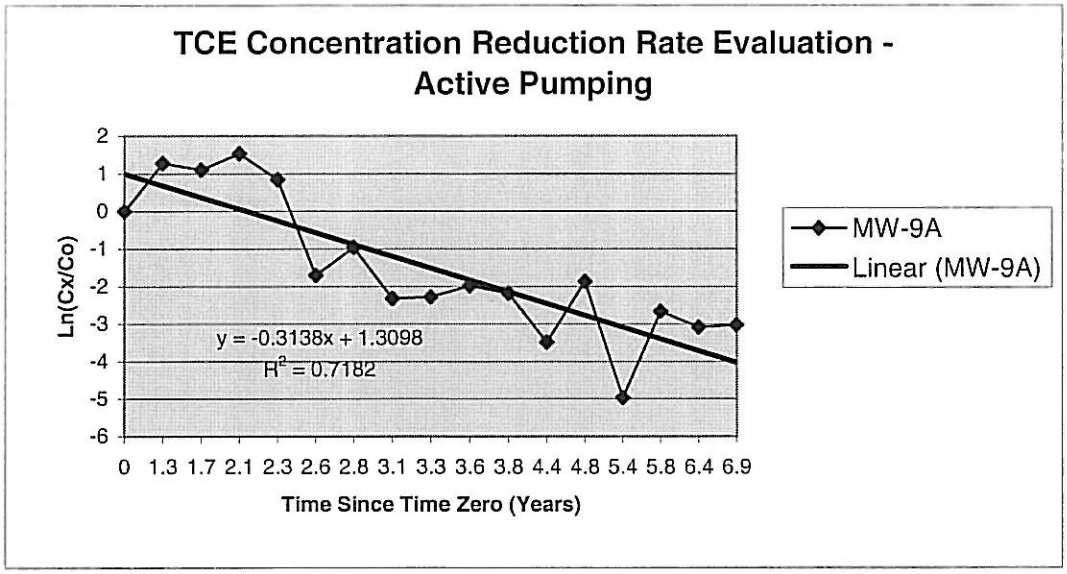

DCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
y = -0.5194x + 0.2504
R2 = 0.5541
0
1.5
4.4
Time Since Time Zero (Years)
MW-15C
Linear (MW-15C)
Linear (MW-15C)

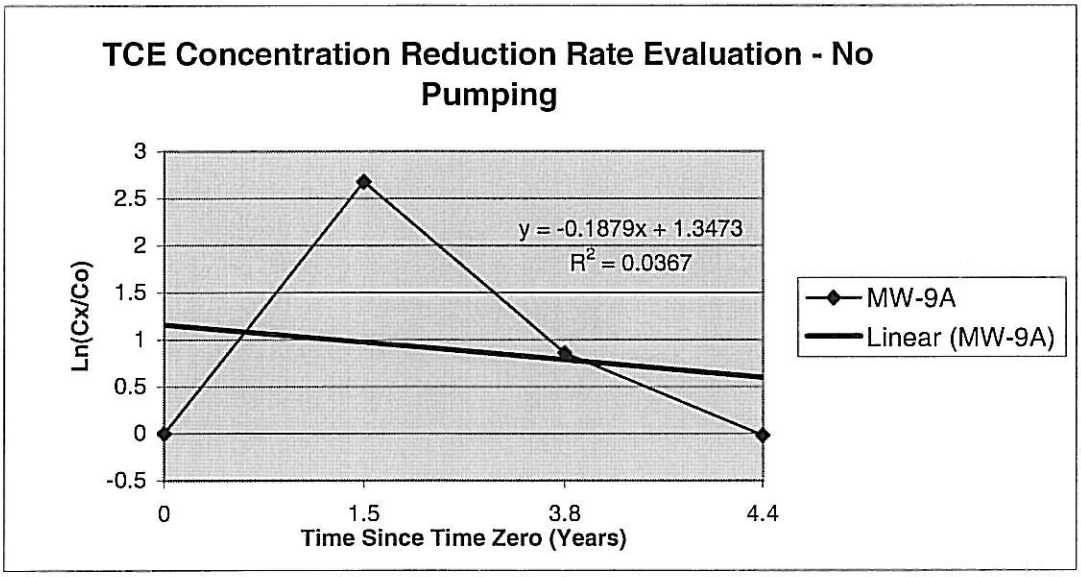

TCE Concentration Reduction Rate Evaluation - Active Pumping
y = 0.0054x - 0.0365
R2 = 0.0039
Ln(Cx/Co)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
2.3
2.8
3.3
3.8
4.8
5.8
6.9
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

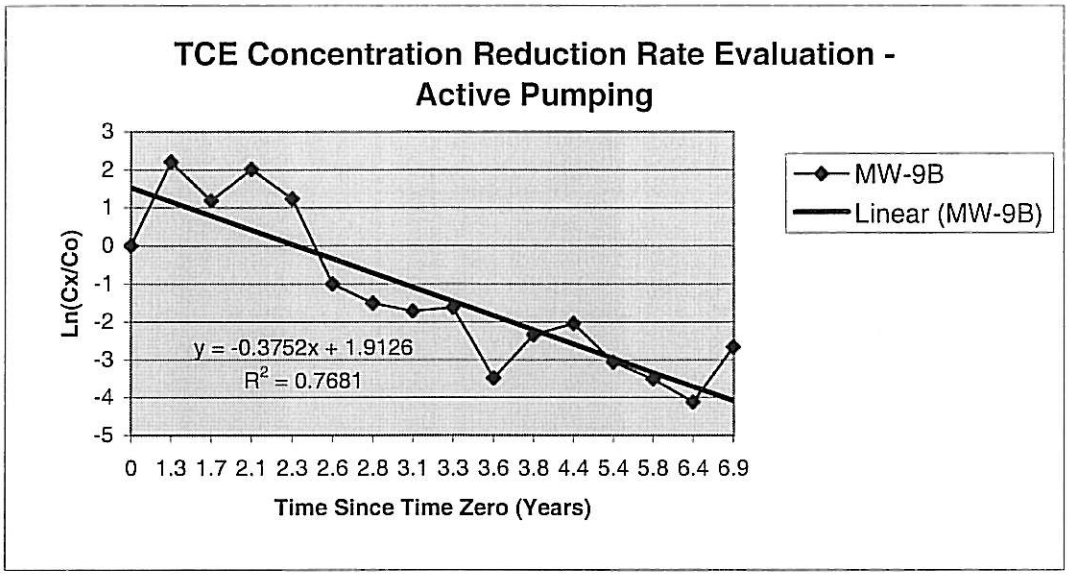

TCE Concentration Reduction Rate Evaluation - No Pumping
y = -1.0086x + 2.631
R2 = 0.3192
Ln(Cx/Co)
4
3
2
1
0
-1
-2
-3
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

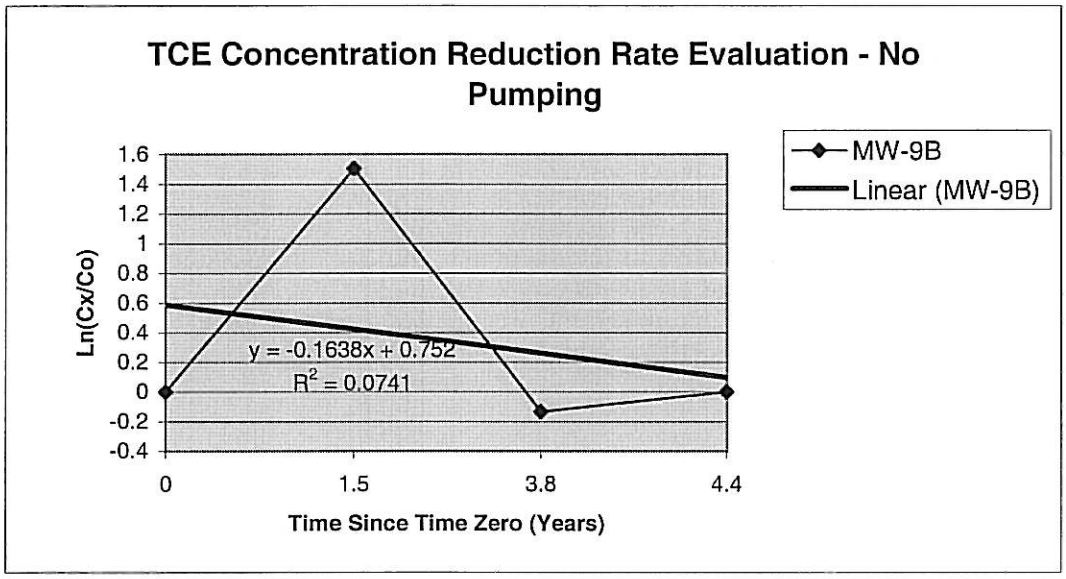

TCE Concentration Reduction Rate Evaluation - Active Pumping
0.5
0
-0.5
-1
-1.5
-2
-2.5
Ln(Cx/Co)
y = 0.2824x - 1.0652
R2 = 0.1256
0
1.3
2.8
4.4
Time Since Time Zero (Years)
MW-8C
Linear (MW-8C)


TCE Concentration Reduction Rate Evaluation - No Pumping
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
Ln(Cx/Co)
y = -0.4544x + 0.2695
R2 = 0.679
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-8C
Linear (MW-8C)

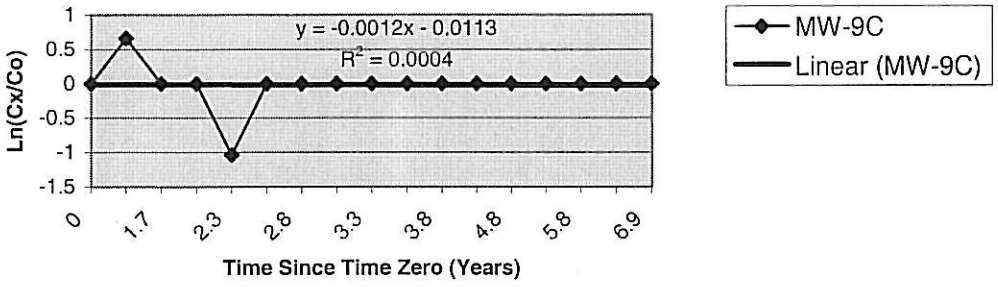

TCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
1
0
-1
-2
-3
-4
-5
-6
y = -0.3138x + 1.3098
R2 = 0.7182
0 1.3 1.7 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 4.8 5.4 5.8 6.4 6.9
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)


TCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
3
2.5
2
1.5
1
0.5
0
-0.5
y = -0.1879x + 1.3473
R2 = 0.0367
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)

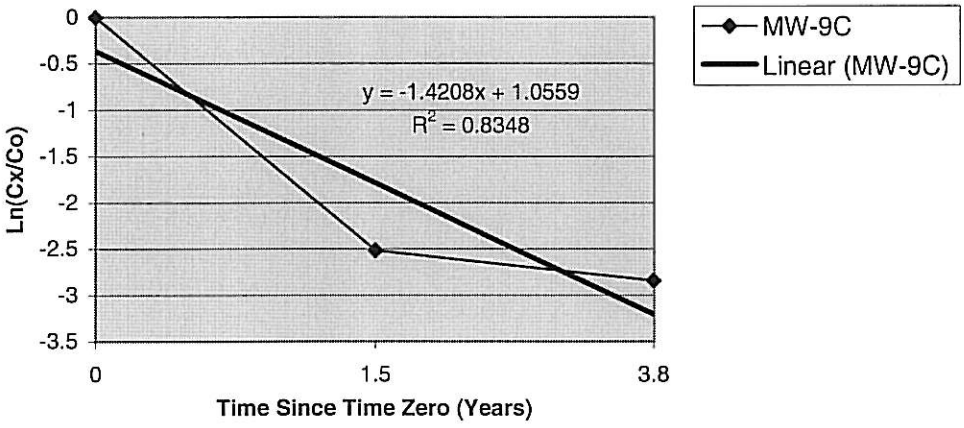

TCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
3
2
1
0
-1
-2
-3
-4
-5
y = -0.3752x + 1.9126
R2 = 0.7681
0 1.3 1.7 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 5.4 5.8 6.4 6.9
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

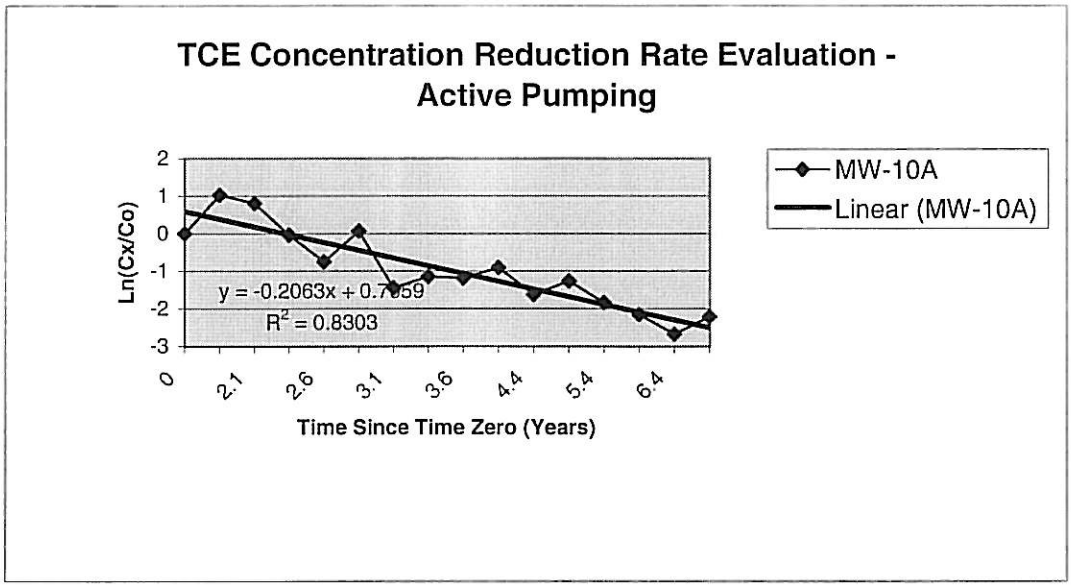

TCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
y = -0.1638x + 0.752
R2 = 0.0741
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

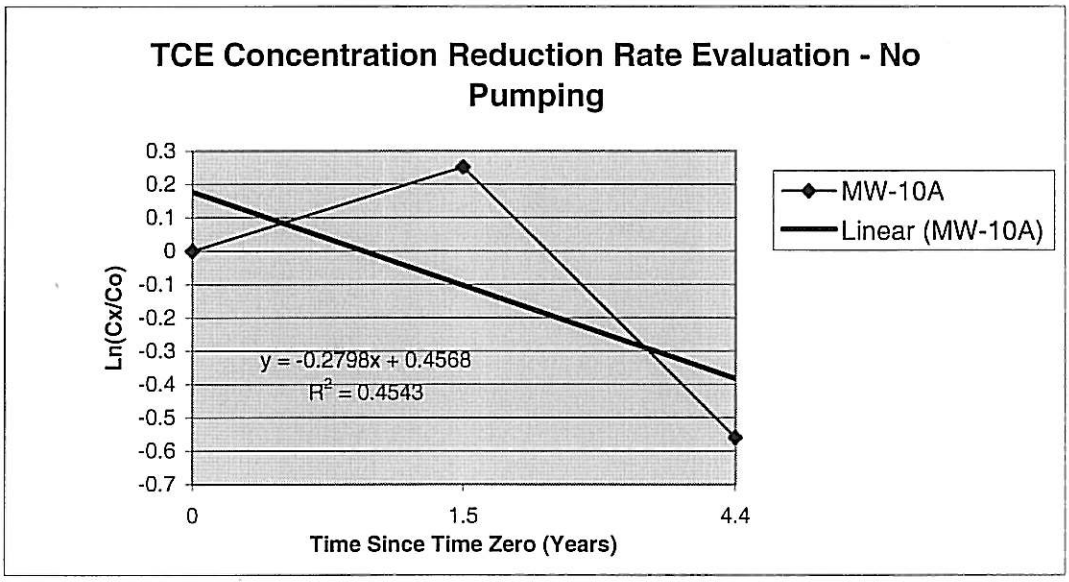
TCE Concentration Reduction Rate Evaluation - Active Pumping

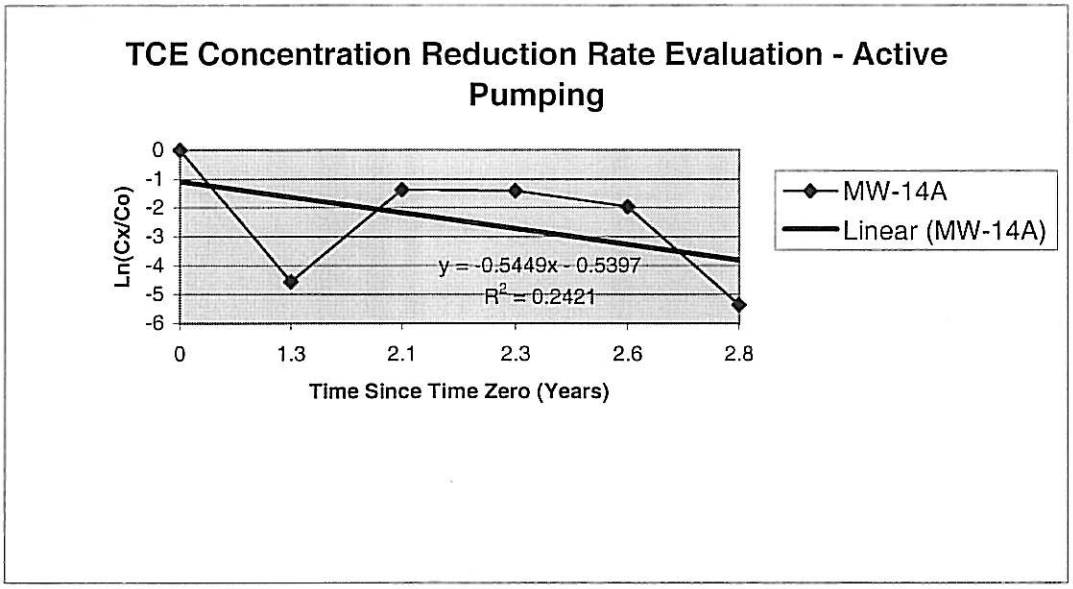


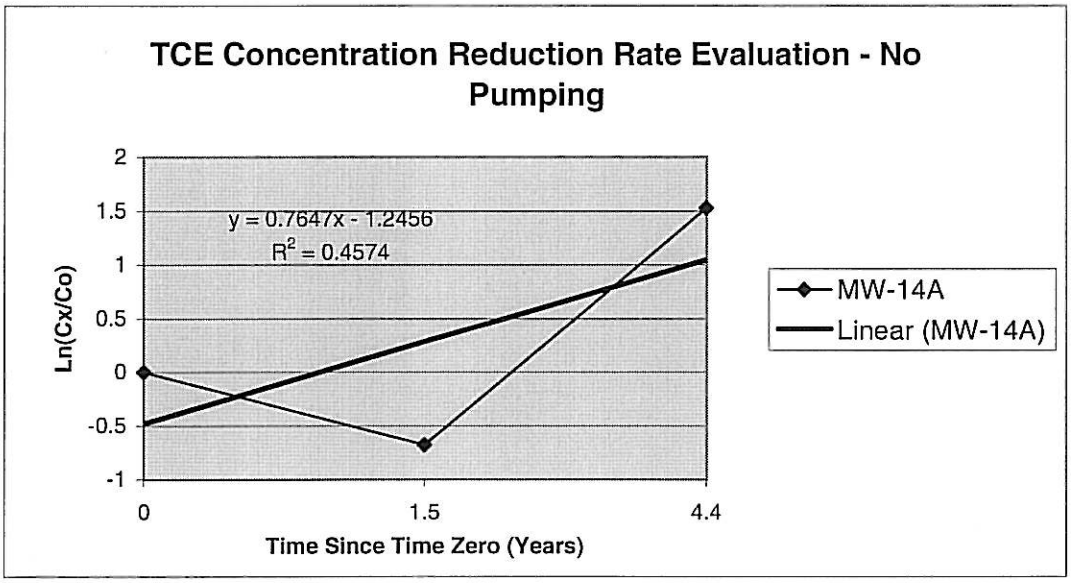
TCE Concentration Reduction Rate Evaluation - No Pumping

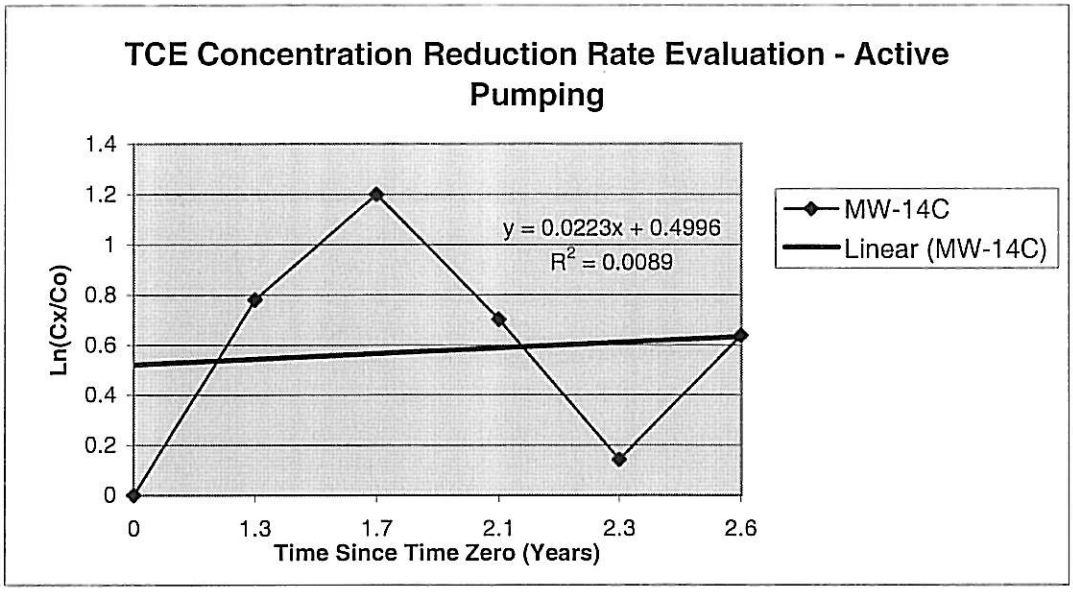


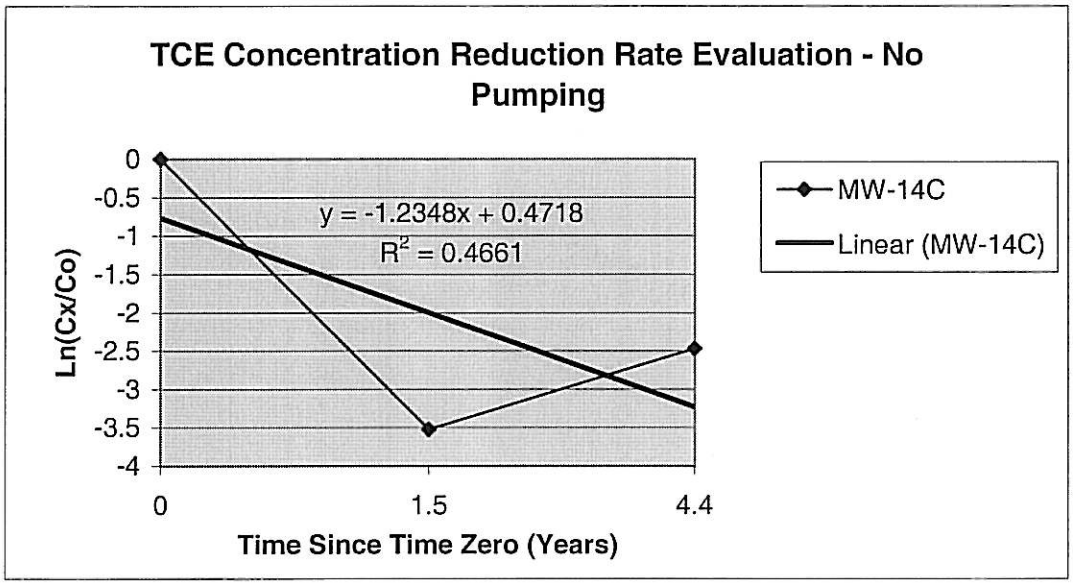

TCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
1
0
-1
-2
-3
y = -0.2063x + 0.7059
R2 = 0.8303
0
2.1
2.6
3.1
3.6
4.4
5.4
6.4
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)


TCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
y = -0.2798x + 0.4568
R2 = 0.4543
0
1.5
4.4
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)

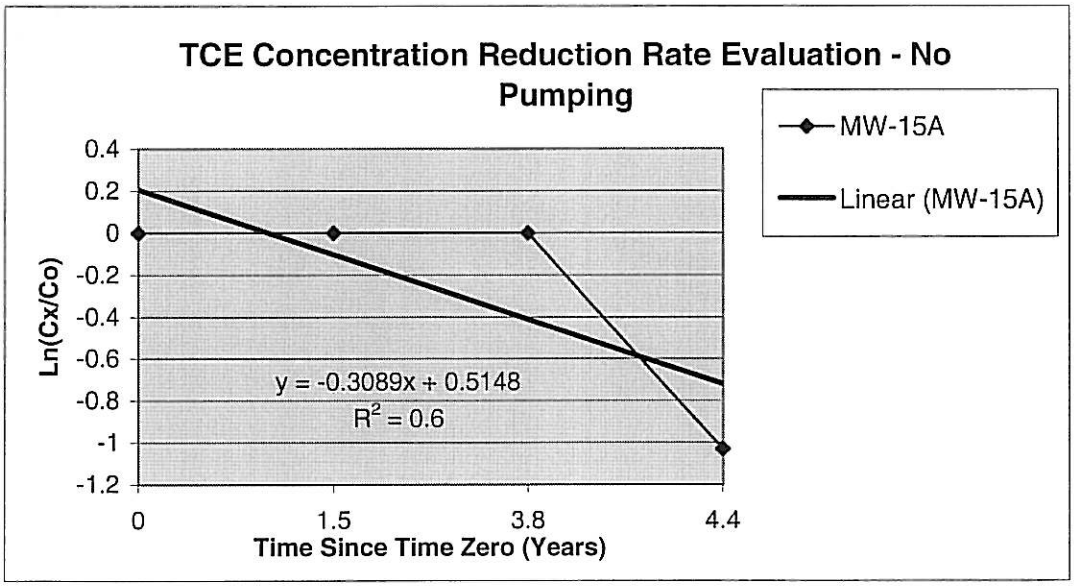

TCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0
-1
-2
-3
-4
-5
-6
y = -0.5449x - 0.5397
R2 = 0.2421
0
1.3
2.1
2.3
2.6
2.8
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)

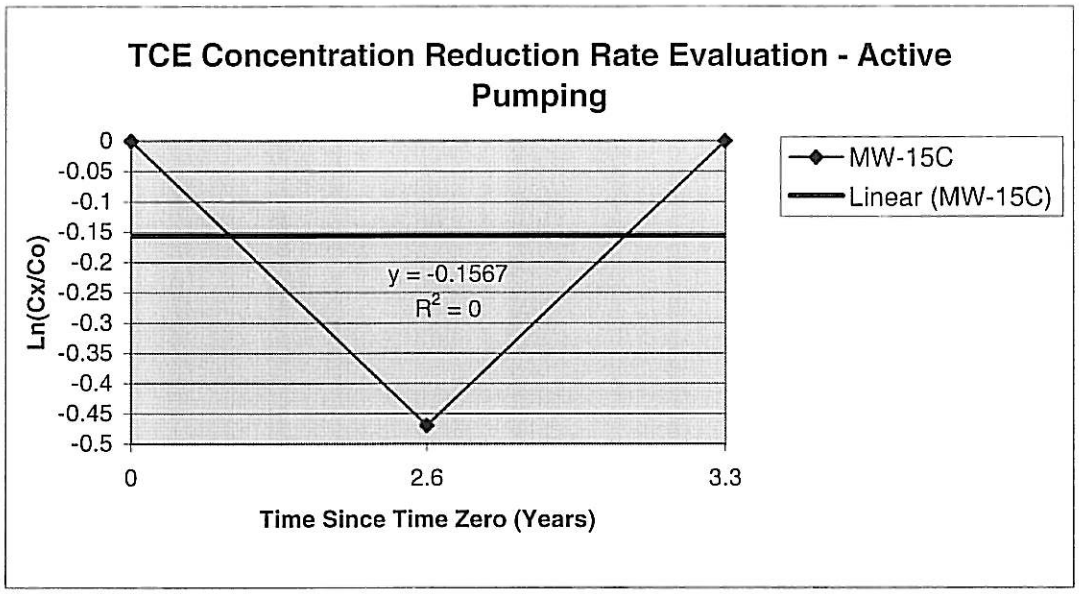

TCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
2
1.5
1
0.5
0
-0.5
-1
y = 0.7647x - 1.2456
R2 = 0.4574
0
1.5
4.4
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)

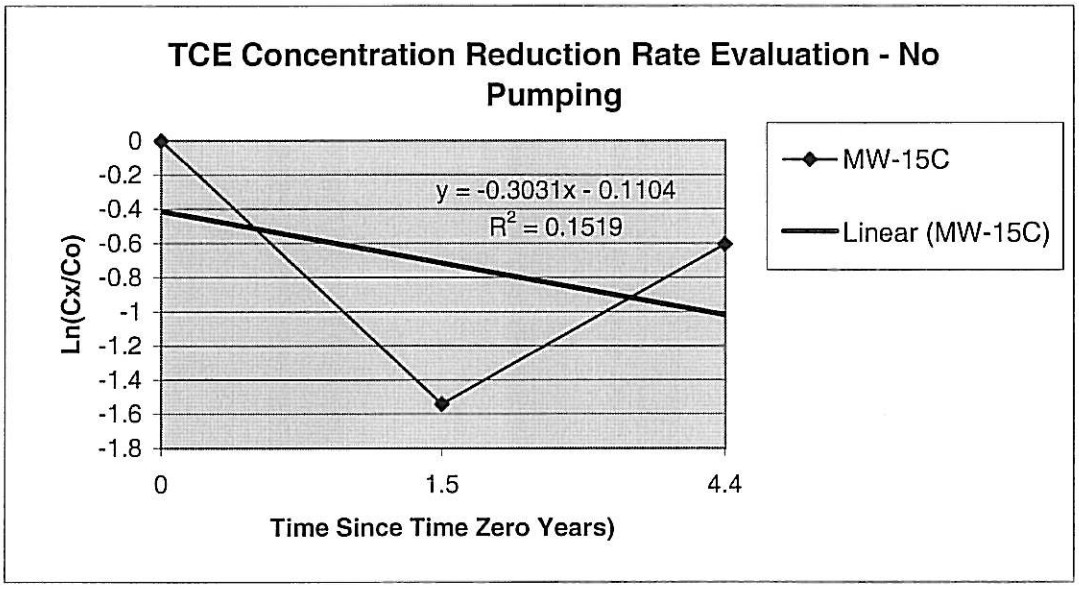

TCE Concentration Reduction Rate Evaluation - Active Pumping
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Ln(Cx/Co)
y = 0.0223x + 0.4996
R2 = 0.0089
MW-14C
Linear (MW-14C)
0
1.3
1.7
2.1
2.3
2.6
Time Since Time Zero (Years)


TCE Concentration Reduction Rate Evaluation - No Pumping
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
Ln(Cx/Co)
y = -1.2348x + 0.4718
R2 = 0.4661
MW-14C
Linear (MW-14C)
0
1.5
4.4
Time Since Time Zero (Years)

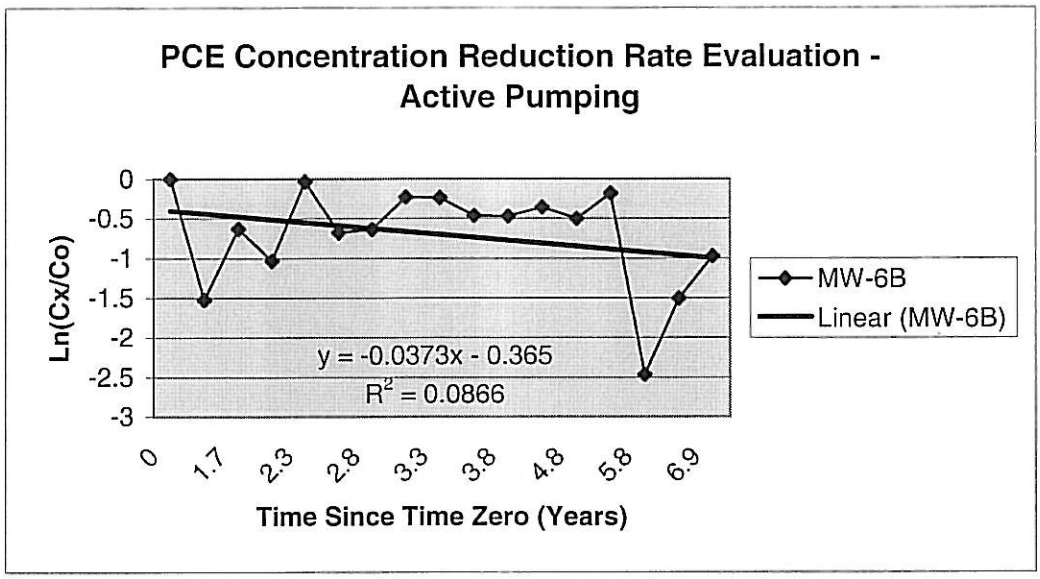
Concentration Reduction Rate for 15A Under a Pumping Scenario was not Determined Because Reported Concentrations Have Been Less Than Detection Limits Since the Inception of Pumping.

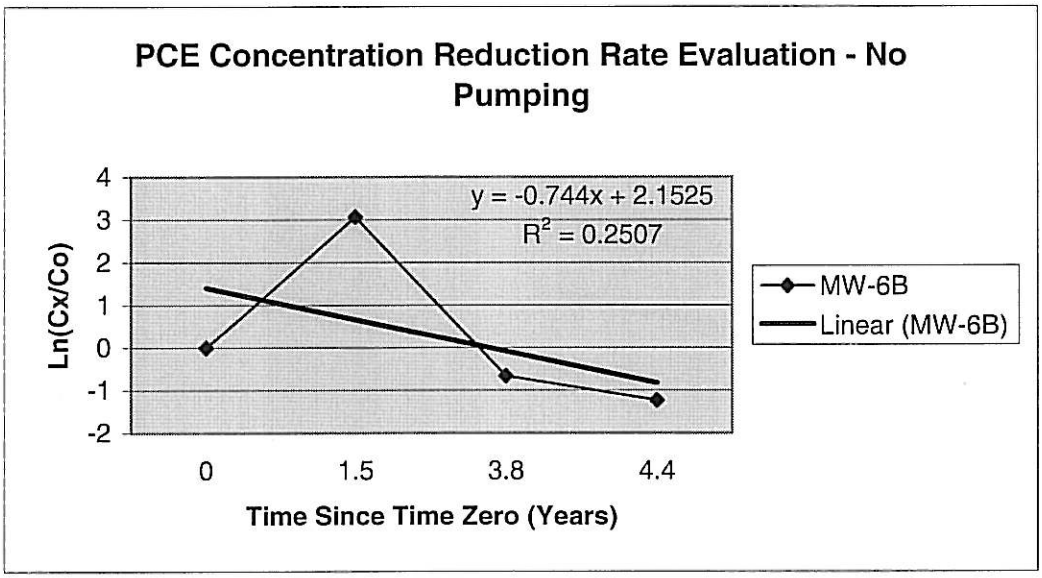



TCE Concentration Reduction Rate Evaluation - Active Pumping
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.4
-0.45
-0.5
Ln(Cx/Co)
y = -0.1567
R2 = 0
0
2.6
3.3
Time Since Time Zero (Years)
MW-15C
Linear (MW-15C)

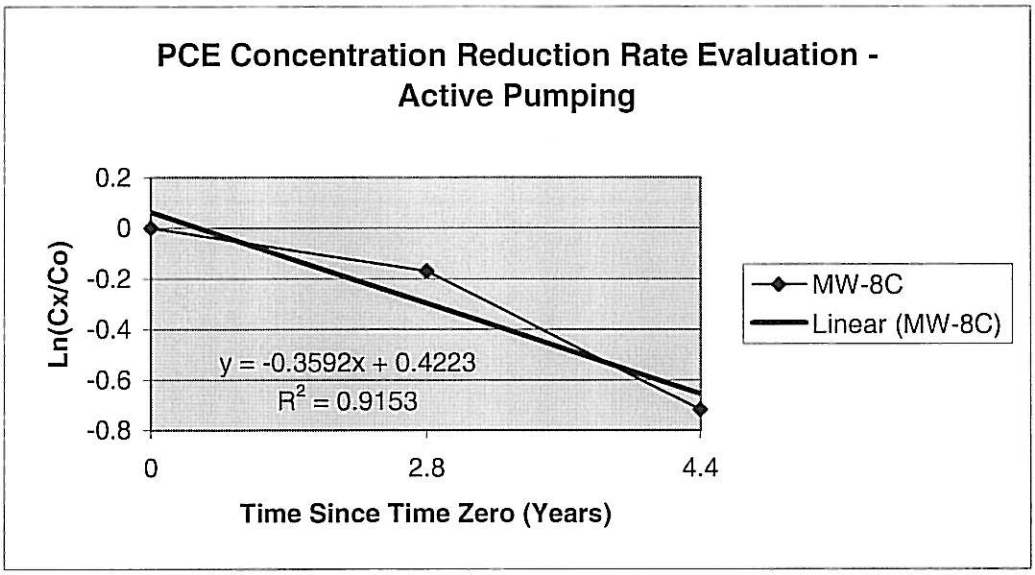

TCE Concentration Reduction Rate Evaluation - No Pumping
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
Ln(Cx/Co)
y = -0.3031x - 0.1104
R2 = 0.1519
0
1.5
4.4
Time Since Time Zero Years)
MW-15C
Linear (MW-15C)

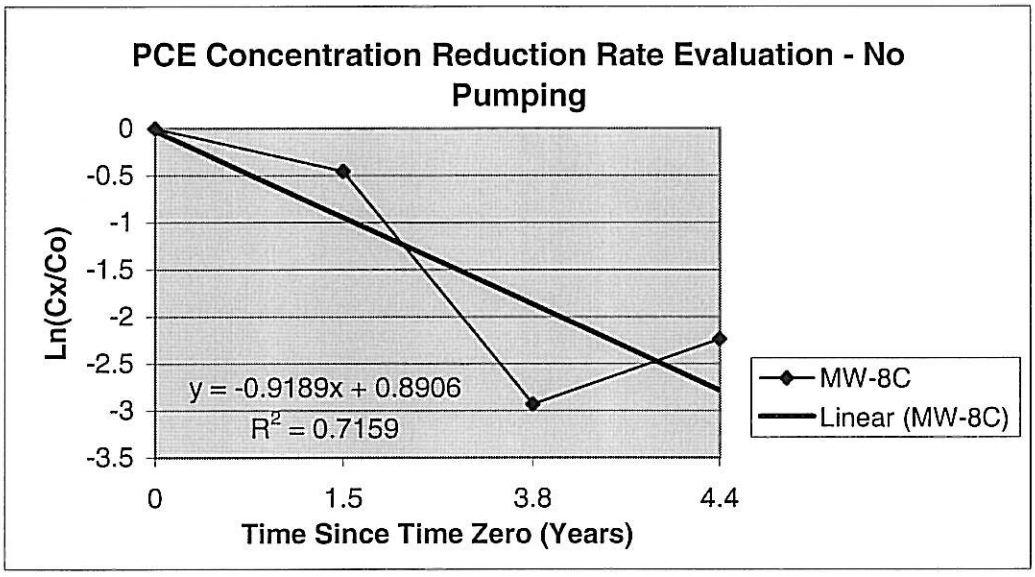
PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
-3
y = -0.0373x - 0.365
R2 = 0.0866
0
1.7
2.3
2.8
3.3
3.8
4.8
5.8
6.9
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

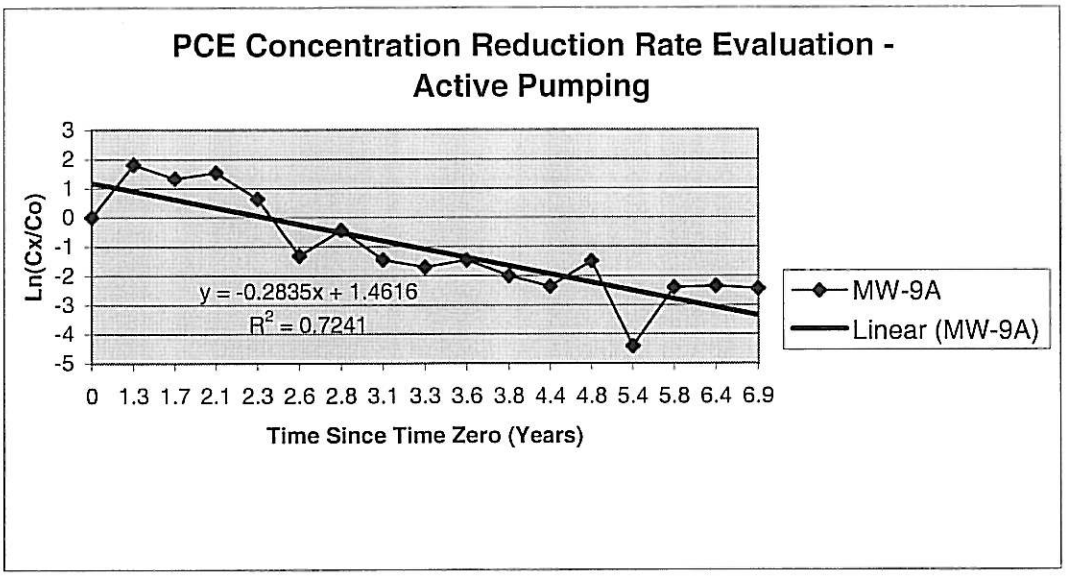

PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
4
3
2
1
0
-1
-2
y = -0.744x + 2.1525
R2 = 0.2507
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-6B
Linear (MW-6B)

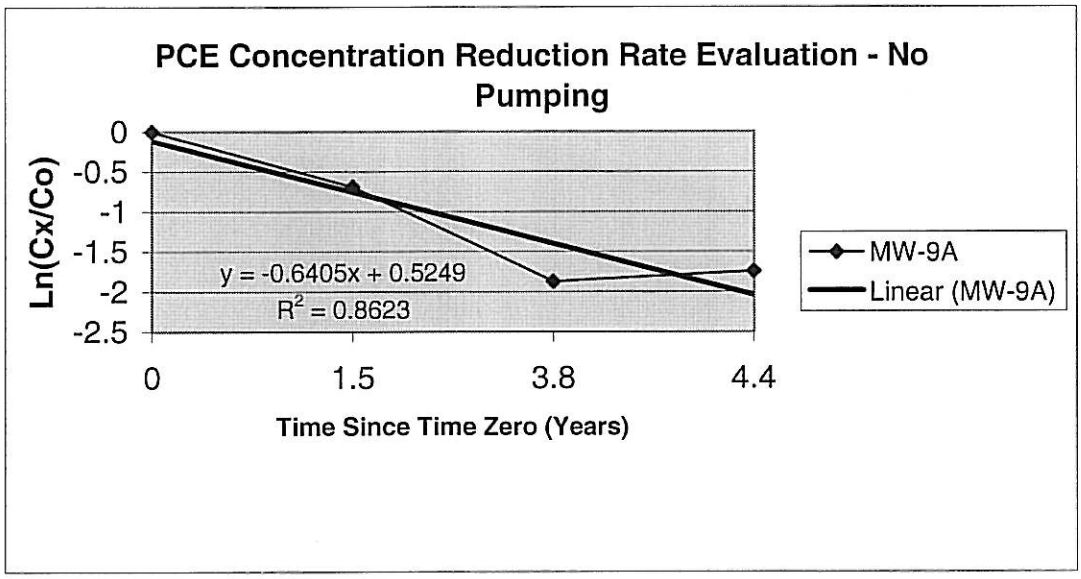
PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0.2
0
-0.2
-0.4
-0.6
-0.8
y = -0.3592x + 0.4223
R2 = 0.9153
0
2.8
4.4
Time Since Time Zero (Years)
MW-8C
Linear (MW-8C)

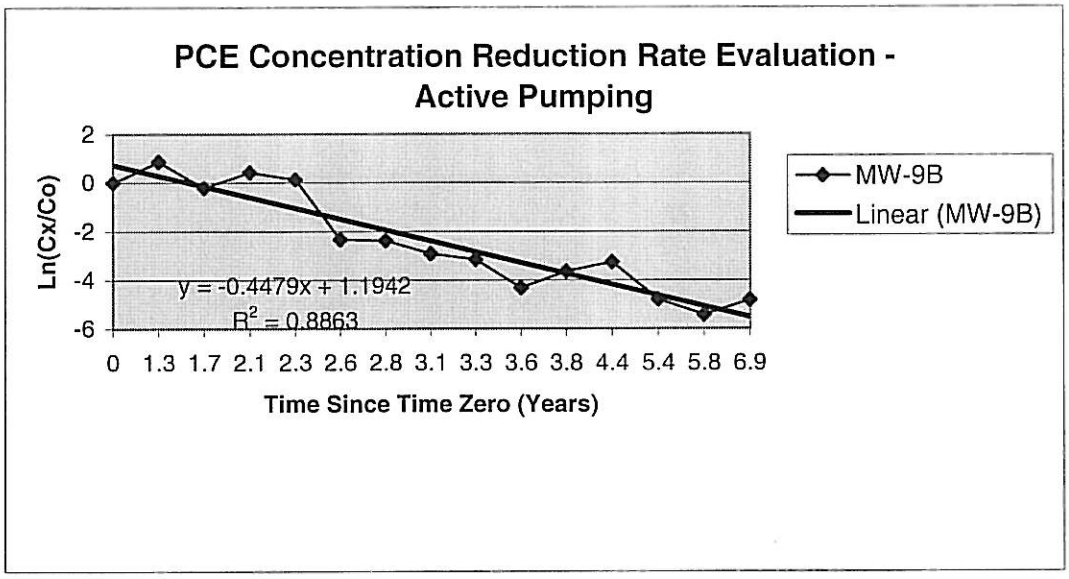

PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
y = -0.9189x + 0.8906
R2 = 0.7159
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-8C
Linear (MW-8C)

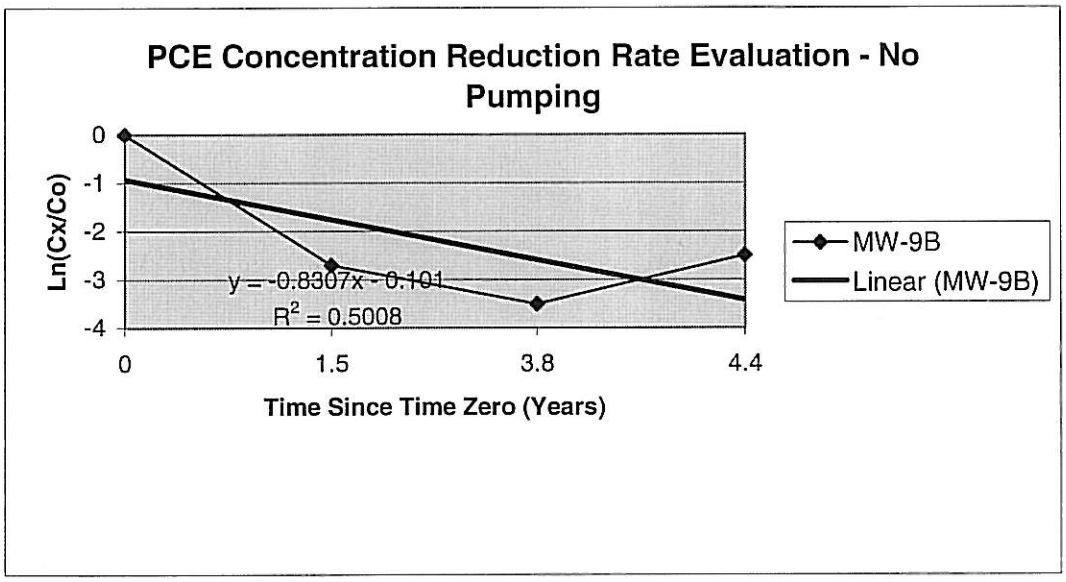
PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
3
2
1
0
-1
-2
-3
-4
-5
y = -0.2835x + 1.4616
R2 = 0.7241
0 1.3 1.7 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 4.8 5.4 5.8 6.4 6.9
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)


PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
y = -0.6405x + 0.5249
R2 = 0.8623
0
1.5
3.8
4.4
Time Since Time Zero (Years)
MW-9A
Linear (MW-9A)

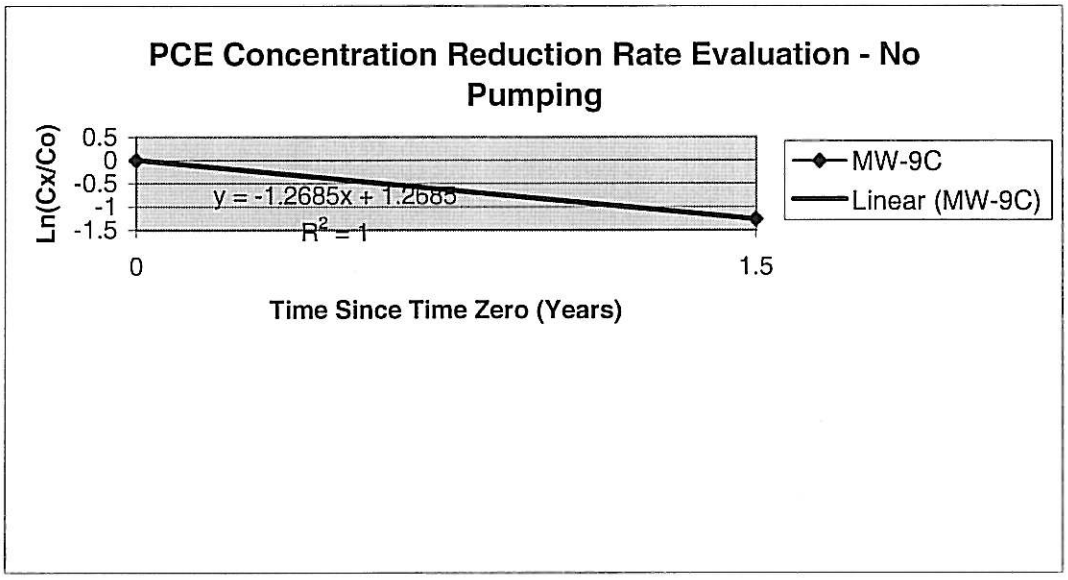
PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
2
0
-2
-4
-6
y = -0.4479x + 1.1942
R2 = 0.8863
0 1.3 1.7 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 5.4 5.8 6.9
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

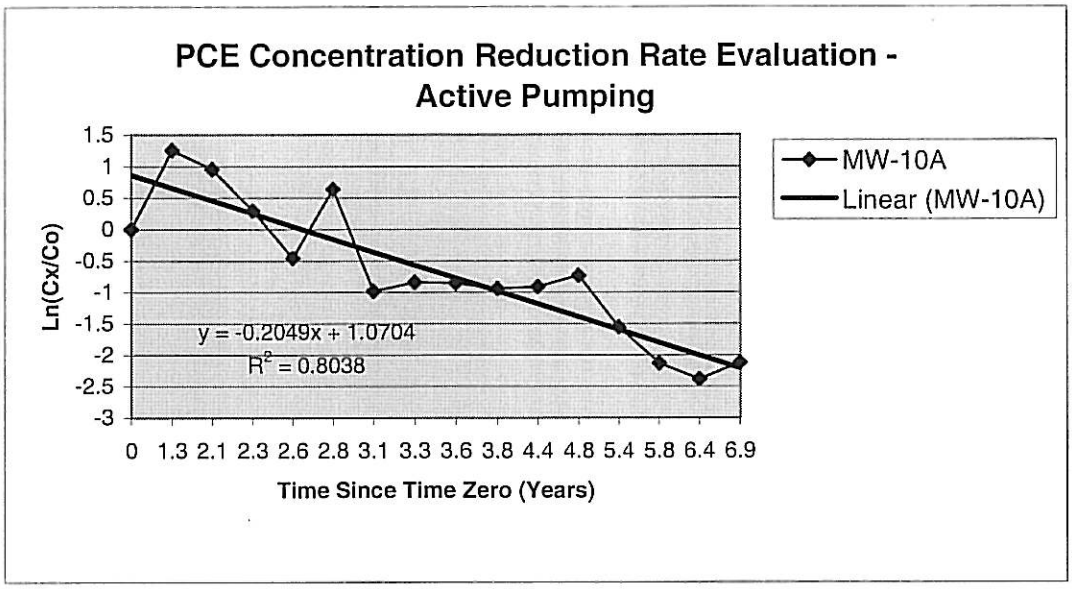

PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-1
-2
-3
-4
y = -0.8307x - 0.101
R2 = 0.5008
0 1.5 3.8 4.4
Time Since Time Zero (Years)
MW-9B
Linear (MW-9B)

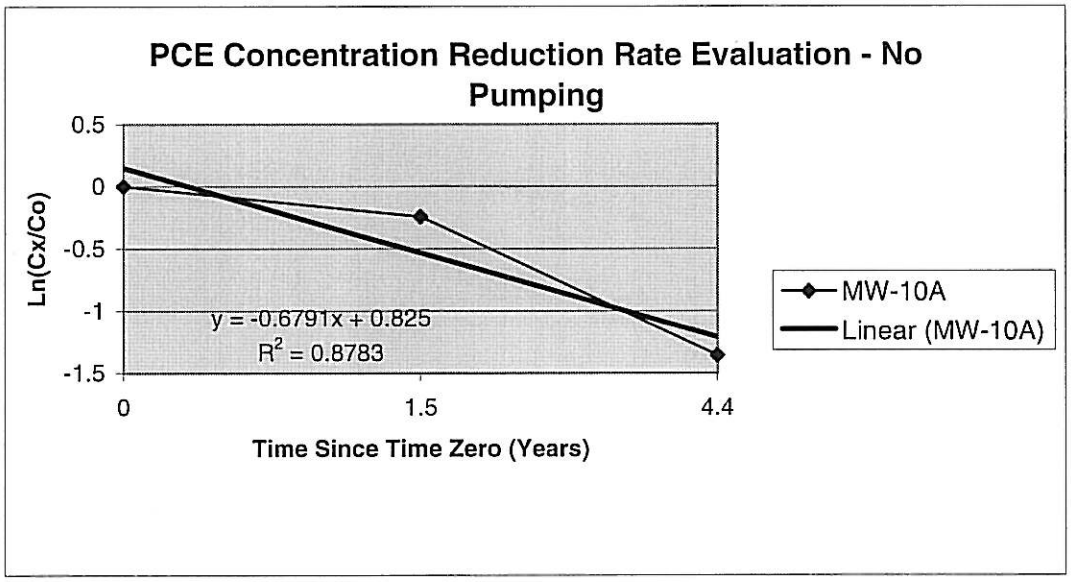
PCE

Regression Analysis Not Completed for Active Pumping at MW-9C Because Baseline Sample was Non-Detect for PCE

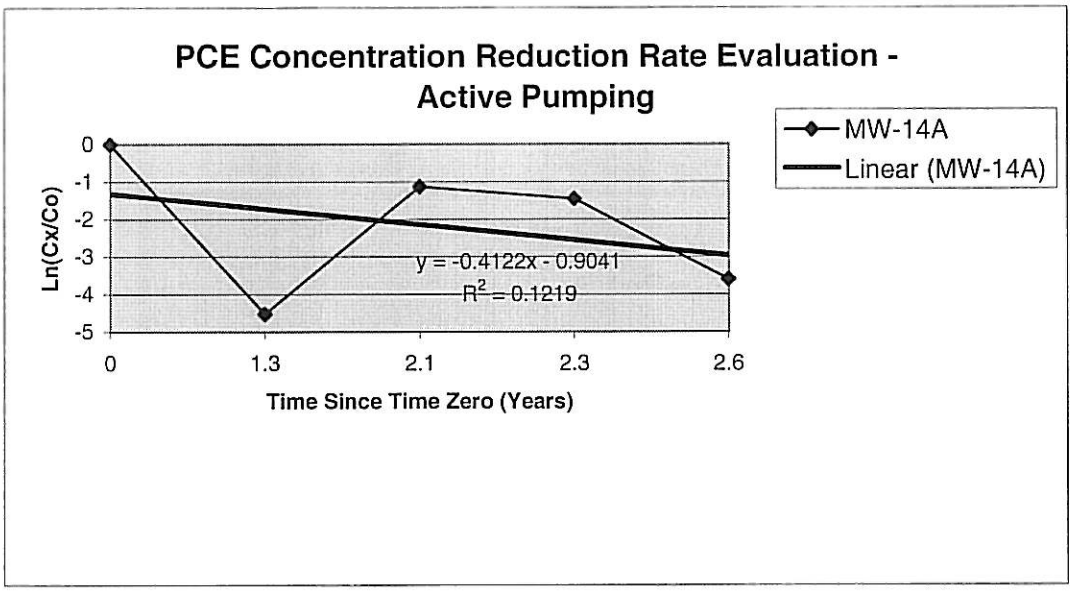


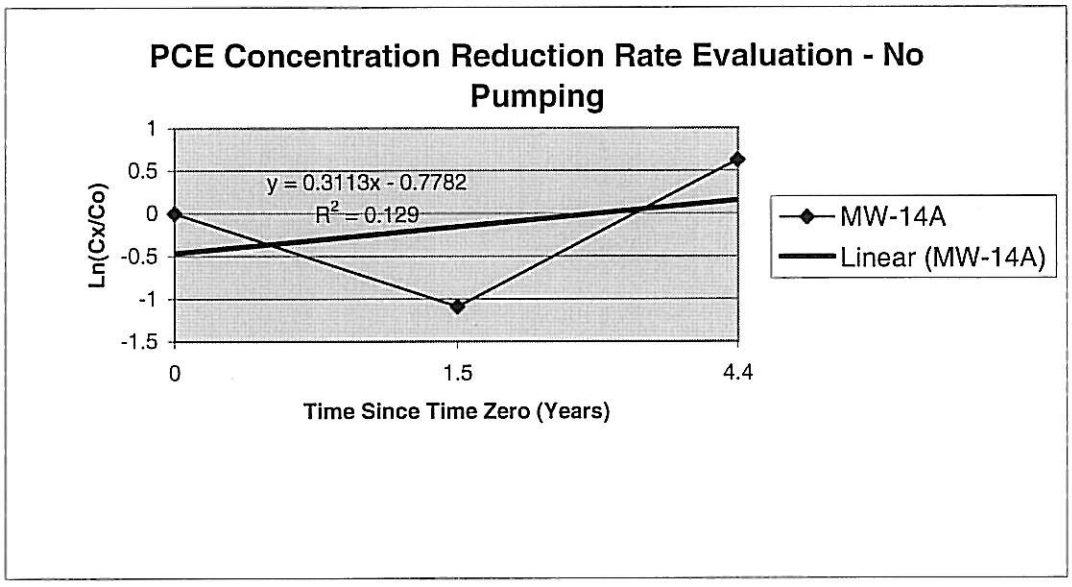
PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
y = -0.2049x + 1.0704
R2 = 0.8038
0 1.3 2.1 2.3 2.6 2.8 3.1 3.3 3.6 3.8 4.4 4.8 5.4 5.8 6.4 6.9
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)

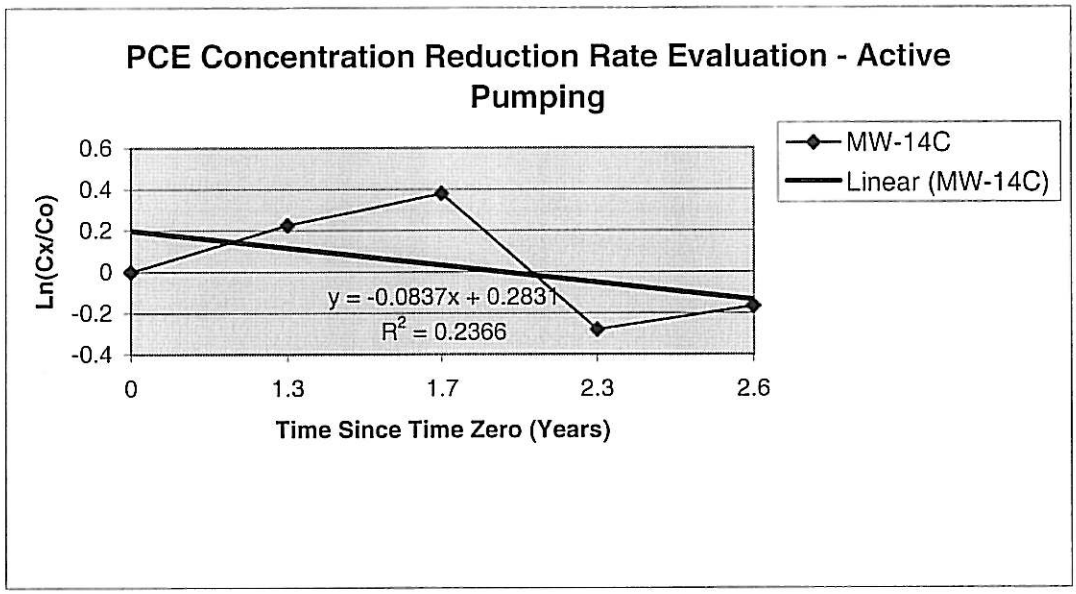

PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0.5
0
-0.5
-1
-1.5
y = -0.6791x + 0.825
R2 = 0.8783
0
1.5
4.4
Time Since Time Zero (Years)
MW-10A
Linear (MW-10A)

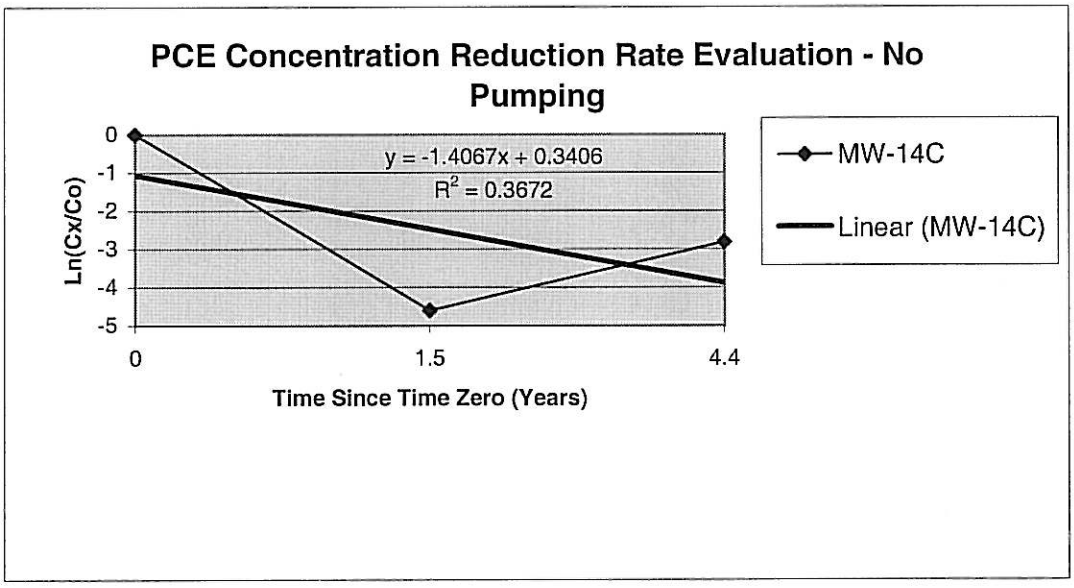
PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0
-1
-2
-3
-4
-5
y = -0.4122x - 0.9041
R2 = 0.1219
0
1.3
2.1
2.3
2.6
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)


PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
1
0.5
0
-0.5
-1
-1.5
y = 0.3113x - 0.7782
R2 = 0.129
0
1.5
4.4
Time Since Time Zero (Years)
MW-14A
Linear (MW-14A)

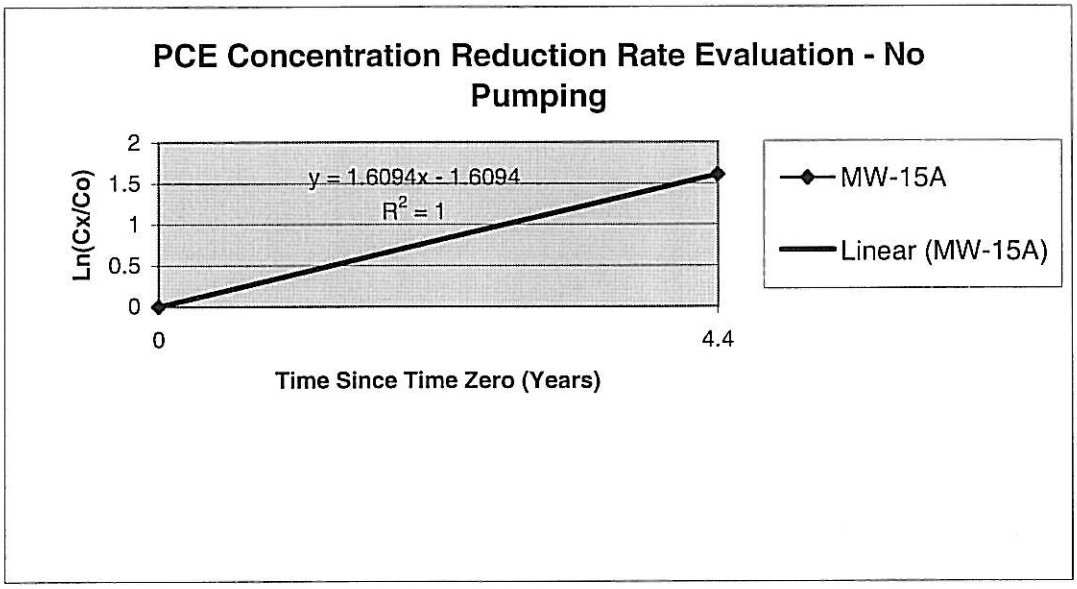
PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0.6
0.4
0.2
0
-0.2
-0.4
y = -0.0837x + 0.2831
R2 = 0.2366
0
1.3
1.7
2.3
2.6
Time Since Time Zero (Years)
MW-14C
Linear (MW-14C)

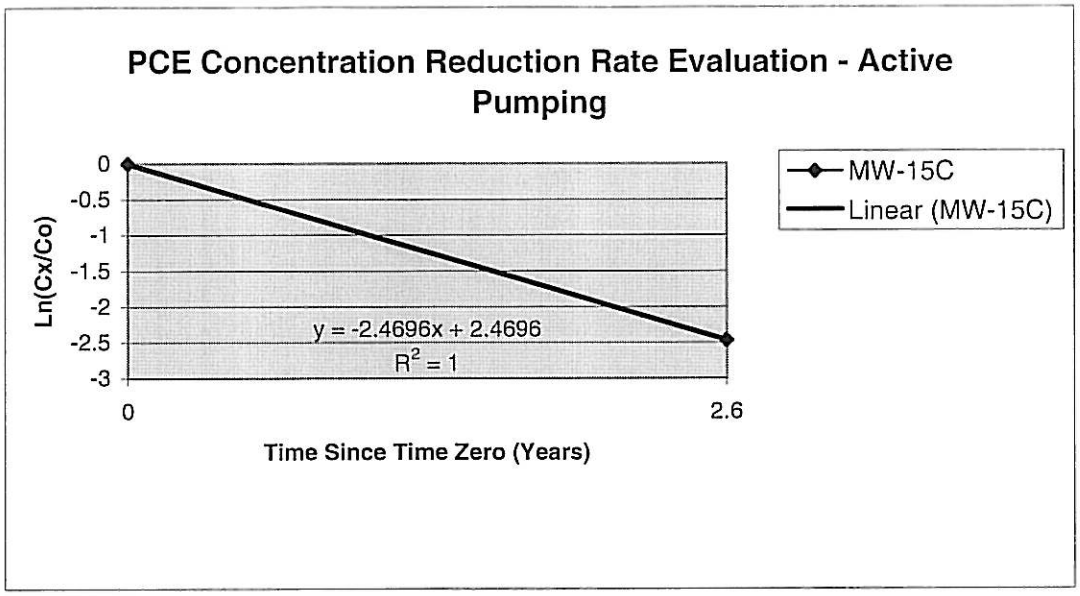

PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-1
-2
-3
-4
-5
y = -1.4067x + 0.3406
R2 = 0.3672
0
1.5
4.4
Time Since Time Zero (Years)
MW-14C
Linear (MW-14C)

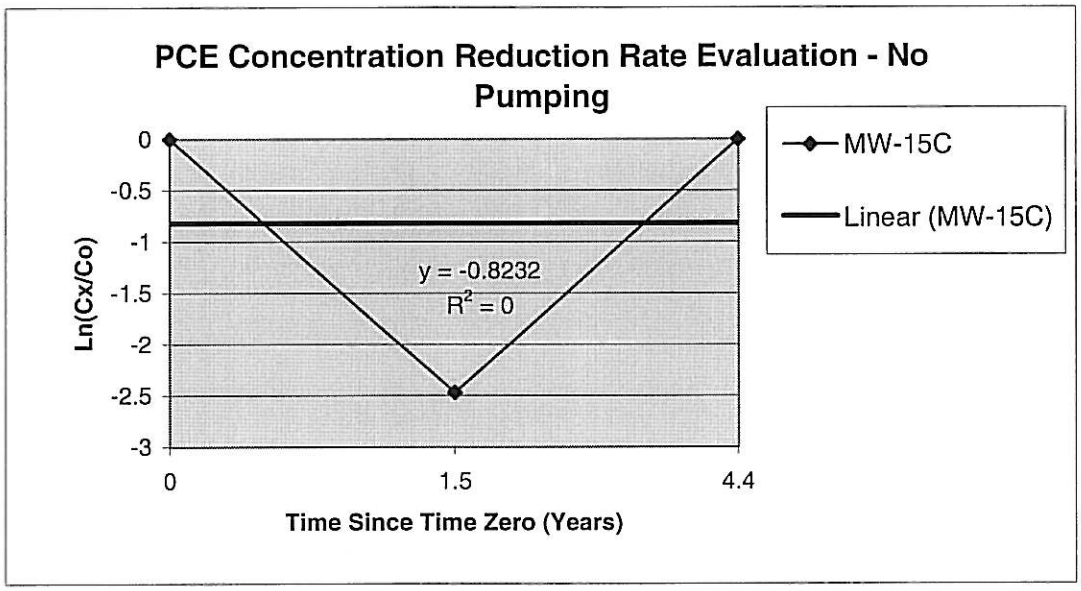
PCE

Well 15A attenuation rate cannot be evaluated due to insufficient detected values



PCE


PCE Concentration Reduction Rate Evaluation - Active Pumping
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
-3
y = -2.4696x + 2.4696
R2 = 1
0
2.6
Time Since Time Zero (Years)
MW-15C
Linear (MW-15C)


PCE Concentration Reduction Rate Evaluation - No Pumping
Ln(Cx/Co)
0
-0.5
-1
-1.5
-2
-2.5
-3
y = -0.8232
R2 = 0
0
1.5
4.4
Time Since Time Zero (Years)
MW-15C
Linear (MW-15C)

APPENDIX C

Acceptance of Closure Certification Letter from Washington State Department of Ecology

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Northwest Regional Office, 3190 - 160th Ave S.E. • Bellevue, Washington 98008-5452 • (206) 649-7000

September 3, 1997

CERTIFIED MAIL
P 115 514 037

Mr. Andro B. Wipplinger
Supervisor, Environmental Management
Boeing Defense and Space Group
P.O. Box 3707
Seattle, WA 98124-2207

Dear Mr. Wipplinger:

Re: Ecology's Acceptance of Certification for Final Facility Clean Closure of the Boeing Developmental Center (WAD 093639946).

The Department of Ecology, Hazardous Waste and Toxics Reduction Program, (Ecology) has received and reviewed the clean closure certification and the supporting documentation for final facility closure of the Boeing Developmental Center Building 9-50, 9-60, and 9-69/70 Dangerous Waste Container Storage Areas [*Closure Certification Report, Building 9-50, 9-60, and 9-69/70, Container Storage Area*, dated April 1997]. In addition, Ecology has previously received and reviewed the clean closure certification and supporting documentation for the Building 9-101 above ground dangerous waste storage tanks [*Above Ground Tank Closure Investigation Report, Building 9-101, Boeing Developmental Center*, dated June 17, 1993]. These reports were submitted as required by WAC 173-303-400(3), and by reference 40 CFR 265.

The report is documentation that final facility closure of the dangerous waste container storage areas and above ground storage tanks have been completed in accordance with the specifications of the approved closure plans: *Closure Plan, Container Storage Area, Buildings 9-50, 9-60, 9-69/9-70, Boeing Developmental Center, April 1993,* the Ecology closure plan approval letter dated December 7, 1993, and the *Closure Plan, Aboveground Tank Closure Investigation, Building 9-101, Boeing Developmental Center, October 13, 1992.*

Based on the data and information obtained in the above mentioned reports, Ecology accepts the final facility closure certification for the Boeing Developmental Center dangerous waste container storage units located at Buildings 9-50, 9-60, and 9-69/70 in addition to the Building 9-101 dangerous waste above ground storage tanks. The Boeing Developmental Center has now satisfied the interim status requirements for closure of the dangerous waste container storage areas and above ground tanks described above in accordance with WAC 173-303-400(3), by reference 40 CFR 265. As of the date of this letter, The Boeing Developmental Center may no longer store (>90 days), treat, or dispose of dangerous wastes on site. However, the facility will maintain interim status as a dangerous waste storage facility, until all requirements of RCRA corrective action are completed to the satisfaction of Ecology.

The Boeing Developmental Center is released from the financial assurance requirements for closure in accordance with WAC 173-303-400(3), by reference 40 CFR 265.143(h).

Please do not hesitate to call Dean Yasuda at (425) 649-7264 if you have any questions.

Sincerely,

Julie Sellick, Supervisor
Hazardous Waste and Toxics Reduction Section

JAS:jbs

cc: Dean Yasuda, NWRO
Rob Kirkwood, HWTR Financial Assurance Officer