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SUBJECT TO REVISION

March 13, 1989

SUPPLEMENTAL WORK PLAN FOR TASK F
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
HAZARDOUS WASTE AREA
HASSAYAMPA LANDFILL
MARICOPA COUNTY, ARIZONA

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RECOMMENDATIONS

Results from the Stage I investigation for the hazardous waste area at the Hassayampa Landfill indicate that additional work should be conducted to complete the Remedial Investigation. Recommendations from Montgomery & Associates and Conestoga-Rovers & Associates (1989) are summarized as follows:

1. TASK F should consist of the following:

   TASK F1: Soil Evaluation
   TASK F2: Groundwater Monitor Wells
   TASK F3: Groundwater Monitoring Program
   TASK F4: Stage III Investigation (if necessary)

2. Four additional soil borings should be drilled under TASK F1 to obtain data for chemical quality of soils beneath the principal disposal pits for hazardous waste. These soil borings should be drilled, at an angle to the vertical, beneath Pits 1, 2, 3, and 4, and should be drilled to auger bit refusal or until the basaltic lava-flow unit is encountered, whichever occurs first.

3. TASK F2 should include construction, developing, testing, equipping, and sampling three to five proposed groundwater monitor wells, which would be completed in Unit A. The proposed monitor well sites are:

Well Site A: Located approximately 10 to 20 feet downgradient from abandoned monitor well (C-1-5)3daa1[HS-1]. The proposed monitor well at Site A will replace abandoned monitor well HS-1 and should provide water level and water quality data representative for Unit A.

Well Site B: Located approximately 280 feet upgradient from monitor well (C-1-5)3dab3[MW-1UA], to define the lateral extent of groundwater contamination at well MW-1UA in an upgradient direction and to define the source area for the contamination.

Well Site C: Located off-site approximately 680 feet downgradient from monitor well MW-1UA and approximately 400 feet northwest, along the fence line for the landfill, from monitor well (C-1-5)3dac[HS-2]. Purpose for Site C is to define, together with existing monitor wells HS-2, the lateral extent of groundwater contamination at well MW-1UA in a downgradient direction.

Well Site D: Located on-site approximately 190 feet downgradient from abandoned monitor well HS-1. Site D is optional and will be drilled to define the lateral extent of groundwater contamination in a downgradient direction only if contamination is found in the monitor well constructed at Site A.

Well Site E: Located approximately 200 feet south-southeast from abandoned monitor well HS-1. Site E is optional and will be drilled to define the lateral extent of groundwater contamination in a downgradient direction only if contamination is found in the monitor well constructed at Site A.

4. TASK F3 should be conducted to extend the groundwater monitoring program established under TASK G of the RI/FS Work Plan (Montgomery & Associates and Conestoga-Rovers & Associates, 1988a). Results of the monitoring program would be used to document groundwater quality and to detect changes in rate and direction of groundwater movement. The monitoring program would comprise three rounds of collection of groundwater samples and measurement of groundwater levels.

   TASK F3 sampling round no. 1 should be conducted in July 1989 and would comprise collection of groundwater samples from, and measurement of water levels at, the 11 existing on-site monitor wells. TASK F3 sampling round no. 2 would be conducted approximately 30 days after completion of field operations for TASK F2, and should comprise collection of groundwater samples from, and measurement of water levels at, the new and existing on-site monitor wells. TASK F3 sampling round no. 3 would be conducted 13 weeks after TASK F3 sampling round no. 2. Results from TASKS F2 and F3 sampling rounds would be given in monthly data submittals to EPA, as required in the Consent Order.

5. Pursuant to the RI/FS Work Plan, the need for Feasibility Study testing has been evaluated. Additional testing for the Feasibility Study outside of the Remedial Investigation is unnecessary given that the nature of the waste is well documented and that the remedial technologies listed for consideration are established remedial technologies, which are not of an experimental nature.

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SUPPLEMENTAL WORK PLAN FOR TASK F
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HAZARDOUS WASTE AREA
HASSAYAMPA LANDFILL
MARICOPA COUNTY, ARIZONA

INTRODUCTION

On authorization by the Hassayampa Steering Committee, this supplemental Work Plan has been prepared to give objectives and procedures for conduct of TASK F of the Remedial Investigation / Feasibility Study (RI/FS) for the former hazardous waste disposal area at the Hassayampa Landfill. The scope of work for TASKS A through J were described in the comprehensive Work Plan (Errol L. Montgomery & Associates and Conestoga-Rovers & Associates, 1988a). The comprehensive Work Plan was one of three documents submitted to the U. S. Environmental Protection Agency, Region 9, in conjunction with an Administrative Consent Order (U. S. Environmental Protection Agency, Docket No. 88-08) for the Hassayampa Landfill. The other two are: the Quality Assurance Project Plan (QAPP) (Errol L. Montgomery & Associates and Conestoga-Rovers & Associates, 1988b), which contains the Sampling Plan as an attachment; and the Health and Safety Plan (Errol L. Montgomery & Associates and Conestoga-Rovers & Associates, 1988c).

Results of Stage I of the Groundwater Investigation indicate that a Stage II Investigation is necessary to further define the vertical and lateral extent of contamination and to provide information for the Feasibility Study. The scope of work for TASK F of the supplemental Work Plan is described herein. **Figure 1** is a regional location map for the Hassayampa Landfill (the landfill). The landfill is located in the southeast quarter of Section 3, Township 1 South, Range 5 West, Maricopa County, Arizona. Locations for the disposal pits are tentative and approximate, and are shown on **Figure 2**.

The northeast part of the Hassayampa Landfill was designated Arizona's interim hazardous waste disposal facility for a period of approximately 18 months, from April 20, 1979 to October 28, 1980. During this period, disposal of hazardous wastes in the hazardous waste area of the landfill was authorized by Arizona Department of Health Services via a manifest program. Compilations of these manifests were reported by Arizona Department of Health Services (1982 and 1985). These manifests indicate that a wide range of hazardous wastes, including about 3.28 million gallons of liquid wastes and about 4,150 tons of solid wastes, were disposed in Pits 1, 2, 3, and 4, and in Special Pits **(Figure 2)**. Types and quantities of wastes reported to have been designated for disposal in these pits are summarized in **Table 1**.

Two additional pits, Pits A and B **(Figure 2)**, in the hazardous waste area were intended for disposal of nonhazardous wastes. Pits A and B were not included in the hazardous waste manifest program. Cesspool waste and septic tank waste are the principal wastes reported to have been disposed in Pit A (Ecology and Environment, Inc., 1981). Although the waste disposed in Pit B has not been fully determined, hydrate waste is reported to have been disposed in Pit B (Ecology and Environment, Inc., 1981).

The approximate former area of hazardous waste disposal and the approximate location and boundaries of Pits 1, 2, 3, 4, A, and B, and Special Pit areas, shown on **Figure 2** were determined from:

- **Inspection of aerial photos for the landfill for 1976, 1979, 1981, 1982, 1985, 1986, and 1989;**

- Inspection of a hand-drawn sketch of the former hazardous waste disposal area given by Ecology and Environment, Inc. (1981), which was based on results of a site inspection on January 15, 1981; and

- Interviews with Maricopa County Landfill Department personnel.

Results of these investigations indicate that the former area of hazardous waste disposal encompassed an area of approximately 10 acres in the northeast part of the landfill. The entire area used for the landfill operations comprises about 47 acres.

OBJECTIVES

In accordance with the National Contingency Plan, the principal objective of the Remedial Investigation is to define and evaluate potential impacts of the former hazardous waste disposal pits on quality of air, surface water, soil, and groundwater. Potential impacts of the former hazardous waste disposal pits on quality of air and surface water were defined and evaluated during TASK work conducted under the comprehensive Work Plan (Montgomery & Associates and Conestoga-Rovers & Associates, 1988a) and were reported by Errol L. Montgomery & Associates and Conestoga-Rovers and Associates (1989), of which this supplemental Work Plan is Exhibit A. The Remedial Investigation for groundwater includes delineation of the extent of groundwater contamination and the establishment of a monitoring network to detect potential future migration of contaminants from former hazardous waste disposal pits. The scope of TASK F of the Remedial Investigation is designed to achieve the following general objectives:

1. Utilize results of previous investigations to determine the most appropriate course of action for the Remedial Investigation.

2. Obtain sufficient and appropriate data to:

    a. evaluate the potential source(s) of contamination;

    b. delineate, where appropriate, the potential extent of contamination;

c. augment the existing groundwater monitoring network; and

d. provide a sufficient data base for the Feasibility Study.

PROJECT ORGANIZATION AND STUDY TEAM

The scope for TASK F has been prepared by Errol L. Montgomery & Associates, Inc., Tucson, Arizona, and Conestoga-Rovers & Associates, St. Paul, Minnesota. The association of the two consulting firms will provide a capable team for all potential aspects of work at the Hassayampa Landfill. Although both firms will provide technical support and colleague review for all stages of the RI/FS program, Montgomery & Associates assumes the lead role for the Remedial Investigation and Conestoga-Rovers & Associates assumes the lead role for the Feasibility Study.

PREVIOUS INVESTIGATIONS

Results of previous investigations for the Hassayampa Landfill and adjacent areas are sources of information for hydrogeologic conditions, historic disposal practices, disposal pit locations, types of substances disposed, and locations of off-site and on-site wells existing prior to the RI/FS. Previous investigations that provide a thorough review of existing data for the landfill or landfill area include, in chronological order:

1. **Hydrogeologic Conditions and Waste Disposal at the Hassayampa, Casa Grande and Somerton Landfills, Arizona.** Report prepared by Kenneth D. Schmidt and Robert C. Scott for Arizona Department of Health Services, dated January 1977.

2. **The Hassayampa Landfill hazardous waste disposal site: disposal analysis (April 20, 1979 - October 28, 1980).** Prepared by Bureau of Waste Control, Arizona Department of Health Services, dated 1980.

3. **Site Inspection Report on Hassayampa Landfill, Hassayampa, Arizona.** Prepared by Ecology and Environment, Inc., for U. S. Environmental Protection Agency, dated February 10, 1981.

4. Arizona Department of Health Services inter-office memorandum, dated October 27, 1981, from Bob Hollander to Tibaldo Canez. RE: Alternatives and cost estimates for completion of monitoring wells at the Hassayampa Landfill.

5. Letter, dated November 19, 1981, from James Angell, Arizona Department of Health Services, to William Wood, City of Phoenix Engineering Department. RE: Monitoring well specifications.

6. **Geotechnical Evaluation of the Influence of Hassayampa Landfill Hazardous Wastes on the PVNGS Conveyance Pipeline.** Report prepared by Ertec Western, Inc.,for Arizona Nuclear Power Project and NUS Corporation, dated March 17, 1982.

7. **Open Dump Inventory of Hassayampa Landfill, Ground Water Criterion.** Report prepared by Arizona Department of Health Services, dated September 1982.

8. **Site Inspection and Sampling Documentation Report, Hassayampa Landfill.** Prepared by Ecology and Environment, Inc., for U. S. Environmental Protection Agency, dated August 5, 1983.

9. **Analytical Results, Case #1717.** Prepared by Ecology and Environment, Inc., for U. S. Environmental Protection Agency, dated December 21, 1983.

10. **Hassayampa Landfill Site Inspection Report.** Prepared by Arizona Department of Health Services, dated May 1, 1985.

11. **Study of Waterlogging Problems in the West Salt River and Hassayampa Sub-Basins of the Phoenix Active Management Area: Task 1A - Evaluation of Past Hydrogeologic Conditions.** Report prepared by Montgomery & Associates for Arizona Department of Water Resources, dated August 25, 1986.

12. **Results of Preliminary Hydrogeologic Investigations, Hassayampa Landfill, Maricopa County, Arizona.** Memorandum Report prepared by Montgomery & Associates for the Hassayampa Steering Committee, dated April 22, 1987.

13. **Study of waterlogging problems in the West Salt River and Hassayampa Sub-Basins of the Phoenix Active Management Area: modified overall study evaluation.** Report prepared by Montgomery & Associates and Desert Agricultural and Technology Systems, Inc., for Arizona Department of Water Resources, dated January 14, 1988.

14. **Draft groundwater monitoring report, Remedial Investigation / Feasibility Study, Hazardous Waste Area, Hassayampa Landfill, Maricopa County, Arizona.** Report prepared by Montgomery & Associates and Conestoga-Rovers & Associates for the Hassayampa Steering Committee, dated December 23, 1988.

15. **Stage I report for Remedial Investigation / Feasibility Study, Hazardous Waste Area, Hassayampa Landfill, Maricopa County, Arizona.** Draft Report prepared by Montgomery & Associates and Conestoga-Rovers & Associates for the Hassayampa Steering Committee, dated March 13, 1989.

TOPOGRAPHY

The topography of the landfill area is characterized by a broad basin floor that slopes gently to the south. Approximately one-half mile south from the landfill, the alluvial plain is broken by Arlington Mesa. The landfill lies on the edge of a flat alluvial plain, adjacent to the Hassayampa River floodplain. Narrow ravines cut the alluvial plain east from the landfill, and form the margin of the Hassayampa River floodplain. From the east boundary of the Site, slope of the land surface steepens downward approximately four percent to the floodplain.

Topography across the Hassayampa Landfill is undulatory due to the frequent reworking of landfill pits in the active part of the property. However, the closed hazardous waste area is covered by a graded soil cover that is relatively flat to gently sloping. Access for vehicles is generally good in the closed hazardous waste area, where surficial soils are relatively compacted and firm. Surficial soils in parts of the active landfill are loose and are generally passable only to off-road vehicles. Altitude of land surface at the hazardous waste area ranges from about 910 to 915 feet msl.

HYDROGEOLOGIC CONDITIONS

The Hassayampa Landfill is located in the lower Hassayampa River basin. The lower Hassayampa River basin is bounded on the east by the White Tank Mountains, on the south by the Buckeye Hills, and on the west by the Palo Verde Hills. Hydrogeologic conditions in the basin are typical for the Basin and Range Province in central and southern Arizona, where mountain blocks have been uplifted and basins have been downthrown along high-angle normal faults. However, no structural features have been reported to occur at the landfill. The Hassayampa Landfill lies on an alluvial plain underlain by a thick sequence of basin-fill deposits.

REGIONAL HYDROGEOLOGIC UNITS

Regional hydrogeologic units in the landfill area include, in descending order: the Recent alluvial deposits; the basin-fill deposits; and the bedrock complex.

Recent Alluvial Deposits

The Recent alluvial deposits occur along the floodplain of the Hassayampa River east from the landfill, along Luke Wash west from the landfill, and along large tributary stream channels. These deposits consist chiefly of unconsolidated gravel, sand, and silt of Quaternary age. Groundwater levels in the landfill area generally lie below the base of the Recent alluvial deposits. Because these deposits are commonly coarse-grained and unconsolidated, they have high permeability and provide the principal media for infiltration of ephemeral streamflow.

Basin-fill Deposits

The basin-fill deposits have been classified into the Upper, Middle, and Lower Alluvium units. Analysis of drillers' logs and reports for water wells and exploration boreholes in the Hassayampa Landfill area indicates that a thick sequence of basin-fill deposits underlies most of the landfill area. The basin-fill deposits are underlain by a bedrock complex. Cooley (1973) indicated that thickness of the basin-fill deposits exceeds 1,200 feet at the landfill. Oppenheimer and Sumner (1980) indicated that maximum depth to bedrock at the landfill may be in the range from 3,200 to 4,800 feet. The basin-fill deposits comprise the principal source of groundwater to wells in the landfill area, and is generally referred to as the regional aquifer.

Inspection of drillers' logs for wells in the study area indicates that the Upper Alluvium unit generally consists of a non-lithified to slightly lithified sequence of interbedded, poorly sorted sediments, which range in size from clay to boulders. Zones of caliche are common in the Upper Alluvium unit. Locally, basaltic lave-flow rocks of the Arlington Mesa basalt flow occur within the Upper Alluvium unit. Source for these lava-flow rocks is Arlington Mesa. Data from the drillers' logs and isopach maps given by the U. S. Bureau of Reclamation (1976) suggest that thickness of the Upper Alluvium unit in the landfill area is in the range from 200 to 300 feet.

In general, the Middle Alluvium unit is weakly cemented and consists of interbedded clay, silt, silty sand, sand, and gravel strata. Fugro (1980) reported that the Middle Alluvium unit in areas west from the landfill includes the Palo Verde clay. The Palo Verde clay is reported to be a massive clay layer and is the confining unit for the regional aquifer (Long, 1983). The Palo Verde clay is reported to occur as far north as the Buckeye-Salome Highway and as far east as Arlington.

The Lower Alluvium unit consists of a heterogeneous sequence of interbedded, moderately to firmly lithified conglomerate, gravel, sand, and clay. Based on drillers' logs and structural contour maps given by the U. S. Bureau of Reclamation (1976), depth to the top of the Lower Alluvium unit in the landfill area may be in the range from about 500 to 600 feet.

Bedrock Complex

The bedrock complex crops out in the mountains surrounding the lower Hassayampa River basin and consists chiefly of granitic and metamorphic rocks (Long, 1983). Locally within the bedrock complex, volcanic rocks and sedimentary rocks overlie the granitic and metamorphic rocks. The sedimentary and volcanic rocks may exceed 1,400 feet in thickness and consist of interbedded sequences of fractured basalt, tuff, tuffaceous sandstone, and coarse-grained sandstone (Fugro, 1980).

SITE HYDROGEOLOGIC FEATURES

Hydrogeologic features at the landfill were determined based chiefly on:

- Results of drilling, testing, and lithologic logs for 12 on-site soil borings drilled during the Remedial Investigation (Montgomery & Associates, 1988d and 1988e);
- Results of drilling, testing, lithologic logs, and borehole geophysical logs for nine on-site monitor wells and an exploration boring drilled during the Remedial Investigation (Montgomery & Associates, 1988d, 1988e, 1988f, 1988g, 1988h, and 1988i);
- Lithologic information for pre-existing on-site monitor wells constructed for Arizona Department of Health Services (Arizona Department of Health Services, 1982 and 1985); and
- Lithologic information for two pre-existing on-site vadose zone monitor wells and a soil boring drilled for Ertec Western, Inc. (Ertec Western, Inc., 1982).

The following on-site monitor wells were constructed by Montgomery & Associates during the Stage I of the Remedial Investigation:

(C-1-5)3dab3 [MW-1UA]
(C-1-5)3daa2 [MW-2UA]
(C-1-5)3daa4 [MW-3UA]
(C-1-5)3dab5 [MW-4UA]
(C-1-5)3dab7 [MW-5UA]

(C-1-5)3dab1 [MW-1UB]
(C-1-5)3dab4 [MW-2UB]
(C-1-5)3daa3 [MW-3UB]
(C-1-5)3dab6 [MW-4UB]

In addition, Montgomery & Associates drilled on-site exploration boring (C-1-5)3dab2 [EX-1]. The following on-site monitor wells were constructed by Arizona Department of Health Services: (C-1-5)3daa1 [HS-1], (C-1-5)3dac [HS-2], and (C-1-5)3dda1 [HS-3].

Recent alluvial deposits do not crop out at the landfill. The shallow basin-fill deposits at the landfill were the target of the hydrogeologic investigation. Results of the Stage I drilling program suggest that the Upper Alluvium unit at the landfill occurs from land surface to a depth of about 270 feet. For the purpose of this Report, the Upper Alluvium unit may be subdivided, in order of increasing depth, into the following units: upper alluvial deposits unit; basaltic lava-flow unit; Unit A; and Unit B.

Results indicate that a clay unit, which was encountered at a depth of 268 feet in exploration boring EX-1, may be the top of the upper part of the Middle Alluvium unit. The landfill is near the outer limit of the reported area of occurrence of the Palo Verde clay. However, lithologic character of the clay unit encountered in exploration boring EX-1 indicates that the clay unit may be tentatively classified as the Palo Verde clay.

Upper Alluvial Deposits Unit

The upper alluvial deposits unit consists chiefly of interbedded silty sand and gravelly sand, with cobbles and siltstone interbeds from land surface to an average depth of about 33 feet below land surface. The unit consists chiefly of interbedded clayey silt, silty clay, and sandy silt, with siltstone and claystone interbeds, in the average depth interval from 33 to 57 feet.

Basaltic Lava-flow Unit

The basaltic lava-flow unit consists chiefly of basaltic lava-flow rocks in the average depth interval from 57 to 72 feet below land surface. The lava-flow rocks are generally vesicular and are generally weathered in the upper part of the unit. The unit is part of the Arlington Mesa basalt flow, which erupted from Arlington Mesa. Results from the Stage I drilling program indicate that the basaltic lava-flow unit dips gently to the northeast.

Unit A

The part of the Upper Alluvium unit from the base of the basaltic lava-flow unit to the top of the Middle Alluvium unit is the uppermost water-bearing part of the regional basin-fill deposits aquifer, and is classified into Units A and B. Unit A comprises the uppermost fine-grained water-bearing strata.

Unit A consists chiefly of interbedded clayey silt and silty clay, with a thin layer of interbedded sandy silt and siltstone. Unit A occurs in the average depth interval from 72 to 107 feet below land surface, and the uppermost groundwater level at the landfill generally occurs in the upper part of Unit A.

Unit B

Unit B is bounded on the top by Unit A and on the bottom by the Middle Alluvium unit. The uppermost strata of Unit B is defined as the uppermost coarse-grained water-bearing strata of the regional aquifer.

Unit B consists chiefly of interbedded coarse-grained and fine-grained strata. The fine-grained strata of Unit B are similar to Unit A, and consist chiefly of interbedded silty clay and clayey silt with some sand. The coarse-grained strata of Unit B consist chiefly of sand and gravel. Top of Unit B occurs at an average depth of 107 feet below land surface. Where penetrated by on-site exploration boring EX-1, Unit B occurs in the depth interval from 116 to 268 feet below land surface.

Palo Verde Clay

A unit consisting chiefly of silty clay was encountered at exploration boring EX-1, and was tentatively classified as the Palo Verde clay. At this location, top of the unit was penetrated at a depth of 268 feet below land surface. The Palo Verde clay appears to comprise a basal confining unit for Unit B.

Site Stratigraphy

Stratigraphic data for the units penetrated by 12 soil borings, an exploration boring, and 12 monitor wells are summarized as follows:

	DEPTH TO TOP OF UNIT (feet)	THICKNESS (feet)	
		RANGE	AVERAGE
BASIN-FILL DEPOSITS UNIT			
coarse-grained part	0	25 - 45	33
fine-grained part	25 - 45	12 - 35	25
BASALTIC LAVA-FLOW UNIT	39 - 68	12 - 29	17
UNIT A	67 - 82	32 - 44	36
UNIT B	101 - 116	152	152
PALO VERDE CLAY	268	---	---

On-site monitor wells MW-1UA, MW-2UA, MW-3UA, MW-4UA, and MW-5UA yield groundwater solely from Unit A. On-site monitor wells MW-1UB, MW-2UB, MW-3UB, and MW-4UB yield groundwater solely from the uppermost coarse-grained strata of Unit B and from several feet of the underlying fine-grained strata. The non-pumping water level in the Unit A monitor wells is more than 20 feet higher than the non-pumping water level in the Unit B monitor wells.

REMEDIAL INVESTIGATION
SUPPLEMENTAL WORK PLAN FOR TASK F

The scope of work for TASK F, Groundwater Investigation - Stage II, of the Remedial Investigation is described under TASKS F1, F2, F3, and F4. Sampling procedures for the RI/FS are given in **Appendix B** of this supplemental Work Plan. **Table 2** gives quantities, types, and frequency of water and soil samples to be obtained during the RI/FS, including Quality Assurance/ Quality Control (QA/QC) samples. A schedule graph for estimated project timing is shown on **Figure 3**.

The purpose of the Remedial Investigation is to characterize site conditions and to evaluate existing or future potential impacts of the former hazardous waste area on the quality of air, surface water, soil, and groundwater, and on public health.

The Remedial Investigation comprises the following seven TASKS:

- TASK A: Source and Soil Evaluation
- TASK B: Air Investigation
- TASK C: Surface Sediment Investigation
- TASK D: Groundwater Investigation - Stage I
- TASK E: Groundwater Monitoring Program
- TASK F: Stage II Investigation
  - F1: Soil Evaluation
  - F2: Groundwater Monitor Wells
  - F3: Groundwater Monitoring Program
  - F4: Stage III Investigation (if necessary)
- TASK G: Remedial Investigation Analysis and Report

The vertical extent of groundwater contamination was defined during the Stage I investigation. The purpose of TASK F is to further define the lateral extent of groundwater contamination, and to obtain data for chemical quality of soils beneath the principal disposal pits for hazardous waste.

Within 15 days after the end of each calendar month during conduct of the RI/FS, Monthly Progress Reports will be submitted to the U. S. Environmental Protection Agency. As set forth in the Consent Order, these reports shall include:

- **A description of progress made during the reporting period;**
- **A description of notable findings and events during the reporting period, including problems encountered and project delays;**
- **A summary of items submitted to the U. S. Environmental Protection Agency under the Consent Order during the reporting period;**
- **A description of the work schedule during the next reporting period, including sampling and testing; and**
- **A description of the Deliverables to be submitted to the U. S. Environmental Protection Agency under the Consent Order during the next month.**

Results of TASK F will be given to EPA in monthly data submittals, as required by the Consent Order, and will be included in the draft Remedial Investigation report.

TASK F1: SOIL EVALUATION

Preliminary investigations conducted by Montgomery & Associates have included delineation of the general boundaries of the former hazardous waste disposal area and the former disposal pits **(Figure 2)**, and the maximum potential extent of lateral migration of liquid wastes in the hazardous waste area. Scope of TASK F1 includes:

- **A soil boring program to delineate the potential extent of downward migration of liquid wastes from the principal disposal pits through the underlying vadose zone.**

Results of TASK F1 will be used in the Feasibility Study to evaluate remedial alternatives.

To provide data for evaluation of the general extent of contaminant migration in the vadose zone, 12 soil borings were drilled and sampled during conduct of operations under TASK A of the comprehensive Work Plan (Montgomery & Associates and Conestoga-Rovers & Associates, 1988a). Results of TASK A indicate that volatile organic compounds and concentrations of trace metals exceeding Maximum Contaminant Levels were not detected.

Four additional soil borings will be drilled under TASK F1 of the supplemental Work Plan for TASK F. These soil borings will be drilled to determine the vertical extent of contaminant migration in soil beneath the four hazardous waste disposal pits. One soil boring will be drilled, at an angle to vertical, beneath each of Pits 1, 2, 3, and 4 **(Figure 2)**. Location and angle of these four soil borings will depend on pit geometry and the capabilities of the drilling equipment. The edges of Pits 1, 2, 3, and 4 will be investigated by digging a shallow trench transverse to the expected north, south, east, and west edges of each pit. Final locations for the four proposed soil borings will be determined based on the trenching operations, and may be modified slightly from the locations shown on **Figure 2**.

The soil borings will be drilled to auger refusal or until the basalt unit is encountered, whichever occurs first. Top of the basalt unit typically occurs at a depth ranging from 50 to 60 feet in the area of Pits 1, 2, 3, and 4. Soil samples for laboratory chemical analyses will be obtained from each of the borings at intervals to be selected by the on-site hydrogeologist based on data obtained during drilling; however, approximately 10-foot sampling intervals, beginning at about five feet below land surface, are expected. A maximum of six to eight soil samples for laboratory chemical analyses will be obtained from each soil boring. For every 10 soil samples analyzed, a duplicate sample will be prepared from the soil samples by the chemical laboratory **(Table 2)**. Zones of low permeability, where contaminants in the vadose zone may tend to accumulate, will be targeted for sampling.

Because a wide range of substances are reported to have been disposed into Pits 1, 2, 3, and 4, all soil samples obtained for laboratory chemical analyses from soil borings will be analyzed for: volatile organic compounds using EPA method 8240; semi-volatile organic compounds using EPA method 8270; pesticides and PCBs using EPA method 8080; and eight metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using the EPA EP Toxicity method. Duplicate soil samples will also be analyzed using these methods. Individual compounds and metals to be analyzed with these methods are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).

At the start of field operations, an excavation will be made in an unused part of the fenced hazardous waste area, near the excavation previously used for TASK A of the comprehensive Work Plan (Montgomery & Associates and Conestoga-Rovers & Associates, 1988a), and will be lined with a double layer of six-mil thickness plastic liner. This excavation will be used for placement of drill cuttings, drilling fluids, and rinse water. Materials in this lined excavation will remain exposed to the atmosphere for a period of several months, preferably summer months, after which a composite sample of the materials will be obtained and analyzed using: EPA method 8240 for volatile organic compounds; EPA method 8270 for base-neutral and acid organic compounds; EPA method 8080 for pesticides and PCB's; EPA method for the characteristic of EP Toxicity; and appropriate tests for determining characteristics of hazardous wastes. If, based on these laboratory chemical analyses, the materials in the lined excavation are not classified as hazardous, the excavation would be covered using soil from the landfill and the burial site would be marked at land surface. If the material is classified as hazardous, the fate of the materials would be decided as part of the Feasibility Study.

The soil borings will be drilled using a hollow-stem flight auger, preferably with the capability for continuous sampling. Prior to drilling the first soil boring and after drilling at each site, the auger drill stem and drilling tools will be cleaned using a hot, high-pressure tap water rinse. Water solutions used to clean the drilling tools will be placed in the lined excavation in the hazardous waste area. Lithologic descriptions will be prepared by the on-site hydrogeologist for soil samples for laboratory chemical analyses, and for soil samples obtained at five-foot intervals from split-spoons or, if available, from continuous cores. **Figure 4** shows the general format for lithologic descriptions. Soil moisture will be monitored closely by visual inspection. Drill cuttings samples, cores, and split-spoon samples that are not used for laboratory analyses, will be placed in containers, labeled, and preserved. If split-spoon samplers are used, a record will be made of the number of blows required to drive the samplers for each depth interval sampled. After soil sample collection is complete, the soil borings will be back-filled with a slurry comprised of cement or Volclay grout from total depth to land surface. Each soil boring location will be marked at land surface. Excess drill cuttings will be placed in the second lined excavation in the hazardous waste area.

During soil boring operations, air quality in the work space will be monitored using a HNU portable gas analyzer. Procedures for air monitoring and personal protection are given in the Health and Safety Plan for the Remedial Investigation (Montgomery & Associates and Conestoga-Rovers & Associates, 1988c).

Soil samples will be obtained by placing portions of the continuous core into sanitary glass jars with teflon-lined or aluminum-lined lids, or by using brass tube inserts with California modified or split-spoon samplers. Sampling tools will be cleaned before and after the collection of each sample for laboratory chemical analyses, according to the following procedure:

1. **Clean with hot, high-pressure tap water spray;**
2. **Wash with trisodiumphosphate solution;**
3. **Rinse with tap water; and**
4. **Rinse with deionized water.**

Water solutions used to clean the sampling tools will be placed in the lined excavation in the hazardous waste area. Where California modified or split-spoon samplers are used, soil samples for laboratory chemical analyses will be contained in four-inch or six-inch brass tube inserts. After sample collection, the ends of the brass tubes will be sealed with Teflon or aluminum sheets and plastic caps, and the samples will be stored on ice until delivery to the laboratory. For each sampling method, samples will be processed, sealed, cooled, and delivered to the laboratory as rapidly as possible to prevent excessive loss of volatile compounds prior to laboratory analysis.

Climatological data for Buckeye, Arizona, indicate that the maximum daily temperature exceeds 90°F for more than 20 days per month during the period from May through October each year (Sellers and Hill, 1974). Review of information for heat stress exposure, given in American Conference of Governmental Industrial Hygienists (1988), and anticipated need for Level C personal protective equipment, indicates that November 1989 is the soonest that field work for the soil boring program could begin. Field operations for the soil boring program are scheduled to be complete three weeks after commencement. Review of laboratory chemical analyses for the soil samples would be complete about 13 weeks after completion of field operations (Figure 3).

TASK F2: GROUNDWATER MONITOR WELLS

TASK F2 will include construction, testing, and equipping as many as five proposed on-site monitor wells. The purpose of these wells is:

- to obtain data for source and lateral extent of contamination at monitor well MW-1UA and abandoned well site HS-1;
- to obtain hydrogeologic data, groundwater samples, and aquifer hydraulic parameters;

- **to provide the basis for determining the need for additional groundwater investigations; and**

- **to provide a basis for selection of a remedial alternative for groundwater contamination.**

Locations for existing monitor wells and tentative locations for proposed monitor wells are shown on **Figure 5.** Final locations for the proposed monitor wells will be cleared with Maricopa County Landfill Department based on location of utilities and other potential hazards or obstructions, and may be modified slightly from the locations shown on **Figure 5.** Final locations will be submitted to the U. S. Environmental Protection Agency for approval. Construction details for the proposed monitor wells are shown on **Figure 6**.

Based on the quantity of waste liquids disposed into Pits 1, 2, 3, and **4 (Table 1)**, and on hydrogeologic conditions at the site, there is concern that the liquids may have percolated downward to the water table. Groundwater level data indicate that the groundwater table occurs in the upper part of Unit A. Lateral migration of the potential contaminants would be more rapid in the underlying Unit B than in Unit A. Unit B comprises the principal groundwater supply for production water wells in the landfill area.

TASK F2 includes construction, developing, testing, equipping, and sampling three to five proposed groundwater monitor wells, which would be completed in Unit A. The proposed monitor well sites are:

<u>Well Site A</u>: Located approximately 10 to 20 feet downgradient from abandoned monitor well HS-1. The proposed monitor well at Site A will replace abandoned monitor well HS-1 and should provide water level and water quality data representative for Unit A.

<u>Well Site B</u>: Located approximately 280 feet upgradient from monitor well MW-1UA, to define the lateral extent of groundwater contamination at well MW-1UA in an upgradient direction and to define the source area for the contamination.

Well Site C: Located off-site approximately 680 feet downgradient from monitor well MW-1UA and approximately 400 feet northwest, along the fence line for the landfill, from monitor well HS-2. Purpose for Site C is to define, together with existing monitor wells HS-2, the lateral extent of groundwater contamination at well MW-1UA in a downgradient direction.

Well Site D: Located on-site approximately 190 feet downgradient from abandoned monitor well HS-1. Site D is optional and will be drilled to define the lateral extent of groundwater contamination in a downgradient direction only if contamination is found in the monitor well constructed at Site A.

Well Site E: Located approximately 200 feet south-southeast from abandoned monitor well (C-1-5)3daa1[HS-1]. Site E is optional and will be drilled to define the lateral extent of groundwater contamination in a downgradient direction only if contamination is found in the monitor well constructed at Site A.

Laboratory chemical analyses for the most recent groundwater samples obtained by Montgomery & Associates from abandoned monitor well (C-1-5)3daa1[HS-1] indicate that volatile organic compounds were present in the groundwater sample at a concentration of 1,716 micrograms per liter (μg/l). **Figure 7** is a schematic diagram of well construction for monitor well (C-1-5)3daa1[HS-1] prior to abandonment in 1988. Groundwater contamination has occurred at the (C-1-5)3daa1[HS-1] site, but it is inconclusive whether the contamination occurred via natural percolation through the vadose zone, via contaminant movement down the annulus of this monitor well, or via construction operations at the well. The proposed Unit A monitor well at Site A is designed to yield representative groundwater data for Unit A at a location that is near, but down-gradient from (C-1-5)3daa1[HS-1].

Laboratory chemical analyses for the most recent groundwater samples obtained by Montgomery & Associates from existing on-site monitor well (C-1-5)3dab3[MW-1UA] **(Figure 5)**, indicates that volatile organic compounds were present in the groundwater sample at a concentration of 146 μg/l. **Figure 8** is a schematic diagram of well construction for monitor well (C-1-5)3dab3[MW-1UA]. Proposed monitor well Sites B and C are located upgradient and downgradient from well (C-1-5)3dab3[MW-1UA], respectively (**Figure 5**). Results from the monitor well at Site B will be used to evaluate if the source of the contamination detected in monitor well MW-1UA is at well MW-1UA or upgradient from well MW-1UA. Results from the monitor well at Site C will be used to evaluate the downgradient extent of the contamination detected in monitor well (C-1-5)3dab3[MW-1UA] (**Figure 5**).

Groundwater samples from the proposed monitor well at Site A will be obtained and analyzed while monitor wells are constructed at Sites B and C. If volatile organic compounds are not detected in the groundwater samples from the monitor well at Site A, monitor wells at Sites D and E (**Figure 5**) will not be drilled. If volatile organic compounds are detected in these samples, monitor wells at Sites D and E (**Figure 5**) will be drilled.

The groundwater sampling results will be used to determine the type and level of treatment needed to remediate groundwater. If no groundwater contamination is discerned from the proposed monitor well array, the wells would function as sentinel wells for early detection of potential future contaminant seepage into groundwater below the site.

Field work for TASK F2 can begin on completion of field work for TASK F1. Field work for TASK F2 will be scheduled to be complete within 13 weeks after drilling operations begin.

Well Construction

Technical specifications for construction, development, testing, and equipping of proposed monitor wells are given in **Appendix B** of the comprehensive Work Plan (Montgomery & Associates and Conestoga-Rovers & Associates, 1988a). The specifications will be submitted to a selected drilling contractor and a drilling contract will be negotiated. The selected drilling contractor will possess a license from the Arizona Department of Water Resources and will have experience on similar projects. Permits will be obtained from Arizona Department of Water Resources to drill and, if necessary, to test the wells for aquifer parameters.

Montgomery & Associates will provide field inspection of drilling, construction, development, testing, equipping, and sampling operations for the proposed monitor wells. The air-rotary drilling method is preferred, and will be used where possible. If drilling conditions indicate that the wells can not be completed using the air-rotary drilling method, bentonite-base mud-rotary drilling methods will be used. The casing schedule for each monitor well will include: 12-inch diameter blank steel surface casing set and cemented from land surface to a depth of 19 feet; eight-inch diameter blank steel conductor casing set and cemented from land surface to the top of the production interval; and four-inch diameter blank and perforated steel inner casing set, but not cemented, from land surface to total depth of the well. **Figure 6** is a schematic diagram of proposed well construction for the Unit A monitor wells, which will be completed in Unit A (sandy silt/silty clay unit). The final zone of production for each well may differ slightly from that shown on **Figure 6.**

During drilling operations, the on-site hydrogeologist will obtain samples of drill cuttings at five-foot intervals and will prepare detailed lithologic descriptions. **Figure 4** shows the general format for lithologic descriptions. The drill cuttings samples will be placed in containers, labeled, and preserved. Other data that will be obtained will include: drill penetration rate; borehole geophysical logs; borehole conditions and reaction of rig during drilling; drilling mud viscosity; monitoring of air quality; water levels; quantities and types of materials used for well construction; and schematic diagrams of well construction.

Air quality in the work space will be monitored during drilling operations using a HNU portable gas analyzer. Procedures for air monitoring and personal safety are given in the Health and Safety Plan for the RI/FS. Prior to drilling the first monitor well and after drilling the last monitor well, a sample of water used for drilling operations will be obtained and analyzed for volatile organic compounds using EPA method 601/602. Individual compounds to be analyzed with this method are listed in the QAPP (Montgomery & Associates (1988b). Prior to drilling the first monitor well and after drilling at each monitor well, the drilling tools will be cleaned using a hot, high-pressure tap water rinse. Drilling mud, together with water solutions used to clean the drilling tools, will be placed in the second lined excavation in the hazardous waste area.

Prior to setting the conductor casing, and again prior to setting the inner casing, borehole geophysical logs will be obtained for each monitor well. The logs will include: single point resistance, focused resistivity, spontaneous potential, natural gamma ray, and caliper. Optional logs may include gamma-gamma density and neutron-neutron porosity. Logging tools will be calibrated prior to logging and portions of each borehole will be logged twice to check for repeatability of logging tool response. Analysis of borehole geophysical logs and lithologic descriptions of drill cuttings will provide a basis for accurate location of tops and bottoms of hydrogeologic units, for placement of perforated intervals in the wells, and for delineation of permeable strata through which groundwater flow may be concentrated.

Prior to setting the four-inch diameter blank and perforated inner casing, the casing will be washed using a trisodiumphosphate solution, if necessary, and/or cleaned using a hot, high-pressure tap water rinse. After the inner casing is set, a sand/gravel pack will be installed via tremie pipe in the annular space between the inner casing and the 7-7/8-inch borehole wall **(Figure 6)**. The sand/gravel pack will be clean, bagged material with a high silica content, and will be designed for the casing perforation size.

Well Development

After construction of each monitor well is complete, well development operations will be conducted to remove drilling fluids and to remove fine-grained sediments from the aquifer adjacent to the perforated interval. The monitor wells will be developed by air-lift pumping and surging until the air-lifted water is reasonably clear and sand-free within five minutes after a surge. If submergence is insufficient for air-lift pumping, the wells will be developed by bailing and/or by pumping with an electric submersible pump. On completion of development operations, the wells will be bailed to remove fill. Records will be made of water levels, pumping rate, and appearance and sediment load of pumped water during development operations. Water removed from each monitor well during development operations will be discharged to an excavation adjacent to the well that is lined with a double layer of six-mil thickness plastic liner. Water discharged to these lined excavations will be allowed to evaporate naturally. Samples of the water removed from each monitor well during development operations will be obtained and analyzed for: volatile organic compounds using EPA method 624; semi-volatile organic compounds using EPA method 625; pesticides and PCB's using EPA method 608; cyanide; routine constituents; trace constituents; pH; and specific electrical conductance. Individual constituents to be analyzed with these EPA methods are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b). These samples will comprise the TASK F2 sampling round no. 1 **(Table 2)**. For every 10 water samples obtained, a duplicate groundwater sample and a field blank will be analyzed for the same suite of parameters **(Table 2)**. In addition, a trip blank will be analyzed for volatile organic compounds for each sample shipment. Results of these initial groundwater samples (TASK F2 round no. 1) will be used to screen for contaminants and to determine if water removed from the wells during pumping tests and sampling operations should also be contained in the lined excavations. If potential contaminants are not detected or are detected below Maximum Contaminant Levels, the water removed during pumping test and sampling operations will be discharged via a perforated hose or pipe to the land surface for evaporation.

Pumping Test Operations

Technical specifications for pumping test operations for the proposed monitor wells are given in **Appendix B** of the comprehensive Work Plan

(Montgomery & Associates and Conestoga-Rovers & Associates, 1988a). After development operations are complete, a short-term pumping test will be conducted at two or three monitor wells using an electric submersible test pump. Pumping test operations will be conducted at two or three wells based on pumping rates sustained during well development operations. Pumping test operations will consist of a brief preliminary test to determine potential pumping rates, a 12-hour pumping period, and a 12-hour water level recovery period. During the pumping period, on-site hydrologic personnel will make standard measurements of pumping rate, water levels in the pumped well and nearby wells, sediment load, and conductance, pH, and temperature of pumped water. Water levels will be measured to the nearest 0.01 foot using electrical water level sounders. The water level sounders, conductivity meter, and pH meter will be calibrated prior to the first pumping test and after the last pumping test. Groundwater samples for laboratory chemical analyses will be obtained from each pumped well near the end of the pumping period. Water samples will be obtained in accordance with the Sampling Plan given in the QAPP. During the recovery period, measurements of water level will be made. Results of the pumping test operations will be analyzed for aquifer transmissivity, storage coefficient, and hydraulic conductivity. These data will be required for computations of groundwater flow velocities, and for evaluation of potential remedial alternatives.

The pumping tests will be designed to meet applicable Arizona Department of Water Resources standards. Capacity of the test pump will be determined based on hydrogeologic conditions encountered during well construction and on depth to water. Components of the pump assembly will be cleaned prior to installation by:

1. Washing in a trisodiumphosphate solution; and
2. Rinsing with a hot, high-pressure tap water spray.

A rigid one-inch diameter PVC sounder conduit will be attached to the pump column pipe, from land surface to the top of the pump. The sounder conduit will be capped and perforated in the bottom five to 10 feet. Pre-pumping water level in the proposed monitor wells will be measured prior to starting each test.

The discharge assembly for the pumped well will consist of a horizontal section of steel discharge pipe extending at least 20 feet from the wellhead. A totalizing flow meter with an instantaneous flow rate indicator needle will be installed on the discharge pipe 10 feet from the wellhead. A 45-degree rise in the discharge pipe will be installed five feet downstream from the flowmeter to ensure full pipe flow through the meter. A pressure gauge will be installed on the top of the discharge pipe at the wellhead. A gate valve to control discharge will be installed between the pressure gauge and the flowmeter. A hose bib for collection of water samples will be installed ont he discharge line between the pressure gauge and the gate valve. Pumping rate will be measured using the flowmeter and by measuring the time required to fill a container of known volume.

If contaminants are not detected or are detected below the Maximum Contaminant Levels in the initial TASK F2 water samples obtained from the pumped wells during development operations, then water pumped from the wells during pumping test operations will be discharged via a perforated hose or pipe to the land surface for evaporation. If contaminants are detected above the Maximum Contaminant Levels in the initial TASK F2 water samples, then water pumped from the wells during pumping test operations will be discharged to excavations adjacent to the wells that are lined with a double layer of six-mil thickness plastic liner. Water discharged to these lined excavations will be allowed to evaporate naturally.

Near the end of the pumping period for each pumping test, groundwater samples for laboratory chemical analyses will be obtained from the discharge pipe. In addition, groundwater samples will be obtained near the end of field operations for TASK F2 from wells that are not selected for conduct of pumping tests. Because a wide range of substances were disposed at the landfill, these TASK F2 round no. 2 groundwater samples will be analyzed for: volatile organic compounds using EPA method 624; semi-volatile organic compounds using EPA method 625; pesticides and PCB's using EPA method 608; cyanide; routine constituents; trace constituents; pH; and specific electrical conductance. Individual constituents to be analyzed with these EPA methods are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b). For every 10 water samples obtained, a duplicate groundwater sample and a field blank will be analyzed for the same suite of parameters **(Table 2)**. In addition, a trip blank will be analyzed for volatile organic compounds for each sample shipment.

Completion of Wellhead and Permanent Pumps

Technical specifications for completion of wellheads and for equipment for the proposed monitor wells are given in **Appendix B** of the comprehensive Work Plan (Montgomery & Associates and Conestoga-Rovers & Associates, 1988a). On completion of pumping test operations, permanent electric submersible pumps will be installed in the proposed monitor wells for future collection of groundwater samples. Pump capacity and pump depth setting will be specified after results of the pumping tests have been analyzed. A rigid one-inch diameter PVC sounder conduit will be attached to the pump column pipe from land surface to the top of the pump, using stainless steel clamps. All wiring will meet local safety codes. The submersible pump assemblies will be suspended from a sanitary well seal. If a nonaqueous hydrocarbon phase is detected in a Unit A monitor well, that well will not be equipped with a permanent submersible pump. Components of the pump assemblies will be new and will be cleaned prior to installation by:

1. Washing in a trisodiumphosphate solution; and
2. Rinsing with a hot, high-pressure tap water spray.

Figure 9 is a schematic diagram for the permanent pump assembly.

The wellheads for the proposed monitor wells will be completed above land surface in locking vaults **(Figure 6)**. A six-foot by six-foot by four-inch cement pad will be installed at each wellhead. Altitude above mean sea level of each wellhead and well location will be surveyed to the nearest 0.1 foot to provide a datum for water level measurements. Four barrier posts, consisting of four-inch diameter blank steel casing cemented in place, will be constructed around each monitor well to protect the wells from damage by vehicles or landfill equipment. The barrier posts and well vault will be painted to increase visibility.

The identification number for each monitor well will be welded on the outside of the surface vault, and on the four-inch blank steel inner casing that extends above the cement pad.

TASK F3: GROUNDWATER MONITORING PROGRAM

The objective of TASK F3 is to extend the groundwater monitoring program established under TASK G of the comprehensive Work Plan (Montgomery & Associates and Conestoga-Rovers & Associates, 1988a). Results of the monitoring program will be used to document groundwater quality and to detect changes in rate and direction of groundwater movement. The monitoring program will comprise three rounds of collection of groundwater samples and measurement of groundwater levels.

TASK F3 sampling round no. 1 will be conducted in July 1989 and will comprise collection of groundwater samples from, and measurement of water levels at, the 11 existing on-site monitor wells. TASK F3 sampling round no. 2 would be conducted approximately 30 days after completion of field operations for TASK F2, and will comprise collection of groundwater samples from, and measurement of water levels at, the new and existing on-site monitor wells. TASK F3 sampling round no. 3 would be conducted 13 weeks after TASK F3 sampling round no. 2, and would be identical to round no. 2. Results from TASKS F2 and F3 sampling rounds will be given in monthly data submittals to EPA, as required in the Consent Order.

Groundwater samples from the existing 11 on-site monitor wells for all TASK F3 sampling rounds will be analyzed for: volatile organic compounds using EPA method 601/602; routine constituents; selected trace constituents previously detected; pH; and specific electrical conductance. The TASK F3 groundwater samples obtained from the new monitor wells constructed under TASK F2 will be analyzed for: volatile organic compounds using EPA method 601/602; routine constituents; pH; specific electrical conductance; and any other constituents detected in groundwater samples obtained during TASK F2. Individual constituents to be analyzed with these EPA methods are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).

In addition, selected groundwater samples obtained during TASK F3 sampling round no. 2 and sampling round no. 3 will be analyzed for the following constituents not listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b): nitrite using EPA method 353.2; total Kjeldahl nitrogen (TKN) using EPA method 351.2; total organic carbon (TOC) using EPA method 415.2; oil and grease using EPA method 413.1; chemical oxygen demand (COD) using modified EPA method 410.4; and, biochemical oxygen demand (BOD) using EPA method 405.1. These additional constituents were requested by Conestoga-Rovers & Associates to provide data for treatability of groundwater. Wells proposed for supplemental sampling and analysis are: Unit A monitor well MW-1UA; proposed Unit A monitor wells A, B, D, and E; and Unit B monitor wells MW-1UB and MW-4UB.

For every 10 water samples obtained, a duplicate groundwater sample and a field blank will be analyzed for the same suite of parameters (**Table 2**). In addition, a trip blank will be analyzed for volatile organic compounds for each sample shipment.

Groundwater samples will be obtained in accordance with the Sampling Plan given in **Appendix B**. Samples will be pumped from the wells using electric submersible pumps. Field measurements of water level, pumping rate, and pH, conductance, and temperature of pumped water will be made for each well. Water levels will be measured using an electrical sounder. Samples will be obtained when three borehole volumes have been pumped from a well or when conductance and pH of the pumped water have stabilized, whichever takes longer.

If contaminants are not detected in the TASK F2 groundwater samples, or are detected at concentrations below the Maximum Contaminant Levels, then water pumped from the wells during TASK F3 sampling operations will be discharged via a perforated hose or pipe to the land surface for evaporation. If contaminants are detected above the Maximum Contaminant Levels in the TASK F2 water samples, then water pumped from the wells during TASK F3 sampling operations will be discharged to excavations adjacent to the wells that are lined with a double layer of six-mil thickness plastic liner. Water discharged to these lined excavations will be allowed to evaporate naturally.

If a nonaqueous hydrocarbon phase occurs on the water surface in any Unit A well, that well will not be equipped with a permanent submersible pump, and subsequent samples from the well will be obtained by bailing. For these conditions, samples would be bailed from the uppermost five feet of water in the well using a clear Teflon or acrylic bailer. The filled bailer would be visually inspected for thickness and character of the hydrocarbon phase. In addition, an ORS Interface Probe would be used to measure water level and free product thickness in the well. A sample of the hydrocarbons would be analyzed for total petroleum hydrocarbons (TPH) using modified EPA method 8015 and for volatile organic compounds using EPA method 624 (Table 2). Individual compounds to be analyzed by these methods are given in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).

TASK F4: GROUNDWATER INVESTIGATION - STAGE III

The necessity and scope of TASK F4 will depend on results of TASKS F.1, F.2, and F.3. The objective of the TASK F4 Stage III groundwater investigation would be to further delineate the extent of groundwater contamination.

TASK F4 would include construction and testing of additional monitoring wells, where necessary and appropriate.

If results of the previous TASKS demonstrate that groundwater contamination has been defined sufficiently, TASK F4 would not be required. If this is not the case, similar procedures to those described in TASK F2 would be followed to install and test the additional wells. TASK F3 would be expanded to include monitoring the additional wells.

If TASK F4 would be required, a Stage III supplemental Work Plan would be prepared and submitted. The supplemental Work Plan would delineate the sequence of events leading to review of results for TASK F4 and to finalization of the Remedial Investigation prior to undertaking the report preparation (TASK G).

ESTIMATED PROJECT TIMING

Figure 3 is a schedule graph for estimated project timing, excluding TASK F4. Initial work for TASK F1 of the Remedial Investigation would begin in November 1989. Excluding TASK F4, completion of the Remedial Investigation may require about 155 weeks (36 months) from the effective date of the Consent Order, which was February 19, 1988. In the event that TASK F4 would be required, an additional six to 12 months or more may be necessary for completion of the Remedial Investigation. Completion of the Feasibility Study may occur within about 73 weeks (17 months) after completion of the Remedial Investigation. On completion of the agency review and comment period, if no substantial amount of additional work is necessary, finalization of the Feasibility Study report could occur within eight weeks.

The time schedule set forth in the Consent Order includes time for regulatory agency review at key points in the RI/FS and time for the EPA Risk Assessment. Changes in time allotted for regulatory agency review and comment during the RI/FS, or for the Risk Assessment, would necessarily require adjustments in the estimated project timing described in the supplemental Work Plan and shown on **Figure 3**.

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Wilson, E. D., Moore, R. T., and Peirce, H. W., 1957. **Geologic map of Maricopa County, Arizona.** Arizona Bureau of Geology and Mineral Technology, Geological Survey Branch, Map 3-5, 1957.

TABLES

TABLE 1. SUMMARY OF WASTES DISPOSED
HASSAYAMPA LANDFILL MARICOPA COUNTY, ARIZONA
(MODIFIED FROM ARIZONA DEPARTMENT OF HEALTH SERVICES, 1985)

PIT	WASTE TYPE DESIGNATED	QUANTITY LIQUID WASTE (gallons)	QUANTITY SOLID WASTE (tons)
SPECIAL PIT	INCOMPATIBLE HAZARDOUS WASTE	134,578	308.64
PIT 1	ORGANICS & OILS	360,805	0
PIT 2	ACIDS & ACID SLUDGES	125,597	0.1
PIT 3	ALKALINE & METALLIC SLUDGES	1,362,636	24.5
PIT 4	PESTICIDES & ALKALINE SLUDGES	1,295,022.2	3,816.46
	TOTAL	3,278,638.25	4,149.7

TABLE 2. SUMMARY OF SAMPLING PROGRAM
HASSAYAMPA LANDFILL, MARICOPA COUNTY, ARIZONA

	..INVESTIGATIVE SAMPLES..			QA/QC SAMPLES: ...DUPLICATE SAMPLES[a]...			......FIELD BLANKS[b].....			......TRIP BLANKS[c]......			GRAND	ASSUMED[d]	
	NUMBER	FREQUENCY	TOTAL	NUMBER	FREQUENCY	TOTAL	NUMBER	FREQUENCY	TOTAL	NUMBER	FREQUENCY	TOTAL	TOTAL	CONCENTRATION	TYPE OF ANALYSIS[e]
WATER SAMPLES[f]															
Task F2 Round 1															
5 New Wells															
w/o HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	L	624, 625, 608, cyanide, routine, trace
w/HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	H	624, 8015 (modified)
Task F2 Round 2															
5 New Wells															
w/o HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	L	624, 625, 608, cyanide, routine, trace
w/HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	H	624, 8015 (modified)
Task F3 Round 1															
11 Existing Wells	11	1	11	2	1	2	2	1	2	2	1	2	17	L	601/602, routine, selected trace
Task F3 Round 2															
11 Existing Wells	11	1	11	2	1	2	2	1	2	2	1	2	17	L	601/602, routine, selected trace
7 Selected Wells	7	1	7	1	1	1	1	1	1	0	0	0	9	L	TKN, TOC, COD, BOD, nitrite, oil & grease
5 New Wells															
w/o HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	L	601/602; routine; (plus any previously detected parameters)
w/HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	H	601/602, 8015 (modified)
Task F3 Round 3															
11 Existing Wells	11	1	11	2	1	2	2	1	2	2	1	2	17	L	601/602, routine, selected trace
7 Selected Wells	7	1	7	1	1	1	1	1	1	0	0	0	9	L	TKN, TOC, COD, BOD, nitrite, oil & grease
5 New Wells															
w/o HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	L	601/602; routine; (plus any previously detected parameters)
w/HC phase	5	1	5	1	1	1	1	1	1	1	1	1	8	H	601/602, 8015 (modified)
Drilling Water	1	2	2	---	---	---	---	---	---	---	---	---	---	L	624

TABLE 2. SUMMARY OF SAMPLING PROGRAM
HASSAYAMPA LANDFILL, MARICOPA COUNTY, ARIZONA

	..INVESTIGATIVE SAMPLES..			QA/QC SAMPLES: ...DUPLICATE SAMPLES[a]...			......FIELD BLANKS[b].....			......TRIP BLANKS[c]......					
	NUMBER	FREQUENCY	TOTAL	NUMBER	FREQUENCY	TOTAL	NUMBER	FREQUENCY	TOTAL	NUMBER	FREQUENCY	TOTAL	GRAND TOTAL	ASSUMED[d] CONCENTRATION	TYPE OF ANALYSIS[e]
TASK F1 SOIL SAMPLES															
4 Soil Borings	32	1	32	4	1	4	---	---	---	---	---	---	36	H	8240, 8270, 8080, EP Toxicity, CERCLA characteristics of hazardous waste
Lined Excavation	1	1	1	1	1	1	---	---	---	---	---	---	2	H	8240, 8270, 8080, EP Toxicity, CERCLA characteristics of hazardous waste

a Duplicates of soil samples for laboratory chemical analyses will be prepared by the laboratory

b Field blanks for water chemical analyses will be prepared using bottled deionized water

c Trip blanks for water chemical analyses will be prepared by the laboratory prior to field operations

d H = High
L = Low

e Numbers refer to EPA method numbers
TKN = Total Kjeldahl nitrogen
TOC = Total organic carbon
COD = Chemical oxygen demand
BOD = Biochemical oxygen demand

f HC - Nonaqueous hydrocarbon phase

NOTE: Frequency indicates the number of times the sample source will be sampled for the indicated sampling round and/or analysis.

TABLE 3. SUMMARY OF SAMPLING REQUIREMENTS
HASSAYAMPA LANDFILL, MARICOPA COUNTY, ARIZONA

PARAMETER (Analyses Method)	MATRIX	CONTAINER	PRESERVATION	MAXIMUM HOLDING TIME FOR PROJECT
Volatile Organic Compounds (EPA methods 624/8240 or 601/602)	Water	Two 40-ml glass vials with Teflon-lined septa	Add 4 drops 1:1 HCl, Refrigerate	14 days
	Soil	400-ml mason jar with Teflon-lined lid, or 4-6 inch brass tube with Teflon/aluminum lined endcaps	Refrigerate	14 days
Semi-Volatile Organics, Pesticides, or PCB's (EPA methods 625/8270 and 608/8080)	Water	Four 1-liter amber glass bottles with Teflon-lined screwcaps	Refrigerate	7 days prior to extraction; 28 days after extraction
	Soil	400-ml mason jar with Teflon/aluminum lined lid	Refrigerate	7 days prior to extraction; 28 days after extraction
Total Petroleum Hydrocarbons (modified EPA method 8015)	Water	Two 40-ml glass vials with Teflon-lined septa	Add 4 drops 1:1 HCl, Refrigerate	14 days
Trace Elements (general)	Water	1-liter plastic bottle	Filter immediately, add 1:1 HNO_3 to pH<2, Refrigerate	28 days
	Soil	One mason jar with Teflon/aluminum lined lid, or 4-6 inch brass tube with Teflon/aluminum lined endcaps	Refrigerate	28 days
Routine Constituents (general)	Water	1-liter plastic bottle	Refrigerate	28 days
Cyanide (total) (EPA method 335.2)	Water	1-liter plastic bottle	Add NaOH to pH>12 Refrigerate	14 days
Ammonia, Nitrate (EPA methods 350.3 and 353.2)	Water	1-liter	Add 1:1 H_2SO_4 to pH <2 Refrigerate	28 days
Nitrite (EPA method 353.2)	Water	500-ml plastic bottle	Add 1:1 H_2SO_4 to pH <2 Refrigerate	48 hours

TABLE 3. SUMMARY OF SAMPLING REQUIREMENTS
HASSAYAMPA LANDFILL, MARICOPA COUNTY, ARIZONA

PARAMETER (Analyses Method)	MATRIX	CONTAINER	PRESERVATION	MAXIMUM HOLDING TIME FOR PROJECT
Total Kjeldahl Nitrogen (TKN) (EPA method 351.2)	Water	1-liter plastic bottle	Add 1:1 H_2SO_4 to pH <2 Refrigerate	28 days
Total Organic Carbon (TOC) (EPA method 415.2)	Water	250-ml amber glass bottle	Add 1:1 H_2SO_4 to pH <2 Refrigerate	28 days
Phosphate (EPA method 365.3) + Chemical Oxygen Demand (COD) (Modified EPA method 410.4)	Water	1-liter plastic bottle	Add 1:1 H_2SO_4 to pH <2 Refrigerate	28 days
Biochemical Oxygen Demand (BOD) (EPA method 405.1)	Water	1-liter plastic bottle	Refrigerate	48 hours
Oil and Grease (EPA method 413.1)	Water	1-liter glass bottle	Add 1:1 H_2SO_4 to pH <2	28 days

ILLUSTRATIONS

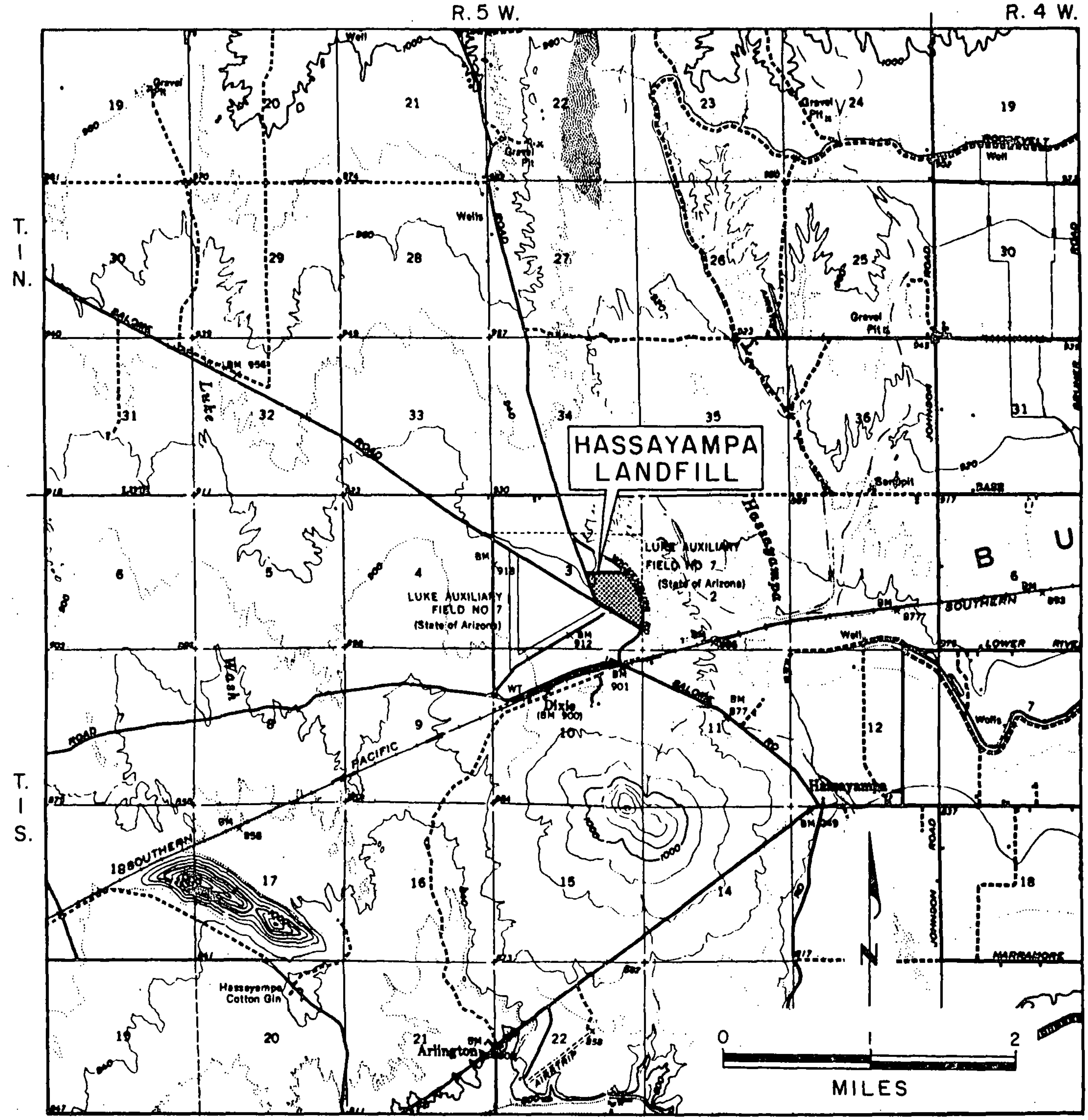
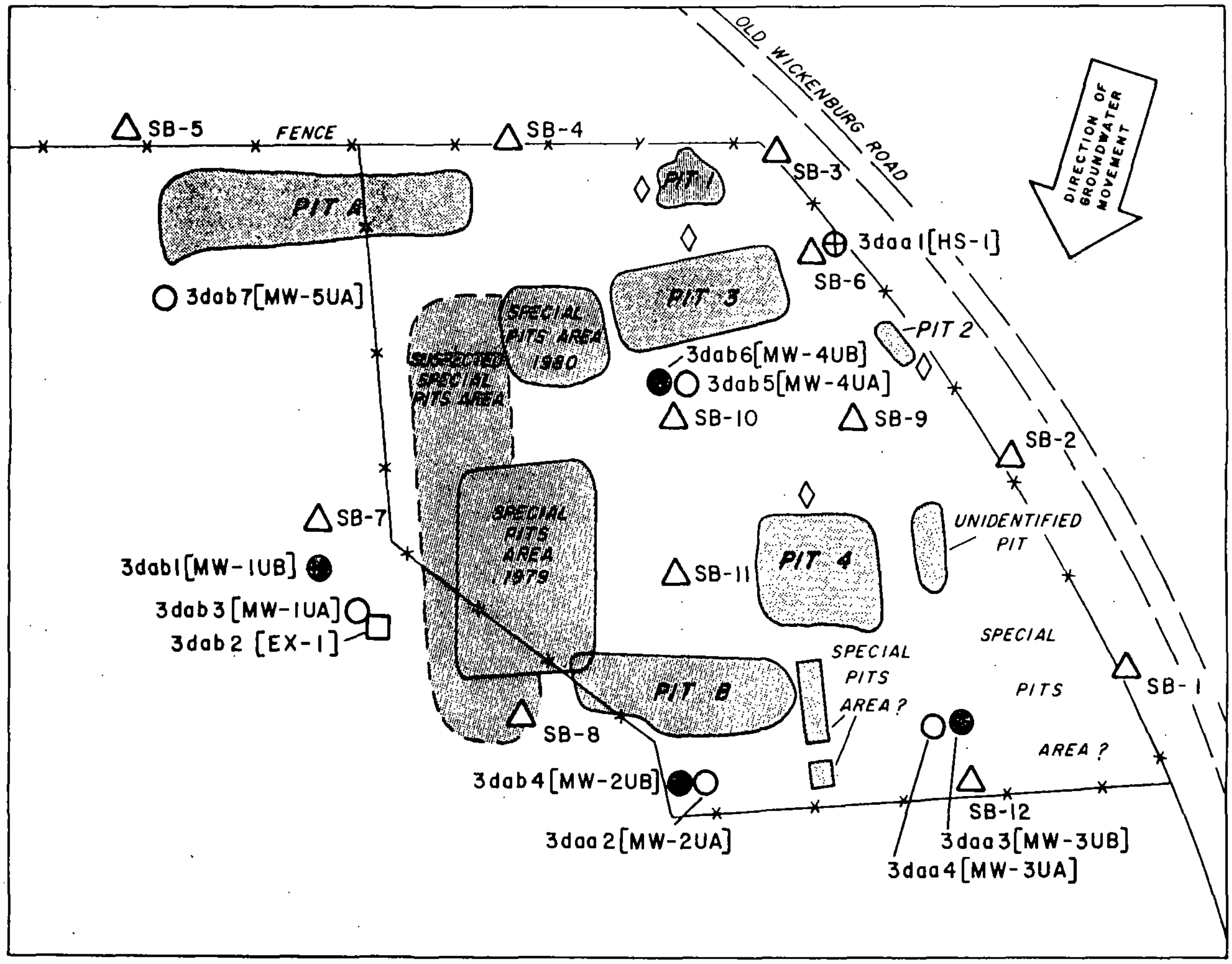


FIGURE 1. REGIONAL LOCATION MAP

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
TUCSON, ARIZONA



EXPLANATION

△ SB-1	SOIL BORING
○ 3dab3 [MW-1UA]	UNIT A MONITOR WELL
● 3dab1 [MW-1UB]	UNIT B MONITOR WELL
□ 3dab2 [EX-1]	EXPLORATION BORING
⊕ 3daa1 [HS-1]	ABANDONED MONITOR WELL Constructed by Arizona Department of Health Services
◊	PROPOSED SOIL BORING
PIT 1	DISPOSAL PIT: locations and boundaries of disposal pits are based on analysis of a January 26, 1981, aerial photo and on reports; locations and boundaries are tentative and approximate

N

0 100 200 300 400
FEET

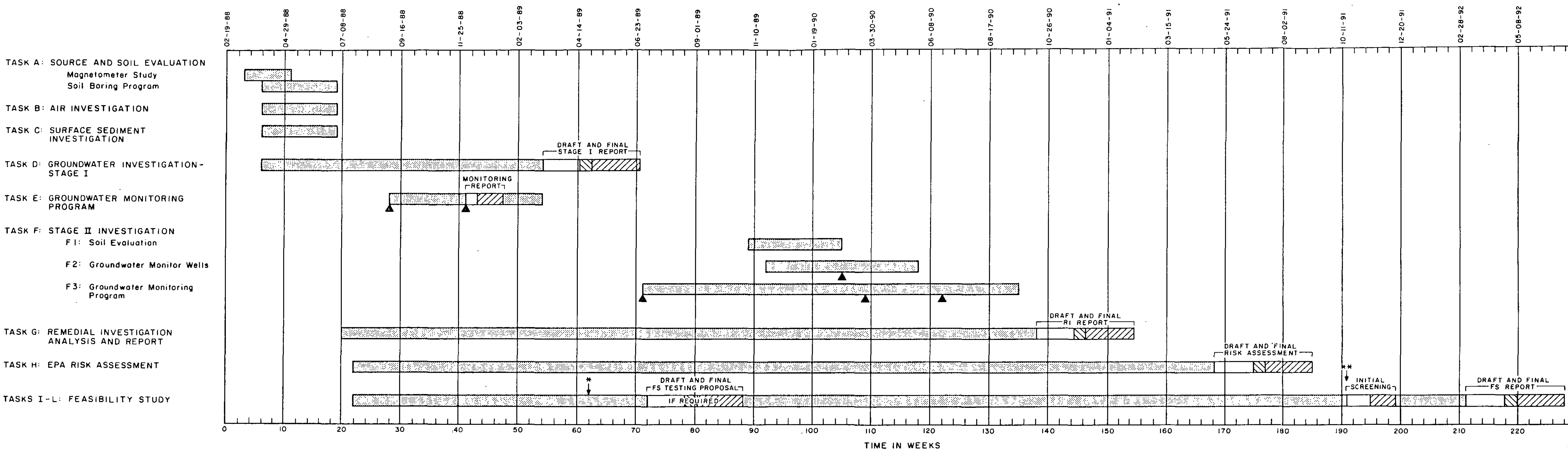
HASSAYAMPA LANDFILL
MARICOPA COUNTY, ARIZONA

LOCATION MAP FOR FORMER HAZARDOUS WASTE AREA

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
TUCSON, ARIZONA

1989

FIGURE 2



EXPLANATION

(stippled bar)	TASK WORK
(open bar)	DOCUMENT REVIEW AND COMMENT/APPROVAL
(cross-hatched bar)	DISCUSSION AND RESOLUTION
(hatched bar)	DOCUMENT FINALIZATION
▲	SAMPLING ROUND

* NOTIFICATION OF REQUIREMENT FOR FS TESTING PROPOSAL SHALL BE GIVEN BY EPA NO LESS THAN 10 WEEKS PRIOR TO DUE DATE FOR DRAFT PROPOSAL. TIME LINE FOLLOWING * WILL SHIFT TO RIGHT AN AMOUNT EQUAL TO ANY DELAY IN NOTIFICATION.

** DRAFT INITIAL SCREENING REPORT WILL BE SUBMITTED 6 WEEKS AFTER SUBMITTAL OF FINAL RISK ASSESSMENT BY EPA. TIME LINE FOLLOWING ** WILL SHIFT TO RIGHT AN AMOUNT EQUAL TO ANY DELAY IN EPA'S SUBMITTAL.

NOTE: If TASK F4 (Stage III Investigation) would be required, all deliverables for TASKS G-L would be delayed from 6 to 12 months or more, except for FS testing proposal.

FIGURE 3. SCHEDULE GRAPH OF ESTIMATED PROJECT TIMING (EXCLUDING TASK F4)

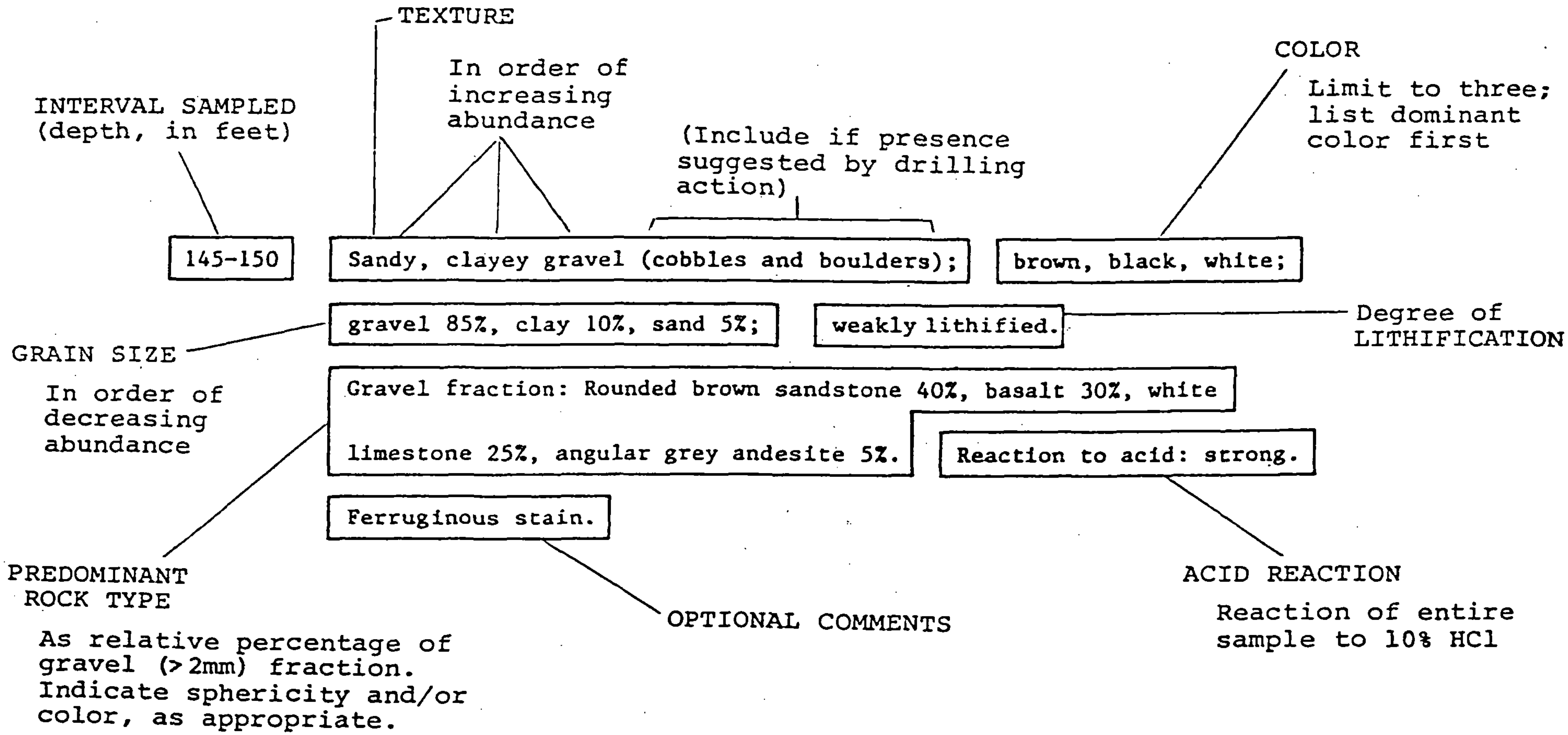
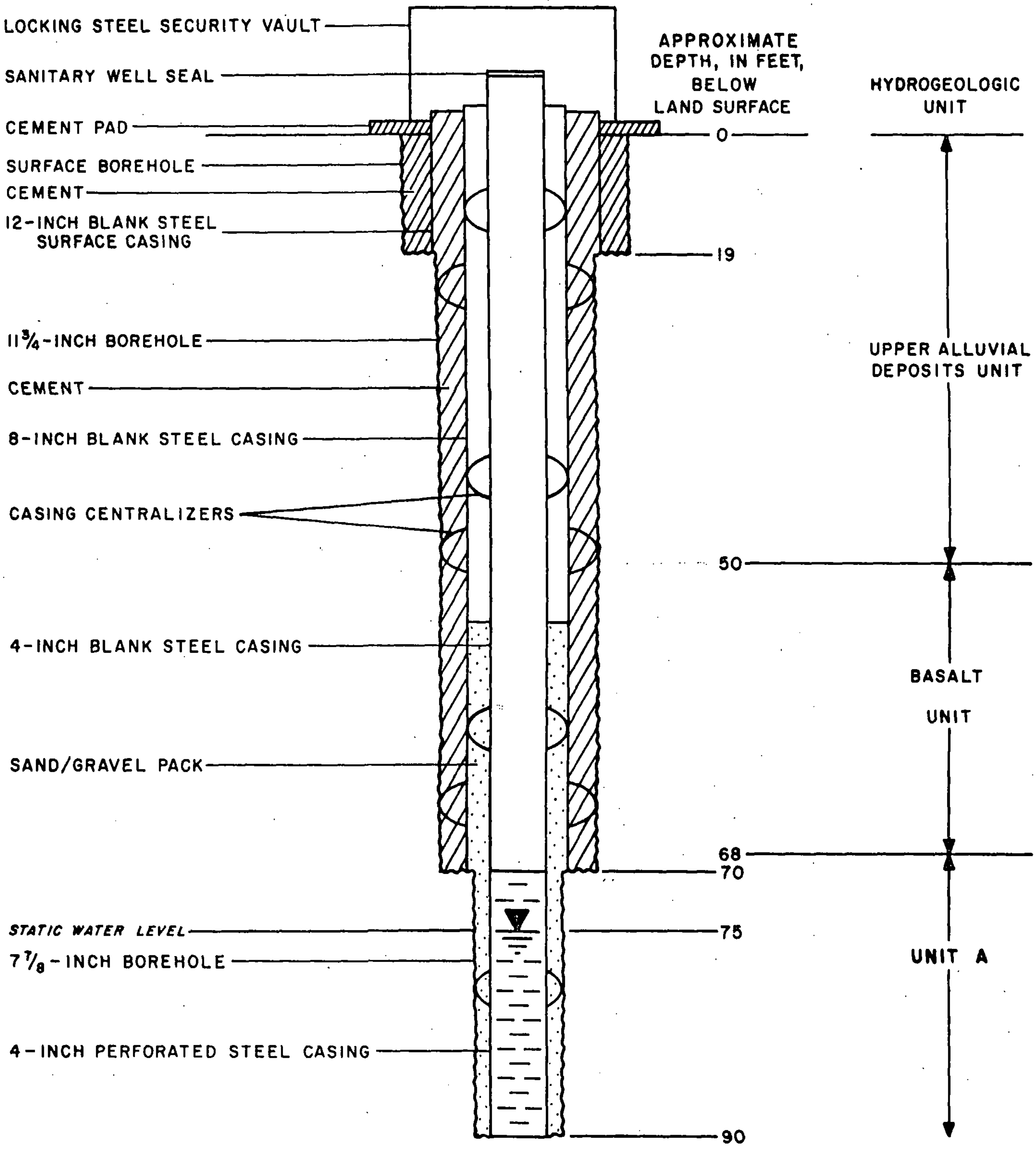


FIGURE 4. GENERAL FORMAT FOR LITHOLOGIC DESCRIPTION



NOTE: CONTRACTOR WILL INSTALL PERMANENT SUBMERSIBLE PUMP

FIGURE 6. SCHEMATIC DIAGRAM OF PROPOSED UNIT A MONITOR WELL

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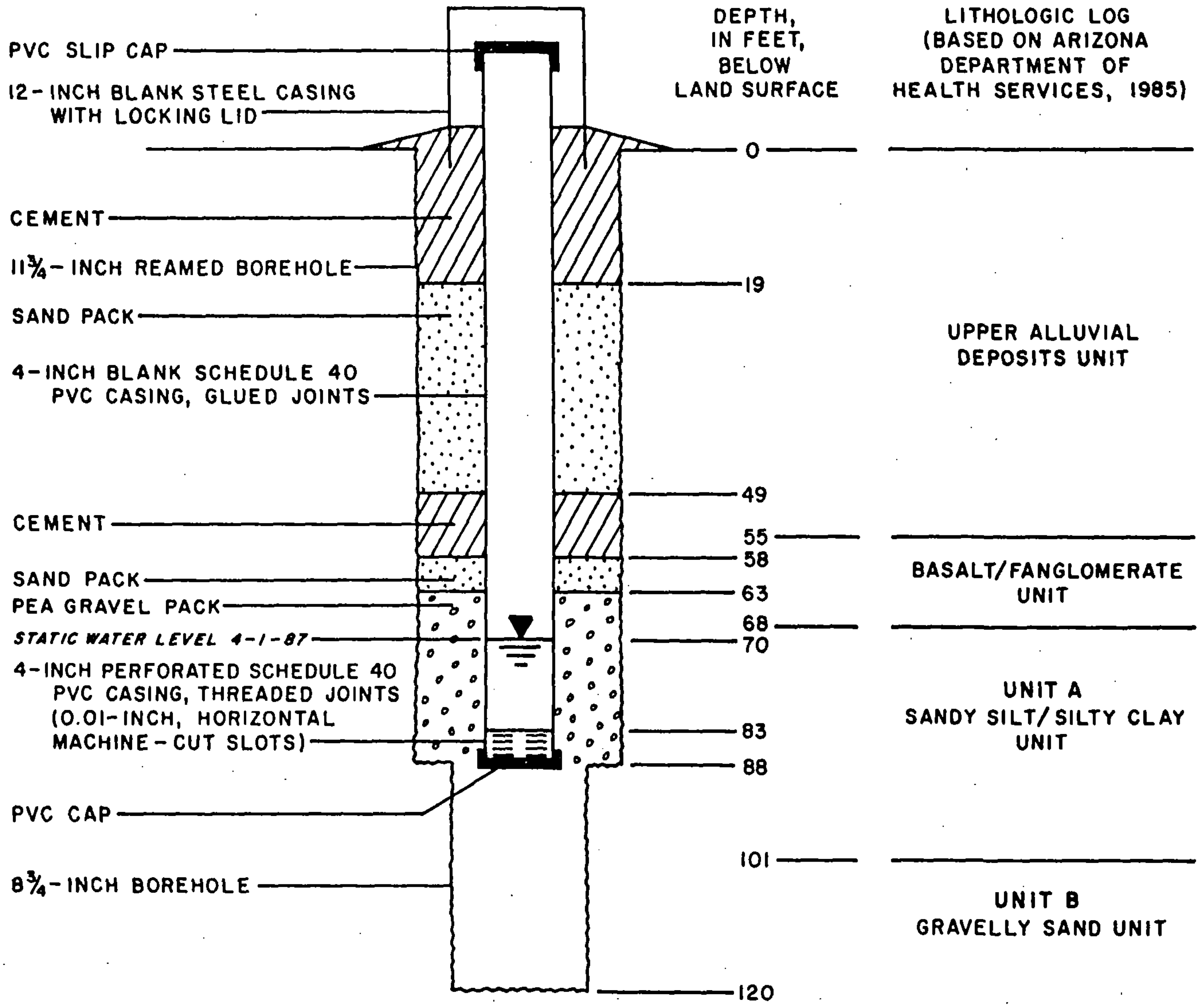

PERFORATED INTERVAL IS BASED ON TV VIDEO SURVEY CONDUCTED 4-1-87

FIGURE 7. SCHEMATIC DIAGRAM OF WELL CONSTRUCTION FOR MONITOR WELL (C-1-5)3daa [HS-1]

ERROL L. MONTGOMERY & ASSOCIATES, INC.
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TUCSON, ARIZONA

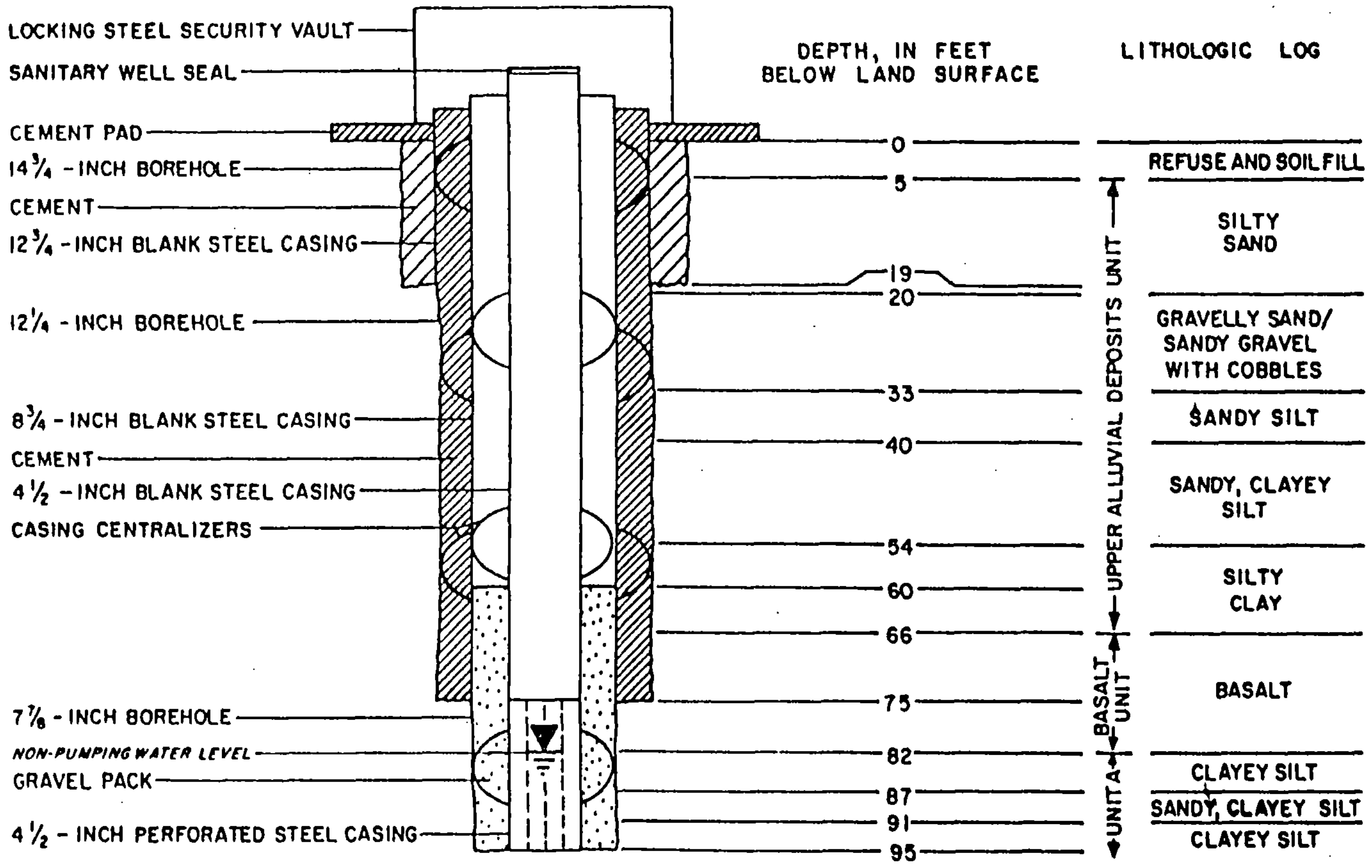
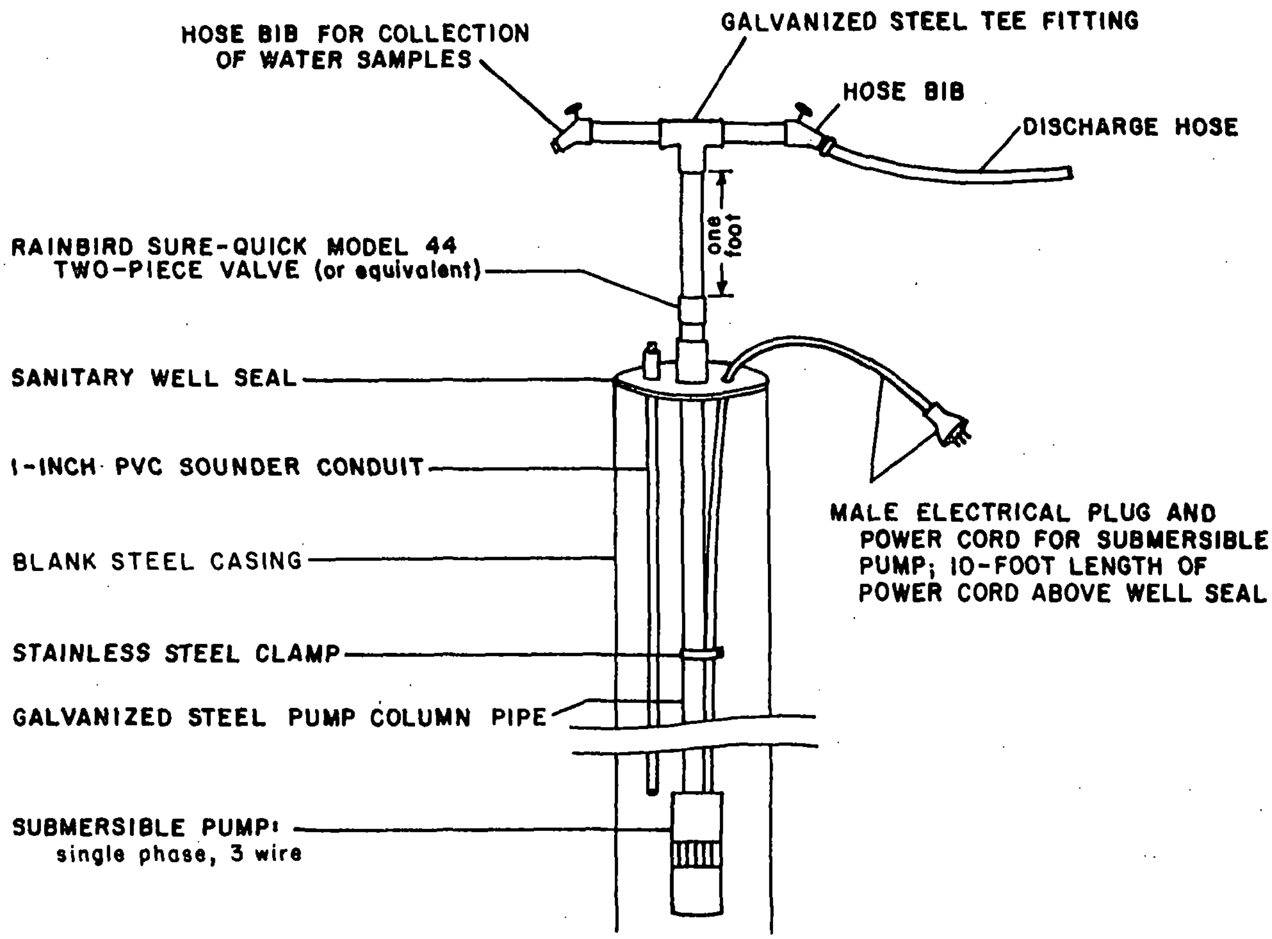


FIGURE 8. SCHEMATIC DIAGRAM OF WELL CONSTRUCTION FOR UNIT A MONITOR WELL (C-1-5)3dab$_3$ [MW-1UA]



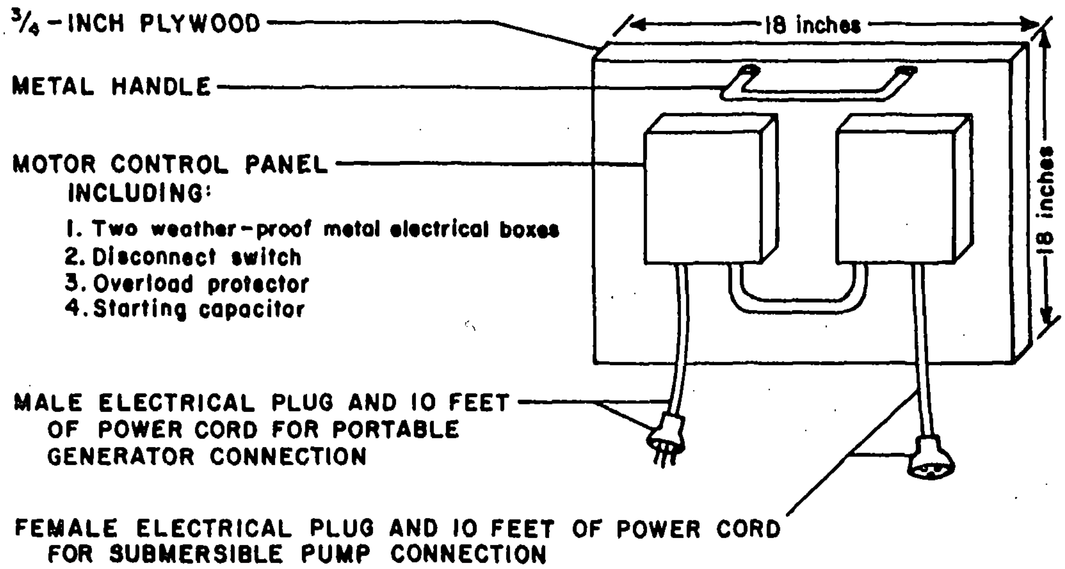


FIGURE 9. SCHEMATIC DIAGRAM FOR PERMANENT WELL HEAD AND PORTABLE MOTOR CONTROL PANEL

Computing minutes required to pump five B.H. volumes:
(T.D.-P.W.L.)(÷Q)= ________ minutes
( )( )

ERROL L. MONTGOMERY & ASSOCIATES, INC.

WATER LEVEL RECORD SHEET (Previous measured W.L.____) Page ______

______ Sampling Round

PUMPED WELL ____________________

Computed Sampling Time ________ Hrs.

Measuring Point ____Top of____________________ Well Location: T.________, R.________, Sec.________

which is ____________ft. above land surface. Well Coordinates: ____________________ft N.

Elevation of Measuring Point ____________________ft above mean sea level. ____________________ft E.

STATIC WATER LEVEL: ____________

Pump Intake ____________ ft.BMP

DATE/TIME AFTER PUMPING STARTED (MINUTES)	HOUR	DEPTH TO WATER (FEET) HELD	WET	DEPTH	PUMPING RATE (GPM)	DRAWDOWN (FT.)		REMARKS (INCLUDE METHOD OF MEASUREMENT) secs per ___ gal.discharge
SOUNDER USED:	#							
CONDUCTIVITY	METER/PROBE USED: #	/#						
pH METER/PROBE USED:	#	/#						

FIGURE 10. FIELD DATA FORM FOR PUMPED WELL

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
1075 EAST FORT LOWELL ROAD, SUITE B
TUCSON, ARIZONA 85719 (602) 881-4912
TELEX: 165597 MONTE TUC

CHAIN OF CUSTODY
TRAFFIC REPORT

Project No.________

□ Organic □ Grab □ Soil
□ Inorganic □ Composite □ Water
□ Other ____________________

[ ]
Sample Number

Sampling Site Name/Code/Well No. ____________________

Sampling Date____________________ and Time of Collection ____________________

Sampling Personnel:
Name ____________________ Signature ____________________
Name ____________________ Signature ____________________
Name ____________________ Signature ____________________

Sampling Point ____________________ and Method of Sampling ____________________

Field Observations ____

Sample, Sample Container Data

Volume	No. Used	Lot No.	Preservatives	Analyses Needed	Destin.	Ship. Method/Date

Special Handling Procedures ____
____
____

FIGURE 11. CHAIN OF CUSTODY TRAFFIC REPORT

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
1075 EAST FORT LOWELL ROAD, SUITE B
TUCSON, ARIZONA 85719 (602) 881-4912
TELEX: 165597 MONTE TUC

ERROL L. MONTGOMERY, P.G.
JOHN W. HARSHBARGER, P.G., P.E.
DONALD K. GREENE, P.E.
WILLIAM R. VICTOR, P.G.
EDWARD W. PEACOCK, P.G.
RONALD H. DEWITT

CHAIN OF CUSTODY
LETTER OF TRANSMITTAL

Date:______________

Job No.:______________

TO:

ATTENTION:

On ______________,______, water sample(s) was (were) shipped to you via ____________________ in _________ parcel(s). The sample(s) was (were) shipped in ____ container(s). Custody seals were (were not) attached to the sample and/or shipping container(s). Upon receipt, the laboratory representative accepting custody of the samples must sign and date the attached Chain of Custody/Analyses Request Schedule. The laboratory representative must remark on the number and integrity of the sample(s) (i.e., condition of custody seal and container, relative temperature of each sample, or other conditions which may affect credibility of laboratory results) in the space provided at the bottom of the Chain of Custody/Analyses Request Schedule. If the integrity of the sample(s) is in question, please notify us immediately.

Please perform the analyses indicated in the attached Chain of Custody/Analyses Request Schedule within the maximum allowable holding times indicated or, if not indicated, those recommended by federal regulatory agencies. The final laboratory report should include at a minimum: all data indicated on sample container labels; date sample was received at the laboratory; date of analysis for each parameter reported; and detection limits. Results of your analyses and the attached Chain of Custody/ Analyses Request Schedule should be sent to our Tucson office.

If you have any questions regarding the shipment or the analyses requested, please contact us.

Very truly yours,

ERROL L. MONTGOMERY & ASSOCIATES, INC.

By:______________________________

Attachment(s).

Title:______________________________

FIGURE 12. CHAIN OF CUSTODY LETTER OF TRANSMITTAL

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
1075 EAST FORT LOWELL ROAD, SUITE B
TUCSON, ARIZONA 85719 (602) 881 4912
TELEX: 165597 MONTE TUC

CHAIN OF CUSTODY
ANALYSES REQUEST SCHEDULE
ORGANICS

Project No. ______

SAMPLE IDENTIFIER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	PRIORITY VOLATILE ORGANICS ONLY	PRIORITY BNA, AND PESTICIDES ONLY	OTHER	MAXIMUM ALLOWABLE HOLDING TIME, STARTING FROM TIME OF COLLECTION	REMARKS

Relinquished by:	Affiliation:	Date:	Time:	Received by:	Affiliation:	Date:	Time:

LABORATORY COMMENTS ON SAMPLE INTEGRITY UPON RECEIPT: ____________________

FIGURE 13. CHAIN OF CUSTODY ANALYSES REQUEST SCHEDULE FOR ORGANICS

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
1075 EAST FORT LOWELL ROAD, SUITE B
TUCSON, ARIZONA 85719 (602) 881-4912
TELEX: 165597 MONTE TUC

CHAIN OF CUSTODY
ANALYSES REQUEST SCHEDULE

ROUTINE PARAMETERS

TO:

FROM: ____________________________

DATE OF SHIPMENT: ________________ NUMBER OF SAMPLES SHIPPED: ________________

SHIPPED VIA: ________________ CONTAINER: ________________

IDENTIFICATION OF SAMPLES

Sample No. Identification	Sampling Date (Time)	Sample Temp./Conductivity/pH

PRE-TREATMENT OF SAMPLES:

DETERMINATIONS TO BE MADE:

Routine Constituents

Calcium	Sulfate	Silica
Magnesium	Nitrate	pH
Sodium	Boron	
Potassium	Fluoride	
Carbonate	Electrical Conductance	
Bicarbonate	Total Dissolved Solids	
Chloride	(Residue @ 180°C)	

Relinquished by:	Affiliation:	Date:	Time:
	E.L. Montgomery & Associates, Inc.		
Received by:	Affiliation:	Date:	Time:

LABORATORY COMMENTS ON SAMPLE INTEGRITY
UPON RECEIPT: ____________________________

FIGURE 14. CHAIN OF CUSTODY ANALYSES REQUEST SCHEDULE FOR ROUTINE PARAMETERS

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
1075 EAST FORT LOWELL ROAD, SUITE B
TUCSON, ARIZONA 85719 (602) 881-4912
TELEX: 165597 MONTE TUC

CHAIN OF CUSTODY
ANALYSES REQUEST SCHEDULE

TRACE ELEMENTS

TO:

FROM: ____________________

DATE OF SHIPMENT: ____________ NUMBER OF SAMPLES SHIPPED: ____________
SHIPPED VIA: ____________ CONTAINER: ____________

IDENTIFICATION OF SAMPLES

Sample No. Identification	Sampling Date (Time)	Sample Temp./Conductivity/pH

PRE-TREATMENT OF SAMPLES:

DETERMINATIONS TO BE MADE:

Relinquished by:	Affiliation:	Date:	Time:
	E.L. Montgomery & Associates, Inc.		
Received by:	Affiliation:	Date:	Time:

LABORATORY COMMENTS ON SAMPLE INTEGRITY UPON RECEIPT: ____________________

Trace Metals and Other Constituents

Iron	Arsenic
Manganese	Silver
Copper	Mercury
Molybdenum	Selenium
Lead	Zinc
Antimony	Nickel
Beryllium	Thallium
Cadmium	Aluminum
Total Chromium	Barium

FIGURE 15. CHAIN OF CUSTODY ANALYSES REQUEST SCHEDULE FOR TRACE ELEMENTS

APPENDIX A

WELL NUMBERING SYSTEM

APPENDIX A

WELL NUMBERING SYSTEM

The well numbers used in this report are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River meridian and base line, which divide the state into four quadrants. These quadrants are designated, counter-clockwise, by the capital letters A, B, C, and D. All land north and east of the point of origin is in quadrant A; all land north and west of the origin is in quadrant B; all land south and west is in quadrant C; and all land south and east is in quadrant D. The first digit of a well number indicates the township, the second digit the range, and the third digit the section in which the well is located. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes a particular 160-acre tract or quarter section; the second letter denotes the 40-acre tract or quarter-quarter section; and the third letter denotes the 10-acre tract or quarter-quarter-quarter section. These letters are also assigned in a counter-clockwise direction, beginning in the northeast quarter. As **Figure A-1** shows, well number (A-1-1)8baa designates the well as being located in the Northeast 1/4, Northeast 1/4, Northwest 1/4, Section 8, Township 1 North, Range 1 East. Where more than one well is located within a 10-acre tract, consecutive numbers beginning with "1" are added as suffixes.

For this investigation, additional well identifiers enclosed in brackets are added as suffixes, as is shown on **Figure 2.** The additional well identifiers are used to identify monitor wells located at the Hassayampa Landfill.

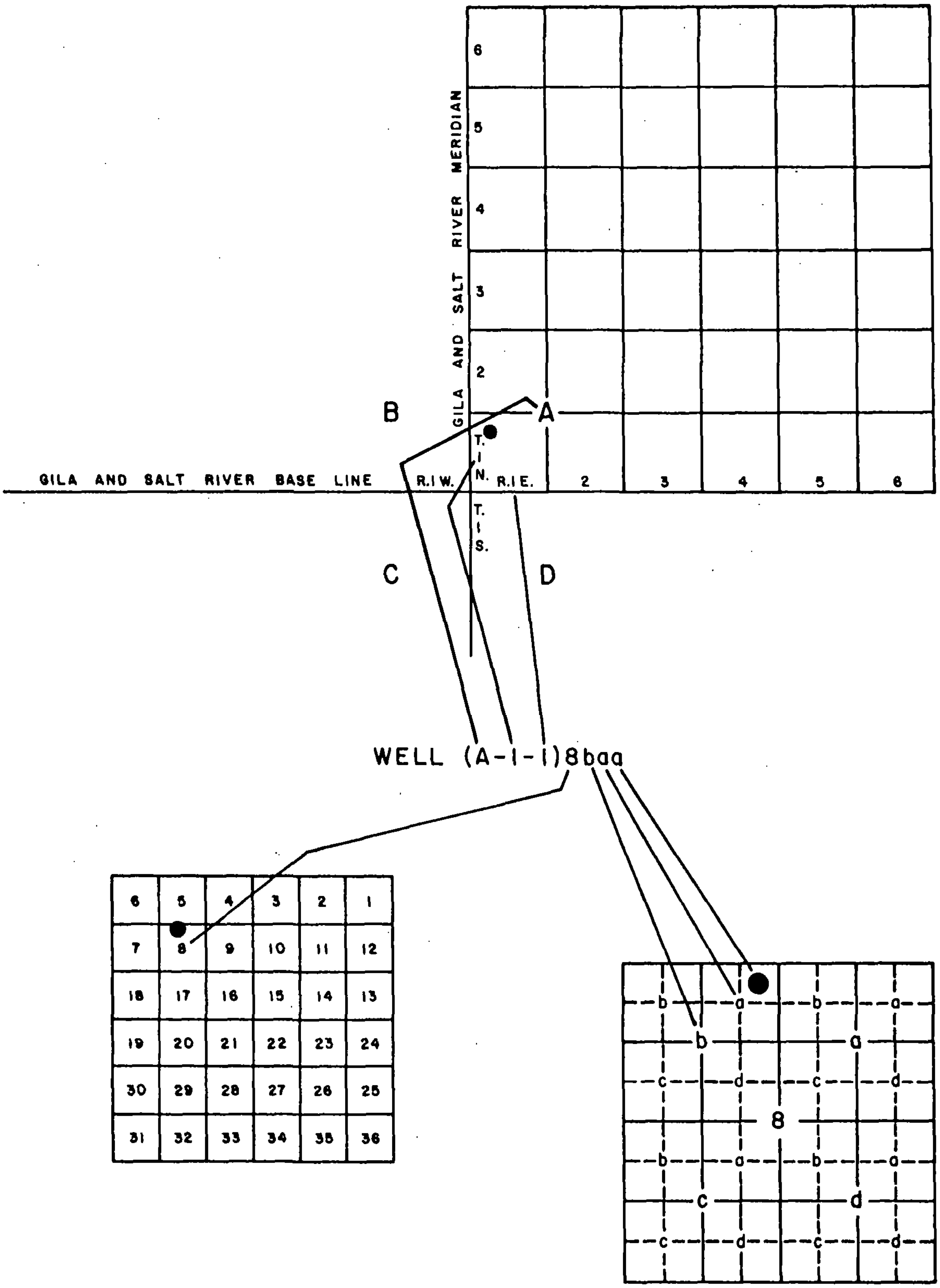


FIGURE A-1. WELL NUMBERING DIAGRAM

APPENDIX B

SAMPLING PLAN FOR
SUPPLEMENTAL WORK PLAN FOR TASK F
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
HAZARDOUS WASTE AREA
HASSAYAMPA LANDFILL
MARICOPA COUNTY, ARIZONA

CONTENTS

APPENDIX B

SAMPLING PLAN FOR SUPPLEMENTAL WORK PLAN FOR TASK F REMEDIAL INVESTIGATION / FEASIBILITY STUDY HAZARDOUS WASTE AREA HASSAYAMPA LANDFILL MARICOPA COUNTY, ARIZONA

INTRODUCTION

The following Sampling Plan describes procedures for obtaining soil and water samples for TASK F of the Remedial Investigation / Feasibility Study (RI/FS) for the hazardous waste area at the Hassayampa Landfill. This Sampling Plan should be used in conjunction with the associated Work Plan, Quality Assurance Project Plan (QAPP) (Errol L. Montgomery & Associates and Conestoga-Rovers & Associates, 1988b), and Health and Safety Plan (Errol L. Montgomery & Associates and Conestoga-Rovers & Associates, 1988c) to conduct proper sampling operations. **Figure 2** shows locations for sampling sites for soil samples. **Figure 5** (located in pocket inside back cover) shows locations for sampling sites for groundwater samples.

Topography across the Hassayampa Landfill is undulatory due to the frequent reworking of landfill pits in the active part of the property. However, the hazardous waste area is covered by a graded soil cover that is reported to be several feet in thickness, and is relatively flat to gently sloping. Access for vehicles is generally good in the hazardous waste area, where surficial soils are relatively compacted and firm. Surficial soils in parts of the active landfill are loose and are generally passable only to off-road vehicles. Access to existing monitor wells, proposed monitor wells, and proposed soil borings is good, except for proposed monitor well Site C.

DATA MANAGEMENT

Data management procedures will be required to document results of field operations, chain of custody, laboratory analyses, and other project related activities. Data management will include maintenance of field notebooks, instrument calibration notebooks, Quality Assurance / Quality Control (QA/QC) notebooks for laboratory results, and project files. Field notebooks will be used to record notes on field operations and to record field data obtained during project TASKS. Items to be recorded for data management documentation will include, but not be limited to, the following:

- site conditions, including weather and location;
- personnel on-site during field operations;
- observations during drilling of soil borings and monitor wells;
- lithologic descriptions of drill cuttings;
- all sampling data and forms, including chain of custody and sample control data;
- time that pertinent sampling operations occur and equations used to calculate volume of water pumped prior to sampling wells;
- QA/QC reviews for data;
- pumping test data and analysis;
- well development data; and
- calibration data for field instrumentation, such as water level sounders, pH meters, conductivity meters, etc.

Entries in field notebooks and calibration notebooks will be initialed and dated. Photographs will be taken of pertinent field operations and site areas. All such photographs will be developed and retained in the project files.

SAMPLING PROCEDURES

Sampling and QA/QC procedures for the RI/FS are designed to ensure that collection, identification, preservation, and transportation of samples will result in properly representative data for site conditions. Quantities, types, and frequency of water and soil samples to be obtained during the RI/FS, including QA/QC samples, are summarized in Table 2. A list of sample containers, preservatives, and holding times for parameters to be analyzed is given in Table 3.

CHAIN OF CUSTODY AND SAMPLE CONTROL PROCEDURES

Chain of custody and sample control procedures will be required to ensure the integrity and preservation of samples during their collection, transportation, and storage prior to laboratory chemical analysis. Examples of typical chain of custody and sample control documents are shown on Figures 10 through 15. These documents will include: field data form (Figure 10); chain of custody traffic report (Figure 11); chain of custody letter of transmittal (Figure 12); chain of custody analysis request schedules with signatures for transfer of custody (Figures 13, 14, and 15); and records and receipts for delivery or shipment of samples. All pertinent data concerning each sample will be recorded on the traffic report (Figure 11), including:

- traffic report sample numbers
- sample description
- sampling personnel
- description of sampling point and sampling methods
- container lot numbers, if applicable
- sample site name and number
- date and time of collection
- field observations
- number and volumes of samples
- preservatives used

- analyses required
- method and date of delivery or shipment
- sample destination
- special handling procedures

Immediately after obtaining a water or soil sample, a unique, pre-printed, pre-numbered, adhesive sample label will be affixed to the sample container and traffic report by the field hydrogeologist. Sample lids and sample labels will be secured with tape, and the samples will be put on ice in an ice chest. Vials for volatile organic analyses will be placed in zip-lock bags and the supply of ice in the ice chest will be maintained to provide proper cooling of the samples. The field hydrogeologist will maintain custody of the samples from the time of collection to time of delivery or shipment to the chemical laboratory. At the end of each sampling day, samples will be hand delivered or will be shipped to the chemical laboratory via bus or via overnight air freight service. If the samples are shipped, receipts for shipment will be obtained. The laboratory will be notified prior to delivery or shipment of samples.

Prior to relinquishing sample custody for shipment, a minimum of two custody seals marked with the sample custodian's initials will be placed across the opening of the shipping container to detect unauthorized opening of the container. Clear tape will be placed over the custody seals to prevent accidental breakage of the seals during shipment. Samples will be preserved by cooling with refrigeration, ice, or artificial substances (such as "Blue Ice") from the time of collection to the time of receipt by the laboratory. Thereafter, the laboratory will preserve the samples in accordance with protocol of analytical methods. Chain of custody and sample control procedures followed by the laboratory will be consistent with the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).

One original copy of the chain of custody documents will accompany the sample shipping container to the laboratory; the sample custodian will retain a copy of these documents. On receipt of the samples at the laboratory, the laboratory will complete the original chain of custody documents, retain a copy for their records, and forward the completed originals to the Tucson, Arizona, office of Errol L. Montgomery & Associates, Inc.

SAMPLE CONTAINERS

For laboratory chemical analyses of water and soil samples, clean unused sample containers will be provided by the chemical laboratory. Requirements for volume, type, and cleanliness of sample containers will be consistent with requirements of the laboratory and with the analytical methods to be used. A list of sample containers, preservatives, and holding times for parameters to be analyzed is given in **Table 3**.

SOIL SAMPLING METHODS

Soil samples will be obtained from soil borings during TASK F1. In addition, samples of drill cuttings, drilling mud, etc., placed in the second lined excavation in the hazardous waste area will be obtained for laboratory chemical analyses after several months of exposure to the atmosphere. Quantities and frequency of soil samples and QA/QC samples to be obtained are given in **Table 2**.

Soil Boring Samples

Four soil borings will be drilled under TASK F1 of the supplemental Work Plan for TASK F. One soil boring will be drilled, at an angle to vertical, beneath Pits 1, 2, 3, and 4 **(Figure 2)**. Soil samples for laboratory chemical analyses will be obtained from each of the borings at intervals to be selected by the on-site hydrogeologist based on data obtained during drilling; however, approximately 10-foot sampling intervals, beginning at about five feet below land surface, are expected. A maximum of six to eight soil samples for laboratory chemical analyses will be obtained from each soil boring. For every 10 soil samples analyzed, a duplicate sample will be prepared from the soil samples by the chemical laboratory (Table 2). Zones of low permeability, where contaminants in the vadose zone may tend to accumulate, will be targeted for sampling.

All soil samples obtained for laboratory chemical analyses from soil borings will be analyzed for: volatile organic compounds using EPA method 8240; semi-volatile organic compounds using EPA method 8270; pesticides and PCBs using EPA method 8080; and eight metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using the EPA EP Toxicity method. Duplicate soil samples will also be analyzed using these methods. Individual compounds and metals to be analyzed with these methods are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).

The soil borings will be drilled using a hollow-stem flight auger, preferably with the capability for continuous sampling. Prior to drilling the first soil boring and after drilling at each site, the auger drill stem and drilling tools will be cleaned using a hot, high-pressure tap water rinse. Lithologic descriptions will be prepared by the on-site hydrogeologist for soil samples for laboratory chemical analyses, and for soil samples obtained at five-foot intervals from split-spoons or, if available, from continuous cores.

Soil samples will be obtained in clean four-inch or six-inch brass tube inserts. After the sampler has been advanced to the specified depth, the core barrel, California modified sampler, or split-spoon sampler will be removed from the auger, and will be opened at a sample processing station located near the drill rig. The brass inserts will be removed from the core barrel, and a lithologic description will be prepared for soils in the barrel or split-spoon. Based on appearance and texture of soils in the brass inserts, brass insert samples considered to be representative for the depth sampled will be selected for laboratory chemical analyses. Each selected insert will be capped on both ends with Teflon or aluminum foil, sealed with tape, marked with sample identifiers, and put in clean glass mason jars or sealable plastic bags. The chain of custody and procedures described in the previous section titled "CHAIN OF CUSTODY AND SAMPLE CONTROL PROCEDURES" will be followed. After the brass inserts are removed, the samplers will be cleaned and equipped with additional clean brass inserts for the collection of subsequent soil samples.

All brass tube inserts will be pre-cleaned by the chemical laboratory, and will be used once and not reused. The core barrel, split-spoon samplers, and other sampling tools will be cleaned before and after the collection of each sample for laboratory chemical analyses, according to the following procedure:

1. **Clean with hot, high-pressure tap water spray;**
2. **Wash with trisodiumphosphate solution;**
3. **Rinse with tap water; and**
4. **Rinse with deionized water.**

Lined Excavation Samples

At the start of field operations, a second lined excavation will be made near the existing lined excavation, and will be used for placement of drill cuttings, drilling fluids, and rinsate generated during TASK F. Materials in this lined excavation will remain exposed to the atmosphere for a period of several months, preferably summer months, after which a composite sample of the materials will be obtained.

The composite sample will be obtained using a stainless steel scoop, a stainless steel bowl, and a clean wide-mouth glass jar. Scoops of material will be obtained from a minimum of 10 evenly spaced locations along the length of the excavation. An effort will be made to obtain the scoops midway between the top and bottom of the material. The scooped material will be placed in a clean stainless steel bowl and the contents of the bowl will then be thoroughly mixed. A jar will be filled with this mixture as completely as practicable to minimize air space, and will be sealed with a Teflon-lined or aluminum-lined lid. Procedures described in the previous section titled "CHAIN OF CUSTODY AND SAMPLE CONTROL PROCEDURES" will be followed. A description of the sampled material will be prepared. A duplicate sample for QA/QC laboratory chemical analyses will be prepared by the chemical laboratory from the soil samples submitted. The composite sample and duplicate sample will be analyzed using: EPA method 8240 for volatile organic compounds; EPA method 8270 for base-neutral and acid organic compounds; EPA method 8080 for pesticides and PCB's; EPA method for the characteristic of EP Toxicity; and appropriate tests for determining characteristics of hazardous wastes.

Sampling tools will be cleaned before and after collection of the sample, according to the following procedure:

1. **Rinse with tap water;**
2. **Wash with trisodiumphosphate solution;**
3. **Rinse with tap water; and**
4. **Rinse with deionized water.**

WATER SAMPLING METHODS

Groundwater samples will be obtained during three sampling rounds as follows:

TASK F2 ROUNDS 1 AND 2: All new monitor wells will be sampled. Groundwater samples will be analyzed for: volatile organic compounds using EPA method 624; semi-volatile organic compounds using EPA method 625; pesticides and PCB's using EPA method 608;

cyanide; routine constituents; trace constituents; pH; and specific electrical conductance.

TASK F3 ROUND 1: Eleven existing on-site monitor wells will be sampled. Groundwater samples will be analyzed for: volatile organic compounds using EPA method 601/602; routine constituents; selected trace constituents that have been detected previously; pH; and specific electrical conductance.

TASK F3 ROUNDS 2 and 3: All on-site monitor wells will be sampled. Groundwater samples from existing monitor wells will be analyzed for: volatile organic compounds using EPA method 601/602; routine constituents; selected trace constituents; pH; and specific electrical conductance. Groundwater samples from new monitor wells will be analyzed for: volatile organic compounds using EPA method 601/602; routine constituents; pH; and specific electrical conductance; and any other constituents detected previously. Additional parameters will be analyzed for selected groundwater samples.

Individual constituents to be analyzed with these EPA methods are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).

Selected groundwater samples obtained during TASK F3 sampling round no. 2 and sampling round no. 3 will be analyzed for the following constituents not listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b): nitrite using EPA method 353.2; total Kjeldahl nitrogen (TKN) using EPA method 351.2; total organic carbon (TOC) using EPA method 415.2; oil and grease using EPA method 413.1; chemical oxygen demand (COD) using modified EPA method 410.4; and, biochemical oxygen demand (BOD) using EPA method 405.1. These additional constituents will provide data for treatability of groundwater. Wells proposed for supplemental sampling and analysis are: Unit A monitor well MW-1UA; proposed monitor wells A, B, D, and E; and Unit B monitor wells MW-1UB and MW-4UB.

For every 10 groundwater samples obtained for organic and/or inorganic analyses, a duplicate and a field blank will be obtained and will be analyzed for the same parameters as the groundwater samples. As a check for possible cross contamination or third source contamination, a trip blank prepared by the chemical laboratory will accompany each group of samples submitted for volatile organic analysis. Field blanks will be prepared by the sampling personnel using bottled deionized water. Quantities and frequency of groundwater samples and QA/QC samples to be obtained are given in **Table 2**. A list of sample containers, preservatives, and holding times for parameters to be analyzed is given in **Table 3**.

If a nonaqueous hydrocarbon phase occurs in a new Unit A monitor well, samples of the nonaqueous phase will be bailed from the well and will be analyzed solely for: volatile organic compounds using EPA method 624; and TPH (Total Petroleum Hydrocarbons) using modified EPA method 8015.

The following procedures will be followed for collection of groundwater samples from the monitor wells:

1. At the beginning of each day of a sampling round, operation of large capacity wells located within one-half mile from the monitor wells to be sampled will be observed and recorded.

2. With the possible exception of groundwater samples obtained during well development operations (TASK D round 1), each well will be sampled using a submersible pump. A water level measurement, using an electrical water level sounder, will be obtained prior to pumping each well. The wellhead assembly for sampling operations at the new Unit A and Unit B monitor wells is shown on **Figure 9**. A pump will be dedicated to each well.

3. A minimum volume of water equal to three borehole volumes will be pumped from each well prior to sampling. The minimum volume, in gallons, will be calculated using the following equation:

   71 x (hole radius, in ft.)^2 x (height of water in hole, in ft.)

   Time when pumping starts and stops will be recorded in a field notebook.

4. During the pumping period, measurements of water level, pumping rate, and pH, temperature, and specific electrical conductance of pumped water will be obtained at intervals determined by the pumping rate and the volume to be pumped. Pumping rate will be determined by measuring the time required to fill a container of known volume. After measurements of specific electrical conductance are stable (within +/- 10 percent of the average), and after a minimum of three borehole volumes have been pumped, water samples will be obtained from the discharge line. Temperature,

pH, and conductance of pumped water will be measured immediately before samples are obtained.

5. All samples will be put on ice at the time of collection and procedures described in the previous section titled "CHAIN OF CUSTODY AND SAMPLE CONTROL PROCEDURES" will be followed. After groundwater samples are collected, a final water level measurement will be obtained and the pump will be turned off.

6. On arrival at a monitor well, the well vault, lock, and protective barrier posts will be inspected for security, damage, and vandalism. The well vault will be locked whenever authorized sampling personnel are not present.

7. If a hydrocarbon phase occurs on the water surface in a Unit A monitor well, the well will not be equipped with a permanent submersible pump and samples will be obtained from the well by bailing. Bailers will be dedicated to each of these wells.

    a. Prior to sampling, a measurement of water level and free product thickness will be made using an ORS Interface Probe.

    b. Samples will be obtained by bailing using a dedicated two-inch by five-foot clear Teflon or acrylic bailer equipped with a check valve. Water withdrawn with the first full bailer will be inspected for character and thickness of the hydrocarbon phase. A sample for laboratory chemical analyses will then be obtained from the hydrocarbon phase in the first full bailer and from as many subsequent bails as are necessary to obtain a sufficient volume of the hydrocarbon phase.

To minimize contact of sampling equipment with surficial soils, sampling equipment will be placed on the cement pad at each well site or on the tailgate of the sampling vehicle.

Water removed from each monitor well during development operations (TASK F2 round 1) will be discharged to a lined excavation adjacent to the well and will be allowed to evaporate naturally. Results of laboratory chemical analyses for the TASK F1 round 1 groundwater samples will be used to screen for contaminants and to determine if water removed from the wells during subsequent sampling operations should also be contained in the lined excavations. For subsequent sampling operations at each well, if potential contaminants are not detected, or are detected at concentrations below

Maximum Contaminant Levels, in the most recent sample from the well, the water removed during sampling operations will be discharged via a perforated hose or pipe to the land surface for evaporation.

Drill Water Samples

As a precautionary check and documentation for drilling water to be used during construction of the Unit A and Unit B monitor wells, water samples from the water truck used for drilling operations will be obtained prior to drilling the first monitor well and after drilling the last TASK F2 monitor well. These samples will be analyzed for volatile organic compounds using EPA method 601/602. Individual compounds to be analyzed with this method are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).

Measurement of Groundwater Levels

Groundwater level measurements will be made using an electrical water level sounder. Prior to groundwater level measurement, the sounder will be rinsed with deionized water and wiped with a clean paper towel. Groundwater levels will be recorded to the nearest 0.01 foot on water level record forms **(Figure 10)**. Site identifier, weather conditions, date and time of measurement, elevation and description of measuring point, and distance of measuring point from land surface will be included in the information recorded. Sounders will be dedicated to the project. The sounders will be calibrated with a steel surveyor chain before each round of water level measurements and when repairs are made. A calibration notebook will be maintained for each sounder and will include: date and time calibrated; points of calibration; personnel conducting the calibrations; and method of calibration. In addition, manufacturer recommended maintenance of the instruments will be conducted and results recorded.

Parameters Measured in the Field

Specific electrical conductance, temperature, and pH of water will be measured in the field during pumping test and sampling operations. Specific electrical conductance of water will be measured using a Beckman Solu Bridge conductivity meter, or equivalent. Measurements of pH will be made using a Beckman pHI 20 or pHI 21 digital pH meter, or equivalent. These pH meters also measure temperature. Measurements of pH and temperature will be verified made using pH paper and a laboratory grade thermometer. The conductivity meter and pH meter will be calibrated with standard solutions before each pumping test and sampling round. Notes from the calibrations will be recorded in the field notebook. In addition, manufacturer recommended maintenance of the instruments will be conducted and results recorded.

Water samples for measurement of these parameters in the field will be obtained in a wide-mouth one-liter polyethylene bottle. The bottle will be rinsed three times with the water to be sampled. After rinsing, the bottle will be filled and measurements of the parameters will be made and recorded. Before and after each measurement, the meter probes and the thermometer will be rinsed with deionized water.

Samples for Organic Analyses

Water samples for volatile organic analyses will be obtained from each monitor well in two 40-milliliter screwcap glass vials fitted with Teflon-coated silicon septa. The vials (no. 13074) and septa (no. 12722) are sold by Pierce Chemical Company, Rockford, Illinois, and will be obtained from the chemical laboratory in a clean and new condition. Sampling will be conducted so as to minimize exposure of the sample to air. First, the vial and cap will be rinsed three times with the water stream to be sampled. After rinsing, four drops of reagent grade 1:1 hydrochloric acid will be added to the vial. The vial will then be filled with the sample water to attain a convex meniscus at the top of the vial. Only the sample water will contact the inside of the vial or cap. The vial will be sealed immediately after filling by placing the septum, Teflon side down, on the meniscus and screwing the cap firmly in place. The vial will be checked for trapped air by inverting the vial, tapping it gently, and inspecting for headspace (air bubbles). If headspace is present, the vial will be emptied and the process will be repeated until no headspace is observed.

If it is necessary to analyze for TPH (Total Petroleum Hydrocarbons) for any Unit A monitor well, samples for TPH analyses will be obtained in the same manner as water samples for volatile organic analyses.

Groundwater samples for analyses of semi-volatile organic compounds, pesticides, and PCB's will be obtained in four one-liter, screwcap, amber glass bottles with Teflon-coated caps. Sampling will be conducted so as to minimize exposure of the sample to air. Methods for filling the bottles will be the same as described above for the vials, except that hydrochloric acid will not be used, a septum will not be used, and the occurrence of headspace will not be cause for refilling the bottle.

For every 10 groundwater samples obtained for organic analyses, a duplicate and a field blank will be obtained and will be analyzed for the same parameters as the groundwater samples. As a check for possible cross contamination or third source contamination, a trip blank prepared by the chemical laboratory will accompany each group of samples submitted for volatile organic analysis. Field blanks will be prepared by the sampling personnel using bottled deionized water.

<u>Samples for Routine Constituent, Trace Constituent and Cyanide Analyses</u>

Groundwater samples for analysis of routine parameters, trace elements, and cyanide will be obtained in new, clean, one-liter polyethylene bottles. The bottles will have relatively long screwcaps with a positive seal lip on the bottle. Prior to filling, the bottle and cap will be rinsed three times with the water stream to be sampled. After rinsing, the bottle will be filled and sealed immediately by screwing the cap firmly in place. Only the sample water will contact the inside of the bottle or cap. Separate bottles will be used for each routine parameter, cyanide, or trace element analysis.

Groundwater samples for trace element analyses will be filtered immediately in the field and will be acidified by adding a sufficient amount of reagent grade 1:1 nitric acid to each bottle to lower the pH to less than two. The bottles will be shaken gently after capping to evenly disperse the acid. Acid preservation and amount of acid used will be noted in the sample custody documents.

Groundwater samples for cyanide analysis and routine analysis will not be filtered in the field. Groundwater samples for cyanide analysis will be treated with sodium hydroxide to raise the pH to 12. The bottles for cyanide analyses will be shaken gently after capping to evenly disperse the sodium hydroxide. Method of preservation for the cyanide sample will be noted in the sample custody documents.

For every 10 groundwater samples obtained for inorganic analyses, a duplicate and a field blank will be obtained and will be analyzed for the same parameters as the groundwater samples. Field blanks will be prepared by the sampling personnel using bottled deionized water.

LABORATORY PROCEDURES

All samples submitted for analyses during this project will be handled and analyzed by the chemical laboratories in accordance with standard procedures and methods established by the laboratories and in accordance with the intent of the EPA Contract Laboratory Program. These procedures and methods include requirements for: purity of standards, solvents, and reagents; glassware; analytical methods; data requirements; laboratory performance; and analytical data review. Detailed discussions for these procedures and methods are given in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b). The chemical laboratories selected for the RI/FS are:

LABORATORY	INTENDED USE
Analytical Technologies, Inc. 2113 South 48th Street, Suite 108 Tempe, Arizona 85282	Principal laboratory for analyses of organic and inorganic parameters in water and soil samples.
Clayton Environmental Conslts, Inc. 1252 Quarry Lane Pleasanton, California 94566	Alternate laboratory for analyses of organic and inorganic parameters in water and soil samples.
Brown and Caldwell 373 South Fair Oaks Avenue Pasadena, California 91105	Alternate laboratory for analyses of organic and inorganic compounds in water and soil samples.
BC Laboratories, Inc. 4100 Pierce Road Bakersfield, California 93308	Alternate laboratory for analyses inorganic parameters in water and soil samples.

The laboratories will follow QA/QC procedures and methods, and will provide QA/QC documentation, which provide reliability of data equivalent to that intended by the EPA Contract Laboratory Program. All laboratory chemical analyses will be conducted in accordance with standard protocols applicable to each method.

QA/QC protocols for the principal laboratory (Analytical Technologies, Inc.) are given in "Analytical Technologies, Inc. Laboratory Quality

Assurance Plan". This document is available for review on request. In addition, the QA/QC protocols for the principal laboratory and the alternate laboratories will be consistent with the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b) and with the intent of the following publications:

1. **"Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses"**, Technical Directive Document No. HQ-8410-01, prepared for the Hazardous Site Control Division of the U. S. Environmental Protection Agency, April 11, 1985.

2. **"Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses"**, U. S. Environmental Protection Agency Office of Emergency and Remedial Response.

3. **"Statement of Work for Organics Analysis"**, U. S. Environmental Protection Agency Contract Laboratory Program, October 1986.

4. **"Statement of Work for Inorganics Analysis"**, U. S. Environmental Protection Agency Contract Laboratory Program, SOW No. 787, July 1987.

ANALYTICAL METHODS

Methods to be used for laboratory chemical analyses for water and soil samples are listed in **Table 2**; individual constituents to be analyzed using these methods are listed in the QAPP (Montgomery & Associates and Conestoga-Rovers & Associates, 1988b).