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CITY CLERK CONTRACT/AGREEMENT NO. 4060

SCOPE OF WORK
FOR
THE TACOMA LANDFILL CONSENT DECREE

1.0 INTRODUCTION

This Scope of Work (SOW) sets forth the tasks necessary to complete the Remedial Design (RD) and the Remedial Action (RA) at the Tacoma Landfill Superfund Site. The Remedial Investigation (RI) and Feasibility Study (FS) were conducted by the City of Tacoma and were completed in December 1987. The Record of Decision (ROD) was signed on March 31, 1988. It shall be the responsibility of the City of Tacoma (hereafter referred to as Settling Defendant) to prepare, submit for approval, and fully implement work plans incorporating each element of this SOW. It shall be the sole responsibility of the Settling Defendant to ensure that work plans as undertaken meet the performance requirements set forth in this SOW and the Consent Decree and the Settling Defendant shall not rely on document and plan approvals provided by the Government Plaintiffs. In addition, the Settling Defendant shall ensure consistency with the National Contingency Plan (NCP) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and shall satisfy all applicable and relevant and appropriate laws and regulations (ARARs).

1.1 Remedial Action Requirements

The requirements of the remedial action at the Tacoma Landfill, as stated in the ROD, are:

1) reduce the production of leachate by placing constraints on further site operations and by capping the landfill;

2) eliminate off-site gas migration through a gas extraction system;

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3) prevent further migration of the contaminated plume and reduce the concentration of contaminants within the plume via a groundwater extraction and treatment system;

4) further protect public health and the environment through monitoring of groundwater, surface water, subsurface gas, and air emissions;

5 provide an alternate water supply (Tacoma Municipal Water) to any residents deprived of their domestic water supply due to demonstrated contamination from the landfill or due to the action of the extraction/treatment system; and

6) establish institutional controls to promote and support the remedial action.

1.2 Project Work Plans

All work performed at and around the site pursuant to this Scope of Work shall be accomplished in accordance with work plans which shall be prepared by the Settling Defendant and submitted for review and approval by the Government Plaintiffs. Work plans shall address implementation of each element of the SOW including: the predesign study consisting of monitoring well installation, sampling activities, extraction system evaluations, treatability studies, and pilot studies; design documents such as design reports, plans, and specifications; construction activities including scheduling, construction quality control/quality assurance, engineering services during construction, and as-built documentation; and the preparation and implementation of operation and maintenance manuals for remedial action facilities including the details and scheduling of performance monitoring. The work plans shall include schedules and a discussion of potential problems which might be encountered.

The Settling Defendant shall implement all plans and work elements according to their terms and according to the schedule approved and incorporated pursuant to Section 9.0 of this SOW. The Settling Defendant shall

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notify the Government Plaintiffs of initiation of any field work at least 7 days prior to the commencement of such work. The work shall commence only after the Settling Defendant has received Government Plaintiff approval.

1.2.1 Project Management Plan (PMP) for RD/RA

1.2.1.1 Remedial Design Project Management Plan

A project management plan for RD activities, including a schedule for completion of RD tasks and submission of deliverables established pursuant to Section 9.0 and Table 5 of this SOW for each element of this SOW, shall be submitted by the Settling Defendant no later than 30 days after lodging of this Consent Decree. Compliance with this schedule, once approved by the Government Plaintiffs, is a requirement of this SOW and notice of the schedule shall be sent to the court. The PMP shall describe the Settling Defendant's management approach to completing the RD tasks for the site. The PMP shall identify the key individuals for the Settling Defendant, and identify levels of authority and lines of communication in working with the Government Plaintiffs. The plan shall also address systems or methods that will be used to ensure technical quality and compliance with project schedules.

1.2.1.2 Remedial Action Project Management Plan

The Settling Defendant shall prepare a preliminary remedial action project management plan, including a brief discussion of tasks, an implementation schedule, a description of the long term operation and maintenance requirements, and institutional controls and monitoring requirements that comply with this SOW and the ROD. This plan shall be included in the Project Management Plan document. When the remedial design details become available, an update of the preliminary remedial action portion of the project management plan, including a more detailed description of the construction tasks, shall be completed and submitted to the Government Plaintiffs for review and approval in accordance with the schedule established pursuant to Section 9.0 (see Section 7.0 of this SOW).

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1.2.2 Health and Safety Plan

All work, including sampling and other field data gathering activities, shall be performed under an appropriate health and safety plan for the protection of workers and the surrounding community in accordance with EPA, OSHA, and WISHA requirements. The Settling Defendant shall submit a site safety plan to the Government Plaintiffs for comment prior to commencing any action on the site. The initial site safety plan submitted (as part of the Predesign Study, Section 3.1.1.2) shall be amended to reflect subsequent field activities and their varying site safety and health requirements. The Settling Defendant shall be solely responsible for ensuring that the plan satisfies all applicable laws and regulations. The Settling Defendant shall appoint a site safety officer (SSO) who shall be responsible for ensuring compliance with the Health and Safety Plan.

The Settling Defendant shall require their contractors and employees to observe safe practices with respect to all active utilities within and around the site including sewer, power, water, and telephone lines.

1.2.3 Quality Assurance Project Plan (QAPP)

A quality assurance project plan shall be developed for the remedial design phase which shall include procedures for: sample custody; data reduction; validation and reporting; internal quality control checks; performance and system audits; preventative maintenance; and corrective action. This plan shall be implemented by the Settling Defendant upon approval of the Government Plaintiffs. The most current of the following guidelines shall be used to develop these plans except where otherwise noted:

USEPA, Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses, July 1988;

USEPA, Laboratory Data Validation, Functional Guidelines for Evaluating Organic Analyses, February 1, 1988;

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USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, SOW no. 788;

USEPA Contract Laboratory Program, Statement of Work for Organics Analysis, October 1986, revised February 1988.

Data Quality Objectives for Remedial Response Activities, EPA/550/G.87/003 and 004;

Quality Assurance Program Plan for Region X, 1986.

1.2.4 Sampling and Analysis Plans (SAP)

All SAPs prepared pursuant to this Scope of Work shall include, at a minimum: a description of procedures for field sampling, sample handling, sample analysis, data analysis, and identification of laboratory analysis procedures. They shall also provide for Contract Laboratory Program (CLP) deliverables as referenced in Exhibit B of the Contract Laboratory Program Statements of Work for Organics and Inorganics (see Section 1.2.3).

In addition, all SAPs shall include data quality objectives and specify quality assurance and quality control (QA/QC) procedures and samples to meet the requirements of the QAPP (Section 1.2.3). SAPS shall be approved by the Government Plaintiffs before any sampling or monitoring begins. Sampling and analysis shall be performed in accordance with approved Ecology and EPA sampling and laboratory protocols and QA procedures in effect at the time of the sampling or analysis activity. Detection limits, with the exception of the screening tests, shall be at least as low as drinking water standards or approved health based criteria, or the EPA-CERCLA contract laboratory program standards, whichever is lower. EPA approved methods shall be used for all possible parameters. If "approved" methods are not available, then proposed methods shall be submitted to the Government Plaintiffs for review and approval prior to their use. The Settling Defendant shall make available raw data within five days of receipt of results, and quality assured data in the format specified in the sampling and analysis plan to the Government Plaintiffs within 90 days of sample collection or field testing or within 15 working days of receipt of all lab

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results for a sampling event, whichever is sooner, and shall submit these results in the monthly progress report (as described in Section XII of the Consent Decree) within thirty calendar days of receipt of the data. Replicate samples shall be collected and analyzed as described in the QAPP or as required by the Government Plaintiffs on a case by case basis.

1.3 Authority of Government Plaintiffs Regarding Deliverables Under This SOW

Any and all documents (deliverables) required to be submitted to the Government Plaintiffs under this SOW are subject to review and approval by the Government Plaintiffs, unless otherwise specified. Such approval may be conditional or may specify required modifications to these documents. The Settling Defendant shall consult with the Government Plaintiffs in preparing all deliverable items under this SOW to minimize the need for such modifications and to determine whether draft submittals are necessary. All deliverables shall be prepared in accordance with applicable EPA and Ecology guidance. Upon approval or modification, all such plans and documents shall be implemented in accordance with their terms and schedules. Bid packages are not subject to approval of the Government Plaintiffs but shall be submitted upon request.

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2.0 CONTINGENCY PLANNING

All work under this SOW must explicitly address those contingencies which are typical to hazardous waste remediation and those provided for in this SOW and the ROD. Specifically, design and/or construction activities under this SOW must provide for the situations discussed in this section.

2.1 New Contaminant Plume

The Settling Defendant shall submit a contingency plan for the expansion and/or modification of the extraction system necessary to control a previously unidentified plume, or a lobe of a plume emanating from the landfill in areas currently considered unaffected. This contingency plan shall include provisions for determining the existence and source of such a previously unidentified plume, or lobe of a plume using, at a minimum, the following criteria:

a) proximity to the landfill;
b) hydraulic gradient;
c) aquifer characteristics;
d) historical data; and
e) types of contaminants.

A previously unidentified plume, or lobe of a plume, is defined as any exceedance of the early warning values described in Section 3.3.2.2 in areas currently considered unaffected. Exceedances shall be determined using the approved method described in Section 3.3.1.3. This plan shall be submitted with the 60 percent design for the extraction treatment system.

2.2 Alternate Water Supply

If contamination (determined through procedures established in Section 4.0) emanating from the landfill is found in the Fircrest wells (located immediately west of the landfill), an alternate water supply shall be provided to the town of Fircrest immediately. A plan to cover such a contingency shall be submitted to the Government Plaintiffs for review and approval no later than 45 days from the date of lodging of this Consent Decree.

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A contingency plan describing how alternate water shall be provided to other currently and potentially impacted areas around the landfill shall be submitted no later than 45 days from the date of lodging of this Consent Decree. This plan shall include procedures for supplying temporary water until the impacted residences can be connected to the Tacoma water system. The plan shall be consistent with Section 4.0 of this SOW.

Construction plans and specifications for expansion of Tacoma City water supplies to affected areas, including all design calculations and the construction schedule shall be submitted within 45 days of residences being supplied with temporary water.

2.3 Operation and Maintenance

The Settling Defendant shall prepare a contingency plan for the instance where the final remedial measures do not meet the performance criteria outlined in this SOW. This plan shall also describe the action the Settling Defendants shall implement if, after the groundwater extraction/treatment system or the gas extraction system has been shut down the monitoring data indicate exceedances of the criteria outlined in Sections 3.3.2 and 7.7.3. This plan shall be submitted as part of the Operation and Maintenance Plan described in Section 7.7.

3.0 TASKS FOR REMEDIAL DESIGN

This section provides a task breakdown for all actions to be performed during the RD phase.

3.1 Predesign Study

The Settling Defendant shall conduct a predesign study to achieve the requirements listed below:

1) to provide sufficient information to delineate the boundary of the plume or plumes and for the purpose of designing the extraction system;

2) to assess whether dense non-aqueous phase liquids (DNAPL) are migrating from the landfill;

3) to complete the characterization of the affected aquifers and associated hydrology necessary to design the extraction system;

4) to establish indicator parameters selected from the Target Compound List and leachate parameters listed in WAC 173-304-490;

5) to sample all monitoring wells (both the TL and MW series) three times in a six month period (to include a high and low water table season);

6) to determine the suitability of the alternative treatment options in meeting the treatment standards;

7) to determine the location of the optimum extraction well network to achieve the groundwater cleanup goals and criteria; and

8) to select the treatment option for RA.

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3.1.1 Monitoring Wells

3.1.1.1 Sampling and Analysis Plan

The Settling Defendant shall submit a SAP, which shall meet the requirements of Section 1.2.4 of this SOW, for review and approval by the Government Plaintiffs prior to initiation of drilling. This plan shall include monitoring well installation procedures, soil chemical and physical sampling requirements, a well installation schedule, and reporting requirements. Data quality objectives for this effort shall also be identified in this plan.

3.1.1.2 Site Safety Plan

A site Health and Safety Plan shall be prepared in accordance with applicable EPA, OSHA, and WISHA requirements. This plan shall address all aspects of the Predesign monitoring wells, including drilling and sampling. The site safety plan shall be prepared as described in Section 1.2.2 of this SOW. This plan shall be submitted with the monitoring well SAP, and shall be updated to reflect subsequent field activities.

3.1.1.3 Monitoring Well Installation

The Settling Defendant shall install required wells listed in Table 1 and at the approximate locations shown on Figure 1. Exact well locations shall be approved by the Government Plaintiffs prior to drilling. All newly constructed wells shall be surveyed to the nearest 0.01 foot, and shall comply with EPA Order No. 215.0, Minimum Set of Data Elements for Groundwater. Well logs and survey data shall be submitted within 30 days of the installation of the last well. Additional wells to those listed may be required by the Government Plaintiffs, if necessary, to achieve the respective requirements listed in Section 3.1.

3.1.1.4 Existing Wells

Existing private wells may be rehabilitated, however data collected will be used for water level data only.

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3.1.2 Groundwater Sampling

3.1.2.1 Sampling and Analysis Plan

The Settling Defendant shall submit a SAP for groundwater sampling which shall meet the requirements of Section 1.2.4 of this SOW, for review and approval of the Government Plaintiffs, prior to groundwater sampling. The SAP shall be amended after the indicator parameters are selected (Section 3.1.2.2) to specify sampling parameters for future sampling rounds. Amendments to the SAP shall be reviewed and approved by the Government Plaintiffs.

3.1.2.2 Groundwater Sampling/Indicator Parameter Selection

The Settling Defendant shall sample each of the new MW series wells and the existing TL series wells (as shown in Figure 1) in accordance with the approved schedule in the SAP. The first round of samples shall be collected during the period of maximum gradient reversal. These samples shall be analyzed for the target compounds listed in Table 2 and leachate parameters listed in WAC 173-304-490. Tentative compounds shall also be identified to ensure that no potential contaminants of concern are overlooked. The Settling Defendant shall utilize this data and historical data to develop a list of indicator parameters to be used throughout the remainder of the RD and RA. The list of indicator parameters shall be submitted in a technical memorandum and shall be reviewed and approved by the Government Plaintiffs prior to its use. The Settling Defendant shall include additional indicator parameters as required by the Government Plaintiffs. Data shall be presented in the format requested by the Government Plaintiffs.

3.1.3 Extraction System Evaluation

The Settling Defendant shall conduct additional modeling studies of the extraction system proposed in the Feasibility Study, considering the additional data obtained during the Predesign Study. The extraction system proposed in the FS, with modifications as required, and other potential extraction configurations shall be evaluated using analytical or numerical modeling techniques. This evaluation shall be conducted in conjunction with the evaluation of the

alternative treatment systems (Section 3.1.4) to recommend the extraction/treatment system for design. The factors to be considered during the evaluation of the extraction system include the following:

1) the groundwater cleanup criteria (Table 3);

2) the cleanup goal of ten years after startup of the remedial action;

3) the impact of capping the landfill on contaminant volumes and mobility;

4) pumping impacts from the Fircrest and Tacoma production wells;

5) current contaminant travel times due to groundwater divide shifts; and

6) effect on surface water and other aquifer uses.

Based on the results of the extraction system evaluation, the extraction well network which assures compliance with performance standards shall be established for design.

3.1.4 Treatability Study

The Settling Defendant shall conduct a treatability study to determine the most effective method (technical and cost) as identified in the ROD of treating the contaminated groundwater. Initial treatability studies for carbon and air stripping treatment technologies shall be conducted using computer modeling techniques.

Treatability studies shall be conducted for landfill leachate and condensate if pretreatment of these current discharges into the sanitary sewer is required. An evaluation of the requirement for pretreatment of landfill leachate and/or condensate shall be conducted (see Section 3.5.10.1) by the Settling Defendant and the Tacoma Sewer Utility. Pretreatment requirements shall be subject to review and approval by the Government Plaintiffs.

3.1.5 Draft Predesign Report

A Draft Predesign Study Report shall be prepared by the Settling Defendant which includes a description of hydrogeologic conditions and contaminant migration using the data collected during the Predesign Study and the data collected during the RI. The report shall also describe how the investigation has met the data requirements of site characterization for design, contaminant plume (including possible DNAPL) definition, and indicator parameter selection as identified in Section 3.1. The report shall present the results of the extraction system evaluation and the treatability studies and shall detail the work plans for the pilot extraction well investigation and any pilot treatment studies required. The pilot treatment study plan shall address laboratory and/or field scale tests designed to achieve the requirements listed in Section 3.2.2. The report shall be submitted to the Government Plaintiffs for review and approval. Government Plaintiffs' comments shall be incorporated into the Final Predesign Study Report (Section 3.2.4).

3.2 Pilot Studies

3.2.1 Pilot Extraction Well Investigation

Pilot Extraction wells shall be installed at the locations described in the Draft Predesign Study Report (upon approval of the Government Plaintiffs). The purpose of these wells is to provide additional aquifer characteristics for extraction well design. At a minimum, a 72 hour pump test shall be performed for each of the pilot test wells to determine aquifer characteristics for use in RD (Section 3.3). After the first pump test, the Settling Defendant may petition the Government Plaintiffs to reduce the duration of subsequent pump tests. Such revisions are subject to the approval of the Government Plaintiffs.

After approval by the Government Plaintiffs of the pilot investigation work plan (submitted as part of the Draft Predesign Report) the Settling Defendant shall submit a SAP for the pilot test well installations and testing. This plan shall include: the proposed pump test methodology; the location and number of wells to be monitored during the pump test; handling and disposal of extracted

water; the construction plans and specifications for the test wells; sampling, analysis, and QA/QC requirements for samples collected during the pumping tests; and the construction and testing schedule. At least one test monitoring well shall be located at least 100 feet away from pumping wells unless other spacing is approved by the Government Plaintiffs. Prior to discharge of pump test water, it shall be analyzed for indicator parameters, determined under Section 3.1.2.2 of this SOW, to determine an appropriate discharge location. Discharge of water contaminated above drinking water standards, health based criteria or Water Quality Criteria (WQC) for protection of fish (as listed in Table 4) to waters of the state, including the storm sewer, shall not be allowed. Discharge to the sanitary sewer shall be consistent with the City's pretreatment program and shall be subject to Government Plaintiff approval.

The SAP for the extraction system pilot study shall be prepared to meet the requirements of Section 1.2.4 of this SOW. The sampling and analysis plan shall be submitted after approval of the Draft Predesign Report.

3.2.2 Pilot Treatment Studies

A pilot study shall be conducted for the treatment method selected in the Draft Predesign Study Report. The pilot study shall also evaluate treatment of leachate and condensate currently discharging to the sanitary sewer, if pretreatment of these discharges is required (Section 3.1.4).

The pilot study shall be conducted to determine the following:

1) the suitability of the treatment method for treating the contaminated groundwater and its ability to meet performance standards described in Section 3.3.2;

2) the predicted effectiveness of the treatment system, its flexibility to treat changing influent levels, and the range of influent concentrations over which the system is effective;

3) the expected air emissions to allow the Government Plaintiffs to determine the need for air emissions treatment;

4) the need for pretreatment of groundwater prior to air stripping or carbon adsorption; and

5) the adaptability of the treatment system for pretreatment of leachate collected from the Central Area and condensate from the gas flares and collection lines.

Prior to conducting any bench scale or vendor tests, the Settling Defendant shall submit the proposed vendor qualifications to the Government Plaintiffs for review and approval. The Settling Defendant shall require vendors selected to conduct any treatability study to comply with the Quality Assurance Project Plan prepared under Section 1 2.3. If the Government Plaintiffs determine that it is necessary to conduct field studies using portable or temporary treatment facilities, the Settling Defendant shall submit a SAP for such studies, including sampling requirements for the influent, effluent, and air emissions monitoring, to be reviewed and approved by the Government Plaintiffs.

The SAP shall be prepared to meet the requirements described in Section 1.2.4 of this SOW.

3.2.3 Draft Pilot Studies Report

A Draft Pilot Studies Report shall be submitted to the Government Plaintiffs describing the findings of pilot extraction well investigations and the treatment studies. The report shall include the results and analysis of the pump tests, the results and analysis of the treatment study, the recommended treatment method, and a discussion of how this method fulfills the requirement of providing for all known, available and reasonable treatment to any substance proposed for discharge to waters of the state.

3.2.4 Final Predesign Report

The Final Predesign Report shall include all Government Plaintiff comments on the Draft Predesign Report, the Draft Pilot Studies Report, and any additional groundwater sampling results. The Settling Defendant shall submit the Final Predesign Report for approval within 30 days of receipt of the Government Plaintiffs' comments on the Draft Pilot Studies Report.

3.3 Design of Groundwater Extraction/Treatment System

3.3.1 Extraction/Treatment Requirements

3.3.1.1 Groundwater Extraction System

The groundwater extraction/treatment system(s) shall be designed to satisfy the extraction system performance criteria identified in Section 3.3.2.1 and shall be designed to control the plume and prevent the spread of contamination. The goal of the groundwater extraction system is to prevent any further degradation of existing water quality beyond the existing boundaries of the plume. For the purposes of design, further degradation is defined as the detection of synthetic organics or a statistically significant increase, over background, of heavy metals and leachate parameters which are emanating from the landfill. Statistical significance shall be determined using the approved methodology described in Section 3.3.1.3.

The system shall be placed within the plume(s) and at the downgradient edge, if necessary, to contain the plume(s). The design of the extraction system shall incorporate capture zone analysis to achieve overlapping cones of depression. Important considerations in placement of the extraction system shall include: concentrations and areal distributions of contaminants in the groundwater at the time of construction, aquifer thickness, hydraulic conductivity, and aquifer boundary conditions. The design shall estimate and account for the reduction in extraction volume due to effects of the landfill cap and how this volume may change over time.

3.3.1.2 Treatment System

The treatment system for the selected remedy as described in the ROD shall be designed to meet specific performance criteria appropriate to the point of discharge of the effluent as described in Section 3.3.2.3 and set forth in Table 4. The design shall be based on the full expected range of influent concentration and the range of treatment efficiency levels determined during the treatment pilot tests. The system must be flexible enough to treat changes in influent concentrations and volumes due to capping effects and to provide pretreatment of the collected leachate and condensate if pretreatment of these sources is required. The design shall incorporate all known, available, and reasonable methods of treatment.

3.3.1.3 Statistical Methods

The Settling Defendant shall submit a plan describing the proposed statistical method for evaluating performance of the extraction system. The method shall be one of the methods described in "Statistical Methods for Evaluating Ground-Water Monitoring Data from Hazardous Waste Facilities," published October 11, 1988 in the Federal Register or in the draft EPA document "Statistical Methods for Evaluating the Attainment of Superfund Cleanup Standards", December 1988. The method shall be used to determine when a statistically significant exceedance of an established performance criteria has occurred and to establish trends in ground water data. This plan shall be submitted to the Government Plaintiffs for review and approval.

3.3.2 Performance Criteria

3.3.2.1 Extraction System

The extraction system shall continue to operate until the water quality at and beyond the point of compliance (defined by WAC 173-304-100(58)), consistently meets drinking water standards, or previously established and approved health-based criteria, as listed in Table 3. Consistency with standards shall be determined using the approved method described in Section 3.3.1.3. The goal is to achieve this level of cleanup in ten years or less.

3.3.2.2 Early Warning Values

Performance of the extraction system will be evaluated based on drinking water standards or approved health based criteria. However, to protect downgradient well owners and the aquifer, the Settling Defendant shall submit a plan for Government Plaintiff review and approval to take effect whenever early warning values are exceeded, in either the private wells or extraction system performance wells. This plan shall specify the procedures to be followed in the event early warning values are exceeded. The plan shall outline the criteria and procedures under which the following actions would apply:

1) resampling well(s) to verify results;
2) increasing or modifying monitoring plan;
3) adjustments to extraction system;
4) providing for alternate water supply;
5) implementation of a trend analysis to determine the likelihood of exceeding a groundwater performance standard; and
6) no action (i.e., continuation of monitoring program and operation of extraction/treatment system).

Early warning values, designed to indicate changing conditions in the aquifer, are as follows:

a) detection level for synthetic organic compounds for which no natural source exists;

b) 20 percent of the primary drinking water standards for other than synthetic organic compounds or other health based criteria; and

c) 50 percent of the secondary drinking water standards or other aesthetic quality criteria.

If the indicator parameter is found in the background water quality, then the early warning value shall be set at a concentration between background and the performance standard. This value shall be reviewed and approved by the Government Plaintiffs before its use.

Exceedances of these early warning values shall be determined using the approved method described in Section 3.3.1.3. Detection limits shall be at least as low as drinking water standards or approved health-based criteria, or EPA CLP detection limits, whichever is lower. Limits shall be established for each of the indicator chemicals determined in Section 3.1.2.2.

The early warning values and reaction to them shall not apply until the groundwater extraction/treatment system has been installed and has completed the initial shakedown period described in Section 3.3.3.2.

In the event that early warning values are exceeded after the extraction/treatment system shakedown period, the Settling Defendant shall notify the Government Plaintiffs within 5 days of receipt of raw data. Within 15 days of receipt of quality assured data, the Settling Defendant shall submit a memorandum (for Government Plaintiffs review and approval) which identifies the actions (e.g., items 1 through 6 above) that shall be taken in response to these exceedances to ensure that performance standards are not exceeded.

3.3.2.3 Treatment System

Fresh and marine water discharge limits for certain organic constituents are listed in Table 4. The Settling Defendant shall develop sanitary sewer discharge limits for review and approval of the Government Plaintiffs. These requirements also apply to leachate from the Central Area and condensate from the gas collection system and flare.

3.3.2.3.1 Fresh Water Discharge

Discharge to fresh water (Leach or Flett Creeks) shall meet the maximum contaminant levels (MCL) developed pursuant to the Safe Drinking Water Act or meet the chronic fresh water criteria for protection of fish as set forth in EPA's Quality Criteria for Water, 1986, whichever is more stringent. If no MCL has been established, the ambient water quality criteria (WQC) for protection of human health for water and fish ingestion shall be used. For the instance where no WQC have been developed, the Settling Defendant shall use additional

guidance documents and Health Advisories to develop and propose an appropriate value. These values shall be reviewed and approved by the Government Plaintiffs. Discharge limits shall be developed for all indicator parameters (see Section 3.1.2.2). Any discharge from the treatment system to a storm sewer which discharges directly to a fresh water body, shall be considered a discharge to fresh waters of the state.

3.3.2.3.2 Marine Discharge

Discharge from the treatment system to a storm sewer which discharges directly to a marine water body, shall be considered a discharge to marine waters of the state. The limit for marine discharges shall be determined using the Chronic Marine Water Criteria set forth in EPA's Quality Criteria for Water, 1986. If such a criterion is not available for a particular contaminant of concern, the limit determined for discharge to a fresh water body shall apply, unless other discharge limits can be established from guidance documents or technical research as approved by the Government Plaintiffs. Discharge limits shall be developed for all indicator parameters.

3.3.2.3.3 Sanitary Sewer Discharge

Discharge of treated groundwater to the sanitary sewer shall satisfy applicable discharge requirements, shall be consistent with the Tacoma Pretreatment Program as revised for the operation of the new secondary sewage treatment plant, and with pretreatment discharge limits approved by the Government Plaintiffs. Discharge limits shall be developed for all selected indicator parameters.

3.3.3 Extraction/Treatment System Sampling and Analysis Plan

The Settling Defendant shall submit a SAP to evaluate performance of the extraction/treatment system(s) as described in Section 3.3.2. This plan shall meet the requirements as described in Section 1.2.4. This plan shall be submitted with the 90 percent extraction/treatment system design report described in Section 3.3.6.

The Settling Defendants shall amend the SAP to specify any additional sampling rounds of the monitoring wells (using the indicator parameters) during the RD phase that may be necessary to establish design concentrations for the treatment process or to monitor contaminant plume migration. Amendments to the SAP shall be reviewed and approved by the Government Plaintiffs.

3.3.3.1 Extraction System Sampling and Analysis Plan

The extraction system sampling and analysis plan shall include installation of performance monitoring wells to be located downgradient of the extraction well system(s). These performance wells shall be placed to assure the effectiveness of the extraction system. The number of performance wells required will depend upon the number of extraction wells needed, the distance over which the extraction wells extend, and the distance between the point of compliance and the extraction system. The number of downgradient performance wells shall not be less than the number of extraction wells plus one, unless a reduction in the number of performance wells is approved by the Government Plaintiffs.

The performance wells shall be monitored monthly for two years after startup and then quarterly thereafter for water levels and approved indicator parameters (see Section 3.1.2.2), in accordance with Section 7.7.3. The Settling Defendant may petition the Government Plaintiffs to reduce the frequency of sampling from monthly to quarterly in less than two years, if an adequate baseline of information has been developed.

3.3.3.2 Treatment System Sampling and Analysis Plan

This plan shall be designed to evaluate both the performance and the efficiency of the treatment system during both the shakedown period and for long term operation. Startup and the intial performance evaluation of the system (shakedown procedures) shall be completed within a four month period and shall, at a minimum, include monitoring of the influent to the treatment plant and the effluent from the plant on a twice weekly basis for four weeks,

followed by weekly sampling. The samples shall be analyzed for indicator parameters developed in Section 3.1.2.2 and sample analysis turnaround shall be 24 to 48 hours.

For an air stripping treatment facility, influent and effluent from the treatment unit shall initially be sampled for four different air to water ratios. For each air to water ratio, two samples of both influent and effluent will be collected, one during the warmest and the other during the coolest periods of the day. The results from this sampling activity shall be used to confirm or modify the system performance/operation curves developed during the pilot treatment study (Section 3.2.2) and the treatment system design (Section 3.3.1.2). After performance curves are developed sampling shall be conducted daily for 1 week to confirm system operation.

For a carbon treatment facility, influent and effluent samples shall be collected daily for two weeks, and on a twice weekly basis thereafter during the shakedown period. The influent and effluent shall also be sampled daily for one week after any changeout of carbon during the shakedown period.

When eight consecutive weekly samples all meet the discharge limits set forth in 3.3.2.3, the sampling frequency to evaluate performance of the system may be reduced to quarterly if approved by the Government Plaintiffs. The treatment system shall be operated and maintained to meet discharge limits. If a quarterly sample indicates a violation of the discharge limits, the Settling Defendant shall submit a plan to adjust the treatment system and shall simultaneously begin weekly sampling of the influent and effluent. Quarterly sampling may resume when the consenting Defendant has demonstrated to the Government Plaintiffs that the system is again in compliance with the stated discharge limits.

3.3.4 Preliminary Design (30 Percent Complete)

The Settling Defendant shall submit a preliminary design of the extraction/treatment system addressing 30 percent of the total design for

approval of the Government Plaintiffs. This submittal shall include a design report and preliminary plans and specifications. The design report shall include the following:

1) A design memorandum establishing design criteria and providing the information needed to design the project. The memorandum shall include complete detailed design criteria and standards for the extraction wells and the treatment plant equipment including sizes, capacities, loading rates, pumping rates, etc. The information shall be in sufficient detail to present the scope of the project clearly and to enable designers to proceed with subsequent design work;

2) a detailed description and evaluation of any models used to aid design;

3) preliminary design calculations for major equipment;

4) preliminary selection of major equipment items and potential suppliers;

5) sketches and schematics as required to illustrate and clarify the components of the extraction/treatment system, including preliminary site layout, preliminary hydraulic profile, process schematics, piping schematics, and chemical feed schematics; and

6) a discussion of how performance requirements, including ARARs have been incorporated into the design.

The plans and specifications shall reflect the same percentage of completion as the designs they support. A detailed outline of construction specifications shall also be included.

3.3.4.1 Long-lead Task Identification

Any long-lead items, such as off-site access for drilling, selection of an off-site RCRA facility for disposal of spent carbon or other hazardous wastes, or

key treatment plant process components, shall be determined at the 30 percent design phase of the process and a critical path schedule developed. The Settling Defendant shall be responsible for obtaining access agreements.

3.3.4.2 Preliminary Construction Schedule and Cost Estimate

A preliminary construction schedule shall be prepared to include drilling, well installation and development, and acquisition of major treatment process components. The preliminary cost estimate developed for the 30 percent submittal shall be of +40 to -20 percent accuracy and shall include equipment and construction costs.

3.3.5 Intermediate Design (60 Percent Complete)

A 60 percent submittal shall be prepared for the Government Plaintiffs, incorporating comments made on the previous submittal and shall include all of the same elements. This submittal shall include construction drawings for the extraction/treatment system and all ancillary facilities.

3.3.6 Prefinal/Final Design

A 90 percent submittal shall be prepared for review of the Government Plaintiffs, incorporating any comments on the 60% design. The plans and specifications shall provide sufficient detail such that all labor, materials, tools, and equipment necessary for the proper execution of the contract will be clearly apparent to the bidders. The final engineer's cost estimate shall be based on prefinal drawings and specifications of 90 percent completion. The accuracy shall be within a +15 to -10 percent range. This estimate shall evaluate the costs of construction and equipment for the complete facility.

After approval of this prefinal design by the Government Plaintiffs, a 100 percent complete document shall be submitted that contains the final plans and specifications for the review and approval of the Government Plaintiffs.

3.4 Design and Installation of the Landfill Cap

3.4.1 Landfill Cap Requirements

The landfill cap shall be designed to minimize infiltration and maximize and control run-off from the landfill. The landfill cap installed shall be selected by the Settling Defendant from one of the basic designs set forth below:

1) a) sufficient topsoil to provide frost protection and vegetative layer, 24 inch minimum;

   b) drainage layer of granular material, depth and slope designed to accommodate flows determined from the HELP model or other hydrological analysis, 12 inch minimum unless analysis shows a greater depth is needed. Geosynthetic drainage products will be considered as suitable replacements for the sand drainage layer. Final selection approval by the Government Plaintiffs is required;

   c) geosynthetic membrane of material compatible with landfill gas condensate, 50 mil minimum;

   d) additional drainage layer as specified above in (b);

   e) additional geosynthetic membrane as specified above in (c);

   f) bedding soil with gradation and degree of angularity approved by the Government Plaintiffs, 12 inch minimum; or

2) a) sufficient topsoil to provide frost protection and vegetative layer, 24 inch minimum;

   b) drainage layer of granular material, depth and slope designed to accommodate flows determined from the HELP model or other hydrological analysis, 12 inch minimum unless analysis shows a greater depth is needed. Geosynthetic drainage products will be considered as suitable replacements for the sand drainage layer. Final selection approval by the Government Plaintiffs is required;

c) geosynthetic membrane of material compatible with landfill gas condensate, 60 mil minimum; and

d) 24 inches of soil compacted to a saturated hydraulic conductivity of not more than $1x10^{-5}$cm/sec, with the top six inches a finely-graded $1x10^{-5}$ layer;

A pilot study to evaluate the utilization of stabilized sludge, as a component of the topsoil requirement of the selected alternative, may be initiated by the Settling Defendant. Application of this product shall be subject to Government Plaintiff approval.

3.4.2 Final Grading and Landfill Cap Installation

Final grading and the landfill cap shall be constructed in three stages as identified below:

1) Stage 1, 1990 construction season - the northeast and southern sections of the landfill and the Receiving Facility cap;

2) Stage 2, 1991 construction season - the western section of the landfill and the section east of the Central Area; and

3) Stage 3, not later than one year after closure - the Central Area, as required by Section 3.4.2.1.

These areas are generally depicted in Figure 2.

The landfill cap design criteria shall be presented for the entire landfill cap in the design report submitted as part of the 30 percent submittal for the Stage 1 cap design. For the Stage 2 and 3 designs, design review packages shall be submitted at the 60 percent complete and the prefinal/final phases.

Increased run-off due to the construction of the cap shall be routed off the landfill to reduce infiltration. The run-off collected from the landfill shall be directed to the appropriate storm or sanitary sewers, consistent with local storm drainage ordinances or pretreatment regulations.

3.4.2.1 Landfill Closure

Final closure of the landfill shall occur no later than ten years after the effective date of the Consent Decree. The Government Plaintiffs may provide, after providing notice and opportunity for public comment, extensions of this deadline of up to a combined 15 years in increments of no longer than 5 years if the Settling Defendant demonstrates to the satisfaction of the Government Plaintiffs all of the following:

1) that the continued operation of the landfill shall not result in a release or substantial threat of release of hazardous substances, pollutants or contaminants to the environment;

2) that performance standards for the extraction/treatment system have been achieved;

3) that since the effective date of the Consent Decree, the Settling Defendant has instituted and is operating an aggressive solid waste recycling and hazardous materials collection program; and

4) that other feasible solid waste management alternatives to disposal at the landfill do not exist.

A closure plan shall be submitted as part of the Operations and Closure Plan required in Section 3.5.1 for Government Plaintiff review and approval. This plan shall include:

1) a fill plan with fill sequence and fill location;

2) partial closure plan;

3) interim cover requirements for completed areas; and

4) waste receipt restrictions (prohibit liquid waste and slurries).

Notwithstanding the foregoing, the Settling Defendant shall bring such areas to final grade and install the landfill cap on a schedule established by the Government Plaintiffs if the Government Plaintiffs determine that such action is necessary to adequately protect human health or the environment.

3.4.3 Preliminary Design (30 Percent Complete)

The Settling Defendant shall submit a preliminary design of the landfill cap addressing not less than 30 percent of the total design. This submittal shall include a design report and preliminary plans and specifications for review and approval of the Government Plaintiffs. The design report shall include the following:

1) design data and criteria;

2) a detailed description and evaluation of any models used to aid the design;

3) preliminary data from borrow sources and design calculations for soil needs;

4) detailed plans to assure that ongoing landfilling operations do not interfere with the construction or performance of the cap;

5) relevant design standards to be used in the final design;

6) a description of phased closure of the landfill;

7) a surface water management plan (Section 3.4.3.1); and

8) a discussion of how all ARARs have been incorporated into the design.

The plans and specifications shall reflect the same percentage of completion as the design they support. A detailed outline of the construction specifications shall be included.

3.4.3.1 Surface Water Management Plan

The Settling Defendant shall prepare a plan for control and management of surface water runoff as defined in WAC 173.304.100(67). This plan shall include the following elements:

1) a description of the existing drainage basin, including any sub-basins present;

2) a discussion of existing storm water management practices and any regulations which apply;

3) detailed calculations of flow and velocity in the drainage channels;

4) calculations for the 25 year/24 hour storm event;

5) a description of needed detention, if any, to comply with City of Tacoma storm drainage ordinances;

6) a description of needed storm water improvements outside the boundaries of the landfill to implement this SOW, including discharge location. Plans and specifications for these improvements shall be submitted with the prefinal (90 percent) design along with a schedule for construction.

3.4.3.2 Long-lead Task Identification

Any long-lead items, shall be determined as part of the 30 percent design and a critical path schedule developed.

3.4.3.3 Preliminary Construction Schedule and Cost Estimate

A preliminary construction schedule shall be prepared addressing: 1) the unlined areas of the landfill, and 2) the lined Central Area. A preliminary cost estimate developed for the 30 percent submittal shall be of +40 to -20 percent accuracy and shall show equipment, labor, and construction costs.

3.4.4 Intermediate Design (60 Percent Complete)

A 60 percent submittal shall be prepared for the Government Plaintiffs, incorporating comments made on the previous submittal and shall include all of the same elements. This submittal shall include construction drawings for the cap and all ancillary facilities.

3.4.5 Prefinal/Final Design

A 90 percent submittal shall be prepared for review and approval of the Government Plaintiffs, incorporating any comments on the 60% design. The plans and specifications shall provide sufficient detail such that all labor, materials, tools, and equipment necessary for the proper execution of the contract will be clearly apparent to the bidders. The final engineer's cost estimate shall be based on prefinal drawings and specifications of 90 percent completion. The accuracy shall be within a +15 to -10 percent range. This estimate shall evaluate the costs of construction and equipment for the complete facility.

After approval of this prefinal design by the Government Plaintiffs, a 100 percent complete document shall be submitted which contains the final plans and specifications for the review and approval of the Government Plaintiffs.

3.5 Design Support Activities

3.5.1 Operations and Closure Plan

The Settling Defendant shall follow the Interim Operations and Maintenance Plan (September 1988), as amended in the March 17, 1989 memorandum responding to the Washington Department of Ecology and the Tacoma Pierce County Health Department comments on the draft plan, until the RD is finalized. The plan as amended meets the Minimum Functional Standards operating requirements (WAC 173-304-460). Sections of the plan shall be amended during the RD and RA, as required by the Government Plaintiffs to reflect new information or changes in landfill operations.

The Interim Operation and Maintenance Plan shall be revised to satisfy requirements of the Consent Decree and the SOW, and shall be submitted for approval within 60 days of Government Plaintiff approval of all remedial designs. The landfill cap and surface water management plan, the extraction/treatment system design and operating plan, the landfill cap operation and maintenance plan, the ground water monitoring plan, the plan for management of hazardous substances and liquids, and the gas system monitoring plan (including both on and off-site monitoring) shall all be incorporated into the Operations and Closure Plan as part of the Final Operations and Closure Plan. The final plan shall be subject to review and approval by the Government Plaintiffs.

3.5.2 Disposal of Hazardous Substances and Liquids

The Settling Defendant shall develop a plan to prevent disposal of liquids and hazardous substances, including those disposed of by small quantity generators, at the landfill. This plan shall be developed in consultation with the Tacoma-Pierce County Health Department. The plan shall include programs such as recycling and hazardous materials collection to minimize the amount of hazardous substances placed in the landfill from generators such as households, business, industry, and others. This plan shall be submitted to the Government Plaintiffs for review and approval within 180 days of lodging of this Consent Decree and programs shall be in effect no later than 18 months after lodging of this Consent Decree. Disposal of any hazardous waste (including dangerous or extremely hazardous waste) regulated under Federal, State, or local laws in the landfill is prohibited.

3.5.3 Expansion of the Central Area

Construction of the liner, installed in 1987 in the Central Area, shall be documented through a construction documentation report. Slope liners over refuse require a variance to the Minimum Functional Standards. If the Tacoma Pierce County Health Department grants such a variance, construction and future expansion of the Central Area shall be consistent with the following requirements:

1) the slope of the liner over refuse, shall be no less than 5:1 (horizontal:vertical) with the exception of the benched area which provides connection to the Phase I liner, and no greater than 3:1, the length of the additional liner over refuse shall be no greater than 300 feet;

2) a Government Plaintiff approved gas control system shall be installed to prevent buildup of gas on the base of the liner;

3) the side slope liner over existing refuse from bottom to top shall be:

   a) 24 inches minimum of compacted native soil;
   b) structural geotextile (geogrid);
   c) 12 inches of sand (for use as liner bedding and gas collection layer;
   d) 60 mil geomembrane;
   e) drainage layer consisting of geonet covered by a filter fabric;
   f) 12 inches minimum of protective soil

4) develop and implement an inspection and maintenance program for the leachate collection system to ensure the system continues functions as designed and to prevent clogging of the leachate collection pipe.

Plans and specifications for expansion of the Central Area shall be submitted for review and approval of the Government Plaintiffs.

3.5.4 Landfill Gas Sampling and Analysis Plan

The Settling Defendant shall submit a SAP, meeting the requirements described in Section 1.2.4, to assess landfill gas migration and to assure that ongoing landfill activities and the remedial action, particularly the landfill cap, do not result in increased migration of landfill gas to areas outside the landfill

boundaries. The plan shall provide for additional gas probes that shall be located in the following areas and as shown on Figure 3, and shall determine whether or not significant concentrations of gas are in the soil:

1) Eighteen probes shall be installed in the areas near the east side apartments complexes, Mason Loop, and Tyler Street. Twelve probes shall be approximately 15 feet deep and six probes shall extend to the water table. These new probes shall be used in conjunction with seven multi-depth probes installed in the spring of 1988.

2) One probe, extending to the water table, shall be installed along the Mullen Street access road. This new probe shall be used in conjunction with four multi-depth probes installed in the spring of 1988.

3) Fifteen probes shall be installed on the west side of the landfill in areas along Orchard Street extending towards the Pipe Company and the nursing home. Nine of these probes shall be approximately 15 feet deep. Six of these probes shall extend to the water table.

4) Six probes shall be installed in the area of 48th Street, south of the landfill. Five of these probes shall be approximately 15 feet deep. One probe shall extend to the water table. These new probes shall be used in conjunction with seven multi-depth probes installed in the spring of 1988.

These probes shall be monitored daily for 30 days after installation. If no significant gas concentrations are found in the soil, the probes shall be monitored weekly and on all days when the barometer reading recorded in the morning is below 29.8 inches of mercury. Significant concentrations of gas are defined in the Minimum Functional Standards as levels exceeding the lower explosive limit (LEL) of methane.

When each section of the landfill cap is installed, the probes outside the landfill boundaries in that area shall be monitored three times per week. If significant concentrations of gas are found in a probe outside the landfill boundaries, that probe shall be monitored on a daily basis until the readings are consistently below the LEL for 30 days. At that time, weekly monitoring shall resume. Landfill gas monitoring shall continue for at least 30 years or until it can be demonstrated to the satisfaction of the Government Plaintiffs that the landfill is no longer generating gas above the LEL.

3.5.5 Landfill Gas Monitoring Evaluation Reports

The following Landfill Gas Monitoring Evaluation Reports shall be submitted to the Government Plaintiffs for review and approval:

1) Gas System Evaluation Report - A report shall be submitted to the Government Plaintiffs summarizing and analyzing the data from the first 60 days of monitoring after installation of the new probes located outside the landfill boundaries. This report shall also include a discussion and evaluation of all gas monitoring data to date.

2) Biannual Landfill Gas Control System Status Reports - These biannual reports shall summarize the gas data and discuss the performance of the landfill gas control system during the previous six months.

3) Landfill Cap Installation Report - A report shall be submitted to the Government Plaintiffs after each section of the landfill cap is installed, summarizing the data obtained from monitoring probe installations and analyzing any changing trends or characteristics of landfill gas migration. These reports shall be submitted within 60 days of the completion of each phase of the landfill cap.

3.5.6 Landfill Gas Management Plan

The landfill Gas Management Plan in the Interim Operations and Maintenance Plan shall be subject to review and approval by the Government Plaintiffs, and amended as required. The Settling Defendant shall ensure that

the plan covers all aspects of operating and maintaining the landfill gas control system. This includes procedures for day to day operations, monitoring procedures, field adjustment procedures, and procedures to be followed if significant concentrations of landfill gas are detected in soils outside the landfill boundaries. A revised Monitoring Program shall be included with the plan.

The extraction system shall be adjusted to prevent significant concentrations of landfill gas from building up in these soils. Adjustment procedures shall include system inspections, increased pumping rates, and installation of additional extraction wells. Whenever one or more gas probes outside the landfill boundaries have soil gas concentrations exceeding the LEL, monitoring of the affected probe shall be daily until the appropriate adjustment procedures have been implemented and the readings are consistently below the LEL for 30 days. If the probes indicate that the adjustment procedures are not controlling gas migration, additional probes may be required by the Government Plaintiffs to determine the extent of migration. The Settling Defendant may petition the Government Plaintiffs to reduce the frequency of sampling if an adequate baseline of information has been developed to demonstrate significant concentrations of gas are not found in soils outside the landfill boundaries.

3.5.7 Utilities Management Plan

A plan shall be submitted, for review and approval of the Government Plaintiffs, for maintenance of the cap integrity in areas where buried and above ground utility lines cross the site. This includes storm and sanitary sewers, water lines, power lines, and telephone lines. Repairs to such lines and sewers shall not cause leakage in the cap. In developing this plan the Settling Defendant shall consult with all affected agencies and companies maintaining rights of way or easements on landfill property and shall determine, for water lines, a schedule for periodic leak detection testing. A contingency plan shall be included in the Utilities Management Plan for the sanitary sewer in the event of collapse or clogging.

3.5.8 Expansion of On-site Facilities

Preliminary plans for the construction of the Public Receiving Facility expansion call for paving of areas containing waste. Waste shall be removed from these areas, for this and any other similar project, prior to paving. However, if waste must be left in place a plan for capping over waste shall be submitted to the Government Plaintiffs for review and approval. Designs for over waste capping shall be compatible with and no less permeable than the cap proposed for the remainder of the site.

3.5.9 Surface Water Sampling and Analysis Plan

The Settling Defendant shall submit a SAP for Leach Creek which meets the requirements described in Section 1.2.4 of this SOW. Base flow in Leach Creek shall be determined using historical records. The Settling Defendant shall establish stream flow gage stations on Leach Creek sufficient to verify stream base flows and the impact of the extraction system on flows in the creek. The Settling Defendant may petition the Government Plaintiffs to discontinue flow measurement if they can demonstrate that the extraction system does not impact base flow in Leach Creek.

Water quality samples shall be collected from at least three locations in Leach Creek (to be identified in the SAP), one to establish background concentrations. Monitoring shall take place upstream and downstream from any point of discharge. If there is no direct discharge to Leach Creek, samples shall be collected from a location near the source and at a location considered likely to intercept contaminated groundwater. At a minimum, surface water samples shall be collected quarterly and analyzed for target compound list volatile organics, heavy metals, and leachate parameters for one year after the extraction system is operational. Sampling frequency shall then be twice annually until one year after the system is shut down. The Settling Defendant may petition the Government Plaintiffs to reduce the required analyses to indicator parameters based on the monitoring data obtained in the predesign study.

Water quality samples of surface runoff shall be collected annually at points where runoff enter the storm sewer system until one year after the landfill is capped. The samples shall be analyzed for indicator parameters (Section 3.1.2.2).

3.5.10 Leachate and Condensate Management

3.5.10.1 Leachate and Condensate Sampling and Analysis Plan

The Settling Defendant shall submit a SAP to evaluate the quantity and quality of condensate from the gas collection system and leachate from the leachate collection system in the Central Area. The plan shall meet the requirements described in Section 1.2.4 of this SOW.

Samples shall be taken from four selected condensate traps currently draining into the landfill and from each separate input currently draining into the sanitary sewer via the leachate collection manhole at the north end of the Central Area. At least two samples shall be collected from each source discharging into the sanitary sewer and analyzed for target compound list substances. These samples shall be collected starting with the predesign study period. If either the leachate or the condensate exceeds Government Plaintiff approved discharge standards for the sanitary sewer it shall be collected and treated before discharge. Discharge limits shall be consistent with discharge location as described in Section 3.3.2.3.

3.5.10.2 Leachate and Condensate Management Plan

Based on the information collected under Section 3.5.10.1, the Settling Defendant shall submit a plan to manage the condensate and leachate being produced. This plan shall address pretreatment needs for the management options developed. If pretreatment is required, it shall be developed as part of the design process outlined in Section 3.3.1.2.

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3.5.11 Air Emissions Management

3.5.11.1 Air Emissions Management Plan

Air emissions from all treatment facilities shall comply with all federal, state, and local air emissions regulations. Design requirements to satisfy air emissions regulations shall be developed as part of the treatment system design described in Section 3.3 of this SOW.

3.5.11.2 Air Emissions Sampling and Analysis Plan

The Settling Defendant shall submit a SAP which shall meet the requirements described in Section 1.2.4. to monitor air emissions from the gas flare and from the air stripper if it is part of the final treatment design. Air samples shall be analyzed for toxic air pollutants as defined by the New Source Review Guidelines for Toxic Air Contaminants (1988 and as revised).

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4.0 ALTERNATE WATER SUPPLY

The Settling Defendant shall continue to monitor nearby public and private water supply wells to protect public health. All water supply wells within the plume, as defined by groundwater data obtained in the RI/FS and the predesign study, shall be monitored quarterly. The Fircrest wells shall be monitored monthly until monitoring wells MW5A and C are installed and operating (Section 3.1.1.3). At a minimum these wells shall be sampled for groundwater indicator parameters as described in Section 3.1.2.2.

If early warning values, as determined in Section 3.3.2.2, are exceeded in any well, that well shall be placed on a monthly monitoring program until the cleanup is completed and the extraction/treatment system has been shut off, or until monthly samples show a decreasing trend in contamination and are less than early warning values, or alternate water has been supplied (Section 2.2).

If, based on monthly sampling, an increasing trend is found in any well such that the Government Plaintiffs determine a drinking water standard or health based criteria may be exceeded, the Settling Defendant shall provide an alternate water supply. Any well which exceeds a primary drinking water standard or an approved health based criteria (see Table 3) shall be immediately taken out of service and replaced with an alternate water supply as per the requirements of Section 2.2 of this SOW. If alternate water has been provided, monthly monitoring of the contaminated well may cease; however, the Government Plaintiffs may require periodic monitoring of such wells as part of routine monitoring practices.

The Settling Defendant shall provide an alternate water supply, as described in Section 2.0, in the event that operation of the extraction system adversely impacts the yield of existing supply wells in use prior to the date of entry of this Consent Decree. Adverse impact is defined as a reduction in water supply to levels below the discharge rate and total allowable annual volume defined by a valid water right, filed with the State of Washington,

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with a priority date prior to the date of entry of this Consent Decree. If a water right has not been granted for a domestic well, adverse impact is defined as reduction below the capacity of the well.

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5.0 INSTITUTIONAL CONTROLS

The Settling Defendant shall submit for Government Plaintiff review and approval a plan for institutional or other controls to restrict drilling of water supply wells in an area from Tyler Street to Leach Creek, and from Center Street to South 56th Street, and other areas identified by the Government Plaintiffs in the event that further monitoring shows the plume to have migrated beyond these limits or if additional water use could adversely affect the performance of the extraction system.

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6.0 REMEDIAL DESIGN PROJECT COMPLETION AND CLOSEOUT

The remedial design project completion shall occur when the design package has been completed, all comments have been incorporated, and approval of the Government Plaintiffs has been obtained.

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7.0 TASKS FOR REMEDIAL ACTION

7.1 Project Planning

The Settling Defendant shall prepare a plan describing efforts related to the initiation of engineering services and management during construction. The major subtasks include finalization of the preliminary RA work plan (see Section 1.2.1.2) and development of a construction management plan. The project plan shall address efforts related to the procurement of a construction contract. The plan shall detail how procurement shall be achieved to avoid construction delays. This includes issuing requests for qualifications, requests for proposals, bid analysis, and contract award. This task also includes application of managerial and decision making techniques during construction. The pre-construction planning and review, project control, contract management, QA/QC, facility start-up and construction closeout, and other techniques used to manage the remedial action activities shall be specified.

7.2 Site Safety Plan

The Settling Defendant shall be responsible for ensuring that the construction contractors prepare a site health and safety plan for the review of the Government Plaintiffs. The plan shall comply with OSHA, WISHA, and other requirements, to cover the workers participating in the remedial action phase and to protect the surrounding community.

7.3 Remedial Action Construction Program Plan

A quality assurance project plan shall be prepared covering the RA phase of the project. This document shall provide the quality requirements needed to assure that upon completion of the remedial action, the requirements of the ROD, the remedial design, and the SOW shall have been met. This document shall be prepared consistent with the Quality Assurance Project Plan submitted for the Remedial Design phase (Section 1.2.3 of this SOW) and other guidance documents.

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7.4 Construction Inspections

The Settling Defendant shall provide support services for the implementation of the Quality Assurance Project Plan for the remedial action. These services include field testing, sample analysis, inspection of field logs and diaries, inspection of work for compliance with contract documents, all monitoring work, and monthly site progress reports. A construction documentation report, including "As-Built" drawings, shall be prepared and submitted for the approval of the Government Plaintiffs within two months of completion of each phase of construction.

7.5 Sampling and Analysis Plan/Cleanup Validation

The Settling Defendant shall develop a plan to acquire specific field samples and other information needed during the operational period of the remedial action, to assure compliance with the consent decree and to assure performance of the system. This plan shall also include analysis and validation of the sampling results. The plan shall describe the specific monitoring wells located upgradient from the extraction system(s) which shall be used to evaluate the level of contamination within the existing plume. These wells shall be sampled quarterly for indicator parameters described in Section 3.1.2.2 until shutoff procedures are implemented (Section 7.7.3). The plan shall be submitted to the Government Plaintiffs for review and approval.

7.6 Remedial Action Implementation

The Settling Defendant shall fully implement all work required in the RA work plans, subject to Government Plaintiff review, inspection, and approval. RA implementation represents the majority of effort and cost for the RD/RA project. This task is the actual construction of the various elements of the approved remedial design.

7.7 Operation and Maintenance Plan

7.7.1 Landfill Cap

An inspection and maintenance plan, subject to review and approval by the

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Government Plaintiffs, shall be developed for the landfill cap. Areas where settlement occurs shall be repaired. Any cracks that develop shall be repaired. The plan shall also include provision for correction of localized subsidence, surface ponding, surface erosion and runoff, detail the frequency of inspection, corrective action response times, personnel needs, and reporting requirements. This plan shall be implemented upon the completion of the first stage of the landfill cap and shall continue for a minimum 30 year period after issuance of the certificate of completion or site closure, whichever is later.

7.7.2 Extraction/Treatment System/Gas Extraction System

An operation and maintenance plan for the extraction/treatment system and the gas extraction system shall be developed to address normal operation, potential operating problems, alternate O&M procedures should systems fail, routine monitoring and laboratory testing, safety requirements, a description of necessary equipment, necessary personnel, budget, and reporting requirements. The plan shall include shakedown procedures and long term operation and maintenance requirements as well as equipment startup and operator training procedures. The plan shall include procedures referenced in Section 3.1.2.2, Early Warning Values, in the event that the system does not contain the plume and early warning values are exceeded downgradient. The plan shall also include treatment system adjustment procedures should the system fail to meet the performance criteria set forth in this SOW. Such adjustment procedures shall be dependent upon the treatment method selected, and may include addition of treatment units, adjustment of the flow rate, or addition of pretreatment units.

Similar procedures shall be developed for the gas extraction system should the data from probes outside the landfill boundaries determine that the existing system is not controlling the migration of gas. Such procedures may include adjustment of the pumping rate or installation of more extraction wells (see Section 3.5.6).

7.7.3 Shut-Off Procedures

The extraction/treatment system shall be shut off only when the groundwater at the point of compliance and within the existing plume has reached the drinking water standards or health based criteria as specified in Table 3 for four consecutive quarterly samples. The goal is to achieve this level of cleanup within 10 years of operation of the system. When the Settling Defendant believes that this requirement has been met, they shall petition the Government Plaintiffs to shut down the extraction/treatment system. After Government Plaintiff approval, the system may be shut down, and the performance monitoring wells (as described in Section 8.0 of this SOW) shall be monitored quarterly for a period of five years or until completion of all landfill cap requirements, whichever is longer. Monitoring shall, at a minimum, consist of indicator parameters defined in Section 3.1.2.2.

If any of these wells exceed the drinking water standards or health based criteria during this monitoring period, the extraction/treatment system shall be restarted until the groundwater again meets standards for four consecutive quarters. If any of the performance wells exceed the early warning values set out in Section 3.1.2.2 during this period, the Settling Defendant shall submit a plan to evaluate what actions (if any) are necessary. The Settling Defendant shall again petition the Government Plaintiffs and demonstrate that these requirements have been met. The Settling Defendant may apply for certification of completion only after the Government Plaintiffs agree that the groundwater quality has been maintained for an entire five year period after completion of landfill cap requirements.

7.8 Project Completion and Closeout

The major elements of this task include consolidation of the project records, final inspection and closeout as described in Section XXXII of the Consent Decree.

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8.0 POST REMEDIAL CARE

8.1 Groundwater Monitoring

Notwithstanding the application of the Settling Defendant for a certificate of completion or issuance by the Government Plaintiffs, additional groundwater monitoring wells may be required to establish compliance with the performance requirements set forth in Sections 3.3.2 and 7.7.3 of this SOW. The Settling Defendant shall submit a plan for installation and monitoring of these performance wells to be installed between the compliance boundary and the extraction system(s). Monitoring shall be quarterly in accordance with Section 7.7.3 of this SOW, and biannually for the subsequent 30 years following issuance of certificate of completion.

8.2 Five Year CERCLA Review

The Settling Defendant shall provide technical support in cooperation with the Government Plaintiffs, to fulfill the 5 year review requirements of CERCLA.

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9.0 PROJECT MANAGEMENT

9.1 Schedule of Work

The Settling Defendant shall develop a work schedule for management tracking of the RD/RA for the review and approval of the Government Plaintiffs. The Settling Defendant shall provide deliverable dates for each deliverable specified in this SOW and indicate the durations and interactions between tasks. The schedule shall identify the requirements for reviews and approvals by the Government Plaintiffs. Deliverable items and required submittal dates which have already been established by this Consent Decree and the SOW, are shown in Table 5. The remaining deliverables and dates shall be identified in the project management plan (Section 1.2.1). The project management plan shall also propose dates for the RA activities. Final dates for the RA activities shall be included in the remedial action work plan (Section 7.1). Unless otherwise specified, final deliverables shall be submitted to the Government Plaintiffs within 30 days of receipt of Government Plaintiff directions for changes to draft deliverables.

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FIGURE 1

PREDESIGN STUDY MONITORING WELLS

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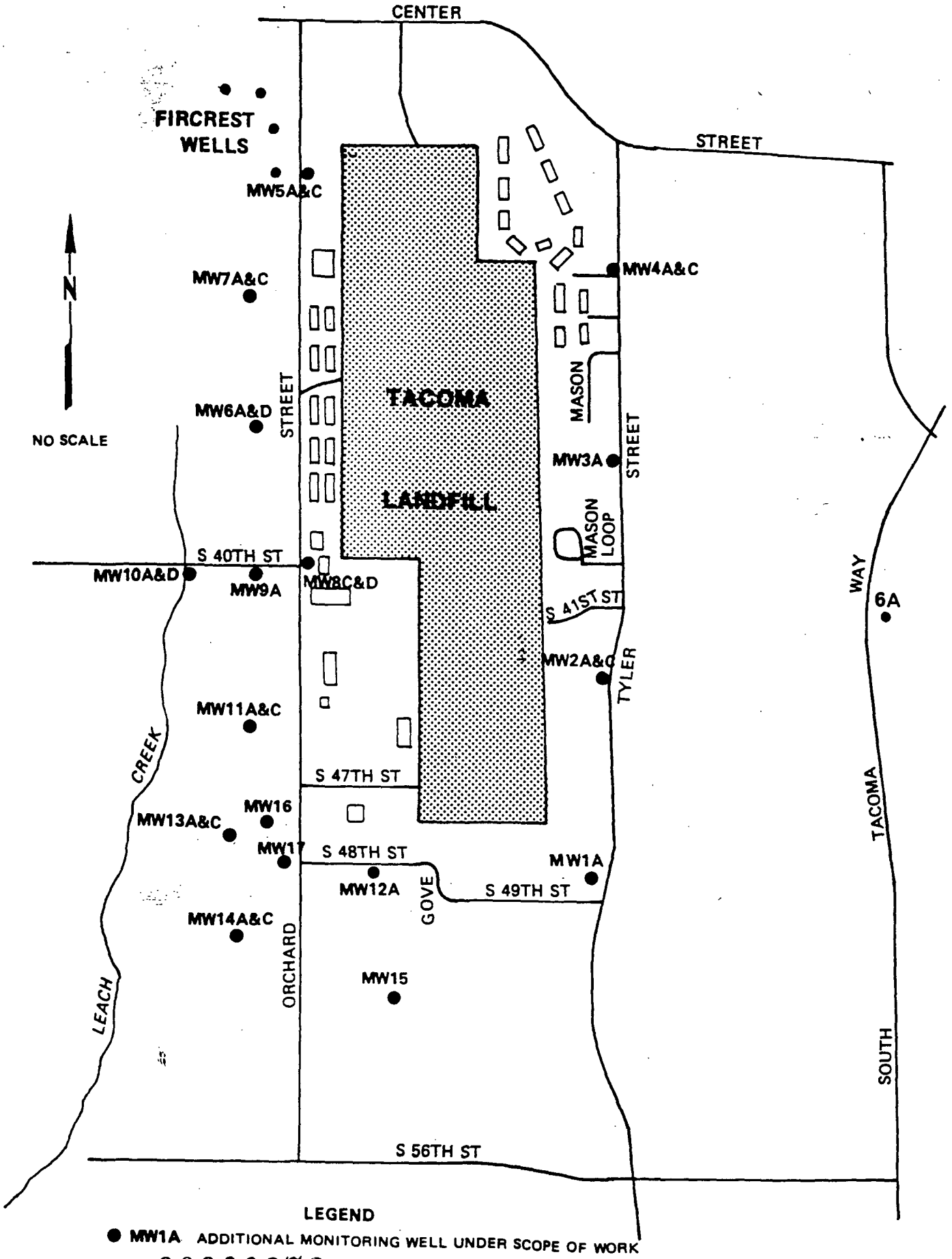

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TABLE 1

PREDESIGN STUDY MONITORING WELLS

Well	Approximate Depth (feet)	Targeted Geologic Unit	Purpose of Well
MW-1A	100	Q_c Water table)	Water quality monitoring in area potentially impacted by gradient reversal
MW-2A and C (Boring depth)	100 150 170	Q_c (Water table) Q_{og}(Tacoma Production Zone) Q_{ol} (Aquitard Surface)	Water quality monitoring in area potentially impacted by gradient reversals during summer months. Boring will be advanced to locate the top of Q_{ol}.
MW-3A	100	Q_c (Water table)	Water quality monitoring in area potentially impacted by gradient reversal
MW-4A and C (Boring depth)	100 140 170	Q_c (Water table) Q_{og}(Tacoma Production Zone) Q_{ol} (Aquitard Surface)	Water quality monitoring in area potentially impacted by gradient reversal. Boring will be advanced to establish top surface of Q_{ol}.
MW-5A and C	90 150	Q_c (Water table) Q_{og} (Fircrest Production Zone)	Early warning for Fircrest production wells.
MW-6A and D	40 150	Q_c or Q_{og} (Water table) Q_{os} (Zone above Aquitard)	Water quality monitoring downgradient of the landfill and DNAPL investigation.
MW-7A and C	60 130	Q_c or Q_{og} (Water table) Q_{og} (Fircrest Production Zone, on top of Q_{ot})	Water quality monitoring downgradient of the landfill. Additional monitoring near Fircrest wells.
MW-8C and D	130 170	Q_{og}(High Permeability Zone) Q_{os}(Zone above Aquitard)	Define vertical dimensions of plume and DNAPL investigation.

TABLE 1 (continued)

CITY CLERK CONTRACT/AGREEMENT

Well	Approximate Depth (feet)	Targeted Geologic Unit	Purpose of Well
MW-9A	10	Q_c (Water table)	Water quality monitoring downgradient of landfill and definition of plume boundary.
MW-10A and D	30 90	Q_c or Q_{og} (Water table) Q_{os} (Zone above Aquitard)	Confirm Leach Creek as discharge zone and water quality monitoring downgradient of landfill.
MW-11A and C	40 80	Q_c (Water table) Q_{og} (Private Well Production Zone)	Water quality monitoring downgradient of landfill and current plume, and definition of plume boundary.
MW-12A	120	Q_c (Water table)	Water quality monitoring downgradient of landfill and definition of plume boundary.
(MW-15		Existing Well	Confirm screened zone, water level measurement.
MW-16		Existing Well	Confirm screened zone, water level measurement.
MW-17)		Existing Well	Confirm screened zone, water level measurement.
MW-13A and C	30 60	Q_c (Water table) Q_{og}(Private well production)	Water quality monitoring downgradient of landfill and current plume, definition of plume.
MW-14A and C	60 80	Q_c (Water table) or Q_{og} (Private well production)	Water quality monitoring downgradient of landfill and current plume, definition of plume.

Notes:

1. Single completion water table monitoring wells (MW-1A, MW-3A, MW-12A) will be drilled by air rotary methods. All other wells will be drilled using hollow stem auger or cable tool drilling methods.

2. Locations are approximate, actual locations dependant on drill rig and property access.

CITY CLERK CONTRACT/AGREEMENT NO. 4066

TABLE 2

TARGET COMPOUND LIST

ORGANIC COMPOUNDS

VOLATILE COMPOUNDS

1. Chloromethane
2. Bromomethane
3. Vinyl Chloride
4. Chloroethane
5. Methylene Chloride
6. Acetone
7. Carbon Disulfide
8. 1,1-Dichloroethene
9. 1,1-Dichloroethane
10. trans-1,2-Dichloroethane
11. Chloroform
12. 1,2-Dichloroethane
13. 2-Butanone
14. 1,1,1-Trichloroethane
15. Carbon tetrachloride
16. Vinyl Acetate
17. Bromodichloromethane
18. 1,2-Dichloropropane
19. cis-1,3-Dichloropropene
20. Trichloroethane
21. Dibromochloromethane
22. 1,1,2-Trichloroethane
23. Benzene
24. trans-1,3-Dichloropropene
25. Bromoform
26. 4-Methyl-2-Pentanone
27. 2-Hexanone
28. Tetrachloroethene
29. Toluene
30. 1,1,2,2-Tetrachloroethane
31. Chlorobenzene
32. Ethyl Benzene
33. Styrene
34. Total Xylenes

CITY CLERK CONTRACT/AGREEMENT

TABLE 2

(Continued)

SEMI-VOLATILE COMPOUNDS

35. Phenol
36. bis(2-Chloroethyl) Ether
37. 2-Chlorophenol
38. 1,3-Dichlorobenzene
39. 1,4-Dichlorobenzene
40. Benzyl Alcohol
41. 1,2-Dichlorobenzene
42. 2-Methylphenol
43. bis(2-Chloroisopropyl)Ether
44. 4-Methylphenol
45. N-Nitroso-Di-n-dipropylamine
46. Hexachloroethane
47. Nitrobenzene
48. Isophorone
49. 2-Nitrophenol
50. 2,4-Dimethylphenol
51. Benzoic Acid
52. 2-bis(2-Chloroethoxy) methane
53. 2,4-Dichlorophenol
54. 1,2,4-Trichlorobenzene
55. Napthalene
56. 4-Chloroaniline
57. Hexachlorobutadiene
58. 4-Chloro-3-Methylphenol
59. 2-Methylnaphthalene
60. hexachlorocyclopentadiene
61. 2,4,6-Trichlorophenol
62. 2,4,5-Trichlorophenol
63. 2-Chloronaphthalene
64. 2-Nitroaniline
65. Dimethylphthalate
66. Acenaphthylene
67. 2,6-Dinitrotoluene
68. 3-Nitroaniline
69. Acenaphthene
70. 2,4-Dinitrophenol
71. 4-Nitrophenol
72. Dibenzofuran
73. 2,4-Dinitrotoluene
74. Diethylphthalate
75. 4-Chlorophenyl-phenyl ether
76. Fluorene
77. 4-Nitroaniline
78. 4,6-Dinitro-2-Methylphenol
79. N-Nitrosodiphenylamine
80. 4-Bromophenyl ether
81. Hexachlorobenzene
82. Pentachlorophenol
83. Phenanthrene
84. Anthracene
85. Di-n-butylphthalate
86. Fluoranthene
87. Pyrene
88. Butylbenzylphthalate
89. 3,3'-Dichlorobenzidine
90. Benzo(a)anthracene
91. Chrysene
92. bis(2-Ethylhexyl)phthalate
93. Di-n-octylphthalate
94. Benzo(b)fluoranthene
95. Benzo(k)fluoranthene
96. Benzo(a)pyrene
97. Indeno(1,2,3-cd)pyrene
98. Dibenz(a,h)anthracene
99. Benzo(g,h,i)perylene

CITY CLERK CONTRACT/AGREEMENT NO. 9060

TABLE 2

(Continued)

PESTICIDES/PCB COMPOUNDS

100. Alpha-BHC
101. Beta-BHC
102. Delta-BHC
103. Gamma-BHC (Lindane)
104. Heptachlor
105. Aldrin
106. Heptachlor Epoxide
107. Endosulfan I
108. Dieldrin
109. 4,4'-DDE
110. Endrin
111. Endosulfan II
112. 4,4'-DDD
113. Endosulfan Sulfate
114. 4,4'-DDT
115. Methoxychlor
116. Endrin Ketone
117. Alpha Chlordane
118. Gamma Chlordane
119. Toxaphene
120. Aroclor 1016
121. Aroclor 1221
122. Aroclor 1232
123. Aroclor 1242
124. Aroclor 1248
125. Aroclor 1254
126. Aroclor 1260

CITY CLERK CONTRACT/AGREEMENT 4060

TABLE 2
(Continued)

INORGANIC ANALYSES

ELEMENT

Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Iron	Zinc
Lead	Cyanide

CITY CLERK CONTRACT/AGREEMENT NO. 5060

TABLE 2
(continued)

OTHER INORGANIC ANALYSES
(not on the Target Compound List)

Bicarbonate m
Calcium m
Carbonate m
Magnesium m
Potassium m
Silica m
Total Hardness m

m = major constituent

CITY CLERK CONTRACT/AGREEMENT

TABLE 3

GROUNDWATER PERFORMANCE CRITERIA*

Contaminant	Performance Criteria (ug/l)
Benzene	5.0
Chloroethane	20.0
1,1-dichloroethane	20.0
1,2-dichloroethane	5.0
Ethyl Benzene	320.0
Methylene Chloride	5.0
Toluene	175.0
1,1,1-Trichloroethane	200.0
Xylenes	10.0

*This table shall be developed and completed for the entire list of indicator parameters selected under Section 3.1.2.2 of this SOW.

CITY CLERK CONTRACT

TABLE 4

SURFACE WATER DISCHARGE CRITERIA*

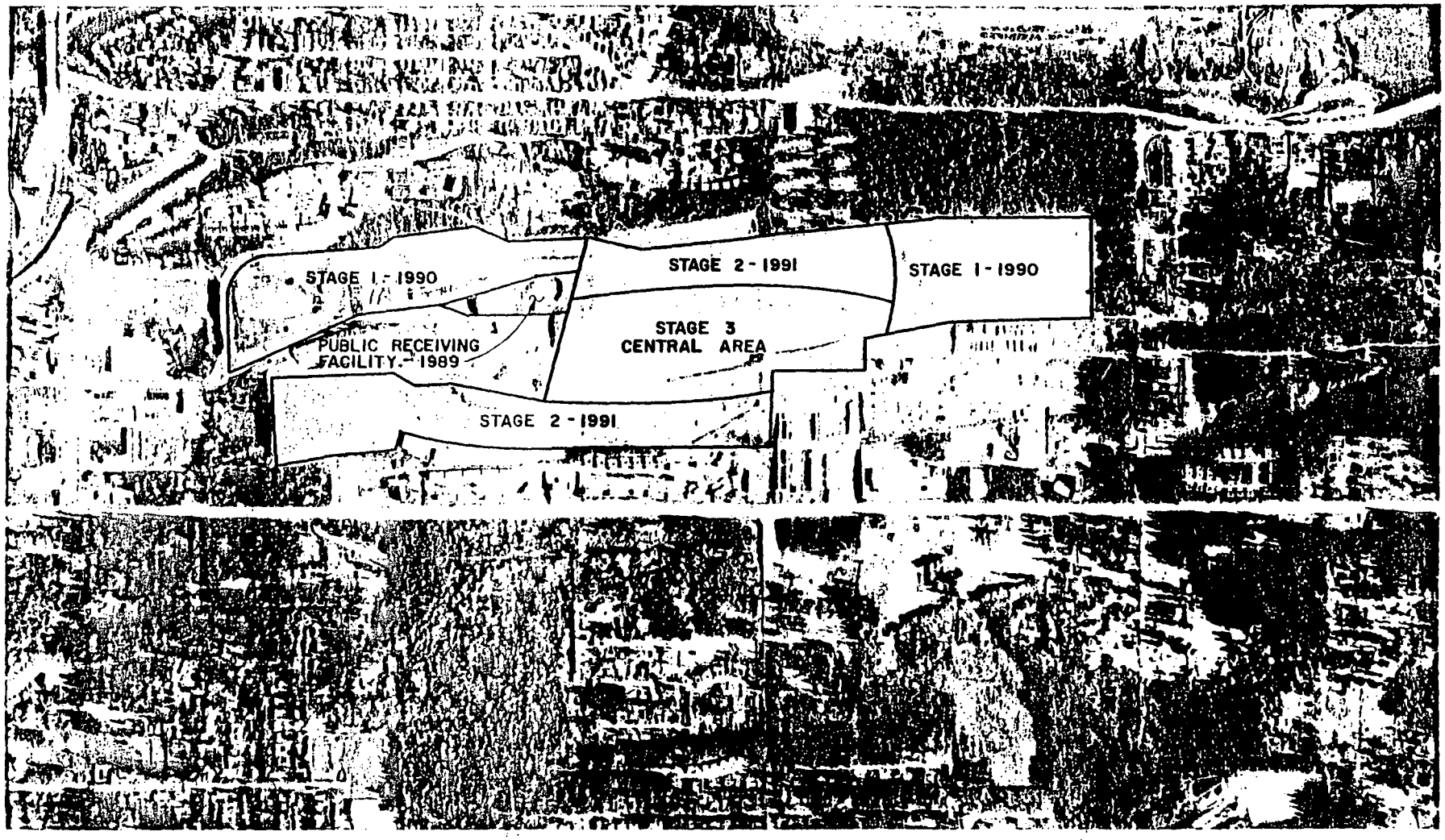
Contaminant Concentration Appropriate to
the Discharge Location (ug/l)

Contaminant	Fresh Water	Marine Water
Benzene	5.0	700.0
Chloroethane	20.0	1130.***
1,1-dichloroethane	20.0	1130.***
1,2-dichloroethane	5.0	1130.0
Ethyl Benzene	320.0	4.3**
Methylene Chloride	5.0	6400.
Toluene	175.0	5000.0
1,1,1-trichloroethane	200.0	312.0
Vinyl Chloride	2.0	2.0**
Xylenes	10.0	10.0**

* This table shall be supplemented to include the entire list of indicator parameters selected under Section 3.1.2.2 of this SOW.

** Value set at fresh water criteria unless other discharge limits can be established from other guidance documents or technical research, as approved by the Government Plaintiffs.

*** Data is not available to develop criteria for this compound. However, since research shows (EPA, 1986) that toxicity of chlorinated ethanes increases with increasing chlorination, the toxicity for Chloroethane and 1,1-dichloroethane should be less than the value for 1,2-dichloroethane.



N

800' 400' 0 800'

SCALE: 1"=800'
(APPROX.)

FIGURE 2
LANDFILL CAP
CONSTRUCTION SCHEDULE

TACOMA LANDFILL RD/RA

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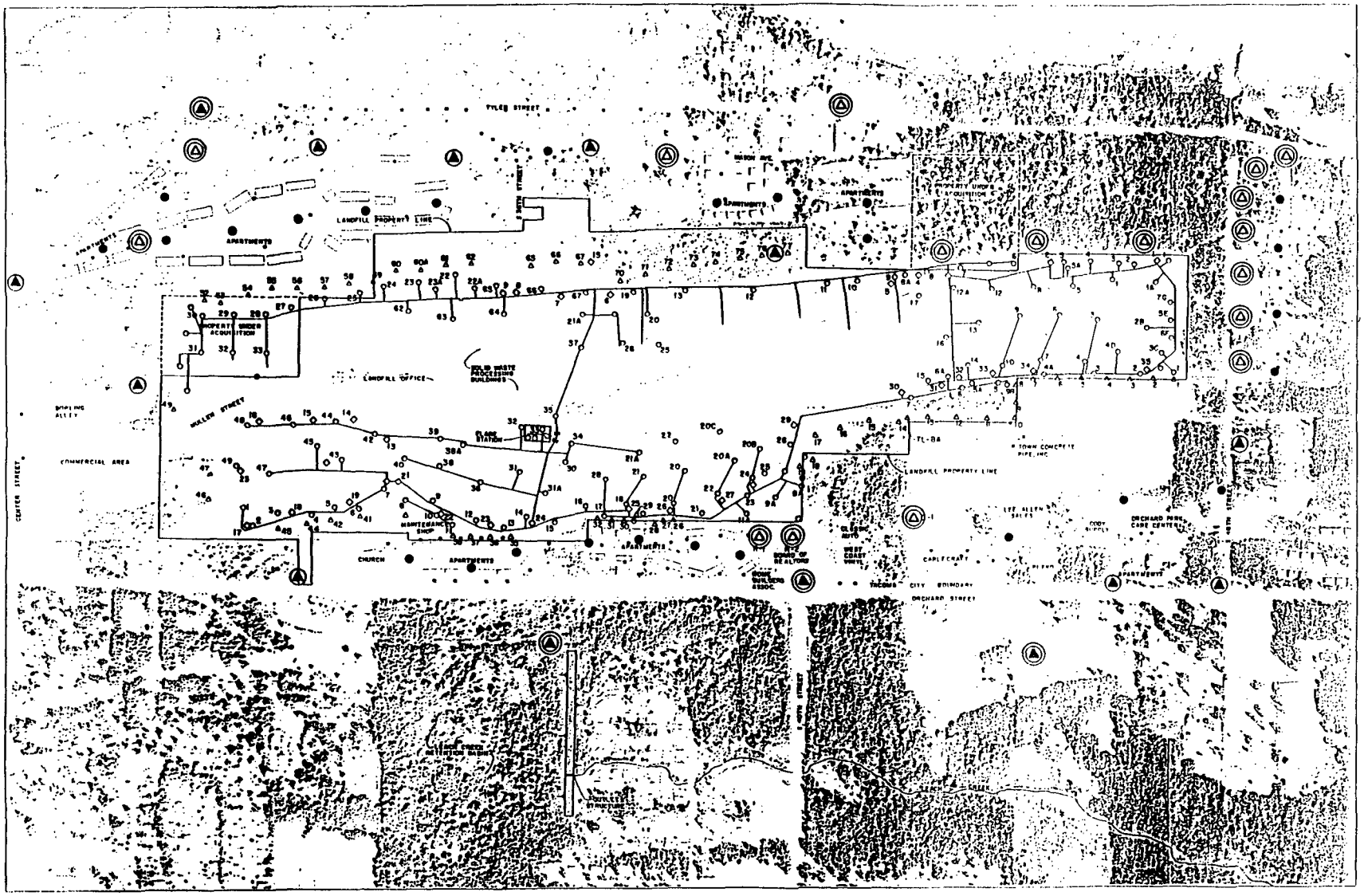


LEGEND

- GAS WELL
- PROBE
- CONDENSATION DRAIN
- OFFSITE MONITORING LOCATION

EXISTING OFF-SITE PROBE STATIONS (Multi-Depth)

PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth)

PROPOSED OFF-SITE PROBE STATIONS (Shallow)

PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth) COMBINED WITH WATER WE

FIGURE 3
PREDESIGN STUDY
LANDFILL GAS PROBE LOCATIONS

TACOMA LANDFILL

00000283

CITY CLERK'S CONTRACT

TABLE 5

LIST OF DELIVERABLES

Deliverable	Submittal Date
Public Receiving Facility Cap Design	
Monitoring Well SAP	Within 30 days of lodging of Consent Decree
Draft Health and Safety Plan	With Monitoring Well SAP.
Final Health and Safety Plan	Within 30 days receipt of comments Draft Health and Safety Plan.
Draft Project Management Plan (PMP)	Within 30 days of lodging of Consent Decree.
Final PMP	Within 30 days of receipt of comments on Draft PMP.
Draft QAPP - for remedial design	With Draft PMP.
Final QAPP for remedial design	Within 30 days receipt of comments on Draft QAPP.
Draft Groundwater SAP	With Draft QAPP
Final Groundwater SAP	Within 30 days of receipt of comments on Draft Groundwater SAP
Leachate & Condensate Sampling and Analysis Plan (SAP)	Within 30 days of lodging of Consent Decree.
Fircrest Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Alternate Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Landfill Gas Sampling & Analysis Plan	Within 90 days of lodging of Consent Decree.
Well Logs & Survey Data	Within 30 days of last well installation.
Indicator Parameter Selection	Within 90 days of first round of groundwater sampling.
Surface Water SAP	Within 120 days of lodging of Consent Decree.

TABLE 5

List of Deliverables
2

Disposal of Hazardous Substances & Liquids Plan	Within 180 days of lodging of Consent Decree
Draft Predesign Report	Within 180 days of lodging of Consent Decree
Draft Statistical Methods Proposal	In Draft Predesign Study Report
Pilot Extraction Well Work Plan	In Draft Predesign Study Report
Pilot Treatment Study Work Plan	In Draft Predesign Study Report
Pilot Extraction Well SAP	Within 30 days receipt of comments on Draft Predesign Report
Pilot Treatment Study SAP	Within 30 days of receipt of comments on Draft Predesign Report
Final Statistical Methods Selection	Within 30 days of comments on draft Predesign Study Report
Draft Pilot Studies Report	
Final Predesign Study Report	Within 30 days of receipt of comments on Draft Pilot Studies Report
Extraction/Treatment System Preliminary Design (30%)	
Extraction/Treatment System Intermediate Design (60%)	
New Plume Contingency Plan	With 60% Extraction/Treatment Design
Extraction/Treatment System Prefinal Design (90%)	
Extraction Treatment System SAP	With 90% Extraction/Treatment Design
Air Emissions SAP	With 90% Extraction/treatment Design
Extraction/Treatment System Final Design (100%)	
Landfill Cap Preliminary Design (30%)	
Surface Water Management Plan	With Cap 30% Design Report

CITY CLERK CONTRACT

TABLE 5

List of Deliverables
3

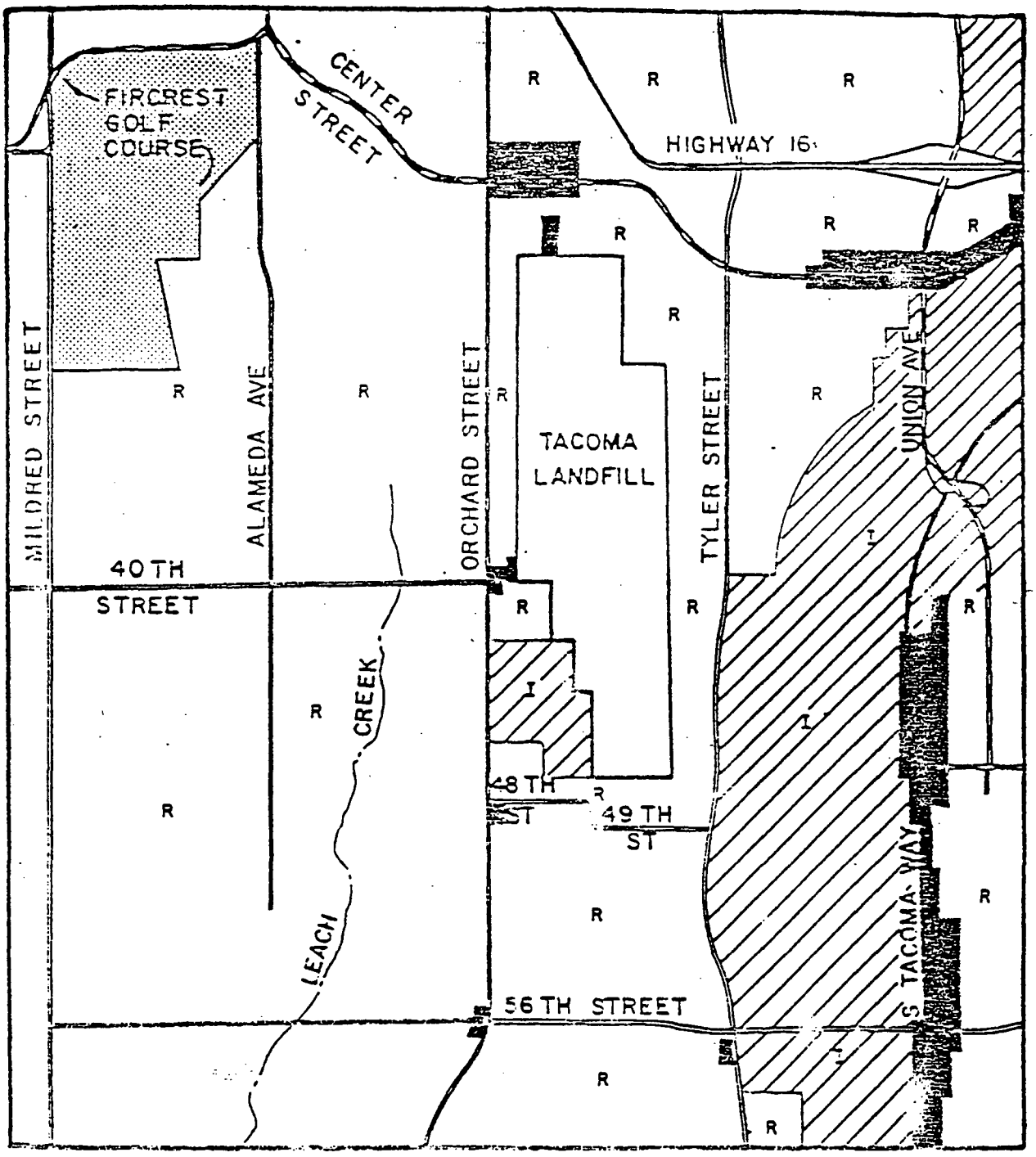
Landfill Cap Intermediate Design (60%)	
Landfill Cap Prefinal Design (90%) Utilities Management Plan	With 90% Stage 1 Landfill Cap Design
Landfill Cap Final Design (100%)	
Final Central Area Expansion Design Report Plans and Specifications	
Gas System Evaluation Reports	
Landfill Gas Management Plan	
Landfill Gas Cap Installation Report	Within 60 days of completion of each stage of landfill cap
Leachate & Condensate Management Plan	
Air Emissions Management Plan	
Operations and Closure Plan	Within 60 days of approval of all remedial designs
Landfill Closure Plan	With Operations & Closure Plan
O & M Contingency Plan	With O&M Plans in Operations and Closure Plan
Institutional Controls Plan	
Remedial Design Project Closeout	June 30, 1991
Remedial Action PMP - Update	June 30, 1991
Remedial Action Site Safety Plan	
Remedial Action Construction Program Plan	
Remedial Action SAP	
Construction Documentation Report	
Operation and Maintenance Plan	
Project Closeout	Sept. 30, 1992

APPENDIX III
TO TACOMA LANDFILL CONSENT DECREE

ACCESS AGREEMENT

APPENDIX IV
TO TACOMA LANDFILL CONSENT DECREE

MAP OF THE SITE



LEGEND

COMMERCIAL

INDUSTRIAL

RESIDENTAL

00000289

0 1000 2000 4000

SCALE: 1" = 2000'

APPENDIX V
TO TACOMA LANDFILL CONSENT DECREE

LIST OF HAZARDOUS SUBSTANCES DETECTED
AT THE TACOMA LANDFILL

Volatile Organic Compounds

Tetrachloroethene
Trans-1,2-Dichloroethene
Trichloroethene
1,1-Dichloroethene
Vinyl Chloride
1,1,1-Trichloroethane
1,1-Dichloroethane
1,2-Dichloroethane
Chloroethane
Benzene
Ethylbenzene
Chlorobenzene
Toluene
Xylene (Total)
2-Butanone
2-Hexanone
1,2-Dichloropropane
Trans 1,3-Dichloropropene
Styrene
Carbon Disulfide
Chloroform
Chloromethane
Bromodichloromethane
Methylene Chloride
Acetone
4-Methyl-2-pentanone

Semi-Volatile Organic Compounds

Hexachlorobenzene
Polynuclear Aromatic Compounds
Pthalate Esters
1,4-Dichlorobenzene
N-nitro-Sodiphenylamine
Benzyl Alcohol
Benzoic Acid
4-Methylphenol
Isophorone
Phenol

Metals

Arsenic
Cadmium
Chromium
Copper
Mercury
Nickel
Lead
Zinc
Iron
Aluminum
Manganese

CITY CLERK CONTRACT/AGREEMENT NO. 9060

APPENDIX VI
TO TACOMA LANDFILL CONSENT DECREE

PRE-SETTLEMENT REMEDIAL DESIGN STIPULATION AND AGREED ORDER

FILED ____ LODGED
RECEIVED
NOV 13 1989
CLERK U.S. DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON AT TACOMA
BY ____ DEPUTY

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON

UNITED STATES OF AMERICA, ON BEHALF OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY and the STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY, Plaintiffs, v. CITY OF TACOMA, Defendant.	C89-583T CIVIL ACTION No. PRE-SETTLEMENT REMEDIAL DESIGN STIPULATION AND AGREED ORDER

STIPULATION AND AGREED ORDER

Plaintiffs, the United States of America, ("United States") and the state of Washington have filed an action under sections 106 and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. Section 9606, 9607 et seq., (CERCLA) and the model Toxics Control Act, against the City of Tacoma, ("Settling Parties").

CITY CLERK CONFORMED COPY NO. [illegible]

In order to expedite the commencement of the remedial action at the Tacoma Landfill site, which is the subject of this action, the United States and the Settling Parties, stipulate as follows:

A. To commence and complete work, submit documents, and to otherwise perform in accordance with the Consent Decree consented to by the Settling Parties and lodged with but not yet entered by this Court.

B. The Parties to this stipulation acknowledge that this stipulation has been entered into in anticipation of settlement and may be affected by a consent decree entered subsequent to this filing. The Parties agree to comply with the terms of this stipulation unless the terms of any subsequently entered consent decree expressly supersede the terms of this stipulation.

Stipulated by:

CITY OF TACOMA

ERLING O. MORK
City Manager
City of Tacoma
Tacoma, Washington

8/16/89
Date

FRED A. THOMPSON
Director of Public Works
City of Tacoma
Tacoma, Washington

16 AUG. 1989
Date

CITY CLERK CONTRACT AMENDMENT NO. 96-60

Leslie T. Granski — 8/15/89
DAVID H. DOW — Date
Director of Finance 8/15/89
Acting
City of Tacoma
Tacoma, Washington

Attest: [signature] — 8-16-89
Date

City Clerk
City of Tacoma
Tacoma, Washington

Approved as to form: [signature] — Aug 16, 1989
Date

City Attorney
City of Tacoma
Tacoma, Washington

UNITED STATES

[signature] — 11/6/89
STEVEN NOVICK — Date
Attorney
Land and Natural Resources Division
U.S. Department of Justice
Washington, D.C. 20536

[signature] — NOV 3 1989
RICHARD B. STEWART — Date
Assistant Attorney General
Land and Natural Resources Division
U.S. Department of Justice
Washington, D.C. 20530

Robert T. Bond for

ROBIE G. RUSSELL
Regional Administrator
Environmental Protection Agency,
Region 10
Seattle, Washington

Sept. 15, 1989
Date

MIKE McKAY
UNITED STATES ATTORNEY

Jackson L. Fox

JACKSON L. FOX
Special Assistant United States Attorney
3600 Seafirst Fifth Avenue Plaza
800 Fifth Avenue
Seattle, Washington 98104

November 9, 1989
Date

STATE OF WASHINGTON

Carol L. Fleskes

CAROL S. FLESKES
Hazardous Waste Investigations
and Cleanup Program Manager
Department of Ecology
Olympia, Washington 98504

Aug. 18, 1989
Date

JEFFREY S. MYERS
Assistant Attorney General
State of Washington
Olympia, Washington 98504

Aug 18, 1989
Date

IT IS SO ORDERED this _____ day of _____, 1989.

UNITED STATES DISTRICT JUDGE

CITY CLERK CONTRACT/AGREEMENT NO. 406

TABLE 4

SURFACE WATER DISCHARGE CRITERIA*

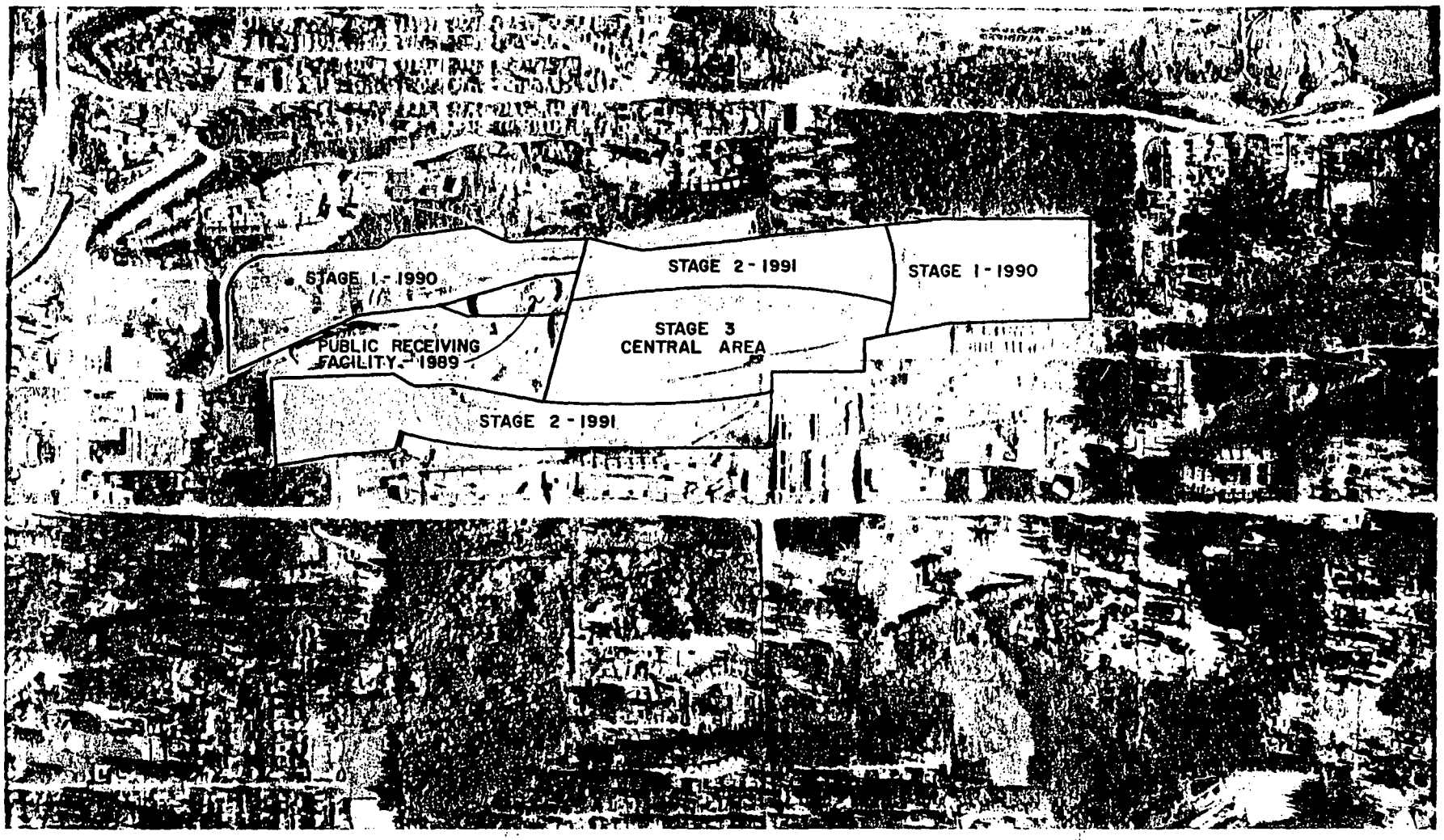
Contaminant Concentration Appropriate to
the Discharge Location (ug/l)

Contaminant	Fresh Water	Marine Water
Benzene	5.0	700.0
Chloroethane	20.0	1130.***
1,1-dichloroethane	20.0	1130.***
1,2-dichloroethane	5.0	1130.0
Ethyl Benzene	320.0	4.3**
Methylene Chloride	5.0	6400.
Toluene	175.0	5000.0
1,1,1-trichloroethane	200.0	312.0
Vinyl Chloride	2.0	2.0**
Xylenes	10.0	10.0**

* This table shall be supplemented to include the entire list of indicator parameters selected under Section 3.1.2.2 of this SOW.

** Value set at fresh water criteria unless other discharge limits can be established from other guidance documents or technical research, as approved by the Government Plaintiffs.

*** Data is not available to develop criteria for this compound. However, since research shows (EPA, 1986) that toxicity of chlorinated ethanes increases with increasing chlorination, the toxicity for Chloroethane and 1,1-dichloroethane should be less than the value for 1,2-dichloroethane.



N

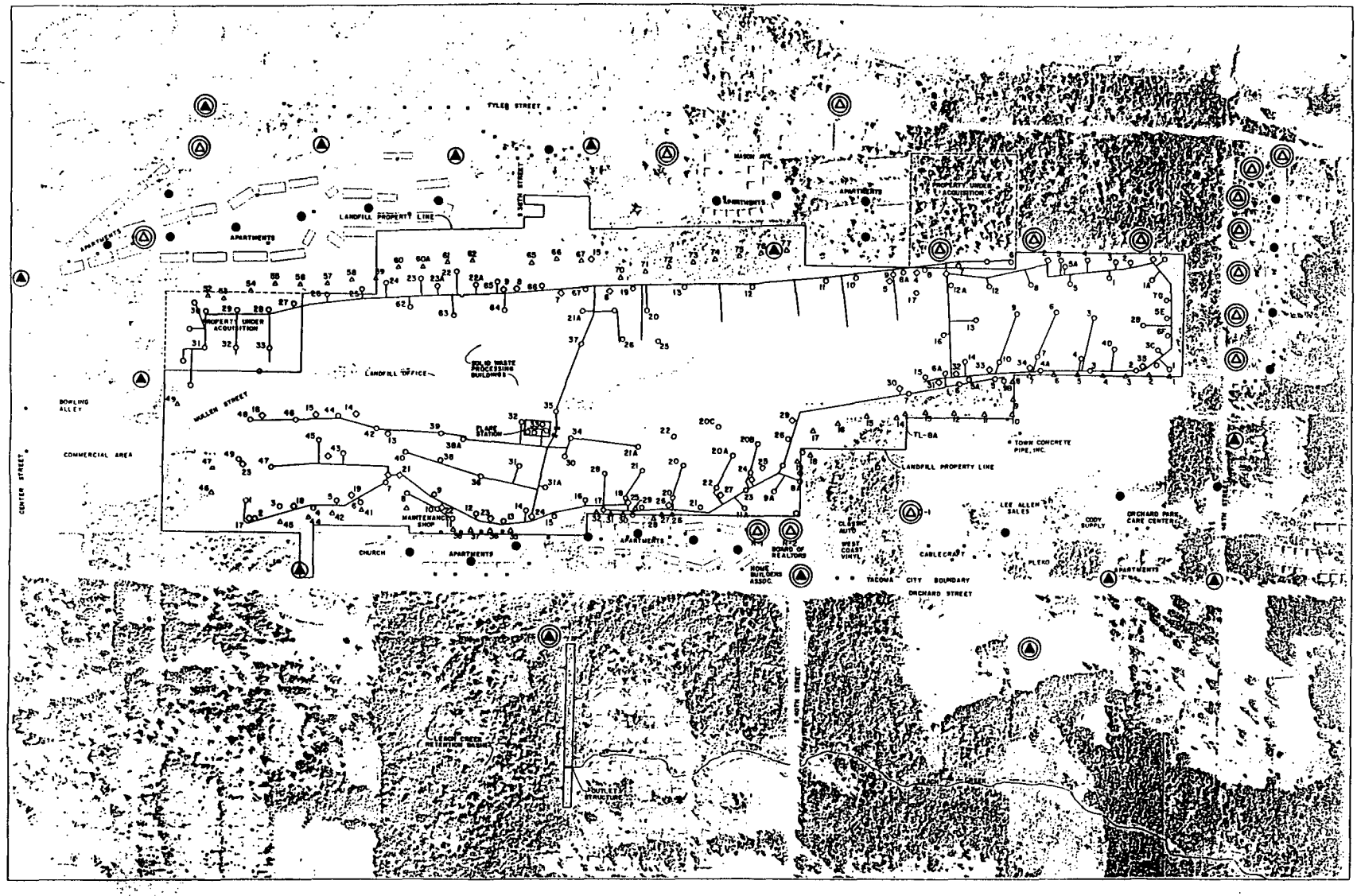
800' 400' 0 800'

SCALE: 1" = 800'
(APPROX.)

FIGURE 2
LANDFILL CAP
CONSTRUCTION SCHEDULE

TACOMA LANDFILL RD/RA

00000282



LEGEND

- GAS WELL
- PROBE
- CONDENSATION DRAIN
- OFFSITE MONITORING LOCATION
- EXISTING OFF-SITE PROBE STATIONS (Multi-Depth)
- PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth)
- PROPOSED OFF-SITE PROBE STATIONS (Shallow)
- PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth) COMBINED WITH WATER WELL

FIGURE 3
PREDESIGN STUDY
LANDFILL GAS PROBE LOCATIONS

TACOMA LANDFILL

00000283

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 5

LIST OF DELIVERABLES

Deliverable	Submittal Date
Public Receiving Facility Cap Design	
Monitoring Well SAP	Within 30 days of lodging of Consent Decree
Draft Health and Safety Plan	With Monitoring Well SAP.
Final Health and Safety Plan	Within 30 days receipt of comments Draft Health and Safety Plan.
Draft Project Management Plan (PMP)	Within 30 days of lodging of Consent Decree.
Final PMP	Within 30 days of receipt of comments on Draft PMP.
Draft QAPP - for remedial design	With Draft PMP.
Final QAPP for remedial design	Within 30 days receipt of comments on Draft QAPP.
Draft Groundwater SAP	With Draft QAPP
Final Groundwater SAP	Within 30 days of receipt of comments on Draft Groundwater SAP
Leachate & Condensate Sampling and Analysis Plan (SAP)	Within 30 days of lodging of Consent Decree.
Fircrest Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Alternate Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Landfill Gas Sampling & Analysis Plan	Within 90 days of lodging of Consent Decree.
Well Logs & Survey Data	Within 30 days of last well installation.
Indicator Parameter Selection	Within 90 days of first round of groundwater sampling.
Surface Water SAP	Within 120 days of lodging of Consent Decree.

CITY CLERK CONTRACT 4060

TABLE 5

List of Deliverables
2

Disposal of Hazardous Substances & Liquids Plan	Within 180 days of lodging of Consent Decree
Draft Predesign Report	Within 180 days of lodging of Consent Decree
Draft Statistical Methods Proposal	In Draft Predesign Study Report
Pilot Extraction Well Work Plan	In Draft Predesign Study Report
Pilot Treatment Study Work Plan	In Draft Predesign Study Report
Pilot Extraction Well SAP	Within 30 days receipt of comments on Draft Predesign Report
Pilot Treatment Study SAP	Within 30 days of receipt of comments on Draft Predesign Report
Final Statistical Methods Selection	Within 30 days of comments on draft Predesign Study Report
Draft Pilot Studies Report	
Final Predesign Study Report	Within 30 days of receipt of comments on Draft Pilot Studies Report
Extraction/Treatment System Preliminary Design (30%)	
Extraction/Treatment System Intermediate Design (60%)	
New Plume Contingency Plan	With 60% Extraction/Treatment Design
Extraction/Treatment System Prefinal Design (90%)	
Extraction Treatment System SAP	With 90% Extraction/Treatment Design
Air Emissions SAP	With 90% Extraction/treatment Design
Extraction/Treatment System Final Design (100%)	
Landfill Cap Preliminary Design (30%)	
Surface Water Management Plan	With Cap 30% Design Report

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 5

List of Deliverables
3

Landfill Cap Intermediate Design (60%)	
Landfill Cap Prefinal Design (90%) Utilities Management Plan	With 90% Stage 1 Landfill Cap Design
Landfill Cap Final Design (100%)	
Final Central Area Expansion Design Report Plans and Specifications	
Gas System Evaluation Reports	
Landfill Gas Management Plan	
Landfill Gas Cap Installation Report	Within 60 days of completion of each stage of landfill cap
Leachate & Condensate Management Plan	
Air Emissions Management Plan	
Operations and Closure Plan	Within 60 days of approval of all remedial designs
Landfill Closure Plan	With Operations & Closure Plan
O & M Contingency Plan	With O&M Plans in Operations and Closure Plan
Institutional Controls Plan	
Remedial Design Project Closeout	June 30, 1991
Remedial Action PMP - Update	June 30, 1991
Remedial Action Site Safety Plan	
Remedial Action Construction Program Plan	
Remedial Action SAP	
Construction Documentation Report	
Operation and Maintenance Plan	
Project Closeout	Sept. 30, 1992

CITY CLERK CONTRACT AGREEMENT NO. 4060

APPENDIX III
TO TACOMA LANDFILL CONSENT DECREE

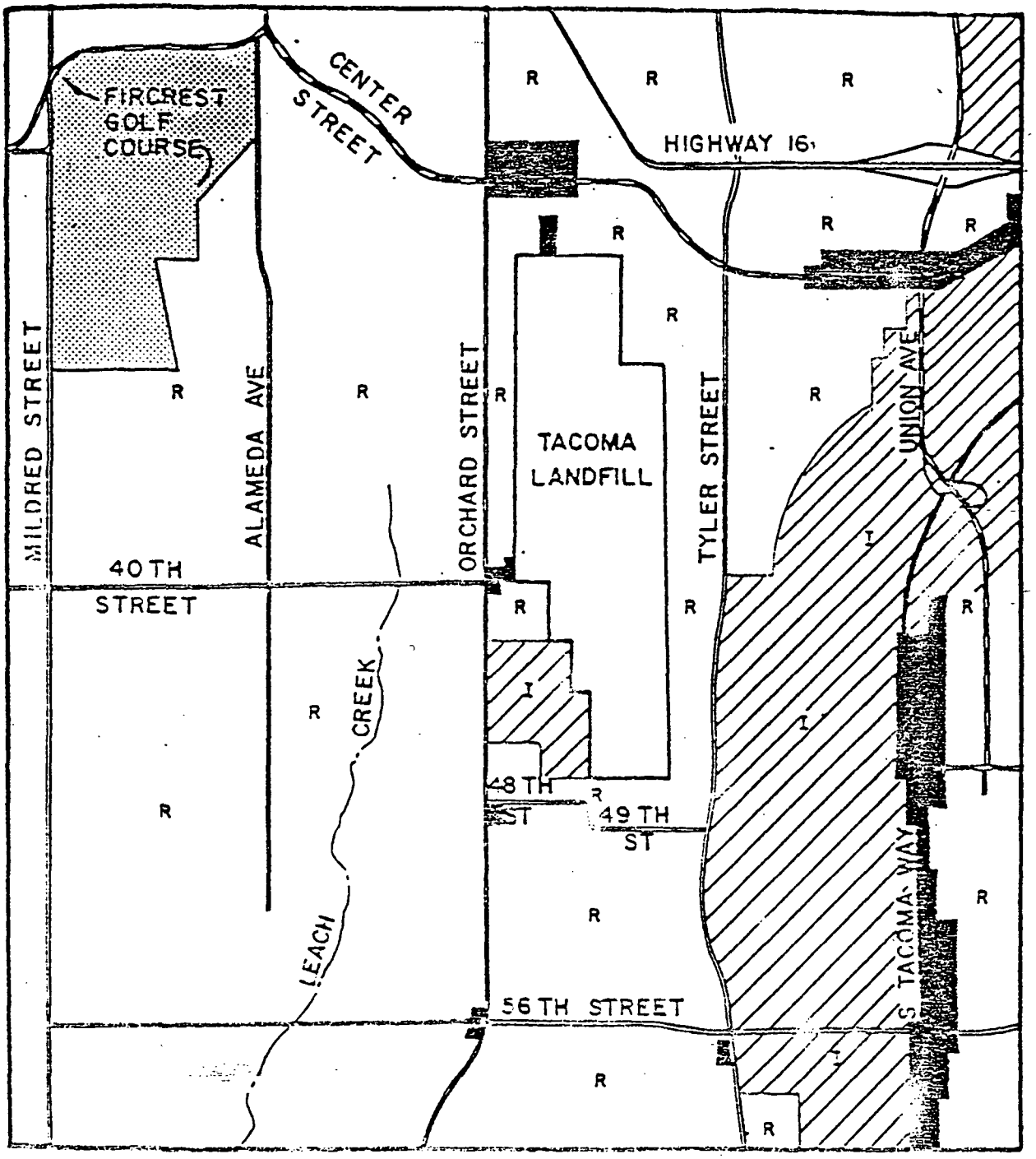
ACCESS AGREEMENT

CITY CLERK COMPTROLLER 4060

APPENDIX IV
TO TACOMA LANDFILL CONSENT DECREE

MAP OF THE SITE

CITY CLERK CONTRACT/AGREEMENT NO. 40



LEGEND

COMMERCIAL

INDUSTRIAL

RESIDENTAL

00000289

0 1000 2000 4000

SCALE 1" = 2000'

APPENDIX V
TO TACOMA LANDFILL CONSENT DECREE

LIST OF HAZARDOUS SUBSTANCES DETECTED AT THE TACOMA LANDFILL

Volatile Organic Compounds

Tetrachloroethene
Trans-1,2-Dichloroethene
Trichloroethene
1,1-Dichloroethene
Vinyl Chloride
1,1,1-Trichloroethane
1,1-Dichloroethane
1,2-Dichloroethane
Chloroethane
Benzene
Ethylbenzene
Chlorobenzene
Toluene
Xylene (Total)
2-Butanone
2-Hexanone
1,2-Dichloropropane
Trans 1,3-Dichloropropene
Styrene
Carbon Disulfide
Chloroform
Chloromethane
Bromodichloromethane
Methylene Chloride
Acetone
4-Methyl-2-pentanone

Semi-Volatile Organic Compounds

Hexachlorobenzene
Polynuclear Aromatic Compounds
Pthalate Esters
1,4-Dichlorobenzene
N-nitro-Sodiphenylamine
Benzyl Alcohol
Benzoic Acid
4-Methylphenol
Isophorone
Phenol

Metals

Arsenic
Cadmium
Chromium
Copper
Mercury
Nickel
Lead
Zinc
Iron
Aluminum
Manganese

CITY CLERK CONTRACT/AGREEMENT NO. 4060

APPENDIX VI
TO TACOMA LANDFILL CONSENT DECREE

PRE-SETTLEMENT REMEDIAL DESIGN STIPULATION AND AGREED ORDER

CITY CLERK'S OFFICE

FILED ____ LODGED
RECEIVED
NOV 13 1989
CLERK U.S. DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON AT TACOMA
BY DEPUTY

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON

UNITED STATES OF AMERICA, ON BEHALF OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY and the STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY, Plaintiffs, v. CITY OF TACOMA, Defendant.	C89-583T CIVIL ACTION No. PRE-SETTLEMENT REMEDIAL DESIGN STIPULATION AND AGREED ORDER

STIPULATION AND AGREED ORDER

Plaintiffs, the United States of America, ("United States") and the state of Washington have filed an action under sections 106 and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. Section 9606, 9607 et seq., (CERCLA) and the model Toxics Control Act, against the City of Tacoma, ("Settling Parties").

CITY CLERK CONTRACT DOCUMENT NO. 4060

In order to expedite the commencement of the remedial action at the Tacoma Landfill site, which is the subject of this action, the United States and the Settling Parties, stipulate as follows:

A. To commence and complete work, submit documents, and to otherwise perform in accordance with the Consent Decree consented to by the Settling Parties and lodged with but not yet entered by this Court.

B. The Parties to this stipulation acknowledge that this stipulation has been entered into in anticipation of settlement and may be affected by a consent decree entered subsequent to this filing. The Parties agree to comply with the terms of this stipulation unless the terms of any subsequently entered consent decree expressly supersede the terms of this stipulation.

Stipulated by:

CITY OF TACOMA

ERLING O. MORK
City Manager
City of Tacoma
Tacoma, Washington

8/16/89
Date

FRED A. THOMPSON
Director of Public Works
City of Tacoma
Tacoma, Washington

16 AUG. 1989
Date

CITY CLERK CONTRACT AGREEMENT NO. 9060

Leslie P. Gianoli — 8/15/89

DAVID H. DOW — Date

Director of Finance 8/15/89

City of Tacoma

Tacoma, Washington

Attest: [signature] — 8-16-89

City Clerk — Date

City of Tacoma

Tacoma, Washington

Approved as [signature] — Aug 16, 1989

to form: — Date

City Attorney

City of Tacoma

Tacoma, Washington

UNITED STATES

[signature] — 11/6/89

STEVEN NOVICK — Date

Attorney

Land and Natural Resources Division

U.S. Department of Justice

Washington, D.C. 20536

[signature] — NOV 3 1989

RICHARD B. STEWART — Date

Assistant Attorney General

Land and Natural Resources Division

U.S. Department of Justice

Washington, D.C. 20530

ROBIE G. RUSSELL
Regional Administrator
Environmental Protection Agency,
Region 10
Seattle, Washington

Sept. 15, 1989
Date

MIKE McKAY
UNITED STATES ATTORNEY

JACKSON L. FOX
Special Assistant United States Attorney
3600 Seafirst Fifth Avenue Plaza
800 Fifth Avenue
Seattle, Washington 98104

November 9, 1989
Date

STATE OF WASHINGTON

CAROL L. FLESKES
Hazardous Waste Investigations
and Cleanup Program Manager
Department of Ecology
Olympia, Washington 98504

Aug. 18, 1989
Date

JEFFREY S. MYERS
Assistant Attorney General
State of Washington
Olympia, Washington 98504

Aug 18, 1989
Date

IT IS SO ORDERED this _____ day of _____, 1989.

UNITED STATES DISTRICT JUDGE

United States District Court

WESTERN DISTRICT OF WASHINGTON

UNITED STATES OF AMERICA,
ON BEHALF OF THE UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
and the
STATE OF WASHINGTON,
DEPARTMENT OF ECOLOGY

v.

CITY OF TACOMA

SUMMONS IN A CIVIL ACTION

CASE NUMBER:

C89-583T

TO: (Name and Address of Defendant)

City of Tacoma, Washington
747 Market Street
Tacoma, Washington 98402

YOU ARE HEREBY SUMMONED and required to file with the Clerk of this Court and serve upon

PLAINTIFF'S ATTORNEY (name and address)

Steven Novick
Land and Natural Resources Division
Environmental Enforcement Section
U.S. Department of Justice
10th Street and Pennsylvania Ave., N.W.
Washington, D.C. 20530

an answer to the complaint which is herewith served upon you, within _____ days after service of this summons upon you, exclusive of the day of service. If you fail to do so, judgment by default will be taken against you for the relief demanded in the complaint.

BRUCE RIFKIN

CLERK

NOV 13 1989

DATE

Karen Kuefler

BY DEPUTY CLERK

Loan Copy
Please return
to EPA

FILED LODGED
RECEIVED
NOV 13 1989
CLERK U.S. DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON AT TACOMA
DEPUTY

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WASHINGTON

UNITED STATES OF AMERICA, ON BEHALF OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY and the STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY, Plaintiffs, v. CITY OF TACOMA Defendant.	C89-583T CIVIL ACTION No. CONSENT DECREE

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CITY CLERK CONTRACT ... NO. 90160

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CITY CLERK C...

I. BACKGROUND

1. The United States Environmental Protection Agency ("EPA"), pursuant to Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. § 9605, placed the Commencement Bay/South Tacoma Channel - Tacoma Landfill Site in Tacoma, Washington (the "Facility" as specifically defined in Paragraph 18 of this Consent Decree) on the National Priorities List, which is set forth at 40 C.F.R. Part 300, Appendix B, by publication in the Federal Register on September 8, 1983, 48 Fed. Reg. 40658 (1983).

2. In response to a release of hazardous substances at or from the Facility, the City of Tacoma, Tacoma Refuse Utility on July 27, 1986, commenced a Remedial Investigation and Feasibility Study ("RI/FS") pursuant to a Response Order by Consent for the Site issued by the State of Washington Department of Ecology ("Ecology").

3. Investigations conducted by the EPA, Ecology, the Settling Defendant and others since 1983 have identified hazardous substances in the soil and groundwater at and around the Site, as well as the migration of landfill gas to adjoining properties. Chlorinated organic compounds, including 1,1,1 - trichloroethane and methylene chloride were detected in three private drinking water wells southwest of the Site.

4. The Settling Defendant completed a Remedial Investigation ("RI") Report on December 18, 1987, and completed a Feasibility Study ("FS") Report on December 22, 1987. The FS Report contains a proposed plan for remedial action at the Facility.

5. On or about January 20, 1988, U.S. EPA, pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, published notice of the completion of the RI/FS and of the proposed plan for remedial action and provided opportunity for public comment to be submitted in writing to EPA by March 4, 1988 or orally at a public meeting held in the City of Tacoma, Washington, on February 11, 1988. EPA, pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, has kept a transcript of the public meeting and has made this transcript available to the public.

6. Pursuant to Section 122(j) of CERCLA, 42 U.S.C. § 9622(j), EPA notified the Federal natural resource trustee of negotiations with potentially responsible parties on the subject of addressing the release or threatened release of hazardous substances at the Facility and EPA has encouraged the participation of the Federal natural resource trustee in such negotiations.

7. Certain persons have provided comments on EPA's proposed plan for remedial action, and to such comments EPA provided a summary of responses. Considering the proposed plan for remedial action and the public comments received, EPA has reached a decision on a final remedial action plan, and the

defendant signatory to this Consent Decree ("Settling Defendant") as defined in Paragraph 18 of this Consent Decree, is in agreement with such plan.

8. EPA's decision on the final remedial action plan is embodied in a document called a Record of Decision ("ROD"), issued March 31, 1988, to which the State has given its concurrence, and which includes a discussion of EPA's reasons for the final plan, a response to each of the significant comments, criticisms and new data submitted during the public comment period for the proposed remedial action plan and any significant changes (and the reasons for such changes) in the proposed remedial action plan.

9. The United States of America ("United States"), on behalf of the United States Environmental Protection Agency and the State of Washington Department of Ecology ("Ecology"), have filed a complaint against the Defendant in this Court pursuant to Sections 106 and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act of 1986 ("CERCLA"), 42 U.S.C. §§ 9606 and 9607 and the State of Washington Model Toxics Control Act (initiative to the Legislature Number 97).

10. The United States and Ecology in their complaint seek (1) reimbursement of response costs incurred to date by EPA and Ecology at the Tacoma Landfill Site in Tacoma, Washington ("the Site"); (2) an injunction requiring the Defendant to

perform remedial work at the Site, as provided in the Record of Decision ("ROD") signed on March 31, 1988 by the EPA Regional Administrator, Region 10, and concurred with by Ecology, and in conformity with the National Contingency Plan ("NCP"), 40 C.F.R. Part 300 (as amended); (3) recovery of costs that will be incurred by EPA and Ecology in connection with such remedial work; and (4) such other relief as the Court finds appropriate.

11. Pursuant to Section 121(d)(1), the United States, Ecology, and Settling Defendant ("the Settling Parties") believe that the remedial action described in this Consent Decree and adopted by EPA and Ecology will attain a degree of cleanup of hazardous substances, pollutants and contaminants released into the environment and of control of further release which at a minimum assures protection of human health and the environment at the Site.

12. The Settling Parties believe the remedial action described in this Consent Decree adopted by EPA and Ecology will provide a level or standard of control for such hazardous substances, pollutants, or contaminants which at least attains legally applicable or relevant and appropriate standards, requirements, criteria, or limitations under federal environmental law or state environmental or facility citing law in accordance with Section 121(d)(2) of CERCLA, 42 U.S.C. § 9621(d)(2); and that the remedial action is in accordance with Section 121 of CERCLA, 42 U.S.C. § 9621, and with the NCP, 40 C.F.R. Part 300. Cleanup standards selected are in compliance

with § 3(2)(d) of the Model Toxics Control Act which requires such standards to be at least as stringent as those required by CERCLA, § 121, and other applicable state and federal laws.

13. The Settling Defendant agrees to implement the remedial action adopted by EPA and Ecology in the ROD attached hereto as Appendix I to this Consent Decree, and EPA and Ecology have determined that the Work required under the Consent Decree will be done properly by Settling Defendant, and that Settling Defendant is qualified to implement the remedial action contained in the ROD.

14. The Settling Parties recognize, and intend to further the public interest in the expedition of the cleanup of the Site and to avoid prolonged and complicated litigation between the Settling Parties.

15. The Settling Parties have agreed to the entry of this Consent Decree; provided that none of the facts or statements herein related shall constitute or be considered admissions of fact or any acknowledgement of liability or fault by consenting Defendant with respect to claims not related to enforcement of this Decree.

NOW, THEREFORE, it is hereby Ordered, Adjudged, and Decreed:

II. JURISDICTION

16. This Court has jurisdiction over the subject matter herein, pursuant to 28 U.S.C. §§ 1331 and 1345, 42

U.S.C. § 9613 and the Model Toxics Control Act (Initiative 97), and over the parties consenting hereto. No Party hereto shall challenge this Court's jurisdiction to enter and enforce this Consent Decree. The parties stipulate that venue in this court is proper pursuant to 42 U.S.C. § 9613(b) and request that a single judge be assigned to decide all issues arising out of this Consent Decree.

III. PARTIES BOUND

17. This Consent Decree applies to and is binding upon the undersigned parties and their successors, assigns, officers, employees, and agents. The undersigned representative of each party to this Consent Decree certifies that he or she is fully authorized by the party or parties whom she or he represents to enter into the terms and conditions of this Consent Decree and to execute and legally bind that party to it. Settling Defendant shall provide a copy of this Consent Decree to each contractor hired to perform the Work required by this Consent Decree and shall require each contractor to provide a copy thereof to any subcontractor retained to perform any part of the Work required by this Consent Decree. Settling Defendant shall condition any contracts for work upon compliance with this Consent Decree. Settling Defendant shall be responsible to the United States and the State of Washington to ensure that its contractors and subcontractors perform the Work contemplated herein in accordance with this Consent Decree.

IV. DEFINITIONS

18. Whenever the following terms are used in this Consent Decree and the Exhibits and Appendices attached hereto, the following definitions specified in this Paragraph shall apply.

A. "ARAR" means a federal or state standard, requirement, criterion, or limitation that is legally applicable or relevant and appropriate to cleanup of the Site, within the meaning of 42 U.S.C. § 9621(d).

B. "Architect" or "Engineer" means the company or companies retained by the Settling Defendant to prepare the construction plans and specifications necessary to accomplish the remedial action described in the ROD and Scope of Work which are attached to this Consent Decree as Appendices I and II.

C. "Consent Decree" means this Decree and all Exhibits and Appendices attached hereto.

D. "Contractor" or "Subcontractor" means the company or companies retained by or on behalf of the Settling Defendant to undertake and complete the Work required by this Consent Decree. Each Contractor and Subcontractor shall be qualified to do those portions of the Work for which it is retained. Each Contractor and Subcontractor shall be deemed to be related by contract to the Settling Defendant within the meaning of Section 107(b) of CERCLA, 42 U.S.C. § 9607(b).

E. "Ecology" means the Washington Department of Ecology.

F. "EPA" means the United States Environmental Protection Agency.

G. "Government Plaintiffs" means the State of Washington Department of Ecology and the United States of America on behalf of EPA, acting alone or together.

H. "Hazardous substance" shall have the meaning provided in Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

I. "Institutional Controls" refers to the land use restrictions and other regulations, ordinances, covenants, and controls developed pursuant to the Consent Decree to maintain the integrity and prevent the unauthorized disturbance of the cap, groundwater extraction wells, treatment facilities, and other structures that will be constructed at the Site as part of the remedial actions.

J. "Model Toxics Control Act" means State Initiative to the Legislature Number 97.

K. "National Contingency Plan ('NCP')" is set forth in 40 C.F.R. Part 300, and any revisions thereof.

L. "Pollutants and Contaminants" shall have the meaning provided in Section 101(33) of CERCLA, 42 U.S.C. § 9601(33).

M. "Record of Decision ('ROD')" shall mean the EPA Record of Decision set forth as Appendix I to this Consent Decree relating to the Site signed on March 31, 1988, by the Regional Administrator, EPA Region 10, and all attachments thereto.

N. "Remedial Action" shall have the meaning provided in Section 101(24) of CERCLA, 42 U.S.C. § 9601(24), and in particular, shall mean all Work required by this Consent Decree, including Appendix II, and all attachments thereto and plans and schedules thereunder, and all amendments to any of the above made in accordance with this Consent Decree.

O. "Remedial Design/Remedial Action Work Plan ('RD/RA Work Plan')" shall mean the plans and their attachments, which describes studies, plans, and remedial actions to be undertaken at and around the site, and includes all studies, plans, standards, schedules, specifications, drawings, and other documents approved or developed by the Government Plaintiffs pursuant to this Consent Decree.

P. "Remedial Investigation/Feasibility Study ('RI/FS')" shall be used as each term is defined in 40 C.F.R. § 300.6.

Q. "Response Costs" means any past and future costs incurred by the Government Plaintiffs pursuant to CERCLA, including oversight costs.

R. "Scope of Work ('SOW')" means the scope of work for implementation of the remedial design, remedial action, and operation and maintenance of the remedial action at the Site, as set forth in Appendix II.

S. "Settling Defendant" means the City of Tacoma.

T. "Settling Parties" means the United States of America, the State of Washington and the Settling Defendant.

U. "State" refers to the State of Washington.

V. Tacoma Landfill Site ("Site") means the approximately 190 acres of land in Pierce County, located in Tacoma, Washington, that is bordered by South 31st Street on the north, Tyler Street on the east, Orchard Street on the west, and by South 48th Street to the south, as shown on the map attached as Appendix IV, and any portions of other properties that contain hazardous substances as a result of a release at the Landfill.

W. "U.S. DOJ" means the United States Department of Justice.

X. "Work" means the design, construction, and implementation, in accordance with this Consent Decree, of the tasks described in the ROD, Scope of Work, and any schedules or plans required to be submitted pursuant thereto.

V. GENERAL PROVISIONS

19. Commitment of Government Plaintiffs and Settling Defendant:

A. Settling Defendant agrees to finance and perform the Work.

B. The Work shall be completed in accordance with all of the requirements of this Decree, the ROD, and the Scope of Work (SOW), including performance standards,

specifications and time periods set forth in Section VI hereof, and in the SOW and ROD.

C. The Government Plaintiffs agree to perform all reviews required under this Consent Decree within the time periods set forth in Section VI hereof, except that any such conduct by the Government Plaintiffs, jointly or severally, described herein by means of the words "shall," "may," or "will," etc., shall not impose an obligation or duty on the Government Plaintiffs, and shall operate at most and only if legally appropriate as a condition precedent to a duty of the Settling Defendant to perform some act or refrain from acting as appropriate under the terms of this Decree.

20. Permits and Approvals:

A. All activities undertaken by the Settling Defendant pursuant to this Consent Decree shall be undertaken in accordance with the requirements of all applicable local, state, and federal laws, regulations, and permits. The Government Plaintiffs have determined that the obligations and procedures authorized under this Consent Decree are consistent with the authority of the Government Plaintiffs under applicable law to establish appropriate remedial measures for the Site.

B. The Government Plaintiffs have determined that no federal, state, or local permits are required for Work conducted entirely on-site as described in the SOW. However, the substantive requirements of the permits shall be met. Settling Defendant shall obtain all permits or approvals necessary for

off-site work under federal, state, or local laws and shall submit timely applications and requests for any such permits and approvals.

C. The Settling Parties agree that if Settling Defendant or its Contractors arrange for the storage, treatment, disposal, or transportation of any hazardous substance off-site, then Settling Defendant will, as required, obtain EPA and Ecology prior written approval of the use of any such off-site facility in accordance with 42 U.S.C. § 9621(e) and RCW 70.105 and will comply with the applicable provisions of 40 C.F.R. Parts 261, 262, 263, 264, 265, and any relevant EPA policies or guidances.

D. The standards and provisions of Section XIV describing Force Majeure shall govern delays in obtaining permits required for the Work and also the denial of any such permits. However, Settling Defendant is required to make complete and timely application for permits and must provide any additional information needed by the regulatory agency in a timely manner.

E. Settling Defendant shall include in all contracts or subcontracts entered into for Work required under this Consent Decree, provisions stating that such Contractors or Subcontractors, including their agents and employees, shall perform all activities required by such contracts or subcontracts in compliance with all applicable laws and regulations. This Consent Decree is not, nor shall it act as, nor is it intended by the Settling Parties to be, a permit issued pursuant to any federal or state statute or regulation.

21. Conveyance of Site/Institutional Controls

A. The restrictions and obligations set forth in this Consent Decree or developed under it shall run with the land and shall be binding upon any and all persons who acquire any interest in any property included in the Site. Within thirty (30) calendar days of entry of this Consent Decree, the Settling Defendant shall record a copy of this Decree with the Auditor's Office, Pierce County, Washington. A copy of the recorded notice shall be sent to Ecology and EPA.

B. The Site as described herein may be freely alienated provided that at least sixty (60) calendar days prior to the date of such alienation, the Settling Defendant notifies the Government Plaintiffs of such proposed alienation, the name of the grantee, and a description of the Settling Defendant's obligations, if any, to be performed by such grantee. In the event of such alienation, all of Settling Defendant's obligations pursuant to this Decree shall continue to be met by the Settling Defendant or, subject to EPA and Ecology approval, by Settling Defendant and the grantee.

C. Any deed, title, or other instrument of conveyance regarding the Site shall contain a notice that the Site is the subject of this Consent Decree, setting forth the style of the case, case number, and Court having jurisdiction herein. Said notation shall also notify any potential purchasers of property contained within the Site that:

(1) The land has been used to manage hazardous substances and the hazardous substances, including those listed in Appendix V to this Consent Decree remain under the cap.

(2) Post-remedial action land use is restricted such that use of the property must never be allowed to disturb the integrity of the cap, or any other component of any containment system, or the function of the Site's monitoring system, unless the Regional Administrator for EPA Region 10 and the Ecology Director find that the disturbance:

a. is necessary to the proposed use of the property and will not increase the potential hazard to human health or the environment; or

b. is necessary to reduce a threat to human health or the environment; and

(3) Restrictions upon the use of groundwater beneath the Site include a prohibition against pumping of groundwater in affected aquifers for purposes other than monitoring or Remedial Action. Anyone seeking to use the groundwater beneath the Site must also comply with all additional present and future restrictions placed on the use of such groundwater by the City of Tacoma or Ecology.

D. The Settling Defendant shall perform all actions necessary or appropriate to implement the above-referenced Institutional Controls on site properties within its jurisdiction. The Settling Defendant shall use its best

efforts to perform or cause to be performed all actions necessary or appropriate to implement the above-referenced institutional controls on site properties outside its jurisdiction. Such actions and efforts shall include, but not be limited to: the recording of notices, plot plans, and other similar documents; and giving notice to local zoning authorities or other governmental entities. The Settling Defendant shall report to the Government Plaintiffs concerning its performance of all such actions.

22. Incorporation of Documents

All exhibits, appendices, and attachments to this Consent Decree and any and all reports, plans, specifications, schedules, and other documents required by the terms of this Consent Decree and approved or developed by the Government Plaintiffs in accordance with the provisions of this Consent Decree (including its exhibits, appendices, and attachments) are incorporated into this Consent Decree and enforceable under it.

VI. PERFORMANCE OF THE WORK BY SETTLING DEFENDANT

23. All remedial design work to be performed by the Settling Defendant pursuant to this Consent Decree shall be under the direction and supervision of a qualified professional architect or engineer with experience in hazardous waste management. Prior to the initiation of remedial design work for the Site, the Settling Defendant shall notify EPA and Ecology in writing, of the name, title, and qualifications of any engineer

or architect proposed to be used in carrying out the remedial design work to be performed pursuant to this Consent Decree.

24. All remedial action work to be performed by the Settling Defendant pursuant to this Consent Decree shall be under the direction and supervision of a qualified professional engineer. Within thirty (30) calendar days prior to the initiation of the remedial action work at the Site, the Settling Defendant shall notify EPA and Ecology in writing, of the name, title, and qualifications of the proposed engineer, and the names of principal contractors and/or subcontractors proposed to be used in carrying out the work to be performed pursuant to this Consent Decree.

25. Appendix II to this Consent Decree provides a Scope of Work ("SOW") for the completion of remedial design and remedial action at the Site. This SOW is incorporated into and made an enforceable part of this Consent Decree.

26. The following Work shall be performed:

A. Within thirty (30) calendar days of the date of the lodging of this Consent Decree with the Court, the Settling Defendant shall submit a Project Management Plan to Ecology and EPA for the remedial design and remedial action at the Site. Additional work plans and reports shall be submitted as required by the SOW. The Project Management Plan, work plans, and reports shall be developed in conformance with the ROD, SOW, "EPA Superfund Remedial Design and Remedial Action Guidance," and the National Contingency Plan (NCP).

B. The Work Plan submittals shall include, but not be limited to, the following project plans: (1) sampling and analysis plans; (2) a health and safety plan; (3) a quality assurance project plan; (4) construction schedules; and (5) an operations and maintenance plan. The Project Management and Work Plans shall include a schedule for implementation of the RD/RA tasks and submittal of RD/RA reports.

C. The Project Management Plan and all other required work plans, documents and reports (hereinafter referred to as "documents") shall be subject to review, modification, and approval by the Government Plaintiffs, consistent with this Consent Decree and Scope of Work.

D. Within thirty (30) calendar days of any document required by this Decree, the Government Plaintiffs shall notify the Settling Defendant, in writing, of approval or disapproval of the document, or any part thereof. In the event that a longer review period is required, the Government Plaintiffs shall notify Settling Defendant of that fact within twenty-five (25) calendar days of receipt of the document. In the event of disapproval, the Government Plaintiffs shall specify, in writing, any deficiencies and required modifications to the document. Nothing in this provision shall negate the Government Plaintiffs' right to approve or disapprove a submittal by the Settling Defendant should the time periods stated in this paragraph be exceeded by Ecology or EPA.

E. Within thirty (30) calendar days of receipt of any document disapproval, the Settling Defendant shall submit a revised document to Ecology and EPA which incorporates the Government Plaintiffs' modifications or shall provide a notice of dispute pursuant to Section XV below.

F. Settling Defendant shall proceed to implement the work detailed in the Project Management and Work Plan upon approval of such plans by the Government Plaintiffs. Unless otherwise directed by the Government Plaintiffs in writing, the Settling Defendant shall not commence field activities until approval by the Government Plaintiffs of the plan covering such activities. A copy of the fully approved Project Management and Work Plans shall be filed with this Court and shall be deemed incorporated into and made an enforceable part of this Consent Decree. All Work shall be conducted in accordance with CERCLA, the Model Toxics Control Act, the NCP, the "EPA Superfund Remedial Design and Remedial Action Guidance," and the requirements of this Consent Decree, including the standards, specifications, and schedules contained in the Project Management and Work Plans.

27. The Settling Parties acknowledge and agree that the SOW and the RD/RA Work Plans and Project Management Plan do not constitute a warranty or representation of any kind by the Government Plaintiffs that the SOW or Project Management and RD/RA Work Plans, will achieve the performance goals and standards set forth in the ROD and in this Consent Decree; and

shall not foreclose the Government Plaintiffs from seeking compliance with all terms and conditions of this Consent Decree, including the achievement of the applicable performance goals and cleanup standards.

28. The Performance Goals and Cleanup Standards are described in the attached Record of Decision and Scope of Work, and include, but are not limited to, the following:

A. Groundwater Cleanup Levels

Drinking water standards, or established and approved health based criteria.

B. Performance Levels for Treatment System Discharge To Surface Water *

(ug/L)

Constituent	Fresh Water	Marine Water
Benzene	5.0	700.0
Chloroethane	20.0	1130.0
1,1-dichloroethane	20.0	1130.0
1,2-dichloroethane	5.0	1130.0
Ethyl benzene	320.0	4.3 **
Methylene Chloride	5.0	6400.0
Toluene	175.0	5000.0
1,1,1-trichloroethane	200.0	312.0
Vinyl chloride	2.0	2.0 **
Xylenes	10.0	10.0 **

* This table shall be supplemented to include the entire list of indicator parameters selected under section 3.1.2.2 of the SOW.

** Value set at fresh water criteria unless other discharge limits can be established from other guidance documents or technical research, as approved by the Government Plaintiffs.

Treatment system effluent must also meet water quality standards, as set forth in WAC 173-201.

C. Performance Levels for Discharge to a Sanitary Sewer

The Settling Defendant shall meet the discharge limits established pursuant to WAC 173-216 and approved by the Government Plaintiffs, and must meet pretreatment regulations, City of Tacoma Code, Chapter 12.08, as revised.

29. No modification by the Settling Defendant shall be made in the performance of the Work which varies from the standards, specifications, or schedules of completion contained in the SOW or the approved Project Management and work plans without prior written approval of the Government Plaintiffs after written notification setting forth the nature of and the reasons for any such requested modification; provided, however, that minor modifications approved by the RPM/On-Scene Coordinator (OSC) and recorded in field notes or meeting minutes and signed by the RPM/OSC, shall satisfy the requirements of this paragraph. The RPM/OSC shall not have authority to modify the performance goals and cleanup standards set forth in paragraph 28 above.

30. The Settling Defendant may petition the Government Plaintiffs for relief from the requirements of the SOW if they can demonstrate, based upon new information, that the Work requirements are inconsistent with CERCLA or the NCP. Any disputes arising under this Section shall be resolved pursuant to the dispute resolution procedures of Section XV.

VII. ADDITIONAL WORK

31. The Settling Defendant shall be required to conduct an abbreviated RI/FS to explore alternative remedial actions should either one of the following events occur:

A. At the end of the pilot study conducted pursuant to the SOW, the Government Plaintiffs determine that groundwater extraction and treatment will not satisfy the requirements of the ROD and Scope of Work.

B. Following certification of the completion of the Remedial Action, contamination levels in the surface water, or groundwater on site exceed the performance standards set forth in the Consent Decree and the ROD.

32. Any alternatives considered by the Settling Defendant shall be evaluated for consistency with the NCP and submitted to EPA and Ecology for review and approval. Before the Government Plaintiffs select an alternative remedial action, they shall provide for a public comment period and EPA shall amend the ROD as appropriate. The Settling Defendant is not relieved of its obligations under this Consent Decree until the performance goals and cleanup standards set forth in this Consent Decree are met.

33. Any additional work determined to be necessary by the Settling Defendant and approved by the Government Plaintiffs or determined to be necessary by the Government Plaintiffs to meet the performance goals and cleanup standards shall be completed by the Settling Defendant in accordance with the

standards, specifications, and schedules approved by the Government Plaintiffs.

VIII. PERIODIC REVIEW TO ASSURE PROTECTION OF HUMAN HEALTH AND ENVIRONMENT

34. To the extent required by Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and any applicable regulations, the Governments Plaintiffs shall review the Remedial Action at the Site at least every five (5) years after the entry of this Consent Decree to assure that human health and the environment are being adequately protected by the Remedial Action being implemented. If upon such review, the Government Plaintiffs determine that further response action in accordance with Section 104 or 106 of CERCLA or further remedial action in accordance with the Model Toxics Control Act is appropriate at the Site, then, consistent with Section XIX of this Consent Decree, the Government Plaintiffs may take or require such action.

35. The Settling Defendant shall be provided with an opportunity to confer with the Government Plaintiffs on any response action required as a result of the Government Plaintiffs' 5-year review and to submit written comments for the record. After the period for submission of written comments is closed, the Government Plaintiffs, shall, in writing, either affirm, modify, or rescind the determination of the need for further response action. The final decision of the Government Plaintiffs shall be subject to review pursuant to the dispute

resolution provisions in Section XV to the extent permitted by Section 113 of CERCLA, 42 U.S.C. § 9613.

IX. IMPLEMENTATION OF REMEDIAL ACTION

36. In the event that the Government Plaintiffs determine that the Settling Defendant has failed to implement the Remedial Action, the Government Plaintiffs may, after notice to the Settling Defendant and consistent with the Dispute Resolution procedures of Section XV, perform any or all portions of the Remedial Action that remain incomplete. If the Government Plaintiffs perform all or portions of the Remedial Action because of the Settling Defendant's failure to comply with their obligations under this Consent Decree, the Settling Defendant shall reimburse the Government Plaintiffs for the costs of doing such work and all interest due within one hundred and twenty (120) days of receipt of demand for payment of such costs, provided that the Settling Defendant is not obligated under this section to reimburse the Plaintiffs for costs incurred for work inconsistent with or beyond the scope of the Remedial Action, unless it is work carried out under the five year reopener provided for by CERCLA as amended, which is referenced in Section VIII, or is work carried out as additional work, which is identified in Section VII. In any proceeding for costs under this section, the Settling Defendant shall have the burden of proving that costs claimed by the Government Plaintiffs were for

work inconsistent with or beyond the scope of the Remedial Action, or were inconsistent with the NCP.

X. QUALITY ASSURANCE

37. Settling Defendant shall use quality assurance, quality control, and chain of custody procedures in accordance with EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (QAM-005/80), EPA's "Data Quality Objective Guidance" (EPA/540/G87/003 and 004), and subsequent amendments to such guidelines. Prior to the commencement of any monitoring project under this Consent Decree and in accordance with the schedule and requirements delineated in or established pursuant to the SOW, Settling Defendant shall submit Quality Assurance Project Plans (QAPPs) to EPA and Ecology. The Government Plaintiffs, after review of Settling Defendant's QAPPs, shall notify the Settling Defendant of any required modifications, conditional approval, disapproval, or approval of the QAPPs. Upon notification of disapproval or any need for modifications, Settling Defendant shall make all required modifications in the QAPPs subject to the dispute resolution provisions of Section XV. Sampling data generated consistent with the QAPPs shall be admissible as evidence, including in any proceeding under Section XV of this Decree or any proceeding to enforce this decree.

38. Selection of any laboratory to be utilized by Settling Defendant in implementing this Consent Decree is subject

to approval by the Government Plaintiffs. Settling Defendant shall ensure that EPA and Ecology and their authorized representatives have access to each laboratory, laboratory worker, laboratory record, and item of equipment utilized in implementing this Consent Decree. Settling Defendant shall also require each laboratory selected to submit a quality assurance plan for Ecology and EPA review. Any laboratory selected shall be certified in timely fashion pursuant to Chapter 173-50 WAC. In addition, Settling Defendant shall require each laboratory to perform analyses of samples provided by EPA and Ecology according to EPA and Ecology specified methods, to demonstrate the quality of each laboratory's analytical data.

XI. SITE ACCESS, SAMPLING, DOCUMENT AVAILABILITY

39. To the extent that the site or other areas where work is to be performed hereunder are presently owned or leased by parties other than those bound by this Consent Decree, Settling Defendant shall use its best efforts to obtain signed access agreements for itself, its contractors and agents, and EPA and Ecology and their contractors and agents from the present owners and lessees no less than ninety (90) days in advance of the date such work is scheduled to commence, or such other time frame approved by the Government Plaintiffs. Said access agreements shall be provided to the Government Plaintiffs within five (5) days of their execution, and will be attached as part of Appendix III of this Decree. If the work includes the

installation and operation of monitoring wells, pumping wells, or treatment facilities, or other response actions, Settling Defendant shall use its best efforts to obtain access agreements that provide that no conveyance of title, easement, or other interest in the property shall be consummated without provisions for the continued operation of such wells, treatment facilities, or other response actions on the property, and also provide that the owners of any property where monitoring wells, pumping wells, treatment facilities or other response actions are located shall notify the Government Plaintiffs and Settling Defendant by Certified Mail, at least thirty (30) days prior to any conveyance, of the property owner's intent to convey any interest in the property and of the provisions made or to be made for the continued operation of the monitoring wells, pumping wells, treatment facilities, or other response actions installed pursuant to this Consent Decree.

40. In the event that the Settling Defendant does not obtain adequate access agreements within the time period prescribed, Settling Defendant shall notify the Government Plaintiffs in writing within five (5) calendar days after the close of such period regarding both the lack of such agreements and the efforts made to obtain them. In the event that the Government Plaintiffs obtain access for the Settling Defendant, Settling Defendant agrees to indemnify the Government Plaintiffs for all costs incurred in obtaining such access. Payment shall

be made in accordance with the provisions of section XVII (Reimbursement).

41. The Government Plaintiffs or any authorized representative of the Government Plaintiffs shall have the authority to enter and freely move about all property at the Site at all reasonable times for the purpose of, inter alia: inspecting records, operation logs, and contracts related to the Site; reviewing the progress in carrying out the terms of this Consent Decree; conducting such tests or collecting samples as they may deem necessary; using a camera, sound recording, or other documentary type equipment to record work done pursuant to this Consent Decree; and verifying the data submitted to the Government Plaintiffs by the Settling Defendant. Before entering the landfill property, the Government Plaintiffs shall notify the Refuse Utility of their intent to enter the landfill property, unless other arrangements are agreed to by the parties or otherwise provided for by court order. Nothing in this consent decree shall be construed to limit any rights of entry the Government Plaintiffs have under either State or Federal law.

42. Settling Defendant shall make available to the Government Plaintiffs the results of all sampling and/or tests, quality assurance data, and other data generated by Settling Defendant with respect to the implementation of this Consent Decree within ninety (90) days of sample collection or field testing or within fifteen (15) days of receipt of all results for a sampling event, whichever is sooner, and shall submit these

results in the monthly progress report as described in Section XII of this Consent Decree within thirty (30) calendar days of receipt of the data, provided that where Settling Defendant has or gathers, data not required by this Consent Decree, such data shall be submitted within fifteen (15) days of a request therefore in writing.

43. At the request of the Government Plaintiffs, or its designated representatives, Settling Defendant shall allow split or replicate samples to be taken by the Government Plaintiffs, and/or their authorized representatives, of any samples collected by Settling Defendant pursuant to the implementation of this Consent Decree. As required by 42 U.S.C. § 9604(e)(4)(b), the Government Plaintiffs and their representatives shall provide to Consenting Defendant a receipt for all samples taken, provide, if requested, a portion of all samples taken, and provide a copy of the results of any analysis made of samples taken. Settling Defendant shall notify the Government Plaintiffs not less than seven (7) calendar days in advance of any well installation or sample collection activity. In addition, the Government Plaintiffs shall have the right to take any additional samples that the Government Plaintiffs deem necessary.

XII. REPORTING REQUIREMENTS

44. Settling Defendant shall provide or cause their contractors or agents to prepare and provide to the Government

Plaintiffs written monthly progress reports which: (1) describe the actions which have been taken toward achieving compliance with this Consent Decree during the previous month; (2) include all results of sampling and tests and all other data received by Settling Defendant during the previous month regarding the Work; (3) include all work products completed under the Project Management and Work Plans during the previous month; (4) describe all actions, data, and deliverables which are scheduled for the next two months and provide other information relating to the progress of construction as is customary in the industry; (5) include information regarding percentage of completion of the RD/RA Work, unresolved delays encountered or anticipated that may affect the future schedule for implementation of the RD/RA Work, and a description of efforts made to mitigate those delays or anticipated delays. These progress reports are to be submitted to the Government Plaintiffs by the tenth day of every month following the first full month after the effective date of this Consent Decree.

45. If the date for submission of any item or notification required by this Consent Decree falls upon a weekend or state, city, or federal holiday, the time period for submission of that item or notification is extended to the next working day following the weekend or holiday.

46. Upon the occurrence of any event during performance of the Work which, pursuant to Section 103 of CERCLA, 42 U.S.C. § 9603, and pursuant to 40 C.F.R. § 300.63, requires

reporting to the National Response Center, Settling Defendant shall within twenty-four (24) hours orally notify the RPMs, and the Emergency Response Section, Region 10, United States Environmental Protection Agency, in addition to the reporting required by Section 103 of CERCLA. Within twenty (20) calendar days of the onset of such an event, Settling Defendant shall furnish to the Government Plaintiffs a written report setting forth the events which occurred and the measures taken, and to be taken, in response thereto. Within thirty (30) calendar days of the conclusion of such an event, Settling Defendant shall submit a report setting forth all final actions taken to respond thereto.

XIII. DESIGNATION OF REMEDIAL PROJECT MANAGER/ON-SCENE COORDINATOR AND PROJECT COORDINATOR

47. EPA and Ecology shall each designate a Remedial Project Manager (RPM) and alternate for the Site, and the Government Plaintiffs may designate other representatives, including EPA and Ecology employees, and federal and state contractors and consultants, to observe and monitor the progress of any activity undertaken pursuant to this Consent Decree. The RPMs shall have the authority lawfully vested in RPMs and On-Scene Coordinators by the National Contingency Plan, 40 C.F.R. Part 300. In addition, the RPMs shall have authority to halt, conduct, or direct any work required by this Consent Decree and to take any necessary response action when, in the opinion of the RPM, conditions at the Site may or do present or contribute to an

imminent and substantial endangerment to public health or welfare or to the environment. In the event the RPM does require such cessation of the Work, the RPM/OSC then shall have the authority to require the Settling Defendant to take actions in accordance with the instructions of the RPM to avoid or mitigate the endangerment or release which the RPM believes may occur. If the Settling Defendant objects to any order by the RPM, it may petition the Court to stay or set aside the order of the RPM. The filing of such a petition shall not operate to stay the effectiveness of such order, nor shall it in any way operate to preclude the Government Plaintiffs from taking response actions, or from seeking to enforce such order. Settling Defendant shall also designate a Project Coordinator who will have primary responsibility for ensuring the implementation of the Work at the Site.

48. To the maximum extent possible, except as specifically provided in this Consent Decree, communications between Settling Defendant and the Government Plaintiffs concerning the implementation of the Work under this Consent Decree shall be made between the Project Coordinator and the RPMs.

49. Within twenty (20) calendar days of the effective date of this Consent Decree, Settling Defendant and the Government Plaintiffs shall notify each other, in writing, of the name, address, and telephone number of the designated Project Coordinator and Alternate Project Coordinator, and the RPMs for

EPA and Ecology and their Alternates. Any Party may change its respective project manager/coordinator by notifying the other Party, in writing, at least ten (10) calendar days prior to the change.

XIV. FORCE MAJEURE

50. Force Majeure for purposes of this Consent Decree is defined as any event arising from causes entirely beyond the control of the Settling Defendant which Settling Defendant could not avoid by the exercise of due diligence and which delays or prevents the performance of any obligation under this Consent Decree. Force Majeure shall not include increased costs or expenses in connection with the performance of the Work under the Consent Decree, or changed financial circumstances of Settling Defendant.

51. When circumstances occur which may delay the completion of any phase of the Work or delay access to the Site or to any property on which any part of the Work is to be performed, whether or not caused by a force majeure event, Settling Defendant shall promptly orally notify the RPMs, or in the event of the RPMs' unavailability, the alternates. Within five (5) working days of the event which Settling Defendant contend is responsible for the delay, Settling Defendant shall supply to Government Plaintiffs in writing the reason(s) for and anticipated duration of such delay, the measures taken and to be taken by Settling Defendant to prevent or minimize the delay, and

the timetable for implementation of such measures. Failure to give oral notice to the RPMs and to give written explanation to Government Plaintiff in a timely manner shall constitute a waiver of any claim of force majeure.

52. Upon the occurrence of an event which Settling Defendant allege is a force majeure event, Settling Defendant may request an extension of schedule in accordance with Section XXII.

53. If the Government Plaintiffs and Settling Defendant cannot agree that the reason for the delay was a force majeure event, or that the duration of the delay is or was warranted under the circumstances, the Settling Parties shall resolve the dispute according to Section XV hereafter. Settling Defendant has the burden of proving force majeure as a defense to compliance with this Consent Decree.

XV. DISPUTE RESOLUTION

54. The parties to this Consent Decree shall attempt to resolve expeditiously and informally any disagreements concerning implementation of this Consent Decree or any Work required hereunder. Informal negotiations between the parties to the dispute may last for a period of up to fourteen (14) calendar days from the date that notice of the existence of the dispute is first given.

55. In the event that any dispute arising under this Consent Decree is not resolved informally within the time period indicated in paragraph 54 above, any party desiring dispute

resolution under this Section shall give written notice to the other parties to the Decree within ten (10) calendar days of the end of the informal dispute resolution period.

56. Within ten (10) calendar days of the service of notice of dispute pursuant to paragraph 55, the party who gave the notice shall serve on the other parties to this Decree a written statement of the issues in dispute, the relevant facts upon which the dispute is based, and factual data, analysis or opinion supporting its position, and all supporting documentation on which such party relies (hereinafter the "Statement of Position"). Opposing parties shall serve their Statements of Position, including supporting documentation, no later than ten (10) calendar days after receipt of the complaining party's Statement of Position. In the event that these ten-day time periods for exchange of Statements of Position may cause a delay in the Work, they shall be shortened in accordance with written notice by the Government Plaintiffs.

57. An administrative record of any dispute under this Section shall be maintained by the Government Plaintiffs. The record shall include the written notification of such dispute and the Statements of Positions served pursuant to the preceding paragraph. The record shall be available for review by all parties.

58. Upon review of the administrative record the Government Plaintiffs shall issue a final decision and order resolving the dispute.

59. Any decision and order of the Government Plaintiffs pursuant to the preceding Paragraph 58 shall be binding unless a Notice of Judicial Appeal is filed with this Court within ten (10) calendar days of receipt of the Government Plaintiffs' decision and order. In any event, judicial review will be conducted on the administrative record, using an arbitrary and capricious standard. The Settling Defendant shall bear the burden of proof for demonstrating that the decision is arbitrary and capricious. The filing of a judicial appeal shall not stay Settling Defendant's obligation to pay stipulated penalties pursuant to Section XVIII. After the date of termination of this Consent Decree specified in Section XXXII hereof, judicial review will be available only by instituting new action(s) to the extent permitted by law.

60. The invocation of the procedures stated in this Section shall not extend or postpone Settling Defendant's obligations under this Consent Decree with respect to the disputed issue unless and until the Government Plaintiffs find, or the Court orders, otherwise.

61. In no event will the performance standards for the Work be subject to dispute resolution.

62. Any dispute arising under this Consent Decree between the Government Plaintiffs shall be resolved in accordance with a Memorandum of Agreement (MOA) executed by the Government Plaintiffs, which shall be filed with the Court and be deemed incorporated into this Consent Decree.

XVI. RETENTION AND AVAILABILITY OF INFORMATION

63. Settling Defendant shall make available to EPA and Ecology, and shall retain, during the pendency of this Consent Decree and for a period of ten (10) years after its termination, all records, data, and documents in their possession, custody, or control which relate to the performance of this Consent Decree, including, but not limited to, documents reflecting the results of any sampling, tests, or other data or information generated or acquired by any of them, or on their behalf, with respect to the Site and all documents pertaining to their own or any other person's liability for response action or costs under CERCLA. Settling Defendant shall require all such records in the possession of contractors or agents to be provided to it and shall retain originals or true copies of all such records. After the ten (10) year period of document retention, Settling Defendant shall notify U.S. DOJ, EPA, and Ecology at least ninety (90) calendar days prior to the destruction of any such documents, and upon request by U.S. DOJ, EPA or Ecology, Settling Defendant shall relinquish custody of the documents to the requesting party.

64. Settling Defendant may assert business confidentiality claims covering part or all of the information provided in connection with this Consent Decree in accordance with Section 104(e)(7)(A) of CERCLA, 42 U.S.C. § 9604(e)(7)(A), and pursuant to 40 C.F.R. § 2.203(b).

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65. Information determined to be confidential by EPA will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B, and such information shall be treated by Ecology consistent with Ch. 42.17 RCW and Ch. 43.21A RCW. If no such claim accompanies the information when it is submitted to the EPA or Ecology, the public may be given access to such information without further notice to Settling Defendant.

66. Information acquired or generated by Settling Defendant in performance of the Work that is subject to the provisions of Section 104(e)(7)(F) of CERCLA, 42 U.S.C. § 9604(e)(7)(F), shall not be claimed as confidential by Settling Defendant.

XVII. REIMBURSEMENT

67. Settling Defendant shall pay $511,158.26, plus interest due. Interest shall begin to accrue on the unpaid balance on the date of the entry of this Consent Decree. Payment shall be made in four quarterly installments of not less than $127,789.57, due on October 31, 1989, January 31, 1990, April 30, 1990, and July 31, 1990 to the "EPA Hazardous Substance Response Superfund." Such payments shall be sent to the U.S. Attorney's Office Att: Barbara Brouner, 800 Fifth Avenue, Seattle, Washington, 98101, in the form of a certified or cashier check payable to "Hazardous Substances Superfund," and shall contain the site name and civil action number. A copy of each

check with an explanatory transmittal letter shall be sent to the Director of the Hazardous Waste Division, EPA, Region 10.

68. The payments made under Paragraph 67 of this Section are reimbursement of any costs incurred through February 3, 1987 for state cooperative agreement costs, through July 31, 1988 for TES contract costs, through October 22, 1988 for EPA payroll costs, indirect costs, and other contract costs, and through November 18, 1988 for EPA regional travel costs, claimed by the United States in this action. Nothing herein shall be construed as limiting the rights of the United States to seek any cost recovery from liable persons not a party to this Decree. In consideration of the monies received under Paragraph 67 of this Section, the United States covenants not to sue Settling Defendant for such past costs pursuant to CERCLA, 42 U.S.C. § 9601 et seq.

69. Settling Defendant shall pay $83,601.85, plus interest due. Interest shall begin to accrue on the unpaid balance on the date of the entry of this Consent Decree. Payment shall be made in four quarterly installments of not less than $20,902.67, due on October 31, 1989, January 31, 1990, April 30, 1990, and July 31, 1990 to the State Toxics Control Account of the State of Washington. Such payments shall be sent to the appropriate account, identified by Ecology, in the form of a certified or cashier check Payable to the "State of Washington," and shall contain the site name and civil action number. The payments made under this paragraph are reimbursement

of costs incurred through March 31, 1989 (past costs) claimed by Ecology in this action. Payment of funds pursuant to this Paragraph shall fully satisfy the Settling Defendant's obligations for past costs incurred by Ecology. Nothing herein shall be construed as limiting the rights of Ecology to seek any cost recovery from liable persons not party to this Decree. In consideration of the monies received under this paragraph, the State of Washington covenants not to sue Settling Defendant for any past costs. Interest on all amounts owed to the State of Washington under this Consent Decree, shall be calculated as provided for in RCW 4.56.110 and 19.52.020.

70. Settling Defendant shall pay all Response Costs incurred by the United States and the State of Washington relating to the Site incurred prior to the entry of this Consent Decree and not covered by paragraphs 67, 68, and 69, including any interest due, within ninety (90) days of the submission of itemized cost statements and supporting documentation. Such costs include but are not limited to, payroll, travel, indirect and contracting costs. Settling Defendant shall also pay costs incurred by the United States after the effective date of this Consent Decree for oversight of the Remedial Design and Remedial Action. Payments to the United States shall be made by the Settling Defendant on an annual basis and within sixty (60) calendar days of the submission of itemized cost statements and supporting documentation, and include any interest due. The United States shall submit its oversight cost claims following

the end of each federal fiscal year. Payments shall be made as specified in paragraph 67 above, and shall include any interest due. In consideration of and upon payment of all Response Costs as required by this paragraph, the United States covenants not to sue Settling Defendant for any costs incurred in overseeing the Work.

71. The Settling Defendant agrees to reimburse the State Toxics Control Account of the State of Washington, for Ecology's reasonable and appropriate costs, including costs due under paragraph 70, as shown by an itemized statement of such costs compiled and presented in conformance with State of Washington Financial Management standards and procedures associated with Ecology's oversight of the Remedial Design and Remedial Action that are consistent with the NCP or the Model Toxics Control Act. Within ninety (90) days of the end of such fiscal quarter, Ecology will submit to the Settling Defendant an itemized statement of Ecology's expenses for the previous quarter. Following receipt of the itemized statement, the Settling Defendant shall pay, within ninety (90) days, into the State Toxics Control Account of the State of Washington, the required sum, which shall include any interest due.

72. If oversight costs are outstanding at the time the United States and the State of Washington plan to terminate this Consent Decree, Settling Defendant shall, within sixty (60) calendar days of the submission of an itemized cost statement and supporting documentation by the United States and/or the State of

Washington, and before termination of this Consent Decree, pay such oversight costs and any interest due.

73. The Response Costs set forth in this Section are not inconsistent with the NCP.

XVIII. STIPULATED PENALTIES

74. Settling Defendant shall pay stipulated penalties in the amounts set forth in Paragraph 81 for each violation of the requirements of this Consent Decree or of the Project Management and Work Plans approved pursuant to this Consent Decree, unless the Government Plaintiffs determine that such failure is excused under Section XIV ("Force Majeure"). Violations by Settling Defendant shall include, but are not limited to, failure to complete an activity under this Consent Decree within the specified time schedules in and approved under this Consent Decree. Modifications of the time for performance shall be made pursuant to Section XXII ("Extension of Schedules").

75. All penalties begin to accrue on the day that complete performance is due or a violation occurs, and continue to accrue through the final day of correction of the noncompliance. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Consent Decree.

76. Following the determination by the Government Plaintiffs that Settling Defendant has failed to comply with any

requirement of this Consent Decree, the Government Plaintiffs shall give Settling Defendant written notification of the same and describe the noncompliance. This notice shall also indicate the amount of penalties currently due, and the rate of accrual for continuous violations.

77. All penalties owed under this Section shall be payable within thirty (30) calendar days of receipt of the notification of noncompliance, unless Settling Defendant invokes the dispute resolution procedures under Section XV. Penalties shall accrue from the date of violation regardless of whether the Government Plaintiffs have notified Settling Defendant of a violation. Interest shall begin to accrue on the unpaid balance at the end of the thirty day period pursuant to Paragraph 84 of this Section. Such penalties shall be paid by certified check one-half to the "Hazardous Substances Superfund" and one-half to the State Toxics Control Account, and shall contain Settling Defendant's complete and correct address, the site name, and the civil action number. All checks to the Hazardous Substance Superfund shall be mailed to U.S. Attorney's Office, Attn: Barbara Brouner, 800 Fifth Avenue, Seattle, Washington, 98101. All checks to the State Toxics Control Account shall be sent to the appropriate account, identified by Ecology.

78. Neither the filing of a petition to resolve a dispute nor the payment of penalties shall alter in any way Settling Defendant's obligation to fully perform the requirements of this Consent Decree.

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79. Settling Defendant may dispute the Government Plaintiffs' right to the stated amount of penalties by invoking the dispute resolution procedures under Section XV. Penalties shall accrue but need not be paid during the dispute resolution period. If the District Court becomes involved in the resolution of the dispute, the period of dispute shall end upon the rendering of a decision by the District Court regardless of whether any party appeals such decision. If Settling Defendant does not prevail upon resolution, the Government Plaintiffs have the right to collect all penalties which accrue prior to and during the period of dispute. In the event of an appeal, such penalties shall be placed into an escrow account until a decision has been rendered by the final court of appeal. If Settling Defendant prevails upon resolution, no penalties shall be payable.

80. No penalties shall accrue for violations of this Consent Decree caused by events determined by the Government Plaintiffs to be beyond the control of Settling Defendant as identified in Section XIV ("Force Majeure"). Settling Defendant has the burden of proving force majeure or compliance with this Consent Decree.

81. The following stipulated penalties shall be payable per violation per day for any noncompliance identified in Paragraph 74 above. The Government Plaintiffs shall assess the stipulated penalties at or above the minimum and at or below the maximum. Such assessment is committed to the sole discretion of

CITY CLERK CONTRACT

the Government Plaintiffs and is not subject to dispute.

Minimum	Maximum	Period of Noncompliance
$2,000	$5,000	1st through 14th day
$5,000	$10,000	15th through 30th day
$10,000	$25,000	31st day and beyond

82. No payments made under this Section shall be tax deductible.

83. This Section shall remain in full force and effect for the term of this Consent Decree.

84. Pursuant to 31 U.S.C. § 3717, interest shall accrue on any amounts overdue at a rate established by the Department of Treasury for any period after the date of billing. A handling charge will be assessed at the end of each thirty day late period, and a six percent per annum penalty charge will be assessed if the penalty is not paid within ninety (90) calendar days of the due date.

85. If Settling Defendant fails to pay stipulated penalties, the Government Plaintiffs may institute proceedings to collect the penalties. Notwithstanding the stipulated penalties provisions of this Section, the Government Plaintiffs may elect to assess civil penalties and/or bring an action in U.S. District Court pursuant to Section 109 of CERCLA, as amended, or other applicable law to enforce the provisions of this Consent Decree. Payment of stipulated penalties shall not preclude the Government Plaintiffs from electing to pursue any other remedy or sanction to enforce this Consent Decree, including seeking additional

penalties for court or criminal contempt proceedings, and nothing shall preclude the Government Plaintiffs from seeking statutory penalties against Settling Defendant for violations of any statutory or regulatory requirements.

XIX. COVENANT NOT TO SUE

86. In consideration of actions which will be performed and payments which will be made by the Settling Defendant under the terms of this Consent Decree, and except as otherwise specifically provided in this Decree, the Government Plaintiffs covenant not to sue the Settling Defendant or its officers, directors, employees, or agents for Covered Matters. With respect to suits brought by the Government Plaintiffs, Covered Matters shall include the civil claims with respect to the Site asserted by Plaintiff United States on behalf of EPA, under Sections 106 and 107 of CERCLA and by the State of Washington on behalf of Ecology, under CERCLA or the Model Toxics Control Act, in the Complaint filed herein. With respect to future liability, this covenant not to sue shall take effect upon certification by the Government Plaintiffs of the completion of the Remedial Action concerning the Site.

87. "Covered Matters" does not include:

A. Liability arising from hazardous substances removed from the Site;

B. Natural resource damages;

C. Criminal liability;

D. Claims based on a failure by the Settling Defendant to meet the requirements of this Consent Decree;

E. Liability for violations of Federal and State law which occur during implementation of the remedial action;

F. Any matters for which the Government Plaintiffs are owed indemnification under Section XXI hereof;

G. Liability for costs incurred by the Government Plaintiffs arising from the past, present, or future disposal of hazardous substances outside of this Site;

H. Liability for contamination at the Site by contaminants not identified in the ROD and those contaminants not subject to Maximum Contaminant Levels promulgated pursuant to the Safe Drinking Water Act ("SDWA"), 42 U.S.C. § 300 et seq.

XX. RESERVATION OF RIGHTS

88. Notwithstanding any other provision in this Consent Decree, the Government Plaintiffs reserve the right to institute proceedings in this action or in a new action or to issue an order seeking to compel the Settling Defendant to perform any additional response work at the Site or necessitated

by a release from the Site, and the Government Plaintiffs reserve the right to institute proceedings in this action or in a new action seeking to reimburse the Government Plaintiffs for their Response Costs relating to the Site, if:

A. for proceedings prior to certification of completion of the Remedial Action concerning the Site;

(i) conditions at the Site, previously unknown to the United States or the State of Washington, are discovered after the entry of this Consent Decree, or

(ii) information is received, in whole or in part, after the entry of this Consent Decree,

and these previously unknown conditions or this information indicates that the Remedial Action is not adequately protective of human health or the environment; and

B. for proceedings subsequent to the certification of completion of the Remedial Action concerning the Site,

(i) conditions at the Site, previously unknown to the United States or the State of Washington, are discovered after the certification of completion by the Government Plaintiffs, or

(ii) information is received, in whole or

in part, after the certification of completion,

and these previously unknown conditions or this information indicates that the remedial action is not adequately protective of human health or the environment.

89. Notwithstanding any other provision in this Consent Decree, the covenant not to sue in Section XIX shall not relieve the Settling Defendant of its obligation to meet and maintain compliance with the requirements set forth in this Consent Decree, including the conditions in the ROD, which are incorporated herein. The United States and the State of Washington reserve their rights to take response actions at the Site in the event of a breach of the terms of this Consent Decree and to seek recovery of costs incurred after entry of the Consent Decree: (1) resulting from such a breach; (2) relating to any portion of the Work funded or performed by the United States and the State of Washington; or (3) incurred by the United States and the State of Washington as a result of having to seek judicial assistance to remedy conditions at or adjacent to the Site.

90. Nothing in this Consent Decree shall constitute or be construed as a release or a covenant not to sue regarding any claim or cause of action against any person, firm, trust, joint venture, partnership, corporation, or other entity not a signatory to this Consent Decree for any liability it may have arising out of or relating to the Site. The Government

Plaintiffs expressly reserve the right to sue any person other than the Settling Defendant, in connection with the Site.

XXI. INDEMNIFICATION; OTHER CLAIMS

91. Settling Defendant agrees to indemnify, save, and hold harmless the United States, EPA, the State of Washington, Ecology and/or their agents, employees and representatives from any and all claims or causes of action arising from acts or omissions of Settling Defendant and/or its officers, employees, agents, contractors or representatives in carrying out the activities pursuant to this Consent Decree. EPA and Ecology shall notify Settling Defendant of any such claims or actions within sixty (60) working days of receiving notice that such a claim or action is anticipated or has been filed. EPA and Ecology agree not to act with respect to any such claim or action without first providing Settling Defendant an opportunity to participate. Settling Defendant does not hereby assume liability or responsibility for claims or liabilities arising from the negligence of the Government Plaintiffs, its officers, agents or representatives.

92. Nothing in this Consent Decree shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person, firm, partnership, corporation, or state or local government entity not a signatory to this Consent Order for any liability it may have arising out of or relating in any way to the generation, storage, treatment,

CITY CLERK COPY

handling, transportation, release, or disposal of any hazardous substances, hazardous wastes, pollutants, or contaminants found at, taken to, or taken from the site.

93. EPA and Ecology are not to be construed as parties to, and do not assume any liability for any contract entered into by Settling Defendant in carrying out the activities pursuant to this Consent Decree. The proper completion of the Work under this Consent Decree is solely the responsibility of Settling Defendant.

94. Settling Defendant waives its right to assert any claims against the Hazardous Substances Superfund under CERCLA that are related to any past costs or costs incurred in the Work performed pursuant to this Consent Decree, and nothing in this Consent Decree shall be construed as EPA's preauthorization of a claim against the Hazardous Substances Superfund.

95. Settling Defendant waives its right to assert any claims against the State Toxics Control Account under the Model Toxics Control Act that are related to any past costs or costs incurred in the work performed pursuant to this Consent Decree, and nothing in this Consent Decree shall be considered as Ecology's preauthorization of a claim against the State Toxics Control Account.

96. Nothing in this Consent Decree shall be construed to limit the right of the City of Tacoma to apply for grants from the local toxics control account, pursuant to Section 7(3) of the Model Toxics Control Act and any regulations promulgated

thereunder, or any other financial assistance which may become available in the future from any source.

97. The Settling Defendant covenants not to sue or assert any claims or causes of action against the United States and the state of Washington, their employees, the Hazardous Substance Superfund and the State Toxics Control Account for costs, damages or attorney's fees arising out of response activities at the site.

XXII. EXTENSION OF SCHEDULES

98. Any request by Settling Defendant for an extension shall be submitted in writing and shall specify:

A. the timetable, or schedule for which an extension is sought;

B. the length of the extension sought;

C. the cause for the extension; and

D. any related timetable, deadline or schedule that would be affected if the extension were granted.

99. The Government Plaintiffs may extend timetables and schedules upon receipt of a timely request for extension. An extension may be sought in the event of any one of the following:

A. An event of force majeure as defined in Article XIV;

B. A delay caused by the Government Plaintiff's failure to meet any requirement of this Consent Decree; or

C. A stoppage of work pursuant to Section XXIII, or Paragraph 47 of this Consent Decree.

100. If the Government Plaintiffs agree that an extension of schedule is warranted under the circumstances, the Settling Parties may modify the RD/RA Work schedule to provide such additional time necessary to allow the completion of the specific phase of the Work and/or any succeeding phase of the work affected by such delay. If there is no consensus among the Parties as to whether all or part of the requested extension is warranted, the timetable or schedule shall not be extended except in accordance with the determination resulting from the dispute resolution process.

101. In addition, the Government Plaintiffs' designated remedial project managers may provide extensions of up to thirty (30) days in other circumstances if they jointly determine in their collective discretion that such extensions are appropriate. Such determinations are not subject to dispute resolution.

102. Upon any modification of schedules as provided herein, the Government Plaintiffs shall file a notice reflecting such modifications with the Court.

XXIII. ENDANGERMENT

103. In the event the Government Plaintiffs determine or concur in a determination by another local, state, or federal agency that activities implementing this Consent Decree, or any

other circumstances or activities, are creating or have the potential to create an imminent and substantial endangerment to the public health or welfare or the environment, the Government Plaintiffs may order the Settling Defendant to stop further implementation of this Consent Decree for such period of time as needed to abate the danger.

104. In the event the Settling Defendant determines that activities undertaken in furtherance of this Consent Decree or any other circumstances or activities are creating or have the potential to create an imminent and substantial endangerment to the people on the Site or in the surrounding area or to the environment, the Settling Defendant may stop implementation of this Consent Decree for such periods of time necessary for the Government Plaintiffs to evaluate the situation and determine whether the Settling Defendant should proceed with implementation of the Consent Decree or whether the work stoppage should be continued until the danger is abated. The Settling Defendant shall notify the project managers as soon as possible, but not later than twenty-four (24) hours if the stoppage occurs on a weekday, and forty-eight (48) hours if the stoppage occurs on a weekend or holiday, after such stoppage of work, and provide the Government Plaintiffs with documentation of its analysis in reaching its determination that it was necessary to stop work. If the Government Plaintiffs disagree with the determination by the Settling Defendant it may order the Settling Defendant to resume implementation of the Consent Decree.

105. Any disagreements pursuant to this clause shall be resolved through the dispute resolution procedures.

XXIV. NOTICES

106. Whenever, under the terms of this Consent Decree, notice is required to be given, a report or other document is required to be forwarded by one party to another, or service of any papers or process is necessitated by the dispute resolution provisions of Section XV hereof, such correspondence shall be directed to the following individuals at the addresses specified:

As to EPA:

Three copies to:

a. Tacoma Landfill Remedial Project Manager (HW-113)
Superfund Branch
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

As to the State of Washington or Ecology,

Three copies to:

b. Tacoma Landfill Site Manager
Department of Ecology
Hazardous Waste Investigations and Cleanup Program
Mail Stop PV-11
Olympia, Washington 98504-8711

As to Settling Defendant,

One copy to:

c. Tacoma City Attorney
1120 Municipal Building
747 Market Street
Tacoma, Washington 98402

CITY CLERK 4060

d. Tacoma Director of Public Works
420 Municipal Building
747 Market Street
Tacoma, Washington 98402-3769

XXV. CONSISTENCY WITH NATIONAL CONTINGENCY PLAN

107. The Consenting Parties and Settling Defendant agree that if the Government Plaintiffs determine that the Work is properly performed as set forth in Section V and VI hereof, then the Work is consistent with the provisions of the NCP pursuant to 42 U.S.C. § 9605.

XXVI. COMPLIANCE WITH LAWS

108. Subject to the limitations of Paragraph 107, all actions carried out by the Consenting Parties pursuant to this Consent Decree shall be done in accordance with all applicable federal and state statutes, rules, regulations and ordinances.

XXVII. RESPONSE AUTHORITY

109. Nothing in this Consent Decree shall be deemed to limit the response authority of the Government Plaintiffs under 42 U.S.C. §§ 9604 and 9606, and the Model Toxics Control Act, or to alter the applicable legal principles governing the judicial review of EPA's Record of Decision concerning remedial action at the Site.

XXVIII. MODIFICATION

110. Except as provided for herein, there shall be no modification of this Consent Decree without written approval of all parties to this Consent Decree.

XXVIX. PUBLIC PARTICIPATION

111. The Government Plaintiffs shall publish a notice of this Consent Decree's availability for review and comment upon its lodging with the United States District Court as a proposed settlement in this matter pursuant to the provisions of 42 U.S.C. § 9622 and 28 C.F.R. § 50.7. The Government Plaintiffs will provide persons who are not parties to the proposed settlement with the opportunity to file written comments during at least a thirty (30) calendar day period following such notice. The Government Plaintiffs will file with the Court a copy of any comments received and the responses of the Government Plaintiffs to such comments. After the closing of the public comment period, the Government Plaintiffs reserve the right after review of such comments to withdraw their consent to the settlement if such comments disclose facts or considerations which indicate that the proposed settlement is inappropriate, improper, or inadequate.

112. Ecology has provided public notice and held a hearing on this proposed settlement in compliance with Section 4(4)(a) of the Model Toxics Control Act. Ecology finds that this Consent Decree will lead to a more expeditious cleanup and is in

compliance with cleanup standards under Section 3(2)(d) and remedial orders issued by Ecology.

XXX. COMMUNITY RELATIONS

113. Settling Defendant shall cooperate with the Government Plaintiffs in providing information regarding the progress of the remedial design and remedial action at the Site to the public. As may be requested by the Government Plaintiffs, Settling Defendant agrees to participate in the preparation of appropriate information disseminated to the public and in public meetings which may be held or sponsored by EPA or Ecology to explain activities at or concerning the Site. The Government Plaintiffs shall be responsible for community relations.

XXXI. FINANCIAL RESPONSIBILITY

114. The Settling Defendant shall, within ten (10) working days of the date of entry of this Consent Decree, and every ninety (90) calendar days thereafter, submit to the Government Plaintiffs, financial reports that include cash flow projections that project the amount of funds that will be necessary to pay for all work related to performing the work required by this Decree on a quarterly basis for the following year, as well as a description of the amount and type of funding currently available to pay such costs. If the amount of funding is less than the amount projected to be needed for the following

180 day period, the Settling Defendant shall within thirty (30) calendar days of submittal of the financial report:

A. Obtain or otherwise make available sufficient money to bring the amount of funds available up to the amount projected to be needed for the 180 calendar days following submittal of the financial report; and

B. Submit to the Government Plaintiffs an updated financial report which includes a description of the amount and type of all additional funding made available.

115. The Government Plaintiffs, through their review and/or approval of financial reports, do not guarantee the monetary sufficiency of funding obtained or otherwise made available pursuant to this section, or the legal sufficiency of any arrangements made to fund the work required by this Consent Decree. Notwithstanding the requirements of this section, Settling Defendant remains fully responsible for all its obligations under this Decree.

XXXII. EFFECTIVE AND TERMINATION DATES

116. This Consent Decree shall be effective upon the date of its entry by the Court.

117. Certification of Completion of Remedial Action:

a. Application

When Settling Defendant determines that it has completed the Work, it shall submit to the Government Plaintiffs a Notice of Completion and a final report as required by the

RD/RA Work Plan. The final report must summarize the Work performed, any modification to the RD/RA Work Plan, and the performance standards achieved. The summary shall include or reference any supporting documentation.

b. Certification

Upon receipt of the Notice of Completion of Remedial Action, the Government Plaintiffs shall review the accompanying report and any other supporting documentation and the remedial actions taken. Prior to the issuance of a Certification of Completion, the Government Plaintiffs shall undertake a review of the Remedial Action under Sections VII and VIII of this Consent Decree. The Government Plaintiffs shall issue a Certification of Completion upon its determination that (1) Settling Defendant have satisfactorily completed the Work and has achieved standards of performance required under this Consent Decree; (2) no corrective action under Section VIII is necessary; (3) all Response Costs and stipulated penalties required to be paid under this Consent Decree have been paid in full by Settling Defendant; and (4) the terms of this Consent Decree have been complied with.

118. Termination

Upon the filing of the Certification of Completion, pursuant to Paragraph 117, and a showing that the other terms of this Consent Decree (other than the post-termination obligations referred to below) including payment of all costs and stipulated penalties due hereunder, have been complied with, this Consent

Decree shall be terminated upon motion of any Settling Party and order of this Court. However, Settling Defendant's obligation to finance and perform required maintenance and other routine maintenance that would normally be performed by a property owner (such as patching of pavement, and caring for vegetation) and the obligation to continually monitor groundwaters and surface waters at the Site as set forth in the SOW and RD/RA Work Plan, and the conveyance of site requirements and institutional controls imposed by paragraph 21, shall survive the termination of this Consent Decree and shall be enforceable by the United States and the State of Washington by re-institution of this action or by institution of a new action.

XXXIII. RETENTION OF JURISDICTION

119. This Court shall retain jurisdiction over this matter for the purposes of interpreting, implementing, modifying, enforcing or terminating the terms of this Consent Decree, and of adjudicating disputes between the parties under this Consent Decree.

ENTERED this _____day of _____, 1989.

_____
UNITED STATES DISTRICT JUDGE

The parties whose signatures appear below hereby consent to the terms of this Consent Decree. The consent of the United States is subject to the public notice and comment requirements of 28 C.F.R. § 50.7 and 42 U.S.C. § 9622. The

consent of the State of Washington is subject to the public notice and hearing requirements of Section 4(4) of the Model Toxics Control Act and is expressly conditioned upon the entry of findings by the Department of Ecology required therein.

CITY OF TACOMA, WASHINGTON

By: _____ Dated: 8/16/89
ERLING O. MORK
City Manager

By: _____ Dated: 16 Aug 1989
FRED A THOMPSON
Director of Public Works

By: _____ Dated: 8/15/89
DAVID H. DOW
acting Director of Finance 8/15/89

Attest: _____ Dated: 8-16-89
City Clerk

Approved as to form:

By: _____ Dated: Aug 16, 1989
Asst City Attorney

UNITED STATES OF AMERICA

By: _____ Dated: November 13 1989
Assistant Attorney General
Land and Natural Resources Division
U.S. Department of Justice
Washington, D.C. 20530

CITY CLERK CONTRACT

By: _____ Dated: Nov. 6 1989

Attorney
Land and Natural Resources
Division
U.S. Department of Justice
Washington, D.C. 20536

MIKE McKAY
UNITED STATES ATTORNEY

By: Jackson L. Fox Dated: Nov. 9, 1989
JACKSON L. FOX
Special Assistant United States Attorney
3600 Seafirst Fifth Avenue Plaza
800 Fifth Avenue
Seattle, Washington 98104

CITY CLERK CONTRACT/AGREEMENT NO. 466

By: Robert O Bud for
ROBIE G. RUSSELL
Regional Administrator
EPA, Region 10
Seattle, Washington 98101

Dated: Sept. 15, 1989

STATE OF WASHINGTON

By: Carol L. Fleskes
CAROL L. FLESKES
Hazardous Waste Investigations
and Cleanup Program Manager
Department of Ecology
Olympia, Washington 98504

Dated: Aug. 18, 1989

By: [signature]
JEFFREY S. MYERS
Assistant Attorney General
State of Washington
Olympia, Washington 98504

Dated: Aug 18, 1989

2-2

CITY CLERK CONTRACT/AGREEMENT NO.

APPENDICES

Appendix I	Record of Decision
Appendix II	Scope of Work
Appendix III	Access Agreements
Appendix IV	Map of the Site
Appendix V	List of Hazardous Substances Detected at the Tacoma Landfill
Appendix VI	Pre-Settlement Remedial Design Stipulation and Agreed Order

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SUPERFUND BRANCH

CITY CLERK CONTRACT/AGREEMENT NO. 16

APPENDIX I
TO TACOMA LANDFILL CONSENT DECREE

RECORD OF DECISION

CITY CLERK CONTRACT AGREEMENT NO. 4[illegible]

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION
FINAL REMEDIAL ACTION
COMMENCEMENT BAY - SOUTH TACOMA CHANNEL
TACOMA LANDFILL
TACOMA, WASHINGTON

CITY CLERK CONTRACT AMENDMENT NO. 5[illegible]

RECORD OF DECISION

REMEDIAL ALTERNATIVE SELECTION

Site

Commencement Bay - South Tacoma Channel, Tacoma Landfill site - Tacoma, Pierce County, Washington.

Purpose

This decision document presents the selected final remedial action for the site, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and consistent with (where not precluded by SARA) the National Contingency Plan (NCP, 40 CFR Part 300). The State of Washington, in close consultation with EPA, has developed and concurred with the selected remedy. A copy of the state concurrence letter is attached as Appendix D.

Basis for Decision

The decision is based upon the administrative record for the site, as obtained from the files of the Washington State Department of Ecology and the U.S. Environmental Protection Agency (EPA). This record includes, but is not limited to, the following documents:

- Remedial Investigation Report for the Tacoma Landfill, Tacoma, Washington (December 1987)

- Feasibility Study of the Tacoma Landfill Site, Final Report (December 1987)

- Decision Summary of Remedial Alternative Selection

- Responsiveness Summary (attached as Appendix B)

- Staff summaries and documents--An index (Appendix C) identifies other items which are included in this administrative record.

Description

This record of decision (ROD) addresses source control of on-site contaminants through capping of the landfill and extraction of methane gas. Management of migration for off-site contaminants will be through a groundwater extraction and treatment system.

The remedial action is designed to:

- reduce the production of leachate by placing constraints on further site operations and by capping the landfill.

- eliminate off-site gas migration through the gas extraction system.

- prevent further migration of the contaminated plume via the groundwater extraction-treatment system.

- further protect public health and the environment via monitoring of groundwater, surface water, gas probes, and air emissions.

- o provide an alternate water supply (Tacoma municipal water) to any residents deprived of their domestic supply due to demonstrated contamination from the landfill or due to the action of the extraction-treatment system.

Treatment will be sufficient to reduce contaminant levels in the groundwater to or below cleanup standards. Performance levels for the identified contaminants of concern are presented in Table 8. The methodology to be used to develop performance levels for the other contaminants in the groundwater is discussed in the Selected Remedial Alternative section of the ROD. Treatment should be permanent, and should effectively reduce the toxicity and mobility of the contaminants. Performance levels are not to be exceeded during the operational life of the remedial action. Treated water discharge shall at all times be consistent with federal laws and Washington State laws. Any treatment system which will produce air emissions will be designed to meet appropriate federal and state Air Toxics Guidelines and to use Best Available Control Technology (BACT) on the effluent air stream.

Containment of the plume will be confirmed by installation and periodic sampling of monitoring wells as well as continued, scheduled monitoring of private and public wells. Extraction will continue until water quality at the compliance boundary (defined by WAC 173-304 as the edge of the filled area) consistently meets or exceeds drinking water standards, or previously established and approved health-based criteria. In addition to meeting health-based criteria, potential impacts to public and private water supplies, and to Leach Creek must be considered in the decision to shut off the system.

Those residents who are deprived of domestic drinking water, either because their wells water quality shows demonstrated contamination from the landfill or because the quantity available has been reduced by the action of the extraction-treatment system, will be connected to city water supplies.

Source control measures are expected to reduce contaminant concentrations in the groundwater system. Source control measures consist of constructing a cap on the landfill and appropriate regrading to minimize infiltration and maximize run-off, ultimately reducing leachate volume and toxicity. Unlined areas of the landfill will be capped as soon as possible. WAC 173-304 defines the minimum requirements for a cap on a municipal landfill. A more stringent cap will be required unless further analysis of the cap, to be provided during remedial design, shows that a significant reduction in leachate volume or toxicity would not be achieved.

Increased run-off due to the construction of the cap will be routed off the landfill to reduce infiltration. The run-off collected from the landfill will be directed to the appropriate storm or sanitary sewers, consistent with local storm drainage ordinances or pre-treatment regulations. The storm drainage plan, prepared as part of the remedial design, will determine and minimize any impacts on downstream increases in peak flow.

The city of Tacoma (Tacoma) will implement a closure plan for the landfill consistent with Washington State Minimum Functional Standards for Landfill Closure (WAC 173-304), and as appropriate, Washington State Dangerous Waste Regulations (WAC 143-303).

Institutional controls will be implemented, consistent with the final design, to assure that the remedial action will continue to protect health and the environment. Tacoma, in cooperation with the town of Fircrest and Pierce County, will pursue the establishment of an ordinance, or other suitable methodology, to restrict drilling of water supply wells in an area from Tyler Street to Leach Creek, and from Center Street to approximately South 56th Street.

CITY CLERK CONTRACT/AGREEMENT NO. 4

Declaration

Consistent with CERCLA, as amended by SARA, and the NCP, it is determined that the selected remedy as described above is protective of human health and the environment, attains Federal and State requirements which are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference expressed in SARA for treatment that reduces toxicity, mobility, or volume. Finally, it is determined that this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

3-31-88
Date

Regional Administrator
Environmental Protection Agency
EPA - Region 10

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CITY CLERK CONTRACT/AGREEMENT NO.

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION
FINAL REMEDIAL ACTION
TACOMA LANDFILL
TACOMA, WASHINGTON

CITY CLERK CONTRACT/AGREEMENT NO.

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I. SITE DESCRIPTION AND LOCATION

The Tacoma Landfill, operated by the City of Tacoma Refuse Utility, is located in Sections 12 and 13 of Township 20 North, Range 2 East, Pierce County, Washington. The landfill covers 190 acres and is bounded approximately by South 31st Street on the north, Tyler Street on the east, South 48th Street on the south, and Orchard Street on the west. Figures 1, 2 and 3 illustrate the location of the landfill, the vicinity surrounding the landfill, and the site itself. The landfill serves a population of approximately 212,000. To date, approximately 4.0 million tons of refuse have been deposited at the landfill since it opened in 1960. Currently about 600 tons per day of refuse are placed in the landfill.

The landfill does not accept hazardous wastes for disposal. However, the landfill received wastes in the 1960s and 1970s that have since been designated as hazardous substances under State and Federal law.

Figure 2 shows the general topography of the landfill and surrounding area. Drumlins (low, long ridges) abound in the general area and display a north-south axial configuration. Solid waste has been disposed of at the site between five drumlins. The landfill's western boundary is approximately one quarter mile from Leach Creek, but the landfill does not lie in the flood plain of that creek. The landfill is surrounded primarily by residential development and open land, with some commercial and industrial development. Land use for the area surrounding the landfill is shown on Figure 3. No use of natural resources other than groundwater is noted on land use inventories. Several utilities (sewer, water, and storm) pass through the site.

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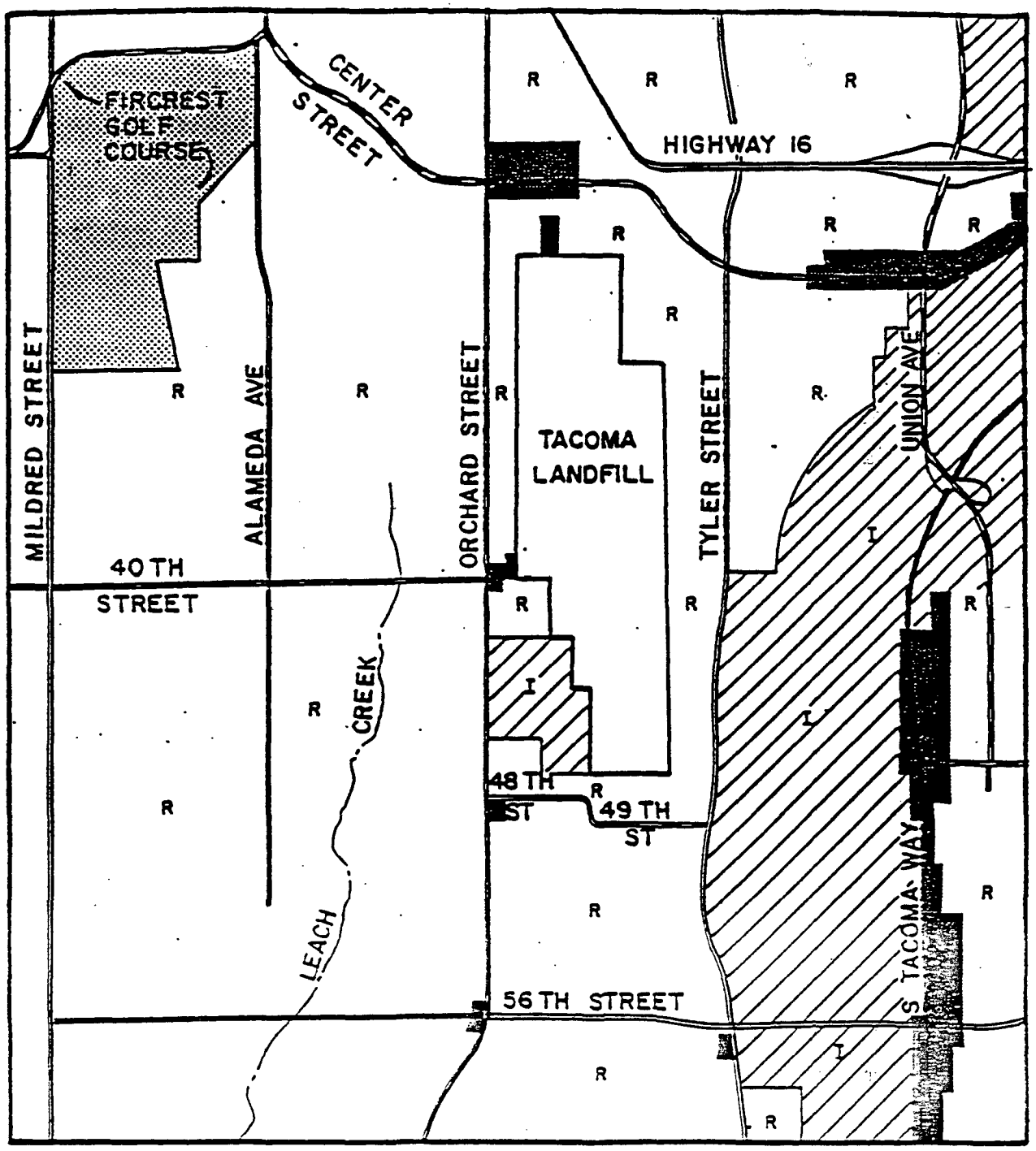
Apartments, undeveloped land, and commercial properties including a bowling alley, offices, building supply and paint stores, and gas stations are located north of the landfill. Immediately east of the landfill are apartment complexes, single family residences, and undeveloped land. The area further east between Tyler Street and South Tacoma Way is occupied by the Burlington Northern Railroad, industrial/commercial development, and an open area known as the South Tacoma Swamp. Between the west edge of the landfill and Orchard Street there are several apartment buildings and commercial establishments. West of Orchard Street and south of the landfill there is residential development and undeveloped land.

The landfill lies in the central portion of the Tacoma/Fircrest upland ground water system. A significant area for the central upland in the vicinity of the landfill is Leach Creek.



LEGEND

COMMERCIAL

INDUSTRIAL

RESIDENTAL

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SCALE 1" = 2000'

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FIGURE 3
LANDFILL ZONING MAP
TACOMA LANDFILL RI/FS

CITY CLERK CONTRACT/AGREEMENT

II. SITE HISTORY

A. Landfill History and Operations

The Tacoma Landfill began operations in 1960, and now serves a population of approximately 212,000. The wastes received and disposed at the landfill include garbage, rubbish, industrial wastes, construction and demolition wastes, street refuse, litter, and bulky waste. To date, approximately 4.0 million tons of refuse have been deposited at the landfill. Filled areas vary from 20 to 80 feet deep. Currently some 600 tons per day of refuse are placed in the landfill.

Most of the site has already been filled. The next section of the site to be filled is called the Central Area Pit. This section of the landfill covers approximately 18 acres and was developed during the summer and fall of 1987. A flexible membrane liner and leachate collection system were installed in the Central Area Pit. The liner and leachate collection system were designed primarily to maximize volume for waste disposal. To date, there has been no documentation received on the integrity of the liner.

Day to day operations of the landfill are regulated by the Tacoma-Pierce County Health Department (TPCHD) with oversight by the Washington Department of Ecology (Ecology); the operating permit is issued annually by TPCHD.

At the current rate, the 190-acre site has a remaining life expectancy of approximately four to five years if all the solid waste material is disposed without a significant reduction in volume. Tacoma has indicated it intends to implement programs to extend the life expectancy of the landfill.

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There are many large and small industries in the Tacoma/Pierce County area which have disposed of wastes at the landfill. Memoranda reviewed during the preparation of the Description of Current Situation report and the RI indicate that some hazardous wastes were disposed of at the landfill. Investigations concerning the volumes, the chemical composition of the wastes, and the disposal locations are ongoing.

B. Regulatory History - Previous Investigations

In 1983 EPA conducted an investigation and detected hazardous compounds in samples of ground water and soils near the landfill. This led EPA to include the landfill on the National Priorities List of hazardous waste sites as part of the South Tacoma Channel site. Through a cooperative agreement with EPA, Ecology began an investigation into contamination at the site in 1984. On June 27, 1986, Tacoma assumed responsibility for conducting the remedial investigation and feasibility study under a Response Order on Consent issued by Ecology.

Since 1983 testing has been conducted at and around the Tacoma Landfill by EPA, Ecology, TPCHD, Tacoma, and others. The testing revealed that three private wells contained contaminants. The priority pollutant volatile organic compounds which were detected in the ground water samples were primarily chlorinated organics. Twenty-four volatile organic compounds were found in groundwater contaminated by the landfill.

Because of the concern about the public health effects of the contaminants, particularly vinyl chloride, the TPCHD recommended that Tacoma connect these affected residences to the Tacoma public water system. As a precautionary measure, Tacoma also connected two additional residences whose wells were near the area. Monitoring continues quarterly to ensure the clean water supply for potentially affected residents while appropriate cleanup actions are approved and carried out.

C. The Remedial Investigation/Feasibility Study (RI/FS)

The remedial investigation (RI), conducted by Tacoma's consultant, Black and Veatch, was performed in two phases. Phase 1 activities (July 1986 through January 1987) consisted primarily of field investigations to characterize both the hydrogeology of the site and the contaminants present in the various media at and surrounding the site. Phase 2, conducted from January through November 1987, was designed to fill in data gaps identified at the conclusion of Phase 1 and to provide the data necessary for the endangerment assessment and the feasibility study (FS).

Upon completion of the RI and and evaluation of the alternatives, the City, through their consultants (Black and Veatch), submitted a draft RI and FS report in September and October 1987 for agency review and approval. The final RI/FS reports were published December 1987. Public comment on the studies was completed in March 1988.

III. SITE ENVIRONMENT

The Tacoma Landfill site is located in the northern portion of the Chambers/Clover Creek drainage basin (see Figure 4). This area is part of the Puget Sound lowland. The study area is bounded by: the Tacoma channel to the east; Center Street to the north; 56th Street to the south; and Leach Creek to the west.

A moderate climate prevails. Winter temperatures are seldom below freezing and summer temperatures are rarely above 80°F. Approximately thirty-seven inches of rain fall in a normal year. Studies conducted in the Puget Sound region have indicated that approximately 30% of rainfall becomes groundwater.

The geology of the site consists of a series of glacial materials, mostly sand and gravel laid down over older alluvial silts and sands. The stratigraphic units (layers) described in the Remedial Investigation (Black and Veatch, 1987) from youngest to oldest (top down) are:

A. Vashon Till (dense gray, gravelly, silty, sand) (Qvt)

B. Vashon Advance Outwash (sands/gravels) (Qva)

C. Colvos Sand (dense sand/some gravel) (Qc)

D. Older Gravel (dense sandy gravel) (Qog)

E. Older Till (dense silty, gravelly sand) (Qot)

F. Older Outwash (dense silty, gravelly sand) (Qoa)

G. Older Sand (dense fine/medium sand) (Qos)

H. Older Lacustrine (lake bottom silts) (Qol/Qk)

I. Undifferentiated Quaternary Sediments (Qu)

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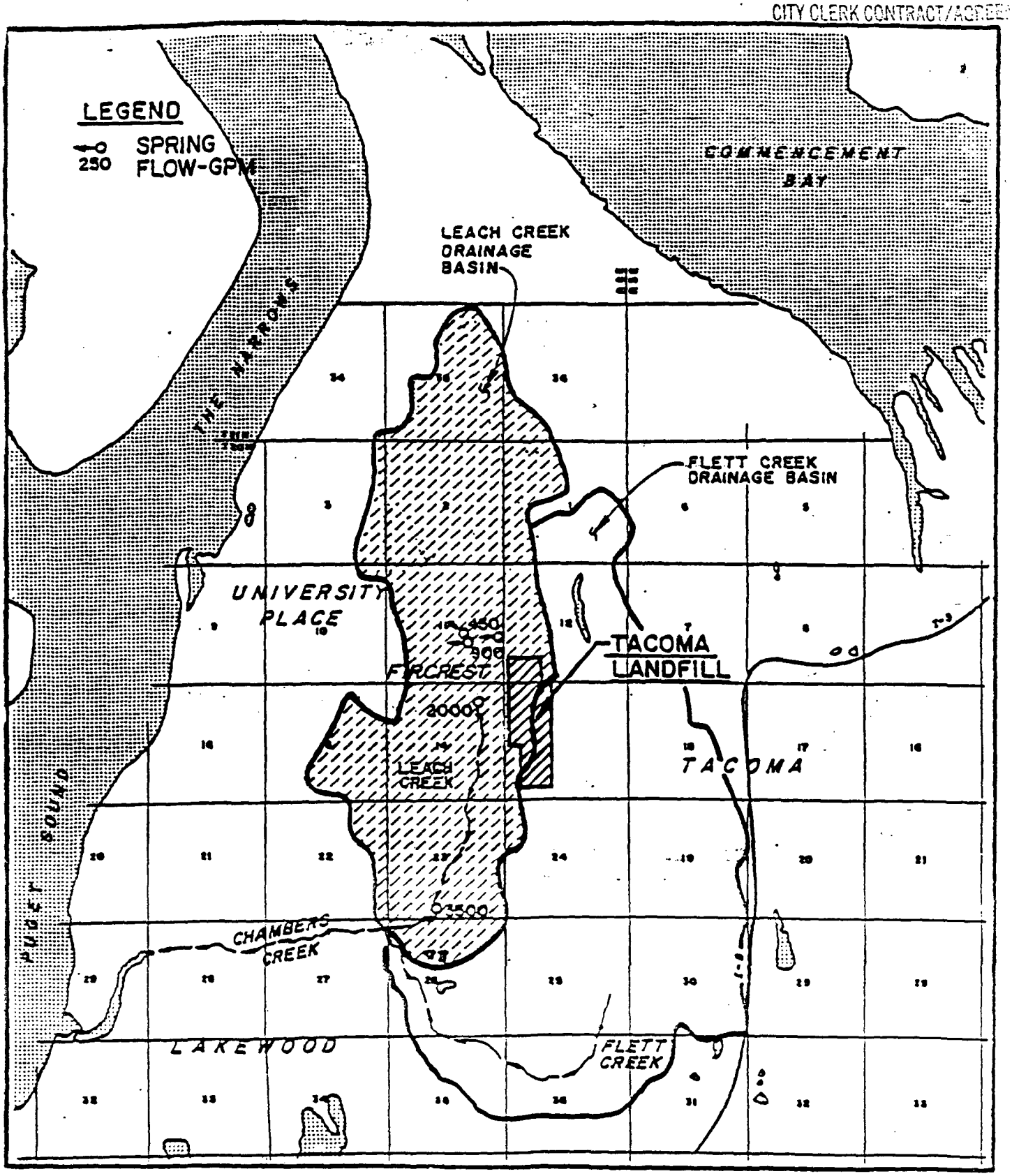

FIGURE ADAPTED FROM CLOVER/ CHAMBERS CREEK GEOHYDROLOGIC STUDY

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FIGURE 4

LEACH CREEK DRAINAGE BASIN

TACOMA LANDFILL RI/FS

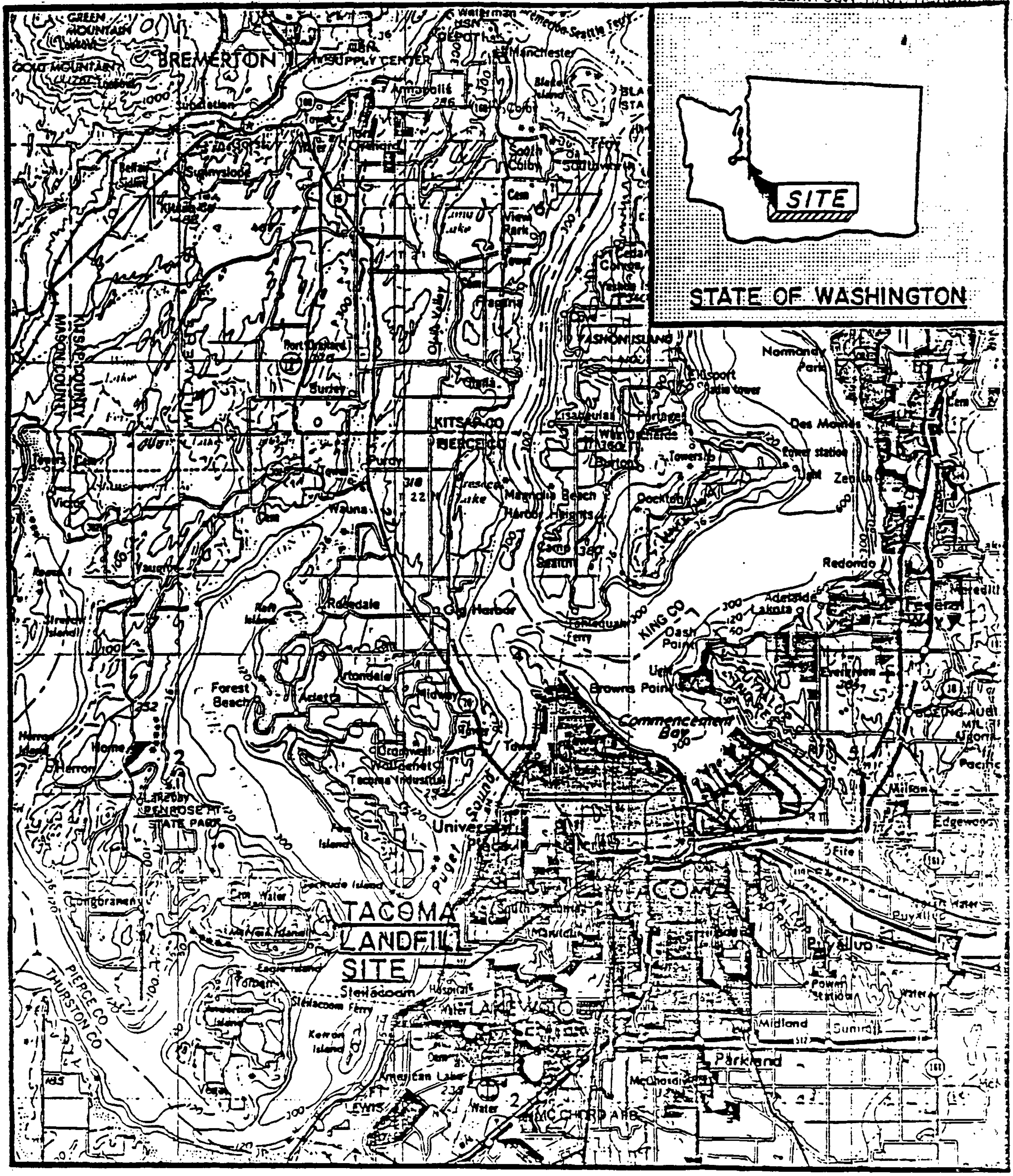
The affected aquifer is located between the lower zones of the Colvos Sand and the Older Lacustrine. The Older Lacustrine unit serves as the regional aquitard in the landfill area. A cross section through the area (Figure 5) shows the ridges, valleys, and the lithology (layers).

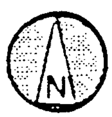
Water, infiltrating through the landfill, picks up various contaminants. Where the Vashon Till is not present beneath the waste, contaminants move with the water through the unsaturated zone and into the aquifer. It is also possible for low solubility, pure phase fluids, called dense, non-aqueous phase liquids (DNAPLs), such as chlorinated hydrocarbons to enter the aquifer. Evidence of this has not been shown, nor has it been disproven. The water table lies within the Colvos Sand unit, about 70 feet below the bottom of the landfill.

The predominant flow direction of the water table aquifer is southwesterly toward Leach Creek. However, during periods of heavy water use by Tacoma city wells (summer and early fall), the groundwater flow direction is reversed. Also, depending on local conditions, groundwater and contaminant movement may be downward or upward.

The Older Alluvium reportedly forms the confining layer. Leach Creek is the closest discharge point of the aquifer. Additional information from future activities will clarify the ground water flow conditions near the creek and elsewhere around the site.

The aquifer is part of the Chambers/Clover Creek Ground Water Management Area. The TPCHD is petitioning EPA for a Sole Source Aquifer designation for





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0 1 2 4 8

SCALE : 1" = 4 MILES

FIGURE 1
SITE LOCATION MAP

TACOMA LANDFILL RI/FS

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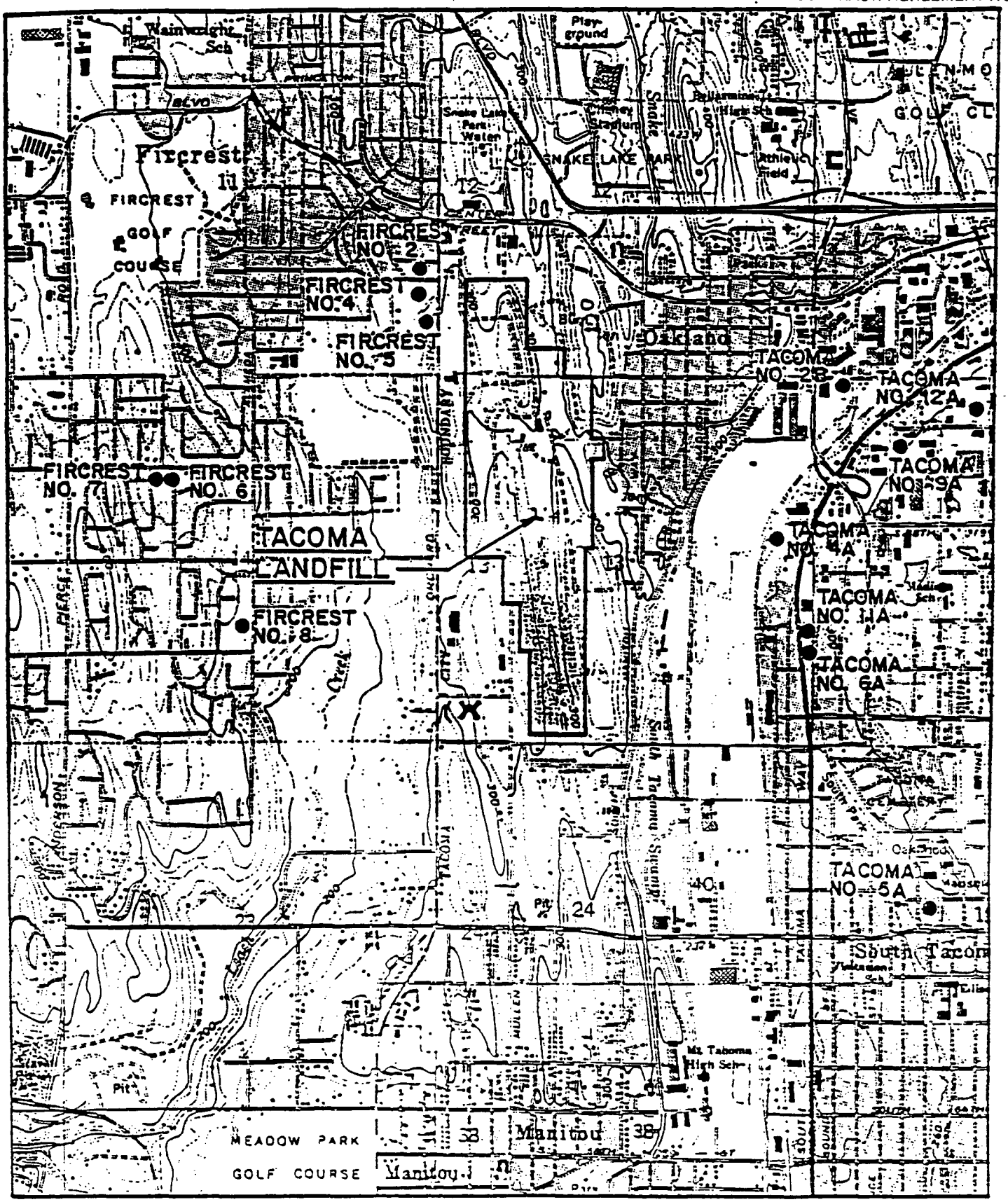

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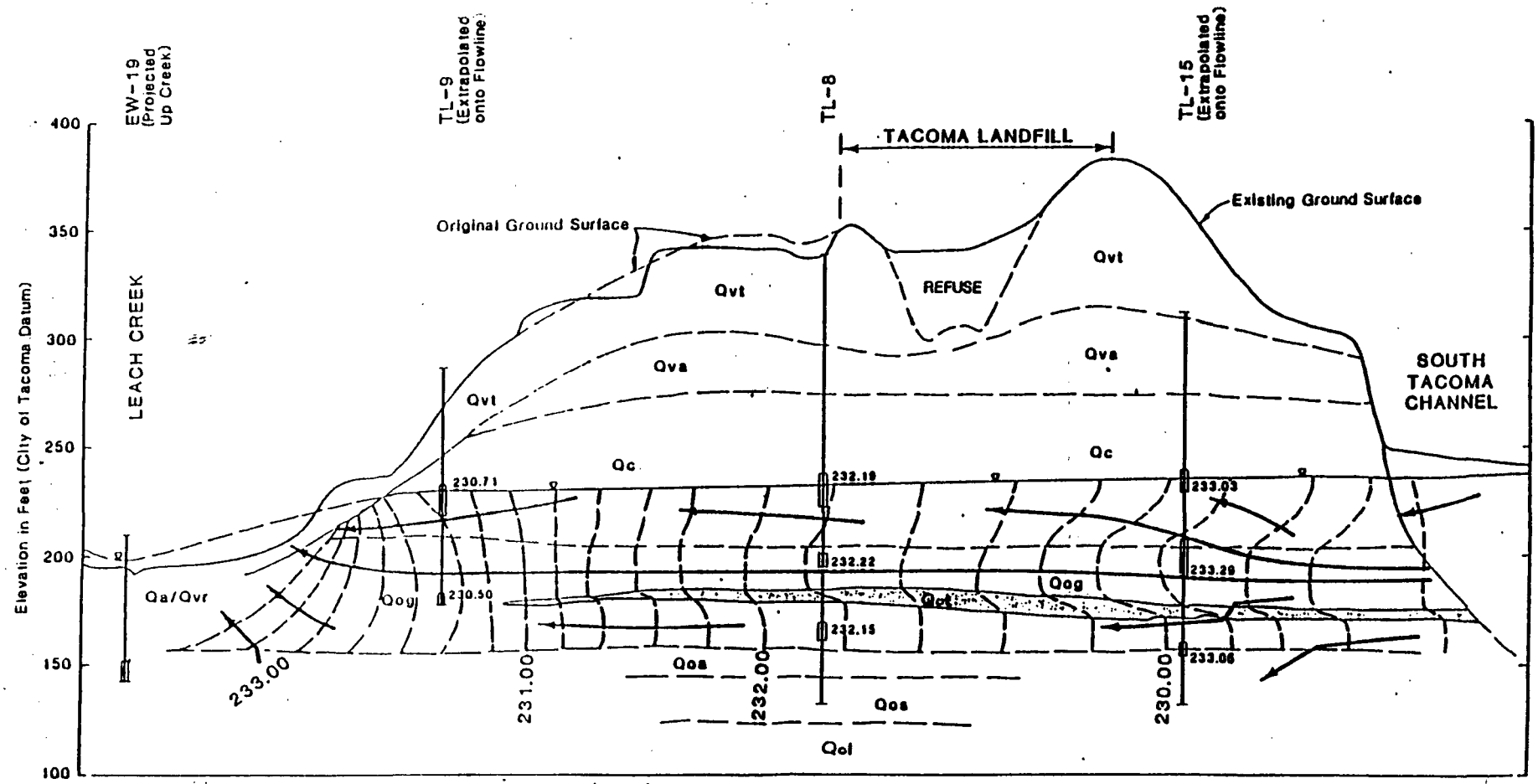
2000' 1000' 0 2000' 4000'

FIGURE 2
SITE VICINITY
PRODUCTION WELL LOCATIONS

TACOMA LANDFILL RI/FS



Geologic contacts are based upon interpolation between outcrops and borings and represent our interpretation of subsurface conditions based on currently available data.

Figure prepared by Hart Crowser, Inc.

Notes: 1. Water table elevations are from 12/4/86. Potentials at lower levels are calculated from average vertical gradients over seven (7) sets of water level measurements (Table 4-2) and therefore represent anticipated average conditions.

2. Flowlines are drawn qualitatively assuming a moderate degree of anisotropy.

TL-8 Well Number

Well Location

Water Table 12/4/86

Screen Section

233.00 Equipotential Line

Water Table Elevation in Feet

Groundwater Flow

Horizontal Scale in Feet
0 400 800

0 50 100
Vertical Scale in Feet
Vertical Exaggeration x 8

FIGURE 5
SITE CROSS SECTION AND LITHOLOGY

TACOMA LANDFILL RI/FS

CITY CLERK CONTRACT/AGREEMENT NO. 3015

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this aquifer. The Town of Fircrest and the City of Tacoma both operate wells near the landfill (see Figure 2). In addition, the aquifer is also used by private individuals for domestic water supply (see Figure 6).

Wetlands downstream of the landfill on Chambers Creek could potentially be exposed to contaminants in the surface water and ground water. None of the five endangered species identified in the State of Washington is common to the area surrounding the landfill.

The topographical lowpoint in the landfill is currently at the north end of the Central Area Pit. Some runoff from surrounding areas drains and discharges to the sanitary sewer. Drainage from the north and along Mullen Street is directed towards a pond situated between the bowling alley parking lot and northern landfill property on Mullen Street. Drainage from the west side of the site is directed toward a catch basin and discharges to the Leach Creek retention basin. The south end of the site drains to the south and is not collected. Drainage patterns are shown in Figure 7.

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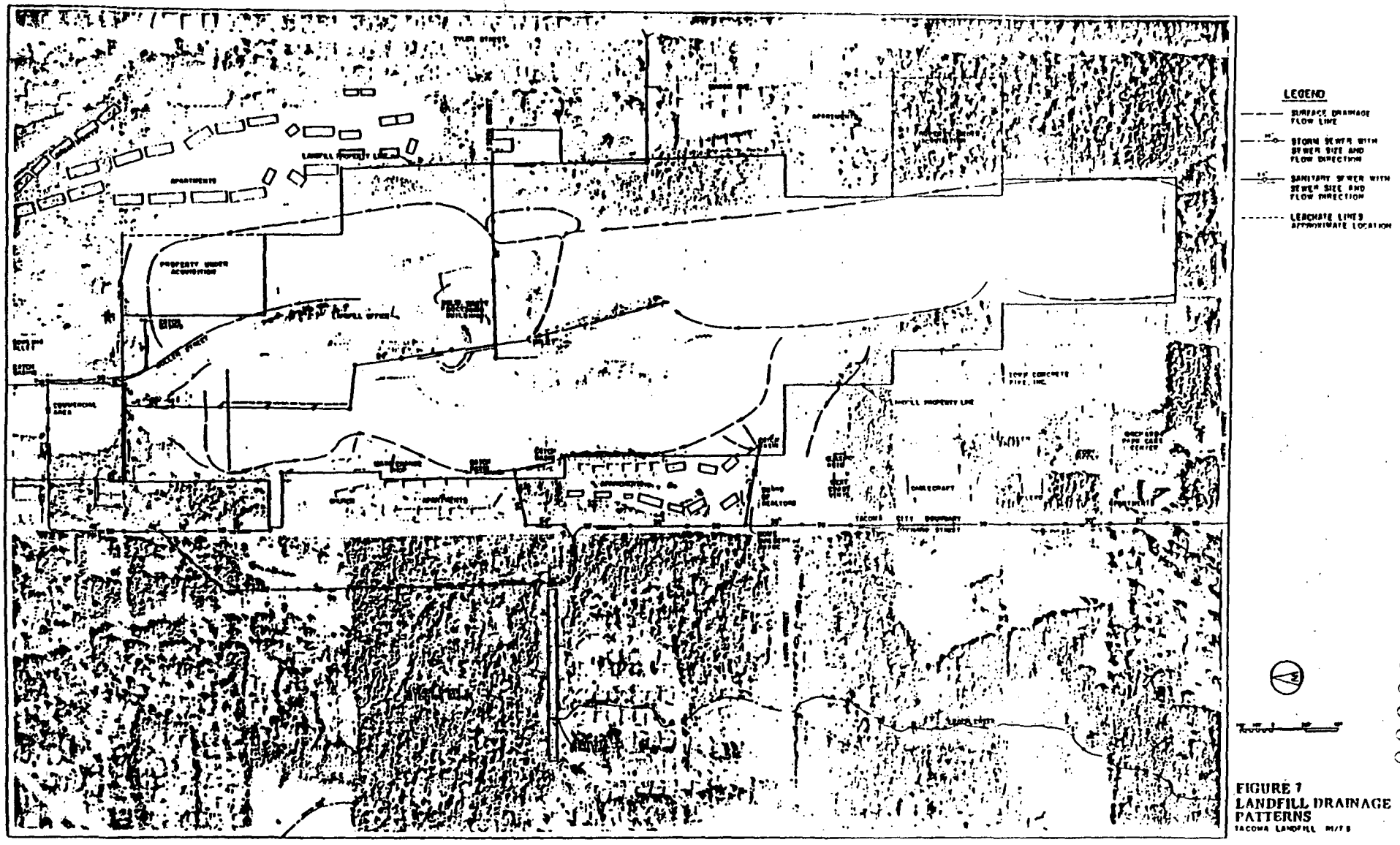

FIGURE 7
LANDFILL DRAINAGE PATTERNS
TACOMA LANDFILL 11/78

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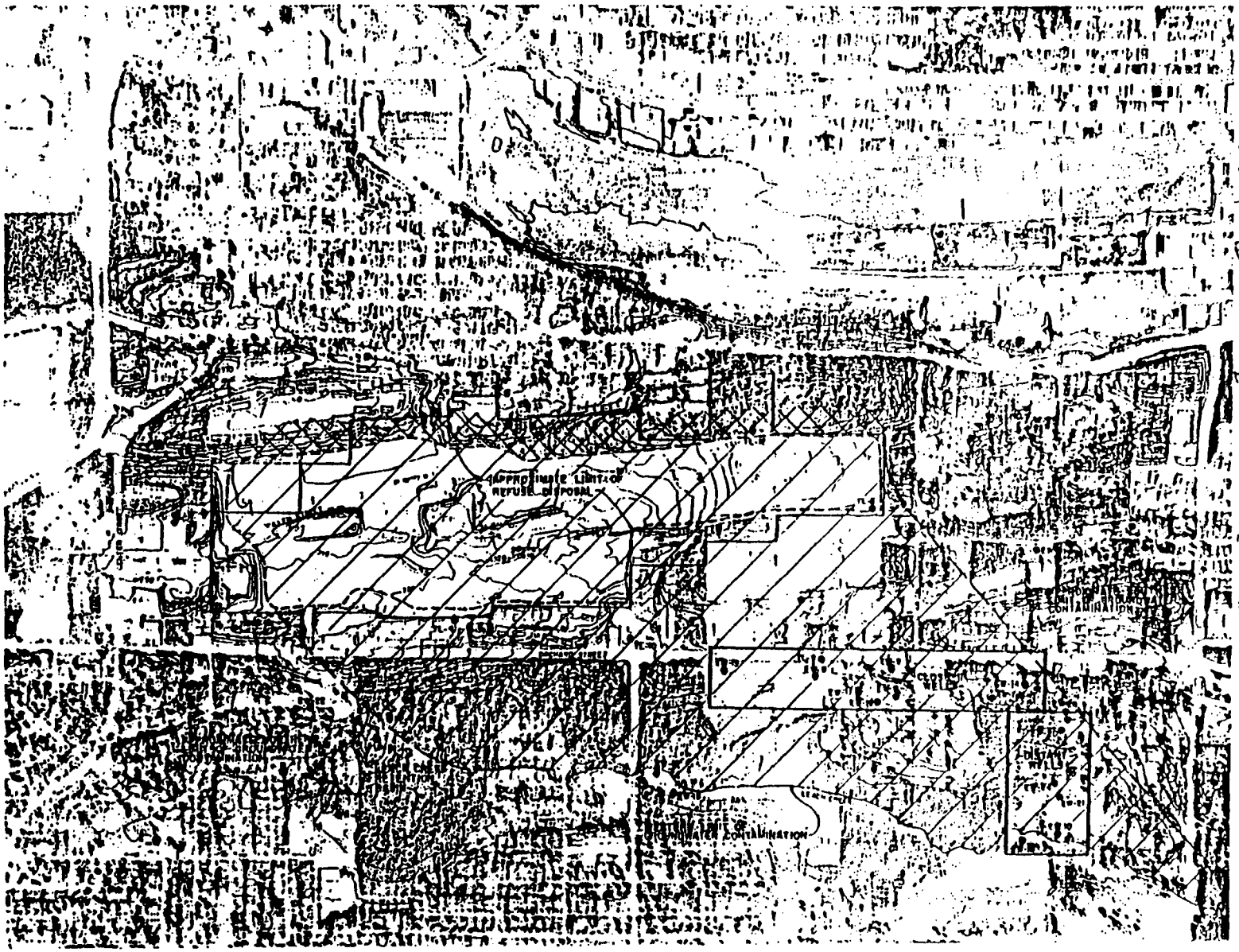

LEGEND

- LANDFILL MONITORING WELL LOCATION
- EXISTING RESIDENTIAL WELL
- FIRCREST WELL
- UNIVERSITY PLACE WELL
- 300' GROUND SURFACE ELEVATION CONTOUR - CITY OF TACOMA DATUM
- APPROXIMATE MAXIMUM AREA POTENTIALLY AFFECTED BY GROUNDWATER CONTAMINATION IN THE FUTURE BASED SOLELY ON CONVECTION OF CONTAMINANTS FROM THE LANDFILL
- APPROXIMATE AREA UPGRADIENT OF THE LANDFILL POTENTIALLY IMPACTED BY GROUNDWATER CONTAMINATION DUE TO GRADIENT REVERSALS

NOTES

1. UP WELLS AND EW-23 ARE NOT CURRENTLY USED AND WERE NOT CONSIDERED IN SELECTING RECEPTOR GROUPS.
2. EXTENT OF GROUNDWATER CONTAMINATION DOES NOT INCLUDE CONTAMINATION DUE TO LANDFILL GAS TRANSPORT.

FIGURE 6
LOCATION OF PRIVATE WE
EXTENT OF CONTAMINATI

TACOMA LANDFILL RI/FS

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CITY CLERK CONTRACT/AGREEMENT NO. 9014

IV. NATURE AND EXTENT OF PROBLEM

A. Extent of Gas Migration

In May 1986, accumulation of landfill gas in a utility vault at the Town Concrete Pipe Company (located immediately adjacent to and west of the landfill) resulted in a small explosion. Tacoma had already hired a consultant (Mandeville Associates) to address problems of gas production and migration at the landfill and was able to immediately initiate a field survey to evaluate the extent of gas migration off-site. Based on this survey, the consultant designed and constructed a gas extraction system to extract, collect and combust the gas. The field survey showed the biggest problem to be southwest of the site and this initial effort concentrated on controlling gas from migrating into businesses in this area.

The current landfill gas system consists of 128 extraction wells, collection piping, 77 gas probe locations, and the motor blower/flare station where contaminants are incinerated. The system layout is shown on Figure 8.

Tacoma has conducted a two-stage gas monitoring program to monitor the effectiveness of the extraction system. Figure 8 shows the locations of 66 probes installed around the landfill. Each of these probes consists of two to five probes able to monitor gas at depths from 6 to 70 feet. These probes are checked twice a week and seem to indicate that the shallower gas is being controlled by the extraction system.

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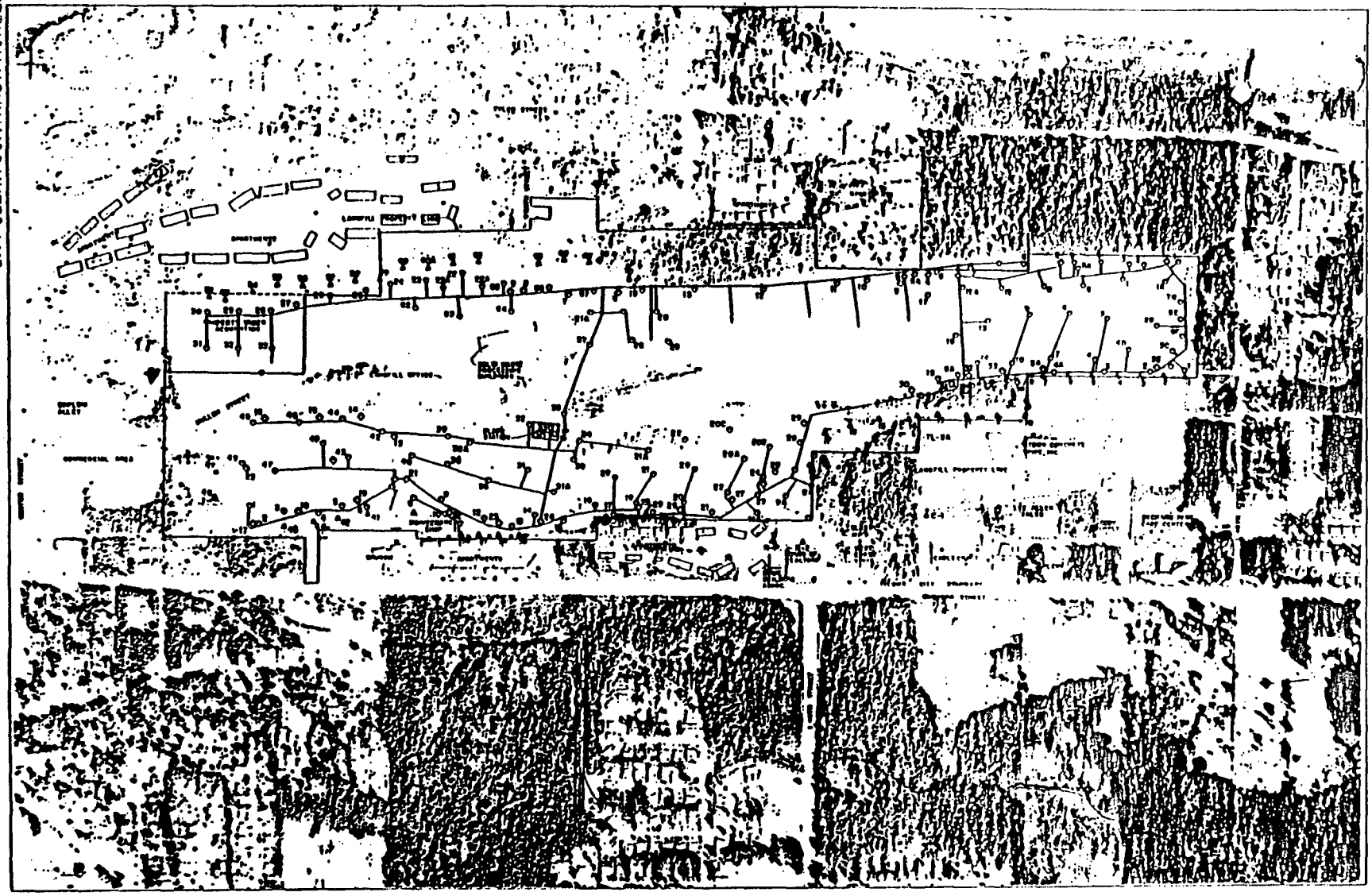

LEGEND

- GAS WELL
- PROBE
- CONDENSATION DRAIN
- [illegible] MONITORING LOCATION

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FIGURE 8
LANDFILL GAS EXTRACTION SYSTEM
TACOMA LANDFILL [illegible]

The gas found deeper than about 35-40 feet is not being controlled as well. As a result of this information, Tacoma is installing approximately 74 new, deep extraction wells around the landfill. This work began on January 27, 1988.

The City has also been conducting an off-site monitoring program beginning in May, 1986. From May 1986 until August 1987, this program focused on businesses and apartments to the south and west of the site, where both ambient and point source measurements were taken. Beginning in August 1987, the current off-site monitoring system began. This consists of monitoring utility vaults in residential areas (shown on Figure 8), and routine ambient and point source monitoring in some businesses and vacant apartments. The data from this effort shows that methane is still escaping the landfill and finding its way to the surface in off-site locations. The utility vault data shows several areas around the landfill to be of particular concern.

The Minimum Function Standards require that the concentrations in off-site structures be below 100 parts per million (ppm) by volume of hydrocarbon in ambient air. From November 1986 through October 1987, the readings of ambient air in off-site structures were below the limit; however, some point sources monitored such as foundation cracks and closed vaults on occasion have shown readings above 100 ppm. Readings above the limit were found in the ambient air in one building west of the landfill near 40th Street (Classic Auto) in November 1987. The City installed four additional gas extraction wells in this area in December 1987. No readings were detected in the building after the first well was connected to the system on December 15, 1987.

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Ecology has requested that additional gas probes be placed in the neighborhoods of concern. The existing probes are well within the influence of the gas extraction wells and do not represent ambient conditions further off-site. Methane concentrations in utility vaults can also be misleading. Gas concentrations fluctuate a great deal with changing atmospheric conditions. Therefore, it is possible that landfill gas could be found in a house without observing it in the vault. Additional gas probes are needed to better determine the performance of the gas extraction system.

A total of 42 landfill gas samples were collected at 26 locations around the landfill. The gas samples collected from gas wells and probes were analyzed for priority pollutant volatile organic compounds (VOC). The analytical results are summarized in Table 1. The methane concentration was analyzed for five of the Phase 1 samples and was field measured for seven of the Phase 2 samples. These results are presented below:

Sample No.	Methane (ppm)	Sample No.	Methane (ppm)
Phase 1		Phase 2	
GS-001	540,000	GS-213	370,000
GS-002	430,000	GS-214	480,000
GS-002DUP	430,000	GS-215	610,000
GS-003	560,000	GS-218	560,000
GS-004	240,000	GS-219	200,000
		GS-220	200,000
		GS-221	200,000

TABLE 1
SUMMARY OF PRIORITY POLLUTANT VOLATILE
ORGANIC COMPOUNDS DETECTED IN LANDFILL GAS SAMPLES
Concentrations in ug/m3

Date	Benzene	Chloro-benzene	Chloro-ethane	1,1-Di-chloro-ethane	1,2-Di chloro-ethane	1,1-Di-chloro-ethene	Trans-1,2-Di chloro-ethene	1,2-Di-chloro-propane
06/25/86	2600	1600	1400	TR	500U	500U	2500	500U
06/25/86	700	500U	1000U	500U	500U	500U	TR	500U
06/25/86	3200	125U	300	125U	125U	125U	500	125U
06/25/86	2400	980	250U	125U	125U	125U	130	125U
06/25/86	2900	950	250U	125U	125U	125U	125U	125U
06/25/86	1800	1400	1000U	500U	500U	500U	700	500U
06/25/86	1800	500U	6300	500U	500U	17000	12000	500U
06/25/86	3000	1100	1000U	500U	500U	500U	500U	500U
06/25/86	1300	1600	1000U	500U	500U	500U	500U	500U
06/25/86	1800	500U	TR	900	TR	TR	23000	500U
06/25/86	2000	1200	TR	500U	500U	1000	16000	500U
06/25/86	4800	800	1400	3700	12000	TR	120000	TR
08/26/86	35.5U	71U	35.5U	35.5U	35.5U	35.5U	35.5U	35.5U
08/26/86	2200	25U	450	1600	25U	45	1200	25U
11/13/86	4800J	100U	2300J	3300J	100U	100U	35000J	2000J
12/09/86	2100	100U	9300	2000	1600	100	20000	100U
12/09/86	1400	100U	1000	2200	1500	100	19000	100U
02/12/87	2600J	1000U	2000U	1000U	1000U	1000U	8600J	1000U
02/10/87	3400	500U	12000	1400B	500U	500U	7700	200J
02/10/87	840J	100U	200U	1000U	1000U	1000U	600J	100U
02/10/87	1200	1000U	1800J	600J	1000U	1000U	2600	1000U
02/12/87	2600	1000U	1200	1500B	1000U	1000U	3000	1000U
02/12/87	4800	1000U	2200	1500	1900	520J	38000	200J
02/10/87	2400	1000U	1300J	800J	1000U	1000U	9400	1000U
02/10/87	2600	1000U	1800J	1500	1000U	580J	56000	1000U
02/10/87	2600	1000U	2000U	1000U	1000U	1000U	4600	1000U
02/10/87	3200J	1000U	2000U	1000U	1000U	1000U	1000U	1000U

TABLE 1 (cont)
SUMMARY OF PRIORITY POLLUTANT VOLATILE
ORGANIC COMPOUNDS DETECTED IN LANDFILL GAS SAMPLES
Concentrations in ug/m3

Sample Locations	Ethyl Benzene	Methy-lene Chloride	Tetra-chloro-ethene	Toluene	1,1,1-Tri-chloro-ethane	Tri-chloro-ethene	Vinyl Chlor-ide
GW-01	68000	1700B	1300	6100	500U	1100	52000
GP-28	4300	2500B	TR	1600	500U	TR	TR
GP-45	18000	TRB	300	11000	125U	125U	26000
GP-32	8100	200B	TR	530	125U	125U	530
GP-32	8000	300B	TR	630	125U	125U	630
GP-33D	39000	TRB	TR	3300	500U	500U	1800
GP-33S	21700	73000	25000	89000	900	3800	39000
GP-25D	30000	500U	TR	1400	500U	500U	TR
GP-25S	36000	TRB	500U	500U	500U	500U	2000
GP-06D	50000	2000B	20000	860000	500U	13000	28000
GP-06S	77000	2500B	4700	210000	500U	5800	47000
FS-01	28000	33000B	24000	84000	TR	25000	38000
GP-13	TRB	250B	35.5U	130B	35.5U	35.5U	71U
GP-14	1200	1600B	2000	26000	900	1100	2900
GP-TL-08A	37000J	500U	3200J	110000J	100U	6700J	13000J
FLARE	18000*	30000*	10000	97000*	1400	10000	12000
FLARE	19000*	50000*	10000	10000*	1300	5800	12000
GW-22	8800BJ	100UJ	600BJ	9800BJ	1000U	600BJ	20000J
GW-12	5600B	240000B	32000B	55000B	5800	9300	20000
GW-28 EAST	50000B	1000UJ	200J	4600B	1000U	200J	2000
GW-28 SW	9000B	1000UJ	600J	36000B	1000U	800J	4800
GW-64	1500B	11000B	2200	14000B	560J	2600B	78000
GW-1a	160000B	1000UJ	12000	150000B	200J	12000	124000
GW-6a	57000B	1000UJ	3200	120000B	1000U	3400	37000
GW-6d	59000B	1000UJ	8400	130000B	1000U	8400	35000
GW-45	12000B	3600B	1000B	8600B	1000U	1000U	16000
GW-45(Dup)	12000BJ	2800BJ	1400J	8400BJ	1000U	800J	16000J

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The landfill gas contains significant concentrations of VOCs and has been proposed as a possible migration pathway for these compounds to the groundwater, particularly when groundwater contamination is found upgradient.

The American Congress of Governmental Industrial Hygienists has issued threshold limit values (TLVs) on airborne concentrations of various substances. These limits are intended as guidelines in the control of potential health hazards. The time-weighted average (TWA) TLV concentration for a normal 8-hour workday and a 40-hour workweek is the concentration which nearly all workers might be exposed to without adverse effect. The compounds detected in landfill gas samples that exceeded 15 percent of the TWA values are given in Table 2. Two of the TWA's were exceeded (toluene and vinyl chloride). The detected concentrations listed in Tables 1 and 2 are from samples collected inside the respective gas well or probe and are not representative of ambient air concentrations.

EPA's ISCST (Industrial Source Complex Short-Term) dispersion model was used to predict the potential landfill air quality impacts. Toluene was generally detected at higher concentrations than other VOCs in the landfill gas samples and had the highest mass flow rate both in and out of the flares during the flare test; therefore, it was selected as the pollutant to be assessed by the air quality analysis.

The worst case analysis predicted the highest toluene concentration (using a one hour averaging time) to be slightly greater than 2 ppb. The Draft New Source Guidelines for Toxic Air Contaminants (Sept. 1986) for the State of Washington indicate a 14 ppb toluene to be the acceptable ambient

TABLE 2

THRESHOLD LIMIT VALUES FOR LANDFILL GAS COMPOUNDS

Compound (CAS Number)	Sample No.	Highest Value Detected ug/m3	TWA[1] ppm	TWA[1] ug/m3
Benzene (71-43-2)	GS-012, GS-217	4,800	10	30,000
1,1-Dichloroethane (75-35-4)	GS-007	17,000	5	20,000
Trans-1,2-Dichloroethene (540-59-0)	GS-012	120,000	200	790,000
Ethylbenzene (100-41-4)	GS-011	77,000 [2]	100	435,000
Methylene Chloride (75-09-2)	GS-007	73,000	100	350,000
Toluene (108-88-3)	GS-010	860,000	100	375,000
Vinyl Chloride (75-01-4)	GS-217	124,000	5	10,000
2-Hexanone (591-78-6)	GS-011	8,200	5	20,000
Total Xylenes (1330-20-7)	GS-011	170,000	100	435,000
1,2-Dichloroethane (107-06-2)	GS-012	12,000	10	40,000

(1) TWA - Time Weighted Average, Reference 34.

(2) A value of 160,000 ug/m^3 was detected for ethylbenzene in sample GS-217; however, ethylbenzene was also detected in the laboratory reagent blank.

level; therefore, it would appear that as long as the current gas collection system remains functional, ambient air concentrations of VOCs should remain well below ambient air standards.

B. Contaminants Detected

Groundwater, surface water, leachate, sanitary sewer, subsurface soil, sediment and landfill gas samples were collected during the RI sampling program. The prevalent contaminants detected during the sampling program were volatile organic compounds followed by semivolatile organic compounds and metals.

Twenty-four volatile organic chemicals were found in the groundwater. Of the twenty-four chemicals, the following seven indicator chemicals were identified in the Endangerment Assessment in the RI as being of most concern because of their toxicity, frequency of occurrence, and primary targets (human population):

- vinyl chloride
- benzene
- 1,2-dichloroethane
- methylene chloride
- 1,1-dichloroethane
- chloroethane
- toluene

In addition, review of the Endangerment Assessment by EPA and Ecology resulted in the inclusion of three additional indicator chemicals listed below:

- xylenes
- 1,1,1-trichloroethane
- ethyl benzene.

The rationale for inclusion of these chemicals is discussed further in the Endangerment Assessment section of this document.

Twenty three private drinking water wells were sampled during the sampling program. For the three wells where contamination exceeded drinking water standards, the City of Tacoma connected the residents to City water. As the plume spreads, it is predicted more private wells would become contaminated at levels above public health standards unless actions are taken to restrict the movement of the plume.

A list of hazardous organic compounds (priority pollutant and hazardous substance list compounds) detected in groundwater samples analyzed during the RI is given in Table 3. Table 4 provides the list of priority pollutant metals detected at the landfill.

C. Extent of Ground Water Contamination

The contaminant pathway of primary concern near the landfill is the ground water. The town of Fircrest supplies water to its residents from six wells located west of the landfill. Three of these wells are only

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TABLE 3

ORGANIC WASTE COMPONENTS DETECTED AT THE TACOMA LANDFILL

Waste Component	Subsurface Soil	Ground-water	Surface Water	Sanitary Sewer and Leachate	Sediment	Gas[a]
Volatile Organic Compounds						
Tetrachloroethene	X	X		X	X	X
Trans-1,2-Dichloroethane	X	X		X		
Trichloroethene	X	X		X	X	X
1,1-Dichloroethene		X		X	X	X
Vinyl Chloride		X		X		X
1,1,1-Trichloroethane		X				X
1,1-Dichloroethane		X		X		X
1,2-Dichloroethane		X				X
Chloroethane		X		X		X
Benzene		X		X	X	X
Ethylbenzene		X	X	X		X
Chlorobenzene		X		X		X
Toluene	X	X	X	X	X	X
Xylene (Total)	X	X		X		X
2-Butanone	X	X		X	X	X
2-Hexanone				X		X
1,2,-Dichloropropane		X		X		X
Trans-1,3-Dichloropropene		X				X
Styrene						X
Carbon Disulfide						X
Chloroform		X	X	X		
Chloromethane						X
Bromo-dichloromethane						
Methylene Chloride	X	X		X	X	X
Acetone	X	X		X	X	X
4-Methyl-2-pentanone		X		X		
SemiVolatile Organic Compounds[b]						
Hexachlorobenzene		X				
PNAs		X			X	
Phenol		X		X		
Pthalate Esters		X			X	
1,4-Dichlorobenzene				X		
N-Nitro-Sodi-phenylamene				X		
Benzyl Alcohol				X		
Benzoic Acid				X		
4-Methy Phenol				X		
Isophorone					X	

[a] Samples not analyzed for semivolatile compounds

[b] Only trace amounts of semivolatile compounds were detected in ground water samples.

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TABLE 4

METALS DETECTED AT TACOMA LANDFILL

	Subsurface Soil	Ground-water	Surface Water	San. Sewer & leachate	Sediment	Gas
Arsenic	X	X	X	X	X	NA
Cadmium		X	X	X	X	NA
Chromium	X	X	X	X	X	NA
Copper	X	X	X	X	X	NA
Mercury	X	X	X	X	X	NA
Nickel	X	X	X	X	X	NA
Lead	X	X	X	X	X	NA
Zinc	X	X	X	X	X	NA
Iron	X	X	X	X	X	NA
Aluminum	X	NA	X	NA	X	NA
Manganese	X	X	X	X	X	NA

NA= not applicable

approximately 0.2 mile from the edge of the landfill. The City of Tacoma operates nine wells to the east of the landfill to supplement summer peak demands on their surface water supply (see Figure 2). In addition, twenty-six known domestic wells are located near the landfill (see Figure 6).

Volatile organic compounds have been detected in 20 monitoring wells installed around the perimeter of the landfill during the RI and in six of the private wells. The highest contaminant concentrations and greatest numbers of compounds were generally found near the water table in the southern portion of the landfill. Water samples from monitoring wells TL-4, TL-8a, TL-11a, and TL-12 illustrate this occurrence. However, the highest concentration of vinyl chloride detected to date on the site was drawn from a deeper portion of the aquifer at monitoring well TL-10b.

Contour maps included in the RI report show the projected distribution of seven of the contaminants of concern in the aquifer associated with the Tacoma Landfill Site:

	Contaminant	Maximum Concentration
a.	Vinyl chloride	80 ug/l
b.	Benzene	19ug/l
c.	1,2-dichloroethane (DCE)	20 ug/l
d.	Methylene chloride	1300 ug/l
e.	1,1-dichloroethane (DCA)	42 ug/l
f.	Chloroethane	55 ug/l
h.	Toluene	60 ug/l

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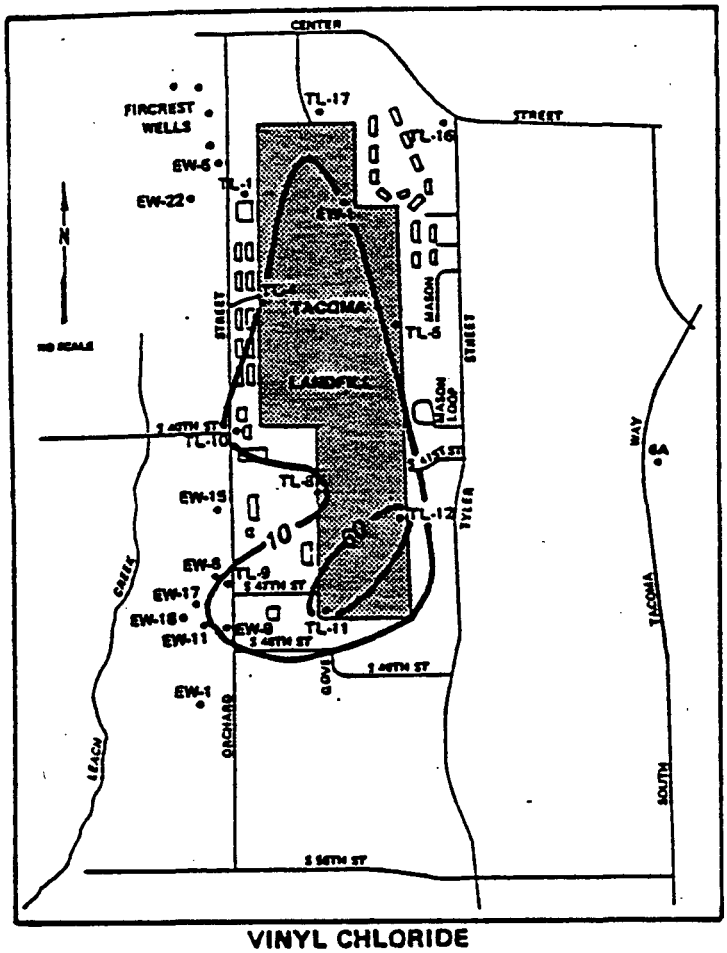
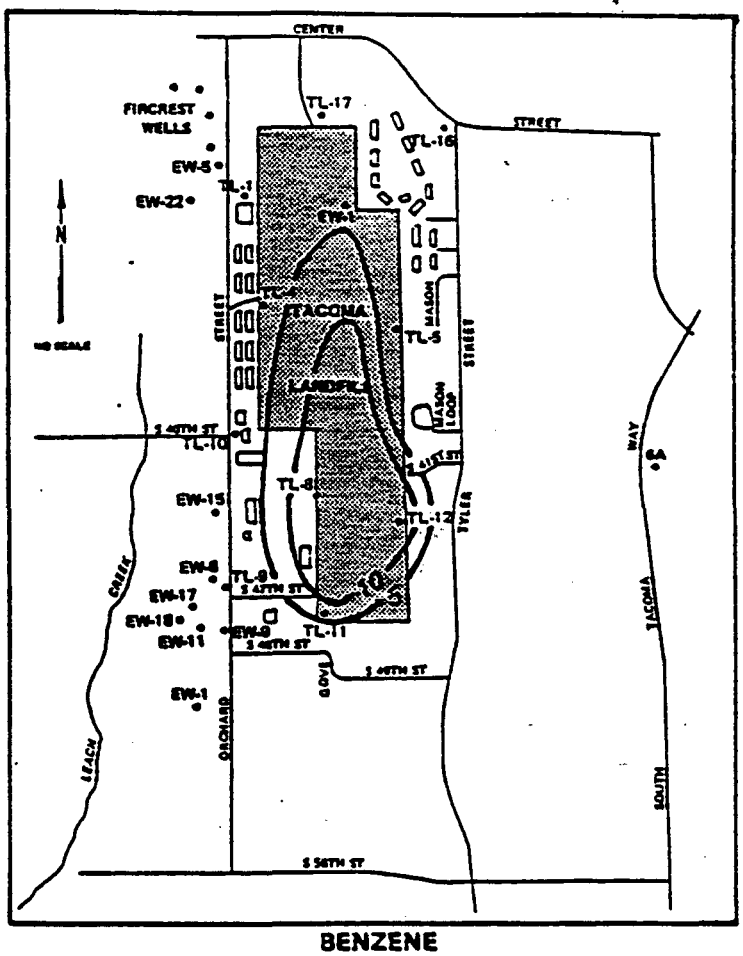
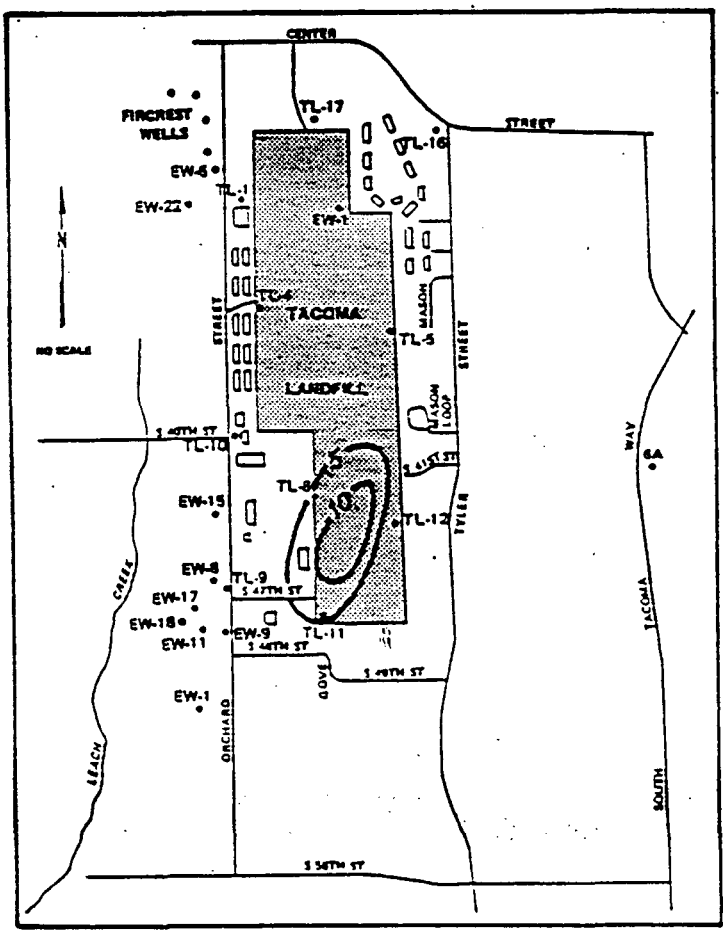
CONTAMINANT DISTRIBUTION IN GROUNDWATER



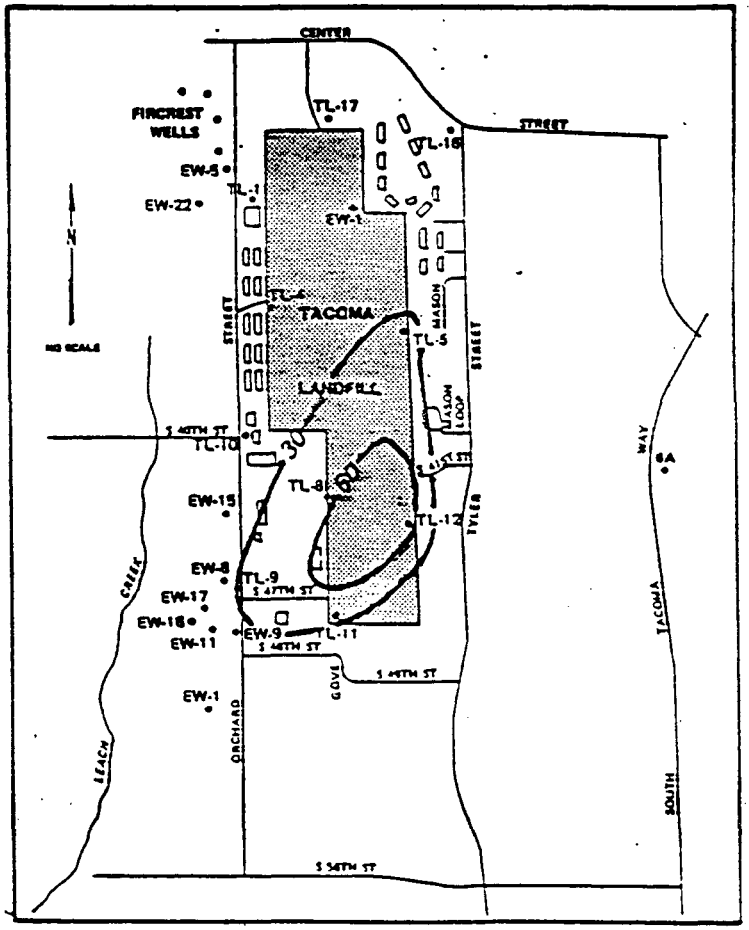
VINYL CHLORIDE



BENZENE



1,2-DICHLOROETHANE



METHYLENE CHLORIDE

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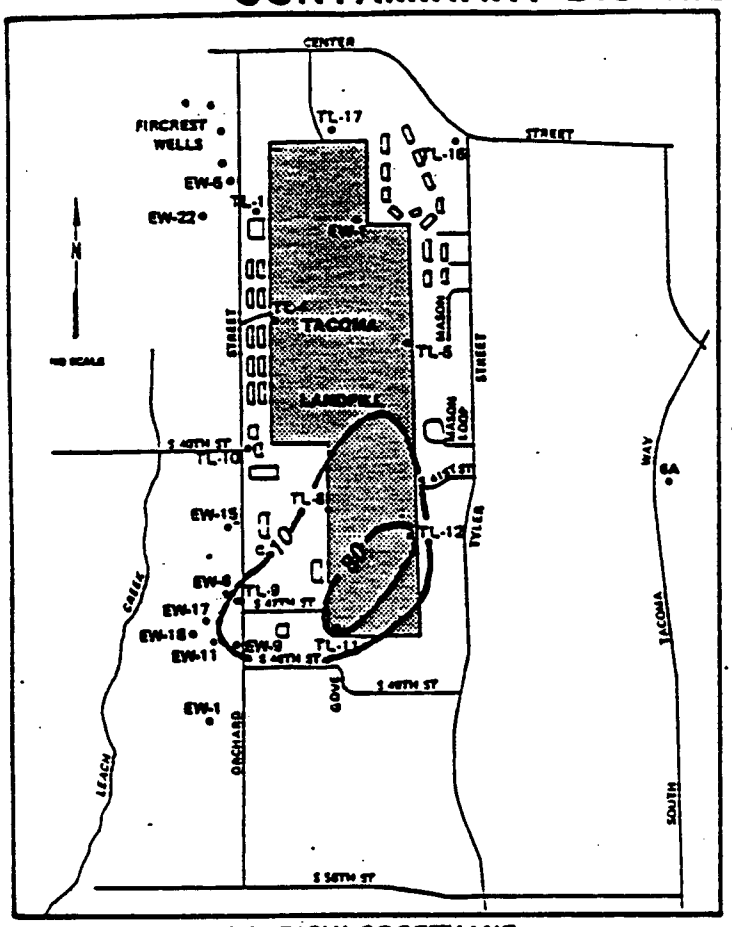
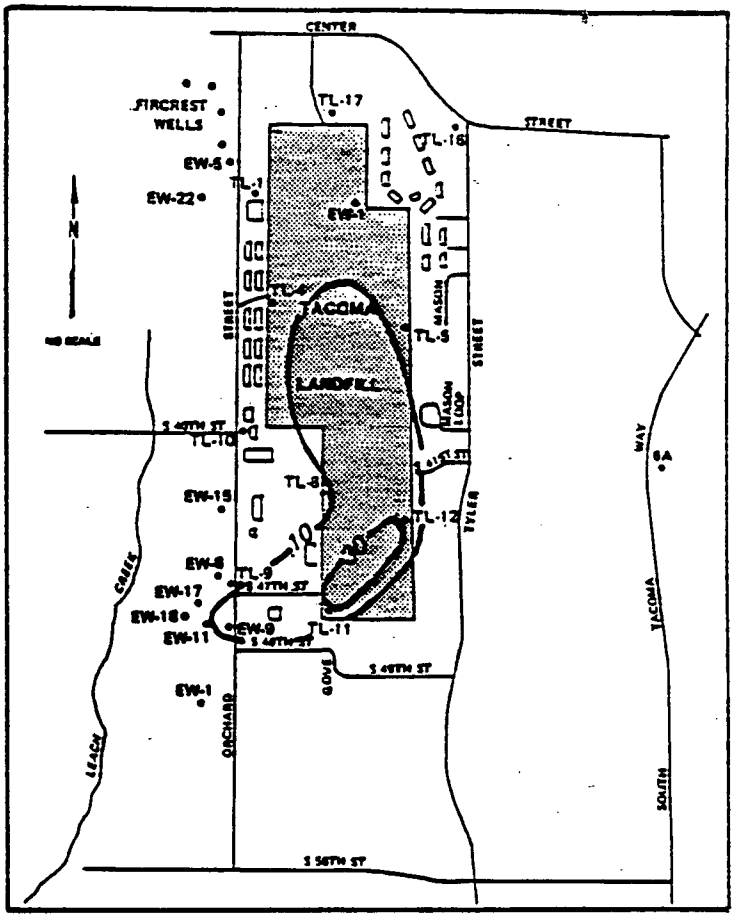
CONCENTRATION CONTOURS IN UG/L FIGURE 9

CITY CLERK CONTRACT/AGREEMENT NO.

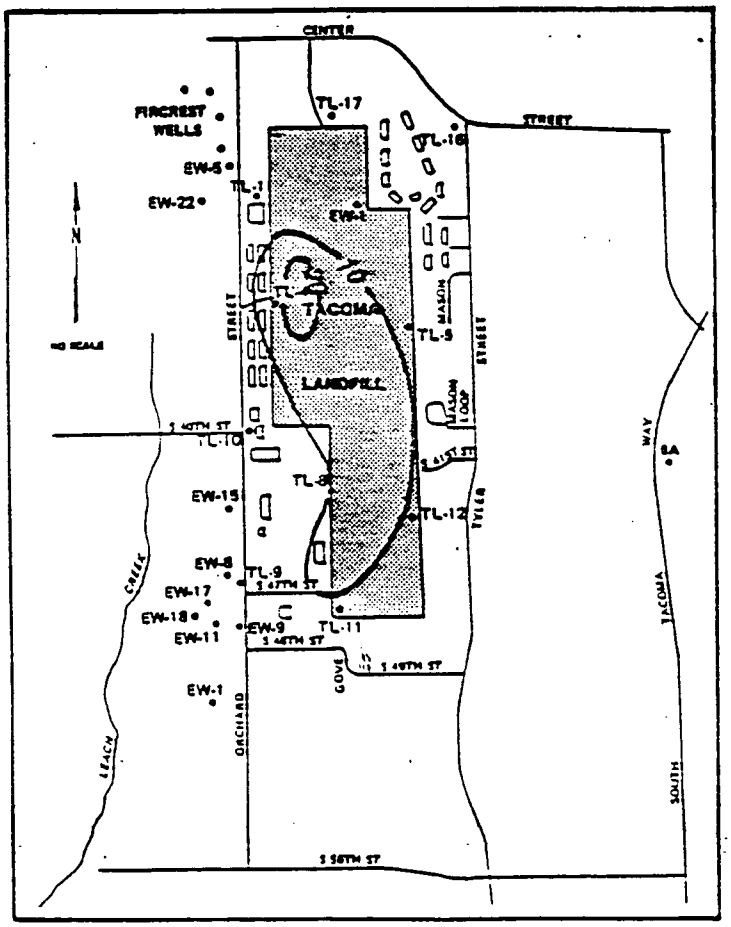
CONTAMINANT DISTRIBUTION IN GROUNDWATER



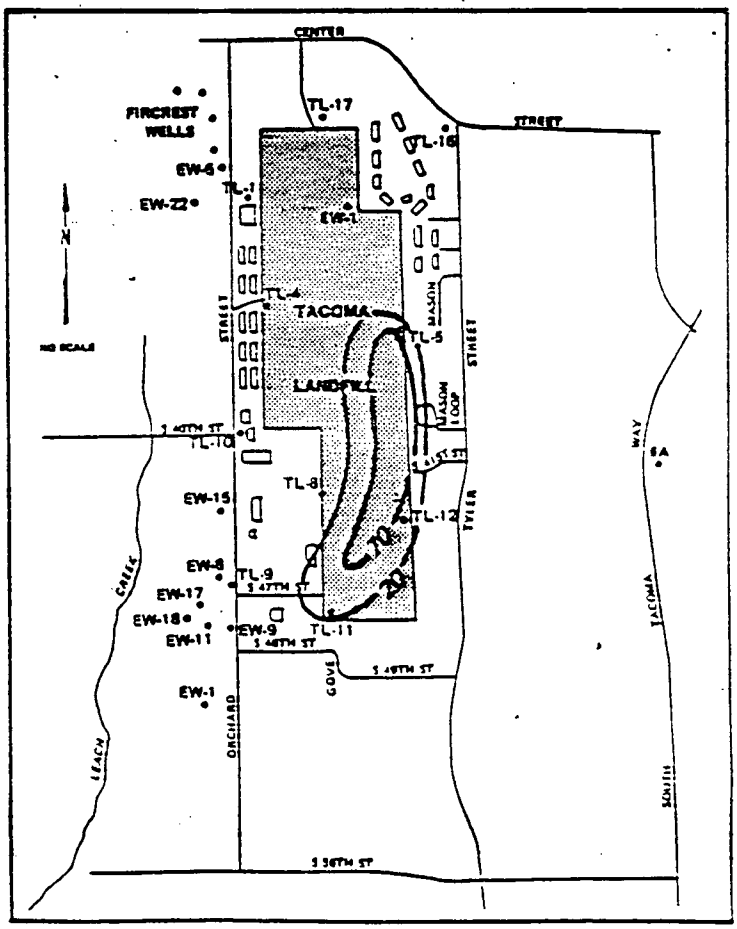
1,1—DICHLOROETHANE



CHLOROETHANE



TOLUENE



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CONCENTRATION CONTOURS IN UG/L

FIGURE 10
CONTAMINANT DISTRIBUT
IN GROUNDWATER (CONT

The contour maps are presented here as Figures 9 and 10 to show the general pattern in which each contaminant has spread in the aquifer.

Priority pollutant semivolatile, base, neutral, and acid extractable compounds were detected in trace amounts in a few of the ground water samples collected at the site. Priority pollutant metals occasionally exceeded maximum contaminant levels (MCLs) established pursuant to the federal Safe Drinking Water Act.

1,1,1-trichloroethane was also found in measurable amounts in wells along 53rd Street West. Routine sampling of these wells has been on an annual basis and it is possible that the landfill is not the only source of contamination. This is in the process of being evaluated.

D. Surface Water

Surface water testing throughout the study area, in general, did not show a significant problem which could be attributed directly to the landfill. At this time most of the surface water is being controlled on-site. There are three notable exceptions to surface water control:

1. The retention pond to the north has been contaminated with toluene. This chemical has also been detected in nearby monitoring well TL-17.

2. Nearby off-site storm sewers receive runoff which discharges to surface water (Leach and Flett Creeks) without retention or pre-treatment.

3. Storm water from the landfill is being conducted to the sanitary sewer.

Leachate was surfacing on the working face that now comprises the east side of the Central Area. The leachate is now being conducted directly to the sanitary sewer through a buried toe drain.

Sediment samples taken from nearby storm sewer outlets show elevated values for metals. However the RI was inconclusive citing other potential sources in addition to the landfill. Surface water (storm water runoff) will be addressed as part of the selected remedy.

E. Future Impacts

As part of the RI/FS, modeling was performed to project future contaminant migration. Contamination has been verified in private wells southwest of the landfill in the direction of Leach Creek.

Tentative flow paths were then plotted based on the mapping of ground water levels over several months. Contaminant flow velocities and dispersion ratios were then estimated and a simplified groundwater contaminant transport model named Plume (Van der Heijde 1983) was run.

Receptor groups were assigned based on location of known contamination and the assumed aquifer discharge. Wells closest to Orchard Street were designated near. Wells downgradient from the near wells were called far. Leach Creek was assumed to be the far boundary. The Fircrest wells were not

included in the model because the flow path analysis did not show them in the line of contamination. However, the flow path analysis was based on current usage rates and pumping conditions of both Fircrest and the Tacoma wellfield, and did not take into account any future changes to these conditions. The Feasibility Study (FS) did not include flow path analysis under differing usage rates and pumping conditions. Therefore, the model is appropriate for prediction of future migration only as far as the assumptions remain valid.

The studies showed that the main plume of groundwater contamination may reach 1200 feet southwest of the landfill. To the west and southeast it may reach 200 feet and to the northeast about 800 feet. Figure 11 shows this plume and how far it would spread if unchecked, and if the model assumptions are correct. The modeling that helped predict the plume's spread assumed that pumping of the Fircrest and City of Tacoma (6a) wells will stay the same. These wells are about 500 and 3500 feet from the site, respectively.

The model predicted that for the next 100 years the aquifer between the landfill and Leach Creek would contain unacceptable levels of contaminants. Table 5 lists the estimated maximum predicted off-site concentrations for the seven indicator chemicals in the RI, and the estimated times to reach maximum concentrations at the close in and distant wells.

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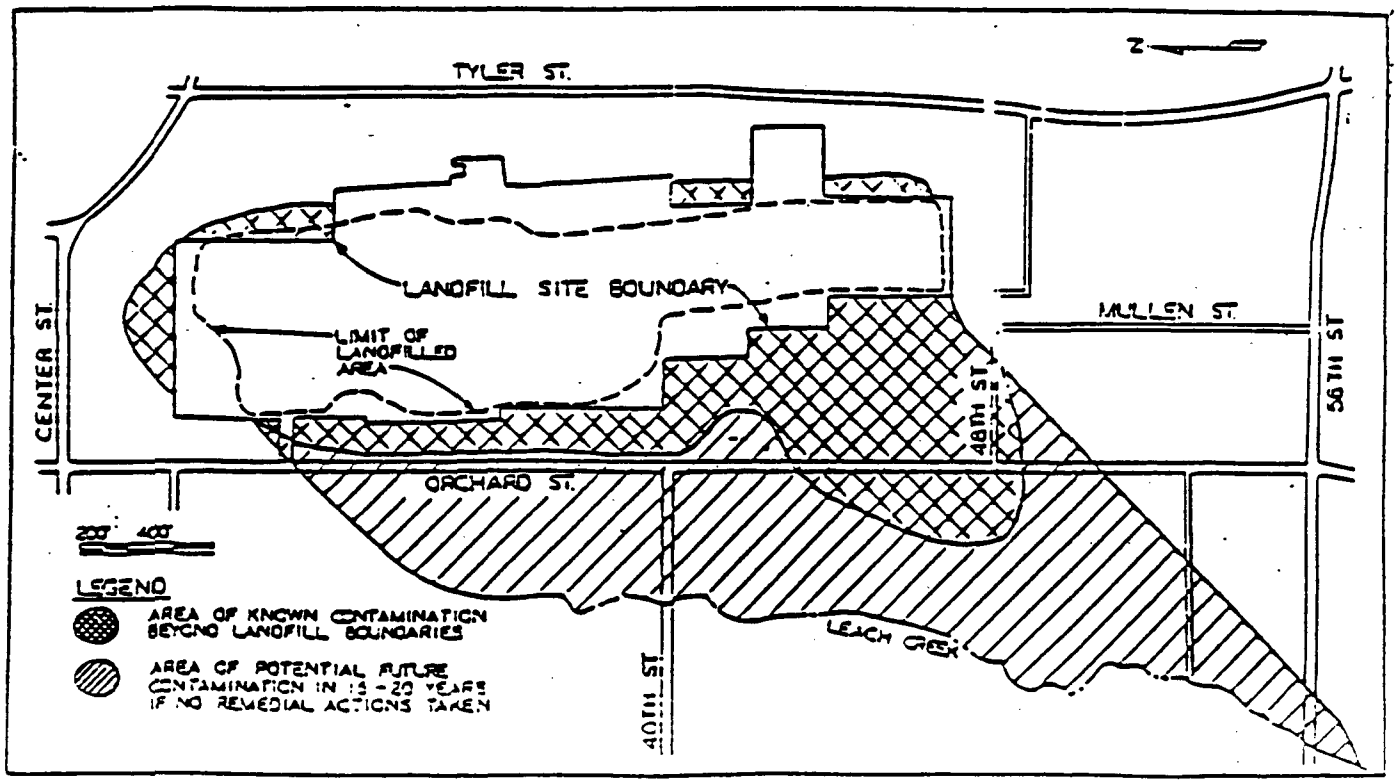
FIGURE 11

CURRENT AND PREDICTED CONTAMINATION



F. Endangerment Assessment

An endangerment assessment was conducted at the Tacoma Landfill to estimate the magnitude and probability of actual or potential harm to public health or the environment caused by the threatened or actual release of hazardous substances. The assessment presented in the RI addressed the potential human health and environmental effects associated with the Tacoma Landfill site in the absence of the any remedial action (i.e., the no action alternative).

The no action alternative is the baseline where no corrective actions take place under Superfund. In the case of the Tacoma Landfill, however, certain corrective actions will take place regardless of the actions taken pursuant to the Superfund site cleanup. These corrective actions must be conducted to meet the requirements of the Washington State Minimum Functional Standards for landfills (WAC 173-304). These actions include: developing an operating and closure plan for the landfill, installation of a cap, installation of a liner and leachate collection for ongoing disposal activities, and installation, operation and maintenance of a methane gas extraction system.

The future operation and maintenance of the landfill gas extraction system and planned refuse processing operations will restrict development of the landfill. Therefore, the endangerment assessment for the no action alternative assumes site access will continue to be restricted in the future. Although several pathways of exposure can be postulated for the site (surface runoff, inhalation of vapors and entrained dust), the primary pathway of concern for this site is groundwater. Since access to the site will be

restricted, the importance of the air pathway will be reduced. The methane gas collection system will also act to minimize the inhalation exposure route. The target receptors are the private and public well owners within the path of contaminant plume. Also of concern is the possibility of heavy metals and organics reaching Leach Creek, and ultimately Puget Sound, either by surface or groundwater routes.

Health Evaluation

The public health evaluation identifies potential threats to human health in the absence of remedial action at the site. This evaluation process includes a hazard assessment, dose/response assessment, exposure assessment and risk characterization.

Twenty-four volatile organic chemicals were detected in the groundwater. Of these, seven were selected as contaminants of concern in the Endangerment Assessment of the RI due to their frequency of occurrence, concentrations found, and primary targets (human population):

- vinyl chloride
- benzene
- 1,2-dichloroethane
- methylene chloride
- 1,1-dichloroethane
- chloroethane
- toluene

However, based on EPA and Ecology's review of the Endangerment Assessment, the following three additional organic chemicals have been added to the list of contaminants of concern:

- o xylenes
- o 1,1,1-trichloroethane
- o ethyl benzene.

This new list of ten organic contaminants of concern were separated into classes of potential carcinogens and noncarcinogens. Vinyl chloride, benzene, 1,2-dichloroethane, and methylene chloride were selected as indicator potential carcinogens. Both vinyl chloride and benzene are classified as human carcinogens by the EPA. Methylene chloride is a B2, probable human carcinogen, based on inadequate data in humans and increased incidence in rats and mice. It is present both on and off-site at considerably less frequencies of occurrence.. 1,2-dichloroethane, despite being found even less frequently than methylene chloride, is ranked as an EPA B2 carcinogen and is included for that reason.

Chosen as noncarcinogen indicator chemicals of concern were 1,1-dichloroethane, chloroethane, toluene, xylenes, 1,1,1-trichloroethane, and ethyl benzene. The three chlorinated ethanes were encountered relatively frequently in the samples, although 1,1-dichloroethane occurs much less frequently than the others. In general, the toxicity and bioconcentration potential of the chlorinated ethanes increases with increased concentration. All but the 1,1,1-isomer are extremely soluble in water. Toxicity concerns

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from their ingestion at significant levels in drinking water lie chiefly in the areas of chronic liver damage and overall central nervous system depression.

Toluene and xylenes were selected largely because of their high frequencies of occurrence, chemical similarities, and potential ecological risk. Toluene was the most commonly detected chemical in water samples off-site, and was roughly equivalent to xylene as fourth most common on-site. Ethyl benzene was included as a chemical of concern because of its relatively frequent occurrence among the more minor chemicals, its leachability, and its tendency to biodegrade relatively slowly in groundwater.

The Endangerment Assessment of the RI calculated the excess lifetime cancer risks from ingestion of carcinogens in groundwater if no alternate water supply is provided, and an estimate of risk if there is short term exposure to the indicator chemicals. Because so many chemicals, both carcinogens and noncarcinogens, are present in the groundwater, the possibilities of additivity and synergism cannot be ignored. However, the Endangerment Assessment of the RI was largely modeled on the concept of the predominant risk being due to the ingestion of water containing vinyl chloride.

The calculation of carcinogenic risk, assuming no alternate water supply is provided, is based on a 70 kg adult consuming 2 liters of contaminated groundwater for 70 years. The increased risk of cancer if a 70 kg adult consumes 2 liters of vinyl chloride contaminated groundwater (at a concentration of 70 ug/L) for 70 years is about 5 in one thousand.

Carcinogenic risks have been calculated for the short term exposure scenario, that a carcinogen migrates to a residential well the day after a "carcinogen free" sample is collected. It is estimated it will take approximately four months from the start of exposure until contamination is detected in the next quarterly sample and before an alternate water supply can be provided. The short term concentration was estimated based on sampling results for the residential wells in which contamination has been detected. The average daily intake was then calculated to account for the four month exposure. The estimated excess cancer risk associated with this short term exposure is less than one in a million.

The population at risk within the predicted plume is divided into three areas: the area within City boundaries, the area within the Town of Fircrest boundaries, and the unincorporated area within Pierce County. Approximately half of the predicted contaminant plume is east of Orchard Street within the Tacoma City limits. There are approximately 26 residences within the projected plume, if contamination continues to flow predominately toward the southwest. Groundwater sampling and hydrogeological investigations conducted during the RI indicate that the plume has reached the existing wells closest to the landfill. Those with close-in wells in which contaminants have been detected have been connected to City water.

There are still three close-in wells not hooked up to City water in which contaminants have not been detected. No contaminants have been detected in the distant wells, and based on the contaminant transport modeling, it will be several years before the wells in this group will be impacted as a result of contaminant migration from the landfill.

Table 5 lists the estimated landfill source concentrations for the seven indicator chemicals listed in the RI and the estimated times to reach maximum concentrations at the close-in and distant wells. The close-in wells would be expected to be maximally impacted by vinyl chloride beginning about 10 to 15 years from now while benzene would not be expected to peak until about 55 to 60 years hence. The distant wells would be expected to reach maximum benzene concentrations in about 85 to 90 years.

There is a possibility that if water from Leach Creek was used in the future as a drinking water supply, exposure to vinyl chloride and/or benzene at levels exceeding their MCLs could occur. There are existing water rights for domestic use of Leach Creek.

Some potential exists for human exposure to contaminants by using private well water for livestock and to water vegetables, etc. However, since the contaminant concentrations of the groundwater being used to water livestock and irrigate crops would be the same as detected in the private wells, it would be highly unlikely that a significant exposure would result from this pathway.

Environmental Evaluation

The Endangerment Assessment in the RI did not compare the levels of organics and metals in the groundwater to ambient Water Quality Criteria (WQC) for the protection of aquatic life. Metals and organic compounds in the groundwater which are above federal or state WQC are of environmental concern. Maximum concentrations detected in either on-site or off-site

TABLE 5

TRAVEL TIMES TO REACH MAXIMUM AND THRESHOLD CONCENTRATIONS, CLOSE-IN AND DISTANT WELLS

Indicator Chemical	Maximum Predicted Offsite Conc. ug/L	Time from Present to Approach Max. Concentration, Yrs. Close-In Wells	Distant Wells	Threshold Conc. ug/L	Time From Present to Back Below Threshold Yrs
Vinyl Chloride(1)	60-70	10-15	25-30	2	>100
Benzene(1)	8-10	55-60	85-90	5	>100
1,2-Dichloroethane(1)	4-5	45-50	75-80	5	NA
Methylene Chloride(1)	150-160	5-10	20-30	36, 5	>100
1,1-Dichloroethane(2)	80	35-40	65-70	271, 27	NA, >100
Chloroethane(2)	30	5-10	20-25	(Very High)	NA
Toluene(2)	30	55-60	85-90	2000	NA

NOTES:

(1) Maximum concentrations for carcinogens are maximum 70 years average.

(2) Maximum concentrations for noncarcinogens are maximum 90 days average.

groundwater for cadmium, chromium, copper, nickel and zinc, all exceeded ambient WQC for the protection of aquatic life. An overview of the VOCs which were identified as potentially harmful to the environment are listed in Table 3.

Flett and Leach Creeks support anadromous salmonid runs, which will be at risk if toxic compounds are present in the creeks during critical phases (e.g., smolting) in their growth cycles. Heavy metals, as well as certain of the organics such as xylene may also pose problems for the health of the downstream wetlands ecosystem as the Leach Creek drainage ultimately enters Puget Sound. This would most markedly impact highly vulnerable organisms such as larval fishes, but parts of the commercially important benthos (shellfish) could also become adversely affected.

Conclusions

Based on a review of the endangerment assessment and data presented in the RI report, the following conclusions were made concerning risk to human health and the environment from contaminants associated with the Tacoma Landfill site:

- Concentrations of several indicator chemicals frequently exceed MCLs in the groundwater. Drinking the water from contaminated wells poses the most significant risk to human health, especially in terms of chemicals in the aggregate.

- Under the no action alternative, some contaminant concentrations in the groundwater plume are predicted to exceed ambient WQC when the plume discharges to Leach Creek. These levels could pose a risk to aquatic biota, especially since the Leach and Flett Creeks wetland area enters Puget Sound.

- Based on EPA and Ecology's review of the Endangerment Assessment in the RI, the agencies agreed that it would be appropriate, for the protection of public health, to establish health-based levels for a larger number of compounds than the seven indicator chemicals selected during the risk assessment. Accordingly, xylenes, 1,1,1-trichloroethane and ethyl benzene have been added to the list of contaminants of concern.

- Depending on the discharge location, performance levels for the selected remedy will be based on MCLs, Water Quality Criteria, or pre-treatment standards. In the absence of established standards or Water Quality Criteria, EPA Region 10 has conducted a risk assessment of the compounds. These are listed in Table 8 of the Selected Remedy portion of this document. The most stringent number will be used for the performance levels for the treatment system if the cleaned water is discharged to surface water. For the other volatile organic chemicals and metals found in the groundwater, EPA and Ecology have identified a methodology for establishing performance levels. This methodology is detailed in the Selected Remedial Alternative section of this document (Section VI).

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V. SUMMARY OF ALTERNATIVES EVALUATION

A. Identification and Screening of Remedial Technologies

In order to develop a complete listing of potential remedial technologies, general response actions corresponding to each contaminant pathway were identified.

The general response actions fall into the following seven primary categories:

- No action
- Institutional controls
- Containment
- Removal
- On-site treatment/discharge
- Off-site treatment/disposal
- Other management options.

Forty potential remedial technologies for controlling contaminant migration were screened. Thirty-one potential remedial technologies were identified for the groundwater pathway and nine potential remedial technologies were identified for the gas migration/air quality pathway. The potential remedial technologies were categorized according to the appropriate general response action. A screening process was applied to these to identify unsatisfactory technologies. Screening criteria were effectiveness, implementability, and cost.

The technologies that were not screened out were assembled into preliminary remedial action alternatives. These alternatives were designed to meet the categories identified by the National Contingency Plan (NCP). Screening criteria contained in the NCP and Superfund Amendments and Reauthorization Act of 1986 (SARA) were overlapped in this process. An initial screening was performed on sixteen separate alternatives. The preliminary remedial action alternatives were screened again in order to eliminate alternatives that adversely impact public health and the environment, or that are more expensive than other alternatives which provide the same degree of remediation. This initial screening of remedial action alternatives produced six remedial alternatives that were subjected to detailed development and analysis.

For ease in presenting the alternatives to the public, alternatives 2, 4, 8, and 12 as numbered in the FS report (Black & Veatch 1987) were combined since they represented just one technical category (i.e., pump, treat, and discharge). The alternatives then became no action, alternative water supply/landfill cap, and pump, treat, and discharge with landfill cap. Four treatment options are included in the last alternative (see Table 6). Information packages available to the public contained these three alternatives, which were also presented at a public meeting on February 11, 1988.

B. Methodology for Detailed Evaluation of Remedial Alternatives

The detailed evaluation in the FS discusses cost-effectiveness of an alternative in terms of technical, environmental and public health, and

institutional concerns. Requirements of the NCP were met by evaluating each alternative with respect to the following criteria:

- Technical Feasibility
- Public Health Impacts
- Environmental Impacts
- Institutional Requirements
- Cost Analysis.

This analysis facilitates the comparison of similar components among the alternatives for the same criteria.

Technical Feasibility

The technical evaluation considered the performance, reliability, implementability, and safety factors of the remedial actions. Performance of each alternative was based on the alternative's expected effectiveness and its useful life. Key considerations in evaluating reliability included operation and maintenance (O&M) requirements and the demonstrated performance of the technologies at similar sites. While SARA requirements do not include demonstrated performance, the six final remedial alternatives evaluated against this criteria were known technologies. For implementability, both the constructability and the time required to achieve a given level of response were considered. Constructability addresses whether the alternative can be constructed on the site and the impact of external conditions on the construction. The time it takes to implement an alternative and the time to

achieve beneficial results that attain or exceed relevant or applicable standards were also considered. The safety evaluation considers short-term and long-term threats to the safety of nearby residents and to persons working on-site. Major risks to consider are exposure to hazardous substances, fire, and explosion due to activities conducted during implementation of the remedial action.

Public Health Impacts

The public health evaluation of alternatives assesses the extent to which each alternative mitigates long or short-term exposure to any residual contamination and protects public health during and after completion of the remedial action. In evaluating both long and short-term public health impacts, two primary areas were considered. Evaluation of short-term impacts considered health effects on workers during construction of the remedial action and on the public for the interim period prior to remedial action implementation. Long-term impacts were judged based on chronic intake of the contaminant over a lifetime.

Environmental Impacts

Each remedial alternative was evaluated for beneficial and adverse environmental impacts for the long and short-term. Criteria for evaluating beneficial effects were final environmental conditions, improvements in the

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biological environment, and improvements in resources people use. Criteria for evaluating adverse effects were the expected effect of the remedial action and the measures taken in the event inevitable or irreversible effects occur.

Institutional Requirements

Institutional requirements are divided into three categories: community concerns, conformance with Applicable or Relevant and Appropriate Requirements (ARARs), and permitting requirements. Community concerns addresses the public's acceptance of the selected remedial action alternatives. The remedial action alternatives developed in the FS should address all legally applicable or relevant and appropriate standards, requirements, criteria, or limitations to be consistent with SARA. Institutional constraints are those mechanisms available to ensure administrative control over activities at the site (zoning, permits, ordinances, etc.).

Cost Analysis

Detailed cost analysis of alternatives involves estimating the expenditures required to complete each measure in terms of capital costs, and annual operation and maintenance costs for a 30-year period. Once these values were determined and a present worth calculated for each alternative, a comparative evaluation was made. The cost estimates presented in the FS section were based on conceptual designs prepared for the alternatives (i.e., without detailed engineering data). These estimates were accurate between +50 percent and -30 percent in 1987 dollars.

Rating Alternatives

A rating system is used to evaluate alternatives, and the terms high, moderate, and low are assigned to each. A high rating indicates that the alternative promotes the intent of the criterion and/or meets or exceeds the remedial objectives. A moderate rating indicates that the alternative only partially promotes the intent of the criterion; however, the alternative does remediate the problem to an acceptable extent even though it does not meet all the remedial objectives. A low rating indicates that the alternative does not promote the criterion and/or does not meet the remedial objectives.

An evaluation of each alternative is contained in Tables 6 and 7. These evaluations are based on numerical ratings of each criterion contained in the FS (Black & Veatch 1987). A criterion was subdivided into one or a few factors, which were rated from 1 to 5. To establish the criterion numerical rate, numerals assigned to each factor within the criterion were averaged. For this report, ratings were assigned as follows:

Numerical Rating	New Criterion Rating
$\leq$2.00	High
2.01-3.99	Moderate
$\geq$4.00	Low

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TABLE 6

SUMMARY OF DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

No.	Alternative (No. in FS)	Cost ($1,000)		Criterion				
		Capital	Present Worth	Public Health Impacts	Environmental Impacts	Technical Feasibility	Institutional Requirements	Community Concerns
	No Action (1)	--	--	Low	Low	N/A	Low	Low
	Alternative Water Supply/ Landfill Cap (3)	16,423	18,376	High	Moderate	High	High	High
	Pump, Treatment, and Discharge with Landfill Cap							
	a. Off-site Treatment at Sewage Treatment Plant (2)	17,932	23,418	High	High	Moderate	High	High
	b. On-site Treatment (Air Stripping and Carbon Adsorption (4)	19,532	22,717	High	High	Moderate	High	High
	c. On-site Treatment Carbon Adsorption (8)	19,266	23,417	High	High	Moderate	High	High
	d. On-site Treatment (Air Stripping) (12)	18,971	21,015	High	High	Moderate	High	High

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CITY CLERK CONTRACT/AGREEMENT NO. 4-[illegible]

TABLE 7

SECTION 121(b) (1) (A-G) FACTORS

	Alternative					
Criterion	1	2	3a	3b	3c	3d
Compliance with ARARs	Low	Moderate	High	High	High	High
Reduction of Toxicity, Mobility, Volume	Low	Moderate	High	High	High	High
Short-Term Effectiveness	Low	High	Moderate	Moderate	Moderate	Moderate
Long-Term Effectiveness	Low	Moderate	High	High	High	High
Implementability	N/A	High	Moderate	Moderate	Moderate	Moderate
Cost (See Table 6)						
Community Acceptance	Low	Moderate	High	High	High	High
State Acceptance	Low	Moderate	High	High	High	Moderate
Overall Protection of Human Health and the Environment	Low	Moderate	High	High	High	High

C. Results of Detailed Evaluation of Remedial Alternatives

This section presents a summary of the detailed evaluation of the remedial alternatives in terms of costs, public health impacts, environmental impacts, technical feasibility, institutional requirements, and community concerns. A summary of these items is presented in Table 6 according to 1985 RI/FS Guidance Factors (EPA 1985) and an evaluation of the remedial alternatives according to the Section 121(b)(1)(A-G) factors is shown in Table 7.

Non-cost Evaluation

As shown in Table 6, Alternatives 2, 3a, 3b, 3c, and 3d all had four high ratings and one moderate rating. Therefore, they would be judged comparable alternatives under this system of rating criteria. However, evaluating alternatives using guidance from Section 121(b)(1)(A-G) factors reveals some differences (Table 7). The (A-G) factors are used to assess alternative remedial actions for permanent solutions and to assess alternative treatment technologies that yield a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant. Alternatives 3a, 3b, and 3c, have six high ratings and two moderate ratings. Alternative 3d has five high ratings and three moderate ratings. Alternative 2 has only two high ratings and six moderate ratings. It is clear that Alternatives 3a through 3c would be considered superior to to the other alternatives.

Cost Summary and Sensitivity Analysis

Cost estimates prepared for each alternative involved approximation, assumptions, estimations, interpretations, and engineering judgment. To provide some indication of sensitivity of the costs to changes in key parameters, a sensitivity analysis was performed.

The cost of closing the landfill is the major cost for all the alternatives under consideration, and is the same for each. The treatment process cost could be the most variable because alternatives would not yield the same influent concentrations. To evaluate the impact that changes in concentration would have on carbon adsorption treatment costs, concentrations of two and three times the predicted value were analyzed. The carbon adsorption unit cost was chosen for analysis on the basis of its potential impact on overall treatment cost estimates of Alternatives 3b and 3c. When the concentration of contaminants in the waste stream is doubled, the carbon usage (cost) will increase by approximately 1.5 times. The total cost for Alternative 3b would increase 3.8 percent while the total cost for Alternative 3c would increase 6.8 percent. For the case when the contaminant concentrations are tripled, the carbon cost will approximately double. The total cost for Alternative 3b would increase 7.3 percent while the total cost for Alternative 3c would increase 9.7 percent.

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CITY CLERK CONTRACT/AGREEMENT NO. 1[illegible]

VI. SELECTED REMEDIAL ALTERNATIVE (No. 3)

A. Description of Selected Remedy

The selected remedy includes a landfill cap and gas extraction system to control the source, and a ground water extraction and treatment system to control migration of the plume. All extracted water will be treated to specific performance standards, monitored to ensure compliance and will be properly discharged. The Tacoma water supply system will be expanded to assure sufficient water is available should any water supply (public or private) become contaminated from the landfill. The remedy also includes a closure schedule for operation of the landfill.

The remedy is designed to:

- Prevent further migration of the plume via the ground water extraction-treatment system.
- Reduce the production of leachate by placing constraints on site operations and by properly grading and capping the landfill.
- Eliminate off-site gas migration through the gas extraction system.
- Further protect public health and the environment via monitoring of groundwater, surface water, gas probes, air emissions, and provision of alternate water supplies where necessary.

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Management of Migration

Migration control will be achieved through a ground water extraction and treatment system, and a system or method to confirm performance. Activities necessary to develop those systems shall be conducted during remedial design. Wells for this system will be placed within and, if necessary, downgradient to contain the plume. Containment is defined as controlling the plume and preventing the spread of contamination. The goal of the containment system is to prevent any further degradation of existing water quality beyond the boundaries of the existing plume. The extraction wells should be designed to achieve this objective. The existence of the gradient reversal due to pumping by the city of Tacoma wellfield, local effects from pumping the Fircrest wells, or monitoring results at the landfill may result in the need for extraction wells at locations other than those identified in the feasibility study. Minimum flows as required by WAC 173-512 shall be maintained in Leach and Flett Creeks.

The treatment process shall be permanent and shall effectively reduce the toxicity, mobility, and volume of contaminants. It shall also employ all known, available, and reasonable methods to treat the contaminated ground water, and to prevent the spread of contamination. Discharge of treated ground water may be to either Leach Creek, Flett Creek, or the sanitary sewer.

If the discharge is to either Leach Creek or Flett Creek, the effluent must meet or exceed maximum contaminant levels (MCLs) developed pursuant to the Safe Drinking Water Act or meet the chronic fresh water criteria as set forth in EPA's Quality Criteria for Water, 1986 (EPA 440/5-86-001), whichever

is more stringent. Both of these creeks have existing water rights on them, although they are closed to further appropriation by WAC 173-512. In addition, both creeks support anadromous salmonid runs.

Most of the contaminants found at the Tacoma Landfill do not currently have MCLs. For the VOCs listed in Table 3, and for metals in the groundwater, which EPA and Ecology have not established treatment levels, a methodology for determining the appropriate discharge limits has been established. If no MCL has been established for a contaminant, the ambient water quality criteria (WQC) for protection of human health for water and fish ingestion will be used. If the value for protection of fish (the chronic fresh water criteria) is lower than the value for protection of human health, the lower value will be applied. If there are no WQC at all, then additional guidance documents, such as Health Advisories from EPA's Office of Drinking Water or any appropriate toxicological profiles, will be used to develop treatment levels. These treatment levels must be reviewed and approved by both Ecology and EPA prior to their use. This methodology will be used to set performance levels for any other contaminants identified in the groundwater and traceable to the landfill.

For six of the volatile organic compounds listed in Table 8, appropriate treatment levels have been identified. These are based on Safe Drinking Water Act MCLs or ambient WQC. In the absence of an MCL or ambient WQC, EPA Region 10 conducted a risk assessment of the chemical and provided an appropriate treatment goal for the protection of public health, welfare and the environment. These goals are listed in column three of Table 8 and will be used as performance goals for the treatment system. In addition, the effluent

TABLE 8

PERFORMANCE LEVELS FOR TREATMENT SYSTEM

DISCHARGE TO SURFACE WATER

TACOMA LANDFILL

(ug/L)

Constituent	Safe Drinking Water Act MCL	Water Quality Criteria Water and(1) Fish	Water Quality Criteria Chronic(2) Fresh water	EPA Reg. 10 Risk(3) Assess.
Benzene	5	0.66*	53	
Chloroethane				20
1,1-dichloroethane				20
1,2-dichloroethane	5	0.94*	20,000	
Ethyl benzene		1,400	320	
Methylene chloride				5*
Toluene		14	175	
1,1,1-trichloroethane	200	18,400		
Vinyl chloride	2			
Xylenes				10

(1) EPA Quality Criteria for Water, 1986 EPA 440/5-86-001, for water and fish ingestion by humans.

(2) Chronic fresh water criteria for protection of aquatic life. Where no values for chronic exposure were available, the acute values were divided by 100.

(3) Based on EPA Region 10 Risk Assessment.

* Values presented for carcinogens are at the 10^{-6} risk level.

must meet water quality standards as set forth in 173-201 (Water Quality Standards for Waters of the State of Washington).

If the option of discharge to the sanitary sewer is chosen, it must be consistent with discharge limitations as defined by WAC 173-216 (State Waste Discharge Program) and must meet pre-treatment regulations (City of Tacoma Code, Chapter 12.08), as revised for operation of the secondary sewage treatment plant.

Any treatment system which results in contaminant air emissions shall be designed to address appropriate ambient air quality values as determined by Ecology's Draft New Source Review Guidelines for Toxic Air Contaminants, (September 1986, or as revised). In addition, the Puget Sound Air Pollution Control Authority (PSAPCA) has made the determination that all new sources shall use Best Available Control Technology (BACT). This also will be a requirement of the treatment system design. BACT may involve a different technology for different contaminants.

The extraction and treatment system can be shut off when water quality within the plume, outside the compliance boundary (defined by WAC 173-304 as the edge of the filled area), consistently meets or exceeds drinking water standards, or previously established and approved health-based criteria. In addition to meeting health-based criteria, potential impacts to public and private water supplies and to Leach Creek must be considered in the decision to shut off the system. Ecology and EPA will reevaluate the implemented system every five years to assure that it is working properly and to propose any modifications that could facilitate the cleanup of the groundwater.

Source Control

Source control measures consist of constructing a cap on the landfill to minimize infiltration and maximize run-off. Unlined areas of the landfill will be capped as soon as possible. WAC 173-304 defines the minimum requirements for a cap on a municipal landfill. A more stringent cap will be required unless further analysis of the cap, to be provided during remedial design, shows that a significant reduction in leachate volume or toxicity would not be achieved.

Increased run-off due to the construction of the cap will be routed off the landfill to reduce infiltration. The slope of the cap and construction of drainage structures will be consistent with WAC 173-304. The run-off collected from the landfill will be directed to the appropriate storm or sanitary sewers, consistent with local storm drainage ordinances or pre-treatment regulations. The storm drainage plan, prepared as part of the remedial design, will determine and minimize any downstream increases in peak flow.

The Minimum Functional Standards (MFS) (WAC 173-304) prohibit filling in unlined areas after November 1989. These standards contain specific liner requirements which will apply to all municipal landfills by this date. Compliance with Minimum Functional Standards is determined by TPCHD, in accordance with Ecology review. Insufficient information has been received by Ecology and TPCHD to evaluate compliance of the liner installation with Minimum Functional Standard requirements. If the liner is determined not to be in compliance, a variance will be required from TPCHD to operate the Central Area Pit.

In the interim, the City has identified several unlined areas which need to be filled to meet minimum slope requirements in WAC 173-304. Additional filling in these areas will be kept to the minimum required to meet the final grade requirements of the Minimum Functional Standards. The City plans to develop an unfilled area of the landfill (North Borrow Pit) for future waste disposal. Filling of this or other previously unused areas will require a liner consistent with WAC 173-304.

Should a variance be needed and granted, the Central Area Pit will be brought up to final grade in accordance with the Operations and Closure Plan to minimize leachate production. Leachate head wells will be installed in the waste in the Central Area to assure that the leachate head requirements of WAC 173-304 are being met. Ecology and EPA will identify and approve of the appropriate number of leachate head wells during the Remedial Design phase.

MFS requires operating landfills to submit an operating plan by October 1987. A schedule for closure of the landfill under WAC 173-304 is considered part of the remedial action at this site. The schedule, developed as part of the required Operations and Closure Plan, will address various waste reduction measures and develop contingency plans if these measures do not produce the expected results. The contingency plans will include specific dates for beginning the process to site another municipal solid waste disposal facility to serve the City of Tacoma. Waste reduction measures to be considered include, but are not limited to:

- increased recycling including a program to exclude hazardous waste from the landfill

- incineration of the light fraction of shredded waste at the Tacoma City Light Cogeneration plant

- pyrolysis of the heavy fraction of shredded waste at an on-site facility

Several utilities pass through the site. The Operations and Closure Plan will provide for rerouting these utilities around the site or developing a testing and maintenance program that will ensure their long-term integrity without interfering with the selected remedy.

The production of methane gas at the landfill is being addressed through the installation of a gas extraction system and is being monitored using a series of gas probes installed around the landfill. The gas collected by the extraction system is burned by the combusters which meet PSAPCA's BACT requirements. Any future expansion of this system will be required to comply with these requirements. Additional gas probes will be installed in the surrounding neighborhoods to verify that the extraction system is preventing off-site gas migration. If significant concentrations of gas are found in the soils off-site, further gas extraction wells may have to be installed to collect and control these methane sources.

Because landfill gas is warmer than the ambient air, condensate collects in the gas collection line. This condensate is currently allowed to drain back into the landfill. Condensate from the flare station is collected and discharged to the sanitary sewer. As part of the remedial design, the

quantity and quality of these condensates will be determined. If significant concentrations or volume of condensates are found, the condensate shall be collected and treated appropriately. Source monitoring of the gas burners and the treatment plant system will be required.

Monitoring

Ground water monitoring wells shall be installed in locations appropriate for obtaining the following information:

- determine if the ground water extraction system is preventing the spread of the contaminant plume
- determine the extent of plume migration to the east of the site
- identify any potential impacts to Leach Creek and the Fircrest well system
- ensure there is no dense phase plume migrating away from the site in the deepest zones of the aquifer.

Ecology and EPA will review and approve of the number and location of the groundwater monitoring wells during the Remedial Design phase of the cleanup program.

Leach Creek will be monitored for both water quality and quantity. Other surface waters acting as receiving waters for either the groundwater

extraction system or the surface drainage system will be monitored for water quality. Effluent from the treatment system will also be monitored to assure that discharge limitations are not exceeded. The nature and extent of the monitoring program, including bioassays, will be developed during the Remedial Design phase of the cleanup program.

At a minimum, the private wells in the path of the plume will continue to be monitored on a quarterly basis. Fircrest wells will be sampled monthly. Any well, public or private, which becomes contaminated due to the landfill will be replaced and water will be supplied from existing City of Tacoma water supply systems. If EPA and Ecology make a determination that any well is in danger of exceeding an MCL, or a contaminant level based on an EPA risk assessment, connection to Tacoma's municipal water supply will be required. Aesthetic quality will also be a consideration in making this determination.

Tacoma, in cooperation with the Town of Fircrest, and Pierce County, will pursue the establishment of an ordinance, or other suitable methodology, to restrict drilling of water supply wells in an area from Tyler Street to Leach Creek; and from Center Street to approximately South 56th Street.

B. Statutory Determinations

The selected remedy meets all statutory requirements for the overall protection of human health and the environment. The groundwater extraction system will remove contaminated groundwater migrating from the landfill and prevent contamination from spreading in the aquifer. The movement of contamination to nearby Leach Creek should be prevented by groundwater

pumping. Treatment of the extracted water will be designed to reduce the toxicity, mobility and volume of contaminants and prevent them from returning to the groundwater or surface water environment. Nearby residents affected by contaminated groundwater, or by low water volume or flow as a result of the operation of the extraction-treatment system, will be connected to Tacoma's municipal water system.

The selected remedy must also meet all Applicable or Relevant and Appropriate Requirements (ARARs) and should address those items listed in the To Be Considered category. These are listed and their application is briefly described in Attachment A.

The laws and regulations of concern include but are not limited to the following:

1. Resource Conservation and Recovery Act (RCRA; 42 USC 6901), RCRA regulations (40 CFR 261 to 280), Washington State Dangerous Waste Regulations (WAC 173-303 and 70.105 RCW), and Washington State Minimal Functional Standards for Solid Waste Handling (WAC 173-304 and 70.95 RCW).

   Groundwater protection requirements of RCRA and Washington State Dangerous Waste Regulations will be attained by installation of the landfill cap to minimize leachate production, and operation of the groundwater extraction wells to remove contaminated groundwater. The selected remedy prevents further spread of groundwater contamination and

constitutes a Corrective Action Program as specified in 40 CFR 264.100 and WAC 173-303-645(11). Closure of the Tacoma Landfill to State Minimum Functional Standards will be evaluated to ensure consistency with RCRA landfill closure standards.

2. Safe Drinking Water Act (42 USC 300), and Primary Drinking Water Standards (40 CFR 141).

Groundwater will meet maximum contamination levels (MCLs) and appropriate health-based standards as the contaminated plume is removed and leachate generation is minimized. The selected remedy will prevent exposing the public to contaminated drinking water by monitoring residential wells for MCLs and connecting the house to Tacoma's municipal water supply when conditions require it. Any affected public water supplies also will be connected to city water. Therefore, by monitoring, providing an alternate drinking water supply, and restricting groundwater use (until the aquifer no longer exceeds these levels) in the area, the selected remedy will meet the requirements of these regulations.

3. Clean Air Act (72 USC 7401).

If an airstripping system is used, concentrations of contaminants in the air stripper off-gases will be required to meet the requirements of the Clean Air Act. The flares for the methane gas extraction system must also meet the requirements of the Clean Air Act.

4. Clean Water Act (33 USC 1251), National Pollution Discharge Elimination System (NPDES; 40 CFR 122), NPDES Permit Program (WAC 173-220), and Water Pollution Control Act (RCW 90-48).

The selected remedy treats the extracted water to meet MCLs, health-based standards, or Water Quality Criteria prior to discharge. Therefore, there will be no adverse impact on surface waters resulting from discharge of treated groundwater, and the requirements of these regulations will be attained. The landfill cap will reduce leachate generation and therefore reduce the impact on groundwater. Storm drainage will be collected and discharged either to existing storm sewers or to surface waters. Contaminated storm water runoff will meet pre-treatment regulations and will be discharged to the sanitary sewer. Groundwater extraction and treatment will further reduce the contaminant plume. Other substantive aspects of the NPDES Permit System will be met during the design phase, although no permit is actually required.

Although on-site remedial work does not require a permit, the substantive requirements of any applicable permit will be met. Federal, state, or local permits which are required for off-site activities will be obtained.

5. Rules and Regulations of the State Board of Health Regarding Public Water Systems (WAC 248-54).

The selected remedy provides standards for connection to an alternative drinking water supply for all residents who require these supplies in conformance with these regulations.

6. Protection of Withdrawal Facilities Associated with Groundwater Rights (WAC 173-150).

This regulation protects water rights both in terms of water quality and quantity. Groundwater quality will reach levels less than MCLs; therefore the selected remedy complies with that portion of the regulation. The other portion of the regulation requires that surrounding wells not be deprived of their water supply due to other groundwater removal actions. Alternative water supplies will be made available to all residents affected by groundwater removal actions to meet the requirements of this regulation.

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7. Minimum Functional Standards for Landfills (WAC 173-314 and 70.95 RCW).

The technology to be applied to remediate the landfill at a minimum will meet the Washington state standards for ongoing landfill operations, closure, capping, leachate containment, and methane control.

8. Hazardous Waste Cleanup Act (70.105B RCW).

The selected remedy will be the cleanup standards established by this act.

The selected remedy meets the SARA preference for permanent solutions to the maximum extent practicable. Treatment technologies are used as a principal element of the remedy and they will effectively reduce the toxicity, mobility, and volume of the contaminants permanently. Connection of residents, as required, to the Tacoma municipal water water supply is also considered a long-term solution.

The selected remedy meets all objectives of remedial action in that it provides a safe water supply and therefore protects public health, provides a permanent solution with moderately frequent maintenance, protects the environment to the maximum extent practicable, and reduces toxicity, mobility, or volume as a principle element of treatment. The selected remedy meets the requirement of cost-effectiveness.

VII. ENFORCEMENT

On June 27, 1986, Tacoma assumed responsibility for conducting the RI/FS under a Response Order on Consent issued by Ecology. The remedial action is anticipated to be accomplished voluntarily by the responsible parties. EPA and Ecology intend to start a negotiation period after the signing of the Record of Decision and will ensure that the remedial action proceeds. Finally, EPA and Ecology are still considering the possibility of identifying additional parties who may be potentially responsible for conditions at the site. Other than the June 27, 1986 Consent Order, there has never been any enforcement action taken by the regulatory agencies (i.e., EPA or Ecology) regarding the Tacoma Landfill site. If the responsible parties decline to implement the selected remedy as described in the Record of Decision, however, EPA and Ecology will seek appropriate enforcement action.

VIII COMMUNITY RELATIONS

Community relations activities conducted at the Tacoma Landfill site to date include the following:

- In 1983, the Tacoma landfill was included as part of the South Tacoma Channel site on the National Priorities List under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

- In May 1985, Ecology and Black & Veatch began Remedial Investigation (RI) Phase I.

- In December 1985, Ecology and Black & Veatch began implementing the RI Project Work Plan and Sampling Plan Phase I.

- In 1985, a community relations plan was developed by Black & Veatch and Hall and Associates for Ecology.

- From May 1985 to the present, the City of Tacoma maintained correspondence with interested local residents and well owners by providing notification of quarterly sampling and outlining analytical results.

- In May 1986, the City of Tacoma issued a fact sheet discussing management of methane gas at the landfill.

- On May 13, 1986, U.S. EPA, in cooperation with the City of Tacoma and Ecology, conducted a public meeting to discuss well water quality of private wells surrounding the landfill.

- In July 1986, the City of Tacoma issued a press release and letter to residents discussing background and scope of the RI.

- In July 1986, the City of Tacoma and Ecology signed a consent agreement establishing guidelines for the RI/FS.

- In August 1986, the City of Tacoma began sampling 13 private wells located near the landfill.

- In February 1987, the Phase I Sampling Plan, Phase II Sampling Plan and Phase I RI Report were completed and made available to the public through Tacoma City and County libraries.

- On April 16, 1987, Ecology, in cooperation with the City of Tacoma and EPA , conducted a public meeting and provided a fact sheet discussing progress of the RI/FS.

- In January, 1988 a public notice was published in the Tacoma News Tribune announcing the availability of the RI and FS Reports and a public meeting to be held February 11, 1988.

- On February 11,1988, Ecology, in cooperation with EPA and the City of Tacoma, conducted a public meeting to discuss alternatives for cleaning up the groundwater and controlling methane gas at the landfill, including the agencies' preferred plan.

- From February 4 through March 4, 1988, public comments on the RI/FS were accepted and documented.

- In February and March 1988 the the Responsiveness Summary and Record of Decision were written.

CITY CLERK CONTRACT/AGREEMENT NO. 0

APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A. FEDERAL LAWS AND REGULATIONS

- Resource Conservation and Recovery Act (RCRA) (42 USC 6901), Subtitle C:

  - Protection of groundwater (40 CFR 264, Subpart F) Closure and post-closure of landfills (40 CFR 264, Subpart G) [Note: These are administered by Ecology under Dangerous Waste Regulations, WAC 173-303]

- Safe Drinking Water Act (SWDW) (42 USC 300):

  - Drinking Water Standards (40 CFR 141). Enforceable Maximum Contaminant Levels (MCLs), Which are relevant and appropriate at this site. [NOTE: This is administered by the Department of Social and Health Services under WAC 248-54-175 for public water supplies]

- Clean Water Act (CWA) (33 USC 1251):

  - National Pollutant Discharge Elimination System (NPDES) (40 CFR

122) [Note: NPDES program is administered by Ecology under WAC 173-220]

- Water Quality Criteria (EPA440/5-86-001).

o Clean Air Act (CAA) (72 USC 7401):

- National Emission Standards for Hazardous Air Pollutants (NESHAPS) [Note: NESHAPS Program is administered by Ecology and Puget Sound Air Pollution Control Agency under WAC 173-403].

o OSHA 29 CFR 1910:

- governs worker safety at hazardous waste sites.

B. WASHINGTON STATE LAWS AND REGULATIONS

- Dangerous Waste Regulations, WAC 173-303: established standards for handling and disposal of hazardous waste.

- Minimum Functional Standards for Solid Waste Handling, 70.95 RCW and WAC 173-304: requirements for operation and closure of solid waste disposal facilities.

- Hazardous Waste Cleanup, Chapter 70.105B RCW: standards for the cleanup of hazardous waste sites.

- Water Quality Standards for Waters of the State of Washington, WAC 173-201: Standards for discharge to Flett Creek, or Leach Creek, or surface waters of the state.

- Submission of Plans and Reports for Construction of Wastewater Facilities, WAC 173-240: standards for the design, operation and maintenance of waste water treatment systems.

- National Pollutant Discharge Elimination System Permit Program, WAC 173-220: Discharge limitations if treated water is discharged into surface waters.

- Underground Injection Control Program, WAC 173-218: discharge standards for reinjection of treated water into the ground.

- State Waste Discharge Permit Program, WAC 173-216: Standards for the discharge to the sanitary sewer or groundwater (except by injection).

- Washington Clear Air Act, RCW 70.94: applicable for discharging pollutants into the atmosphere from a new source.

- General Regulations for Air Pollution Sources, WAC 173-400.

- Implementation of Regulations for Air Contaminant Sources, WAC 173-403.

- Emission Standards and Controls for Sources Emitting Volatile Organic Compounds, WAC 173-490.

- Instream Resources Protection Program - Chambers-Clover Creeks Basin, WAC 173-512: governs minimum water flow and levels requirements.

- Protection Associated with Groundwater Rights, WAC 173-150-100: applicable to activities that would degrade water quality.

- Minimum Standards for Construction and Maintenance of Water Wells, WAC 173-160: governs design of extraction and monitoring wells.

- Water Well Construction Act, RCW 18.104: provides for the regulation of water well construction.

- Water Pollution Control Act, RCW 90.48: standards for the protection of surface water and groundwater.

- Management of Waters of the State, RCW 90.54.020: provides for the protection of state water quality.

TO BE CONSIDERED

- Ecology New Source Review Guidelines for Toxic Air Contaminants in the State of Washington, September 1986.

- EPA Policy Statement - Groundwater Protection Strategy.

- Washington Department of Ecology Final Cleanup Policy: (Technical memorandum dated July 10, 1984) used for guidance in establishing cleanup levels.

- State Water Code, RCW 90.03 and Water Rights, RCW 90.14: establishes water rights permits necessary for water withdrawals, including groundwater extraction.

- State Environmental Policy Act (SEPA), WAC 197-11: covers all actions which may have significant environmental impact.

- State Protection of Upper Aquifer Zones, WAC 173-154: restricts activities that would impair senior groundwater rights, including water level lowering and water quality degradation.

- Protection of Withdrawal Facilities Associated with Groundwater Rights, WAC 173-150: restricts activities that would impair senior groundwater rights, including water levels lowering and water quality degradation.

- City of Tacoma Code, Chapter 12.08: pre-treatment regulations which govern discharge to the sanitary sewer.

- Pierce County Storm Drainage Ordinance 86-60: provides guidelines for the report criteria, analysis and design of public and private storm drainage systems.

CITY CLERK CONTRACT/AGREEMENT NO. 406

APPENDIX B

RESPONSIVENESS SUMMARY

This community relations responsiveness summary is divided into the following sections:

Section 1.0 Overview. This section reviews the U.S. Environmental Protection Agency s (EPA) preferred alternative for corrective action, and likely public reaction to this alternative.

Section 2.0 Background on Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during remedial planning activities at the Tacoma Landfill site.

Section 3.0 Summary of Major Comments Received During the Public Comment Period and Agency Responses to the Comments. Both written and oral comments are categorized by relevant topics. EPA's responses to these major comments are also provided.

Section 4.0 Remaining Concerns. This section describes remaining community concerns that EPA and Ecology should consider in conducting the remedial design and remedial action at the Tacoma Landfill site.

Community relations activities conducted during remedial response activities at the Tacoma Landfill site are listed in Attachment A to this summary.

CITY CLERK CONTRACT/AGREEMENT NO. 4066

1.0 OVERVIEW

The City of Tacoma, under a Response Order on Consent issued by the Washington State Department of Ecology, completed a Remedial Investigation/Feasibility Study (RI/FS) for the Tacoma Landfill site, located south of Tacoma, Washington. From 1960 through the 1980s, the landfill has received refuse and garbage from the city's collection service. Hazardous materials were part of the refuse. Contaminants were discovered in nearby drinking water wells at levels high enough to cause public health concerns. The cleanup alternative recommended by Ecology to EPA, was to intercept the advance of contaminants by extracting the contaminated water, treating it, and discharging the cleaned water. This alternative is described in more detail in the Feasibility Study (Chapter 4; Black & Veatch 1987) and in the Selected Remedial Alternative section of the Record of Decision (Section VI).

In this summary, concerns of the local community about problems at the site, the recommended cleanup alternative, and the study process itself are described. Public comment also indicates that residents hope the cleanup will be as quick and thorough as possible, and not raise additional problems through its implementation. Only one potentially responsible party, the City of Tacoma, has been identified to date although an investigation to identify others has been initiated. The identified responsible parties will share cleanup costs. Residents are concerned about the funding to perform the cleanup and any adverse impact upon refuse collection rates.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Community interest in the Tacoma Landfill began as early as 1968 when local residents complained of poor water quality in their private wells. This condition continued throughout the 1970s. The residents are currently concerned about leachate from the landfill contaminating their private wells, and methane gas entering their homes.

Early in the Remedial Investigation/Feasibility Study (RI/FS) process (1985), Hall and Associates interviewed local residents and government officials and compiled a list of community concerns regarding the landfill. The following is a compilation of community concerns in 1985:

- Lack of interest and unwillingness to provide water testing by the public health agency.
- Lack of candor by government officials, particularly relating to contamination of wells in University Place during the late 1970s.
- Quality of drinking water.
- Health of small children in the neighborhood and recent miscarriages.
- Cost of replacing private wells and connecting residences to the city's water system.

- Inconvenience associated with using bottled water

- Need to be kept informed of landfill related activities.

The City of Tacoma and Ecology developed a community relations plan in an effort to keep the public informed of RI/FS activities. The City of Tacoma has addressed public concerns by holding meetings with residents to discuss RI/FS activities and public health concerns. Attachment A summarizes the community relations activities conducted at the South Tacoma Landfill. The following is a record of those activities:

1) In 1968, the City of Tacoma Department of Public Works began receiving complaints of contamination of the Home Builder's Association well, located at South 40th and Orchard Streets.

Actions: The City of Tacoma conducted a chemical analysis of the well water. Results revealed the water contained a high iron content, was discolored, and had a slight odor. The city installed a leachate collection system comprised of a gravel drain and dike. The dike diverted leachate flow to the drain that discharged to a perforated manhole connected to the city sewer system. An additional cover placed over the fill promoted surface water drainage, inhibited infiltration of water, and reduced leachate production. The Home Builder's Association was eventually connected to the city's water system.

2) In the late 1970s, wells owned by the University Place Water Company located west of the landfill, were found to contain elevated levels of iron and manganese. Residents complained of unappealing water taste, color, and odor.

Actions: An investigation conducted by Ecology indicated that well water contamination could have resulted from surface water or groundwater from the landfill, or from water migration through material containing high levels of iron and manganese. Residents served by these wells were eventually connected to the city's water system and these wells have not yet been abandoned in accordance with State requirements.

3) In 1985, prior to the RI, groundwater samples were collected from wells near the landfill and analyzed for U.S. EPA priority pollutant volatile organic compounds. Four private wells located in the vicinity of the landfill were found to contain priority pollutant volatile organic compounds.

Actions: In June 1985, vinyl chloride was detected in the (b)(6) s well and they were connected to the city's water system. Vinyl chloride was detected in the (b)(6) 's well and they were connected to the city's water system in June 1986. Although vinyl chloride was not detected in the remaining two wells (those of the (b)(6) and (b)(6) residences), the city supplied these residences with bottled water for drinking. The (b)(6) and (b)(6) residences were later connected to the city's water system in October and December 1986, respectively. In 1987, the (b)(6) and (b)(6) residences were connected to the city's water system because vinyl chloride contaminated their wells.

4) Early in 1986, local citizens were becoming concerned about the quality of water from their private wells.

Actions: Ecology, in cooperation with the City of Tacoma and EPA, conducted a public meeting on May 13, 1986 to discuss affects of potential leachate migration to private wells. The meeting was open exclusively to private well owners. Twenty citizens and ten city, state, and federal representatives attended. At this time, Black & Veatch was still acting as a consultant for Ecology. A description and history of the site was outlined, the affects of methane gas migration were discussed, and an agenda and fact sheet were distributed.

5) In May 1986, local residents voiced concern about lateral methane gas migration at the City of Tacoma municipal landfill.

Actions: The city hired a consultant (Mandeville Associates) to investigate gas production and the extent of off-site migration prior to the release incident. The city conducted field surveys using portable explosimeters and found methane gas had migrated beyond the landfill boundaries. As a result of these findings, a gas extraction system comprised of 128 gas extraction wells with gas probes at 66 locations was installed. Initial efforts focused on controlling gas in businesses located southwest of the site. A flare station with permanent flares was installed in November 1986. The city implemented a gas monitoring program for structures surrounding the landfill. Both ambient and point sources were measured.

6) As early as 1983, local residents were voicing concerns about potential groundwater contamination from leachate migrating from the landfill.

Actions: In June 1986, the City of Tacoma, under the direction of Ecology, assumed responsibility for conducting an RI/FS. Quarterly groundwater monitoring activities were established to identify hazardous contaminants. The city continued contact with specific residents by notifying them of sampling dates and reporting analytical results. Public involvement in landfill issues is maintained by Ecology conducting public meetings and providing fact sheets on recent landfill activities and studies.

7) As the RI progressed in 1987, local citizens continued to voice concerns and questions.

Actions: Ecology, in cooperation with the City of Tacoma and EPA, conducted a public meeting on April 16, 1987 to discuss the progress of the RI/FS. Groundwater well monitoring procedures and analytic results were addressed. At that time, three to four residences had been connected to the city's water supply. Methane gas migration and monitoring were discussed. Dr. Branchflower, a consultant to the City of Tacoma, discussed risk assessment at the landfill site. Black & Veatch, acting as consultants to the city, provided graphical representation of well locations and migration pathways. An agenda and fact sheet were distributed.

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8) After the RI/FS was made public in February 1988, citizens had concerns and unanswered questions.

Actions: On February 11, 1988, Ecology, in cooperation with EPA and the City of Tacoma, conducted a public meeting to discuss remedial alternatives for cleaning up leachate and methane gas at the landfill. Questions relating to the RI/FS were answered and public comments were recorded.

3.0 SUMMARY OF MAJOR COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES TO THE COMMENTS

The public comment period was open from February 4 through March 4, 1988. Ecology held a public meeting in Tacoma on February 11, 1988 to explain the study and the remedial alternatives. Formal comments received at that meeting concerned providing an alternate water supply, coordinating planning, evaluating alternative design options, and implementing new landfill operations including recycling and ash disposal. The last comment is considered beyond the scope of the FS.

Comments from members of the public, primarily Tacoma area residents, regarding the FS report are summarized below. Questions were addressed to U.S. EPA, Ecology, the Tacoma-Pierce County Health Department (TPCHD), and City of Tacoma representatives and their consultants.

FORMAL COMMENTS

Four participants from the public presented formal comments during the public hearing. Those comments are summarized below.

1) Provision of an alternative water supply for residents whose wells have been contaminated regardless of the chosen alternative was a concern of one participant.

Response: The preferred alternative includes provision of an alternate, unthreatened water supply (municipal water) to any resident whose water supply is adversely impacted as further describes in the ROD by contamination emanating from the landfill.

2) One comment addressed the need to incorporate long-term planning in future studies. The speaker noted that seven years ago, many of today's problems connected with the landfill were not known and not planned for. Another comment addressed the need for more coordination in the planning process between the consultants and agencies connected with landfill studies.

Response: Long term planning of the landfill operation is conducted at the local level with assistance and review by the state. Selection of the preferred alternative under CERCLA/SARA included analysis of long-term needs. Long-term planning is part of the studies. Ecology and EPA agree that more coordination is needed and have incorporated this into ongoing community relation activities.

3) Several design options were offered by one participant who felt that they should have been considered during the evaluation of remedial alternatives. These options are as follows:

- An aeration facility to remove volatile material from the groundwater.
- A system of wells completely encircling the landfill to intercept and retrieve contaminated groundwater.

- Incorporation of removable pumps and sequencing pumping to optimize groundwater retrieval.

- Discharge of treated groundwater to the Simpson pulp mill or other use of treated groundwater as a water supply.

- Use of extracted methane to produce electricity.

Response: Ecology and EPA will take note of these suggestions and they will be evaluated during the Remedial Design phase as appropriate.

4) A comment was received concerning the potential threat to public health caused by heat generation from spontaneous combustion of materials in the proposed sealed landfill. Such conditions might lead to an explosion that would endanger nearby apartments and their inhabitants, and taxpayers would be obligated to pay for the damage.

Response: The landfill will be continuously monitored so that spontaneous combustion problems should not occur. Should a problem occur, the landfill has a contingency plan and an emergency response plan in place.

5) Several comments were received concerning the feasibility of a recycling program and landfill operations.

Response: The subject of the public meeting was cleanup of the landfill, not implementation of a recycling program or operation of the landfill. However, landfill operations have been addressed in the selected remedy. Tacoma will be required to submit an Operations and Closure Plan pursuant to State Minimum Functional Standards for Landfills (WAC 173-304) which will address waste reduction measures. These measures include: increased recycling including a program to exclude hazardous waste from the landfill; incineration of the light fraction of shredded waste at the Tacoma City Light Cogeneration plant and; pyrolysis of the heavy fraction of shredded waste at an on-site facility.

QUESTIONS AND COMMENTS

Questions from the audience as a whole, and responses from the appropriate government representative, are summarized below.

1) The efficacy of the cap was questioned because of the potential for prolonging methane gas production. The source of material for the cap was questioned. The discharge point for pumped water and the applicable discharge standard was requested. Some participants were concerned that hazardous material would remain in the landfill. The adequacy of the design because of changing site hydraulic conditions (e.g., drought) and nearby pumping was questioned.

Response: State regulations require landfills to be capped to limit leachate migration, and address any subsequent increase in methane gas migration. An appropriate material will be evaluated for technical merit and feasibility and utilized for a cap. Water discharged into the sewer, should that treatment option be selected, will be treated before in enters the sewer to a level consistent with pre-treatment requirements. Water discharged to surface water will be treated to drinking water standards, or Water Quality Criteria (for fresh water), whichever is more stringent. For those contaminants for which no drinking water standard or Water Quality Criteria exist, a methodology has been established in the Record of Decision (ROD) for the Tacoma landfill to establish the appropriate treatment levels. These levels will be reviewed and approved by EPA and Ecology. The exact point of discharge (sewer or stream) will be evaluated during the Remedial Design phase and has not yet been determined. A technology to treat the hazardous material remaining in the landfill has not been developed, although removal has been considered but ruled out because of the large volume. The preferred alternative is believed to be the most cost and technically effective means of dealing with the problem.

Changing hydraulic conditions may impact the configuration of the contaminant plume. However, sufficient monitoring will be done to evaluate such a change. The City of Tacoma will be required to contain the plume regardless of its location.

2) A number of questions concerned disposal and classification of ash from the proposed incinerator. If ash is classified as non-hazardous, it may be placed in the landfill.

Response: No hazardous waste will go into the landfill. Disposal of ash in the landfill would be contrary to the goal of maintaining the landfill for as long as possible because ash would take up space and reduce the expected operating life of the landfill. The state is developing an ash regulation to determine if an ash should be classified as hazardous or non-hazardous and is also determining the appropriate requirements for disposal and monitoring.

3) Several questions and comments were made concerning operation of the Refuse Derived Fuel Plant (RDF) and the incinerator.

Response: The purpose of the public meeting was cleanup of the landfill. While questions and comments concerning the RDF plant are not relevant to the meeting agenda, they are duly noted as a point of public interest and concern and passed on to the appropriate agencies.

4) Methane production within the landfill was questioned by a number of participants. Reuse of the southwestern area of the landfill was questioned because it may aggravate the methane problem. Provisions for the continued methane gas migration to depth should be made.

Response: It is believed that the gas extraction system will sufficiently control methane release throughout the landfill. Seventy-four new wells to contain deep methane will be installed by mid April. The Selected Remedy has required the placement of off-site probes (shallow and deep) to monitor the effectiveness of the system. There will be adequate monitoring at the probes and in the neighborhood to ensure the system is working appropriately.

5) Public health, monitoring procedures, and health standards were addressed by several members of the audience. The need for expediency in the cleanup was noted because of unhealthy conditions in the area. The confidence associated with no adverse health effects from the methane gas and water pollution was questioned. Development of apartments and houses for local residents if methane was known to be a problem was also questioned. Onerous odors have been noted in the morning near the landfill. The availability of data from monitoring programs and the extent of the methane monitoring program was questioned. One participant asked where her well water could analyzed for chemicals. Another asked if any microbiological analysis was performed.

Response: In response to these concerns, the TPCHD responded in the meeting with these perspectives:

> Construction standards for recently completed apartments and regular monitoring increase the confidence that there will be no adverse health effects. Concentration of gas measured in houses has not approached explosive levels anywhere. The odors come from

by-products of the rotting garbage, not necessarily from methane gas. No adverse health effects are caused by these by-products. The health department monitors the incidence of disease, and data do not indicate that landfill gas is making people sick. All houses around the landfill have been monitored in the past. Occupants of the houses are given the instrument readings if they wish at least once a year. The health department analyzes for all hazardous organic compounds in wells downgradient of the landfill once a year. Private laboratories can provide the same analyses. Only total coliforms are analyzed for during microbiological monitoring.

Ecology and EPA perspectives:

The agencies recognize the need for expediency in implementing the cleanup. However, the major exposure pathway is via groundwater which is spreading contamination very slowly. With the addition of the cap, and the completion of the gas extraction system, odor problems should be substantially reduced. EPA and Ecology recognize the need for further community education regarding the methane gas collection system and monitoring program.

6) Provision of an alternate water supply for residents whose wells are contaminated or become dry because of the groundwater extraction was a concern of two people. One person questioned why discharged water was not being made available to area residents.

Response: The preferred alternative contains provisions for an unthreatened water supply (e.g., municipal water) for all residents whose

wells are contaminated. Similar arrangements will be provided for any resident whose water volume is affected by the operation of a groundwater extraction system.

7) The cost of cleanup and the source of funding were addressed by a number of people. Increases in refuse collection fees were also a concern.

Response: The estimated cost of the preferred alternative is 24 million dollars. It is expected the customers of the refuse utility may be paying for this expense. Refuse collection fees may be increased by the City of Tacoma 8-16 percent to provide sufficient funds, or funding may be available to offset costs to the City. There is a toxics control account available through Ecology's Solid and Hazardous Waste Program.

8) Confidence placed on findings of the RI/FS and the need for contingency plans were questioned. The comprehensiveness of the studies was also questioned. If the preferred alternative fails, will action be taken?

Response: The studies were performed with oversight by Ecology and EPA following guidelines provided by EPA (CERCLA). Although 100 percent assurance is probably impossible to attain, the consensus of opinion is that problems at the site have been identified sufficiently that a remedial action (preferred alternative) can be identified. Further work needed for design will be completed during the Remedial Design phase. Intensive groundwater monitoring and placement of additional wells and gas probes will provide the necessary information to monitor the

effectiveness of the selected remedy. Connection to city water (should a problem immediately occur) is part of the selected remedy. The Tacoma-Pierce County Health Department has an action plan for responding to elevated methane gas levels (which includes evacuation, if necessary).

9) Several questions concerning the site conditions relative to geology and hydrology were asked. These questions concerned permeability, thickness, and depth of geologic units underlying the site.

Response: The requested information was provided at the meeting and is contained in the transcript of the public meeting.

10) There was a question on why sampling for inorganic constituents in the groundwater was not performed. The effect of seasonal variations upon sampling results was also questioned. The speaker noted that a previous study had revealed a very dramatic seasonal change during low flow periods.

Response: Sampling for inorganic constituents (e.g., metals) has been conducted. Monitoring wells near the landfill are monitored quarterly, allowing for observation of seasonal variations in groundwater chemistry. The data collected to date do not indicate such a seasonal variation. Low flow periods are normally associated with surface water conditions. The Remedial Investigation was not designed to evaluate conditions and seasonal variation in Leach Creek.

11) Written comments concerning a variety of subjects were received at the public meeting from one individual. The comments concerned alternative design options, the operation of the groundwater extraction and treatment system, use of discharged water as a water supply, public health, and recycling of materials in refuse.

Response: The majority of these comments have been addressed in previous responses since they were presented orally at the meeting. Those comments concerning recycling of materials ordinarily disposed of at the landfill are not within the scope of the RI/FS, and therefore are not relevant to the final cleanup of the landfill.

12) Written comment was submitted during the designated comment period by the National Oceanic and Atmospheric Administration (NOAA). The comments focused on concern that the freshwater environment of Leach Creek could be impacted, and should be evaluated by bioassay and benthos sampling.

Response: Since there are existing water rights for domestic use of Leach Creek, the selected remedy has set standards to minimize degradation. Ecological effects via contamination of Leach Creek and its downstream tidal wetlands is a recognized concern by both Ecology and EPA. Sampling of indicator benthos from the intertidal area would be worthwhile, and bioassays of Leach Creek samples would also be advisable at key intervals prior to and after cleanup efforts. It is further

described in the selected remedy that the applicable EPA ambient Water Quality Criteria (WQC) for either protection of human health, or aquatic life, will be used, whichever is lower.

Evaluation of conditions, sediment contamination, seasonal variation in Leach Creek, etc., was not the original intent of the Remedial Investigation.

4. REMAINING CONCERNS

The following issues have been discussed but have not yet been resolved:

- What will be the point of discharge for extracted groundwater?
- What process will be used to bring extracted groundwater into compliance with discharge standards or requirements?
- Will alternative uses of treated water be identified?

Response: The point of discharge will be decided during the Remedial Design phase of the cleanup process. If the point of discharge is the city sanitary sewer, the treated water must meet the city of Tacoma's pre-treatment standards. If discharge is to surface water, the Record of Decision identifies appropriate treatment levels for the identified contaminants of concern, and establishes a methodology for identifying treatment levels for the other volatile organic compounds and metals in the groundwater.

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Attachment A

Community relations activities conducted at the Tacoma Landfill site to date include the following:

- In 1983, the Tacoma landfill was included as part of the South Tacoma Channel site on the National Priorities List under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

- In May 1985, Ecology and Black & Veatch began Remedial Investigation (RI) Phase I.

- In December 1985, Ecology and Black & Veatch began implementing the RI Project Work Plan and Sampling Plan Phase I.

- In 1985, a community relations plan was developed by Black & Veatch and Hall and Associates for Ecology.

- From May 1985 to the present, the City of Tacoma maintained correspondence with local residents and well owners by providing notification of quarterly sampling and outlining analytical results.

- In May 1986, the City of Tacoma issued a fact sheet discussing management of methane gas at the landfill.

- On May 13, 1986, U.S. EPA, in cooperation with the City of Tacoma and Ecology, conducted a public meeting to discuss well water quality of private wells surrounding the landfill.

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- In July 1986, the City of Tacoma issued a press release and letter to residents discussing background and scope of the RI.

- In July 1986, the City of Tacoma and Ecology signed a consent agreement establishing guidelines for the RI/FS.

- In August, 1986, the City of Tacoma began sampling 13 private wells located near the landfill.

- In February 1987, the Phase I Sampling Plan, Phase II Sampling Plan and Phase I RI Report were completed and made available to the public through Tacoma City and County libraries.

- On April 16, 1987, Ecology, in cooperation with the City of Tacoma and EPA , conducted a public meeting and provided a fact sheet discussing progress of the RI/FS.

- In January 1988 a public notice was published in the Tacoma News Tribune announcing the availability of the RI and FS Reports and a public meeting to be held February 11, 1988.

- On February 11, 1988, Ecology, in cooperation with EPA and the City of Tacoma, conducted a public meeting to discuss alternatives for cleaning up the groundwater and controlling methane gas at the landfill, including the agencies' preferred plan.

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- From February 4 through March 4, 1988, public comments on the RI/FS were accepted and documented.

- In February and March 1988 the Responsiveness Summary and Record of Decision were written.

CITY CLERK CONTRACT/AGREEMENT NO. [illegible]

APPENDIX C

INDEX TO ADMINISTRATIVE RECORD

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 1.1 000012	1.1 General Information	Letter in response to concern regarding the presence of phenol in the water system with attached distribution list	7/25/78	3	Moe R. Batra Department of Social and Health Services	Ms. (b) (6) Ms. Mr. Ms. R.B. Bourglaze, University Place Water Company	
AR 1.1 000013	1.1 General Information	Cover letter attached to copy of analytical results of water samples collected from the water system and attached distribution list.	7/27/78	3	Moe R. Batra Department of Social and Health Services	Ms. (b) (6) Ms. Mr. Ms. R.B. Bourglaze, University Place Water Company Mr. Pat Ewing Russ Hulet, Suburban Times	
AR 1.1 000014	1.1 General Information	Letter regarding assignation of water rights to the City of Tacoma with attached list of University Place Water Company water rights and attached contract between the City of Tacoma and the University Place Water Company	2/26/79	9	John A. Roller Department of Public Utilities	Walt Bergstrom, WDOE	
AR 1.1 000015	1.1 General Information	Cover letter regarding attached Draft Environmental Impact Statement for the South Tacoma Flood Control Facilities on Flett Creek	4/9/79	126	Phillip M. Ringrose Department of Public Works City of Tacoma	EPA	
AR 1.1 000016	1.1 General Information	1980 Annual Report Solid Waste Management	12/31/80	61	City of Tacoma Public Works Department, Refuse Utilities		
AR 1.1 000017	1.1 General Information	Cover letter regarding attached Preliminary Geotechnical Site Evaluation, Tacoma Landfill Site	9/24/82	14	Dennis R. Stettler, Hart-Crowser & Assoc, Inc.	Mr. Harry Berry The Berry and Berry Associates	
AR 1.1 000018	1.1 General Information	State of Washington Public Water Supply System Listing of Pierce County wells	11/5/82	4	Department of Public Utilities		
AR 1.1 000019	1.1 General Information	Statement regarding Leach Creek Survey with attached map of Leach Creek holding basin and attached copy of envelope		3	Tacoma Pierce County Health Dept	Chuck Shenk, EPA	
AR 1.1 000020	1.1 General Information	Draft Appendix C - General plan of landfill operations (Part V.B-Disposal Sites-Design and Operation of Application Form)	unknown	7	unknown		

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CITY CLERK CONTRACT/AGREEMENT NO.

INDEX TO ADMINISTRATIVE RECORD FOR TACOMA LANDFILL

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
Section 1.0	BACKGROUND						
AR 1.1 000001	1.1 General Information	Cover letter regarding attached report to City of Tacoma Department of Public Works on Test Operation Well #20/2-13D1 and cover letter regarding attached report to City of Tacoma Department of Public Works on Investigation Of Ground Water Geology Pollution And Potential Vicinity Of Proposed Orchard Street Sanitary Landfill Site Extension.	05/29/63	25	Byron I. Larsen B.I. Larsen & Associates	Mr. (b) (6) Mr. John Bronnow Department of Public Works, City of Tacoma	
AR 1.1 000002	1.1 General Information	Ground-water Contamination South 40th & Orchard Street Control and Prevention Report.	12/69	12	City of Tacoma, Department of Public Works, Engineering		
AR 1.1 000003	1.1 General Information	Water well report	10/2/70	22	Mr. Richardson Richardson Well Drilling Company, Inc.		
AR 1.1 000004	1.1 General Information	Department of Ecology Inspection Report	8/6/75	1	WDOE		
AR 1.1 000005	1.1 General Information	Solid Waste Management Statistical and Cost Data, Refuse Utility	12/31/75	31	City of Tacoma Public Works Department		
AR 1.1 000006	1.1 General Information	Draft Environmental Impact Statement for Operation of the City of Tacoma's Solid Waste Disposal Site and Resource Recovery System.	7/16/76	69	Refuse Utility Division	Department of Public Works	
AR 1.1 000007	1.1 General Information	Memo regarding Environmental Impact Statement Review	7/20/76	1	Walter D. Jaspers, EPA	Tobias A. Hegdahl, EPA	
AR 1.1 000008	1.1 General Information	Memo regarding review of Draft Environmental Impact Statement	8/4/76	1	Tobias A. Hegdahl, EPA	Walt Jaspers, EPA	
AR 1.1 000009	1.1 General Information	Letter regarding EPA review of Draft Environmental Impact Statement	8/9/76	2	Walter D. Jaspers, EPA	Ronald M. Button, Department of Public Works	
AR 1.1 000010	1.1 General Information	Sanitary Landfill Site Engineering Report	9/14/76	33	City of Tacoma, Public Works Department	WDOE	
AR 1.1 000011	1.1 General Information	Telephone report regarding well contamination from landfill	4/19/78	1	Mr. Bourgaize University Place Water Company	WDOE	

CITY CLERK CONTRACT NO. 4401

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 1.2 000013	1.2 Site Evaluation Sampling Data	Letter regarding Pierce County University Place Water System Wells University #11, #3-1, Fircrest, and Jones	10/27/78	2	Moe R. Batra Department of Social and Health Services	Dean Wood, WDOE	
AR 1.2 000014	1.2 Site Evaluation Sampling Data	Data summary for metals - sample source, the Atlas Foundry, Tacoma Landfill	Unknown	1	WDOE		
AR 1.2 000015	1.2 Site Evaluation Sampling Data	Data summary for well at Purdy Landfill in Pierce County	5/23/80		G. Freeman, WDOE		
AR 1.2 000016	1.2 Site Evaluation Sampling Data	Table III-8, Water chemical analysis for the town of Fircrest	9/3/81	1	Water Management Associates, Inc.		
AR 1.2 000017	1.2 Site Evaluation Sampling Data	Sample results for inorganic and organic analyses, Case #1477/SAS 373J and attached memo regarding additional sampling at Tacoma Landfill with additional sampling results	1/12/83		ChemTech	Unknown	
AR 1.2 000018	1.2 Site Evaluation Sampling Data	Organic and inorganic analyses for Tacoma Landfill Case 1477/SAS 373J	1/12/83	12	ChemTech		
AR 1.2 000019	1.2 Site Evaluation Sampling Data	Organic and inorganic analyses for Tacoma Landfill	4/26/83	9	EPA Lab, Manchester		
AR 1.2 000020	1.2 Site Evaluation Sampling Data	Organic and inorganic analyses for Tacoma Landfill	4/26/83	7	EPA Lab, Manchester		
AR 1.2 000021	1.2 Site Evaluation Sampling Data	Metal Analysis Required - Water report form	4/26/83	1	EPA Region 10 Laboratory		
AR 1.2 000022	1.2 Site Evaluation Sampling Data	Results of standard analyses with attached tentatively identified compounds and sample results for inorganic and organic analyses	4/26/83	18	EPA Laboratory; ChemTech		
AR 1.2 000023	1.2 Site Evaluation Sampling Data	Metal data-AA-HGA 2100(water) and Metal data-sediments-vegetation-tissue; HGA 2100	4/27/83	28	EPA	(b) (6)	
AR 1.2 000024	1.2 Site Evaluation Sampling Data	EPA Region 10 Laboratory metal analysis required-water report form, attached results of standard analyses and specifically identified compounds	6/13/83	8	EPA Region 10 Laboratory		
AR 1.2 000025	1.2 Site Evaluation Sampling Data	Memo regarding review of Tacoma TCDD contract data	9/20/83	1	J. N. Blazevich, EPA	Dr. (b) (6)	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 1.1 000021	1.1 General Information	Newspaper article entitled, "Is The Tacoma Landfill Ruining Our Water?"	6/85	3	Peter Andrews Tacoma/Pierce County Review		
AR 1.1 000022	1.1 General Information	Application for disposal site permit	8/15/85	12	City of Tacoma Refuse Utility	WDOE	
AR 1.2 000001	1.2 Site Evaluation Sampling Data	Chemical analysis summary for Pierce County	4/72	3	U.S. Geological Survey		
AR 1.2 000002	1.2 Site Evaluation Sampling Data	Table 1 - records of selected wells (contains some unverified)	1929-1976	4	Unknown		
AR 1.2 000003	1.2 Site Evaluation Sampling Data	Report of analysis on well water from University Place Water District well #3-1	3/17/77		Bennetts Chemical Laboratory, Inc.	University Place Water Company	
AR 1.2 000004	1.2 Site Evaluation Sampling Data	Priority pollutants data report	7/3/78	8	Unknown		
AR 1.2 000005	1.2 Site Evaluation Sampling Data	Water sample information for standard complete chemical analysis	4/23/73	3	Moe Batra Department of Social and Health Services	University Place Water System	
AR 1.2 000006	1.2 Site Evaluation Sampling Data	Analysis report regarding sample #7104	6/30/78	1	Michael J. Etchingham AT am test inc.	(b) (6)	
AR 1.2 000007	1.2 Site Evaluation Sampling Data	Priority Pollutants Data Report	7/3/78 & 7/17/78	3	Unknown		
AR 1.2 000008	1.2 Site Evaluation Sampling Data	Field sample data sheets and general purpose data sheet	7/17/78	3	J. Gedlund Department of Social and Health Services	EPA	
AR 1.2 000009	1.2 Site Evaluation Sampling Data	Letter regarding attached transmittal of analytical results for water samples collected from the University Place Water Company	7/26/78	2	William A. Mullen, EPA	Bob Leaver Department of Social and Health Services	
AR 1.2 000010	1.2 Site Evaluation Sampling Data	Transmittal for Treatment Plants Routing regarding sewage overflow with attached memo regarding Leach Creek water quality analysis	8/4/78	3	Hufford, Sewer Utility Division	(b) (6)	
AR 1.2 000011	1.2 Site Evaluation Sampling Data	Olympia Laboratory data summary, with attached hand-ritten note, telephone report regarding well contamination problem, request for analysis and memo regarding resampling of wells	8/22/78	11	WDOE		
AR 1.2 000012	1.2 Site Evaluation Sampling Data	Letter regarding analytical results of water samples collected from the University Place Water Company	9/13/78	1	William A Mullen, EPA	Moe Batra Department of Social and Health Services	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 2.2 000006	2.2 Site Investigation Report	Memo regarding development of a Tacoma Landfill sampling plan with attached city plans for Tacoma Landfill groundwater survey	1/7/83	5	Roy R. Jones, EPA	William A. Mullen, EPA	
AR 2.2 000007	2.2 Site Investigation Report	Memo regarding additional sampling at the Tacoma Landfill	4/14/83	1	Chuck Shenk	William Schmidt, EPA	
AR 2.2 000008	2.2 Site Investigation Report	Memo regarding site inspection and orientation	6/12/85	3	Donald Leske, WDOE	File	
AR 2.2 000009	2.2 Site Investigation Report	Memo regarding site inspection and orientation with attached figure of site utilities and drainage and photographs of University Place wells	6/12/85	8	Donald Leske, WDOE	File	
AR 2.3 000001	2.3 Site Identification	Memorandum regarding request for authorization to proceed with Remedial Investigation/Feasibility Study at the Tacoma Municipal Landfill - Action Memorandum	4/20/82	3	William N. Heedman for Gene A. Lucero, EPA	Rita Lavelle, EPA	
AR 2.3 000002	2.3 Site Identification	Letter regarding EPA water sampling studies with information regarding sample location	unknown	2	John F. Newland, EPA	Robert Sparling City of Tacoma, Department of Public Utilities	
AR 2.3 000003	2.3 Site Identification	Letter to citizen regarding laboratory analyses and quality data evaluation of domestic water	4/26/83	1	John F. Newland, EPA	(b) (6)	
AR 2.3 000004	2.3 Site Identification	Letter regarding laboratory analyses and quality data evaluation for the town of Fircrest water wells No. 2 and No. 8.	4/26/83	1	John F. Newland, EPA	(b) (6), Town of Fircrest	
AR 2.3 000005	2.3 Site Identification	Letter regarding laboratory analyses and quality data evaluation for the golf course irrigation well.	4/26/83	1	John F. Newland, EPA	Mr. (b) (6), Fircrest Golf Club	
AR 2.3 000006	2.3 Site Identification	Letter regarding laboratory analyses and quality data evaluation of analytical data for domestic well.	4/26/83	1	John F. Newland, EPA	(b) (6)	
AR 2.3 000007	2.3 Site Identification	Letter regarding EPA Water Sampling Study at the City of Tacoma Landfill and in the immediate vicinity, with information regarding sample locations.	4/29/83	2	Chuck Shenk, EPA	Doug Pierce, Tacoma Pierce County Health Department	
AR 2.3 000008	2.3 Site Identification	Letter regarding EPA Water Sampling Study at the City of Tacoma Landfill and in the immediate vicinity, with information regarding sample locations.	4/29/83	2	Chuck Shenk, EPA	Robert James, Department of Social and Health Services	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
Section 2.0	SITE IDENTIFICATION						
AR 2.1 000001	2.1 Preliminary Assessment Report	Potential hazardous waste site log regarding site identified by "Eckhardt Report" 11/27/79	1	P.L. Wheeler, EPA			
AR 2.1 000002	2.1 Preliminary Assessment Report	Potential hazardous waste site log regarding Center and Mullen Sanitary Landfill	11/27/79	4	P.L. Wheeler, EPA		
AR 2.1 000003	2.1 Preliminary Assessment Report	Potential hazardous waste site identification and preliminary assessment form re Tacoma Landfill	4/80	4	Phil Wong, EPA		
AR 2.1 000004	2.1 Preliminiary Assessment Report	Potentital hazardous waste site identification and preliminary assessment form re Tacoma Landfill	4/80	4	Neil Thompson, EPA		
AR 2.1 000005	2.1 Preliminary Assessment Report	Potential hazardous waste site identification and preliminary assessment regarding Center and Mullen sanitary landfill	4/80	4	Neil Thompson, EPA		
AR 2.1 000006	2.1 Preliminary Assessment Report	Potential hazardous waste site final strategy determination form regarding Tacoma City Landfill	6/80	2	Neil Thompson, EPA		
AR 2.1 000007	2.1 Preliminary Assessment Report	Hazardous waste sites evaluation of section 311 clean-up requirements, environmental emergency section, EPA-Region 10	6/2/80	2	E.E.S.		
AR 2.2 000001	2.2 Site Investigation Report	Potential hazardous waste site inspection report	4/80	11	Phillip Wong, EPA		
AR 2.2 000002	2.2 Site Investigation Report	Memo regarding hazardous waste site investigation with attached summary report of the waste site investigation	5/15/80	3	Phillip Wong, EPA	(b) (6) John Barrett EPA	
AR 2.2 000003	2.2 Site Investigation Report	Proposed co-municipal landfill reconnaissance study	10/15/82	1	EPA		
AR 2.2 000004	2.2 Site Investigation Report	Memo regarding request for ESD support on Tacoma Municipal Landfill preliminary field investigation	11/8/82	2	Chuck Shenk, EPA	William B. Schaidt, EPA	
AR 2.2 000005	2.2 Site Investigation Report	Preliminary field investigation plan, Tacoma Municipal Landfill (refuse utility), with attached list of attendees at the 10/26/82 Tacoma Landfill meeting	11/12/82	4	EPA		

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CITY CLERK CONFIDENTIAL

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 3.1 000010	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached laboratory testing results for halognated volatile organic compounds and description of TOX method.	2/18/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000011	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached laboratory testing results for halognated volatile organic compounds and description of TOX method.	2/18/87	4	Phillip Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000012	31. Well Owners - Correspondence	Letter regarding well water sampling activity with attached laboratory testing results for halognated volatile organic compounds and description of TOX method.	2/20/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Mr. and Mrs. (b) (6)	
AR 3.1 000013	3.1 Well Owners - Correspondence	List of well owners who were sent the attached letter regarding Total Organic Halides or Tox analysis.	2/24/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000014	3.1 Well Owners - Correspondence	List of well owners with attached letter regarding well water sampling activity and Total Organic Halides analysis.	2/25/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000015	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached results for Total Organic Halides analysis and description of TOX method.	2/25/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Mr. and Mrs. (b)	
AR 3.1 000016	3.1 Well Owners - Correspondence	Letter regarding Black & Veatch's quarterly conducting of sampling and testing of wells with attached list of well owners' addresses.	6/11/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(see attached list)	
AR 3.1 000017	3.1 Well Owners - Correspondence	Letter regarding Black & Veatch's conducting of quarterly sampling and testing of wells.	10/12/87	1	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Well Owner	
AR 3.2 000001	3.2 Water Supplied to Residents	Preliminary health assessment of Tacoma wells.	8/29/85	1	Pat Storm, EPA		
AR 3.2 000002	3.2 Water Supplied to Residents	Memo regarding drinking water data, Tacoma Landfill Superfund site.	12/13/85	1	Agency for Toxic Substances and Disease Registry (ATSDR)	Joel Mulder, EPA	
AR 3.2 000003	3.2 Water Supplied to Residents	Memo regarding water samples, Tacoma Landfill and proposed meeting.	9/16/86	1	Jane Hedges, Solid Waste Program	Derek, Bob, Don, and Al	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 2.3 000009	2.3 Site Identification	Letter regarding EPA Water Sampling Study at the City of Tacoma Landfill with information regarding sample locations.	4/29/83	2	Chuck Shenk, EPA	Frank Monahan, WDOE	
AR 2.3 000010	2.3 Site Identification	Letter regarding EPA second round of water and sediment sampling in and around the Tacoma Landfill with information regarding sample locations.	9/2/83	2	Chuck Shenk, EPA	(b) (6), City of Tacoma	
Section 3.0	INTERIM REMEDIAL MEASURES						
AR 3.1 000001	3.1 Well Owners - Correspondence	Letter regarding the results of tests and analysis of water supply with attached comments and sample results.	4/10/85	5	Derek I. Sandison, Tacoma/Pierce County Health Department	(b) (6)	
AR 3.1 000002	3.1 Well Owners - Correspondence	Letter regarding attached comments and results of sample testing on water supply.	4/10/85	5	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000003	3.1 Well Owners - Correspondence	Letter regarding attached comments and sampling results from testing of domestic water supply.	4/11/85	4	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000004	3.1 Well Owners - Correspondence	Letter regarding well sampling activity with attached summary of results for the inorganic analysis.	4/11/85	2	Derek I. Sandison, Pierce County Health Department		
AR 3.1 000005	3.1 Well Owners - Correspondence	Letter regarding well sampling activity as part of a groundwater quality survey with attached inorganic chemical test results.	4/11/85	2	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000006	3.1 Well Owners - Correspondence	Letter regarding preliminary test data based upon domestic well water sampling.	6/21/85	1	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000007	3.1 Well Owners - Correspondence	Letter regarding detection of materials in water supply.	6/23/85	2	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000008	3.1 Well Owners - Correspondence	Letter regarding well sampling activity conducted as part of Landfill's remedial investigation. Attached list of Tacoma Landfill wells.	10/3/86	2	Phillip M. Ringrose, City of Tacoma, Refuse Utilities Division		
AR 3.1 000009	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached testing results for halognated volatile organic compounds and description of TOX method.	2/18/87	5	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Mr. and Mrs. (b) (6)	

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CITY CLERK CONTRACT/AGREEMENT NO.

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 3.3 000002	3.3 Methane Gas Danger	Letter regarding excessive methane gas levels from the landfill and monitoring requirement.	5/14/86	2	Russell S. Post Tacoma/Pierce County Health Department	Phil Ringrose Refuse Utility Division, City of Tacoma	
Section 4.0	REMEDIAL INVESTIGATION-STATE LEAD/ECOLOGY						
AR 4.1 000001	4.1 Correspondence	Letter regarding future WDOE hazardous waste actions at the Tacoma Landfill site.	10/8/84	2	Fred Gardner, WDOE	Mr. Gene Olive Southeast Tacoma Neutral Water Company	
AR 4.1 000002.	4.1 Correspondence	Letter requesting EPA assistance in the sampling of five domestic wells on Orchard Street.	3/4/85	1	Jane A. Hedges Tacoma/Pierce County Health Department	Roy Jones, EPA	
AR 4.1 000003	4.1 Correspondence	Letter regarding domestic well survey.	7/5/85	1	Jane Hedges Tacoma/Pierce County Health Department	Fred Gardner, WDOE	
AR 4.1 000004	4.1 Correspondence	Letter regarding city counsel approval on the consent order for the city to do the remedial investigation/feasibility study.	6/17/86	1	Fred Gardner, WDOE	Bob Sparling Public Utilities Department	
AR 4.2 000001	4.2 Handwritten Notes	Handwritten notes regarding well contamination.	1/22/85	1	(b) (6)	P. Kmet, WDOE	
AR 4.3 000001	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase I.	11/21/84	20	Paul D. McRoberts Black & Veatch, Prepared for WDOE		
AR 4.3 000002	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase I.	12/7/84	47	Paul D. McRoberts Black & Veatch, Prepared for WDOE		
AR 4.3 000003	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase II.	4/10/85	37	Black & Veatch, Prepared for WDOE		
AR 4.3 000004	4.3 Work Plan	Project Work Plan for Conceptual-Feasibility Studies.	12/10/85	10	Black & Veatch, Prepared for WDOE		
AR 4.3 000005	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase II.	12/12/85	19	Black & Veatch, Prepared for WDOE		
AR 4.4 000001	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Quality Assurance Plan - Tacoma Landfill Well Water Sampling (Drinking Water) EPA/WDOE/TPSCH	Unknown	5	EPA, Contract Laboratory Program		
AR 4.4 000002	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Draft Quality Assurance Project Plan Remedial Investigation B&V Project #11889.201	7/26/85	129	Black & Veatch, Prepared for WDOE		

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 3.2 000004	3.2 Water Supplied to Residents	Letter regarding alternative water supply for residences.	9/26/86		Fred Gardner, WDOE	Fred Thompson, City of Tacoma, Department of Public Works	
AR 3.2 000005	3.2 Water Supplied to Residents	Letter regarding alternative water service to the (b) (6) residence.	10/10/86	2	Phillip M. Ringrose, City of Tacoma, Refuse Utilities Division	Fred Gardner, WDOE	
AR 3.2 000006	3.2 Water Supplied to Residents	Letter in response to request to connect the (b) (6) residences to city water.	10/10/86	1	Fred A. Thompson Tacoma Department of Public Works	Fred Gardner, WDOE	
AR 3.2 000007	3.2 Water Supplied to Residents	Letter regarding WDOE position in response to City of Tacoma decision not to supply water to several additional residences near Tacoma Landfill.	10/10/86	2	Fred Gardner, WDOE	Fred Thompson, Tacoma Department of Public Works	
AR 3.2 000008	3.2 Water Supplied to Residents	Letter regarding water wells near Tacoma Landfill and the steps taken to protect public health	10/31/86	2	Al Allen Tacoma/Pierce County Health Department	Joe Stortini, Tacoma/Pierce County Board of Health Doug Southerland, Tacoma/Pierce County Board of Health	
AR 3.2 000009	3.2 Water Supplied to Residents	Memorandum regarding meeting with Dr. (b) (6)	10/31/86	2	Patricia C. Storm, EPA	File	
AR 3.2 000010	3.2 Water Supplied to Residents	Letter in response to Fred Gardner's letter of 10/20/86 concerning connection of the (b) and the (b) (6) residences to city water.	11/3/86	2	Fred A. Thompson Tacoma Department of Public Works	Fred Gardner, WDOE	
AR 3.2 000011	3.2 Water Supplied to Residents	Letter regarding Tacoma Landfill RI/FS progress report 9/27/86-10/26/86	11/10/86	2	Philip M. Ringrose City of Tacoma, Refuse Utility Division	Fred Gardner, WDOE	
AR 3.2 000012	3.2 Water Supplied to Residents	Letter requesting information and agency assistance in researching the health affects of exposure to vinyl chloride	12/29/86	1	Donald L. Oliver Tacoma/Pierce County Health Department	Ms. Pat Storm, EPA	
AR 3.2 000013	3.2 Water Supplied to Residents	Tacoma drinking water wells health assessment.	Unknown	1	WDOE		
AR 3.3 000001	3.3 Methane Gas Danger	Letter regarding 10/17/85 meeting which discussed minimum functional standards regarding geohydrological study and compliance with the new regulations.	1/6/86	2	Jane Hedges Tacoma/Pierce County Health Department	W.J. Larson Tacoma Refuse Utility	

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CITY CLERK'S OFFICE

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000012	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000013	4.5 Sampling and Analysis Data	Field sampling data/chain of custody, Orchard Street sampling.	1/28/85	5	Sweet, Edwards & Associates, Inc.	Tacoma/Pierce County Health Department	
AR 4.5 000014	4.5 Sampling and Analysis Data	Sampling data.	1/28/85	1	Brown & Caldwell, Weyerhauser		
AR 4.5 000015	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85	1	Unknown		
AR 4.5 000016	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85 & 3/5/85	1	Brown & Caldwell, Weyerhaeuser, City Laboratory		
AR 4.5 000017	4.5 Sampling and Analysis Data	Residential sampling data and attached preliminary health assessment of Tacoma wells and attached EPA Region 10 Lab Management Systems sample project analysis results. Sample dates - 1/28/85, 3/5/85, 6/18/85, and 6/19/85.	1/28/85 & 3/5/85	21	Unknown		
AR 4.5 000018	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85 & 1/31/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000019	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85 & 1/31/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000020	4.5 Sampling and Analysis Data	Cover memo regarding attached PLU student data on groundwater quality near Tacoma Landfill.	1/31/85	14	(b) (6)	Fred Gardner, WDOE	
AR 4.5 000021	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85 & 3/5/85	1	Brown & Caldwell, Weyerhaeuser, City Laboratory		
AR 4.5 000022	4.5 Sampling and Analysis Data	Interdepartmental communications memo regarding Orchard Street well water analysis with sampling results.	2/19/85 & 3/19/85	2	Christopher L. Getchell Waste Water Lab, City of Tacoma	William J. Larson Refuse Utility, City of Tacoma	
AR 4.5 000023	4.5 Sampling and Analysis Data	Cover letter regarding attached report of analytical results for the Orchard Street wells.	2/25/85	4	Molly Adolfson Brown & Caldwell Consulting Engineers	Derek Sandison Tacoma/Pierce County Health Department	
AR 4.5 000024	4.5 Sampling and Analysis Data	EPA Region 10 Lab Management System sample/project analysis results for well drinking water.	3/5/85	6	EPA Lab, Manchester		

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.4 000003	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Draft Appendices for Quality Assurance Project Plan B&V Project #11889.201.	8/30/85	172	Black & Veatch, Prepared for WDOE		
AR 4.4 000004	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Sampling Plan for Remedial Investigation Phase II.	12/20/85	30	Black & Veatch, Prepared for WDOE		
AR 4.4 000005	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Quality Assurance Project Plan Remedial Investigation B&V Project #11889.201.	3/21/86	256	Black & Veatch, Prepared for WDOE		
AR 4.5 000001	4.5 Sampling and Analysis Data	Table A-1 through A-7a water quality analysis - Sample dates 1970-1983, University Place Wells.	Unknown	37	Unknown		
AR 4.5 000002	4.5 Sampling and Analysis Data	Letter regarding well water sampling activities in the town of Fircrest.	1/23/84	2	Don Anderson Water Management Associates, Inc.	Tim Kane Town of Fircrest Water Department	
AR 4.5 000003	4.5 Sampling and Analysis Data	Water samples in the vicinity of the Tacoma Landfill	6/30/84-8/12/84	3	Unknown		
AR 4.5 000004	4.5 Sampling and Analysis Data	Water bacteriological analysis.	7/22/84	1	Washington Department of Social and Health Services		
AR 4.5 000005	4.5 Sampling and Analysis Data	Water bacteriological analysis.	7/24/84	1	Washington Department of Social and Health Services		
AR 4.5 000006	4.5 Sampling and Analysis Data	Water bacteriological analysis.	8/12/84	1	Washington Department of Social and Health Services		
AR 4.5 000007	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85 & 1/31/85	1	Washington Department of Social and Health Services	Tacoma-Pierce County Health Department	
AR 4.5 000008	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85 & 1/28/85	1	Washington Department of Social and Health Services		
AR 4.5 000009	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85	1	Washington Department of Social and Health Services		
AR 4.5 000010	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85 & 4/17/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000011	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000038	4.5 Sampling and Analysis Data	Water bacteriological analysis.	3/5/85	1	Washington Department of and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000039	4.5 Sampling and Analysis Data	Handwritten notes regarding sampling data: attached general purpose data sheet, determination for chloride, SO4, and conductivity.	3/12/85	4	EPA Region 10 Laboratory	(b) (6)	
AR 4.5 000040	4.5 Sampling and Analysis Data	Letter of transmittal regarding attached scan for Orchard Street wells and quantitation reports.	3/13/85	29	Brown & Caldwell	Patricia Storm, EPA	
AR 4.5 000041	4.5 Sampling and Analysis Data	Handwritten note regarding attached handwritten letter regarding quality assurance and lab data.	4/5/85	2	(b) (6)	(b) (6)	
AR 4.5 000042	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85	12	(b) (6)	Tacoma/Pierce County Health Department	
AR 4.5 000043	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85 & 5/16/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000044	4.5 Sampling and Analysis Data	Cover letter regarding attached QA/QC data for the Pierce County/Tacoma groundwater analysis using EPA methods 624, data includes scan and services quantitation report.	5/13/85	28	James C. Hein Brown & Caldwell	Pat Storm, EPA	
AR 4.5 000045	4.5 Sampling and Analysis Data	Region 10 Management System sample/project analysis results.	6/18/85	3	EPA Region 10 Lab		
AR 4.5 000046	4.5 Sampling and Analysis Data	Cover letter regarding attached sample results for well water.	7/5/85	5	Jane Hedges Tacoma/Pierce County Health Department	Fred Gardner, WDOE	
AR 4.5 000047	4.5 Sampling and Analysis Data	Cover letter regarding water system analysis, attached water sample information for inorganic chemcial analyses.	7/1/85	15	Cheryl L. Bergener Washington Department of Social and Health Services	Tacoma/Pierce County Health Department	
AR 4.5 000048	4.5 Sampling and Analysis Data	Acid/Base/Neutral compounds sampling data.	8/12/85	11	(b) (6)	EPA Lab Region 10	
AR 4.5 000049	4.5 Sampling and Analysis Data	Typically identified compounds sheets.	8/14/85	2	Gerry Muth, EPA Lab Region 10		
AR 4.5 000050	4.5 Sampling and Analysis Data	Tentatively identified compounds sheets attached organic analysis data sheets, sample #251575 through 251590.	8/14/85	21	Gerry Muth, EPA Region 10 Lab		

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000025	4.5 Sampling and Analysis Data	General purpose data sheet, determination SO4.	3/12/85	1	J. Beckner, EPA Lab	(b) (6)	
AR 4.5 000026	4.5 Sampling and Analysis Data	EPA Region 10 Laboratory metal analysis required-water.	3/5/85	1	(b) (6)		
AR 4.5 000027	4.5 Sampling and Analysis Data	EPA Region 10 Laboratory general analysis required-water.	3/5/85	1			
AR 4.5 000028	4.5 Sampling and Analysis Data	General purpose data sheets, determination purgeables, halocarbons-water, attached field sample data and chain of custody sheets.	3/8/85	4			
AR 4.5 000029	4.5 Sampling and Analysis Data	Chain of custody record.	3/5/85	1		EPA	
AR 4.5 000030	4.5 Sampling and Analysis Data	General purpose data sheets, determination purgeables, halocarbons-water, attached field sample data and chain of custody sheets.	3/5/85	4	EPA Lab	(b) (6)	
AR 4.5 000031	4.5 Sampling and Analysis Data	General purpose data sheets, determination purgeables, halocarbons-water.	3/17/85	4	EPA Lab Region 10		
AR 4.5 000032	4.5 Sampling and Analysis Data	General purpose data sheet determination, purgeable halocarbons-water, attached field sample data and chain of custody sheets.	3/7/85	4	EPA Region 10 Laboratory		
AR 4.5 000033	4.5 Sampling and Analysis Data	General purpose data sheet, determination purgeable halocarbons-water, attached field sample data and chain of custody sheets.	3/8/85	4	EPA Region 10 Laboratory		
AR 4.5 000034	4.5 Sampling and Analysis Data	General purpose data sheet, determination chloride.	3/12/85	1	EPA Region 10 Laboratory		
AR 4.5 000035	4.5 Sampling and Analysis Data	General purpose data sheet, determination conductivity.	3/6/85	1	EPA Region 10 Laboratory		
AR 4.5 000036	4.5 Sampling and Analysis Data	Water bacteriological analysis.	3/5/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000037	4.5 Sampling and Analysis Data	Water bacteriological analysis.	3/5/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.1 000004	5.1 Correspondence-General	Memo regarding wells near Tacoma Landfill.	10/28/86	1	Don Oliver Director of Environmental Health Tacoma/Pierce County Health Department	Al Allen Director of Health Tacoma/Pierce County Health Department	
AR 5.1 000005	5.1 Correspondence-General	Memo regarding water wells near Tacoma Landfill.	10/31/86	2	Al Allen Director of Health Tacoma/Pierce County Health Department	The Honorable Joe Stortini, Tacoma/Pierce County Board of Health The Honorable Doug Southerland, Tacoma/Pierce County Board of Health	
AR 5.1 000006	5.1 Correspondence-General	Letter regarding utility operation and the Feasibility Study Report for Tacoma Landfill.	1/27/87	2	Fred Gardner, WDOE	Fred Thompson City of Tacoma, Department of Public Works	
AR 5.1 000007	5.1 Correspondence-General	Memorandum regarding Tacoma Landfill site visit, January 28, 1987.	1/30/87	1	Bill Myers, WDOE	Fred Gardner, WDOE	
AR 5.1 000008	5.1 Correspondence-General	Memo regarding discharge of acquifer test water.	1/30/87	1	Michael P. Price City of Tacoma	Philip M. Ringrose City of Tacoma	
AR 5.1 000009	5.1 Correspondence-General	Memo regarding inspection of work at Tacoma Landfill.	2/2/87	1	Bill Myers, WDOE	Fred Gardner, WDOE	
AR 5.1 000010	5.1 Correspondence-General	Letter regarding Tacoma Landfill Remedial Investigation Feasibility Study.	4/9/87	1	Philip M. Ringrose City of Tacoma	Fred Gardner, WDOE	
AR 5.1 000011	5.1 Correspondence-General	Letter regarding discharges to the sanitary sewer from Tacoma Landfill pump testing.	4/13/87	1	Carol Kraege, WDOE	Chan Odell Central Treatment Plant, Tacoma	
AR 5.1 000012	5.1 Correspondence-General	Letter regarding approval to discharge pump test water from the City of Tacoma Landfill.	4/20/87	1	Michael P. Price City of Tacoma	Carol Kraege, WDOE	
AR 5.1 000013	5.1 Correspondence-General	Memo regarding Tacoma Landfill central area development design report.	4/23/87	3	Carol Kraege, WDOE	Jim Knudson, WDOE	
AR 5.1 000014	5.1 Correspondence-General	Letter regarding groundwater portion of the Remedial Investigation of the Tacoma Landfill.	5/15/87	2	Glenn Bruck, EPA	Thair Jorgenson City of Tacoma	
AR 5.1 000015	5.1 Correspondence-General	Letter regarding groundwater portion of the Remedial Investigation of the Tacoma Landfill.	5/15/87	2	Glenn Bruck, EPA	Thair Jorgenson City of Tacoma	
AR 5.1 000016	5.1 Correspondence-General	Cover letter regarding attached specifications for the oil mat access road at Tacoma Landfill.	5/19/87	3	Phillip M. Ringrose City of Tacoma	Fred Gardner, WDOE	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000051	4.5 Sampling and Analysis Data	Transmittal sheet regarding attached Tacoma Landfill data from 3/85 by EPA Region 10 Lab Management System sample/project analysis results.	9/18/85	9	Joyce Crosson, EPA	Patricia Storm, EPA	
AR 4.5 000052	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #1 Sample numbers 85100650 through 85100654	3/5/85	4	EPA		
AR 4.5 000053	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #2 Sample numbers 85100655 through 85100659	3/5/85	4	EPA		
AR 4.5 000054	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #3 Sample numbers 85100660 through 85100664	3/5/85	4	EPA		
AR 4.5 000055	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #4 Sample numbers 85100665 through 85100669	3/5/85	4	EPA		
AR 4.5 000056	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #5 Sample numbers 85100670 through 85100674	3/5/85	4	EPA		
AR 4.5 000057	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis Results. Sample number 85251575 through 85251590	3/5/85	4	EPA		
AR 4.6 000001	4.6 Remedial Investigations-Phase I Description of Current Situation	Remedial Investigations-Phase I Description of Current Situation.	5/29/85	78	Mark G. Snyder Paul C. McRoberts Black & Veatch, Prepared for WDOE		
AR 4.7 000001	4.7 Preliminary Health and Safety Assessment	Preliminary Health and Safety Assessment of Tacoma Landfill Remedial Investigation.	no date	17	Elizabeth A. Taylor Phoenix Safety Associates, Ltd., Prepared for Black & Veatch on behalf of WDOE		
Section 5.0	REMEDIAL INVESTIGATION POTENTIALLY RESPONSIBLE PARTY LEAD, CITY OF TACOMA.						
AR 5.1 000001	5.1 Correspondence-General	Letter regarding responsibilities for negotiations with PRP.	6/23/86	2	Patricia C. Storm, EPA	Fred Gardner, WDOE	
AR 5.1 000002	5.1 Correspondence-General	Memo regarding water samples, Tacoma Landfill and proposed meeting.	9/16/86	1	Jane Hedges Solid Waste Program	Derek, Bob, Don & Al	
AR 5.1 000003	5.1 Correspondence-General	Memo regarding site visit, Tacoma Landfill	10/6/86	1	Bill Myers, WDOE	Fred Gardner, WDOE	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.1 000017	5.1 Correspondence-General	Memo regarding additional site characterization needs at Tacoma Landfill.	6/8/87	2	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000018	5.1 Correspondence-General	Memo regarding evaluation of pumping test results from PW8A.	7/13/87	2	Bill Myers, WDOE	Tacoma Landfill File Fred Gardner, WDOE	
AR 5.1 000019	5.1 Correspondence-General	Memo regarding deep exploration boring at Tacoma Landfill.	7/27/87	1	R.C. Prior Hart Crowser	Bill Myers, WDOE	
AR 5.1 000020	5.1 Correspondence-General	Letter regarding deep exploration boring, Tacoma Landfill.	7/29/87	1	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000021	5.1 Correspondence-General	Letter regarding deep exploration boring, Tacoma Landfill.	7/29/87	1	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000022	5.1 Correspondence-General	Letter regarding new deliverable date for Remedial Investigation Report.	9/9/87	2	Glynis Stumpf, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000023	5.1 Correspondence-General	Letter regarding ecology review and comment on the Draft Remedial Investigation Report for Tacoma Landfill.	10/13/87	3	Peter Kmet, WDOE Glynis Stumpf, WDOE	Thair Jorgensen, City of Tacoma	
AR 5.1 000024	5.1 Correspondence-General	Responses to ecology comments on the draft Remedial Investigation Report.	10/13/87	16	Unknown	Unknown	
AR 5.1 000025	5.1 Correspondence-General	Schedule for Tacoma Landfill.	11/18/87	1	Unknown	Unknown	
AR 5.1 000026	5.1 Correspondence-General	Ecology review and comment on the Draft Feasibility Study Report for Tacoma Landfill.	11/12/87	3	Glynis A. Stumpf, WDOE	Thair Jorgensen, City of Tacoma	
AR 5.1 000027	5.1 Correspondence-General	Letter regarding Tacoma Landfill Remedial Investigation/Feasibility Study.	11/13/87	2	Thair Jorgensen City of Tacoma	Glynis Stumpf, WDOE	
AR 5.1 000028	5.1 Correspondence-General	Letter regarding Tacoma comments to ecology remedial investigation comments.	11/24/87	1	Glynis A. Stumpf, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000029	5.1 Correspondence-General	Letter regarding methane gas monitoring program and installation of shallow gas probes.	12/16/87	2	Peter Kmet, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000030	5.1 Correspondence-General	Letter regarding methane gas generation and migration and installation of shallow gas probes.	12/16/87	2	Peter Kmet, WDOE	Jody Snyder, Tacoma-Pierce County Health Department	
AR 5.2 000001	5.2 Handwritten Notes	Inspection report for Tacoma Landfill.	2/24/87	1	Bill Myers, WDOE	Unknown	
AR 5.2 000002	5.2 Handwritten Notes	Inspection report for Tacoma Landfill	4/28/87	1	Bill Myers, WDOE	Unknown	
AR 5.2 000003	5.2 Handwritten Notes	Memo regarding Tacoma Landfill pumping procedure.	4/28/87	1	(b) (6)	Fred Gardner, WDOE	

CITY CLERK CONFIDENTIAL

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.2 000004	5.2 Handwritten Notes	Inspection report regarding Tacoma Landfill.	5/1/87	1	Bill Myers, WDOE	Unknown	
AR 5.2 000005	5.2 Handwritten Notes	Memo regarding Tacoma Landfill drilling.	1987	2	Fred Gardner, WDOE	(b) (6)	
AR 5.3 000001	5.3 Work Plans	Attachment A Tacoma Landfill Remedial Investigation/Feasibility Study Scope of Work Phase I with attached map of proposed sampling locations.	6/1/86	13	Black & Veatch		
AR 5.3 000002	5.3 Work Plans	Cover letter attached RI/FS scope of work Phase I.	6/19/86	13	Phillip Ringrose City of Tacoma	Fred Gardner, WDOE	
AR 5.3 000003	5.3 Work Plans	Document outlining data management plan for RI.	9/26/86	10	USEPA	Unknown	
AR 5.3 000004	5.3 Work Plans	Attachment A to Amendment No. 3 to the Agreement for Engineering Serivces between Black & Veatch, Engineers-Architects and the City of Tacoma for the Tacoma Landfill RI/FS and Central Area Development Project.	1/27/87	22	Black & Veatch	Unknown	
AR 5.4 000001	5.4 Sampling and Analysis Plans	Letter regarding attached memorandum, modifications to sampling plan, and draft groundwater quality monitoring program, for private wells near Tacoma Landfill.	11/19/86	26	Thomas L. Rutherford Black & Veatch	Patricia Storm, USEPA	
AR 5.4 000002	5.4 Sampling and Analysis Plans	Sampling plan regarding gorundwater quality monitoring program for existing wells near the Tacoma Landfill and attached Table I re Groundwater Sample Locations and Analyses.	12/15/86	3	Black & Veatch	Uknown	
AR 5.4 000003	5.4 Sampling and Analysis Plans	Sampling plan for Tacoma Landfill Remedial Investigation Phase II.	1/30/87	35	Black & Veatch Engineers/Archtitects for the City of Tacoma	Unknown	
AR 5.4 000004	5.4 Sampling and Analysis Plans	Letter regarding deep exploration boring at Tacoma Landfill.	7/29/87	1	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.4 000005	5.4 Sampling and Analysis Plans	Memo regarding attached revisions to the sampling plan for Tacoma Landfill Phase II Round III.	11/12/87	4	T.L. Ruthorford Black & Veatch for the City of Tacoma	D. Yamamoto, EPA	
AR 5.5 000001	5.5 Sampling and Analysis Data	Appendix B including Map with Well locations, well data, groundwater flow shallow aquifer, groundwater flow deeper aquifer, geohydrologic section.	5/29/85	8	Black & Veatch	Unknown	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000011	5.5 Sampling and Analysis Data	Letter regarding analytical results on gas samples collected on 6/25/86 at Tacoma Landfill, attached letter regarding time weighted average and short-time exposure limits.	7/18/86	5	T.L. Rutherford Black & Veatch	Phil Ringrose City of Tacoma Refuse Utility	
AR 5.5 000012	5.5 Sampling and Analysis	Cover letter regarding attached averages and short-term exposure limits.	7/28/86	2	Michael L.R. Housley Black & Veatch	Phil Ringrose City of Tacoma Refuse Utility	
AR 5.5 000013	5.5 Sampling and Analysis Data	Letter regarding time weighted averages and short-term exposure limits, attached organic sample narrative METRO sample #268500, attached GCMS organic analysis data report for volatiles, quantitation reports, and scans.	7/28/86	21	Michael L.R. Housley Black & Veatch	Phil Ringrose City of Tacoma Refuse Utility	
AR 5.5 000014	5.5 Sampling and Analysis Data	Olympic Environmental Laboratory data summary, Leach Creek, Tacoma.	9/25/86	1	WDOE	Unknown	
AR 5.5 000015	5.5 Sampling and Analysis Data	Groundwater samples, volatile organic compounds	8/86 & 10/86	4	Unknown	Unknown	
AR 5.5 000016	5.5 Sampling and Analysis Data	Groundwater samples, inorganic compounds.	8/86, 10/86 & 11/86	2	Unknown	Unknown	
AR 5.5 000017	5.5 Sampling and Analysis Data	Subsurface soil samples, volatile.	8/86 & 9/86	1	Unknown	Unknown	
AR 5.5 000018	5.5 Sampling and Analysis Data	Sediment samples, volatile organic compounds, semivolatile organic compounds.	7/86 & 8/86	4	Unknown	Unknown	
AR 5.5 000019	5.5 Sampling and Analysis Data	List of sampling activies for Tacoma Landfill wells.	8/86, 10/86 & 11/86	1	Unknown	Unknown	
AR 5.5 000020	5.5 Sampling and Analysis Data	Surface water leachate and sewer samples, semivolatile organic compounds.	7/86-10/86	2	Unknown	Unknown	
AR 5.5 000021	5.5 Sampling and Analysis Data	Cover letter regarding attached priority pollutant analysis results.	9/9/86	5	Michael L.R. Housley Black & Veatch	Mr. Thair Jorgenson City of Tacoma Refuse Utility	
AR 5.5 000022	5.5 Sampling and Analysis Data	Cover memo regarding organic analysis of Leach Creek water samples, attached organic analysis data sheets for semivolatile compounds and volatile compounds.	9/22/86	8	Dick Huntamer, WDOE	Bill Myers, WDOE	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000002	5.5 Sampling and Analysis Data	Landfill gas samples volatile organic compounds.	6/25/86	2	Unknown	Unknown	
AR 5.5 000003	5.5 Sampling and Analysis Data	Description of Tacoma Landfill investigation landfill gas samples, attached landfill gas sample, and volatile organic compound data.	6/25/86	3	Unknown	Unknown	
AR 5.5 000004	5.5 Sampling and Analysis Data	Sample report form, project code 877, attached request for analysis.	6/27/86	4	Merly McMall, WEOE Jeff Bauman, METRO		
AR 5.5 000005	5.5 Sampling and Analysis Data	Organic sample narrative, METRO sample #268501, attached GCMS organic analysis data report for volatiles scans, and quantitation reports, METRO A-B-N extraction scheme for water, METRO pesticide extraction scheme for water.	6/27/86	19	METRO	Unknown	
AR 5.5 000006	5.5 Sampling and Analysis Data	Organic sample narrative, METRO sample #248503, attached GCMS organic analysis data report for volatiles scans, and quantitation reports, METRO A-B-N extraction scheme for water, METRO pesticide extraction scheme for water.	6/27/86	19	METRO	Unknown	
AR 5.5 000007	5.5 Sampling and Analysis Data	Organic sample narrative, METRO sample #268502, attached GCMS organic analysis data report for volatiles scans, and quantitation reports, METRO A-B-N extraction scheme for water, METRO pesticide extraction scheme for water.	6/27/86	19	METRO	Unknown	
AR 5.5 000008	5.5 Sampling and Analysis Data	Organic sampling narrative METRO sample #MB86VII01, attached GCMS organic analysis data report, quantitation reports and scans.	7/1/86	16	METRO	Unknown	
AR 5.5 000009	5.5 Sampling and Analysis Data	GCMS organic analysis data reports, sample #MB860701, attached scans and quantitation reports.	7/9/86	16	METRO	Unknown	
AR 5.5 000010	5.5 Sampling and Analysis Data	Cover letter regarding attached proposed schedule of sampling activities, sample container requirements, and sample preservatives, a list of contract laboratory program protection limits, and a list of additional parameters for analysis.	7/11/86	13	Michael L.R. Housley Black & Veatch	Mr. Christoph Getchell City of Tacoma Public Works	

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CITY CLERK CONTRACT/AGREEMENT NO. 4016

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000023	5.5 Sampling and Analysis Data	Cover memo regarding attached organic analysis of Leach Creek, Tacoma Landfill water and soil samples.	9/22/86	14	Dick Huntamer, WDOE	Bill Myers, WDOE	
AR 5.5 000024	5.5 Sampling and Analysis Data	Request for analysis, Manchester Environmental Laboratories.	9/24/86	2	Bill Myers, WDOE	Unknown	
AR 5.5 000025	5.5 Sampling and Analysis Data	Request for analysis, Manchester Environmental Laboratories.	9/24/86	2	Bill Myers, WDOE	Unknown	
AR 5.5 000026	5.5 Sampling and Analysis Data	Request for analysis, Manchester Environmental Laboratories.	9/26/86	2	Bill Myers, WDOE	Unknown	
AR 5.5 000027	5.5 Sampling and Analysis Data	Summary of detected volatile compounds, attached list of existing well sampling locations and analytical data for priority pollutants, volatile and organic compounds and inorganic compounds.	8/86	31	Black & Veatch	Unknown	
AR 5.5 000028	5.5 Sampling and Analysis Data	Letter regarding analytical results of groundwater samples.	10/2/86	2	Thomas L. Rutherford Black & Veatch	Thair Jorgensen City of Tacoma Refuse Utility	
AR 5.5 000029	5.5 Sampling and Analysis Data	Letter regarding attached analytical results for priority pollutant volatile compounds, priority pollutant metals, major ions and drinking water parameters.	10/2/86	36	Thomas L. Rutherford Black & Veatch	Mr. Thair Jorgenson City of Tacoma Refuse Utility	
AR 5.5 000030	5.5 Sampling and Analysis Data	Olympia Environmental Laboratory data summary.	11/4/86	1	WDOE	Unknown	
AR 5.5 000031	5.5 Sampling and Analysis Data	Environmental Laboratory data summary metals.	1/21/87	2	WDOE	Unknown	
AR 5.5 000032	5.5 Sampling and Analysis Data	Organic sample narrative METRO sample #137859, attached GCM organic analysis report for volatiles, pesticide compounds quantitation reports and scans.	10/23/86	18	METRO	Unknown	
AR 5.5 000033-	5.5 Sampling and Analysis Data	Cover letter regarding attached volatile organic analysis data sheet and map of South Tacoma channel.	10/29/86	3	Thomas L. Rutherford Black & Veatch	Patricia C. Storm, EPA	
AR 5.5 000034	5.5 Sampling and Analysis Data	Letter regarding landfill groundwater study and connection of residences to city water.	11/3/86	2	Fred A Thompson City of Tacoma, Department of Public Works	Fred Gardner, WDOE	
AR 5.5 000034a	5.5 Sampling and Analysis Data	Memo regarding Tacoma Landfill update - related health department issues.	11/6/86	3	Fred Gardner, WDOE	(b) (6)	
AR 5.5 000035	5.5 Sampling and Analysis Data	Environmental Laboratory data summary, metals.	2/26/87	2	WDOE	Unknown	

CITY CLERK CONTRACT/AGREEMENT NO. 4104

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000036	5.5 Sampling and Analysis Data	Olympia Environmental Laboratory data summary.	12/5/86	1	WDOE	Unknown	
AR 5.5 000037	5.5 Sampling and Analysis Data	Organic sample narrative METRO sample #477062, attached GCMs organic analysis data report, GCMs organic data report for volatiles, quantitation reports and scans.	11/21/86	28	METRO	Unknown	
AR 5.5 000038	5.5 Sampling and Analysis Data	Remedial Investigation Phase I Field Investigation Data, Preliminary.	12/2/86	134	Black & Veatch, Hart-Crowser & Associates, Inc. Prepared for City of Tacoma		
AR 5.5 000039	5.5 Sampling and Analysis Data	Letter regarding attached data sheets for private well samples, revised tables 1 and 2, 12/19/86 sampling plan, summary table of the volatile organic compounds detected in the total organic halogen (TOX) values, and tables listing volatile organic compounds.	1/30/87	15	Thomas L. Rutherford Black & Veatch	Thair Jorgenson, City of Tacoma, Refuse Utility	
AR 5.5 000040	5.5 Sampling and Analysis Data	Landfill gas samples, volatile organic compounds, groundwater samples, halogenated organic compounds, metals analyses, groundwater samples, solid waste regulations and treatment parameters.	2/87 & 3/87	9	Unknown	Unknown	
AR 5.5 000041	5.5 Sampling and Analysis Data	Cover letter regarding attached data sheets for volatile organic compounds for private wells near the landfill.	4/8/87	24	Michael L.R. Housely Black & Veatch	City of Tacoma Refuse Utility	
AR 5.5 000042	5.5 Sampling and Analysis Data	Pumping test data, project TFS hydrologist: CTE, Job #1775.01.	5/2/87	10	Unknown	Unknown	
AR 5.5 000043	5.5 Sampling and Analysis Data	Memo regarding attached samples collected during Round 1 of Phase II of the Tacoma Landfill's Remedial Investigation.	5/8/87	6	Black & Veatch	City of Tacoma	
AR 5.5 000044	5.5 Sampling and Analysis Data	Memo regarding quality assurance report #3.	5/13/87	17	Black & Veatch	City of Tacoma	
AR 5.5 000045	5.5 Sampling and Analysis Data	Letter regarding Tacoma Landfill Remedial Investigation/Feasibility Study and attached lab results for volatile organic compounds, priority pollutants and hazardous substances.	5/14/87	5	Phillip M. Ringrose City of Tacoma Refuse Division	Fred Gardner, WDOE	
AR 5.5 000046	5.5 Sampling and Analysis Data	Data sheets from 5/14/87 Technical Progress Report regarding volatile organic compounds, priority pollutants, and hazardous substance list.	3/20/87	3	Black & Veatch	Unknown	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000047	5.5 Sampling and Analysis Data	Water level data regarding South Tacoma Swamp wells.	6/1/87	1	Hart-Crowser & Associates, Inc.	Unknown	
AR 5.5 000048	5.5 Sampling and Analysis Data	P.W.-8A production well constant rate pumping test drawdown and recovery data measured in TL-8A through 8C observation wells.	6/87	5	Hart-Crowser & Associates, Inc.	Unknown	
AR 5.5 000049	5.5 Sampling and Analysis Data	Groundwater sample data sheets for volatile organic compounds and for halogenated organic compounds.	6/87	7	Unknown	Unknown	
AR 5.5 000050	5.5 Sampling and Analysis Data	Table 3 solid waste regulation parameters, Remedial Investigation Phase II, Round 2 monitoring well samples.	6/87	1	Unknown	Unknown	
AR 5.5 000051	5.5 Sampling and Analysis Data	Surface water samples, halogenated organic compounds.	6/16/87	1	Unknown	Unknown	
AR 5.5 000052	5.5 Sampling and Analysis Data	Solid waste regulation parameters in Remedial Investigation Phase II, Round 2 surface water samples.	6/16/87	1	Unknown	Unknown	
AR 5.5 000053	5.5 Sampling and Analysis Data	Leachate samples, volatile organic compounds-EPA Method 624.	6/17/87	1	Unknown	Unknown	
AR 5.5 000054	5.5 Sampling and Analysis Data	Table 4 solid waste regualtion parameters Remedial Investigation Phase I, Round 2, private well samples.	6/87	1	Unknown	Unknown	
AR 5.5 000055	5.5 Sampling and Analysis Data	Solid waste regulation parameters Remedial Investigation Phase II, Round 2, leachate samples.	6/18/87	1	Unknown	Unknown	
AR 5.5 000056	5.5 Sampling and Analysis Data	Landfill gas samples, volatile organic compounds, halogenated compounds, groundwater samples, solid waste regulation and treatment parameters.	2/87 & 3/87	9	Unknown	Unknown	
AR 5.5 000057	5.5 Sampling and Analysis Data	Memo regarding quality assurance report #3.	5/13/87	8	Black & Veatch	City of Tacoma	
AR 5.5 000058	5.5 Sampling and Analysis Data	Memo regarding samples collected during Round 1 of Phase II of the Tacoma Landfill Remedial Investigation, attached revised tables 6 through 10 from the sampling plan.	5/8/87	6	Black & Veatch	City of Tacoma	

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CITY CLERK CONTRACT NUMBER

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000059	5.5 Sampling and Analysis Data	Letter report regarding information collected during pumping test performed at Tacoma Landfill on 5/2/87.	6/18/87	22	Russell C. Prior Charles T. Ellingson Hart-Crowser, Inc.	Thomas Rutherford Black & Veatch	
AR 5.5 000060	5.5 Sampling and Analysis Data	Table 5 regarding dissolved iron and manganese concentrations for RI Phase II, Round 2, private well samples.	6/18/87 & 6/19/87	1	Black & Veatch	Unknown	
AR 5.5 000061	5.5 Sampling and Analysis Data	Memo regarding evaluation of pumping test results from PWBA.	7/14/87	1	Bill Myers, WDOE	Fred Gardner, WDOE	
AR 5.5 000062	5.5 Sampling and Analysis Data	Environmental Laboratory data summary, metals, Leach Creek, Tacoma.	10/16/87	1	WDOE	Unknown	
AR 5.5 000063	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 surface water samples.	7/30/87	2	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00064	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 leachate samples.	7/30/87	2	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00065	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 groundwater samples.	8/4/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser	
AR 5.5 00066	5.5 Sampling and Analysis Data	Letter regarding attached analysis sheets for private wells, volatile organic compounds, priority pollutants, halogenated organic compounds, memo regarding Phase II, Round 2 leachate samples, and memo regarding Phase II, Round 2 surface water samples.	8/6/87	41	Thair Jorgenson City of Tacoma Refuse Utility Division	Glynis Stumpf, WDOE	
AR 5.5 000067	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 groundwater samples.	8/16/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 00068	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 leachate samples.	8/18/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00069	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 surface water samples.	8/17/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00070	5.5 Sampling and Analysis Data	Letter regarding resampling of Holly and Fircrest wells. Attached data sheets regarding volatile organic compounds.	9/4/87	3	Thomas L. Rutherford Black & Veatch	Thair Jorgensen City of Tacoma Refuse Utility	
AR 5.5 000071	5.5 Sampling and Analysis Data	Private well analyses Tacoma Landfill RI-Phase II, Round 3 Draft.	11/17/87	2	Black & Veatch	Unknown	
AR 5.5 000072	5.5 Sampling and Analysis Data	List of private wells.	no date	1	Unknown	Unknown	
AR 5.5 000073	5.5 Sampling and Analysis Data	Table 1, field paramters and total organic carbon for groundwater samples collected during Phase II, Round 2 Tacoma Landfill RI.	no date	2	Black & Veatch	Unknown	
AR 5.5 000074	5.5 Sampling and Analysis Data	Table 2 tentatively identified compounds from the groundwater samples collected from landfill monitoring wells during Phase II, Round 2 of the Tacoma Landfill RI.	no date	1	Black & Veatch	Unknown	
AR 5.6 000001	5.6 Remedial Investigation/Draft Reports and Comments	Draft Remedial Investigation Report, Vol. 1.	9/1/87	209	Black & Veatch, Prepared for City of Tacoma		
AR 5.6 000002	5.6 Remedial Investigation/Draft Reports and Comments	Draft Remedial Investigation Report Vol. 2, appendices.	9/1/87	598	Black & Veatch, Prepared for City of Tacoma		
AR 5.6 000003	5.6 Remedial Investigation/Draft Reports and Comments	Letter regarding EPA agency review of Draft Remedial Investigation Reports.	9/14/87	1	Phillip M. Ringrose City of Tacoma Refuse Utility Division	Debbie Yamamoto, EPA	
AR 5.6 000004	5.6 Remedial Investigation/Draft Reports and Comments	Figures 4-20 through 4-23 regarding groundwater contamination submitted with city progress reports.	9/21/87	4	City of Tacoma	Unknown	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.6 000005	5.6 Remedial Investigation/Draft Reports and Comments	Memo regarding Tacoma Landfill Remedial Investigation/Feasibility Study Risk Assessment, attached calculation of risk from vinyl chloride in groundwater.	11/16/87	4	Thomas L. Rutherford Black & Veatch	City of Tacoma	
AR 5.6 000006	5.6 Remedial Investigation/Draft Reports and Comments	Specific comments by Ecology, Tacoma Landfill Remedial Investigation report.	no date	17	WDOE	Unknown	
AR 5.6 000007	5.6 Remedial Investigation/Draft Reports and Comments	Specific comments to Tacoma Remedial Investigation comments.	no date	2	WDOE	Unknown	
AR 5.7 000001	5.7 Remedial Investigation/Final Report	Remedial Investigation Final Report, Vol. 1.	12/18/87	250	Black & Veatch, Prepared for City of Tacoma		
AR 5.7 000002	5.7 Remedial Investigation/Final Report	Remedial Investigation Final Report, Vol. 2, Appendices	12/18/87	440	Black & Veatch, Prepared for City of Tacoma		
AR 5.7 000003	5.7 Remedial Investigation/Final Report	Remedial Investigation Final Report, Vol. 3, Appendices	12/18/87	340	Black & Veatch Prepared for the City of Tacoma, Washington.	Unknown	
Section 6.0	FEASIBILITY STUDY, POTENTIALLY RESPONSIBLE PARTY LEAD						
AR 6.1 000001	6.1 Preliminary Screening of Remedial Technology Alternatives	Cover letter regarding attached Draft Preliminary Remedial Technology Screening Report.	3/3/87	30	Black & Veatch Engineers/Architects, Prepared for the City of Tacoma, Washington.	Mr. Thair Jorgenson City of Tacoma Refuse Utility	
AR 6.1 000002	6.1 Preliminary Screening of Remedial Technology Alternatives	Cover letter regarding attached Remedial Action Alternative Development and Initial Screening Report, Review draft.	6/11/87	99	Thomas L. Rutherford Black & Veatch, Engineers/Architects	Ms. Patricia C. Storm U.S. Environmental Protection Agency	
AR 6.2 000001	6.2 Feasibility Study, Draft and Comments	Draft Feasibility Study Report, Tacoma Landfill, Vol. 1, including cover letter.	9/26/87	234	Thomas L. Rutherford Black & Veatch	Ms. Glynis Stumpf, WDOE	
AR 6.2 000002	6.2 Feasibility Study, Draft and Comments	Draft Feasibility Study Report, Tacoma Landfill, Vol. 2 Appendices.	9/23/87	184	Black & Veatch Engineers/Architects	Ms. Glynis Stumpf, WDOE	
AR 6.2 000003	6.2 Feasibility Study, Draft and Comments	Letter concerning copies of the agency review draft of Tacoma Landfill Remedial Investigation.	9/14/87	1	Phillip M. Ringrose, Public Works Utility Services, City of Tacoma	Debbie Yamamoto, EPA	
AR 6.2 000004	6.2 Feasibility Study, Draft and Comments	Letter regarding copies of the Agency review draft of Feasibility Study Report, Tacoma Landfill.	10/1/87	1	Phillip M. Ringrose, Public Works Utility Services, City of Tacoma	Debbie Yamamoto, EPA	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 6.2 000005	6.2 Feasibility Study, Draft and Comments	Specific comments by Washington Department of Ecology regarding Tacoma Landfill Feasibility Study Report.	Unknown	6	WDOE	Unknown	
AR 6.3 000001	6.3 Feasibility Study, Final Reports	Feasibility Study Final Report Vol. 1	12/22/87	256	Black & Veatch, Engineers/Architects Prepared for the City of Tacoma, Washington	Unknown	
AR 6.3 000002	6.3 Feasibility Study, Final Reports	Feasibility Study Final Report, Tacoma Landfill, Vol. 2 Appendices.	12/22/87	196	Black & Veatch, Engineers/Architects. Prepared for the City of Tacoma, Washington	Unknown	
AR 6.4 000001	6.4 Applicable Relevant and Appropriate Requirements	Letter concerning the Superfund Amendments and Reauthorization Act requirements regarding the ARARs specifically for the Tacoma Landfill site Feasibility Study.	3/2/87	2	James L. Bradford, Black & Veatch	Mr. Fred Gardner, WDOE	
Section 7.0	RECORD OF DECISION						
AR 7.1 000001	7.1 Correspondence	Memo re Review of ROD Table and Health-Based numbers. Attached Table re Performeance Levels for Treatement System/Discharge to Surface Water.	3/25/88	3	Michael Watson, Regional Toxicologist U.S. EPA	Deborah Yamamoto, Superfund Program, U.S. EPA Region X	
AR 7.1 000002	7.1 Correspondence	Memo re brief review of "ROP," Tacoma Landfill, Black and Veatch.	3/25/88	3	Michael Watson, Regional Toxicologist, U.S. EPA Region X	Deborah Yamamoto, Superfund Program, U.S. EPA Region X	
AR 7.1 000003	7.1 Correspondence	Telephone Record re Central Cell Timer.	10/9/87	1	Mark Synder, Black & Veatch	Jim Oberlander, WDOE	
AR 7.1 000004	7.1 Correspondence	Handwritten memo re attached handout from a Geosynthetic 87 Conference in New Orleans, USA.	11/10/87	13	Pete Kmet, WDOE	Carol Kraege, Glynis Stumpf, Jim Oberlander; WDOE	
AR 7.1 000005	7.1 Correspondence	Telephone Record re possible methane gas problems.	12/16/87	1	Tom Henderson, Inpsector, Tacoma Fire Department	J. Oberlander, WDOE	
AR 7.1 000006	7.1 Correspondence	Routing slip re attached telephone record concerning landfill cell manholes.	1/11//88	2	Pete Kmet, WDOE	Glynis Stumpf, WDOE	
AR 7.1 000007	7.1 Correspondence	Memo re recording barograph.	1/27/88	1	Jim Oberlander, HWCP, WDOE	Darrel Weaver, Air Programs, WDOE	
AR 7.2 000001	7.2 Review of Tacoma Landfill Closure Plan	Cover letter re attached reviews of Tacoma Landfill: Draft Operations Plan and Draft Closure Plan and appendix re proposed additional monitoring wells and map re well locations.	3/21/88	8	Pete Kmet, WDOE	Doug Pierce, Tacoma-Pierce County Health Department	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 7.3 000001	7.3 Inspection Reports	Inspection Report re New Cell and Attached report re New Cell Construction.	9/17/87	5	J. Oberlander, WDOE	File	
AR 7.3 000002	7.3 Inspection Reports	Inspection Report re New Cell Construction.	9/22/87	6	J. Oberlander, WDOE	File	
AR 7.3 000003	7.3 Inspection Reports	Inspection Report re Central Pit Area where geomembrane was being installed.	9/24/87	2	P. Kmet and J. Oberlander, WDOE	File	
AR 7.3 000004	7.3 Inspection Reports	Inspection Report re liner and leachate trench.	9/24/87	1	C. Kraege, G. Stumpf, WDOE	File	
AR 7.3 000005	7.3 Inspection Reports	Inspection Reports re Central Cell Construction.	9/25/88	2	J. Oberlander, WDOE	File	
AR 7.3 000006	7.3 Inspection Reports	Inspection Reports re New Central Cell.	9/26/87	1	S. Milham, J. Oberlander, WDOE	File	
AR 7.3 000007	7.3 Inspection Reports	Inspection Report re New Cell.	9/28/87	1	J. Oberlander, WDOE	File	
AR 7.3 000008	7.3 Inspection Reports	Inspection Report re site visit.	9/29/87	1	Carol Kraege, WDOE	File	
AR 7.3 000009	7.3 Inspection Reports	Inspection Report re New Central Lined Cell.	9/30/87	1	Boose, Oberlander, WDOE	File	
AR 7.3 000010	7.3 Inspection Reports	Inspection Report re New Cell.	10/2/87	1	Oberlander, WDOE	File	
AR 7.3 000011	7.3 Inspection Reports	Inspection Report re Central Cell.	10/9/87	1	Brady, Oberlander, WDOE	File	
AR 7.3 000012	7.3 Inspection Reports	Inspection Report re liner installation.	10/12/87	2	P. Kmet and J. Oberlander, WDOE	File	
AR 7.3 000013	7.3 Inspection Reports	Inspection Report re New Central Cell.	10/15/87	2	J. Knudson, J. Oberlander, WDOE	File	
AR 7.3 000014	7.3 Inspection Reports	Inspection Report re New Central Cell.	10/22/87	2	J. Oberlander, WDOE	File	
AR 7.3 000015	7.3 Inspection Reports	Inspection Report re vacuum test.	11/6/87	2	Cummings, Kraege, Oberlander; WDOE	File	
AR 7.3 000016	7.3 Inspection Reports	Inspection Report re Central Cell Project.	11/13/87	1	M. Duerr, J. Oberlander, WDOE	File	
AR 7.3 000017	7.3 Inspection Reports	Inspection Report re liner area, leachate detection and collection manhole. Attached map.	12/17/87	3	John Coate, Jim Oberlander, WDOE	File	
AR 7.3 000018	7.3 Inspection Reports	Inspection Report re Central Cell Toe drain leachate flows. Attached Table re ranges of variation in leachate characteristics and photos	1/21/88	4	Sara Brallier, TPCHD; Oberlander, WDOE	File	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 7.4 000001	7.4 Record of Decision	Transmittal memo re attached Record of Decision, Remedial Alternative Selection, Final Remedial Action, Commencement Bay-South Tacoma Channel, Tacoma Landfill. Attached Appendices re: Applicable or Relevant and Appropriate Requirements, Responsiveness Summary, Index to Administrative Record and State Concurrence Letter.	3/30/88	151	Charles E. Findley, Director Hazardous Waste Division, U.W. EPA Region X	Robie G. Russell, Regional Administrator, U.S. EPA Region X	
Section 8.0	STATE COORDINATION						
AR 8.1 000001	8.1 Correspondence	Letter re: State concurrence with Record of Decision	3/30/88	1	Andrea Beatty Riniker, Director WDOE	Robie Russell, Regional Administrator, U.S. EPA Region X	
Section 9.0	ENFORCEMENT						
AR 9.1 000001	9.1 Notice Letters and Responses	Notice letter regarding potential liability for federal actions at the Tacoma Landfill site.	10/16/85	1	Randall F. Smith for Charles E. Findley, Director Hazardous Waste Division, U.S. Environmental Protection Agency	Erling Mork, City Manager, City of Tacoma	
AR 9.1 000002	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. Erling Mork, City Manager, City of Tacoma	
AR 9.1 000003	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. William Larsen Refuse Utility Division, City of Tacoma	
AR 9.1 000004	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. Bob Myrick, Water Division, City of Tacoma	
AR 9.1 000005	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. Roger Sparling, Solid Waste Utility Manager, City of Tacoma	
AR 9.2 000001	9.2 Endangerment Assessment	Cover letter regarding attached Endangerment Assessment Report Outline.	4/3/87	4	Phillip M. Ringrose, Refuse Utility Division, City of Tacoma	Fred Gardner, WDOE	
AR 9.3 000001	9.3 Response Order by Consent	Response Order by Consent in the matter of Tacoma Landfill.	6/27/86	35	WDOE		

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CITY CLERK CONTRACT/AGREEMENT NO. 4

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 9.3 000002	9.3 Response Order by Consent	Request for Resolution for the City Council meeting of Tuesday, July 1, 1986 concerning the Remedial Investigation at the Tacoma Landfill site.	6/17/86	4	R. D. Sparling, Refuse Utility Public Works Department, City of Tacoma		
AR 9.4 000001	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Notification of Hazardous Waste site and a telephone use report regarding sample information.	6/3/81	9	Ronald West, Chemical Processors, Inc.	U.S. EPA Hooker Chemical Co., Operations Division W. J. Larsen, City of Tacoma Public Works	
AR 9.4 000002	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Memo regarding landfill reconnaissance strategy for Commencement Bay, City of Tacoma.	9/8/82	2	Robert A. Poss for James M. Evert, Toxic Substances Control Branch, United States Environmental Protection Agency	Alexandra B. Smith, Air and Waste Management Division, U.S. EPA	
AR 9.4 000003	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Memorandum on research of waste sources with attached table on physical characteristics of potential landfill contaminants and compounds detected in landfill gas.	12/2/86	11	Thomas L. Rutherford, Black & Veatch	Thair Jorgenson, City of Tacoma Refuse Utility	
AR 9.4 000004	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Technical Progress Report detailing physical characteristics of potential landfill contaminants and compounds detected in landfill gas.	12/10/86	3	Black & Veatch	Unknown	
AR 9.5 000001	9.5 Landfill Operating Permit	Letter outlining conditions regarding the attached 1987 conditional operating permit for City of Tacoma Landfill.	5/14/87	4	Jody L. Snyder, R.S. Tacoma-Pierce County Health Department	Phillip Ringrose, Refuse Utility Division, City of Tacoma	
Section 10.0	HEALTH ASSESSMENT						
Section 11.0	NATURAL RESOURCE TRUSTEES						
AR 11.1 000001	11.1 Correspondence	Cover letter re concern for salmon habitat at Leach Creek and attached comments on the Remedial Investigation Report.	3/4/88	5	Lew Consiglieri, Coastal Resource Coordinator, U.S. Department of Commerce, National Oceanic and Atomospheric Administration	Deborah Yamamoto, EPA Region X	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
Section 12.0	CONGRESSIONAL HEARINGS/INQUIRIES						
Section 13.0	PUBLIC PARTICIPATION/STATE LEAD						
AR 13.1 000001	13.1 Community Relations Plan	Community Relations Plan for the Tacoma Landfill Preliminary Investigation.	5/6/85	42	Susan Hall, Hall & Associates	Fred Gardner, WDOE	
AR 13.2 000001	13.2 Meeting Notices - General Correspondence	Letter regarding meeting concerning reconnaissance level investigation of the Tacoma Municipal Landfill portion of the Commencement Bay Site.	10/21/82	1	Robert A. Poss, EPA	Jim Valentine, Town Administrator, Fircrest, Washington	
AR 13.2 000002	13.2 Meeting Notices - General Correspondence	General updated information regarding Tacoma Landfill situation, well location map, and selected and monitoring well data.		7	WDOE	Unknown	
AR 13.2 000003	13.2 Meeting Notices - General Correspondence	Two letters regarding information repositories established for the Tacoma Landfill Remedial Action Program.	5/24/85	3	Laurie G. Robertson, Hall & Associates	Fred Gardner, WDOE Kenneth Harvey, Tacoma Public Library	
AR 13.2 000004	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation with attached Information Repository Index	6/5/85	3	Mark G. Snyder, Black & Veatch	Ms. Pat Devine, U.S. EPA Regional Library	
AR 13.2 000005	13.2 Meeting Notices - General Correspondence	Two letters regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation, with attached Information Repository Index.	6/5/85	5	Mark G. Snyder, Black & Veatch	Mr. Derek Sandison Tacoma-Pierce County Health Department Mr. Wilbur Larson, City of Tacoma Department of Public Works	
AR 13.2 000006	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation, with attached Information Repository Index.	6/5/85	3	Mark G. Snyder, Black & Veatch	Mr. Dean Hampton, Pierce County Library	
AR 13.2 000007	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation with attached Information Repository Index and memo regarding Information Repositories.	6/5/85	4	Mark G. Snyder, Black & Veatch	Mr. Kenneth Harvey, Tacoma Public Library	

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CITY CLERK CONTRACT/AGREEMENT NO. 90

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 13.2 000008	13.2 Meeting Notices - General Correspondence	Memo regarding Tacoma Landfill Information Repository with attached list of repositories, index form, initial correspondence to the repository personnel, and draft letter.	4/10/86	7	Laurie Robertson, Hall & Associates	Claire Ryan, WDOE	
AR 13.2 000009	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Tacoma Landfill.	5/1/86	1	Claire Ryan, WDOE	Ms. Pat Divine, U.S. EPA Regional Library	
AR 13.2 000010	13.2 Meeting Notices - General Correspondence	Agenda for Tacoma Landfill informational meeting at Fircrest Recreation Center.	5/15/86	1	WDOE	Unknown	
AR 13.2 000011	13.2 Meeting Notices - General Correspondence	Attendance register from the Tacoma Landfill informational meeting at Fircrest Recreational Center.	5/13/86	2	WDOE	Unknown	
AR 13.2 000012	13.2 Meeting Notices - General Correspondence	Letter regarding packet information sent to residents near Tacoma Landfill.	5/15/86	1	Claire Ryan, WDOE	(b) (6) , Tacoma	
AR 13.3 000001	13.3 Press Releases/Fact Sheets	News release regarding funding and study of Tacoma Landfill.	9/28/84	2	Kathy Davidson, U.S. EPA	Press	
AR 13.3 000002	13.3 Press Releases/Fact Sheets	Fact sheet regarding preliminary test results on drinking water well contamination.	6/25/85	2	Fred Gardner, WDOE	Unknown	
AR 13.3 000003	13.3 Press Releases/Fact Sheets	Well contamination fact sheet	4/15/85	5	Derek Sandison, Tacoma-Pierce County Health Department Fred Gardner, WDOE	Unknown	
AR 13.3 000004	13.3 Press Releases/Fact Sheets	Fact sheet regarding drinking water well contamination.	6/25/85		WDOE	Unknown	
AR 13.3 000005	13.3 Press Releases/Fact Sheets	Fact sheet regarding well contamination, with attached map.	4/15/85	3	Fred Gardner, WDOE	Unknown	
AR 13.3 000006	13.3 Press Releases/Fact Sheets	Press release regarding the Remedial Investigation and Feasibility Study for Tacoma Landfill.	4/5/86	1	Dave Frutiger and Thair Jorgenson, City of Tacoma, Refuse Utility Division	Unknown	
AR 13.4 000001	13.4 Comments and Responses	Letter re Public Meeting on February 11, 1988 and request for alternate water supply for residents on 53rd Street West.	2/20/88	4	C.L. Kelly, Jr. Citizen of Tacoma, Washington	Ms. Glynis Stumpf, WDOE	
AR 13.4 000002	13.4 Comments and Responses	Letter re comments on proposed Tacoma Landfill Cleaning and the Public Meeting on February 11, 1988. Attached newspaper article "The EPA essens its fear of toxins."	2/26/88	3	Kenneth F. Olson, Tacoma Public Utilities	Ms. Glynis Stumpf, WDOE	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 13.4 000003	13.3 Comments and Responses	Responsiveness Summary	3/88	25	U.S. EPA Region 10, WDOE	File	
AR 13.5 000001	13.5 Public Meeting Transcripts	Transcript of Proceedings, Public Meeting February 11, 1988	2/11/88	87	Carol Kraege, Glynix Stumpf, Bill Myers, WDOE; Deborah Yamamoto, EPA Region X	File	
Section 14.0	PUBLIC PARTICIPATION - POTENTIALLY RESPONSIBLE PARTY LEAD						
AR 14.1 000001	14.1 Meeting Notices - General Correspondence	Letter regarding Tacoma Landfill general information with attached memo from the Office of the Governor.	6/19/86	2	Andrea Beatty-Riniker, WDOE	Mr. (b) (6), Tacoma	
AR 14.1 000002	14.1 Meeting Notices - General Correspondence	Letter regarding Remedial Investigation/Feasibility Study.	7/21/86	1	Fred Gardner, WDOE	Mr. (b) (6), Tacoma	
AR 14.1 000003	14.1 Meeting Notices - General Correspondence	Letter to residents regarding general information on Tacoma Landfill clean-up.	7/28/86	1	Claire Ryan, Hazardous Waste Cleanup Program, WDOE	Residents near Tacoma Landfill	
AR 14.1 000004	14.1 Meeting Notices - General Correspondence	Cover letter regarding hazardous waste cleanup program's active files.	7/29/86	1	Terese Neu Richmond, Office of the Attorney General	(b) (6), Seattle	
AR 14.1 000005	14.1 Meeting Notices - General Correspondence	Letter regarding Department of Ecology's information repository.	10/6/86	1	Mimi Sheridan, Hall & Associates	Fred Gardner, WDOE	
AR 14.1 000006	14.1 Meeting Notices - General Correspondence	Letter regarding information repository for groundwater contamination at Tacoma Landfill.	10/6/86	1	Mimi Sheridan, Hall & Associates	Dean Hampton, Pierce County Library	
AR 14.1 000007	Meeting Notices - General Correspondence	Letters regarding information repository materials for Tacoma Landfill.	2/26/87	3	Phillip M. Ringrose, City of Tacoma	Dave Palmer, Tacoma Public Library Russell Post, Tacoma-Pierce County Health Department Dean Hampton, Pierce County Library	
AR 14.1 000008	14.1 Meeting Notices - General Correspondence	Letter regarding Tacoma Landfill Remedial Investigation/Feasibility Study, and upcoming meeting for Tacoma area residents.	4/10/87	2	Phillip M. Ringrose, City of Tacoma	Residents near Tacoma Landfill	
AR 14.1 000009	14.1 Meeting Notices - General Correspondence	Agenda for well owners' meeting with attached charts, maps and tables.	4/16/87	10	City of Tacoma, WDOE	Tacoma area well owners	

CITY CLERK CONTRACT/AGREEMENT NO. 10

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 14.1 000010	14.1 Meeting Notices - General Correspondence	Letter from resident regarding specific health concerns due to well contamination.	Unknown	3	(b) (6) [redacted], Tacoma	Unknown	
AR 14.1 000011	14.1 Meeting Notices - General Correspondence	Listing of general information repositories.	Unknown	1	Unknown	Unknown	
AR 14.1 000012	14.1 Meeting Notices - General Correspondence	Meeting Notice for the Washington Department of Ecology public meeting on the Tacoma Landfill site.	2/11/88	1	WDOE	Unknown	
AR 14.2 000001	14.2 Press Releases/Fact Sheets	Press release regarding seeping methane gas in Tacoma.	5/20/86	2	Joseph Turner, The News Tribune, Tacoma	Unknown	
AR 14.2 000002	14.2 Press Releases/Fact Sheets	Routing and transmittal slip with attached draft news release regarding Tacoma Landfill investigation plans.	7/7/86	2	WDOE	Pat Storm, EPA	
AR 14.2 000003	14.2 Press Releases/Fact Sheets	Press release regarding Remedial Investigation/Feasibility Study for Tacoma Landfill.	Unknown	1	Dave Frutiger, Thair Jorgenson, Refuse Utility, City of Tacoma	Press	
AR 14.2 000004	14.2 Press Releases/Fact Sheets	Fact sheet regarding the proposed Tacoma Landfill clean-up with figure site map, landfill cross section, and summary of detailed evaluation.	1988	8	Glynis Stumpf, WDOE	Unknown	
15.0	TECHNICAL SOURCES AND GUIDANCE DOCUMENTS						
AR 15.1 000001	15.1 Technical Sources and Guidance Documents	Report regarding chemical analysis of public water supplies.	11/72	37	Washington State Department of Social and Health Services	Unknown	
AR 15.1 000002	15.1 Technical Sources and Guidance Documents	Cover letter with attached geological survey concerning preliminary evaluation of hydrology and water quality near the Tacoma Landfill.	5/19/85	41	Philip J. Carpenter United States Department of Interior with WDOE	Mr. Chuck Shenk, EPA	
AR 15.1 000003	15.1 Technical Sources and Guidance Documents	Memorandum regarding additional air quality modeling.	12/23/86	12	Dan Nelson Black & Veatch - Kansas City	Mark Snyder Black & Veatch - Seattle	
AR 15.1 000004	15.1 Technical Sources and Guidance Documents	Summary regarding Chambers/Clover Creek Aquifer Sole Source Petition	6/87	3	Deborah Yamamota, EPA	File	
AR 15.1 000005	15.1 Technical Sources and Guidance Documents	Reference Section from Remedial Investigation Final Report Vol. 1	12/87	3	Black & Veatch Prepared for the City of Tacoma		Publicly Available
AR 15.1 000006	15.1 Technical Sources and Guidance Documents	Reference Section from Feasibility Study Final Report Vol. 1	12/87	1	Black & Veatch Prepared for the City of Tacoma		Publicly Available

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
	15.1 Technical Sources and Guidance Documents	Tacoma-Pierce County Health Department Sole Source Aquifer Petition Chambers/Clover Creek Aquifer	6/87		Alfred M. Allen, Director of Health, Tacoma/Pierce County Health Department	Robie Russell Regional Administrator, U.S. EPA	Tacoma-Pierce County Health Department
AR 15.2 000001	15.2 Maps, Graphics, Photos	Cover letter with attached water level contours, and base map.	8/7/87	6	Bill Myers Hazardous Waste Clean-up Program, WDOE	Mr. Glenn Bruck, U.S. EPA	
AR 15.2 000002	15.2 Maps, Graphics, Photos	Appendix D: Support Drawings for Landfill.	Unknown	7	Unknown	Unknown	
AR 15.2 000003	15.2 Maps, Graphics, Photos	Maps of Leachate sample locations and surface water sample locations.	Unknown	4	Unknown	Unknown	
AR 15.2 000004	15.2 Maps, Graphics, Photos	List of Photos, Maps and Graphics. Actual maps, graphics and photos located at WDOE (Site) File	no date	2			

CITY CLERK CONTRACT/AGREEMENT NO. 96

NDEX TO CONFIDENTIAL PORTION OF TACOMA LANDFILL ADMINISTRATIVE RECORD

bc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
R 4.3 000002	4.3 Work Plans	Project Work Plan for RI Phase I - Contract Pricing Proposal Tables, Remedial Action Section Work Assignment.	12/7/84	10	Black & Veatch Prepared for WDOE		
R 4.3 000003	4.3 Work Plans	Project Work Plan for RI Phase II - Table 6.1 Project Budget Summary, Table 6.3-1 Direct Labor Hours	4/10/85	2	Black & Veatch Prepared for WDOE		
R 4.3 000004	4.3 Work Plans	Project Work Plan for Conceptual Feasibility Study, Table 4-1 Conceptual Cost Estimated, Table 6.3-2 Direct Labor Hours, Table 6.3-3 Direct Labor Costs, Table 6.4-1 Other Direct Costs, Table 6.4-2 Other Direct Costs, Table 6.4-3 Other Direct Costs.	12/10/85	6	Black & Veatch Prepared for WDOE		

CITY CLERK SOUTH

APPENDIX D

STATE CONCURRENCE LETTER

ANDREA BEATTY RINIKER
Director

CITY CLERK CONTRACT/AGREEMENT NO.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

March 30, 1988

Mr. Robie Russell
Regional Administrator
U.S. EPA - Region 10
1200 Sixth Avenue
Seattle, WA 98101

Re: Record of Decision (ROD) for the Tacoma Landfill Site, Tacoma, Washington

Dear Mr. Russell:

The Washington State Department has completed its review of the Tacoma Landfill ROD. Based on this review, the State concurs with the selected remedy. The major elements the remedy provides for are:

1. Prevention of further groundwater contamination via a groundwater extraction/treatment system.

2. Reducing the future production of leachate by constraints on site operations and by proper grading and capping of the landfill.

3. Elimination of off-site gas migration through operation of an existing gas control system and expansion of this system, if necessary.

4. Further protection of public health and the environment via monitoring of groundwater, surface water, gas and air emmissions, and provision of alternate water supplies where necessary.

I know Ecology and EPA staff have been working long hours and in close cooperation to complete this ROD in a timely manner. We look forward to successful consent decree negotiations with the City of Tacoma to implement the ROD.

Sincerely,

Andrea Beatty Riniker
Director

MC:sjm

cc: Mike Rundlett

CITY CLERK CONTRACT/AGREEMENT NO. 4060

APPENDIX II
TO TACOMA LANDFILL CONSENT DECREE

SCOPE OF WORK

1-1

CITY CLERK CONTRACT/AGREEMENT NO.

SCOPE OF WORK
FOR
TACOMA LANDFILL CONSENT DECREE

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CITY CLERK CONTRACT/AGREEMENT

SCOPE OF WORK
FOR
THE TACOMA LANDFILL CONSENT DECREE

1.0 INTRODUCTION

This Scope of Work (SOW) sets forth the tasks necessary to complete the Remedial Design (RD) and the Remedial Action (RA) at the Tacoma Landfill Superfund Site. The Remedial Investigation (RI) and Feasibility Study (FS) were conducted by the City of Tacoma and were completed in December 1987. The Record of Decision (ROD) was signed on March 31, 1988. It shall be the responsibility of the City of Tacoma (hereafter referred to as Settling Defendant) to prepare, submit for approval, and fully implement work plans incorporating each element of this SOW. It shall be the sole responsibility of the Settling Defendant to ensure that work plans as undertaken meet the performance requirements set forth in this SOW and the Consent Decree and the Settling Defendant shall not rely on document and plan approvals provided by the Government Plaintiffs. In addition, the Settling Defendant shall ensure consistency with the National Contingency Plan (NCP) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and shall satisfy all applicable and relevant and appropriate laws and regulations (ARARs).

1.1 Remedial Action Requirements

The requirements of the remedial action at the Tacoma Landfill, as stated in the ROD, are:

1) reduce the production of leachate by placing constraints on further site operations and by capping the landfill;

2) eliminate off-site gas migration through a gas extraction system;

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3) prevent further migration of the contaminated plume and reduce the concentration of contaminants within the plume via a groundwater extraction and treatment system;

4) further protect public health and the environment through monitoring of groundwater, surface water, subsurface gas, and air emissions;

5 provide an alternate water supply (Tacoma Municipal Water) to any residents deprived of their domestic water supply due to demonstrated contamination from the landfill or due to the action of the extraction/treatment system; and

6) establish institutional controls to promote and support the remedial action.

1.2 Project Work Plans

All work performed at and around the site pursuant to this Scope of Work shall be accomplished in accordance with work plans which shall be prepared by the Settling Defendant and submitted for review and approval by the Government Plaintiffs. Work plans shall address implementation of each element of the SOW including: the predesign study consisting of monitoring well installation, sampling activities, extraction system evaluations, treatability studies, and pilot studies; design documents such as design reports, plans, and specifications; construction activities including scheduling, construction quality control/quality assurance, engineering services during construction, and as-built documentation; and the preparation and implementation of operation and maintenance manuals for remedial action facilities including the details and scheduling of performance monitoring. The work plans shall include schedules and a discussion of potential problems which might be encountered.

The Settling Defendant shall implement all plans and work elements according to their terms and according to the schedule approved and incorporated pursuant to Section 9.0 of this SOW. The Settling Defendant shall

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notify the Government Plaintiffs of initiation of any field work at least 7 days prior to the commencement of such work. The work shall commence only after the Settling Defendant has received Government Plaintiff approval.

1.2.1 Project Management Plan (PMP) for RD/RA

1.2.1.1 Remedial Design Project Management Plan

A project management plan for RD activities, including a schedule for completion of RD tasks and submission of deliverables established pursuant to Section 9.0 and Table 5 of this SOW for each element of this SOW, shall be submitted by the Settling Defendant no later than 30 days after lodging of this Consent Decree. Compliance with this schedule, once approved by the Government Plaintiffs, is a requirement of this SOW and notice of the schedule shall be sent to the court. The PMP shall describe the Settling Defendant's management approach to completing the RD tasks for the site. The PMP shall identify the key individuals for the Settling Defendant, and identify levels of authority and lines of communication in working with the Government Plaintiffs. The plan shall also address systems or methods that will be used to ensure technical quality and compliance with project schedules.

1.2.1.2 Remedial Action Project Management Plan

The Settling Defendant shall prepare a preliminary remedial action project management plan, including a brief discussion of tasks, an implementation schedule, a description of the long term operation and maintenance requirements, and institutional controls and monitoring requirements that comply with this SOW and the ROD. This plan shall be included in the Project Management Plan document. When the remedial design details become available, an update of the preliminary remedial action portion of the project management plan, including a more detailed description of the construction tasks, shall be completed and submitted to the Government Plaintiffs for review and approval in accordance with the schedule established pursuant to Section 9.0 (see Section 7.0 of this SOW).

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1.2.2 Health and Safety Plan

All work, including sampling and other field data gathering activities, shall be performed under an appropriate health and safety plan for the protection of workers and the surrounding community in accordance with EPA, OSHA, and WISHA requirements. The Settling Defendant shall submit a site safety plan to the Government Plaintiffs for comment prior to commencing any action on the site. The initial site safety plan submitted (as part of the Predesign Study, Section 3.1.1.2) shall be amended to reflect subsequent field activities and their varying site safety and health requirements. The Settling Defendant shall be solely responsible for ensuring that the plan satisfies all applicable laws and regulations. The Settling Defendant shall appoint a site safety officer (SSO) who shall be responsible for ensuring compliance with the Health and Safety Plan.

The Settling Defendant shall require their contractors and employees to observe safe practices with respect to all active utilities within and around the site including sewer, power, water, and telephone lines.

1.2.3 Quality Assurance Project Plan (QAPP)

A quality assurance project plan shall be developed for the remedial design phase which shall include procedures for: sample custody; data reduction; validation and reporting; internal quality control checks; performance and system audits; preventative maintenance; and corrective action. This plan shall be implemented by the Settling Defendant upon approval of the Government Plaintiffs. The most current of the following guidelines shall be used to develop these plans except where otherwise noted:

USEPA, Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses, July 1988;

USEPA, Laboratory Data Validation, Functional Guidelines for Evaluating Organic Analyses, February 1, 1988;

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USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, SOW no. 788;

USEPA Contract Laboratory Program, Statement of Work for Organics Analysis, October 1986, revised February 1988.

Data Quality Objectives for Remedial Response Activities, EPA/550/G.87/003 and 004;

Quality Assurance Program Plan for Region X, 1986.

1.2.4 Sampling and Analysis Plans (SAP)

All SAPs prepared pursuant to this Scope of Work shall include, at a minimum: a description of procedures for field sampling, sample handling, sample analysis, data analysis, and identification of laboratory analysis procedures. They shall also provide for Contract Laboratory Program (CLP) deliverables as referenced in Exhibit B of the Contract Laboratory Program Statements of Work for Organics and Inorganics (see Section 1.2.3).

In addition, all SAPs shall include data quality objectives and specify quality assurance and quality control (QA/QC) procedures and samples to meet the requirements of the QAPP (Section 1.2.3). SAPS shall be approved by the Government Plaintiffs before any sampling or monitoring begins. Sampling and analysis shall be performed in accordance with approved Ecology and EPA sampling and laboratory protocols and QA procedures in effect at the time of the sampling or analysis activity. Detection limits, with the exception of the screening tests, shall be at least as low as drinking water standards or approved health based criteria, or the EPA-CERCLA contract laboratory program standards, whichever is lower. EPA approved methods shall be used for all possible parameters. If "approved" methods are not available, then proposed methods shall be submitted to the Government Plaintiffs for review and approval prior to their use. The Settling Defendant shall make available raw data within five days of receipt of results, and quality assured data in the format specified in the sampling and analysis plan to the Government Plaintiffs within 90 days of sample collection or field testing or within 15 working days of receipt of all lab

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results for a sampling event, whichever is sooner, and shall submit these results in the monthly progress report (as described in Section XII of the Consent Decree) within thirty calendar days of receipt of the data. Replicate samples shall be collected and analyzed as described in the QAPP or as required by the Government Plaintiffs on a case by case basis.

1.3 Authority of Government Plaintiffs Regarding Deliverables Under This SOW

Any and all documents (deliverables) required to be submitted to the Government Plaintiffs under this SOW are subject to review and approval by the Government Plaintiffs, unless otherwise specified. Such approval may be conditional or may specify required modifications to these documents. The Settling Defendant shall consult with the Government Plaintiffs in preparing all deliverable items under this SOW to minimize the need for such modifications and to determine whether draft submittals are necessary. All deliverables shall be prepared in accordance with applicable EPA and Ecology guidance. Upon approval or modification, all such plans and documents shall be implemented in accordance with their terms and schedules. Bid packages are not subject to approval of the Government Plaintiffs but shall be submitted upon request.

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2.0 CONTINGENCY PLANNING

All work under this SOW must explicitly address those contingencies which are typical to hazardous waste remediation and those provided for in this SOW and the ROD. Specifically, design and/or construction activities under this SOW must provide for the situations discussed in this section.

2.1 New Contaminant Plume

The Settling Defendant shall submit a contingency plan for the expansion and/or modification of the extraction system necessary to control a previously unidentified plume, or a lobe of a plume emanating from the landfill in areas currently considered unaffected. This contingency plan shall include provisions for determining the existence and source of such a previously unidentified plume, or lobe of a plume using, at a minimum, the following criteria:

a) proximity to the landfill;
b) hydraulic gradient;
c) aquifer characteristics;
d) historical data; and
e) types of contaminants.

A previously unidentified plume, or lobe of a plume, is defined as any exceedance of the early warning values described in Section 3.3.2.2 in areas currently considered unaffected. Exceedances shall be determined using the approved method described in Section 3.3.1.3. This plan shall be submitted with the 60 percent design for the extraction treatment system.

2.2 Alternate Water Supply

If contamination (determined through procedures established in Section 4.0) emanating from the landfill is found in the Fircrest wells (located immediately west of the landfill), an alternate water supply shall be provided to the town of Fircrest immediately. A plan to cover such a contingency shall be submitted to the Government Plaintiffs for review and approval no later than 45 days from the date of lodging of this Consent Decree.

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A contingency plan describing how alternate water shall be provided to other currently and potentially impacted areas around the landfill shall be submitted no later than 45 days from the date of lodging of this Consent Decree. This plan shall include procedures for supplying temporary water until the impacted residences can be connected to the Tacoma water system. The plan shall be consistent with Section 4.0 of this SOW.

Construction plans and specifications for expansion of Tacoma City water supplies to affected areas, including all design calculations and the construction schedule shall be submitted within 45 days of residences being supplied with temporary water.

2.3 Operation and Maintenance

The Settling Defendant shall prepare a contingency plan for the instance where the final remedial measures do not meet the performance criteria outlined in this SOW. This plan shall also describe the action the Settling Defendants shall implement if, after the groundwater extraction/treatment system or the gas extraction system has been shut down the monitoring data indicate exceedances of the criteria outlined in Sections 3.3.2 and 7.7.3. This plan shall be submitted as part of the Operation and Maintenance Plan described in Section 7.7.

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3.0 TASKS FOR REMEDIAL DESIGN

This section provides a task breakdown for all actions to be performed during the RD phase.

3.1 Predesign Study

The Settling Defendant shall conduct a predesign study to achieve the requirements listed below:

1) to provide sufficient information to delineate the boundary of the plume or plumes and for the purpose of designing the extraction system;

2) to assess whether dense non-aqueous phase liquids (DNAPL) are migrating from the landfill;

3) to complete the characterization of the affected aquifers and associated hydrology necessary to design the extraction system;

4) to establish indicator parameters selected from the Target Compound List and leachate parameters listed in WAC 173-304-490;

5) to sample all monitoring wells (both the TL and MW series) three times in a six month period (to include a high and low water table season);

6) to determine the suitability of the alternative treatment options in meeting the treatment standards;

7) to determine the location of the optimum extraction well network to achieve the groundwater cleanup goals and criteria; and

8) to select the treatment option for RA.

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3.1.1 Monitoring Wells

3.1.1.1 Sampling and Analysis Plan

The Settling Defendant shall submit a SAP, which shall meet the requirements of Section 1.2.4 of this SOW, for review and approval by the Government Plaintiffs prior to initiation of drilling. This plan shall include monitoring well installation procedures, soil chemical and physical sampling requirements, a well installation schedule, and reporting requirements. Data quality objectives for this effort shall also be identified in this plan.

3.1.1.2 Site Safety Plan

A site Health and Safety Plan shall be prepared in accordance with applicable EPA, OSHA, and WISHA requirements. This plan shall address all aspects of the Predesign monitoring wells, including drilling and sampling. The site safety plan shall be prepared as described in Section 1.2.2 of this SOW. This plan shall be submitted with the monitoring well SAP, and shall be updated to reflect subsequent field activities.

3.1.1.3 Monitoring Well Installation

The Settling Defendant shall install required wells listed in Table 1 and at the approximate locations shown on Figure 1. Exact well locations shall be approved by the Government Plaintiffs prior to drilling. All newly constructed wells shall be surveyed to the nearest 0.01 foot, and shall comply with EPA Order No. 215.0, Minimum Set of Data Elements for Groundwater. Well logs and survey data shall be submitted within 30 days of the installation of the last well. Additional wells to those listed may be required by the Government Plaintiffs, if necessary, to achieve the respective requirements listed in Section 3.1.

3.1.1.4 Existing Wells

Existing private wells may be rehabilitated, however data collected will be used for water level data only.

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3.1.2 Groundwater Sampling

3.1.2.1 Sampling and Analysis Plan

The Settling Defendant shall submit a SAP for groundwater sampling which shall meet the requirements of Section 1.2.4 of this SOW, for review and approval of the Government Plaintiffs, prior to groundwater sampling. The SAP shall be amended after the indicator parameters are selected (Section 3.1.2.2) to specify sampling parameters for future sampling rounds. Amendments to the SAP shall be reviewed and approved by the Government Plaintiffs.

3.1.2.2 Groundwater Sampling/Indicator Parameter Selection

The Settling Defendant shall sample each of the new MW series wells and the existing TL series wells (as shown in Figure 1) in accordance with the approved schedule in the SAP. The first round of samples shall be collected during the period of maximum gradient reversal. These samples shall be analyzed for the target compounds listed in Table 2 and leachate parameters listed in WAC 173-304-490. Tentative compounds shall also be identified to ensure that no potential contaminants of concern are overlooked. The Settling Defendant shall utilize this data and historical data to develop a list of indicator parameters to be used throughout the remainder of the RD and RA. The list of indicator parameters shall be submitted in a technical memorandum and shall be reviewed and approved by the Government Plaintiffs prior to its use. The Settling Defendant shall include additional indicator parameters as required by the Government Plaintiffs. Data shall be presented in the format requested by the Government Plaintiffs.

3.1.3 Extraction System Evaluation

The Settling Defendant shall conduct additional modeling studies of the extraction system proposed in the Feasibility Study, considering the additional data obtained during the Predesign Study. The extraction system proposed in the FS, with modifications as required, and other potential extraction configurations shall be evaluated using analytical or numerical modeling techniques. This evaluation shall be conducted in conjunction with the evaluation of the

alternative treatment systems (Section 3.1.4) to recommend the extraction/treatment system for design. The factors to be considered during the evaluation of the extraction system include the following:

1) the groundwater cleanup criteria (Table 3);

2) the cleanup goal of ten years after startup of the remedial action;

3) the impact of capping the landfill on contaminant volumes and mobility;

4) pumping impacts from the Fircrest and Tacoma production wells;

5) current contaminant travel times due to groundwater divide shifts; and

6) effect on surface water and other aquifer uses.

Based on the results of the extraction system evaluation, the extraction well network which assures compliance with performance standards shall be established for design.

3.1.4 Treatability Study

The Settling Defendant shall conduct a treatability study to determine the most effective method (technical and cost) as identified in the ROD of treating the contaminated groundwater. Initial treatability studies for carbon and air stripping treatment technologies shall be conducted using computer modeling techniques.

Treatability studies shall be conducted for landfill leachate and condensate if pretreatment of these current discharges into the sanitary sewer is required. An evaluation of the requirement for pretreatment of landfill leachate and/or condensate shall be conducted (see Section 3.5.10.1) by the Settling Defendant and the Tacoma Sewer Utility. Pretreatment requirements shall be subject to review and approval by the Government Plaintiffs.

3.1.5 Draft Predesign Report

A Draft Predesign Study Report shall be prepared by the Settling Defendant which includes a description of hydrogeologic conditions and contaminant migration using the data collected during the Predesign Study and the data collected during the RI. The report shall also describe how the investigation has met the data requirements of site characterization for design, contaminant plume (including possible DNAPL) definition, and indicator parameter selection as identified in Section 3.1. The report shall present the results of the extraction system evaluation and the treatability studies and shall detail the work plans for the pilot extraction well investigation and any pilot treatment studies required. The pilot treatment study plan shall address laboratory and/or field scale tests designed to achieve the requirements listed in Section 3.2.2. The report shall be submitted to the Government Plaintiffs for review and approval. Government Plaintiffs' comments shall be incorporated into the Final Predesign Study Report (Section 3.2.4).

3.2 Pilot Studies

3.2.1 Pilot Extraction Well Investigation

Pilot Extraction wells shall be installed at the locations described in the Draft Predesign Study Report (upon approval of the Government Plaintiffs). The purpose of these wells is to provide additional aquifer characteristics for extraction well design. At a minimum, a 72 hour pump test shall be performed for each of the pilot test wells to determine aquifer characteristics for use in RD (Section 3.3). After the first pump test, the Settling Defendant may petition the Government Plaintiffs to reduce the duration of subsequent pump tests. Such revisions are subject to the approval of the Government Plaintiffs.

After approval by the Government Plaintiffs of the pilot investigation work plan (submitted as part of the Draft Predesign Report) the Settling Defendant shall submit a SAP for the pilot test well installations and testing. This plan shall include: the proposed pump test methodology; the location and number of wells to be monitored during the pump test; handling and disposal of extracted

water; the construction plans and specifications for the test wells; sampling, analysis, and QA/QC requirements for samples collected during the pumping tests; and the construction and testing schedule. At least one test monitoring well shall be located at least 100 feet away from pumping wells unless other spacing is approved by the Government Plaintiffs. Prior to discharge of pump test water, it shall be analyzed for indicator parameters, determined under Section 3.1.2.2 of this SOW, to determine an appropriate discharge location. Discharge of water contaminated above drinking water standards, health based criteria or Water Quality Criteria (WQC) for protection of fish (as listed in Table 4) to waters of the state, including the storm sewer, shall not be allowed. Discharge to the sanitary sewer shall be consistent with the City's pretreatment program and shall be subject to Government Plaintiff approval.

The SAP for the extraction system pilot study shall be prepared to meet the requirements of Section 1.2.4 of this SOW. The sampling and analysis plan shall be submitted after approval of the Draft Predesign Report.

3.2.2 Pilot Treatment Studies

A pilot study shall be conducted for the treatment method selected in the Draft Predesign Study Report. The pilot study shall also evaluate treatment of leachate and condensate currently discharging to the sanitary sewer, if pretreatment of these discharges is required (Section 3.1.4).

The pilot study shall be conducted to determine the following:

1) the suitability of the treatment method for treating the contaminated groundwater and its ability to meet performance standards described in Section 3.3.2;

2) the predicted effectiveness of the treatment system, its flexibility to treat changing influent levels, and the range of influent concentrations over which the system is effective;

3) the expected air emissions to allow the Government Plaintiffs to determine the need for air emissions treatment;

4) the need for pretreatment of groundwater prior to air stripping or carbon adsorption; and

5) the adaptability of the treatment system for pretreatment of leachate collected from the Central Area and condensate from the gas flares and collection lines.

Prior to conducting any bench scale or vendor tests, the Settling Defendant shall submit the proposed vendor qualifications to the Government Plaintiffs for review and approval. The Settling Defendant shall require vendors selected to conduct any treatability study to comply with the Quality Assurance Project Plan prepared under Section 1 2.3. If the Government Plaintiffs determine that it is necessary to conduct field studies using portable or temporary treatment facilities, the Settling Defendant shall submit a SAP for such studies, including sampling requirements for the influent, effluent, and air emissions monitoring, to be reviewed and approved by the Government Plaintiffs.

The SAP shall be prepared to meet the requirements described in Section 1.2.4 of this SOW.

3.2.3 Draft Pilot Studies Report

A Draft Pilot Studies Report shall be submitted to the Government Plaintiffs describing the findings of pilot extraction well investigations and the treatment studies. The report shall include the results and analysis of the pump tests, the results and analysis of the treatment study, the recommended treatment method, and a discussion of how this method fulfills the requirement of providing for all known, available and reasonable treatment to any substance proposed for discharge to waters of the state.

3.3.1.2 Treatment System

The treatment system for the selected remedy as described in the ROD shall be designed to meet specific performance criteria appropriate to the point of discharge of the effluent as described in Section 3.3.2.3 and set forth in Table 4. The design shall be based on the full expected range of influent concentration and the range of treatment efficiency levels determined during the treatment pilot tests. The system must be flexible enough to treat changes in influent concentrations and volumes due to capping effects and to provide pretreatment of the collected leachate and condensate if pretreatment of these sources is required. The design shall incorporate all known, available, and reasonable methods of treatment.

3.3.1.3 Statistical Methods

The Settling Defendant shall submit a plan describing the proposed statistical method for evaluating performance of the extraction system. The method shall be one of the methods described in "Statistical Methods for Evaluating Ground-Water Monitoring Data from Hazardous Waste Facilities," published October 11, 1988 in the Federal Register or in the draft EPA document "Statistical Methods for Evaluating the Attainment of Superfund Cleanup Standards", December 1988. The method shall be used to determine when a statistically significant exceedance of an established performance criteria has occurred and to establish trends in ground water data. This plan shall be submitted to the Government Plaintiffs for review and approval.

3.3.2 Performance Criteria

3.3.2.1 Extraction System

The extraction system shall continue to operate until the water quality at and beyond the point of compliance (defined by WAC 173-304-100(58)), consistently meets drinking water standards, or previously established and approved health-based criteria, as listed in Table 3. Consistency with standards shall be determined using the approved method described in Section 3.3.1.3. The goal is to achieve this level of cleanup in ten years or less.

3.3.2.2 Early Warning Values

Performance of the extraction system will be evaluated based on drinking water standards or approved health based criteria. However, to protect downgradient well owners and the aquifer, the Settling Defendant shall submit a plan for Government Plaintiff review and approval to take effect whenever early warning values are exceeded, in either the private wells or extraction system performance wells. This plan shall specify the procedures to be followed in the event early warning values are exceeded. The plan shall outline the criteria and procedures under which the following actions would apply:

1) resampling well(s) to verify results;
2) increasing or modifying monitoring plan;
3) adjustments to extraction system;
4) providing for alternate water supply;
5) implementation of a trend analysis to determine the likelihood of exceeding a groundwater performance standard; and
6) no action (i.e., continuation of monitoring program and operation of extraction/treatment system).

Early warning values, designed to indicate changing conditions in the aquifer, are as follows:

a) detection level for synthetic organic compounds for which no natural source exists;

b) 20 percent of the primary drinking water standards for other than synthetic organic compounds or other health based criteria; and

c) 50 percent of the secondary drinking water standards or other aesthetic quality criteria.

If the indicator parameter is found in the background water quality, then the early warning value shall be set at a concentration between background and the performance standard. This value shall be reviewed and approved by the Government Plaintiffs before its use.

Exceedances of these early warning values shall be determined using the approved method described in Section 3.3.1.3. Detection limits shall be at least as low as drinking water standards or approved health-based criteria, or EPA CLP detection limits, whichever is lower. Limits shall be established for each of the indicator chemicals determined in Section 3.1.2.2.

The early warning values and reaction to them shall not apply until the groundwater extraction/treatment system has been installed and has completed the initial shakedown period described in Section 3.3.3.2.

In the event that early warning values are exceeded after the extraction/treatment system shakedown period, the Settling Defendant shall notify the Government Plaintiffs within 5 days of receipt of raw data. Within 15 days of receipt of quality assured data, the Settling Defendant shall submit a memorandum (for Government Plaintiffs review and approval) which identifies the actions (e.g., items 1 through 6 above) that shall be taken in response to these exceedances to ensure that performance standards are not exceeded.

3.3.2.3 Treatment System

Fresh and marine water discharge limits for certain organic constituents are listed in Table 4. The Settling Defendant shall develop sanitary sewer discharge limits for review and approval of the Government Plaintiffs. These requirements also apply to leachate from the Central Area and condensate from the gas collection system and flare.

3.3.2.3.1 Fresh Water Discharge

Discharge to fresh water (Leach or Flett Creeks) shall meet the maximum contaminant levels (MCL) developed pursuant to the Safe Drinking Water Act or meet the chronic fresh water criteria for protection of fish as set forth in EPA's Quality Criteria for Water, 1986, whichever is more stringent. If no MCL has been established, the ambient water quality criteria (WQC) for protection of human health for water and fish ingestion shall be used. For the instance where no WQC have been developed, the Settling Defendant shall use additional

guidance documents and Health Advisories to develop and propose an appropriate value. These values shall be reviewed and approved by the Government Plaintiffs. Discharge limits shall be developed for all indicator parameters (see Section 3.1.2.2). Any discharge from the treatment system to a storm sewer which discharges directly to a fresh water body, shall be considered a discharge to fresh waters of the state.

3.3.2.3.2 Marine Discharge

Discharge from the treatment system to a storm sewer which discharges directly to a marine water body, shall be considered a discharge to marine waters of the state. The limit for marine discharges shall be determined using the Chronic Marine Water Criteria set forth in EPA's Quality Criteria for Water, 1986. If such a criterion is not available for a particular contaminant of concern, the limit determined for discharge to a fresh water body shall apply, unless other discharge limits can be established from guidance documents or technical research as approved by the Government Plaintiffs. Discharge limits shall be developed for all indicator parameters.

3.3.2.3.3 Sanitary Sewer Discharge

Discharge of treated groundwater to the sanitary sewer shall satisfy applicable discharge requirements, shall be consistent with the Tacoma Pretreatment Program as revised for the operation of the new secondary sewage treatment plant, and with pretreatment discharge limits approved by the Government Plaintiffs. Discharge limits shall be developed for all selected indicator parameters.

3.3.3 Extraction/Treatment System Sampling and Analysis Plan

The Settling Defendant shall submit a SAP to evaluate performance of the extraction/treatment system(s) as described in Section 3.3.2. This plan shall meet the requirements as described in Section 1.2.4. This plan shall be submitted with the 90 percent extraction/treatment system design report described in Section 3.3.6.

The Settling Defendants shall amend the SAP to specify any additional sampling rounds of the monitoring wells (using the indicator parameters) during the RD phase that may be necessary to establish design concentrations for the treatment process or to monitor contaminant plume migration. Amendments to the SAP shall be reviewed and approved by the Government Plaintiffs.

3.3.3.1 Extraction System Sampling and Analysis Plan

The extraction system sampling and analysis plan shall include installation of performance monitoring wells to be located downgradient of the extraction well system(s). These performance wells shall be placed to assure the effectiveness of the extraction system. The number of performance wells required will depend upon the number of extraction wells needed, the distance over which the extraction wells extend, and the distance between the point of compliance and the extraction system. The number of downgradient performance wells shall not be less than the number of extraction wells plus one, unless a reduction in the number of performance wells is approved by the Government Plaintiffs.

The performance wells shall be monitored monthly for two years after startup and then quarterly thereafter for water levels and approved indicator parameters (see Section 3.1.2.2), in accordance with Section 7.7.3. The Settling Defendant may petition the Government Plaintiffs to reduce the frequency of sampling from monthly to quarterly in less than two years, if an adequate baseline of information has been developed.

3.3.3.2 Treatment System Sampling and Analysis Plan

This plan shall be designed to evaluate both the performance and the efficiency of the treatment system during both the shakedown period and for long term operation. Startup and the intial performance evaluation of the system (shakedown procedures) shall be completed within a four month period and shall, at a minimum, include monitoring of the influent to the treatment plant and the effluent from the plant on a twice weekly basis for four weeks,

followed by weekly sampling. The samples shall be analyzed for indicator parameters developed in Section 3.1.2.2 and sample analysis turnaround shall be 24 to 48 hours.

For an air stripping treatment facility, influent and effluent from the treatment unit shall initially be sampled for four different air to water ratios. For each air to water ratio, two samples of both influent and effluent will be collected, one during the warmest and the other during the coolest periods of the day. The results from this sampling activity shall be used to confirm or modify the system performance/operation curves developed during the pilot treatment study (Section 3.2.2) and the treatment system design (Section 3.3.1.2). After performance curves are developed sampling shall be conducted daily for 1 week to confirm system operation.

For a carbon treatment facility, influent and effluent samples shall be collected daily for two weeks, and on a twice weekly basis thereafter during the shakedown period. The influent and effluent shall also be sampled daily for one week after any changeout of carbon during the shakedown period.

When eight consecutive weekly samples all meet the discharge limits set forth in 3.3.2.3, the sampling frequency to evaluate performance of the system may be reduced to quarterly if approved by the Government Plaintiffs. The treatment system shall be operated and maintained to meet discharge limits. If a quarterly sample indicates a violation of the discharge limits, the Settling Defendant shall submit a plan to adjust the treatment system and shall simultaneously begin weekly sampling of the influent and effluent. Quarterly sampling may resume when the consenting Defendant has demonstrated to the Government Plaintiffs that the system is again in compliance with the stated discharge limits.

3.3.4 Preliminary Design (30 Percent Complete)

The Settling Defendant shall submit a preliminary design of the extraction/treatment system addressing 30 percent of the total design for

approval of the Government Plaintiffs. This submittal shall include a design report and preliminary plans and specifications. The design report shall include the following:

1) A design memorandum establishing design criteria and providing the information needed to design the project. The memorandum shall include complete detailed design criteria and standards for the extraction wells and the treatment plant equipment including sizes, capacities, loading rates, pumping rates, etc. The information shall be in sufficient detail to present the scope of the project clearly and to enable designers to proceed with subsequent design work;

2) a detailed description and evaluation of any models used to aid design;

3) preliminary design calculations for major equipment;

4) preliminary selection of major equipment items and potential suppliers;

5) sketches and schematics as required to illustrate and clarify the components of the extraction/treatment system, including preliminary site layout, preliminary hydraulic profile, process schematics, piping schematics, and chemical feed schematics; and

6) a discussion of how performance requirements, including ARARs have been incorporated into the design.

The plans and specifications shall reflect the same percentage of completion as the designs they support. A detailed outline of construction specifications shall also be included.

3.3.4.1 Long-lead Task Identification

Any long-lead items, such as off-site access for drilling, selection of an off-site RCRA facility for disposal of spent carbon or other hazardous wastes, or

key treatment plant process components, shall be determined at the 30 percent design phase of the process and a critical path schedule developed. The Settling Defendant shall be responsible for obtaining access agreements.

3.3.4.2 Preliminary Construction Schedule and Cost Estimate

A preliminary construction schedule shall be prepared to include drilling, well installation and development, and acquisition of major treatment process components. The preliminary cost estimate developed for the 30 percent submittal shall be of +40 to -20 percent accuracy and shall include equipment and construction costs.

3.3.5 Intermediate Design (60 Percent Complete)

A 60 percent submittal shall be prepared for the Government Plaintiffs, incorporating comments made on the previous submittal and shall include all of the same elements. This submittal shall include construction drawings for the extraction/treatment system and all ancillary facilities.

3.3.6 Prefinal/Final Design

A 90 percent submittal shall be prepared for review of the Government Plaintiffs, incorporating any comments on the 60% design. The plans and specifications shall provide sufficient detail such that all labor, materials, tools, and equipment necessary for the proper execution of the contract will be clearly apparent to the bidders. The final engineer's cost estimate shall be based on prefinal drawings and specifications of 90 percent completion. The accuracy shall be within a +15 to -10 percent range. This estimate shall evaluate the costs of construction and equipment for the complete facility.

After approval of this prefinal design by the Government Plaintiffs, a 100 percent complete document shall be submitted that contains the final plans and specifications for the review and approval of the Government Plaintiffs.

3.4 Design and Installation of the Landfill Cap

3.4.1 Landfill Cap Requirements

The landfill cap shall be designed to minimize infiltration and maximize and control run-off from the landfill. The landfill cap installed shall be selected by the Settling Defendant from one of the basic designs set forth below:

1) a) sufficient topsoil to provide frost protection and vegetative layer, 24 inch minimum;

   b) drainage layer of granular material, depth and slope designed to accommodate flows determined from the HELP model or other hydrological analysis, 12 inch minimum unless analysis shows a greater depth is needed. Geosynthetic drainage products will be considered as suitable replacements for the sand drainage layer. Final selection approval by the Government Plaintiffs is required;

   c) geosynthetic membrane of material compatible with landfill gas condensate, 50 mil minimum;

   d) additional drainage layer as specified above in (b);

   e) additional geosynthetic membrane as specified above in (c);

   f) bedding soil with gradation and degree of angularity approved by the Government Plaintiffs, 12 inch minimum; or

2) a) sufficient topsoil to provide frost protection and vegetative layer, 24 inch minimum;

   b) drainage layer of granular material, depth and slope designed to accommodate flows determined from the HELP model or other hydrological analysis, 12 inch minimum unless analysis shows a greater depth is needed. Geosynthetic drainage products will be considered as suitable replacements for the sand drainage layer. Final selection approval by the Government Plaintiffs is required;

c) geosynthetic membrane of material compatible with landfill gas condensate, 60 mil minimum; and

d) 24 inches of soil compacted to a saturated hydraulic conductivity of not more than $1x10^{-5}$cm/sec, with the top six inches a finely-graded $1x10^{-5}$ layer;

A pilot study to evaluate the utilization of stabilized sludge, as a component of the topsoil requirement of the selected alternative, may be initiated by the Settling Defendant. Application of this product shall be subject to Government Plaintiff approval.

3.4.2 Final Grading and Landfill Cap Installation

Final grading and the landfill cap shall be constructed in three stages as identified below:

1) Stage 1, 1990 construction season - the northeast and southern sections of the landfill and the Receiving Facility cap;

2) Stage 2, 1991 construction season - the western section of the landfill and the section east of the Central Area; and

3) Stage 3, not later than one year after closure - the Central Area, as required by Section 3.4.2.1.

These areas are generally depicted in Figure 2.

The landfill cap design criteria shall be presented for the entire landfill cap in the design report submitted as part of the 30 percent submittal for the Stage 1 cap design. For the Stage 2 and 3 designs, design review packages shall be submitted at the 60 percent complete and the prefinal/final phases.

Increased run-off due to the construction of the cap shall be routed off the landfill to reduce infiltration. The run-off collected from the landfill shall be directed to the appropriate storm or sanitary sewers, consistent with local storm drainage ordinances or pretreatment regulations.

3.4.2.1 Landfill Closure

Final closure of the landfill shall occur no later than ten years after the effective date of the Consent Decree. The Government Plaintiffs may provide, after providing notice and opportunity for public comment, extensions of this deadline of up to a combined 15 years in increments of no longer than 5 years if the Settling Defendant demonstrates to the satisfaction of the Government Plaintiffs all of the following:

1) that the continued operation of the landfill shall not result in a release or substantial threat of release of hazardous substances, pollutants or contaminants to the environment;

2) that performance standards for the extraction/treatment system have been achieved;

3) that since the effective date of the Consent Decree, the Settling Defendant has instituted and is operating an aggressive solid waste recycling and hazardous materials collection program; and

4) that other feasible solid waste management alternatives to disposal at the landfill do not exist.

A closure plan shall be submitted as part of the Operations and Closure Plan required in Section 3.5.1 for Government Plaintiff review and approval. This plan shall include:

1) a fill plan with fill sequence and fill location;

2) partial closure plan;

3) interim cover requirements for completed areas; and

4) waste receipt restrictions (prohibit liquid waste and slurries).

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Notwithstanding the foregoing, the Settling Defendant shall bring such areas to final grade and install the landfill cap on a schedule established by the Government Plaintiffs if the Government Plaintiffs determine that such action is necessary to adequately protect human health or the environment.

3.4.3 Preliminary Design (30 Percent Complete)

The Settling Defendant shall submit a preliminary design of the landfill cap addressing not less than 30 percent of the total design. This submittal shall include a design report and preliminary plans and specifications for review and approval of the Government Plaintiffs. The design report shall include the following:

1) design data and criteria;

2) a detailed description and evaluation of any models used to aid the design;

3) preliminary data from borrow sources and design calculations for soil needs;

4) detailed plans to assure that ongoing landfilling operations do not interfere with the construction or performance of the cap;

5) relevant design standards to be used in the final design;

6) a description of phased closure of the landfill;

7) a surface water management plan (Section 3.4.3.1); and

8) a discussion of how all ARARs have been incorporated into the design.

The plans and specifications shall reflect the same percentage of completion as the design they support. A detailed outline of the construction specifications shall be included.

3.4.3.1 Surface Water Management Plan

The Settling Defendant shall prepare a plan for control and management of surface water runoff as defined in WAC 173.304.100(67). This plan shall include the following elements:

1) a description of the existing drainage basin, including any sub-basins present;

2) a discussion of existing storm water management practices and any regulations which apply;

3) detailed calculations of flow and velocity in the drainage channels;

4) calculations for the 25 year/24 hour storm event;

5) a description of needed detention, if any, to comply with City of Tacoma storm drainage ordinances;

6) a description of needed storm water improvements outside the boundaries of the landfill to implement this SOW, including discharge location. Plans and specifications for these improvements shall be submitted with the prefinal (90 percent) design along with a schedule for construction.

3.4.3.2 Long-lead Task Identification

Any long-lead items, shall be determined as part of the 30 percent design and a critical path schedule developed.

3.4.3.3 Preliminary Construction Schedule and Cost Estimate

A preliminary construction schedule shall be prepared addressing: 1) the unlined areas of the landfill, and 2) the lined Central Area. A preliminary cost estimate developed for the 30 percent submittal shall be of +40 to -20 percent accuracy and shall show equipment, labor, and construction costs.

3.4.4 Intermediate Design (60 Percent Complete)

A 60 percent submittal shall be prepared for the Government Plaintiffs, incorporating comments made on the previous submittal and shall include all of the same elements. This submittal shall include construction drawings for the cap and all ancillary facilities.

3.4.5 Prefinal/Final Design

A 90 percent submittal shall be prepared for review and approval of the Government Plaintiffs, incorporating any comments on the 60% design. The plans and specifications shall provide sufficient detail such that all labor, materials, tools, and equipment necessary for the proper execution of the contract will be clearly apparent to the bidders. The final engineer's cost estimate shall be based on prefinal drawings and specifications of 90 percent completion. The accuracy shall be within a +15 to -10 percent range. This estimate shall evaluate the costs of construction and equipment for the complete facility.

After approval of this prefinal design by the Government Plaintiffs, a 100 percent complete document shall be submitted which contains the final plans and specifications for the review and approval of the Government Plaintiffs.

3.5 Design Support Activities

3.5.1 Operations and Closure Plan

The Settling Defendant shall follow the Interim Operations and Maintenance Plan (September 1988), as amended in the March 17, 1989 memorandum responding to the Washington Department of Ecology and the Tacoma Pierce County Health Department comments on the draft plan, until the RD is finalized. The plan as amended meets the Minimum Functional Standards operating requirements (WAC 173-304-460). Sections of the plan shall be amended during the RD and RA, as required by the Government Plaintiffs to reflect new information or changes in landfill operations.

The Interim Operation and Maintenance Plan shall be revised to satisfy requirements of the Consent Decree and the SOW, and shall be submitted for approval within 60 days of Government Plaintiff approval of all remedial designs. The landfill cap and surface water management plan, the extraction/treatment system design and operating plan, the landfill cap operation and maintenance plan, the ground water monitoring plan, the plan for management of hazardous substances and liquids, and the gas system monitoring plan (including both on and off-site monitoring) shall all be incorporated into the Operations and Closure Plan as part of the Final Operations and Closure Plan. The final plan shall be subject to review and approval by the Government Plaintiffs.

3.5.2 Disposal of Hazardous Substances and Liquids

The Settling Defendant shall develop a plan to prevent disposal of liquids and hazardous substances, including those disposed of by small quantity generators, at the landfill. This plan shall be developed in consultation with the Tacoma-Pierce County Health Department. The plan shall include programs such as recycling and hazardous materials collection to minimize the amount of hazardous substances placed in the landfill from generators such as households, business, industry, and others. This plan shall be submitted to the Government Plaintiffs for review and approval within 180 days of lodging of this Consent Decree and programs shall be in effect no later than 18 months after lodging of this Consent Decree. Disposal of any hazardous waste (including dangerous or extremely hazardous waste) regulated under Federal, State, or local laws in the landfill is prohibited.

3.5.3 Expansion of the Central Area

Construction of the liner, installed in 1987 in the Central Area, shall be documented through a construction documentation report. Slope liners over refuse require a variance to the Minimum Functional Standards. If the Tacoma Pierce County Health Department grants such a variance, construction and future expansion of the Central Area shall be consistent with the following requirements:

1) the slope of the liner over refuse, shall be no less than 5:1 (horizontal:vertical) with the exception of the benched area which provides connection to the Phase I liner, and no greater than 3:1, the length of the additional liner over refuse shall be no greater than 300 feet;

2) a Government Plaintiff approved gas control system shall be installed to prevent buildup of gas on the base of the liner;

3) the side slope liner over existing refuse from bottom to top shall be:

   a) 24 inches minimum of compacted native soil;
   b) structural geotextile (geogrid);
   c) 12 inches of sand (for use as liner bedding and gas collection layer;
   d) 60 mil geomembrane;
   e) drainage layer consisting of geonet covered by a filter fabric;
   f) 12 inches minimum of protective soil

4) develop and implement an inspection and maintenance program for the leachate collection system to ensure the system continues functions as designed and to prevent clogging of the leachate collection pipe.

Plans and specifications for expansion of the Central Area shall be submitted for review and approval of the Government Plaintiffs.

3.5.4 Landfill Gas Sampling and Analysis Plan

The Settling Defendant shall submit a SAP, meeting the requirements described in Section 1.2.4, to assess landfill gas migration and to assure that ongoing landfill activities and the remedial action, particularly the landfill cap, do not result in increased migration of landfill gas to areas outside the landfill

boundaries. The plan shall provide for additional gas probes that shall be located in the following areas and as shown on Figure 3, and shall determine whether or not significant concentrations of gas are in the soil:

1) Eighteen probes shall be installed in the areas near the east side apartments complexes, Mason Loop, and Tyler Street. Twelve probes shall be approximately 15 feet deep and six probes shall extend to the water table. These new probes shall be used in conjunction with seven multi-depth probes installed in the spring of 1988.

2) One probe, extending to the water table, shall be installed along the Mullen Street access road. This new probe shall be used in conjunction with four multi-depth probes installed in the spring of 1988.

3) Fifteen probes shall be installed on the west side of the landfill in areas along Orchard Street extending towards the Pipe Company and the nursing home. Nine of these probes shall be approximately 15 feet deep. Six of these probes shall extend to the water table.

4) Six probes shall be installed in the area of 48th Street, south of the landfill. Five of these probes shall be approximately 15 feet deep. One probe shall extend to the water table. These new probes shall be used in conjunction with seven multi-depth probes installed in the spring of 1988.

These probes shall be monitored daily for 30 days after installation. If no significant gas concentrations are found in the soil, the probes shall be monitored weekly and on all days when the barometer reading recorded in the morning is below 29.8 inches of mercury. Significant concentrations of gas are defined in the Minimum Functional Standards as levels exceeding the lower explosive limit (LEL) of methane.

When each section of the landfill cap is installed, the probes outside the landfill boundaries in that area shall be monitored three times per week. If significant concentrations of gas are found in a probe outside the landfill boundaries, that probe shall be monitored on a daily basis until the readings are consistently below the LEL for 30 days. At that time, weekly monitoring shall resume. Landfill gas monitoring shall continue for at least 30 years or until it can be demonstrated to the satisfaction of the Government Plaintiffs that the landfill is no longer generating gas above the LEL.

3.5.5 Landfill Gas Monitoring Evaluation Reports

The following Landfill Gas Monitoring Evaluation Reports shall be submitted to the Government Plaintiffs for review and approval:

1) Gas System Evaluation Report - A report shall be submitted to the Government Plaintiffs summarizing and analyzing the data from the first 60 days of monitoring after installation of the new probes located outside the landfill boundaries. This report shall also include a discussion and evaluation of all gas monitoring data to date.

2) Biannual Landfill Gas Control System Status Reports - These biannual reports shall summarize the gas data and discuss the performance of the landfill gas control system during the previous six months.

3) Landfill Cap Installation Report - A report shall be submitted to the Government Plaintiffs after each section of the landfill cap is installed, summarizing the data obtained from monitoring probe installations and analyzing any changing trends or characteristics of landfill gas migration. These reports shall be submitted within 60 days of the completion of each phase of the landfill cap.

3.5.6 Landfill Gas Management Plan

The landfill Gas Management Plan in the Interim Operations and Maintenance Plan shall be subject to review and approval by the Government Plaintiffs, and amended as required. The Settling Defendant shall ensure that

the plan covers all aspects of operating and maintaining the landfill gas control system. This includes procedures for day to day operations, monitoring procedures, field adjustment procedures, and procedures to be followed if significant concentrations of landfill gas are detected in soils outside the landfill boundaries. A revised Monitoring Program shall be included with the plan.

The extraction system shall be adjusted to prevent significant concentrations of landfill gas from building up in these soils. Adjustment procedures shall include system inspections, increased pumping rates, and installation of additional extraction wells. Whenever one or more gas probes outside the landfill boundaries have soil gas concentrations exceeding the LEL, monitoring of the affected probe shall be daily until the appropriate adjustment procedures have been implemented and the readings are consistently below the LEL for 30 days. If the probes indicate that the adjustment procedures are not controlling gas migration, additional probes may be required by the Government Plaintiffs to determine the extent of migration. The Settling Defendant may petition the Government Plaintiffs to reduce the frequency of sampling if an adequate baseline of information has been developed to demonstrate significant concentrations of gas are not found in soils outside the landfill boundaries.

3.5.7 Utilities Management Plan

A plan shall be submitted, for review and approval of the Government Plaintiffs, for maintenance of the cap integrity in areas where buried and above ground utility lines cross the site. This includes storm and sanitary sewers, water lines, power lines, and telephone lines. Repairs to such lines and sewers shall not cause leakage in the cap. In developing this plan the Settling Defendant shall consult with all affected agencies and companies maintaining rights of way or easements on landfill property and shall determine, for water lines, a schedule for periodic leak detection testing. A contingency plan shall be included in the Utilities Management Plan for the sanitary sewer in the event of collapse or clogging.

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3.5.8 Expansion of On-site Facilities

Preliminary plans for the construction of the Public Receiving Facility expansion call for paving of areas containing waste. Waste shall be removed from these areas, for this and any other similar project, prior to paving. However, if waste must be left in place a plan for capping over waste shall be submitted to the Government Plaintiffs for review and approval. Designs for over waste capping shall be compatible with and no less permeable than the cap proposed for the remainder of the site.

3.5.9 Surface Water Sampling and Analysis Plan

The Settling Defendant shall submit a SAP for Leach Creek which meets the requirements described in Section 1.2.4 of this SOW. Base flow in Leach Creek shall be determined using historical records. The Settling Defendant shall establish stream flow gage stations on Leach Creek sufficient to verify stream base flows and the impact of the extraction system on flows in the creek. The Settling Defendant may petition the Government Plaintiffs to discontinue flow measurement if they can demonstrate that the extraction system does not impact base flow in Leach Creek.

Water quality samples shall be collected from at least three locations in Leach Creek (to be identified in the SAP), one to establish background concentrations. Monitoring shall take place upstream and downstream from any point of discharge. If there is no direct discharge to Leach Creek, samples shall be collected from a location near the source and at a location considered likely to intercept contaminated groundwater. At a minimum, surface water samples shall be collected quarterly and analyzed for target compound list volatile organics, heavy metals, and leachate parameters for one year after the extraction system is operational. Sampling frequency shall then be twice annually until one year after the system is shut down. The Settling Defendant may petition the Government Plaintiffs to reduce the required analyses to indicator parameters based on the monitoring data obtained in the predesign study.

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Water quality samples of surface runoff shall be collected annually at points where runoff enter the storm sewer system until one year after the landfill is capped. The samples shall be analyzed for indicator parameters (Section 3.1.2.2).

3.5.10 Leachate and Condensate Management

3.5.10.1 Leachate and Condensate Sampling and Analysis Plan

The Settling Defendant shall submit a SAP.to evaluate the quantity and quality of condensate from the gas collection system and leachate from the leachate collection system in the Central Area. The plan shall meet the requirements described in Section 1.2.4 of this SOW.

Samples shall be taken from four selected condensate traps currently draining into the landfill and from each separate input currently draining into the sanitary sewer via the leachate collection manhole at the north end of the Central Area. At least two samples shall be collected from each source discharging into the sanitary sewer and analyzed for target compound list substances. These samples shall be collected starting with the predesign study period. If either the leachate or the condensate exceeds Government Plaintiff approved discharge standards for the sanitary sewer it shall be collected and treated before discharge. Discharge limits shall be consistent with discharge location as described in Section 3.3.2.3.

3.5.10.2 Leachate and Condensate Management Plan

Based on the information collected under Section 3.5.10.1, the Settling Defendant shall submit a plan to manage the condensate and leachate being produced. This plan shall address pretreatment needs for the management options developed. If pretreatment is required, it shall be developed as part of the design process outlined in Section 3.3.1.2.

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3.5.11 Air Emissions Management

3.5.11.1 Air Emissions Management Plan

Air emissions from all treatment facilities shall comply with all federal, state, and local air emissions regulations. Design requirements to satisfy air emissions regulations shall be developed as part of the treatment system design described in Section 3.3 of this SOW.

3.5.11.2 Air Emissions Sampling and Analysis Plan

The Settling Defendant shall submit a SAP which shall meet the requirements described in Section 1.2.4. to monitor air emissions from the gas flare and from the air stripper if it is part of the final treatment design. Air samples shall be analyzed for toxic air pollutants as defined by the New Source Review Guidelines for Toxic Air Contaminants (1988 and as revised).

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4.0 ALTERNATE WATER SUPPLY

The Settling Defendant shall continue to monitor nearby public and private water supply wells to protect public health. All water supply wells within the plume, as defined by groundwater data obtained in the RI/FS and the predesign study, shall be monitored quarterly. The Fircrest wells shall be monitored monthly until monitoring wells MW5A and C are installed and operating (Section 3.1.1.3). At a minimum these wells shall be sampled for groundwater indicator parameters as described in Section 3.1.2.2.

If early warning values, as determined in Section 3.3.2.2, are exceeded in any well, that well shall be placed on a monthly monitoring program until the cleanup is completed and the extraction/treatment system has been shut off, or until monthly samples show a decreasing trend in contamination and are less than early warning values, or alternate water has been supplied (Section 2.2).

If, based on monthly sampling, an increasing trend is found in any well such that the Government Plaintiffs determine a drinking water standard or health based criteria may be exceeded, the Settling Defendant shall provide an alternate water supply. Any well which exceeds a primary drinking water standard or an approved health based criteria (see Table 3) shall be immediately taken out of service and replaced with an alternate water supply as per the requirements of Section 2.2 of this SOW. If alternate water has been provided, monthly monitoring of the contaminated well may cease; however, the Government Plaintiffs may require periodic monitoring of such wells as part of routine monitoring practices.

The Settling Defendant shall provide an alternate water supply, as described in Section 2.0, in the event that operation of the extraction system adversely impacts the yield of existing supply wells in use prior to the date of entry of this Consent Decree. Adverse impact is defined as a reduction in water supply to levels below the discharge rate and total allowable annual volume defined by a valid water right, filed with the State of Washington,

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with a priority date prior to the date of entry of this Consent Decree. If a water right has not been granted for a domestic well, adverse impact is defined as reduction below the capacity of the well.

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5.0 INSTITUTIONAL CONTROLS

The Settling Defendant shall submit for Government Plaintiff review and approval a plan for institutional or other controls to restrict drilling of water supply wells in an area from Tyler Street to Leach Creek, and from Center Street to South 56th Street, and other areas identified by the Government Plaintiffs in the event that further monitoring shows the plume to have migrated beyond these limits or if additional water use could adversely affect the performance of the extraction system.

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6.0 REMEDIAL DESIGN PROJECT COMPLETION AND CLOSEOUT

The remedial design project completion shall occur when the design package has been completed, all comments have been incorporated, and approval of the Government Plaintiffs has been obtained.

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7.0 TASKS FOR REMEDIAL ACTION

7.1 Project Planning

The Settling Defendant shall prepare a plan describing efforts related to the initiation of engineering services and management during construction. The major subtasks include finalization of the preliminary RA work plan (see Section 1.2.1.2) and development of a construction management plan. The project plan shall address efforts related to the procurement of a construction contract. The plan shall detail how procurement shall be achieved to avoid construction delays. This includes issuing requests for qualifications, requests for proposals, bid analysis, and contract award. This task also includes application of managerial and decision making techniques during construction. The pre-construction planning and review, project control, contract management, QA/QC, facility start-up and construction closeout, and other techniques used to manage the remedial action activities shall be specified.

7.2 Site Safety Plan

The Settling Defendant shall be responsible for ensuring that the construction contractors prepare a site health and safety plan for the review of the Government Plaintiffs. The plan shall comply with OSHA, WISHA, and other requirements, to cover the workers participating in the remedial action phase and to protect the surrounding community.

7.3 Remedial Action Construction Program Plan

A quality assurance project plan shall be prepared covering the RA phase of the project. This document shall provide the quality requirements needed to assure that upon completion of the remedial action, the requirements of the ROD, the remedial design, and the SOW shall have been met. This document shall be prepared consistent with the Quality Assurance Project Plan submitted for the Remedial Design phase (Section 1.2.3 of this SOW) and other guidance documents.

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7.4 Construction Inspections

The Settling Defendant shall provide support services for the implementation of the Quality Assurance Project Plan for the remedial action. These services include field testing, sample analysis, inspection of field logs and diaries, inspection of work for compliance with contract documents, all monitoring work, and monthly site progress reports. A construction documentation report, including "As-Built" drawings, shall be prepared and submitted for the approval of the Government Plaintiffs within two months of completion of each phase of construction.

7.5 Sampling and Analysis Plan/Cleanup Validation

The Settling Defendant shall develop a plan to acquire specific field samples and other information needed during the operational period of the remedial action, to assure compliance with the consent decree and to assure performance of the system. This plan shall also include analysis and validation of the sampling results. The plan shall describe the specific monitoring wells located upgradient from the extraction system(s) which shall be used to evaluate the level of contamination within the existing plume. These wells shall be sampled quarterly for indicator parameters described in Section 3.1.2.2 until shutoff procedures are implemented (Section 7.7.3). The plan shall be submitted to the Government Plaintiffs for review and approval.

7.6 Remedial Action Implementation

The Settling Defendant shall fully implement all work required in the RA work plans, subject to Government Plaintiff review, inspection, and approval. RA implementation represents the majority of effort and cost for the RD/RA project. This task is the actual construction of the various elements of the approved remedial design.

7.7 Operation and Maintenance Plan

7.7.1 Landfill Cap

An inspection and maintenance plan, subject to review and approval by the

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Government Plaintiffs, shall be developed for the landfill cap. Areas where settlement occurs shall be repaired. Any cracks that develop shall be repaired. The plan shall also include provision for correction of localized subsidence, surface ponding, surface erosion and runoff, detail the frequency of inspection, corrective action response times, personnel needs, and reporting requirements. This plan shall be implemented upon the completion of the first stage of the landfill cap and shall continue for a minimum 30 year period after issuance of the certificate of completion or site closure, whichever is later.

7.7.2 Extraction/Treatment System/Gas Extraction System

An operation and maintenance plan for the extraction/treatment system and the gas extraction system shall be developed to address normal operation, potential operating problems, alternate O&M procedures should systems fail, routine monitoring and laboratory testing, safety requirements, a description of necessary equipment, necessary personnel, budget, and reporting requirements. The plan shall include shakedown procedures and long term operation and maintenance requirements as well as equipment startup and operator training procedures. The plan shall include procedures referenced in Section 3.1.2.2, Early Warning Values, in the event that the system does not contain the plume and early warning values are exceeded downgradient. The plan shall also include treatment system adjustment procedures should the system fail to meet the performance criteria set forth in this SOW. Such adjustment procedures shall be dependent upon the treatment method selected, and may include addition of treatment units, adjustment of the flow rate, or addition of pretreatment units.

Similar procedures shall be developed for the gas extraction system should the data from probes outside the landfill boundaries determine that the existing system is not controlling the migration of gas. Such procedures may include adjustment of the pumping rate or installation of more extraction wells (see Section 3.5.6).

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7.7.3 Shut-Off Procedures

The extraction/treatment system shall be shut off only when the groundwater at the point of compliance and within the existing plume has reached the drinking water standards or health based criteria as specified in Table 3 for four consecutive quarterly samples. The goal is to achieve this level of cleanup within 10 years of operation of the system. When the Settling Defendant believes that this requirement has been met, they shall petition the Government Plaintiffs to shut down the extraction/treatment system. After Government Plaintiff approval, the system may be shut down, and the performance monitoring wells (as described in Section 8.0 of this SOW) shall be monitored quarterly for a period of five years or until completion of all landfill cap requirements, whichever is longer. Monitoring shall, at a minimum, consist of indicator parameters defined in Section 3.1.2.2.

If any of these wells exceed the drinking water standards or health based criteria during this monitoring period, the extraction/treatment system shall be restarted until the groundwater again meets standards for four consecutive quarters. If any of the performance wells exceed the early warning values set out in Section 3.1.2.2 during this period, the Settling Defendant shall submit a plan to evaluate what actions (if any) are necessary. The Settling Defendant shall again petition the Government Plaintiffs and demonstrate that these requirements have been met. The Settling Defendant may apply for certification of completion only after the Government Plaintiffs agree that the groundwater quality has been maintained for an entire five year period after completion of landfill cap requirements.

7.8 Project Completion and Closeout

The major elements of this task include consolidation of the project records, final inspection and closeout as described in Section XXXII of the Consent Decree.

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8.0 POST REMEDIAL CARE

8.1 Groundwater Monitoring

Notwithstanding the application of the Settling Defendant for a certificate of completion or issuance by the Government Plaintiffs, additional groundwater monitoring wells may be required to establish compliance with the performance requirements set forth in Sections 3.3.2 and 7.7.3 of this SOW. The Settling Defendant shall submit a plan for installation and monitoring of these performance wells to be installed between the compliance boundary and the extraction system(s). Monitoring shall be quarterly in accordance with Section 7.7.3 of this SOW, and biannually for the subsequent 30 years following issuance of certificate of completion.

8.2 Five Year CERCLA Review

The Settling Defendant shall provide technical support in cooperation with the Government Plaintiffs, to fulfill the 5 year review requirements of CERCLA.

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9.0 PROJECT MANAGEMENT

9.1 Schedule of Work

The Settling Defendant shall develop a work schedule for management tracking of the RD/RA for the review and approval of the Government Plaintiffs. The Settling Defendant shall provide deliverable dates for each deliverable specified in this SOW and indicate the durations and interactions between tasks. The schedule shall identify the requirements for reviews and approvals by the Government Plaintiffs. Deliverable items and required submittal dates which have already been established by this Consent Decree and the SOW, are shown in Table 5. The remaining deliverables and dates shall be identified in the project management plan (Section 1.2.1). The project management plan shall also propose dates for the RA activities. Final dates for the RA activities shall be included in the remedial action work plan (Section 7.1). Unless otherwise specified, final deliverables shall be submitted to the Government Plaintiffs within 30 days of receipt of Government Plaintiff directions for changes to draft deliverables.

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FIGURE 1

PREDESIGN STUDY MONITORING WELLS

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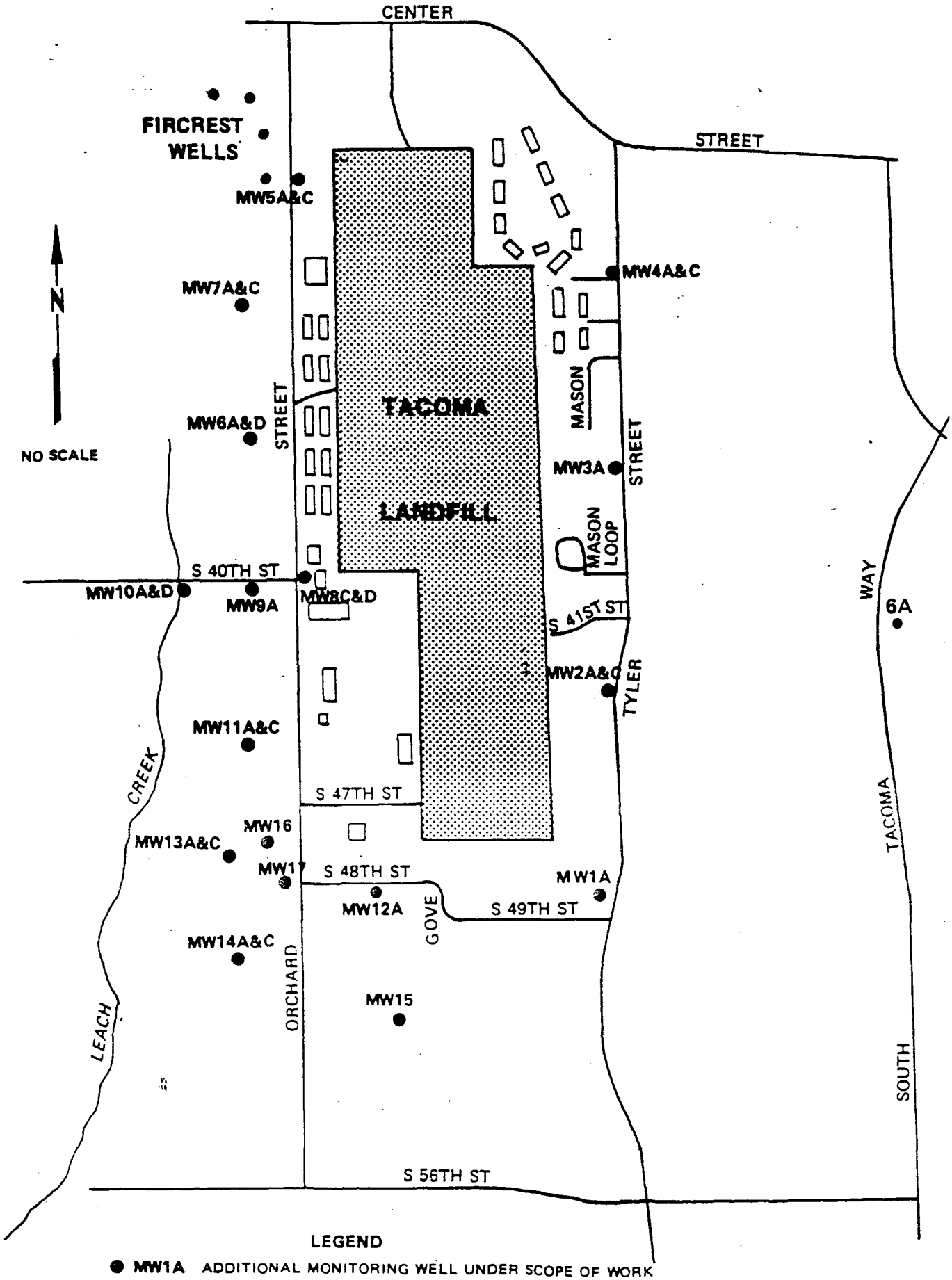

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TABLE 1

PREDESIGN STUDY MONITORING WELLS

Well	Approximate Depth (feet)	Targeted Geologic Unit	Purpose of Well
MW-1A	100	Q_c Water table)	Water quality monitoring in area potentially impacted by gradient reversal
MW-2A and C (Boring depth)	100 150 170	Q_c (Water table) Q_{og}(Tacoma Production Zone) Q_{ol} (Aquitard Surface)	Water quality monitoring in area potentially impacted by gradient reversals during summer months. Boring will be advanced to locate the top of Q_{ol}.
MW-3A	100	Q_c (Water table)	Water quality monitoring in area potentially impacted by gradient reversal
MW-4A and C (Boring depth)	100 140 170	Q_c (Water table) Q_{og}(Tacoma Production Zone) Q_{ol} (Aquitard Surface)	Water quality monitoring in area potentially impacted by gradient reversal. Boring will be advanced to establish top surface of Q_{ol}.
MW-5A and C	90 150	Q_c (Water table) Q_{og} (Fircrest Production Zone)	Early warning for Fircrest production wells.
MW-6A and D	40 150	Q_c or Q_{og} (Water table) Q_{os} (Zone above Aquitard)	Water quality monitoring downgradient of the landfill and DNAPL investigation.
MW-7A and C	60 130	Q_c or Q_{og} (Water table) Q_{og} (Fircrest Production Zone, on top of Q_{ot})	Water quality monitoring downgradient of the landfill. Additional monitoring near Fircrest wells.
MW-8C and D	130 170	Q_{og}(High Permeability Zone) Q_{os}(Zone above Aquitard)	Define vertical dimensions of plume and DNAPL investigation.

TABLE 1 (continued)

Well	Approximate Depth (feet)	Targeted Geologic Unit	Purpose of Well
MW-9A	10	Q_c (Water table)	Water quality monitoring downgradient of landfill and definition of plume boundary.
MW-10A and D	30 90	Q_c or Q_{og} (Water table) Q_{os} (Zone above Aquitard)	Confirm Leach Creek as discharge zone and water quality monitoring downgradient of landfill.
MW-11A and C	40 80	Q_c (Water table) Q_{og} (Private Well Production Zone)	Water quality monitoring downgradient of landfill and current plume, and definition of plume boundary.
MW-12A	120	Q_c (Water table)	Water quality monitoring downgradient of landfill and definition of plume boundary.
(MW-15		Existing Well	Confirm screened zone, water level measurement.
MW-16		Existing Well	Confirm screened zone, water level measurement.
MW-17)		Existing Well	Confirm screened zone, water level measurement.
MW-13A and C	30 60	Q_c (Water table) Q_{og}(Private well production)	Water quality monitoring downgradient of landfill and current plume, definition of plume.
MW-14A and C	60 80	Q_c (Water table) or Q_{og} (Private well production)	Water quality monitoring downgradient of landfill and current plume, definition of plume.

Notes:

1. Single completion water table monitoring wells (MW-1A, MW-3A, MW-12A) will be drilled by air rotary methods. All other wells will be drilled using hollow stem auger or cable tool drilling methods.

2. Locations are approximate, actual locations dependant on drill rig and property access.

CITY CLERK CONTRACT/AGREEMENT NO.

TABLE 2

TARGET COMPOUND LIST

ORGANIC COMPOUNDS

VOLATILE COMPOUNDS

1. Chloromethane
2. Bromomethane
3. Vinyl Chloride
4. Chloroethane
5. Methylene Chloride
6. Acetone
7. Carbon Disulfide
8. 1,1-Dichloroethene
9. 1,1-Dichloroethane
10. trans-1,2-Dichloroethane
11. Chloroform
12. 1,2-Dichloroethane
13. 2-Butanone
14. 1,1,1-Trichloroethane
15. Carbon tetrachloride
16. Vinyl Acetate
17. Bromodichloromethane
18. 1,2-Dichloropropane
19. cis-1,3-Dichloropropene
20. Trichloroethane
21. Dibromochloromethane
22. 1,1,2-Trichloroethane
23. Benzene
24. trans-1,3-Dichloropropene
25. Bromoform
26. 4-Methyl-2-Pentanone
27. 2-Hexanone
28. Tetrachloroethene
29. Toluene
30. 1,1,2,2-Tetrachloroethane
31. Chlorobenzene
32. Ethyl Benzene
33. Styrene
34. Total Xylenes

CITY CLERK CONTRACT AGREEMENT

TABLE 2

(Continued)

SEMI-VOLATILE COMPOUNDS

35. Phenol
36. bis(2-Chloroethyl) Ether
37. 2-Chlorophenol
38. 1,3-Dichlorobenzene
39. 1,4-Dichlorobenzene
40. Benzyl Alcohol
41. 1,2-Dichlorobenzene
42. 2-Methylphenol
43. bis(2-Chloroisopropyl)Ether
44. 4-Methylphenol
45. N-Nitroso-Di-n-dipropylamine
46. Hexachloroethane
47. Nitrobenzene
48. Isophorone
49. 2-Nitrophenol
50. 2,4-Dimethylphenol
51. Benzoic Acid
52. 2-bis(2-Chloroethoxy) methane
53. 2,4-Dichlorophenol
54. 1,2,4-Trichlorobenzene
55. Napthalene
56. 4-Chloroaniline
57. Hexachlorobutadiene
58. 4-Chloro-3-Methylphenol
59. 2-Methylnaphthalene
60. hexachlorocyclopentadiene
61. 2,4,6-Trichlorophenol
62. 2,4,5-Trichlorophenol
63. 2-Chloronaphthalene
64. 2-Nitroaniline
65. Dimethylphthalate
66. Acenaphthylene
67. 2,6-Dinitrotoluene
68. 3-Nitroaniline
69. Acenaphthene
70. 2,4-Dinitrophenol
71. 4-Nitrophenol
72. Dibenzofuran
73. 2,4-Dinitrotoluene
74. Diethylphthalate
75. 4-Chlorophenyl-phenyl ether
76. Fluorene
77. 4-Nitroaniline
78. 4,6-Dinitro-2-Methylphenol
79. N-Nitrosodiphenylamine
80. 4-Bromophenyl ether
81. Hexachlorobenzene
82. Pentachlorophenol
83. Phenanthrene
84. Anthracene
85. Di-n-butylphthalate
86. Fluoranthene
87. Pyrene
88. Butylbenzylphthalate
89. 3,3'-Dichlorobenzidine
90. Benzo(a)anthracene
91. Chrysene
92. bis(2-Ethylhexyl)phthalate
93. Di-n-octylphthalate
94. Benzo(b)fluoranthene
95. Benzo(k)fluoranthene
96. Benzo(a)pyrene
97. Indeno(1,2,3-cd)pyrene
98. Dibenz(a,h)anthracene
99. Benzo(g,h,i)perylene

CITY CLERK CONTRACT AND TERMINAL

TABLE 2
(Continued)

PESTICIDES/PCB COMPOUNDS

100. Alpha-BHC
101. Beta-BHC
102. Delta-BHC
103. Gamma-BHC (Lindane)
104. Heptachlor
105. Aldrin
106. Heptachlor Epoxide
107. Endosulfan I
108. Dieldrin
109. 4,4'-DDE
110. Endrin
111. Endosulfan II
112. 4,4'-DDD
113. Endosulfan Sulfate
114. 4,4'-DDT
115. Methoxychlor
116. Endrin Ketone
117. Alpha Chlordane
118. Gamma Chlordane
119. Toxaphene
120. Aroclor 1016
121. Aroclor 1221
122. Aroclor 1232
123. Aroclor 1242
124. Aroclor 1248
125. Aroclor 1254
126. Aroclor 1260

CITY CLERK

TABLE 2
(Continued)

INORGANIC ANALYSES

ELEMENT

Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Iron	Zinc
Lead	Cyanide

CITY CLERK CONTRACT

TABLE 2
(continued)

OTHER INORGANIC ANALYSES
(not on the Target Compound List)

Bicarbonate m
Calcium m
Carbonate m
Magnesium m
Potassium m
Silica m
Total Hardness m

m = major constituent

CITY CLERK CONTRACT/AGREEMENT

TABLE 3

GROUNDWATER PERFORMANCE CRITERIA*

Contaminant	Performance Criteria (ug/l)
Benzene	5.0
Chloroethane	20.0
1,1-dichloroethane	20.0
1,2-dichloroethane	5.0
Ethyl Benzene	320.0
Methylene Chloride	5.0
Toluene	175.0
1,1,1-Trichloroethane	200.0
Xylenes	10.0

*This table shall be developed and completed for the entire list of indicator parameters selected under Section 3.1.2.2 of this SOW.

CITY CLERK CONTRACT/AGREEMENT NO. 106

TABLE 4

SURFACE WATER DISCHARGE CRITERIA*

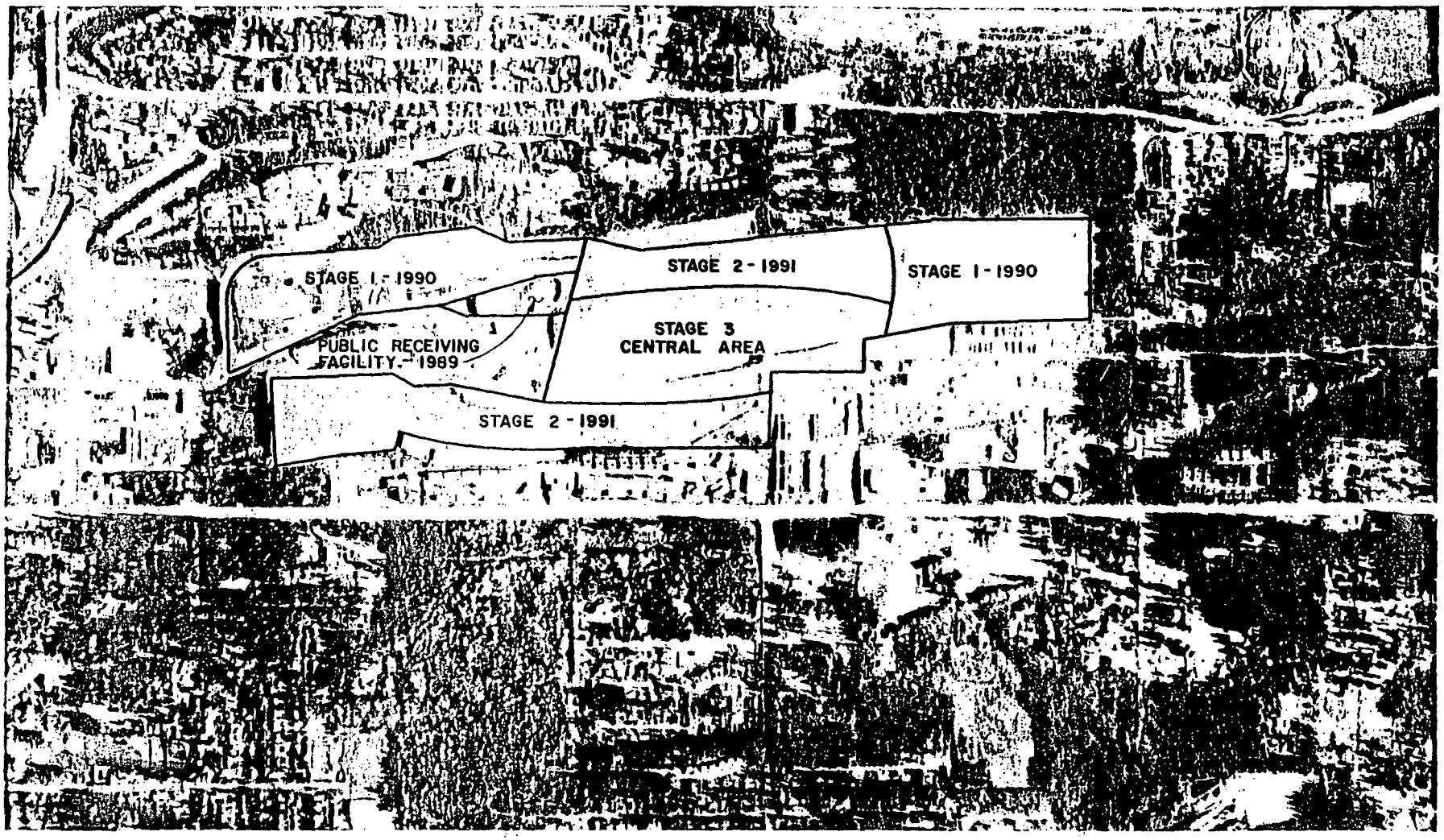
Contaminant Concentration Appropriate to the Discharge Location (ug/l)

Contaminant	Fresh Water	Marine Water
Benzene	5.0	700.0
Chloroethane	20.0	1130.***
1,1-dichloroethane	20.0	1130.***
1,2-dichloroethane	5.0	1130.0
Ethyl Benzene	320.0	4.3**
Methylene Chloride	5.0	6400.
Toluene	175.0	5000.0
1,1,1-trichloroethane	200.0	312.0
Vinyl Chloride	2.0	2.0**
Xylenes	10.0	10.0**

* This table shall be supplemented to include the entire list of indicator parameters selected under Section 3.1.2.2 of this SOW.

** Value set at fresh water criteria unless other discharge limits can be established from other guidance documents or technical research, as approved by the Government Plaintiffs.

*** Data is not available to develop criteria for this compound. However, since research shows (EPA, 1986) that toxicity of chlorinated ethanes increases with increasing chlorination, the toxicity for Chloroethane and 1,1-dichloroethane should be less than the value for 1,2-dichloroethane.



N

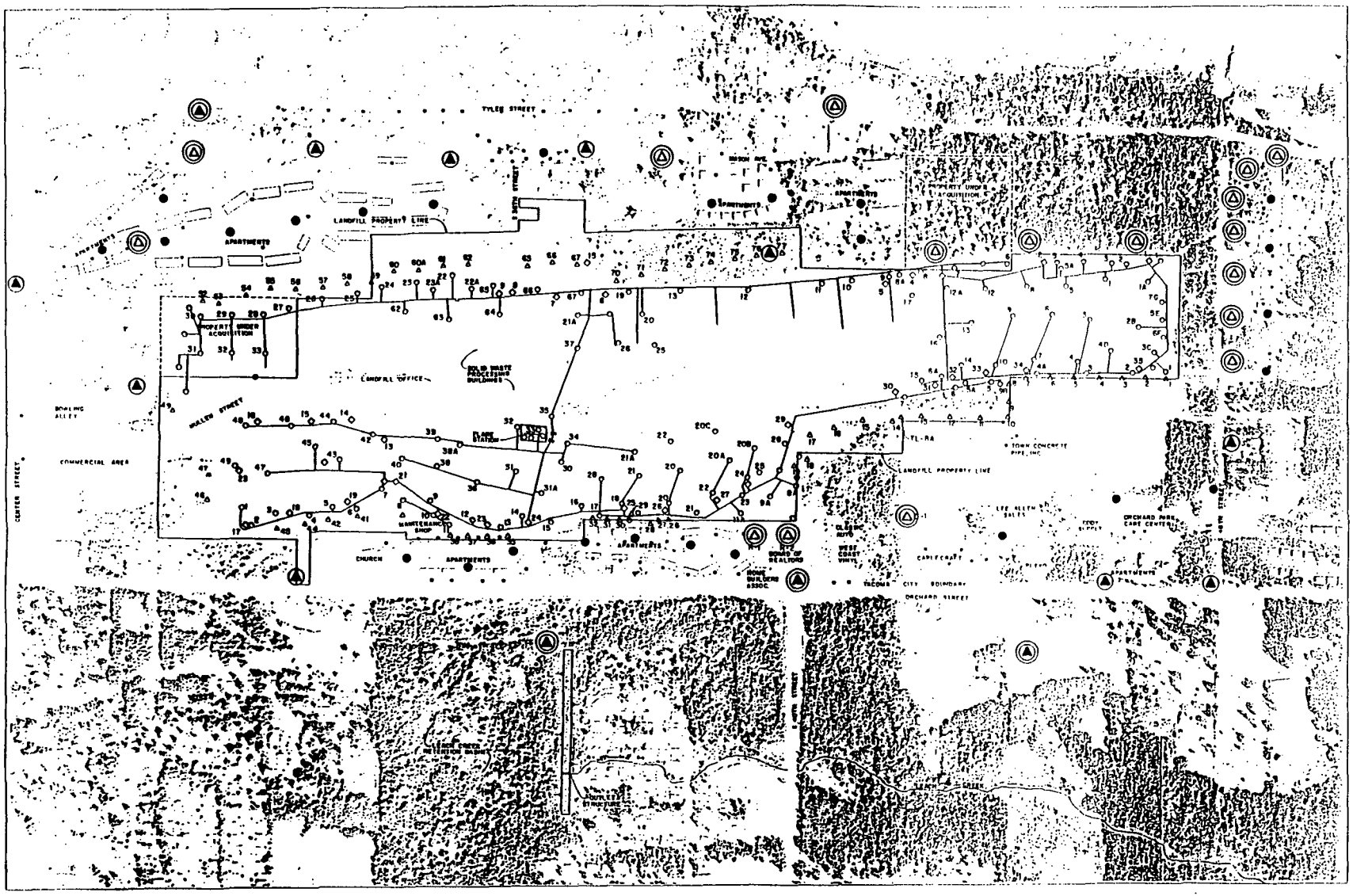
800' 400' 0 800'

SCALE: 1" = 800'
(APPROX.)

FIGURE 2
LANDFILL CAP
CONSTRUCTION SCHEDULE

TACOMA LANDFILL RD/RA

00000282



LEGEND

- GAS WELL
- PROBE
- CONDENSATION DRAIN
- OFFSITE MONITORING LOCATION
- EXISTING OFF-SITE PROBE STATIONS (Multi-Depth)
- PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth)
- PROPOSED OFF-SITE PROBE STATIONS (Shallow)
- PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth) COMBINED WITH WATER WE

FIGURE 3
PREDESIGN STUDY
LANDFILL GAS PROBE LOCATIONS

TACOMA LANDFILL

00300283

CITY OF LOS ANGELES

TABLE 5

LIST OF DELIVERABLES

Deliverable	Submittal Date
Public Receiving Facility Cap Design	
Monitoring Well SAP	Within 30 days of lodging of Consent Decree
Draft Health and Safety Plan	With Monitoring Well SAP.
Final Health and Safety Plan	Within 30 days receipt of comments Draft Health and Safety Plan.
Draft Project Management Plan (PMP)	Within 30 days of lodging of Consent Decree.
Final PMP	Within 30 days of receipt of comments on Draft PMP.
Draft QAPP - for remedial design	With Draft PMP.
Final QAPP for remedial design	Within 30 days receipt of comments on Draft QAPP.
Draft Groundwater SAP	With Draft QAPP
Final Groundwater SAP	Within 30 days of receipt of comments on Draft Groundwater SAP
Leachate & Condensate Sampling and Analysis Plan (SAP)	Within 30 days of lodging of Consent Decree.
Fircrest Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Alternate Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Landfill Gas Sampling & Analysis Plan	Within 90 days of lodging of Consent Decree.
Well Logs & Survey Data	Within 30 days of last well installation.
Indicator Parameter Selection	Within 90 days of first round of groundwater sampling.
Surface Water SAP	Within 120 days of lodging of Consent Decree.

TABLE 5

List of Deliverables
2

Disposal of Hazardous Substances & Liquids Plan	Within 180 days of lodging of Consent Decree
Draft Predesign Report	Within 180 days of lodging of Consent Decree
Draft Statistical Methods Proposal	In Draft Predesign Study Report
Pilot Extraction Well Work Plan	In Draft Predesign Study Report
Pilot Treatment Study Work Plan	In Draft Predesign Study Report
Pilot Extraction Well SAP	Within 30 days receipt of comments on Draft Predesign Report
Pilot Treatment Study SAP	Within 30 days of receipt of comments on Draft Predesign Report
Final Statistical Methods Selection	Within 30 days of comments on draft Predesign Study Report
Draft Pilot Studies Report	
Final Predesign Study Report	Within 30 days of receipt of comments on Draft Pilot Studies Report
Extraction/Treatment System Preliminary Design (30%)	
Extraction/Treatment System Intermediate Design (60%)	
New Plume Contingency Plan	With 60% Extraction/Treatment Design
Extraction/Treatment System Prefinal Design (90%)	
Extraction Treatment System SAP	With 90% Extraction/Treatment Design
Air Emissions SAP	With 90% Extraction/treatment Design
Extraction/Treatment System Final Design (100%)	
Landfill Cap Preliminary Design (30%)	
Surface Water Management Plan	With Cap 30% Design Report

CITY CLERK CONTRACT ATTACHMENT No. V0160

TABLE 5

List of Deliverables
3

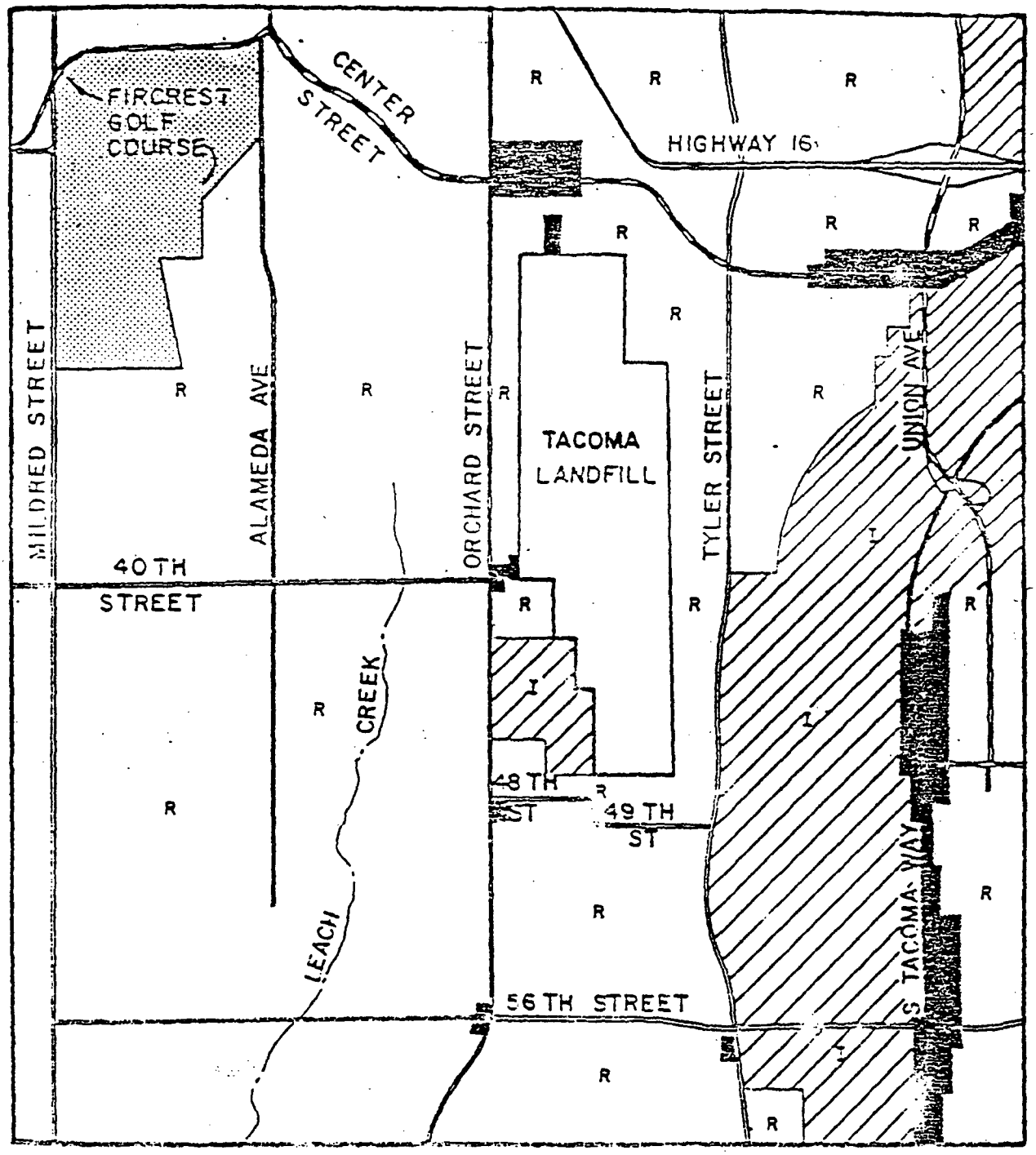
Landfill Cap Intermediate Design (60%)	
Landfill Cap Prefinal Design (90%) Utilities Management Plan	With 90% Stage 1 Landfill Cap Design
Landfill Cap Final Design (100%)	
Final Central Area Expansion Design Report Plans and Specifications	
Gas System Evaluation Reports	
Landfill Gas Management Plan	
Landfill Gas Cap Installation Report	Within 60 days of completion of each stage of landfill cap
Leachate & Condensate Management Plan	
Air Emissions Management Plan	
Operations and Closure Plan	Within 60 days of approval of all remedial designs
Landfill Closure Plan	With Operations & Closure Plan
O & M Contingency Plan	With O&M Plans in Operations and Closure Plan
Institutional Controls Plan	
Remedial Design Project Closeout	June 30, 1991
Remedial Action PMP - Update	June 30, 1991
Remedial Action Site Safety Plan	
Remedial Action Construction Program Plan	
Remedial Action SAP	
Construction Documentation Report	
Operation and Maintenance Plan	
Project Closeout	Sept. 30, 1992

APPENDIX III
TO TACOMA LANDFILL CONSENT DECREE

ACCESS AGREEMENT

APPENDIX IV
TO TACOMA LANDFILL CONSENT DECREE

MAP OF THE SITE



LEGEND

COMMERCIAL

INDUSTRIAL

RESIDENTAL

00000289

0 1000 2000 4000

SCALE 1" = 2000'

4660

APPENDIX V
TO TACOMA LANDFILL CONSENT DECREE

LIST OF HAZARDOUS SUBSTANCES DETECTED
AT THE TACOMA LANDFILL

Volatile Organic Compounds

Tetrachloroethene
Trans-1,2-Dichloroethene
Trichloroethene
1,1-Dichloroethene
Vinyl Chloride
1,1,1-Trichloroethane
1,1-Dichloroethane
1,2-Dichloroethane
Chloroethane
Benzene
Ethylbenzene
Chlorobenzene
Toluene
Xylene (Total)
2-Butanone
2-Hexanone
1,2-Dichloropropane
Trans 1,3-Dichloropropene
Styrene
Carbon Disulfide
Chloroform
Chloromethane
Bromodichloromethane
Methylene Chloride
Acetone
4-Methyl-2-pentanone

Semi-Volatile Organic Compounds

Hexachlorobenzene
Polynuclear Aromatic Compounds
Pthalate Esters
1,4-Dichlorobenzene
N-nitro-Sodiphenylamine
Benzyl Alcohol
Benzoic Acid
4-Methylphenol
Isophorone
Phenol

Metals

Arsenic
Cadmium
Chromium
Copper
Mercury
Nickel
Lead
Zinc
Iron
Aluminum
Manganese

CITY CLERK CONTRACT/AGREEMENT NO. 10160

APPENDIX VI
TO TACOMA LANDFILL CONSENT DECREE

PRE-SETTLEMENT REMEDIAL DESIGN STIPULATION AND AGREED ORDER

FILED ____ LODGED
RECEIVED
NOV 13 1989
CLERK U.S. DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON AT TACOMA
BY DEPUTY

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON

UNITED STATES OF AMERICA, ON BEHALF OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY and the STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY, Plaintiffs, v. CITY OF TACOMA, Defendant.	C89-583T CIVIL ACTION No. PRE-SETTLEMENT REMEDIAL DESIGN STIPULATION AND AGREED ORDER

STIPULATION AND AGREED ORDER

Plaintiffs, the United States of America, ("United States") and the state of Washington have filed an action under sections 106 and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. Section 9606, 9607 et seq., (CERCLA) and the model Toxics Control Act, against the City of Tacoma, ("Settling Parties").

CITY CLERK CONFORMED COPY

In order to expedite the commencement of the remedial action at the Tacoma Landfill site, which is the subject of this action, the United States and the Settling Parties, stipulate as follows:

A. To commence and complete work, submit documents, and to otherwise perform in accordance with the Consent Decree consented to by the Settling Parties and lodged with but not yet entered by this Court.

B. The Parties to this stipulation acknowledge that this stipulation has been entered into in anticipation of settlement and may be affected by a consent decree entered subsequent to this filing. The Parties agree to comply with the terms of this stipulation unless the terms of any subsequently entered consent decree expressly supersede the terms of this stipulation.

Stipulated by:

CITY OF TACOMA

ERLING O. MORK
City Manager
City of Tacoma
Tacoma, Washington

8/16/89
Date

FRED A. THOMPSON
Director of Public Works
City of Tacoma
Tacoma, Washington

16 AUG. 1989
Date

CITY CLERK CONTRACT NUMBER ENTERED NO. 9066

Leslie T. Gronski — 8/15/89

DAVID H. DOW — Date

Director of Finance 8/15/89

City of Tacoma

Tacoma, Washington

Attest: — 8-16-89

Date

City Clerk

City of Tacoma

Tacoma, Washington

Approved as to form: — Aug 16, 1989

Date

City Attorney

City of Tacoma

Tacoma, Washington

UNITED STATES

Steve Novick — 11/6/89

STEVEN NOVICK — Date

Attorney

Land and Natural Resources Division

U.S. Department of Justice

Washington, D.C. 20536

Richard B. Stewart — NOV 3 1989

RICHARD B. STEWART — Date

Assistant Attorney General

Land and Natural Resources Division

U.S. Department of Justice

Washington, D.C. 20530

Robert T. Neal for

ROBIE G. RUSSELL
Regional Administrator
Environmental Protection Agency,
Region 10
Seattle, Washington

Sept. 15, 1989
Date

MIKE McKAY
UNITED STATES ATTORNEY

Jackson L. Fox

JACKSON L. FOX
Special Assistant United States Attorney
3600 Seafirst Fifth Avenue Plaza
800 Fifth Avenue
Seattle, Washington 98104

November 9, 1989
Date

STATE OF WASHINGTON

Carol L. Fleskes

CAROL S. FLESKES
Hazardous Waste Investigations
and Cleanup Program Manager
Department of Ecology
Olympia, Washington 98504

Aug. 18, 1989
Date

JEFFREY S. MYERS
Assistant Attorney General
State of Washington
Olympia, Washington 98504

Aug 18, 1989
Date

IT IS SO ORDERED this _____ day of _____, 1989.

UNITED STATES DISTRICT JUDGE

CITY CLERK CONTRACT/AGREEMENT NO. 4069

APPENDIX I
TO TACOMA LANDFILL CONSENT DECREE

RECORD OF DECISION

CITY CLERK CONTRACT/AGREEMENT NO. 4060

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION
FINAL REMEDIAL ACTION
COMMENCEMENT BAY - SOUTH TACOMA CHANNEL
TACOMA LANDFILL
TACOMA, WASHINGTON

CITY CLERK CONT... ...MENT NO. 4060

RECORD OF DECISION

REMEDIAL ALTERNATIVE SELECTION

Site

Commencement Bay - South Tacoma Channel, Tacoma Landfill site - Tacoma, Pierce County, Washington.

Purpose

This decision document presents the selected final remedial action for the site, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and consistent with (where not precluded by SARA) the National Contingency Plan (NCP, 40 CFR Part 300). The State of Washington, in close consultation with EPA, has developed and concurred with the selected remedy. A copy of the state concurrence letter is attached as Appendix D.

Basis for Decision

The decision is based upon the administrative record for the site, as obtained from the files of the Washington State Department of Ecology and the U.S. Environmental Protection Agency (EPA). This record includes, but is not limited to, the following documents:

- Remedial Investigation Report for the Tacoma Landfill, Tacoma, Washington (December 1987)

- Feasibility Study of the Tacoma Landfill Site, Final Report (December 1987)

- Decision Summary of Remedial Alternative Selection

- Responsiveness Summary (attached as Appendix B)

- Staff summaries and documents--An index (Appendix C) identifies other items which are included in this administrative record.

Description

This record of decision (ROD) addresses source control of on-site contaminants through capping of the landfill and extraction of methane gas. Management of migration for off-site contaminants will be through a groundwater extraction and treatment system.

The remedial action is designed to:

- reduce the production of leachate by placing constraints on further site operations and by capping the landfill.

- eliminate off-site gas migration through the gas extraction system.

- prevent further migration of the contaminated plume via the groundwater extraction-treatment system.

- further protect public health and the environment via monitoring of groundwater, surface water, gas probes, and air emissions.

- o provide an alternate water supply (Tacoma municipal water) to any residents deprived of their domestic supply due to demonstrated contamination from the landfill or due to the action of the extraction-treatment system.

Treatment will be sufficient to reduce contaminant levels in the groundwater to or below cleanup standards. Performance levels for the identified contaminants of concern are presented in Table 8. The methodology to be used to develop performance levels for the other contaminants in the groundwater is discussed in the Selected Remedial Alternative section of the ROD. Treatment should be permanent, and should effectively reduce the toxicity and mobility of the contaminants. Performance levels are not to be exceeded during the operational life of the remedial action. Treated water discharge shall at all times be consistent with federal laws and Washington State laws. Any treatment system which will produce air emissions will be designed to meet appropriate federal and state Air Toxics Guidelines and to use Best Available Control Technology (BACT) on the effluent air stream.

Containment of the plume will be confirmed by installation and periodic sampling of monitoring wells as well as continued, scheduled monitoring of private and public wells. Extraction will continue until water quality at the compliance boundary (defined by WAC 173-304 as the edge of the filled area) consistently meets or exceeds drinking water standards, or previously established and approved health-based criteria. In addition to meeting health-based criteria, potential impacts to public and private water supplies, and to Leach Creek must be considered in the decision to shut off the system.

Those residents who are deprived of domestic drinking water, either because their wells water quality shows demonstrated contamination from the landfill or because the quantity available has been reduced by the action of the extraction-treatment system, will be connected to city water supplies.

Source control measures are expected to reduce contaminant concentrations in the groundwater system. Source control measures consist of constructing a cap on the landfill and appropriate regrading to minimize infiltration and maximize run-off, ultimately reducing leachate volume and toxicity. Unlined areas of the landfill will be capped as soon as possible. WAC 173-304 defines the minimum requirements for a cap on a municipal landfill. A more stringent cap will be required unless further analysis of the cap, to be provided during remedial design, shows that a significant reduction in leachate volume or toxicity would not be achieved.

Increased run-off due to the construction of the cap will be routed off the landfill to reduce infiltration. The run-off collected from the landfill will be directed to the appropriate storm or sanitary sewers, consistent with local storm drainage ordinances or pre-treatment regulations. The storm drainage plan, prepared as part of the remedial design, will determine and minimize any impacts on downstream increases in peak flow.

The city of Tacoma (Tacoma) will implement a closure plan for the landfill consistent with Washington State Minimum Functional Standards for Landfill Closure (WAC 173-304), and as appropriate, Washington State Dangerous Waste Regulations (WAC 143-303).

Institutional controls will be implemented, consistent with the final design, to assure that the remedial action will continue to protect health and the environment. Tacoma, in cooperation with the town of Fircrest and Pierce County, will pursue the establishment of an ordinance, or other suitable methodology, to restrict drilling of water supply wells in an area from Tyler Street to Leach Creek, and from Center Street to approximately South 56th Street.

Declaration

Consistent with CERCLA, as amended by SARA, and the NCP, it is determined that the selected remedy as described above is protective of human health and the environment, attains Federal and State requirements which are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference expressed in SARA for treatment that reduces toxicity, mobility, or volume. Finally, it is determined that this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

3-31-88
Date

Regional Administrator
Environmental Protection Agency
EPA - Region 10

CITY CLERK CONTRACT/AGREEMENT NO. 4060

APPENDIX II
TO TACOMA LANDFILL CONSENT DECREE

SCOPE OF WORK

CITY CLERK CONTRACT/AGREEMENT NO. 4060

SCOPE OF WORK
FOR
TACOMA LANDFILL CONSENT DECREE

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SCOPE OF WORK
FOR
THE TACOMA LANDFILL CONSENT DECREE

1.0 INTRODUCTION

This Scope of Work (SOW) sets forth the tasks necessary to complete the Remedial Design (RD) and the Remedial Action (RA) at the Tacoma Landfill Superfund Site. The Remedial Investigation (RI) and Feasibility Study (FS) were conducted by the City of Tacoma and were completed in December 1987. The Record of Decision (ROD) was signed on March 31, 1988. It shall be the responsibility of the City of Tacoma (hereafter referred to as Settling Defendant) to prepare, submit for approval, and fully implement work plans incorporating each element of this SOW. It shall be the sole responsibility of the Settling Defendant to ensure that work plans as undertaken meet the performance requirements set forth in this SOW and the Consent Decree and the Settling Defendant shall not rely on document and plan approvals provided by the Government Plaintiffs. In addition, the Settling Defendant shall ensure consistency with the National Contingency Plan (NCP) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and shall satisfy all applicable and relevant and appropriate laws and regulations (ARARs).

1.1 Remedial Action Requirements

The requirements of the remedial action at the Tacoma Landfill, as stated in the ROD, are:

1) reduce the production of leachate by placing constraints on further site operations and by capping the landfill;

2) eliminate off-site gas migration through a gas extraction system;

3) prevent further migration of the contaminated plume and reduce the concentration of contaminants within the plume via a groundwater extraction and treatment system;

4) further protect public health and the environment through monitoring of groundwater, surface water, subsurface gas, and air emissions;

5 provide an alternate water supply (Tacoma Municipal Water) to any residents deprived of their domestic water supply due to demonstrated contamination from the landfill or due to the action of the extraction/treatment system; and

6) establish institutional controls to promote and support the remedial action.

1.2 Project Work Plans

All work performed at and around the site pursuant to this Scope of Work shall be accomplished in accordance with work plans which shall be prepared by the Settling Defendant and submitted for review and approval by the Government Plaintiffs. Work plans shall address implementation of each element of the SOW including: the predesign study consisting of monitoring well installation, sampling activities, extraction system evaluations, treatability studies, and pilot studies; design documents such as design reports, plans, and specifications; construction activities including scheduling, construction quality control/quality assurance, engineering services during construction, and as-built documentation; and the preparation and implementation of operation and maintenance manuals for remedial action facilities including the details and scheduling of performance monitoring. The work plans shall include schedules and a discussion of potential problems which might be encountered.

The Settling Defendant shall implement all plans and work elements according to their terms and according to the schedule approved and incorporated pursuant to Section 9.0 of this SOW. The Settling Defendant shall

notify the Government Plaintiffs of initiation of any field work at least 7 days prior to the commencement of such work. The work shall commence only after the Settling Defendant has received Government Plaintiff approval.

1.2.1 Project Management Plan (PMP) for RD/RA

1.2.1.1 Remedial Design Project Management Plan

A project management plan for RD activities, including a schedule for completion of RD tasks and submission of deliverables established pursuant to Section 9.0 and Table 5 of this SOW for each element of this SOW, shall be submitted by the Settling Defendant no later than 30 days after lodging of this Consent Decree. Compliance with this schedule, once approved by the Government Plaintiffs, is a requirement of this SOW and notice of the schedule shall be sent to the court. The PMP shall describe the Settling Defendant's management approach to completing the RD tasks for the site. The PMP shall identify the key individuals for the Settling Defendant, and identify levels of authority and lines of communication in working with the Government Plaintiffs. The plan shall also address systems or methods that will be used to ensure technical quality and compliance with project schedules.

1.2.1.2 Remedial Action Project Management Plan

The Settling Defendant shall prepare a preliminary remedial action project management plan, including a brief discussion of tasks, an implementation schedule, a description of the long term operation and maintenance requirements, and institutional controls and monitoring requirements that comply with this SOW and the ROD. This plan shall be included in the Project Management Plan document. When the remedial design details become available, an update of the preliminary remedial action portion of the project management plan, including a more detailed description of the construction tasks, shall be completed and submitted to the Government Plaintiffs for review and approval in accordance with the schedule established pursuant to Section 9.0 (see Section 7.0 of this SOW).

1.2.2 Health and Safety Plan

All work, including sampling and other field data gathering activities, shall be performed under an appropriate health and safety plan for the protection of workers and the surrounding community in accordance with EPA, OSHA, and WISHA requirements. The Settling Defendant shall submit a site safety plan to the Government Plaintiffs for comment prior to commencing any action on the site. The initial site safety plan submitted (as part of the Predesign Study, Section 3.1.1.2) shall be amended to reflect subsequent field activities and their varying site safety and health requirements. The Settling Defendant shall be solely responsible for ensuring that the plan satisfies all applicable laws and regulations. The Settling Defendant shall appoint a site safety officer (SSO) who shall be responsible for ensuring compliance with the Health and Safety Plan.

The Settling Defendant shall require their contractors and employees to observe safe practices with respect to all active utilities within and around the site including sewer, power, water, and telephone lines.

1.2.3 Quality Assurance Project Plan (QAPP)

A quality assurance project plan shall be developed for the remedial design phase which shall include procedures for: sample custody; data reduction; validation and reporting; internal quality control checks; performance and system audits; preventative maintenance; and corrective action. This plan shall be implemented by the Settling Defendant upon approval of the Government Plaintiffs. The most current of the following guidelines shall be used to develop these plans except where otherwise noted:

USEPA, Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses, July 1988;

USEPA, Laboratory Data Validation, Functional Guidelines for Evaluating Organic Analyses, February 1, 1988;

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USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, SOW no. 788;

USEPA Contract Laboratory Program, Statement of Work for Organics Analysis, October 1986, revised February 1988.

Data Quality Objectives for Remedial Response Activities, EPA/550/G.87/003 and 004;

Quality Assurance Program Plan for Region X, 1986.

1.2.4 Sampling and Analysis Plans (SAP)

All SAPs prepared pursuant to this Scope of Work shall include, at a minimum: a description of procedures for field sampling, sample handling, sample analysis, data analysis, and identification of laboratory analysis procedures. They shall also provide for Contract Laboratory Program (CLP) deliverables as referenced in Exhibit B of the Contract Laboratory Program Statements of Work for Organics and Inorganics (see Section 1.2.3).

In addition, all SAPs shall include data quality objectives and specify quality assurance and quality control (QA/QC) procedures and samples to meet the requirements of the QAPP (Section 1.2.3). SAPS shall be approved by the Government Plaintiffs before any sampling or monitoring begins. Sampling and analysis shall be performed in accordance with approved Ecology and EPA sampling and laboratory protocols and QA procedures in effect at the time of the sampling or analysis activity. Detection limits, with the exception of the screening tests, shall be at least as low as drinking water standards or approved health based criteria, or the EPA-CERCLA contract laboratory program standards, whichever is lower. EPA approved methods shall be used for all possible parameters. If "approved" methods are not available, then proposed methods shall be submitted to the Government Plaintiffs for review and approval prior to their use. The Settling Defendant shall make available raw data within five days of receipt of results, and quality assured data in the format specified in the sampling and analysis plan to the Government Plaintiffs within 90 days of sample collection or field testing or within 15 working days of receipt of all lab

results for a sampling event, whichever is sooner, and shall submit these results in the monthly progress report (as described in Section XII of the Consent Decree) within thirty calendar days of receipt of the data. Replicate samples shall be collected and analyzed as described in the QAPP or as required by the Government Plaintiffs on a case by case basis.

1.3 Authority of Government Plaintiffs Regarding Deliverables Under This SOW

Any and all documents (deliverables) required to be submitted to the Government Plaintiffs under this SOW are subject to review and approval by the Government Plaintiffs, unless otherwise specified. Such approval may be conditional or may specify required modifications to these documents. The Settling Defendant shall consult with the Government Plaintiffs in preparing all deliverable items under this SOW to minimize the need for such modifications and to determine whether draft submittals are necessary. All deliverables shall be prepared in accordance with applicable EPA and Ecology guidance. Upon approval or modification, all such plans and documents shall be implemented in accordance with their terms and schedules. Bid packages are not subject to approval of the Government Plaintiffs but shall be submitted upon request.

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2.0 CONTINGENCY PLANNING

All work under this SOW must explicitly address those contingencies which are typical to hazardous waste remediation and those provided for in this SOW and the ROD. Specifically, design and/or construction activities under this SOW must provide for the situations discussed in this section.

2.1 New Contaminant Plume

The Settling Defendant shall submit a contingency plan for the expansion and/or modification of the extraction system necessary to control a previously unidentified plume, or a lobe of a plume emanating from the landfill in areas currently considered unaffected. This contingency plan shall include provisions for determining the existence and source of such a previously unidentified plume, or lobe of a plume using, at a minimum, the following criteria:

a) proximity to the landfill;
b) hydraulic gradient;
c) aquifer characteristics;
d) historical data; and
e) types of contaminants.

A previously unidentified plume, or lobe of a plume, is defined as any exceedance of the early warning values described in Section 3.3.2.2 in areas currently considered unaffected. Exceedances shall be determined using the approved method described in Section 3.3.1.3. This plan shall be submitted with the 60 percent design for the extraction treatment system.

2.2 Alternate Water Supply

If contamination (determined through procedures established in Section 4.0) emanating from the landfill is found in the Fircrest wells (located immediately west of the landfill), an alternate water supply shall be provided to the town of Fircrest immediately. A plan to cover such a contingency shall be submitted to the Government Plaintiffs for review and approval no later than 45 days from the date of lodging of this Consent Decree.

A contingency plan describing how alternate water shall be provided to other currently and potentially impacted areas around the landfill shall be submitted no later than 45 days from the date of lodging of this Consent Decree. This plan shall include procedures for supplying temporary water until the impacted residences can be connected to the Tacoma water system. The plan shall be consistent with Section 4.0 of this SOW.

Construction plans and specifications for expansion of Tacoma City water supplies to affected areas, including all design calculations and the construction schedule shall be submitted within 45 days of residences being supplied with temporary water.

2.3 Operation and Maintenance

The Settling Defendant shall prepare a contingency plan for the instance where the final remedial measures do not meet the performance criteria outlined in this SOW. This plan shall also describe the action the Settling Defendants shall implement if, after the groundwater extraction/treatment system or the gas extraction system has been shut down the monitoring data indicate exceedances of the criteria outlined in Sections 3.3.2 and 7.7.3. This plan shall be submitted as part of the Operation and Maintenance Plan described in Section 7.7.

3.0 TASKS FOR REMEDIAL DESIGN

This section provides a task breakdown for all actions to be performed during the RD phase.

3.1 Predesign Study

The Settling Defendant shall conduct a predesign study to achieve the requirements listed below:

1) to provide sufficient information to delineate the boundary of the plume or plumes and for the purpose of designing the extraction system;

2) to assess whether dense non-aqueous phase liquids (DNAPL) are migrating from the landfill;

3) to complete the characterization of the affected aquifers and associated hydrology necessary to design the extraction system;

4) to establish indicator parameters selected from the Target Compound List and leachate parameters listed in WAC 173-304-490;

5) to sample all monitoring wells (both the TL and MW series) three times in a six month period (to include a high and low water table season);

6) to determine the suitability of the alternative treatment options in meeting the treatment standards;

7) to determine the location of the optimum extraction well network to achieve the groundwater cleanup goals and criteria; and

8) to select the treatment option for RA.

3.1.1 Monitoring Wells

3.1.1.1 Sampling and Analysis Plan

The Settling Defendant shall submit a SAP, which shall meet the requirements of Section 1.2.4 of this SOW, for review and approval by the Government Plaintiffs prior to initiation of drilling. This plan shall include monitoring well installation procedures, soil chemical and physical sampling requirements, a well installation schedule, and reporting requirements. Data quality objectives for this effort shall also be identified in this plan.

3.1.1.2 Site Safety Plan

A site Health and Safety Plan shall be prepared in accordance with applicable EPA, OSHA, and WISHA requirements. This plan shall address all aspects of the Predesign monitoring wells, including drilling and sampling. The site safety plan shall be prepared as described in Section 1.2.2 of this SOW. This plan shall be submitted with the monitoring well SAP, and shall be updated to reflect subsequent field activities.

3.1.1.3 Monitoring Well Installation

The Settling Defendant shall install required wells listed in Table 1 and at the approximate locations shown on Figure 1. Exact well locations shall be approved by the Government Plaintiffs prior to drilling. All newly constructed wells shall be surveyed to the nearest 0.01 foot, and shall comply with EPA Order No. 215.0, Minimum Set of Data Elements for Groundwater. Well logs and survey data shall be submitted within 30 days of the installation of the last well. Additional wells to those listed may be required by the Government Plaintiffs, if necessary, to achieve the respective requirements listed in Section 3.1.

3.1.1.4 Existing Wells

Existing private wells may be rehabilitated, however data collected will be used for water level data only.

3.1.2 Groundwater Sampling

3.1.2.1 Sampling and Analysis Plan

The Settling Defendant shall submit a SAP for groundwater sampling which shall meet the requirements of Section 1.2.4 of this SOW, for review and approval of the Government Plaintiffs, prior to groundwater sampling. The SAP shall be amended after the indicator parameters are selected (Section 3.1.2.2) to specify sampling parameters for future sampling rounds. Amendments to the SAP shall be reviewed and approved by the Government Plaintiffs.

3.1.2.2 Groundwater Sampling/Indicator Parameter Selection

The Settling Defendant shall sample each of the new MW series wells and the existing TL series wells (as shown in Figure 1) in accordance with the approved schedule in the SAP. The first round of samples shall be collected during the period of maximum gradient reversal. These samples shall be analyzed for the target compounds listed in Table 2 and leachate parameters listed in WAC 173-304-490. Tentative compounds shall also be identified to ensure that no potential contaminants of concern are overlooked. The Settling Defendant shall utilize this data and historical data to develop a list of indicator parameters to be used throughout the remainder of the RD and RA. The list of indicator parameters shall be submitted in a technical memorandum and shall be reviewed and approved by the Government Plaintiffs prior to its use. The Settling Defendant shall include additional indicator parameters as required by the Government Plaintiffs. Data shall be presented in the format requested by the Government Plaintiffs.

3.1.3 Extraction System Evaluation

The Settling Defendant shall conduct additional modeling studies of the extraction system proposed in the Feasibility Study, considering the additional data obtained during the Predesign Study. The extraction system proposed in the FS, with modifications as required, and other potential extraction configurations shall be evaluated using analytical or numerical modeling techniques. This evaluation shall be conducted in conjunction with the evaluation of the

alternative treatment systems (Section 3.1.4) to recommend the extraction/treatment system for design. The factors to be considered during the evaluation of the extraction system include the following:

1) the groundwater cleanup criteria (Table 3);

2) the cleanup goal of ten years after startup of the remedial action;

3) the impact of capping the landfill on contaminant volumes and mobility;

4) pumping impacts from the Fircrest and Tacoma production wells;

5) current contaminant travel times due to groundwater divide shifts; and

6) effect on surface water and other aquifer uses.

Based on the results of the extraction system evaluation, the extraction well network which assures compliance with performance standards shall be established for design.

3.1.4 Treatability Study

The Settling Defendant shall conduct a treatability study to determine the most effective method (technical and cost) as identified in the ROD of treating the contaminated groundwater. Initial treatability studies for carbon and air stripping treatment technologies shall be conducted using computer modeling techniques.

Treatability studies shall be conducted for landfill leachate and condensate if pretreatment of these current discharges into the sanitary sewer is required. An evaluation of the requirement for pretreatment of landfill leachate and/or condensate shall be conducted (see Section 3.5.10.1) by the Settling Defendant and the Tacoma Sewer Utility. Pretreatment requirements shall be subject to review and approval by the Government Plaintiffs.

3.1.5 Draft Predesign Report

A Draft Predesign Study Report shall be prepared by the Settling Defendant which includes a description of hydrogeologic conditions and contaminant migration using the data collected during the Predesign Study and the data collected during the RI. The report shall also describe how the investigation has met the data requirements of site characterization for design, contaminant plume (including possible DNAPL) definition, and indicator parameter selection as identified in Section 3.1. The report shall present the results of the extraction system evaluation and the treatability studies and shall detail the work plans for the pilot extraction well investigation and any pilot treatment studies required. The pilot treatment study plan shall address laboratory and/or field scale tests designed to achieve the requirements listed in Section 3.2.2. The report shall be submitted to the Government Plaintiffs for review and approval. Government Plaintiffs' comments shall be incorporated into the Final Predesign Study Report (Section 3.2.4).

3.2 Pilot Studies

3.2.1 Pilot Extraction Well Investigation

Pilot Extraction wells shall be installed at the locations described in the Draft Predesign Study Report (upon approval of the Government Plaintiffs). The purpose of these wells is to provide additional aquifer characteristics for extraction well design. At a minimum, a 72 hour pump test shall be performed for each of the pilot test wells to determine aquifer characteristics for use in RD (Section 3.3). After the first pump test, the Settling Defendant may petition the Government Plaintiffs to reduce the duration of subsequent pump tests. Such revisions are subject to the approval of the Government Plaintiffs.

After approval by the Government Plaintiffs of the pilot investigation work plan (submitted as part of the Draft Predesign Report) the Settling Defendant shall submit a SAP for the pilot test well installations and testing. This plan shall include: the proposed pump test methodology; the location and number of wells to be monitored during the pump test; handling and disposal of extracted

water; the construction plans and specifications for the test wells; sampling, analysis, and QA/QC requirements for samples collected during the pumping tests; and the construction and testing schedule. At least one test monitoring well shall be located at least 100 feet away from pumping wells unless other spacing is approved by the Government Plaintiffs. Prior to discharge of pump test water, it shall be analyzed for indicator parameters, determined under Section 3.1.2.2 of this SOW, to determine an appropriate discharge location. Discharge of water contaminated above drinking water standards, health based criteria or Water Quality Criteria (WQC) for protection of fish (as listed in Table 4) to waters of the state, including the storm sewer, shall not be allowed. Discharge to the sanitary sewer shall be consistent with the City's pretreatment program and shall be subject to Government Plaintiff approval.

The SAP for the extraction system pilot study shall be prepared to meet the requirements of Section 1.2.4 of this SOW. The sampling and analysis plan shall be submitted after approval of the Draft Predesign Report.

3.2.2 Pilot Treatment Studies

A pilot study shall be conducted for the treatment method selected in the Draft Predesign Study Report. The pilot study shall also evaluate treatment of leachate and condensate currently discharging to the sanitary sewer, if pretreatment of these discharges is required (Section 3.1.4).

The pilot study shall be conducted to determine the following:

1) the suitability of the treatment method for treating the contaminated groundwater and its ability to meet performance standards described in Section 3.3.2;

2) the predicted effectiveness of the treatment system, its flexibility to treat changing influent levels, and the range of influent concentrations over which the system is effective;

3) the expected air emissions to allow the Government Plaintiffs to determine the need for air emissions treatment;

4) the need for pretreatment of groundwater prior to air stripping or carbon adsorption; and

5) the adaptability of the treatment system for pretreatment of leachate collected from the Central Area and condensate from the gas flares and collection lines.

Prior to conducting any bench scale or vendor tests, the Settling Defendant shall submit the proposed vendor qualifications to the Government Plaintiffs for review and approval. The Settling Defendant shall require vendors selected to conduct any treatability study to comply with the Quality Assurance Project Plan prepared under Section 1 2.3. If the Government Plaintiffs determine that it is necessary to conduct field studies using portable or temporary treatment facilities, the Settling Defendant shall submit a SAP for such studies, including sampling requirements for the influent, effluent, and air emissions monitoring, to be reviewed and approved by the Government Plaintiffs.

The SAP shall be prepared to meet the requirements described in Section 1.2.4 of this SOW.

3.2.3 Draft Pilot Studies Report

A Draft Pilot Studies Report shall be submitted to the Government Plaintiffs describing the findings of pilot extraction well investigations and the treatment studies. The report shall include the results and analysis of the pump tests, the results and analysis of the treatment study, the recommended treatment method, and a discussion of how this method fulfills the requirement of providing for all known, available and reasonable treatment to any substance proposed for discharge to waters of the state.

3.2.4 Final Predesign Report

The Final Predesign Report shall include all Government Plaintiff comments on the Draft Predesign Report, the Draft Pilot Studies Report, and any additional groundwater sampling results. The Settling Defendant shall submit the Final Predesign Report for approval within 30 days of receipt of the Government Plaintiffs' comments on the Draft Pilot Studies Report.

3.3 Design of Groundwater Extraction/Treatment System

3.3.1 Extraction/Treatment Requirements

3.3.1.1 Groundwater Extraction System

The groundwater extraction/treatment system(s) shall be designed to satisfy the extraction system performance criteria identified in Section 3.3.2.1 and shall be designed to control the plume and prevent the spread of contamination. The goal of the groundwater extraction system is to prevent any further degradation of existing water quality beyond the existing boundaries of the plume. For the purposes of design, further degradation is defined as the detection of synthetic organics or a statistically significant increase, over background, of heavy metals and leachate parameters which are emanating from the landfill. Statistical significance shall be determined using the approved methodology described in Section 3.3.1.3.

The system shall be placed within the plume(s) and at the downgradient edge, if necessary, to contain the plume(s). The design of the extraction system shall incorporate capture zone analysis to achieve overlapping cones of depression. Important considerations in placement of the extraction system shall include: concentrations and areal distributions of contaminants in the groundwater at the time of construction, aquifer thickness, hydraulic conductivity, and aquifer boundary conditions. The design shall estimate and account for the reduction in extraction volume due to effects of the landfill cap and how this volume may change over time.

3.3.1.2 Treatment System

The treatment system for the selected remedy as described in the ROD shall be designed to meet specific performance criteria appropriate to the point of discharge of the effluent as described in Section 3.3.2.3 and set forth in Table 4. The design shall be based on the full expected range of influent concentration and the range of treatment efficiency levels determined during the treatment pilot tests. The system must be flexible enough to treat changes in influent concentrations and volumes due to capping effects and to provide pretreatment of the collected leachate and condensate if pretreatment of these sources is required. The design shall incorporate all known, available, and reasonable methods of treatment.

3.3.1.3 Statistical Methods

The Settling Defendant shall submit a plan describing the proposed statistical method for evaluating performance of the extraction system. The method shall be one of the methods described in "Statistical Methods for Evaluating Ground-Water Monitoring Data from Hazardous Waste Facilities," published October 11, 1988 in the Federal Register or in the draft EPA document "Statistical Methods for Evaluating the Attainment of Superfund Cleanup Standards", December 1988. The method shall be used to determine when a statistically significant exceedance of an established performance criteria has occurred and to establish trends in ground water data. This plan shall be submitted to the Government Plaintiffs for review and approval.

3.3.2 Performance Criteria

3.3.2.1 Extraction System

The extraction system shall continue to operate until the water quality at and beyond the point of compliance (defined by WAC 173-304-100(58)), consistently meets drinking water standards, or previously established and approved health-based criteria, as listed in Table 3. Consistency with standards shall be determined using the approved method described in Section 3.3.1.3. The goal is to achieve this level of cleanup in ten years or less.

3.3.2.2 Early Warning Values

Performance of the extraction system will be evaluated based on drinking water standards or approved health based criteria. However, to protect downgradient well owners and the aquifer, the Settling Defendant shall submit a plan for Government Plaintiff review and approval to take effect whenever early warning values are exceeded, in either the private wells or extraction system performance wells. This plan shall specify the procedures to be followed in the event early warning values are exceeded. The plan shall outline the criteria and procedures under which the following actions would apply:

1) resampling well(s) to verify results;
2) increasing or modifying monitoring plan;
3) adjustments to extraction system;
4) providing for alternate water supply;
5) implementation of a trend analysis to determine the likelihood of exceeding a groundwater performance standard; and
6) no action (i.e., continuation of monitoring program and operation of extraction/treatment system).

Early warning values, designed to indicate changing conditions in the aquifer, are as follows:

a) detection level for synthetic organic compounds for which no natural source exists;

b) 20 percent of the primary drinking water standards for other than synthetic organic compounds or other health based criteria; and

c) 50 percent of the secondary drinking water standards or other aesthetic quality criteria.

If the indicator parameter is found in the background water quality, then the early warning value shall be set at a concentration between background and the performance standard. This value shall be reviewed and approved by the Government Plaintiffs before its use.

Exceedances of these early warning values shall be determined using the approved method described in Section 3.3.1.3. Detection limits shall be at least as low as drinking water standards or approved health-based criteria, or EPA CLP detection limits, whichever is lower. Limits shall be established for each of the indicator chemicals determined in Section 3.1.2.2.

The early warning values and reaction to them shall not apply until the groundwater extraction/treatment system has been installed and has completed the initial shakedown period described in Section 3.3.3.2.

In the event that early warning values are exceeded after the extraction/treatment system shakedown period, the Settling Defendant shall notify the Government Plaintiffs within 5 days of receipt of raw data. Within 15 days of receipt of quality assured data, the Settling Defendant shall submit a memorandum (for Government Plaintiffs review and approval) which identifies the actions (e.g., items 1 through 6 above) that shall be taken in response to these exceedances to ensure that performance standards are not exceeded.

3.3.2.3 Treatment System

Fresh and marine water discharge limits for certain organic constituents are listed in Table 4. The Settling Defendant shall develop sanitary sewer discharge limits for review and approval of the Government Plaintiffs. These requirements also apply to leachate from the Central Area and condensate from the gas collection system and flare.

3.3.2.3.1 Fresh Water Discharge

Discharge to fresh water (Leach or Flett Creeks) shall meet the maximum contaminant levels (MCL) developed pursuant to the Safe Drinking Water Act or meet the chronic fresh water criteria for protection of fish as set forth in EPA's Quality Criteria for Water, 1986, whichever is more stringent. If no MCL has been established, the ambient water quality criteria (WQC) for protection of human health for water and fish ingestion shall be used. For the instance where no WQC have been developed, the Settling Defendant shall use additional

guidance documents and Health Advisories to develop and propose an appropriate value. These values shall be reviewed and approved by the Government Plaintiffs. Discharge limits shall be developed for all indicator parameters (see Section 3.1.2.2). Any discharge from the treatment system to a storm sewer which discharges directly to a fresh water body, shall be considered a discharge to fresh waters of the state.

3.3.2.3.2 Marine Discharge

Discharge from the treatment system to a storm sewer which discharges directly to a marine water body, shall be considered a discharge to marine waters of the state. The limit for marine discharges shall be determined using the Chronic Marine Water Criteria set forth in EPA's Quality Criteria for Water, 1986. If such a criterion is not available for a particular contaminant of concern, the limit determined for discharge to a fresh water body shall apply, unless other discharge limits can be established from guidance documents or technical research as approved by the Government Plaintiffs. Discharge limits shall be developed for all indicator parameters.

3.3.2.3.3 Sanitary Sewer Discharge

Discharge of treated groundwater to the sanitary sewer shall satisfy applicable discharge requirements, shall be consistent with the Tacoma Pretreatment Program as revised for the operation of the new secondary sewage treatment plant, and with pretreatment discharge limits approved by the Government Plaintiffs. Discharge limits shall be developed for all selected indicator parameters.

3.3.3 Extraction/Treatment System Sampling and Analysis Plan

The Settling Defendant shall submit a SAP to evaluate performance of the extraction/treatment system(s) as described in Section 3.3.2. This plan shall meet the requirements as described in Section 1.2.4. This plan shall be submitted with the 90 percent extraction/treatment system design report described in Section 3.3.6.

The Settling Defendants shall amend the SAP to specify any additional sampling rounds of the monitoring wells (using the indicator parameters) during the RD phase that may be necessary to establish design concentrations for the treatment process or to monitor contaminant plume migration. Amendments to the SAP shall be reviewed and approved by the Government Plaintiffs.

3.3.3.1 Extraction System Sampling and Analysis Plan

The extraction system sampling and analysis plan shall include installation of performance monitoring wells to be located downgradient of the extraction well system(s). These performance wells shall be placed to assure the effectiveness of the extraction system. The number of performance wells required will depend upon the number of extraction wells needed, the distance over which the extraction wells extend, and the distance between the point of compliance and the extraction system. The number of downgradient performance wells shall not be less than the number of extraction wells plus one, unless a reduction in the number of performance wells is approved by the Government Plaintiffs.

The performance wells shall be monitored monthly for two years after startup and then quarterly thereafter for water levels and approved indicator parameters (see Section 3.1.2.2), in accordance with Section 7.7.3. The Settling Defendant may petition the Government Plaintiffs to reduce the frequency of sampling from monthly to quarterly in less than two years, if an adequate baseline of information has been developed.

3.3.3.2 Treatment System Sampling and Analysis Plan

This plan shall be designed to evaluate both the performance and the efficiency of the treatment system during both the shakedown period and for long term operation. Startup and the intial performance evaluation of the system (shakedown procedures) shall be completed within a four month period and shall, at a minimum, include monitoring of the influent to the treatment plant and the effluent from the plant on a twice weekly basis for four weeks,

followed by weekly sampling. The samples shall be analyzed for indicator parameters developed in Section 3.1.2.2 and sample analysis turnaround shall be 24 to 48 hours.

For an air stripping treatment facility, influent and effluent from the treatment unit shall initially be sampled for four different air to water ratios. For each air to water ratio, two samples of both influent and effluent will be collected, one during the warmest and the other during the coolest periods of the day. The results from this sampling activity shall be used to confirm or modify the system performance/operation curves developed during the pilot treatment study (Section 3.2.2) and the treatment system design (Section 3.3.1.2). After performance curves are developed sampling shall be conducted daily for 1 week to confirm system operation.

For a carbon treatment facility, influent and effluent samples shall be collected daily for two weeks, and on a twice weekly basis thereafter during the shakedown period. The influent and effluent shall also be sampled daily for one week after any changeout of carbon during the shakedown period.

When eight consecutive weekly samples all meet the discharge limits set forth in 3.3.2.3, the sampling frequency to evaluate performance of the system may be reduced to quarterly if approved by the Government Plaintiffs. The treatment system shall be operated and maintained to meet discharge limits. If a quarterly sample indicates a violation of the discharge limits, the Settling Defendant shall submit a plan to adjust the treatment system and shall simultaneously begin weekly sampling of the influent and effluent. Quarterly sampling may resume when the consenting Defendant has demonstrated to the Government Plaintiffs that the system is again in compliance with the stated discharge limits.

3.3.4 Preliminary Design (30 Percent Complete)

The Settling Defendant shall submit a preliminary design of the extraction/treatment system addressing 30 percent of the total design for

approval of the Government Plaintiffs. This submittal shall include a design report and preliminary plans and specifications. The design report shall include the following:

1) A design memorandum establishing design criteria and providing the information needed to design the project. The memorandum shall include complete detailed design criteria and standards for the extraction wells and the treatment plant equipment including sizes, capacities, loading rates, pumping rates, etc. The information shall be in sufficient detail to present the scope of the project clearly and to enable designers to proceed with subsequent design work;

2) a detailed description and evaluation of any models used to aid design;

3) preliminary design calculations for major equipment;

4) preliminary selection of major equipment items and potential suppliers;

5) sketches and schematics as required to illustrate and clarify the components of the extraction/treatment system, including preliminary site layout, preliminary hydraulic profile, process schematics, piping schematics, and chemical feed schematics; and

6) a discussion of how performance requirements, including ARARs have been incorporated into the design.

The plans and specifications shall reflect the same percentage of completion as the designs they support. A detailed outline of construction specifications shall also be included.

3.3.4.1 Long-lead Task Identification

Any long-lead items, such as off-site access for drilling, selection of an off-site RCRA facility for disposal of spent carbon or other hazardous wastes, or

key treatment plant process components, shall be determined at the 30 percent design phase of the process and a critical path schedule developed. The Settling Defendant shall be responsible for obtaining access agreements.

3.3.4.2 Preliminary Construction Schedule and Cost Estimate

A preliminary construction schedule shall be prepared to include drilling, well installation and development, and acquisition of major treatment process components. The preliminary cost estimate developed for the 30 percent submittal shall be of +40 to -20 percent accuracy and shall include equipment and construction costs.

3.3.5 Intermediate Design (60 Percent Complete)

A 60 percent submittal shall be prepared for the Government Plaintiffs, incorporating comments made on the previous submittal and shall include all of the same elements. This submittal shall include construction drawings for the extraction/treatment system and all ancillary facilities.

3.3.6 Prefinal/Final Design

A 90 percent submittal shall be prepared for review of the Government Plaintiffs, incorporating any comments on the 60% design. The plans and specifications shall provide sufficient detail such that all labor, materials, tools, and equipment necessary for the proper execution of the contract will be clearly apparent to the bidders. The final engineer's cost estimate shall be based on prefinal drawings and specifications of 90 percent completion. The accuracy shall be within a +15 to -10 percent range. This estimate shall evaluate the costs of construction and equipment for the complete facility.

After approval of this prefinal design by the Government Plaintiffs, a 100 percent complete document shall be submitted that contains the final plans and specifications for the review and approval of the Government Plaintiffs.

3.4 Design and Installation of the Landfill Cap

3.4.1 Landfill Cap Requirements

The landfill cap shall be designed to minimize infiltration and maximize and control run-off from the landfill. The landfill cap installed shall be selected by the Settling Defendant from one of the basic designs set forth below:

1) a) sufficient topsoil to provide frost protection and vegetative layer, 24 inch minimum;

   b) drainage layer of granular material, depth and slope designed to accommodate flows determined from the HELP model or other hydrological analysis, 12 inch minimum unless analysis shows a greater depth is needed. Geosynthetic drainage products will be considered as suitable replacements for the sand drainage layer. Final selection approval by the Government Plaintiffs is required;

   c) geosynthetic membrane of material compatible with landfill gas condensate, 50 mil minimum;

   d) additional drainage layer as specified above in (b);

   e) additional geosynthetic membrane as specified above in (c);

   f) bedding soil with gradation and degree of angularity approved by the Government Plaintiffs, 12 inch minimum; or

2) a) sufficient topsoil to provide frost protection and vegetative layer, 24 inch minimum;

   b) drainage layer of granular material, depth and slope designed to accommodate flows determined from the HELP model or other hydrological analysis, 12 inch minimum unless analysis shows a greater depth is needed. Geosynthetic drainage products will be considered as suitable replacements for the sand drainage layer. Final selection approval by the Government Plaintiffs is required;

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c) geosynthetic membrane of material compatible with landfill gas condensate, 60 mil minimum; and

d) 24 inches of soil compacted to a saturated hydraulic conductivity of not more than $1x10^{-5}$cm/sec, with the top six inches a finely-graded $1x10^{-5}$ layer;

A pilot study to evaluate the utilization of stabilized sludge, as a component of the topsoil requirement of the selected alternative, may be initiated by the Settling Defendant. Application of this product shall be subject to Government Plaintiff approval.

3.4.2 Final Grading and Landfill Cap Installation

Final grading and the landfill cap shall be constructed in three stages as identified below:

1) Stage 1, 1990 construction season - the northeast and southern sections of the landfill and the Receiving Facility cap;

2) Stage 2, 1991 construction season - the western section of the landfill and the section east of the Central Area; and

3) Stage 3, not later than one year after closure - the Central Area, as required by Section 3.4.2.1.

These areas are generally depicted in Figure 2.

The landfill cap design criteria shall be presented for the entire landfill cap in the design report submitted as part of the 30 percent submittal for the Stage 1 cap design. For the Stage 2 and 3 designs, design review packages shall be submitted at the 60 percent complete and the prefinal/final phases.

Increased run-off due to the construction of the cap shall be routed off the landfill to reduce infiltration. The run-off collected from the landfill shall be directed to the appropriate storm or sanitary sewers, consistent with local storm drainage ordinances or pretreatment regulations.

3.4.2.1 Landfill Closure

Final closure of the landfill shall occur no later than ten years after the effective date of the Consent Decree. The Government Plaintiffs may provide, after providing notice and opportunity for public comment, extensions of this deadline of up to a combined 15 years in increments of no longer than 5 years if the Settling Defendant demonstrates to the satisfaction of the Government Plaintiffs all of the following:

1) that the continued operation of the landfill shall not result in a release or substantial threat of release of hazardous substances, pollutants or contaminants to the environment;

2) that performance standards for the extraction/treatment system have been achieved;

3) that since the effective date of the Consent Decree, the Settling Defendant has instituted and is operating an aggressive solid waste recycling and hazardous materials collection program; and

4) that other feasible solid waste management alternatives to disposal at the landfill do not exist.

A closure plan shall be submitted as part of the Operations and Closure Plan required in Section 3.5.1 for Government Plaintiff review and approval. This plan shall include:

1) a fill plan with fill sequence and fill location;

2) partial closure plan;

3) interim cover requirements for completed areas; and

4) waste receipt restrictions (prohibit liquid waste and slurries).

Notwithstanding the foregoing, the Settling Defendant shall bring such areas to final grade and install the landfill cap on a schedule established by the Government Plaintiffs if the Government Plaintiffs determine that such action is necessary to adequately protect human health or the environment.

3.4.3 Preliminary Design (30 Percent Complete)

The Settling Defendant shall submit a preliminary design of the landfill cap addressing not less than 30 percent of the total design. This submittal shall include a design report and preliminary plans and specifications for review and approval of the Government Plaintiffs. The design report shall include the following:

1) design data and criteria;

2) a detailed description and evaluation of any models used to aid the design;

3) preliminary data from borrow sources and design calculations for soil needs;

4) detailed plans to assure that ongoing landfilling operations do not interfere with the construction or performance of the cap;

5) relevant design standards to be used in the final design;

6) a description of phased closure of the landfill;

7) a surface water management plan (Section 3.4.3.1); and

8) a discussion of how all ARARs have been incorporated into the design.

The plans and specifications shall reflect the same percentage of completion as the design they support. A detailed outline of the construction specifications shall be included.

3.4.3.1 Surface Water Management Plan

The Settling Defendant shall prepare a plan for control and management of surface water runoff as defined in WAC 173.304.100(67). This plan shall include the following elements:

1) a description of the existing drainage basin, including any sub-basins present;

2) a discussion of existing storm water management practices and any regulations which apply;

3) detailed calculations of flow and velocity in the drainage channels;

4) calculations for the 25 year/24 hour storm event;

5) a description of needed detention, if any, to comply with City of Tacoma storm drainage ordinances;

6) a description of needed storm water improvements outside the boundaries of the landfill to implement this SOW, including discharge location. Plans and specifications for these improvements shall be submitted with the prefinal (90 percent) design along with a schedule for construction.

3.4.3.2 Long-lead Task Identification

Any long-lead items, shall be determined as part of the 30 percent design and a critical path schedule developed.

3.4.3.3 Preliminary Construction Schedule and Cost Estimate

A preliminary construction schedule shall be prepared addressing: 1) the unlined areas of the landfill, and 2) the lined Central Area. A preliminary cost estimate developed for the 30 percent submittal shall be of +40 to -20 percent accuracy and shall show equipment, labor, and construction costs.

3.4.4 Intermediate Design (60 Percent Complete)

A 60 percent submittal shall be prepared for the Government Plaintiffs, incorporating comments made on the previous submittal and shall include all of the same elements. This submittal shall include construction drawings for the cap and all ancillary facilities.

3.4.5 Prefinal/Final Design

A 90 percent submittal shall be prepared for review and approval of the Government Plaintiffs, incorporating any comments on the 60% design. The plans and specifications shall provide sufficient detail such that all labor, materials, tools, and equipment necessary for the proper execution of the contract will be clearly apparent to the bidders. The final engineer's cost estimate shall be based on prefinal drawings and specifications of 90 percent completion. The accuracy shall be within a +15 to -10 percent range. This estimate shall evaluate the costs of construction and equipment for the complete facility.

After approval of this prefinal design by the Government Plaintiffs, a 100 percent complete document shall be submitted which contains the final plans and specifications for the review and approval of the Government Plaintiffs.

3.5 Design Support Activities

3.5.1 Operations and Closure Plan

The Settling Defendant shall follow the Interim Operations and Maintenance Plan (September 1988), as amended in the March 17, 1989 memorandum responding to the Washington Department of Ecology and the Tacoma Pierce County Health Department comments on the draft plan, until the RD is finalized. The plan as amended meets the Minimum Functional Standards operating requirements (WAC 173-304-460). Sections of the plan shall be amended during the RD and RA, as required by the Government Plaintiffs to reflect new information or changes in landfill operations.

The Interim Operation and Maintenance Plan shall be revised to satisfy requirements of the Consent Decree and the SOW, and shall be submitted for approval within 60 days of Government Plaintiff approval of all remedial designs. The landfill cap and surface water management plan, the extraction/treatment system design and operating plan, the landfill cap operation and maintenance plan, the ground water monitoring plan, the plan for management of hazardous substances and liquids, and the gas system monitoring plan (including both on and off-site monitoring) shall all be incorporated into the Operations and Closure Plan as part of the Final Operations and Closure Plan. The final plan shall be subject to review and approval by the Government Plaintiffs.

3.5.2 Disposal of Hazardous Substances and Liquids

The Settling Defendant shall develop a plan to prevent disposal of liquids and hazardous substances, including those disposed of by small quantity generators, at the landfill. This plan shall be developed in consultation with the Tacoma-Pierce County Health Department. The plan shall include programs such as recycling and hazardous materials collection to minimize the amount of hazardous substances placed in the landfill from generators such as households, business, industry, and others. This plan shall be submitted to the Government Plaintiffs for review and approval within 180 days of lodging of this Consent Decree and programs shall be in effect no later than 18 months after lodging of this Consent Decree. Disposal of any hazardous waste (including dangerous or extremely hazardous waste) regulated under Federal, State, or local laws in the landfill is prohibited.

3.5.3 Expansion of the Central Area

Construction of the liner, installed in 1987 in the Central Area, shall be documented through a construction documentation report. Slope liners over refuse require a variance to the Minimum Functional Standards. If the Tacoma Pierce County Health Department grants such a variance, construction and future expansion of the Central Area shall be consistent with the following requirements:

1) the slope of the liner over refuse, shall be no less than 5:1 (horizontal:vertical) with the exception of the benched area which provides connection to the Phase I liner, and no greater than 3:1, the length of the additional liner over refuse shall be no greater than 300 feet;

2) a Government Plaintiff approved gas control system shall be installed to prevent buildup of gas on the base of the liner;

3) the side slope liner over existing refuse from bottom to top shall be:

   a) 24 inches minimum of compacted native soil;
   b) structural geotextile (geogrid);
   c) 12 inches of sand (for use as liner bedding and gas collection layer;
   d) 60 mil geomembrane;
   e) drainage layer consisting of geonet covered by a filter fabric;
   f) 12 inches minimum of protective soil

4) develop and implement an inspection and maintenance program for the leachate collection system to ensure the system continues functions as designed and to prevent clogging of the leachate collection pipe.

Plans and specifications for expansion of the Central Area shall be submitted for review and approval of the Government Plaintiffs.

3.5.4 Landfill Gas Sampling and Analysis Plan

The Settling Defendant shall submit a SAP, meeting the requirements described in Section 1.2.4, to assess landfill gas migration and to assure that ongoing landfill activities and the remedial action, particularly the landfill cap, do not result in increased migration of landfill gas to areas outside the landfill

boundaries. The plan shall provide for additional gas probes that shall be located in the following areas and as shown on Figure 3, and shall determine whether or not significant concentrations of gas are in the soil:

1) Eighteen probes shall be installed in the areas near the east side apartments complexes, Mason Loop, and Tyler Street. Twelve probes shall be approximately 15 feet deep and six probes shall extend to the water table. These new probes shall be used in conjunction with seven multi-depth probes installed in the spring of 1988.

2) One probe, extending to the water table, shall be installed along the Mullen Street access road. This new probe shall be used in conjunction with four multi-depth probes installed in the spring of 1988.

3) Fifteen probes shall be installed on the west side of the landfill in areas along Orchard Street extending towards the Pipe Company and the nursing home. Nine of these probes shall be approximately 15 feet deep. Six of these probes shall extend to the water table.

4) Six probes shall be installed in the area of 48th Street, south of the landfill. Five of these probes shall be approximately 15 feet deep. One probe shall extend to the water table. These new probes shall be used in conjunction with seven multi-depth probes installed in the spring of 1988.

These probes shall be monitored daily for 30 days after installation. If no significant gas concentrations are found in the soil, the probes shall be monitored weekly and on all days when the barometer reading recorded in the morning is below 29.8 inches of mercury. Significant concentrations of gas are defined in the Minimum Functional Standards as levels exceeding the lower explosive limit (LEL) of methane.

When each section of the landfill cap is installed, the probes outside the landfill boundaries in that area shall be monitored three times per week. If significant concentrations of gas are found in a probe outside the landfill boundaries, that probe shall be monitored on a daily basis until the readings are consistently below the LEL for 30 days. At that time, weekly monitoring shall resume. Landfill gas monitoring shall continue for at least 30 years or until it can be demonstrated to the satisfaction of the Government Plaintiffs that the landfill is no longer generating gas above the LEL.

3.5.5 Landfill Gas Monitoring Evaluation Reports

The following Landfill Gas Monitoring Evaluation Reports shall be submitted to the Government Plaintiffs for review and approval:

1) Gas System Evaluation Report - A report shall be submitted to the Government Plaintiffs summarizing and analyzing the data from the first 60 days of monitoring after installation of the new probes located outside the landfill boundaries. This report shall also include a discussion and evaluation of all gas monitoring data to date.

2) Biannual Landfill Gas Control System Status Reports - These biannual reports shall summarize the gas data and discuss the performance of the landfill gas control system during the previous six months.

3) Landfill Cap Installation Report - A report shall be submitted to the Government Plaintiffs after each section of the landfill cap is installed, summarizing the data obtained from monitoring probe installations and analyzing any changing trends or characteristics of landfill gas migration. These reports shall be submitted within 60 days of the completion of each phase of the landfill cap.

3.5.6 Landfill Gas Management Plan

The landfill Gas Management Plan in the Interim Operations and Maintenance Plan shall be subject to review and approval by the Government Plaintiffs, and amended as required. The Settling Defendant shall ensure that

the plan covers all aspects of operating and maintaining the landfill gas control system. This includes procedures for day to day operations, monitoring procedures, field adjustment procedures, and procedures to be followed if significant concentrations of landfill gas are detected in soils outside the landfill boundaries. A revised Monitoring Program shall be included with the plan.

The extraction system shall be adjusted to prevent significant concentrations of landfill gas from building up in these soils. Adjustment procedures shall include system inspections, increased pumping rates, and installation of additional extraction wells. Whenever one or more gas probes outside the landfill boundaries have soil gas concentrations exceeding the LEL, monitoring of the affected probe shall be daily until the appropriate adjustment procedures have been implemented and the readings are consistently below the LEL for 30 days. If the probes indicate that the adjustment procedures are not controlling gas migration, additional probes may be required by the Government Plaintiffs to determine the extent of migration. The Settling Defendant may petition the Government Plaintiffs to reduce the frequency of sampling if an adequate baseline of information has been developed to demonstrate significant concentrations of gas are not found in soils outside the landfill boundaries.

3.5.7 Utilities Management Plan

A plan shall be submitted, for review and approval of the Government Plaintiffs, for maintenance of the cap integrity in areas where buried and above ground utility lines cross the site. This includes storm and sanitary sewers, water lines, power lines, and telephone lines. Repairs to such lines and sewers shall not cause leakage in the cap. In developing this plan the Settling Defendant shall consult with all affected agencies and companies maintaining rights of way or easements on landfill property and shall determine, for water lines, a schedule for periodic leak detection testing. A contingency plan shall be included in the Utilities Management Plan for the sanitary sewer in the event of collapse or clogging.

3.5.8 Expansion of On-site Facilities

Preliminary plans for the construction of the Public Receiving Facility expansion call for paving of areas containing waste. Waste shall be removed from these areas, for this and any other similar project, prior to paving. However, if waste must be left in place a plan for capping over waste shall be submitted to the Government Plaintiffs for review and approval. Designs for over waste capping shall be compatible with and no less permeable than the cap proposed for the remainder of the site.

3.5.9 Surface Water Sampling and Analysis Plan

The Settling Defendant shall submit a SAP for Leach Creek which meets the requirements described in Section 1.2.4 of this SOW. Base flow in Leach Creek shall be determined using historical records. The Settling Defendant shall establish stream flow gage stations on Leach Creek sufficient to verify stream base flows and the impact of the extraction system on flows in the creek. The Settling Defendant may petition the Government Plaintiffs to discontinue flow measurement if they can demonstrate that the extraction system does not impact base flow in Leach Creek.

Water quality samples shall be collected from at least three locations in Leach Creek (to be identified in the SAP), one to establish background concentrations. Monitoring shall take place upstream and downstream from any point of discharge. If there is no direct discharge to Leach Creek, samples shall be collected from a location near the source and at a location considered likely to intercept contaminated groundwater. At a minimum, surface water samples shall be collected quarterly and analyzed for target compound list volatile organics, heavy metals, and leachate parameters for one year after the extraction system is operational. Sampling frequency shall then be twice annually until one year after the system is shut down. The Settling Defendant may petition the Government Plaintiffs to reduce the required analyses to indicator parameters based on the monitoring data obtained in the predesign study.

Water quality samples of surface runoff shall be collected annually at points where runoff enter the storm sewer system until one year after the landfill is capped. The samples shall be analyzed for indicator parameters (Section 3.1.2.2).

3.5.10 Leachate and Condensate Management

3.5.10.1 Leachate and Condensate Sampling and Analysis Plan

The Settling Defendant shall submit a SAP to evaluate the quantity and quality of condensate from the gas collection system and leachate from the leachate collection system in the Central Area. The plan shall meet the requirements described in Section 1.2.4 of this SOW.

Samples shall be taken from four selected condensate traps currently draining into the landfill and from each separate input currently draining into the sanitary sewer via the leachate collection manhole at the north end of the Central Area. At least two samples shall be collected from each source discharging into the sanitary sewer and analyzed for target compound list substances. These samples shall be collected starting with the predesign study period. If either the leachate or the condensate exceeds Government Plaintiff approved discharge standards for the sanitary sewer it shall be collected and treated before discharge. Discharge limits shall be consistent with discharge location as described in Section 3.3.2.3.

3.5.10.2 Leachate and Condensate Management Plan

Based on the information collected under Section 3.5.10.1, the Settling Defendant shall submit a plan to manage the condensate and leachate being produced. This plan shall address pretreatment needs for the management options developed. If pretreatment is required, it shall be developed as part of the design process outlined in Section 3.3.1.2.

3.5.11 Air Emissions Management

3.5.11.1 Air Emissions Management Plan

Air emissions from all treatment facilities shall comply with all federal, state, and local air emissions regulations. Design requirements to satisfy air emissions regulations shall be developed as part of the treatment system design described in Section 3.3 of this SOW.

3.5.11.2 Air Emissions Sampling and Analysis Plan

The Settling Defendant shall submit a SAP which shall meet the requirements described in Section 1.2.4. to monitor air emissions from the gas flare and from the air stripper if it is part of the final treatment design. Air samples shall be analyzed for toxic air pollutants as defined by the New Source Review Guidelines for Toxic Air Contaminants (1988 and as revised).

4.0 ALTERNATE WATER SUPPLY

The Settling Defendant shall continue to monitor nearby public and private water supply wells to protect public health. All water supply wells within the plume, as defined by groundwater data obtained in the RI/FS and the predesign study, shall be monitored quarterly. The Fircrest wells shall be monitored monthly until monitoring wells MW5A and C are installed and operating (Section 3.1.1.3). At a minimum these wells shall be sampled for groundwater indicator parameters as described in Section 3.1.2.2.

If early warning values, as determined in Section 3.3.2.2, are exceeded in any well, that well shall be placed on a monthly monitoring program until the cleanup is completed and the extraction/treatment system has been shut off, or until monthly samples show a decreasing trend in contamination and are less than early warning values, or alternate water has been supplied (Section 2.2).

If, based on monthly sampling, an increasing trend is found in any well such that the Government Plaintiffs determine a drinking water standard or health based criteria may be exceeded, the Settling Defendant shall provide an alternate water supply. Any well which exceeds a primary drinking water standard or an approved health based criteria (see Table 3) shall be immediately taken out of service and replaced with an alternate water supply as per the requirements of Section 2.2 of this SOW. If alternate water has been provided, monthly monitoring of the contaminated well may cease; however, the Government Plaintiffs may require periodic monitoring of such wells as part of routine monitoring practices.

The Settling Defendant shall provide an alternate water supply, as described in Section 2.0, in the event that operation of the extraction system adversely impacts the yield of existing supply wells in use prior to the date of entry of this Consent Decree. Adverse impact is defined as a reduction in water supply to levels below the discharge rate and total allowable annual volume defined by a valid water right, filed with the State of Washington,

with a priority date prior to the date of entry of this Consent Decree. If a water right has not been granted for a domestic well, adverse impact is defined as reduction below the capacity of the well.

5.0 INSTITUTIONAL CONTROLS

The Settling Defendant shall submit for Government Plaintiff review and approval a plan for institutional or other controls to restrict drilling of water supply wells in an area from Tyler Street to Leach Creek, and from Center Street to South 56th Street, and other areas identified by the Government Plaintiffs in the event that further monitoring shows the plume to have migrated beyond these limits or if additional water use could adversely affect the performance of the extraction system.

6.0 REMEDIAL DESIGN PROJECT COMPLETION AND CLOSEOUT

The remedial design project completion shall occur when the design package has been completed, all comments have been incorporated, and approval of the Government Plaintiffs has been obtained.

7.0 TASKS FOR REMEDIAL ACTION

7.1 Project Planning

The Settling Defendant shall prepare a plan describing efforts related to the initiation of engineering services and management during construction. The major subtasks include finalization of the preliminary RA work plan (see Section 1.2.1.2) and development of a construction management plan. The project plan shall address efforts related to the procurement of a construction contract. The plan shall detail how procurement shall be achieved to avoid construction delays. This includes issuing requests for qualifications, requests for proposals, bid analysis, and contract award. This task also includes application of managerial and decision making techniques during construction. The pre-construction planning and review, project control, contract management, QA/QC, facility start-up and construction closeout, and other techniques used to manage the remedial action activities shall be specified.

7.2 Site Safety Plan

The Settling Defendant shall be responsible for ensuring that the construction contractors prepare a site health and safety plan for the review of the Government Plaintiffs. The plan shall comply with OSHA, WISHA, and other requirements, to cover the workers participating in the remedial action phase and to protect the surrounding community.

7.3 Remedial Action Construction Program Plan

A quality assurance project plan shall be prepared covering the RA phase of the project. This document shall provide the quality requirements needed to assure that upon completion of the remedial action, the requirements of the ROD, the remedial design, and the SOW shall have been met. This document shall be prepared consistent with the Quality Assurance Project Plan submitted for the Remedial Design phase (Section 1.2.3 of this SOW) and other guidance documents.

7.4 Construction Inspections

The Settling Defendant shall provide support services for the implementation of the Quality Assurance Project Plan for the remedial action. These services include field testing, sample analysis, inspection of field logs and diaries, inspection of work for compliance with contract documents, all monitoring work, and monthly site progress reports. A construction documentation report, including "As-Built" drawings, shall be prepared and submitted for the approval of the Government Plaintiffs within two months of completion of each phase of construction.

7.5 Sampling and Analysis Plan/Cleanup Validation

The Settling Defendant shall develop a plan to acquire specific field samples and other information needed during the operational period of the remedial action, to assure compliance with the consent decree and to assure performance of the system. This plan shall also include analysis and validation of the sampling results. The plan shall describe the specific monitoring wells located upgradient from the extraction system(s) which shall be used to evaluate the level of contamination within the existing plume. These wells shall be sampled quarterly for indicator parameters described in Section 3.1.2.2 until shutoff procedures are implemented (Section 7.7.3). The plan shall be submitted to the Government Plaintiffs for review and approval.

7.6 Remedial Action Implementation

The Settling Defendant shall fully implement all work required in the RA work plans, subject to Government Plaintiff review, inspection, and approval. RA implementation represents the majority of effort and cost for the RD/RA project. This task is the actual construction of the various elements of the approved remedial design.

7.7 Operation and Maintenance Plan

7.7.1 Landfill Cap

An inspection and maintenance plan, subject to review and approval by the

Government Plaintiffs, shall be developed for the landfill cap. Areas where settlement occurs shall be repaired. Any cracks that develop shall be repaired. The plan shall also include provision for correction of localized subsidence, surface ponding, surface erosion and runoff, detail the frequency of inspection, corrective action response times, personnel needs, and reporting requirements. This plan shall be implemented upon the completion of the first stage of the landfill cap and shall continue for a minimum 30 year period after issuance of the certificate of completion or site closure, whichever is later.

7.7.2 Extraction/Treatment System/Gas Extraction System

An operation and maintenance plan for the extraction/treatment system and the gas extraction system shall be developed to address normal operation, potential operating problems, alternate O&M procedures should systems fail, routine monitoring and laboratory testing, safety requirements, a description of necessary equipment, necessary personnel, budget, and reporting requirements. The plan shall include shakedown procedures and long term operation and maintenance requirements as well as equipment startup and operator training procedures. The plan shall include procedures referenced in Section 3.1.2.2, Early Warning Values, in the event that the system does not contain the plume and early warning values are exceeded downgradient. The plan shall also include treatment system adjustment procedures should the system fail to meet the performance criteria set forth in this SOW. Such adjustment procedures shall be dependent upon the treatment method selected, and may include addition of treatment units, adjustment of the flow rate, or addition of pretreatment units.

Similar procedures shall be developed for the gas extraction system should the data from probes outside the landfill boundaries determine that the existing system is not controlling the migration of gas. Such procedures may include adjustment of the pumping rate or installation of more extraction wells (see Section 3.5.6).

7.7.3 Shut-Off Procedures

The extraction/treatment system shall be shut off only when the groundwater at the point of compliance and within the existing plume has reached the drinking water standards or health based criteria as specified in Table 3 for four consecutive quarterly samples. The goal is to achieve this level of cleanup within 10 years of operation of the system. When the Settling Defendant believes that this requirement has been met, they shall petition the Government Plaintiffs to shut down the extraction/treatment system. After Government Plaintiff approval, the system may be shut down, and the performance monitoring wells (as described in Section 8.0 of this SOW) shall be monitored quarterly for a period of five years or until completion of all landfill cap requirements, whichever is longer. Monitoring shall, at a minimum, consist of indicator parameters defined in Section 3.1.2.2.

If any of these wells exceed the drinking water standards or health based criteria during this monitoring period, the extraction/treatment system shall be restarted until the groundwater again meets standards for four consecutive quarters. If any of the performance wells exceed the early warning values set out in Section 3.1.2.2 during this period, the Settling Defendant shall submit a plan to evaluate what actions (if any) are necessary. The Settling Defendant shall again petition the Government Plaintiffs and demonstrate that these requirements have been met. The Settling Defendant may apply for certification of completion only after the Government Plaintiffs agree that the groundwater quality has been maintained for an entire five year period after completion of landfill cap requirements.

7.8 Project Completion and Closeout

The major elements of this task include consolidation of the project records, final inspection and closeout as described in Section XXXII of the Consent Decree.

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8.0 POST REMEDIAL CARE

8.1 Groundwater Monitoring

Notwithstanding the application of the Settling Defendant for a certificate of completion or issuance by the Government Plaintiffs, additional groundwater monitoring wells may be required to establish compliance with the performance requirements set forth in Sections 3.3.2 and 7.7.3 of this SOW. The Settling Defendant shall submit a plan for installation and monitoring of these performance wells to be installed between the compliance boundary and the extraction system(s). Monitoring shall be quarterly in accordance with Section 7.7.3 of this SOW, and biannually for the subsequent 30 years following issuance of certificate of completion.

8.2 Five Year CERCLA Review

The Settling Defendant shall provide technical support in cooperation with the Government Plaintiffs, to fulfill the 5 year review requirements of CERCLA.

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9.0 PROJECT MANAGEMENT

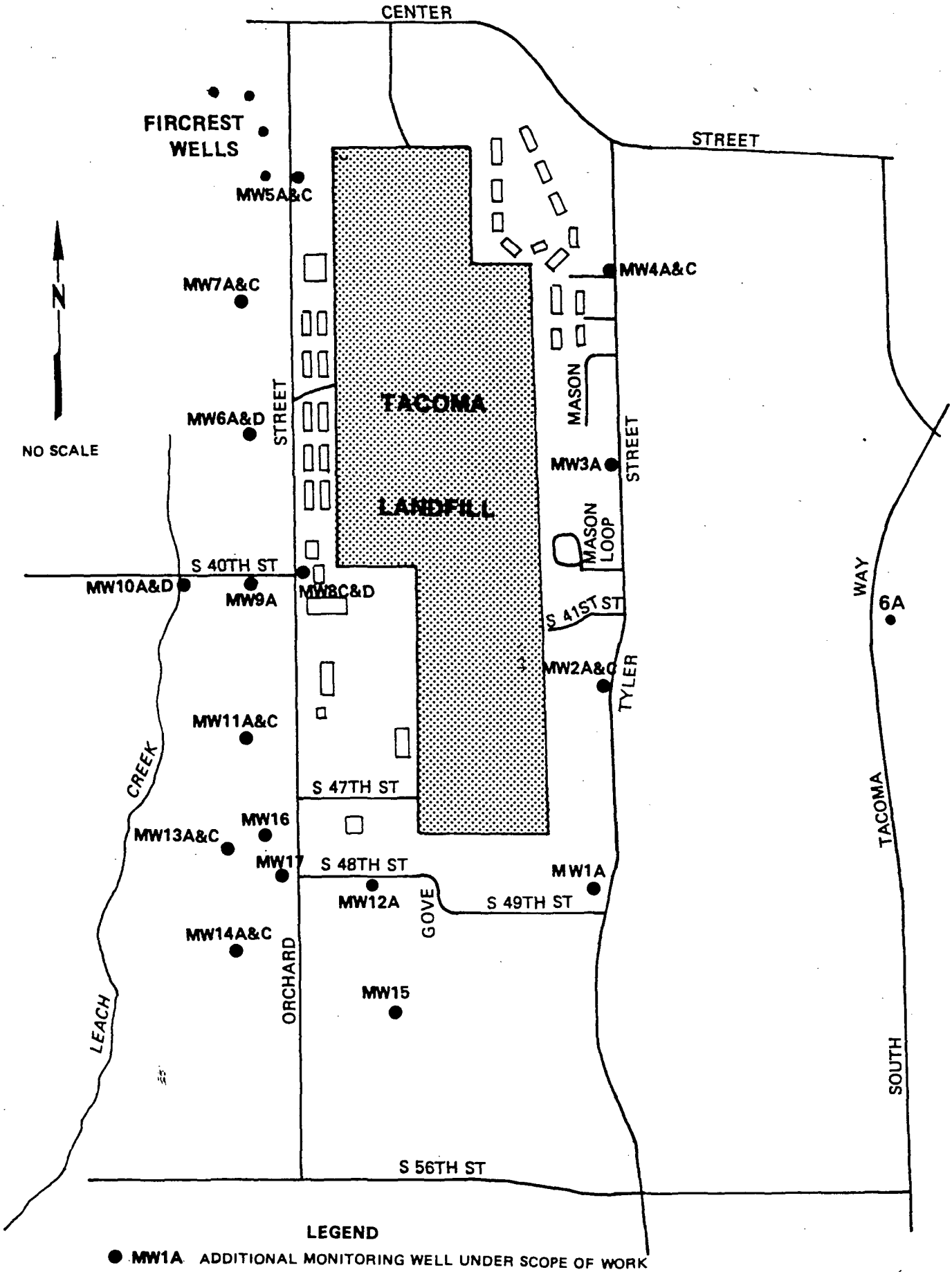
9.1 Schedule of Work

The Settling Defendant shall develop a work schedule for management tracking of the RD/RA for the review and approval of the Government Plaintiffs. The Settling Defendant shall provide deliverable dates for each deliverable specified in this SOW and indicate the durations and interactions between tasks. The schedule shall identify the requirements for reviews and approvals by the Government Plaintiffs. Deliverable items and required submittal dates which have already been established by this Consent Decree and the SOW, are shown in Table 5. The remaining deliverables and dates shall be identified in the project management plan (Section 1.2.1). The project management plan shall also propose dates for the RA activities. Final dates for the RA activities shall be included in the remedial action work plan (Section 7.1). Unless otherwise specified, final deliverables shall be submitted to the Government Plaintiffs within 30 days of receipt of Government Plaintiff directions for changes to draft deliverables.

FIGURE 1

PREDESIGN STUDY MONITORING WELLS

CITY CLERK CONTRACT/AGREEMENT NO. 4060



CITY CLERK CONTRACT/AGREEMENT NO. 40660

TABLE 1

PREDESIGN STUDY MONITORING WELLS

Well	Approximate Depth (feet)	Targeted Geologic Unit	Purpose of Well
MW-1A	100	Q_c Water table)	Water quality monitoring in area potentially impacted by gradient reversal
MW-2A and C (Boring depth)	100 150 170	Q_c (Water table) Q_{og}(Tacoma Production Zone) Q_{ol} (Aquitard Surface)	Water quality monitoring in area potentially impacted by gradient reversals during summer months. Boring will be advanced to locate the top of Q_{ol}.
MW-3A	100	Q_c (Water table)	Water quality monitoring in area potentially impacted by gradient reversal
MW-4A and C (Boring depth)	100 140 170	Q_c (Water table) Q_{og}(Tacoma Production Zone) Q_{ol} (Aquitard Surface)	Water quality monitoring in area potentially impacted by gradient reversal. Boring will be advanced to establish top surface of Q_{ol}.
MW-5A and C	90 150	Q_c (Water table) Q_{og} (Fircrest Production Zone)	Early warning for Fircrest production wells.
MW-6A and D	40 150	Q_c or Q_{og} (Water table) Q_{os} (Zone above Aquitard)	Water quality monitoring downgradient of the landfill and DNAPL investigation.
MW-7A and C	60 130	Q_c or Q_{og} (Water table) Q_{og} (Fircrest Production Zone, on top of Q_{ot})	Water quality monitoring downgradient of the landfill. Additional monitoring near Fircrest wells.
MW-8C and D	130 170	Q_{og}(High Permeability Zone) Q_{os}(Zone above Aquitard)	Define vertical dimensions of plume and DNAPL investigation.

TABLE 1 (continued)

CITY CLERK CONTRACT/AGREEMENT NO. 40

Well	Approximate Depth (feet)	Targeted Geologic Unit	Purpose of Well
MW-9A	10	Q_c (Water table)	Water quality monitoring downgradient of landfill and definition of plume boundary.
MW-10A and D	30 90	Q_c or Q_{og} (Water table) Q_{os} (Zone above Aquitard)	Confirm Leach Creek as discharge zone and water quality monitoring downgradient of landfill.
MW-11A and C	40 80	Q_c (Water table) Q_{og} (Private Well Production Zone)	Water quality monitoring downgradient of landfill and current plume, and definition of plume boundary.
MW-12A	120	Q_c (Water table)	Water quality monitoring downgradient of landfill and definition of plume boundary.
(MW-15		Existing Well	Confirm screened zone, water level measurement.
MW-16		Existing Well	Confirm screened zone, water level measurement.
MW-17)		Existing Well	Confirm screened zone, water level measurement.
MW-13A and C	30 60	Q_c (Water table) Q_{og}(Private well production)	Water quality monitoring downgradient of landfill and current plume, definition of plume.
MW-14A and C	60 80	Q_c (Water table) or Q_{og} (Private well production)	Water quality monitoring downgradient of landfill and current plume, definition of plume.

Notes:

1. Single completion water table monitoring wells (MW-1A, MW-3A, MW-12A) will be drilled by air rotary methods. All other wells will be drilled using hollow stem auger or cable tool drilling methods.

2. Locations are approximate, actual locations dependant on drill rig and property access.

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 2

TARGET COMPOUND LIST

ORGANIC COMPOUNDS

VOLATILE COMPOUNDS

1. Chloromethane
2. Bromomethane
3. Vinyl Chloride
4. Chloroethane
5. Methylene Chloride
6. Acetone
7. Carbon Disulfide
8. 1,1-Dichloroethene
9. 1,1-Dichloroethane
10. trans-1,2-Dichloroethane
11. Chloroform
12. 1,2-Dichloroethane
13. 2-Butanone
14. 1,1,1-Trichloroethane
15. Carbon tetrachloride
16. Vinyl Acetate
17. Bromodichloromethane
18. 1,2-Dichloropropane
19. cis-1,3-Dichloropropene
20. Trichloroethane
21. Dibromochloromethane
22. 1,1,2-Trichloroethane
23. Benzene
24. trans-1,3-Dichloropropene
25. Bromoform
26. 4-Methyl-2-Pentanone
27. 2-Hexanone
28. Tetrachloroethene
29. Toluene
30. 1,1,2,2-Tetrachloroethane
31. Chlorobenzene
32. Ethyl Benzene
33. Styrene
34. Total Xylenes

CITY CLERK CONTRACT/AGREEMENT NO. 40160

TABLE 2
(Continued)

SEMI-VOLATILE COMPOUNDS

35. Phenol
36. bis(2-Chloroethyl) Ether
37. 2-Chlorophenol
38. 1,3-Dichlorobenzene
39. 1,4-Dichlorobenzene
40. Benzyl Alcohol
41. 1,2-Dichlorobenzene
42. 2-Methylphenol
43. bis(2-Chloroisopropyl)Ether
44. 4-Methylphenol
45. N-Nitroso-Di-n-dipropylamine
46. Hexachloroethane
47. Nitrobenzene
48. Isophorone
49. 2-Nitrophenol
50. 2,4-Dimethylphenol
51. Benzoic Acid
52. 2-bis(2-Chloroethoxy) methane
53. 2,4-Dichlorophenol
54. 1,2,4-Trichlorobenzene
55. Napthalene
56. 4-Chloroaniline
57. Hexachlorobutadiene
58. 4-Chloro-3-Methylphenol
59. 2-Methylnaphthalene
60. hexachlorocyclopentadiene
61. 2,4,6-Trichlorophenol
62. 2,4,5-Trichlorophenol
63. 2-Chloronaphthalene
64. 2-Nitroaniline
65. Dimethylphthalate
66. Acenaphthylene
67. 2,6-Dinitrotoluene
68. 3-Nitroaniline
69. Acenaphthene
70. 2,4-Dinitrophenol
71. 4-Nitrophenol
72. Dibenzofuran
73. 2,4-Dinitrotoluene
74. Diethylphthalate
75. 4-Chlorophenyl-phenyl ether
76. Fluorene
77. 4-Nitroaniline
78. 4,6-Dinitro-2-Methylphenol
79. N-Nitrosodiphenylamine
80. 4-Bromophenyl ether
81. Hexachlorobenzene
82. Pentachlorophenol
83. Phenanthrene
84. Anthracene
85. Di-n-butylphthalate
86. Fluoranthene
87. Pyrene
88. Butylbenzylphthalate
89. 3,3'-Dichlorobenzidine
90. Benzo(a)anthracene
91. Chrysene
92. bis(2-Ethylhexyl)phthalate
93. Di-n-octylphthalate
94. Benzo(b)fluoranthene
95. Benzo(k)fluoranthene
96. Benzo(a)pyrene
97. Indeno(1,2,3-cd)pyrene
98. Dibenz(a,h)anthracene
99. Benzo(g,h,i)perylene

TABLE 2
(Continued)

PESTICIDES/PCB COMPOUNDS

100. Alpha-BHC
101. Beta-BHC
102. Delta-BHC
103. Gamma-BHC (Lindane)
104. Heptachlor
105. Aldrin
106. Heptachlor Epoxide
107. Endosulfan I
108. Dieldrin
109. 4,4'-DDE
110. Endrin
111. Endosulfan II
112. 4,4'-DDD
113. Endosulfan Sulfate
114. 4,4'-DDT
115. Methoxychlor
116. Endrin Ketone
117. Alpha Chlordane
118. Gamma Chlordane
119. Toxaphene
120. Aroclor 1016
121. Aroclor 1221
122. Aroclor 1232
123. Aroclor 1242
124. Aroclor 1248
125. Aroclor 1254
126. Aroclor 1260

CITY CLERK CONTRACT/AGREEMENT NO. 40660

TABLE 2
(Continued)

INORGANIC ANALYSES

ELEMENT

Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Iron	Zinc
Lead	Cyanide

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 2
(continued)

OTHER INORGANIC ANALYSES
(not on the Target Compound List)

Bicarbonate m
Calcium m
Carbonate m
Magnesium m
Potassium m
Silica m
Total Hardness m

m = major constituent

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 3

GROUNDWATER PERFORMANCE CRITERIA*

Contaminant	Performance Criteria (ug/l)
Benzene	5.0
Chloroethane	20.0
1,1-dichloroethane	20.0
1,2-dichloroethane	5.0
Ethyl Benzene	320.0
Methylene Chloride	5.0
Toluene	175.0
1,1,1-Trichloroethane	200.0
Xylenes	10.0

*This table shall be developed and completed for the entire list of indicator parameters selected under Section 3.1.2.2 of this SOW.

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 4

SURFACE WATER DISCHARGE CRITERIA*

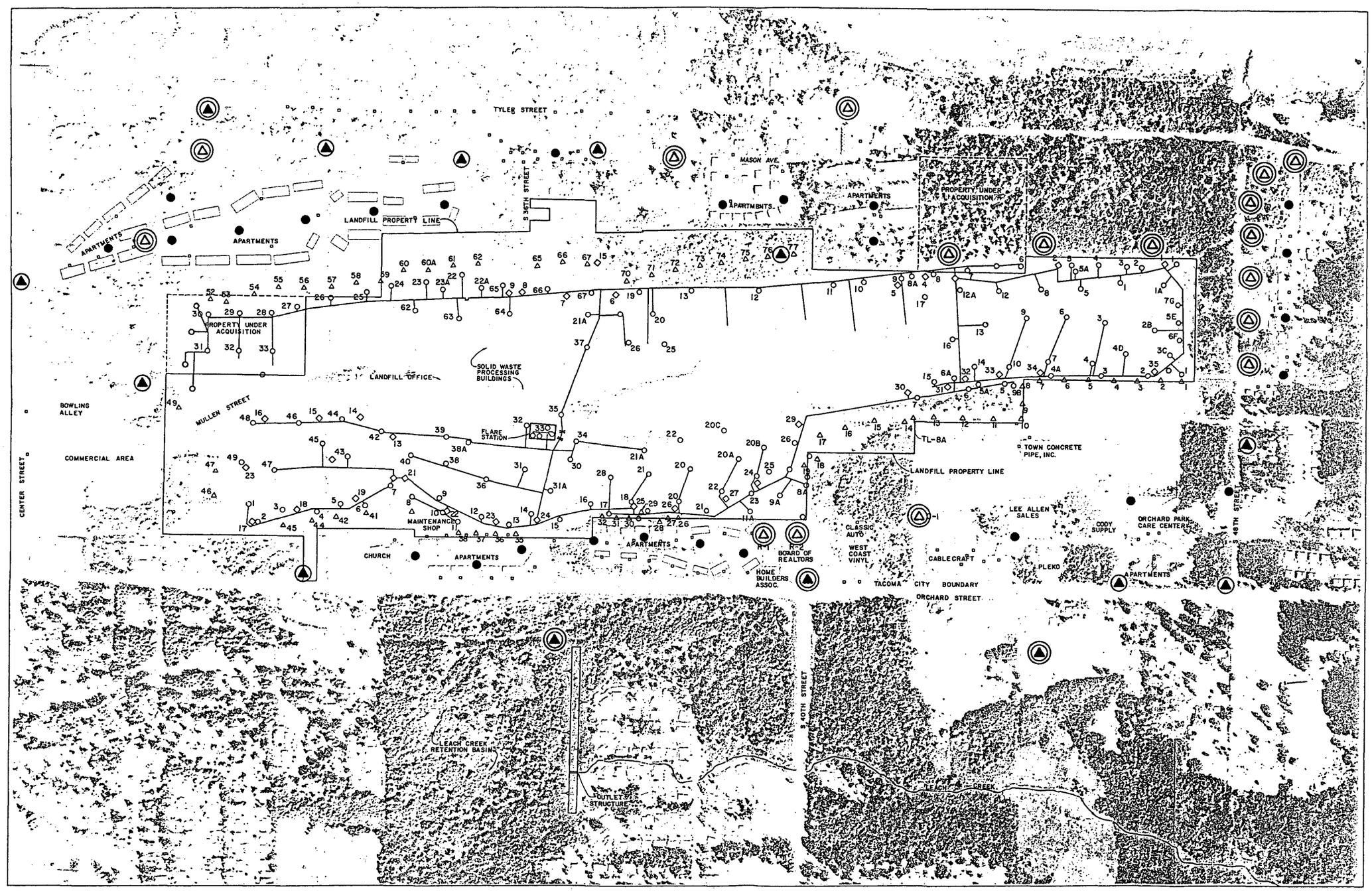
Contaminant Concentration Appropriate to the Discharge Location (ug/l)

Contaminant	Fresh Water	Marine Water
Benzene	5.0	700.0
Chloroethane	20.0	1130.***
1,1-dichloroethane	20.0	1130.***
1,2-dichloroethane	5.0	1130.0
Ethyl Benzene	320.0	4.3**
Methylene Chloride	5.0	6400.
Toluene	175.0	5000.0
1,1,1-trichloroethane	200.0	312.0
Vinyl Chloride	2.0	2.0**
Xylenes	10.0	10.0**

* This table shall be supplemented to include the entire list of indicator parameters selected under Section 3.1.2.2 of this SOW.

** Value set at fresh water criteria unless other discharge limits can be established from other guidance documents or technical research, as approved by the Government Plaintiffs.

*** Data is not available to develop criteria for this compound. However, since research shows (EPA, 1986) that toxicity of chlorinated ethanes increases with increasing chlorination, the toxicity for Chloroethane and 1,1-dichloroethane should be less than the value for 1,2-dichloroethane.



LEGEND

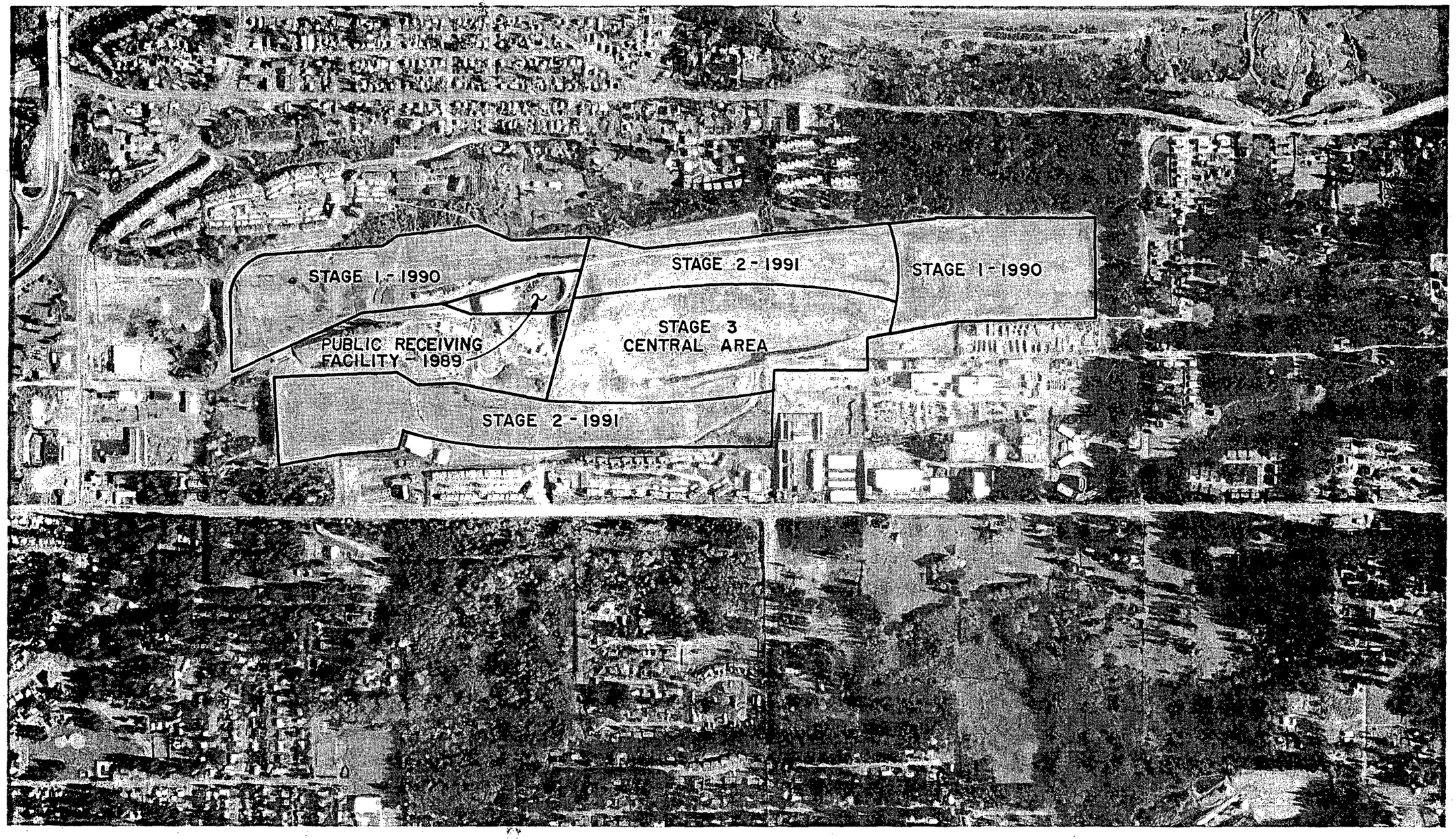
- GAS WELL
- PROBE
- CONDENSATION DRAIN
- OFFSITE MONITORING LOCATION
- EXISTING OFF-SITE PROBE STATIONS (Multi-Depth)
- PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth)
- PROPOSED OFF-SITE PROBE STATIONS (Shallow)
- PROPOSED OFF-SITE PROBE STATIONS (Multi-Depth) COMBINED WITH WATER WELL

200' 100' 0 200' 400'

FIGURE 3
PREDESIGN STUDY
LANDFILL GAS PROBE LOCATIONS

TACOMA LANDFILL

CITY CLERK CONTRACT/AGREEMENT NO. 4060



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800' 400' 0 800'

SCALE: 1" = 800' (APPROX.)

FIGURE 2
LANDFILL CAP
CONSTRUCTION SCHEDULE

TACOMA LANDFILL RD/RA

CITY CLERK CONTRACT/AGREEMENT NO. 4060

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 5

LIST OF DELIVERABLES

Deliverable	Submittal Date
Public Receiving Facility Cap Design	
Monitoring Well SAP	Within 30 days of lodging of Consent Decree
Draft Health and Safety Plan	With Monitoring Well SAP.
Final Health and Safety Plan	Within 30 days receipt of comments Draft Health and Safety Plan.
Draft Project Management Plan (PMP)	Within 30 days of lodging of Consent Decree.
Final PMP	Within 30 days of receipt of comments on Draft PMP.
Draft QAPP - for remedial design	With Draft PMP.
Final QAPP for remedial design	Within 30 days receipt of comments on Draft QAPP.
Draft Groundwater SAP	With Draft QAPP
Final Groundwater SAP	Within 30 days of receipt of comments on Draft Groundwater SAP
Leachate & Condensate Sampling and Analysis Plan (SAP)	Within 30 days of lodging of Consent Decree.
Fircrest Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Alternate Water Supply Contingency Plan	Within 45 Days of lodging of Consent Decree.
Landfill Gas Sampling & Analysis Plan	Within 90 days of lodging of Consent Decree.
Well Logs & Survey Data	Within 30 days of last well installation.
Indicator Parameter Selection	Within 90 days of first round of groundwater sampling.
Surface Water SAP	Within 120 days of lodging of Consent Decree.

TABLE 5

List of Deliverables
2

Disposal of Hazardous Substances & Liquids Plan	Within 180 days of lodging of Consent Decree
Draft Predesign Report	Within 180 days of lodging of Consent Decree
Draft Statistical Methods Proposal	In Draft Predesign Study Report
Pilot Extraction Well Work Plan	In Draft Predesign Study Report
Pilot Treatment Study Work Plan	In Draft Predesign Study Report
Pilot Extraction Well SAP	Within 30 days receipt of comments on Draft Predesign Report
Pilot Treatment Study SAP	Within 30 days of receipt of comments on Draft Predesign Report
Final Statistical Methods Selection	Within 30 days of comments on draft Predesign Study Report
Draft Pilot Studies Report	
Final Predesign Study Report	Within 30 days of receipt of comments on Draft Pilot Studies Report
Extraction/Treatment System Preliminary Design (30%)	
Extraction/Treatment System Intermediate Design (60%)	
New Plume Contingency Plan	With 60% Extraction/Treatment Design
Extraction/Treatment System Prefinal Design (90%)	
Extraction Treatment System SAP	With 90% Extraction/Treatment Design
Air Emissions SAP	With 90% Extraction/treatment Design
Extraction/Treatment System Final Design (100%)	
Landfill Cap Preliminary Design (30%)	
Surface Water Management Plan	With Cap 30% Design Report

CITY CLERK CONTRACT/AGREEMENT NO. 4060

TABLE 5

List of Deliverables
3

Landfill Cap Intermediate Design (60%)	
Landfill Cap Prefinal Design (90%) Utilities Management Plan	With 90% Stage 1 Landfill Cap Design
Landfill Cap Final Design (100%)	
Final Central Area Expansion Design Report Plans and Specifications	
Gas System Evaluation Reports	
Landfill Gas Management Plan	
Landfill Gas Cap Installation Report	Within 60 days of completion of each stage of landfill cap
Leachate & Condensate Management Plan	
Air Emissions Management Plan	
Operations and Closure Plan	Within 60 days of approval of all remedial designs
Landfill Closure Plan	With Operations & Closure Plan
O & M Contingency Plan	With O&M Plans in Operations and Closure Plan
Institutional Controls Plan	
Remedial Design Project Closeout	June 30, 1991
Remedial Action PMP - Update	June 30, 1991
Remedial Action Site Safety Plan	
Remedial Action Construction Program Plan	
Remedial Action SAP	
Construction Documentation Report	
Operation and Maintenance Plan	
Project Closeout	Sept. 30, 1992

CITY CLERK CONTRACT/AGREEMENT NO. 4060

APPENDIX III
TO TACOMA LANDFILL CONSENT DECREE

ACCESS AGREEMENT

CITY CLERK CONTRACT/AGREEMENT NO. 40600

APPENDIX IV
TO TACOMA LANDFILL CONSENT DECREE

MAP OF THE SITE

CITY CLERK CONTRACT/AGREEMENT NO. 4060

APPENDIX V
TO TACOMA LANDFILL CONSENT DECREE

LIST OF HAZARDOUS SUBSTANCES DETECTED AT THE TACOMA LANDFILL

Volatile Organic Compounds

Tetrachloroethene
Trans-1,2-Dichloroethene
Trichloroethene
1,1-Dichloroethene
Vinyl Chloride
1,1,1-Trichloroethane
1,1-Dichloroethane
1,2-Dichloroethane
Chloroethane
Benzene
Ethylbenzene
Chlorobenzene
Toluene
Xylene (Total)
2-Butanone
2-Hexanone
1,2-Dichloropropane
Trans 1,3-Dichloropropene
Styrene
Carbon Disulfide
Chloroform
Chloromethane
Bromodichloromethane
Methylene Chloride
Acetone
4-Methyl-2-pentanone

Semi-Volatile Organic Compounds

Hexachlorobenzene
Polynuclear Aromatic Compounds
Pthalate Esters
1,4-Dichlorobenzene
N-nitro-Sodiphenylamine
Benzyl Alcohol
Benzoic Acid
4-Methylphenol
Isophorone
Phenol

Metals

Arsenic
Cadmium
Chromium
Copper
Mercury
Nickel
Lead
Zinc
Iron
Aluminum
Manganese

CITY CLERK CONTRACT/AGREEMENT NO. 4060

APPENDIX VI
TO TACOMA LANDFILL CONSENT DECREE

PRE-SETTLEMENT REMEDIAL DESIGN STIPULATION AND AGREED ORDER

CITY CLERK CONTRACT/AGREEMENT NO. 4060

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION
FINAL REMEDIAL ACTION
TACOMA LANDFILL
TACOMA, WASHINGTON

CITY CLERK CONTRACT AGREEMENT NO. 9060

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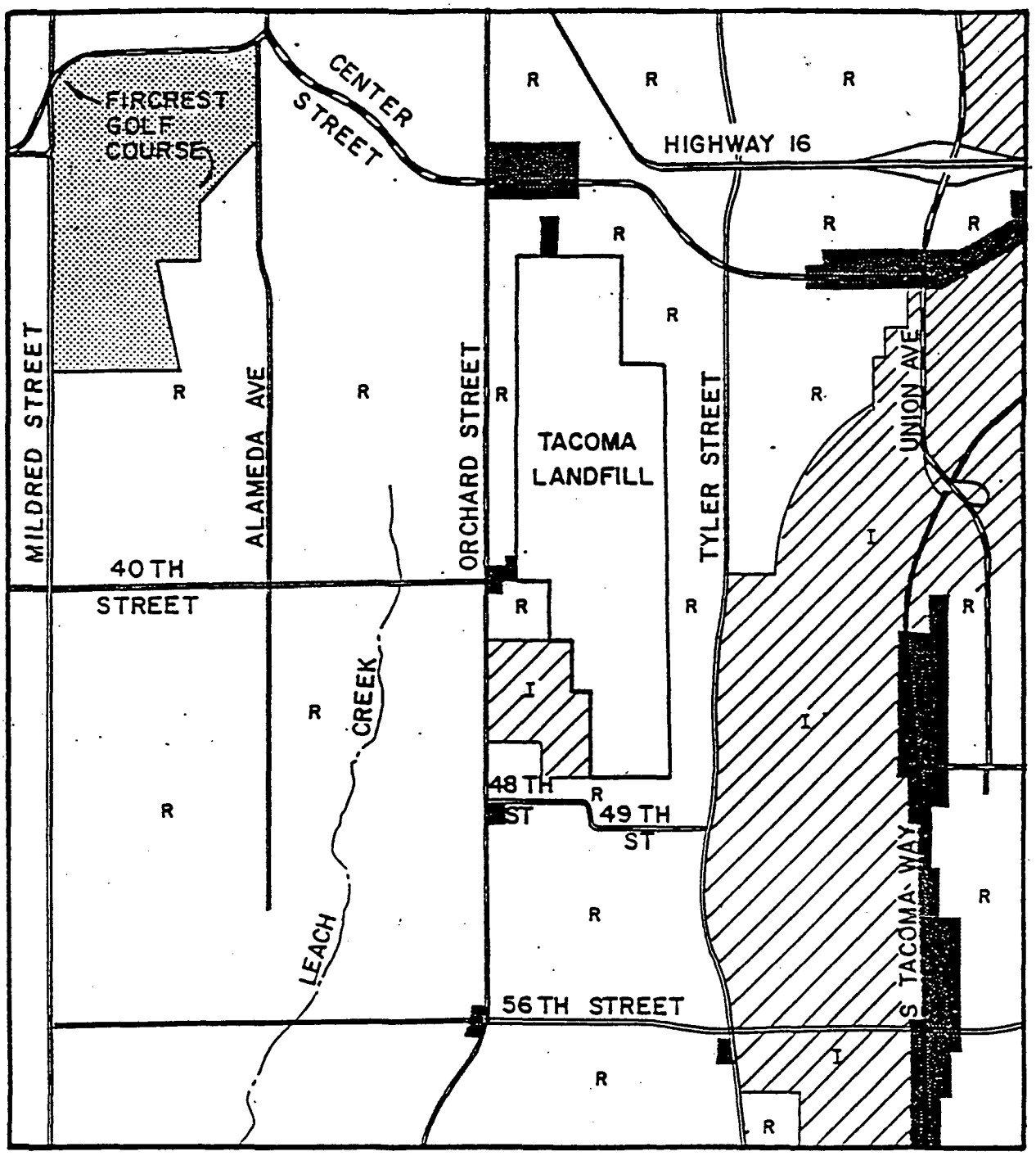
I. SITE DESCRIPTION AND LOCATION

The Tacoma Landfill, operated by the City of Tacoma Refuse Utility, is located in Sections 12 and 13 of Township 20 North, Range 2 East, Pierce County, Washington. The landfill covers 190 acres and is bounded approximately by South 31st Street on the north, Tyler Street on the east, South 48th Street on the south, and Orchard Street on the west. Figures 1, 2 and 3 illustrate the location of the landfill, the vicinity surrounding the landfill, and the site itself. The landfill serves a population of approximately 212,000. To date, approximately 4.0 million tons of refuse have been deposited at the landfill since it opened in 1960. Currently about 600 tons per day of refuse are placed in the landfill.

The landfill does not accept hazardous wastes for disposal. However, the landfill received wastes in the 1960s and 1970s that have since been designated as hazardous substances under State and Federal law.

Figure 2 shows the general topography of the landfill and surrounding area. Drumlins (low, long ridges) abound in the general area and display a north-south axial configuration. Solid waste has been disposed of at the site between five drumlins. The landfill's western boundary is approximately one quarter mile from Leach Creek, but the landfill does not lie in the flood plain of that creek. The landfill is surrounded primarily by residential development and open land, with some commercial and industrial development. Land use for the area surrounding the landfill is shown on Figure 3. No use of natural resources other than groundwater is noted on land use inventories. Several utilities (sewer, water, and storm) pass through the site.



LEGEND

COMMERCIAL

INDUSTRIAL

RESIDENTAL

0 1000 2000 4000

SCALE 1" = 2000'

N

FIGURE 3
LANDFILL ZONING MAP
TACOMA LANDFILL RI/FS

Apartments, undeveloped land, and commercial properties including a bowling alley, offices, building supply and paint stores, and gas stations are located north of the landfill. Immediately east of the landfill are apartment complexes, single family residences, and undeveloped land. The area further east between Tyler Street and South Tacoma Way is occupied by the Burlington Northern Railroad, industrial/commercial development, and an open area known as the South Tacoma Swamp. Between the west edge of the landfill and Orchard Street there are several apartment buildings and commercial establishments. West of Orchard Street and south of the landfill there is residential development and undeveloped land.

The landfill lies in the central portion of the Tacoma/Fircrest upland ground water system. A significant area for the central upland in the vicinity of the landfill is Leach Creek.

II. SITE HISTORY

A. Landfill History and Operations

The Tacoma Landfill began operations in 1960, and now serves a population of approximately 212,000. The wastes received and disposed at the landfill include garbage, rubbish, industrial wastes, construction and demolition wastes, street refuse, litter, and bulky waste. To date, approximately 4.0 million tons of refuse have been deposited at the landfill. Filled areas vary from 20 to 80 feet deep. Currently some 600 tons per day of refuse are placed in the landfill.

Most of the site has already been filled. The next section of the site to be filled is called the Central Area Pit. This section of the landfill covers approximately 18 acres and was developed during the summer and fall of 1987. A flexible membrane liner and leachate collection system were installed in the Central Area Pit. The liner and leachate collection system were designed primarily to maximize volume for waste disposal. To date, there has been no documentation received on the integrity of the liner.

Day to day operations of the landfill are regulated by the Tacoma-Pierce County Health Department (TPCHD) with oversight by the Washington Department of Ecology (Ecology); the operating permit is issued annually by TPCHD.

At the current rate, the 190-acre site has a remaining life expectancy of approximately four to five years if all the solid waste material is disposed without a significant reduction in volume. Tacoma has indicated it intends to implement programs to extend the life expectancy of the landfill.

There are many large and small industries in the Tacoma/Pierce County area which have disposed of wastes at the landfill. Memoranda reviewed during the preparation of the Description of Current Situation report and the RI indicate that some hazardous wastes were disposed of at the landfill. Investigations concerning the volumes, the chemical composition of the wastes, and the disposal locations are ongoing.

B. Regulatory History - Previous Investigations

In 1983 EPA conducted an investigation and detected hazardous compounds in samples of ground water and soils near the landfill. This led EPA to include the landfill on the National Priorities List of hazardous waste sites as part of the South Tacoma Channel site. Through a cooperative agreement with EPA, Ecology began an investigation into contamination at the site in 1984. On June 27, 1986, Tacoma assumed responsibility for conducting the remedial investigation and feasibility study under a Response Order on Consent issued by Ecology.

Since 1983 testing has been conducted at and around the Tacoma Landfill by EPA, Ecology, TPCHD, Tacoma, and others. The testing revealed that three private wells contained contaminants. The priority pollutant volatile organic compounds which were detected in the ground water samples were primarily chlorinated organics. Twenty-four volatile organic compounds were found in groundwater contaminated by the landfill.

Because of the concern about the public health effects of the contaminants, particularly vinyl chloride, the TPCHD recommended that Tacoma connect these affected residences to the Tacoma public water system. As a precautionary measure, Tacoma also connected two additional residences whose wells were near the area. Monitoring continues quarterly to ensure the clean water supply for potentially affected residents while appropriate cleanup actions are approved and carried out.

C. The Remedial Investigation/Feasibility Study (RI/FS)

The remedial investigation (RI), conducted by Tacoma's consultant, Black and Veatch, was performed in two phases. Phase 1 activities (July 1986 through January 1987) consisted primarily of field investigations to characterize both the hydrogeology of the site and the contaminants present in the various media at and surrounding the site. Phase 2, conducted from January through November 1987, was designed to fill in data gaps identified at the conclusion of Phase 1 and to provide the data necessary for the endangerment assessment and the feasibility study (FS).

Upon completion of the RI and and evaluation of the alternatives, the City, through their consultants (Black and Veatch), submitted a draft RI and FS report in September and October 1987 for agency review and approval. The final RI/FS reports were published December 1987. Public comment on the studies was completed in March 1988.

III. SITE ENVIRONMENT

The Tacoma Landfill site is located in the northern portion of the Chambers/Clover Creek drainage basin (see Figure 4). This area is part of the Puget Sound lowland. The study area is bounded by: the Tacoma channel to the east; Center Street to the north; 56th Street to the south; and Leach Creek to the west.

A moderate climate prevails. Winter temperatures are seldom below freezing and summer temperatures are rarely above 80°F. Approximately thirty-seven inches of rain fall in a normal year. Studies conducted in the Puget Sound region have indicated that approximately 30% of rainfall becomes groundwater.

The geology of the site consists of a series of glacial materials, mostly sand and gravel laid down over older alluvial silts and sands. The stratigraphic units (layers) described in the Remedial Investigation (Black and Veatch, 1987) from youngest to oldest (top down) are:

A. Vashon Till (dense gray, gravelly, silty, sand) (Qvt)

B. Vashon Advance Outwash (sands/gravels) (Qva)

C. Colvos Sand (dense sand/some gravel) (Qc)

D. Older Gravel (dense sandy gravel) (Qog)

E. Older Till (dense silty, gravelly sand) (Qot)

F. Older Outwash (dense silty, gravelly sand) (Qoa)

G. Older Sand (dense fine/medium sand) (Qos)

H. Older Lacustrine (lake bottom silts) (Qol/Qk)

I. Undifferentiated Quaternary Sediments (Qu)

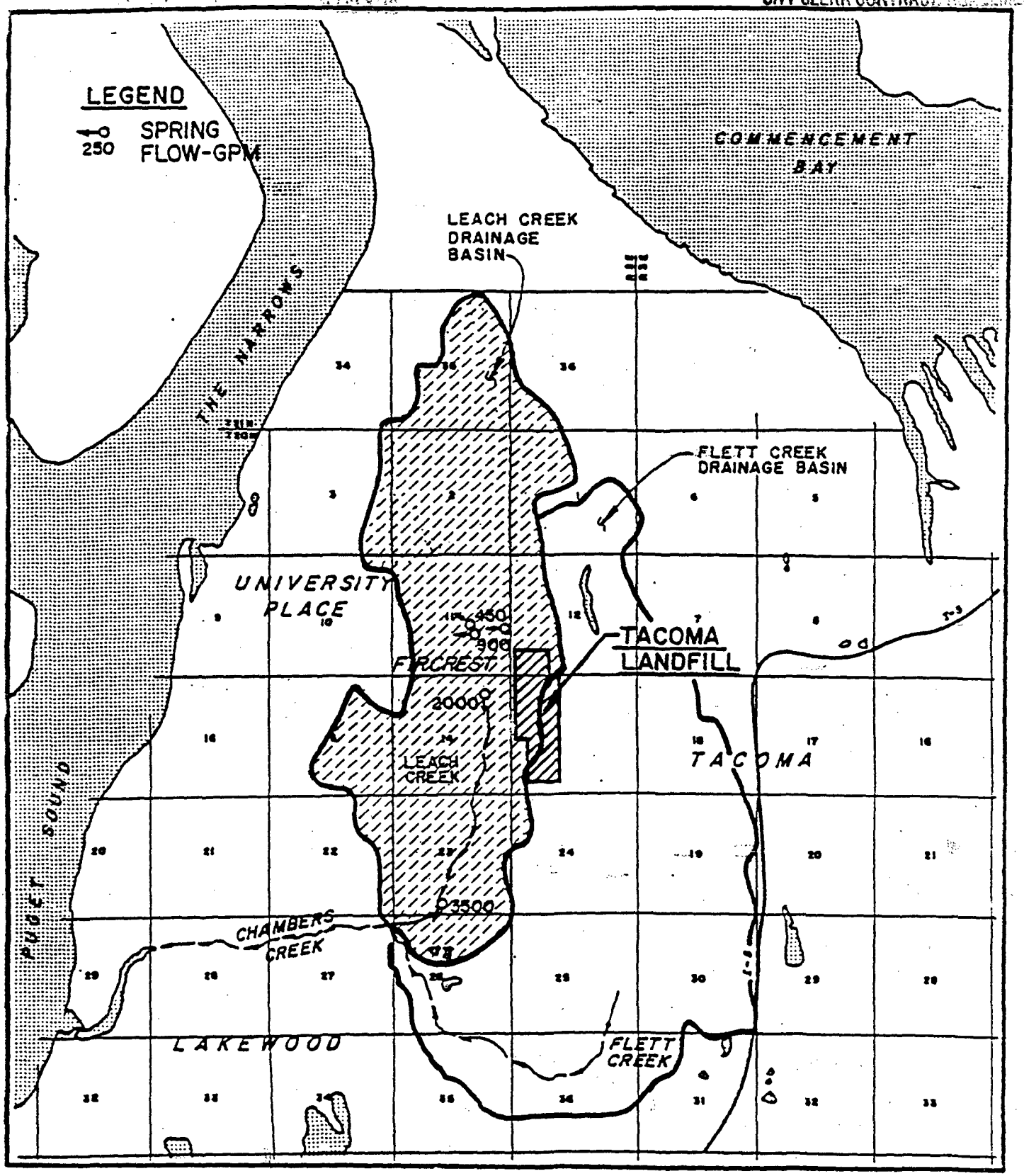


FIGURE ADAPTED FROM CLOVER/ CHAMBERS CREEK GEOHYDROLOGIC STUDY

FIGURE 4

LEACH CREEK DRAINAGE BASIN

TACOMA LANDFILL RI/FS

The affected aquifer is located between the lower zones of the Colvos Sand and the Older Lacustrine. The Older Lacustrine unit serves as the regional aquitard in the landfill area. A cross section through the area (Figure 5) shows the ridges, valleys, and the lithology (layers).

Water, infiltrating through the landfill, picks up various contaminants. Where the Vashon Till is not present beneath the waste, contaminants move with the water through the unsaturated zone and into the aquifer. It is also possible for low solubility, pure phase fluids, called dense, non-aqueous phase liquids (DNAPLs), such as chlorinated hydrocarbons to enter the aquifer. Evidence of this has not been shown, nor has it been disproven. The water table lies within the Colvos Sand unit, about 70 feet below the bottom of the landfill.

The predominant flow direction of the water table aquifer is southwesterly toward Leach Creek. However, during periods of heavy water use by Tacoma city wells (summer and early fall), the groundwater flow direction is reversed. Also, depending on local conditions, groundwater and contaminant movement may be downward or upward.

The Older Alluvium reportedly forms the confining layer. Leach Creek is the closest discharge point of the aquifer. Additional information from future activities will clarify the ground water flow conditions near the creek and elsewhere around the site.

The aquifer is part of the Chambers/Clover Creek Ground Water Management Area. The TPCHD is petitioning EPA for a Sole Source Aquifer designation for

0 1 2 4 8

SCALE : 1" = 4 MILES

FIGURE 1
SITE LOCATION MAP

TACOMA LANDFILL RI/FS

CITY CLERK CONTRACT/AGREEMENT NO. 9060

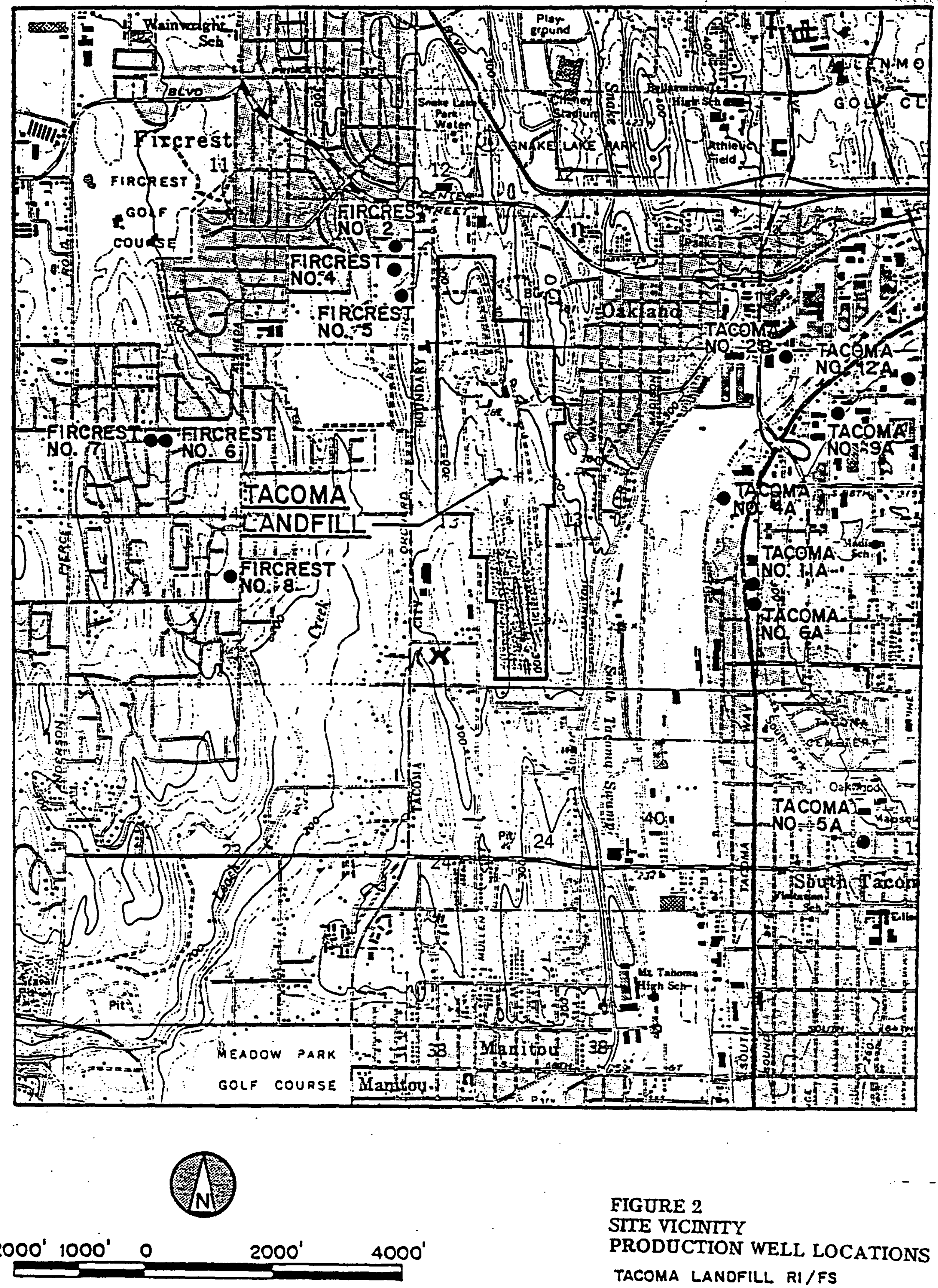
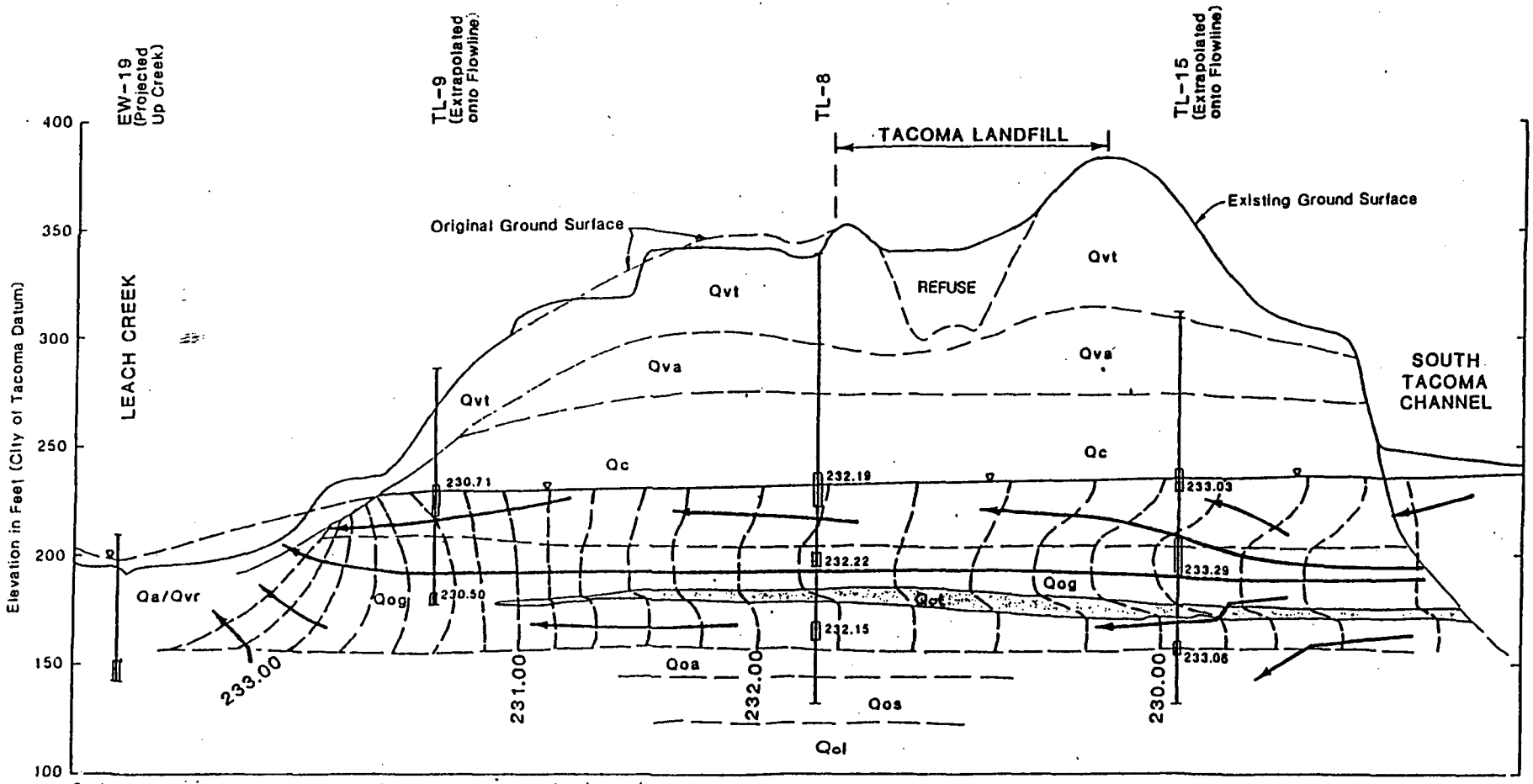


FIGURE 2
SITE VICINITY
PRODUCTION WELL LOCATIONS
TACOMA LANDFILL RI/FS



Geologic contacts are based upon interpolation between outcrops and borings and represent our interpretation of subsurface conditions based on currently available data.

Figure prepared by Hart Crowser, Inc.

Notes: 1. Water table elevations are from 12/4/86. Potentials at lower levels are calculated from average vertical gradients over seven (7) sets of water level measurements (Table 4-2) and therefore represent anticipated average conditions.

2. Flowlines are drawn qualitatively assuming a moderate degree of anisotropy.

TL-8 Well Number

Well Location

Water Table 12/4/86

Screen Section

233.00 Equipotential Line

Water Table Elevation in Feet

Groundwater Flow

Horizontal Scale in Feet
0 400 800

0 50 100
Vertical Scale in Feet
Vertical Exaggeration x 8

FIGURE 5
SITE CROSS SECTION AND LITHOLOGY

TACOMA LANDFILL RI/FS

CITY CLERK CONTRACT/AGREEMENT NO. 5060

this aquifer. The Town of Fircrest and the City of Tacoma both operate wells near the landfill (see Figure 2). In addition, the aquifer is also used by private individuals for domestic water supply (see Figure 6).

Wetlands downstream of the landfill on Chambers Creek could potentially be exposed to contaminants in the surface water and ground water. None of the five endangered species identified in the State of Washington is common to the area surrounding the landfill.

The topographical lowpoint in the landfill is currently at the north end of the Central Area Pit. Some runoff from surrounding areas drains and discharges to the sanitary sewer. Drainage from the north and along Mullen Street is directed towards a pond situated between the bowling alley parking lot and northern landfill property on Mullen Street. Drainage from the west side of the site is directed toward a catch basin and discharges to the Leach Creek retention basin. The south end of the site drains to the south and is not collected. Drainage patterns are shown in Figure 7.

CITY CLERK CONTRACT/AGREEMENT NO. 5060

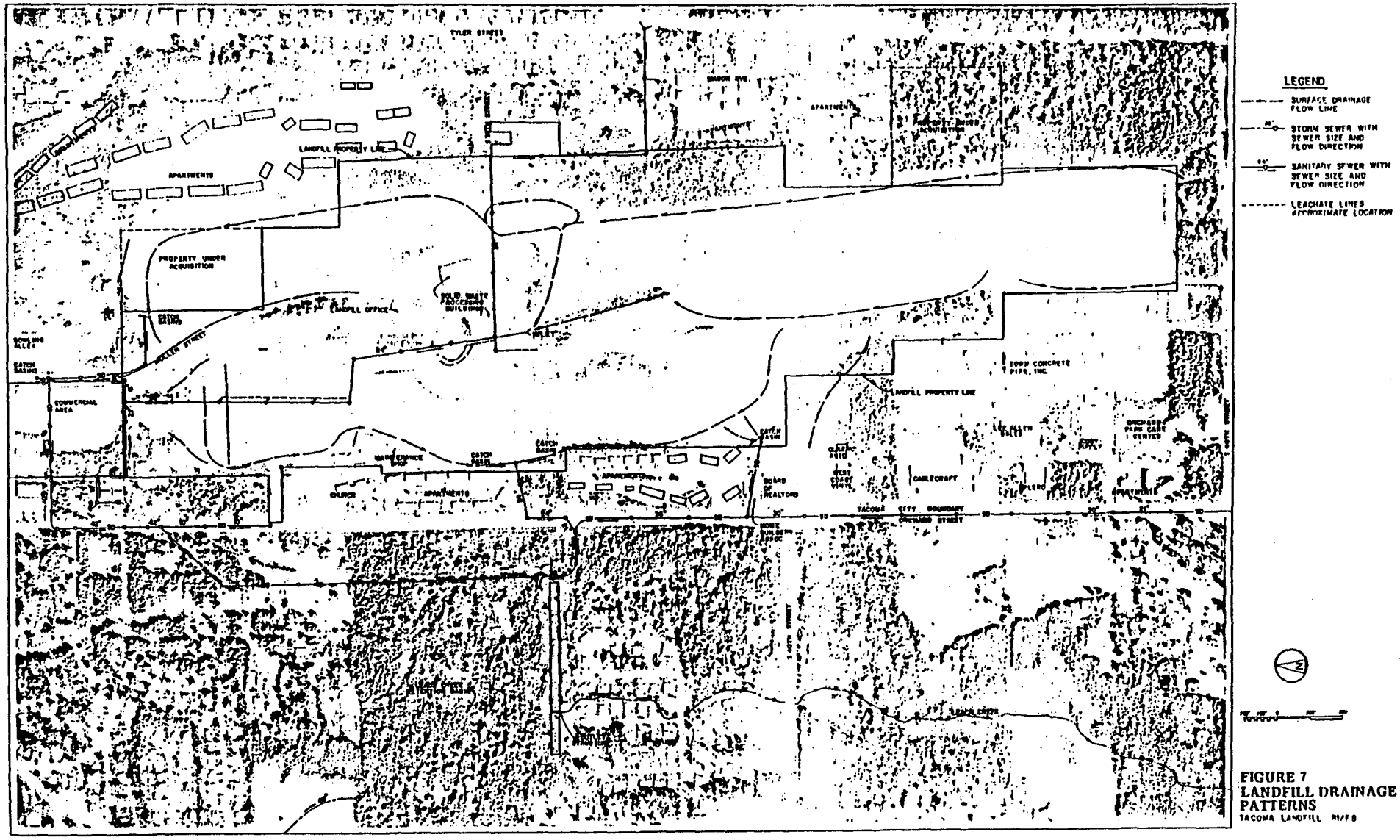
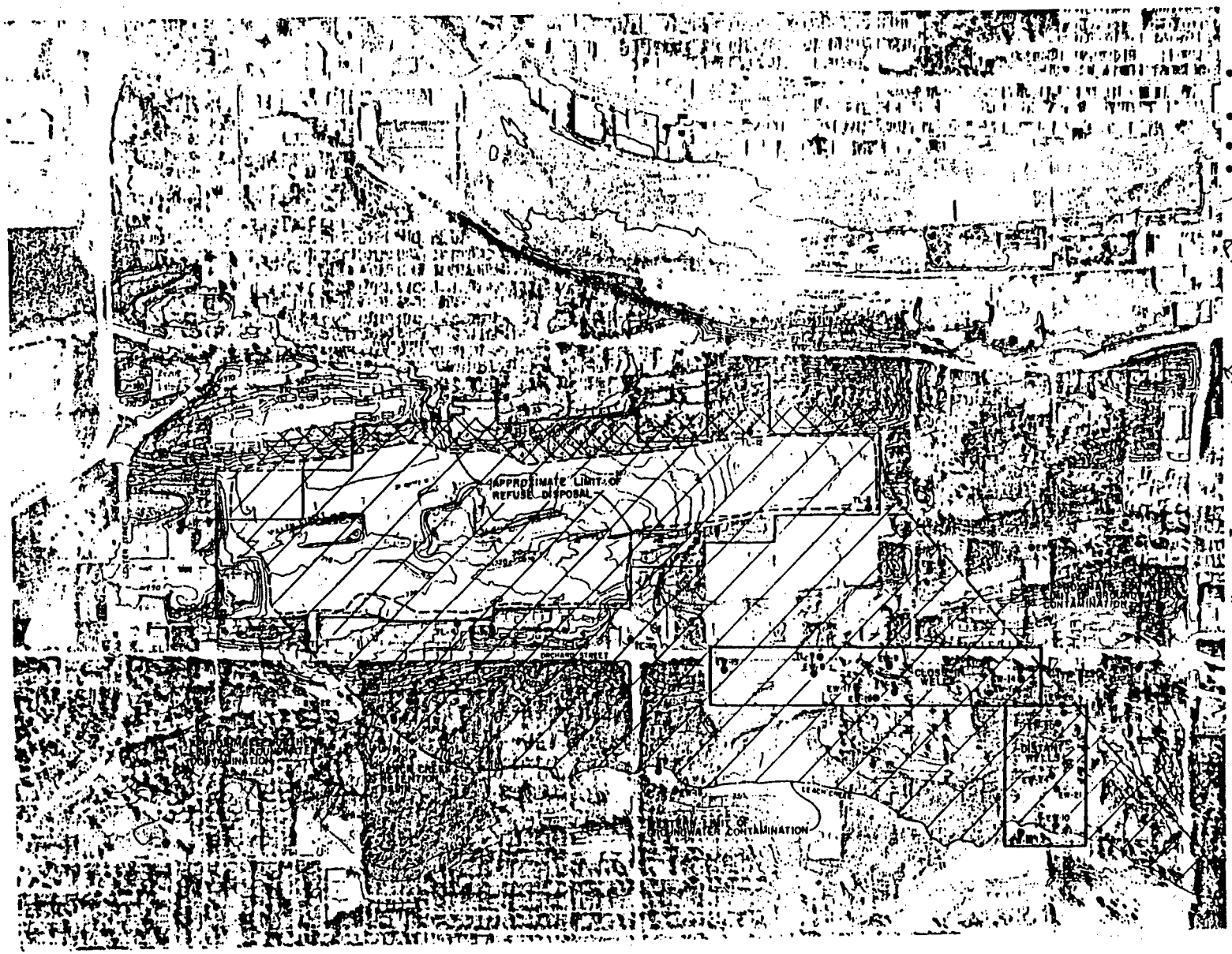


FIGURE 7
LANDFILL DRAINAGE PATTERNS
TACOMA LANDFILL RI/FS



LEGEND

- ● TL-1 LANDFILL MONITORING WELL LOCATION
- ● EW-7 EXISTING RESIDENTIAL WELL
- ● FW-3 FIRCREST WELL
- ● UP-4 UNIVERSITY PLACE WELL
- 300 GROUND SURFACE ELEVATION CONTOUR - CITY OF TACOMA DATUM
- APPROXIMATE MAXIMUM AREA POTENTIALLY AFFECTED BY GROUNDWATER CONTAMINATION IN THE FUTURE BASED SOLELY ON CONVECTION OF CONTAMINANTS FROM THE LANDFILL
- APPROXIMATE AREA UPGRADIENT OF THE LANDFILL POTENTIALLY IMPACTED BY GROUNDWATER CONTAMINATION DUE TO GRADIENT REVERSALS

NOTES

1. UP WELLS AND EW-23 ARE NOT CURRENTLY USED AND WERE NOT CONSIDERED IN SELECTING RECEPTOR GROUPS.
2. EXTENT OF GROUNDWATER CONTAMINATION DOES NOT INCLUDE CONTAMINATION DUE TO LANDFILL GAS TRANSPORT.

N

100' 200' 0 100' 200'

FIGURE 6
LOCATION OF PRIVATE WELL
EXTENT OF CONTAMINATION

TACOMA LANDFILL RI/FS

IV. NATURE AND EXTENT OF PROBLEM

A. Extent of Gas Migration

In May 1986, accumulation of landfill gas in a utility vault at the Town Concrete Pipe Company (located immediately adjacent to and west of the landfill) resulted in a small explosion. Tacoma had already hired a consultant (Mandeville Associates) to address problems of gas production and migration at the landfill and was able to immediately initiate a field survey to evaluate the extent of gas migration off-site. Based on this survey, the consultant designed and constructed a gas extraction system to extract, collect and combust the gas. The field survey showed the biggest problem to be southwest of the site and this initial effort concentrated on controlling gas from migrating into businesses in this area.

The current landfill gas system consists of 128 extraction wells, collection piping, 77 gas probe locations, and the motor blower/flare station where contaminants are incinerated. The system layout is shown on Figure 8.

Tacoma has conducted a two-stage gas monitoring program to monitor the effectiveness of the extraction system. Figure 8 shows the locations of 66 probes installed around the landfill. Each of these probes consists of two to five probes able to monitor gas at depths from 6 to 70 feet. These probes are checked twice a week and seem to indicate that the shallower gas is being controlled by the extraction system.

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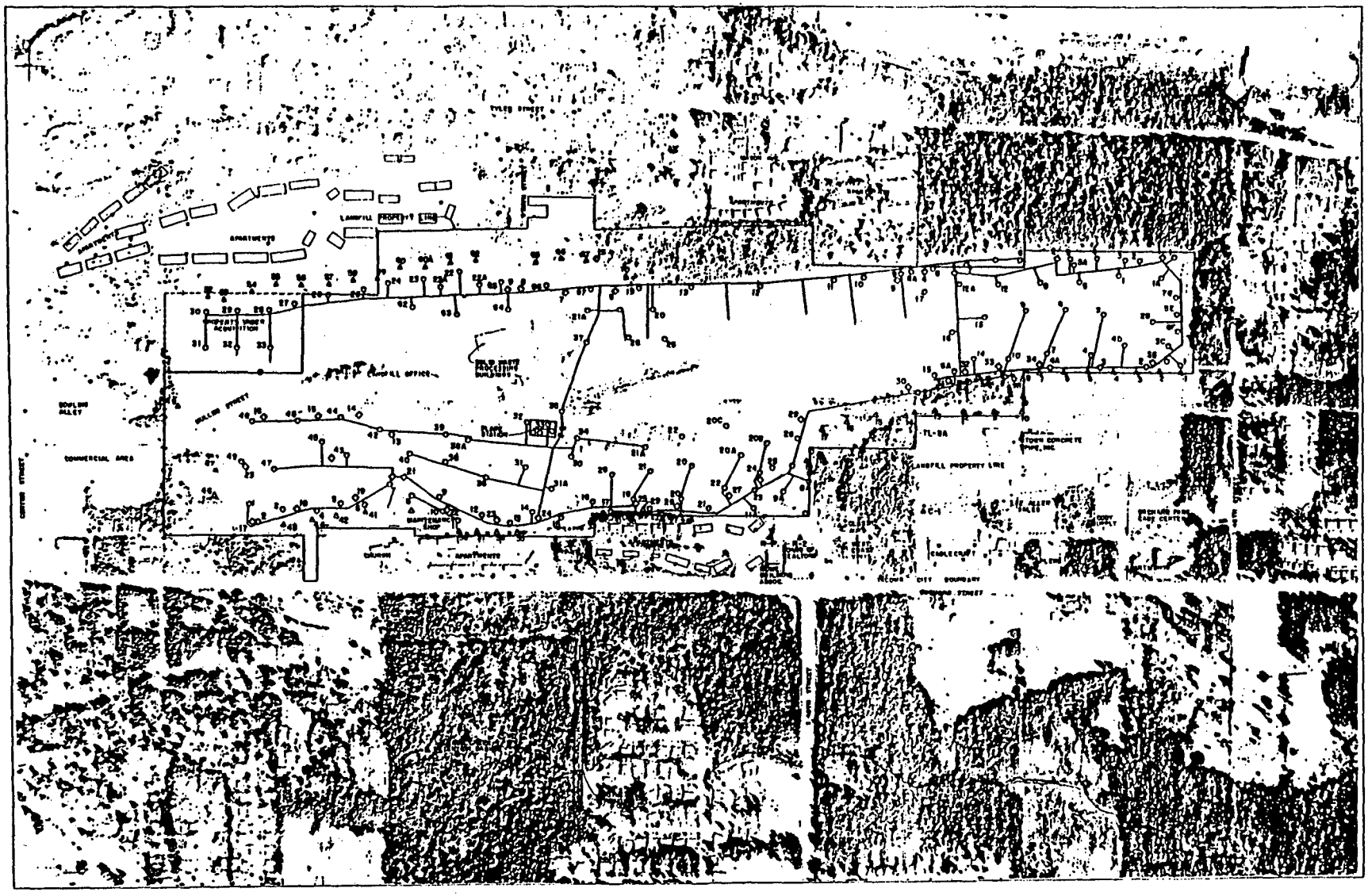

LEGEND

- GAS WELL
- PROBE
- CONDENSATION DRAIN
- OFFSITE MONITORING LOCATION

000000094

FIGURE 8
LANDFILL GAS EXTRACTION SYSTEM
TACOMA LANDFILL 10/79

The gas found deeper than about 35-40 feet is not being controlled as well. As a result of this information, Tacoma is installing approximately 74 new, deep extraction wells around the landfill. This work began on January 27, 1988.

The City has also been conducting an off-site monitoring program beginning in May, 1986. From May 1986 until August 1987, this program focused on businesses and apartments to the south and west of the site, where both ambient and point source measurements were taken. Beginning in August 1987, the current off-site monitoring system began. This consists of monitoring utility vaults in residential areas (shown on Figure 8), and routine ambient and point source monitoring in some businesses and vacant apartments. The data from this effort shows that methane is still escaping the landfill and finding its way to the surface in off-site locations. The utility vault data shows several areas around the landfill to be of particular concern.

The Minimum Function Standards require that the concentrations in off-site structures be below 100 parts per million (ppm) by volume of hydrocarbon in ambient air. From November 1986 through October 1987, the readings of ambient air in off-site structures were below the limit; however, some point sources monitored such as foundation cracks and closed vaults on occasion have shown readings above 100 ppm. Readings above the limit were found in the ambient air in one building west of the landfill near 40th Street (Classic Auto) in November 1987. The City installed four additional gas extraction wells in this area in December 1987. No readings were detected in the building after the first well was connected to the system on December 15, 1987.

Ecology has requested that additional gas probes be placed in the neighborhoods of concern. The existing probes are well within the influence of the gas extraction wells and do not represent ambient conditions further off-site. Methane concentrations in utility vaults can also be misleading. Gas concentrations fluctuate a great deal with changing atmospheric conditions. Therefore, it is possible that landfill gas could be found in a house without observing it in the vault. Additional gas probes are needed to better determine the performance of the gas extraction system.

A total of 42 landfill gas samples were collected at 26 locations around the landfill. The gas samples collected from gas wells and probes were analyzed for priority pollutant volatile organic compounds (VOC). The analytical results are summarized in Table 1. The methane concentration was analyzed for five of the Phase 1 samples and was field measured for seven of the Phase 2 samples. These results are presented below:

Sample No.	Methane (ppm)	Sample No.	Methane (ppm)
Phase 1		Phase 2	
GS-001	540,000	GS-213	370,000
GS-002	430,000	GS-214	480,000
GS-002DUP	430,000	GS-215	610,000
GS-003	560,000	GS-218	560,000
GS-004	240,000	GS-219	200,000
		GS-220	200,000
		GS-221	200,000

TABLE 1
SUMMARY OF PRIORITY POLLUTANT VOLATILE
ORGANIC COMPOUNDS DETECTED IN LANDFILL GAS SAMPLES
Concentrations in ug/m3

Date	Benzene	Chloro-benzene	Chloro-ethane	1,1-Di-chloro-ethane	1,2-Di chloro-ethane	1,1-Di-chloro-ethene	Trans-1,2-Di chloro-ethene	1,2-Di-chloro-propane
06/25/86	2600	1600	1400	TR	500U	500U	2500	500U
06/25/86	700	500U	1000U	500U	500U	500U	TR	500U
06/25/86	3200	125U	300	125U	125U	125U	500	125U
06/25/86	2400	980	250U	125U	125U	125U	130	125U
06/25/86	2900	950	250U	125U	125U	125U	125U	125U
06/25/86	1800	1400	1000U	500U	500U	500U	700	500U
06/25/86	1800	500U	6300	500U	500U	17000	12000	500U
06/25/86	3000	1100	1000U	500U	500U	500U	500U	500U
06/25/86	1300	1600	1000U	500U	500U	500U	500U	500U
06/25/86	1800	500U	TR	900	TR	TR	23000	500U
06/25/86	2000	1200	TR	500U	500U	1000	16000	500U
06/25/86	4800	800	1400	3700	12000	TR	120000	TR
08/26/86	35.5U	71U	35.5U	35.5U	35.5U	35.5U	35.5U	35.5U
08/26/86	2200	25U	450	1600	25U	45	1200	25U
11/13/86	4800J	100U	2300J	3300J	100U	100U	35000J	2000J
12/09/86	2100	100U	9300	2000	1600	100	20000	100U
12/09/86	1400	100U	1000	2200	1500	100	19000	100U
02/12/87	2600J	1000U	2000U	1000U	1000U	1000U	8600J	1000U
02/10/87	3400	500U	12000	1400B	500U	500U	7700	200J
02/10/87	840J	100U	200U	1000U	1000U	1000U	600J	100U
02/10/87	1200	1000U	1800J	600J	1000U	1000U	2600	1000U
02/12/87	2600	1000U	1200	1500B	1000U	1000U	3000	1000U
02/12/87	4800	1000U	2200	1500	1900	520J	38000	200J
02/10/87	2400	1000U	1300J	800J	1000U	1000U	9400	1000U
02/10/87	2600	1000U	1800J	1500	1000U	580J	56000	1000U
02/10/87	2600	1000U	2000U	1000U	1000U	1000U	4600	1000U
02/10/87	3200J	1000U	2000U	1000U	1000U	1000U	1000U	1000U

TABLE 1 (cont)
SUMMARY OF PRIORITY POLLUTANT VOLATILE
ORGANIC COMPOUNDS DETECTED IN LANDFILL GAS SAMPLES
Concentrations in ug/m3

Sample Locations	Ethyl Benzene	Methy-lene Chloride	Tetra-chloro-ethene	Toluene	1,1,1-Tri-chloro-ethane	Tri-chloro-ethene	Vinyl Chlor-ide
GW-01	68000	1700B	1300	6100	500U	1100	52000
GP-28	4300	2500B	TR	1600	500U	TR	TR
GP-45	18000	TRB	300	11000	125U	125U	26000
GP-32	8100	200B	TR	530	125U	125U	530
GP-32	8000	300B	TR	630	125U	125U	630
GP-33D	39000	TRB	TR	3300	500U	500U	1800
GP-33S	21700	73000	25000	89000	900	3800	39000
GP-25D	30000	500U	TR	1400	500U	500U	TR
GP-25S	36000	TRB	500U	500U	500U	500U	2000
GP-06D	50000	2000B	20000	860000	500U	13000	28000
GP-06S	77000	2500B	4700	210000	500U	5800	47000
FS-01	28000	33000B	24000	84000	TR	25000	38000
GP-13	TRB	250B	35.5U	130B	35.5U	35.5U	71U
GP-14	1200	1600B	2000	26000	900	1100	2900
GP-TL-08A	37000J	500U	3200J	110000J	100U	6700J	13000J
FLARE	18000*	30000*	10000	97000*	1400	10000	12000
FLARE	19000*	50000*	10000	10000*	1300	5800	12000
GW-22	8800BJ	100UJ	600BJ	9800BJ	1000U	600BJ	20000J
GW-12	5600B	240000B	32000B	55000B	5800	9300	20000
GW-28 EAST	50000B	1000UJ	200J	4600B	1000U	200J	2000
GW-28 SW	9000B	1000UJ	600J	36000B	1000U	800J	4800
GW-64	1500B	11000B	2200	14000B	560J	2600B	78000
GW-1a	160000B	1000UJ	12000	150000B	200J	12000	124000
GW-6a	57000B	1000UJ	3200	120000B	1000U	3400	37000
GW-6d	59000B	1000UJ	8400	130000B	1000U	8400	35000
GW-45	12000B	3600B	1000B	8600B	1000U	1000U	16000
GW-45(Dup)	12000BJ	2800BJ	1400J	8400BJ	1000U	800J	16000J

The landfill gas contains significant concentrations of VOCs and has been proposed as a possible migration pathway for these compounds to the groundwater, particularly when groundwater contamination is found upgradient.

The American Congress of Governmental Industrial Hygienists has issued threshold limit values (TLVs) on airborne concentrations of various substances. These limits are intended as guidelines in the control of potential health hazards. The time-weighted average (TWA) TLV concentration for a normal 8-hour workday and a 40-hour workweek is the concentration which nearly all workers might be exposed to without adverse effect. The compounds detected in landfill gas samples that exceeded 15 percent of the TWA values are given in Table 2. Two of the TWA's were exceeded (toluene and vinyl chloride). The detected concentrations listed in Tables 1 and 2 are from samples collected inside the respective gas well or probe and are not representative of ambient air concentrations.

EPA's ISCST (Industrial Source Complex Short-Term) dispersion model was used to predict the potential landfill air quality impacts. Toluene was generally detected at higher concentrations than other VOCs in the landfill gas samples and had the highest mass flow rate both in and out of the flares during the flare test; therefore, it was selected as the pollutant to be assessed by the air quality analysis.

The worst case analysis predicted the highest toluene concentration (using a one hour averaging time) to be slightly greater than 2 ppb. The Draft New Source Guidelines for Toxic Air Contaminants (Sept. 1986) for the State of Washington indicate a 14 ppb toluene to be the acceptable ambient

TABLE 2

THRESHOLD LIMIT VALUES FOR LANDFILL GAS COMPOUNDS

Compound (CAS Number)	Sample No.	Highest Value Detected ug/m3	TWA[1] ppm	TWA[1] ug/m3
Benzene (71-43-2)	GS-012, GS-217	4,800	10	30,000
1,1-Dichloroethene (75-35-4)	GS-007	17,000	5	20,000
Trans-1,2-Dichloroethene (540-59-0)	GS-012	120,000	200	790,000
Ethylbenzene (100-41-4)	GS-011	77,000 [2]	100	435,000
Methylene Chloride (75-09-2)	GS-007	73,000	100	350,000
Toluene (108-88-3)	GS-010	860,000	100	375,000
Vinyl Chloride (75-01-4)	GS-217	124,000	5	10,000
2-Hexanone (591-78-6)	GS-011	8,200	5	20,000
Total Xylenes (1330-20-7)	GS-011	170,000	100	435,000
1,2-Dichloroethane (107-06-2)	GS-012	12,000	10	40,000

[1] TWA - Time Weighted Average, Reference 34.

[2] A value of 160,000 ug/m^3 was detected for ethylbenzene in sample GS-217; however, ethylbenzene was also detected in the laboratory reagent blank.

level; therefore, it would appear that as long as the current gas collection system remains functional, ambient air concentrations of VOCs should remain well below ambient air standards.

B. Contaminants Detected

Groundwater, surface water, leachate, sanitary sewer, subsurface soil, sediment and landfill gas samples were collected during the RI sampling program. The prevalent contaminants detected during the sampling program were volatile organic compounds followed by semivolatile organic compounds and metals.

Twenty-four volatile organic chemicals were found in the groundwater. Of the twenty-four chemicals, the following seven indicator chemicals were identified in the Endangerment Assessment in the RI as being of most concern because of their toxicity, frequency of occurrence, and primary targets (human population):

- vinyl chloride
- benzene
- 1,2-dichloroethane
- methylene chloride
- 1,1-dichloroethane
- chloroethane
- toluene

In addition, review of the Endangerment Assessment by EPA and Ecology resulted in the inclusion of three additional indicator chemicals listed below:

- o xylenes
- o 1,1,1-trichloroethane
- o ethyl benzene.

The rationale for inclusion of these chemicals is discussed further in the Endangerment Assessment section of this document.

Twenty three private drinking water wells were sampled during the sampling program. For the three wells where contamination exceeded drinking water standards, the City of Tacoma connected the residents to City water. As the plume spreads, it is predicted more private wells would become contaminated at levels above public health standards unless actions are taken to restrict the movement of the plume.

A list of hazardous organic compounds (priority pollutant and hazardous substance list compounds) detected in groundwater samples analyzed during the RI is given in Table 3. Table 4 provides the list of priority pollutant metals detected at the landfill.

C. Extent of Ground Water Contamination

The contaminant pathway of primary concern near the landfill is the ground water. The town of Fircrest supplies water to its residents from six wells located west of the landfill. Three of these wells are only

TABLE 3

ORGANIC WASTE COMPONENTS DETECTED AT THE TACOMA LANDFILL

Waste Component	Subsurface Soil	Ground-water	Surface Water	Sanitary Sewer and Leachate	Sediment	Gas[a]
Volatile Organic Compounds						
Tetrachloroethene	X	X		X	X	X
Trans-1,2-Dichloroethene	X	X		X		
Trichloroethene	X	X		X	X	X
1,1-Dichloroethene		X		X	X	X
Vinyl Chloride		X		X		X
1,1,1-Trichloroethane		X				X
1,1-Dichloroethane		X		X		X
1,2-Dichloroethane		X				X
Chloroethane		X		X		X
Benzene		X		X	X	X
Ethylbenzene		X	X	X		X
Chlorobenzene		X		X		X
Toluene	X	X	X	X	X	X
Xylene (Total)	X	X		X		X
2-Butanone	X	X		X	X	X
2-Hexanone				X		X
1,2,-Dichloropropane		X		X		X
Trans-1,3-Dichloropropene		X				X
Styrene						X
Carbon Disulfide						X
Chloroform		X	X	X		
Chloromethane						X
Bromo-dichloromethane						
Methylene Chloride	X	X		X	X	X
Acetone	X	X		X	X	X
4-Methyl-2-pentanone		X		X		
SemiVolatile Organic Compounds[b]						
Hexachlorobenzene		X				
PNAs		X			X	
Phenol		X		X		
Pthalate Esters		X			X	
1,4-Dichlorobenzene				X		
N-Nitro-Sodi-phenylamene				X		
Benzyl Alcohol				X		
Benzoic Acid				X		
4-Methy Phenol				X		
Isophorone					X	

[a] Samples not analyzed for semivolatile compounds

[b] Only trace amounts of semivolatile compounds were detected in ground water samples.

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TABLE 4

METALS DETECTED AT TACOMA LANDFILL

	Subsurface Soil	Ground-water	Surface Water	San. Sewer & leachate	Sediment	Gas
Arsenic	X	X	X	X	X	NA
Cadmium		X	X	X	X	NA
Chromium	X	X	X	X	X	NA
Copper	X	X	X	X	X	NA
Mercury	X	X	X	X	X	NA
Nickel	X	X	X	X	X	NA
Lead	X	X	X	X	X	NA
Zinc	X	X	X	X	X	NA
Iron	X	X	X	X	X	NA
Aluminum	X	NA	X	NA	X	NA
Manganese	X	X	X	X	X	NA

NA= not applicable

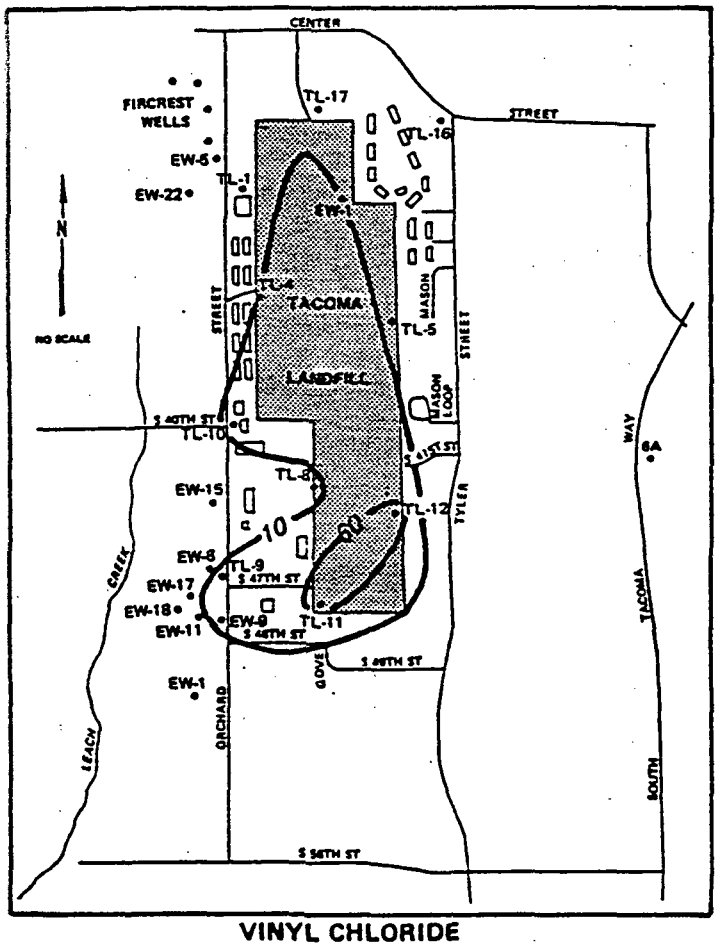
approximately 0.2 mile from the edge of the landfill. The City of Tacoma operates nine wells to the east of the landfill to supplement summer peak demands on their surface water supply (see Figure 2). In addition, twenty-six known domestic wells are located near the landfill (see Figure 6).

Volatile organic compounds have been detected in 20 monitoring wells installed around the perimeter of the landfill during the RI and in six of the private wells. The highest contaminant concentrations and greatest numbers of compounds were generally found near the water table in the southern portion of the landfill. Water samples from monitoring wells TL-4, TL-8a, TL-11a, and TL-12 illustrate this occurrence. However, the highest concentration of vinyl chloride detected to date on the site was drawn from a deeper portion of the aquifer at monitoring well TL-10b.

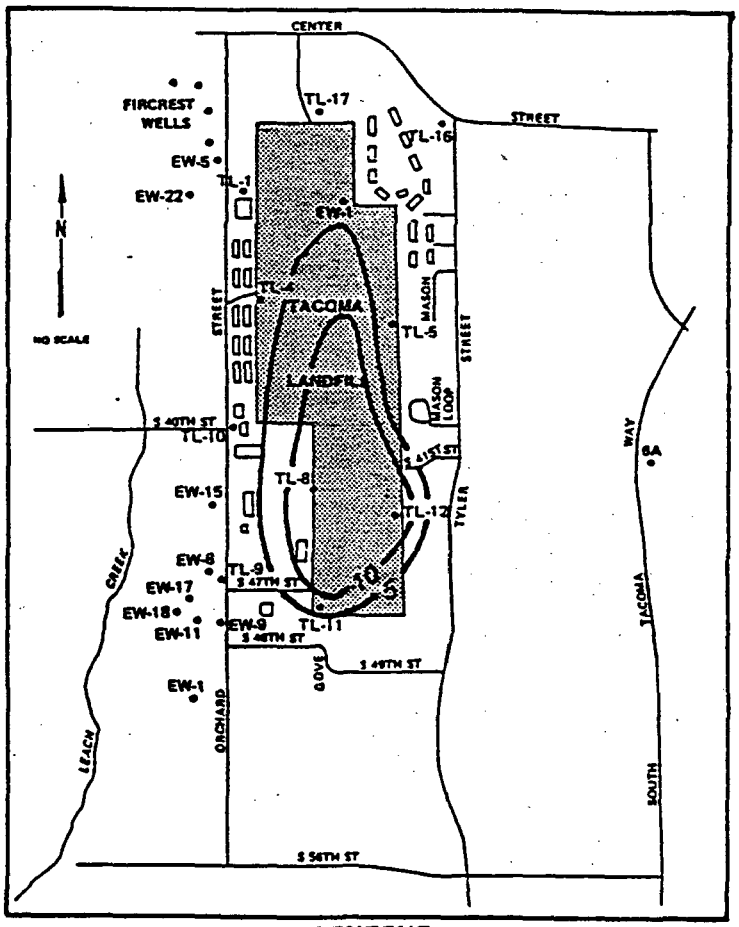
Contour maps included in the RI report show the projected distribution of seven of the contaminants of concern in the aquifer associated with the Tacoma Landfill Site:

	Contaminant	Maximum Concentration
a.	Vinyl chloride	80 ug/l
b.	Benzene	19ug/l
c.	1,2-dichloroethane (DCE)	20 ug/l
d.	Methylene chloride	1300 ug/l
e.	1,1-dichloroethane (DCA)	42 ug/l
f.	Chloroethane	55 ug/l
h.	Toluene	60 ug/l

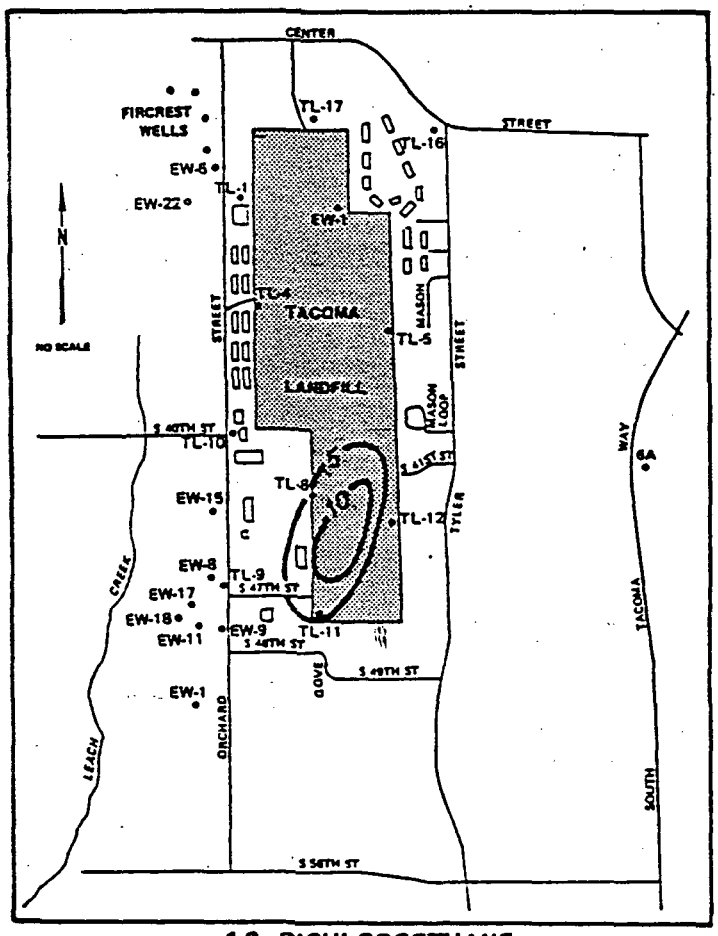
CONTAMINANT DISTRIBUTION IN GROUNDWATER



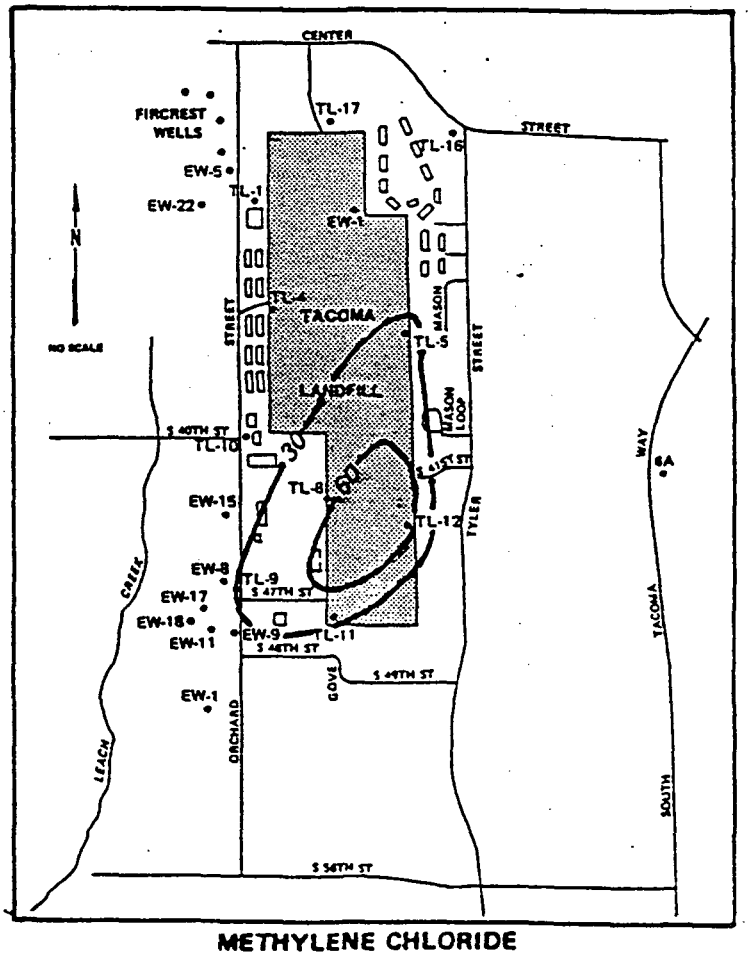
VINYL CHLORIDE



BENZENE



1,2–DICHLOROETHANE



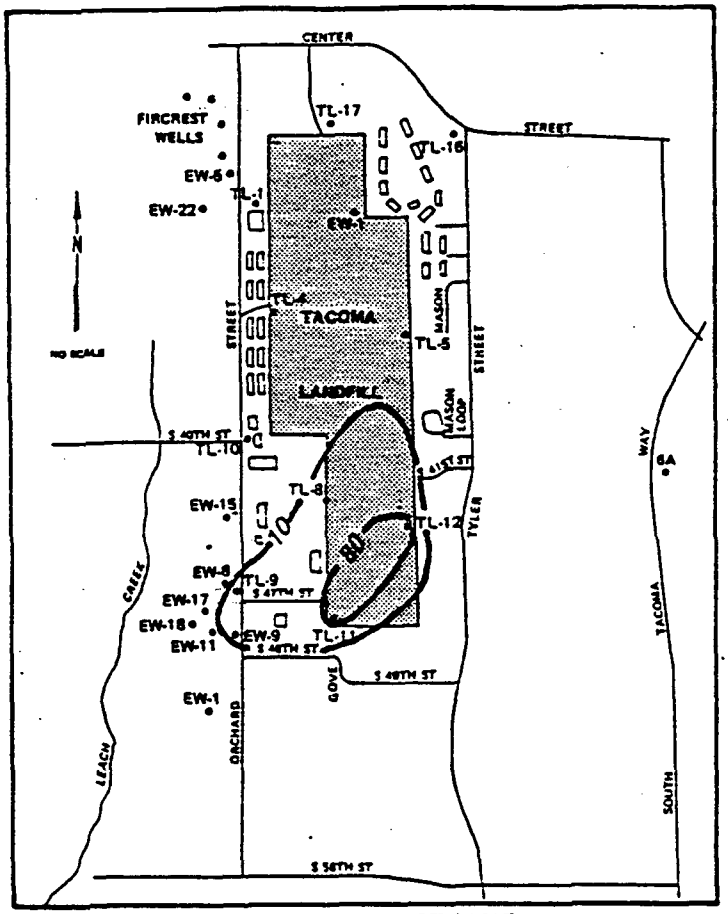
METHYLENE CHLORIDE

CONCENTRATION CONTOURS IN UG/L

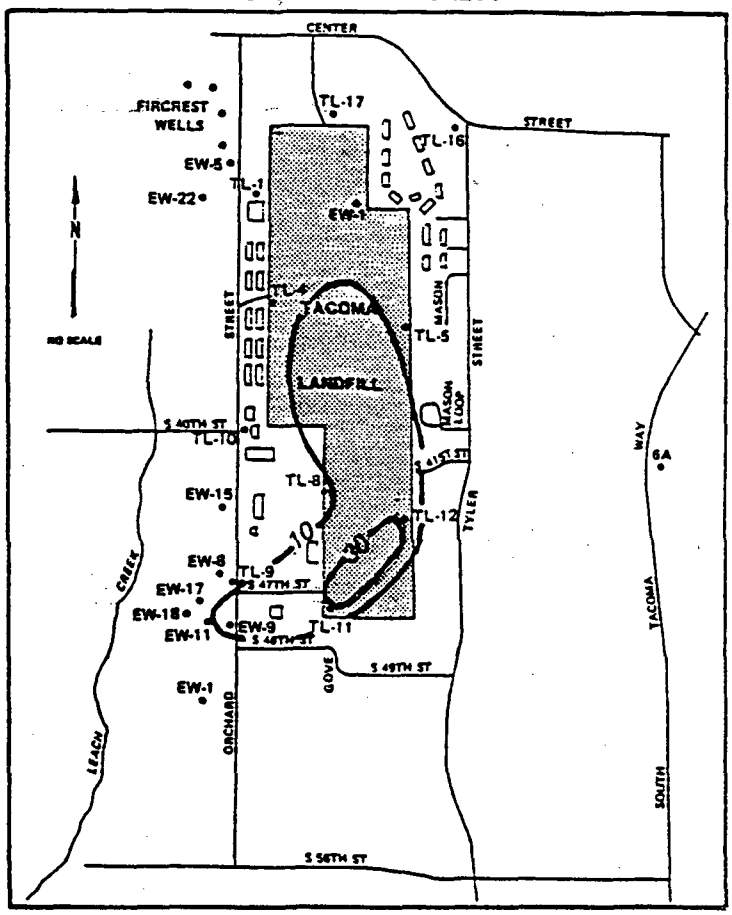
FIGURE 9
CONTAMINANT DISTRIBUTION

CITY CLERK CONTRACT/AGREEMENT NO. 4066

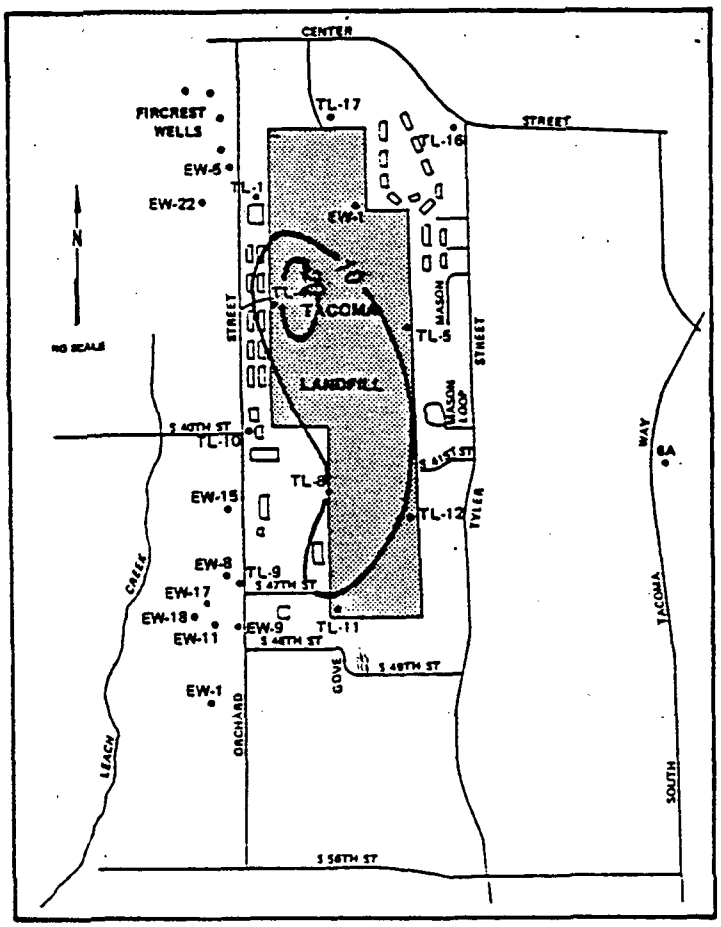
CONTAMINANT DISTRIBUTION IN GROUNDWATER



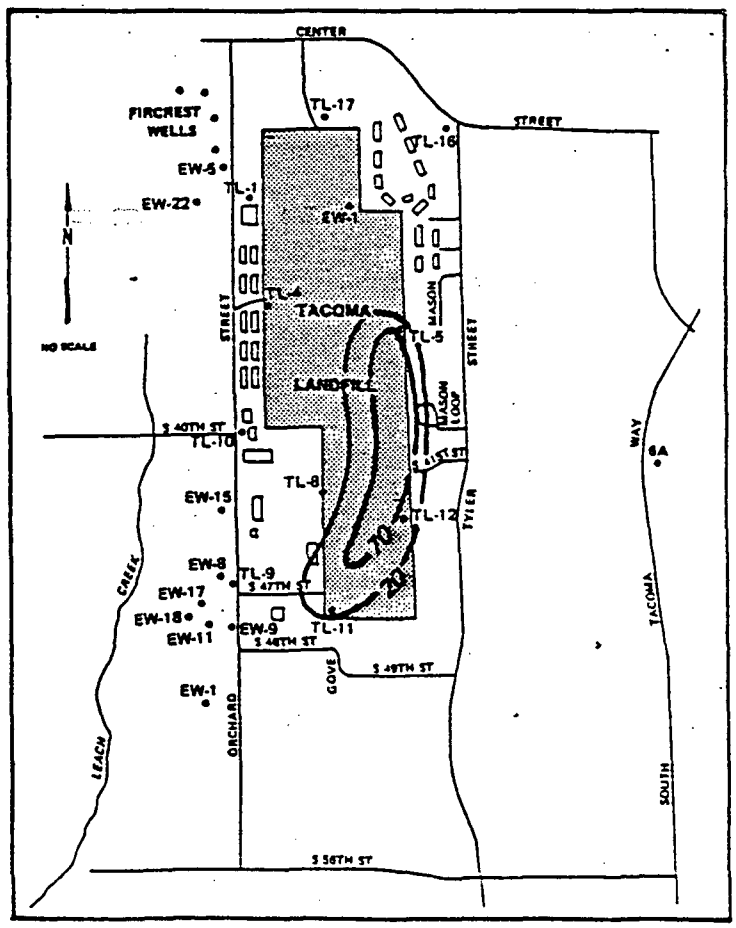
1,1–DICHLOROETHANE



CHLOROETHANE



TOLUENE



TCE

CONCENTRATION CONTOURS IN UG/L

FIGURE 10
CONTAMINANT DISTRIBUTIO
IN GROUNDWATER (CONT'D)

The contour maps are presented here as Figures 9 and 10 to show the general pattern in which each contaminant has spread in the aquifer.

Priority pollutant semivolatile, base, neutral, and acid extractable compounds were detected in trace amounts in a few of the ground water samples collected at the site. Priority pollutant metals occasionally exceeded maximum contaminant levels (MCLs) established pursuant to the federal Safe Drinking Water Act.

1,1,1-trichloroethane was also found in measurable amounts in wells along 53rd Street West. Routine sampling of these wells has been on an annual basis and it is possible that the landfill is not the only source of contamination. This is in the process of being evaluated.

D. Surface Water

Surface water testing throughout the study area, in general, did not show a significant problem which could be attributed directly to the landfill. At this time most of the surface water is being controlled on-site. There are three notable exceptions to surface water control:

1. The retention pond to the north has been contaminated with toluene. This chemical has also been detected in nearby monitoring well TL-17.

2. Nearby off-site storm sewers receive runoff which discharges to surface water (Leach and Flett Creeks) without retention or pre-treatment.

3. Storm water from the landfill is being conducted to the sanitary sewer.

Leachate was surfacing on the working face that now comprises the east side of the Central Area. The leachate is now being conducted directly to the sanitary sewer through a buried toe drain.

Sediment samples taken from nearby storm sewer outlets show elevated values for metals. However the RI was inconclusive citing other potential sources in addition to the landfill. Surface water (storm water runoff) will be addressed as part of the selected remedy.

E. Future Impacts

As part of the RI/FS, modeling was performed to project future contaminant migration. Contamination has been verified in private wells southwest of the landfill in the direction of Leach Creek.

Tentative flow paths were then plotted based on the mapping of ground water levels over several months. Contaminant flow velocities and dispersion ratios were then estimated and a simplified groundwater contaminant transport model named Plume (Van der Heijde 1983) was run.

Receptor groups were assigned based on location of known contamination and the assumed aquifer discharge. Wells closest to Orchard Street were designated near. Wells downgradient from the near wells were called far. Leach Creek was assumed to be the far boundary. The Fircrest wells were not

included in the model because the flow path analysis did not show them in the line of contamination. However, the flow path analysis was based on current usage rates and pumping conditions of both Fircrest and the Tacoma wellfield, and did not take into account any future changes to these conditions. The Feasibility Study (FS) did not include flow path analysis under differing usage rates and pumping conditions. Therefore, the model is appropriate for prediction of future migration only as far as the assumptions remain valid.

The studies showed that the main plume of groundwater contamination may reach 1200 feet southwest of the landfill. To the west and southeast it may reach 200 feet and to the northeast about 800 feet. Figure 11 shows this plume and how far it would spread if unchecked, and if the model assumptions are correct. The modeling that helped predict the plume's spread assumed that pumping of the Fircrest and City of Tacoma (6a) wells will stay the same. These wells are about 500 and 3500 feet from the site, respectively.

The model predicted that for the next 100 years the aquifer between the landfill and Leach Creek would contain unacceptable levels of contaminants. Table 5 lists the estimated maximum predicted off-site concentrations for the seven indicator chemicals in the RI, and the estimated times to reach maximum concentrations at the close in and distant wells.

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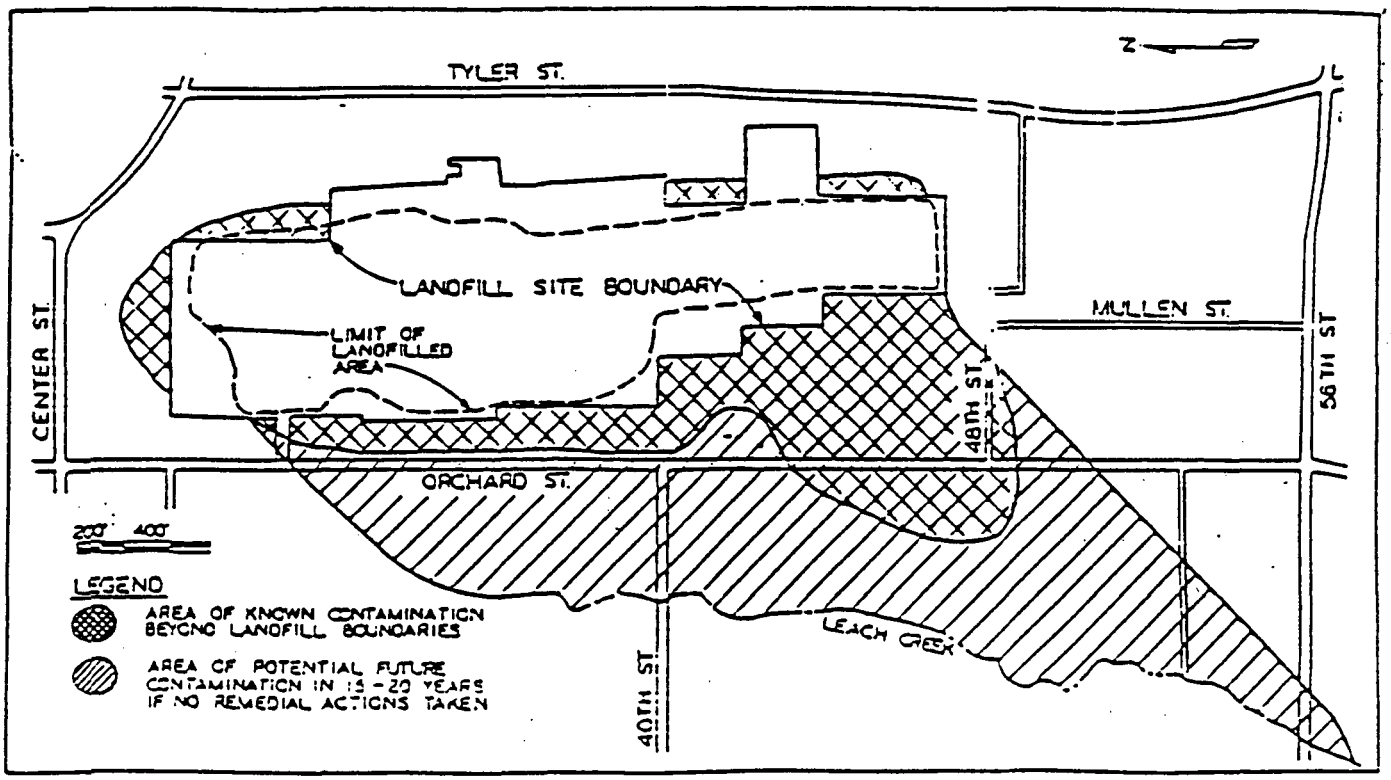
FIGURE 11

CURRENT AND PREDICTED CONTAMINATION



F. Endangerment Assessment

An endangerment assessment was conducted at the Tacoma Landfill to estimate the magnitude and probability of actual or potential harm to public health or the environment caused by the threatened or actual release of hazardous substances. The assessment presented in the RI addressed the potential human health and environmental effects associated with the Tacoma Landfill site in the absence of the any remedial action (i.e., the no action alternative).

The no action alternative is the baseline where no corrective actions take place under Superfund. In the case of the Tacoma Landfill, however, certain corrective actions will take place regardless of the actions taken pursuant to the Superfund site cleanup. These corrective actions must be conducted to meet the requirements of the Washington State Minimum Functional Standards for landfills (WAC 173-304). These actions include: developing an operating and closure plan for the landfill, installation of a cap, installation of a liner and leachate collection for ongoing disposal activities, and installation, operation and maintenance of a methane gas extraction system.

The future operation and maintenance of the landfill gas extraction system and planned refuse processing operations will restrict development of the landfill. Therefore, the endangerment assessment for the no action alternative assumes site access will continue to be restricted in the future. Although several pathways of exposure can be postulated for the site (surface runoff, inhalation of vapors and entrained dust), the primary pathway of concern for this site is groundwater. Since access to the site will be

restricted, the importance of the air pathway will be reduced. The methane gas collection system will also act to minimize the inhalation exposure route. The target receptors are the private and public well owners within the path of contaminant plume. Also of concern is the possibility of heavy metals and organics reaching Leach Creek, and ultimately Puget Sound, either by surface or groundwater routes.

Health Evaluation

The public health evaluation identifies potential threats to human health in the absence of remedial action at the site. This evaluation process includes a hazard assessment, dose/response assessment, exposure assessment and risk characterization.

Twenty-four volatile organic chemicals were detected in the groundwater. Of these, seven were selected as contaminants of concern in the Endangerment Assessment of the RI due to their frequency of occurrence, concentrations found, and primary targets (human population):

- vinyl chloride
- benzene
- 1,2-dichloroethane
- methylene chloride
- 1,1-dichloroethane
- chloroethane
- toluene

However, based on EPA and Ecology's review of the Endangerment Assessment, the following three additional organic chemicals have been added to the list of contaminants of concern:

- xylenes
- 1,1,1-trichloroethane
- ethyl benzene.

This new list of ten organic contaminants of concern were separated into classes of potential carcinogens and noncarcinogens. Vinyl chloride, benzene, 1,2-dichloroethane, and methylene chloride were selected as indicator potential carcinogens. Both vinyl chloride and benzene are classified as human carcinogens by the EPA. Methylene chloride is a B2, probable human carcinogen, based on inadequate data in humans and increased incidence in rats and mice. It is present both on and off-site at considerably less frequencies of occurrence.. 1,2-dichloroethane, despite being found even less frequently than methylene chloride, is ranked as an EPA B2 carcinogen and is included for that reason.

Chosen as noncarcinogen indicator chemicals of concern were 1,1-dichloroethane, chloroethane, toluene, xylenes, 1,1,1-trichloroethane, and ethyl benzene. The three chlorinated ethanes were encountered relatively frequently in the samples, although 1,1-dichloroethane occurs much less frequently than the others. In general, the toxicity and bioconcentration potential of the chlorinated ethanes increases with increased concentration. All but the 1,1,1-isomer are extremely soluble in water. Toxicity concerns

from their ingestion at significant levels in drinking water lie chiefly in the areas of chronic liver damage and overall central nervous system depression.

Toluene and xylenes were selected largely because of their high frequencies of occurrence, chemical similarities, and potential ecological risk. Toluene was the most commonly detected chemical in water samples off-site, and was roughly equivalent to xylene as fourth most common on-site. Ethyl benzene was included as a chemical of concern because of its relatively frequent occurrence among the more minor chemicals, its leachability, and its tendency to biodegrade relatively slowly in groundwater.

The Endangerment Assessment of the RI calculated the excess lifetime cancer risks from ingestion of carcinogens in groundwater if no alternate water supply is provided, and an estimate of risk if there is short term exposure to the indicator chemicals. Because so many chemicals, both carcinogens and noncarcinogens, are present in the groundwater, the possibilities of additivity and synergism cannot be ignored. However, the Endangerment Assessment of the RI was largely modeled on the concept of the predominant risk being due to the ingestion of water containing vinyl chloride.

The calculation of carcinogenic risk, assuming no alternate water supply is provided, is based on a 70 kg adult consuming 2 liters of contaminated groundwater for 70 years. The increased risk of cancer if a 70 kg adult consumes 2 liters of vinyl chloride contaminated groundwater (at a concentration of 70 ug/L) for 70 years is about 5 in one thousand.

Carcinogenic risks have been calculated for the short term exposure scenario, that a carcinogen migrates to a residential well the day after a "carcinogen free" sample is collected. It is estimated it will take approximately four months from the start of exposure until contamination is detected in the next quarterly sample and before an alternate water supply can be provided. The short term concentration was estimated based on sampling results for the residential wells in which contamination has been detected. The average daily intake was then calculated to account for the four month exposure. The estimated excess cancer risk associated with this short term exposure is less than one in a million.

The population at risk within the predicted plume is divided into three areas: the area within City boundaries, the area within the Town of Fircrest boundaries, and the unincorporated area within Pierce County. Approximately half of the predicted contaminant plume is east of Orchard Street within the Tacoma City limits. There are approximately 26 residences within the projected plume, if contamination continues to flow predominately toward the southwest. Groundwater sampling and hydrogeological investigations conducted during the RI indicate that the plume has reached the existing wells closest to the landfill. Those with close-in wells in which contaminants have been detected have been connected to City water.

There are still three close-in wells not hooked up to City water in which contaminants have not been detected. No contaminants have been detected in the distant wells, and based on the contaminant transport modeling, it will be several years before the wells in this group will be impacted as a result of contaminant migration from the landfill.

Table 5 lists the estimated landfill source concentrations for the seven indicator chemicals listed in the RI and the estimated times to reach maximum concentrations at the close-in and distant wells. The close-in wells would be expected to be maximally impacted by vinyl chloride beginning about 10 to 15 years from now while benzene would not be expected to peak until about 55 to 60 years hence. The distant wells would be expected to reach maximum benzene concentrations in about 85 to 90 years.

There is a possibility that if water from Leach Creek was used in the future as a drinking water supply, exposure to vinyl chloride and/or benzene at levels exceeding their MCLs could occur. There are existing water rights for domestic use of Leach Creek.

Some potential exists for human exposure to contaminants by using private well water for livestock and to water vegetables, etc. However, since the contaminant concentrations of the groundwater being used to water livestock and irrigate crops would be the same as detected in the private wells, it would be highly unlikely that a significant exposure would result from this pathway.

Environmental Evaluation

The Endangerment Assessment in the RI did not compare the levels of organics and metals in the groundwater to ambient Water Quality Criteria (WQC) for the protection of aquatic life. Metals and organic compounds in the groundwater which are above federal or state WQC are of environmental concern. Maximum concentrations detected in either on-site or off-site

TABLE 5

TRAVEL TIMES TO REACH MAXIMUM AND THRESHOLD CONCENTRATIONS, CLOSE-IN AND DISTANT WELLS

Indicator Chemical	Maximum Predicted Offsite Conc. ug/L	Time from Present to Approach Max. Concentration, Yrs. Close-In Wells	Distant Wells	Threshold Conc. ug/L	Time From Present to Back Below Threshold Yrs
Vinyl Chloride(1)	60-70	10-15	25-30	2	>100
Benzene(1)	8-10	55-60	85-90	5	>100
1,2-Dichloroethane(1)	4-5	45-50	75-80	5	NA
Methylene Chloride(1)	150-160	5-10	20-30	36, 5	>100
1,1-Dichloroethane(2)	80	35-40	65-70	271, 27	NA, >100
Chloroethane(2)	30	5-10	20-25	(Very High)	NA
Toluene(2)	30	55-60	85-90	2000	NA

NOTES:

(1) Maximum concentrations for carcinogens are maximum 70 years average.

(2) Maximum concentrations for noncarcinogens are maximum 90 days average.

groundwater for cadmium, chromium, copper, nickel and zinc, all exceeded ambient WQC for the protection of aquatic life. An overview of the VOCs which were identified as potentially harmful to the environment are listed in Table 3.

Flett and Leach Creeks support anadromous salmonid runs, which will be at risk if toxic compounds are present in the creeks during critical phases (e.g., smolting) in their growth cycles. Heavy metals, as well as certain of the organics such as xylene may also pose problems for the health of the downstream wetlands ecosystem as the Leach Creek drainage ultimately enters Puget Sound. This would most markedly impact highly vulnerable organisms such as larval fishes, but parts of the commercially important benthos (shellfish) could also become adversely affected.

Conclusions

Based on a review of the endangerment assessment and data presented in the RI report, the following conclusions were made concerning risk to human health and the environment from contaminants associated with the Tacoma Landfill site:

- Concentrations of several indicator chemicals frequently exceed MCLs in the groundwater. Drinking the water from contaminated wells poses the most significant risk to human health, especially in terms of chemicals in the aggregate.

- Under the no action alternative, some contaminant concentrations in the groundwater plume are predicted to exceed ambient WQC when the plume discharges to Leach Creek. These levels could pose a risk to aquatic biota, especially since the Leach and Flett Creeks wetland area enters Puget Sound.

- Based on EPA and Ecology's review of the Endangerment Assessment in the RI, the agencies agreed that it would be appropriate, for the protection of public health, to establish health-based levels for a larger number of compounds than the seven indicator chemicals selected during the risk assessment. Accordingly, xylenes, 1,1,1-trichloroethane and ethyl benzene have been added to the list of contaminants of concern.

- Depending on the discharge location, performance levels for the selected remedy will be based on MCLs, Water Quality Criteria, or pre-treatment standards. In the absence of established standards or Water Quality Criteria, EPA Region 10 has conducted a risk assessment of the compounds. These are listed in Table 8 of the Selected Remedy portion of this document. The most stringent number will be used for the performance levels for the treatment system if the cleaned water is discharged to surface water. For the other volatile organic chemicals and metals found in the groundwater, EPA and Ecology have identified a methodology for establishing performance levels. This methodology is detailed in the Selected Remedial Alternative section of this document (Section VI).

V. SUMMARY OF ALTERNATIVES EVALUATION

A. Identification and Screening of Remedial Technologies

In order to develop a complete listing of potential remedial technologies, general response actions corresponding to each contaminant pathway were identified.

The general response actions fall into the following seven primary categories:

- No action
- Institutional controls
- Containment
- Removal
- On-site treatment/discharge
- Off-site treatment/disposal
- Other management options.

Forty potential remedial technologies for controlling contaminant migration were screened. Thirty-one potential remedial technologies were identified for the groundwater pathway and nine potential remedial technologies were identified for the gas migration/air quality pathway. The potential remedial technologies were categorized according to the appropriate general response action. A screening process was applied to these to identify unsatisfactory technologies. Screening criteria were effectiveness, implementability, and cost.

The technologies that were not screened out were assembled into preliminary remedial action alternatives. These alternatives were designed to meet the categories identified by the National Contingency Plan (NCP). Screening criteria contained in the NCP and Superfund Amendments and Reauthorization Act of 1986 (SARA) were overlapped in this process. An initial screening was performed on sixteen separate alternatives. The preliminary remedial action alternatives were screened again in order to eliminate alternatives that adversely impact public health and the environment, or that are more expensive than other alternatives which provide the same degree of remediation. This initial screening of remedial action alternatives produced six remedial alternatives that were subjected to detailed development and analysis.

For ease in presenting the alternatives to the public, alternatives 2, 4, 8, and 12 as numbered in the FS report (Black & Veatch 1987) were combined since they represented just one technical category (i.e., pump, treat, and discharge). The alternatives then became no action, alternative water supply/landfill cap, and pump, treat, and discharge with landfill cap. Four treatment options are included in the last alternative (see Table 6). Information packages available to the public contained these three alternatives, which were also presented at a public meeting on February 11, 1988.

B. Methodology for Detailed Evaluation of Remedial Alternatives

The detailed evaluation in the FS discusses cost-effectiveness of an alternative in terms of technical, environmental and public health, and

institutional concerns. Requirements of the NCP were met by evaluating each alternative with respect to the following criteria:

- Technical Feasibility
- Public Health Impacts
- Environmental Impacts
- Institutional Requirements
- Cost Analysis.

This analysis facilitates the comparison of similar components among the alternatives for the same criteria.

Technical Feasibility

The technical evaluation considered the performance, reliability, implementability, and safety factors of the remedial actions. Performance of each alternative was based on the alternative's expected effectiveness and its useful life. Key considerations in evaluating reliability included operation and maintenance (O&M) requirements and the demonstrated performance of the technologies at similar sites. While SARA requirements do not include demonstrated performance, the six final remedial alternatives evaluated against this criteria were known technologies. For implementability, both the constructability and the time required to achieve a given level of response were considered. Constructability addresses whether the alternative can be constructed on the site and the impact of external conditions on the construction. The time it takes to implement an alternative and the time to

achieve beneficial results that attain or exceed relevant or applicable standards were also considered. The safety evaluation considers short-term and long-term threats to the safety of nearby residents and to persons working on-site. Major risks to consider are exposure to hazardous substances, fire, and explosion due to activities conducted during implementation of the remedial action.

Public Health Impacts

The public health evaluation of alternatives assesses the extent to which each alternative mitigates long or short-term exposure to any residual contamination and protects public health during and after completion of the remedial action. In evaluating both long and short-term public health impacts, two primary areas were considered. Evaluation of short-term impacts considered health effects on workers during construction of the remedial action and on the public for the interim period prior to remedial action implementation. Long-term impacts were judged based on chronic intake of the contaminant over a lifetime.

Environmental Impacts

Each remedial alternative was evaluated for beneficial and adverse environmental impacts for the long and short-term. Criteria for evaluating beneficial effects were final environmental conditions, improvements in the

biological environment, and improvements in resources people use. Criteria for evaluating adverse effects were the expected effect of the remedial action and the measures taken in the event inevitable or irreversible effects occur.

Institutional Requirements

Institutional requirements are divided into three categories: community concerns, conformance with Applicable or Relevant and Appropriate Requirements (ARARs), and permitting requirements. Community concerns addresses the public's acceptance of the selected remedial action alternatives. The remedial action alternatives developed in the FS should address all legally applicable or relevant and appropriate standards, requirements, criteria, or limitations to be consistent with SARA. Institutional constraints are those mechanisms available to ensure administrative control over activities at the site (zoning, permits, ordinances, etc.).

Cost Analysis

Detailed cost analysis of alternatives involves estimating the expenditures required to complete each measure in terms of capital costs, and annual operation and maintenance costs for a 30-year period. Once these values were determined and a present worth calculated for each alternative, a comparative evaluation was made. The cost estimates presented in the FS section were based on conceptual designs prepared for the alternatives (i.e., without detailed engineering data). These estimates were accurate between +50 percent and -30 percent in 1987 dollars.

Rating Alternatives

A rating system is used to evaluate alternatives, and the terms high, moderate, and low are assigned to each. A high rating indicates that the alternative promotes the intent of the criterion and/or meets or exceeds the remedial objectives. A moderate rating indicates that the alternative only partially promotes the intent of the criterion; however, the alternative does remediate the problem to an acceptable extent even though it does not meet all the remedial objectives. A low rating indicates that the alternative does not promote the criterion and/or does not meet the remedial objectives.

An evaluation of each alternative is contained in Tables 6 and 7. These evaluations are based on numerical ratings of each criterion contained in the FS (Black & Veatch 1987). A criterion was subdivided into one or a few factors, which were rated from 1 to 5. To establish the criterion numerical rate, numerals assigned to each factor within the criterion were averaged. For this report, ratings were assigned as follows:

Numerical Rating	New Criterion Rating
$\leq$2.00	High
2.01-3.99	Moderate
$\geq$4.00	Low

TABLE 6

SUMMARY OF DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

No.	Alternative (No. in FS)	Cost ($1,000)		Criterion				
		Capital	Present Worth	Public Health Impacts	Environmental Impacts	Technical Feasibility	Institutional Requirements	Community Concerns
1	No Action (1)	--	--	Low	Low	N/A	Low	Low
2	Alternative Water Supply/ Landfill Cap (3)	16,423	18,376	High	Moderate	High	High	High
3	Pump, Treatment, and Discharge with Landfill Cap							
	a. Off-site Treatment at Sewage Treatment Plant (2)	17,932	23,418	High	High	Moderate	High	High
	b. On-site Treatment (Air Stripping and Carbon Adsorption (4)	19,532	22,717	High	High	Moderate	High	High
	c. On-site Treatment Carbon Adsorption (8)	19,266	23,417	High	High	Moderate	High	High
	d. On-site Treatment (Air Stripping) (12)	18,971	21,015	High	High	Moderate	High	High

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TABLE 7

SECTION 121(b) (1) (A-G) FACTORS

	Alternative					
Criterion	1	2	3a	3b	3c	3d
Compliance with ARARs	Low	Moderate	High	High	High	High
Reduction of Toxicity, Mobility, Volume	Low	Moderate	High	High	High	High
Short-Term Effectiveness	Low	High	Moderate	Moderate	Moderate	Moderate
Long-Term Effectiveness	Low	Moderate	High	High	High	High
Implementability	N/A	High	Moderate	Moderate	Moderate	Moderate
Cost (See Table 6)						
Community Acceptance	Low	Moderate	High	High	High	High
State Acceptance	Low	Moderate	High	High	High	Moderate
Overall Protection of Human Health and the Environment	Low	Moderate	High	High	High	High

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C. Results of Detailed Evaluation of Remedial Alternatives

This section presents a summary of the detailed evaluation of the remedial alternatives in terms of costs, public health impacts, environmental impacts, technical feasibility, institutional requirements, and community concerns. A summary of these items is presented in Table 6 according to 1985 RI/FS Guidance Factors (EPA 1985) and an evaluation of the remedial alternatives according to the Section 121(b)(1)(A-G) factors is shown in Table 7.

Non-cost Evaluation

As shown in Table 6, Alternatives 2, 3a, 3b, 3c, and 3d all had four high ratings and one moderate rating. Therefore, they would be judged comparable alternatives under this system of rating criteria. However, evaluating alternatives using guidance from Section 121(b)(1)(A-G) factors reveals some differences (Table 7). The (A-G) factors are used to assess alternative remedial actions for permanent solutions and to assess alternative treatment technologies that yield a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant. Alternatives 3a, 3b, and 3c, have six high ratings and two moderate ratings. Alternative 3d has five high ratings and three moderate ratings. Alternative 2 has only two high ratings and six moderate ratings. It is clear that Alternatives 3a through 3c would be considered superior to to the other alternatives.

Cost Summary and Sensitivity Analysis

Cost estimates prepared for each alternative involved approximation, assumptions, estimations, interpretations, and engineering judgment. To provide some indication of sensitivity of the costs to changes in key parameters, a sensitivity analysis was performed.

The cost of closing the landfill is the major cost for all the alternatives under consideration, and is the same for each. The treatment process cost could be the most variable because alternatives would not yield the same influent concentrations. To evaluate the impact that changes in concentration would have on carbon adsorption treatment costs, concentrations of two and three times the predicted value were analyzed. The carbon adsorption unit cost was chosen for analysis on the basis of its potential impact on overall treatment cost estimates of Alternatives 3b and 3c. When the concentration of contaminants in the waste stream is doubled, the carbon usage (cost) will increase by approximately 1.5 times. The total cost for Alternative 3b would increase 3.8 percent while the total cost for Alternative 3c would increase 6.8 percent. For the case when the contaminant concentrations are tripled, the carbon cost will approximately double. The total cost for Alternative 3b would increase 7.3 percent while the total cost for Alternative 3c would increase 9.7 percent.

VI. SELECTED REMEDIAL ALTERNATIVE (No. 3)

A. Description of Selected Remedy

The selected remedy includes a landfill cap and gas extraction system to control the source, and a ground water extraction and treatment system to control migration of the plume. All extracted water will be treated to specific performance standards, monitored to ensure compliance and will be properly discharged. The Tacoma water supply system will be expanded to assure sufficient water is available should any water supply (public or private) become contaminated from the landfill. The remedy also includes a closure schedule for operation of the landfill.

The remedy is designed to:

- Prevent further migration of the plume via the ground water extraction-treatment system.
- Reduce the production of leachate by placing constraints on site operations and by properly grading and capping the landfill.
- Eliminate off-site gas migration through the gas extraction system.
- Further protect public health and the environment via monitoring of groundwater, surface water, gas probes, air emissions, and provision of alternate water supplies where necessary.

Management of Migration

Migration control will be achieved through a ground water extraction and treatment system, and a system or method to confirm performance. Activities necessary to develop those systems shall be conducted during remedial design. Wells for this system will be placed within and, if necessary, downgradient to contain the plume. Containment is defined as controlling the plume and preventing the spread of contamination. The goal of the containment system is to prevent any further degradation of existing water quality beyond the boundaries of the existing plume. The extraction wells should be designed to achieve this objective. The existence of the gradient reversal due to pumping by the city of Tacoma wellfield, local effects from pumping the Fircrest wells, or monitoring results at the landfill may result in the need for extraction wells at locations other than those identified in the feasibility study. Minimum flows as required by WAC 173-512 shall be maintained in Leach and Flett Creeks.

The treatment process shall be permanent and shall effectively reduce the toxicity, mobility, and volume of contaminants. It shall also employ all known, available, and reasonable methods to treat the contaminated ground water, and to prevent the spread of contamination. Discharge of treated ground water may be to either Leach Creek, Flett Creek, or the sanitary sewer.

If the discharge is to either Leach Creek or Flett Creek, the effluent must meet or exceed maximum contaminant levels (MCLs) developed pursuant to the Safe Drinking Water Act or meet the chronic fresh water criteria as set forth in EPA's Quality Criteria for Water, 1986 (EPA 440/5-86-001), whichever

is more stringent. Both of these creeks have existing water rights on them, although they are closed to further appropriation by WAC 173-512. In addition, both creeks support anadromous salmonid runs.

Most of the contaminants found at the Tacoma Landfill do not currently have MCLs. For the VOCs listed in Table 3, and for metals in the groundwater, which EPA and Ecology have not established treatment levels, a methodology for determining the appropriate discharge limits has been established. If no MCL has been established for a contaminant, the ambient water quality criteria (WQC) for protection of human health for water and fish ingestion will be used. If the value for protection of fish (the chronic fresh water criteria) is lower than the value for protection of human health, the lower value will be applied. If there are no WQC at all, then additional guidance documents, such as Health Advisories from EPA's Office of Drinking Water or any appropriate toxicological profiles, will be used to develop treatment levels. These treatment levels must be reviewed and approved by both Ecology and EPA prior to their use. This methodology will be used to set performance levels for any other contaminants identified in the groundwater and traceable to the landfill.

For six of the volatile organic compounds listed in Table 8, appropriate treatment levels have been identified. These are based on Safe Drinking Water Act MCLs or ambient WQC. In the absence of an MCL or ambient WQC, EPA Region 10 conducted a risk assessment of the chemical and provided an appropriate treatment goal for the protection of public health, welfare and the environment. These goals are listed in column three of Table 8 and will be used as performance goals for the treatment system. In addition, the effluent

TABLE 8

PERFORMANCE LEVELS FOR TREATMENT SYSTEM

DISCHARGE TO SURFACE WATER

TACOMA LANDFILL

(ug/L)

Constituent	Safe Drinking Water Act MCL	Water Quality Criteria: Water and(1) Fish	Water Quality Criteria: Chronic(2) Fresh water	EPA Reg. 10 Risk(3) Assess.
Benzene	5	0.66*	53	
Chloroethane				20
1,1-dichloroethane				20
1,2-dichloroethane	5	0.94*	20,000	
Ethyl benzene		1,400	320	
Methylene chloride				5*
Toluene		14	175	
1,1,1-trichloroethane	200	18,400		
Vinyl chloride	2			
Xylenes				10

(1) EPA Quality Criteria for Water, 1986 EPA 440/5-86-001, for water and fish ingestion by humans.

(2) Chronic fresh water criteria for protection of aquatic life. Where no values for chronic exposure were available, the acute values were divided by 100.

(3) Based on EPA Region 10 Risk Assessment.

* Values presented for carcinogens are at the 10^{-6} risk level.

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must meet water quality standards as set forth in 173-201 (Water Quality Standards for Waters of the State of Washington).

If the option of discharge to the sanitary sewer is chosen, it must be consistent with discharge limitations as defined by WAC 173-216 (State Waste Discharge Program) and must meet pre-treatment regulations (City of Tacoma Code, Chapter 12.08), as revised for operation of the secondary sewage treatment plant.

Any treatment system which results in contaminant air emissions shall be designed to address appropriate ambient air quality values as determined by Ecology's Draft New Source Review Guidelines for Toxic Air Contaminants, (September 1986, or as revised). In addition, the Puget Sound Air Pollution Control Authority (PSAPCA) has made the determination that all new sources shall use Best Available Control Technology (BACT). This also will be a requirement of the treatment system design. BACT may involve a different technology for different contaminants.

The extraction and treatment system can be shut off when water quality within the plume, outside the compliance boundary (defined by WAC 173-304 as the edge of the filled area), consistently meets or exceeds drinking water standards, or previously established and approved health-based criteria. In addition to meeting health-based criteria, potential impacts to public and private water supplies and to Leach Creek must be considered in the decision to shut off the system. Ecology and EPA will reevaluate the implemented system every five years to assure that it is working properly and to propose any modifications that could facilitate the cleanup of the groundwater.

Source Control

Source control measures consist of constructing a cap on the landfill to minimize infiltration and maximize run-off. Unlined areas of the landfill will be capped as soon as possible. WAC 173-304 defines the minimum requirements for a cap on a municipal landfill. A more stringent cap will be required unless further analysis of the cap, to be provided during remedial design, shows that a significant reduction in leachate volume or toxicity would not be achieved.

Increased run-off due to the construction of the cap will be routed off the landfill to reduce infiltration. The slope of the cap and construction of drainage structures will be consistent with WAC 173-304. The run-off collected from the landfill will be directed to the appropriate storm or sanitary sewers, consistent with local storm drainage ordinances or pre-treatment regulations. The storm drainage plan, prepared as part of the remedial design, will determine and minimize any downstream increases in peak flow.

The Minimum Functional Standards (MFS) (WAC 173-304) prohibit filling in unlined areas after November 1989. These standards contain specific liner requirements which will apply to all municipal landfills by this date. Compliance with Minimum Functional Standards is determined by TPCHD, in accordance with Ecology review. Insufficient information has been received by Ecology and TPCHD to evaluate compliance of the liner installation with Minimum Functional Standard requirements. If the liner is determined not to be in compliance, a variance will be required from TPCHD to operate the Central Area Pit.

In the interim, the City has identified several unlined areas which need to be filled to meet minimum slope requirements in WAC 173-304. Additional filling in these areas will be kept to the minimum required to meet the final grade requirements of the Minimum Functional Standards. The City plans to develop an unfilled area of the landfill (North Borrow Pit) for future waste disposal. Filling of this or other previously unused areas will require a liner consistent with WAC 173-304.

Should a variance be needed and granted, the Central Area Pit will be brought up to final grade in accordance with the Operations and Closure Plan to minimize leachate production. Leachate head wells will be installed in the waste in the Central Area to assure that the leachate head requirements of WAC 173-304 are being met. Ecology and EPA will identify and approve of the appropriate number of leachate head wells during the Remedial Design phase.

MFS requires operating landfills to submit an operating plan by October 1987. A schedule for closure of the landfill under WAC 173-304 is considered part of the remedial action at this site. The schedule, developed as part of the required Operations and Closure Plan, will address various waste reduction measures and develop contingency plans if these measures do not produce the expected results. The contingency plans will include specific dates for beginning the process to site another municipal solid waste disposal facility to serve the City of Tacoma. Waste reduction measures to be considered include, but are not limited to:

- increased recycling including a program to exclude hazardous waste from the landfill

- incineration of the light fraction of shredded waste at the Tacoma City Light Cogeneration plant

- pyrolysis of the heavy fraction of shredded waste at an on-site facility

Several utilities pass through the site. The Operations and Closure Plan will provide for rerouting these utilities around the site or developing a testing and maintenance program that will ensure their long-term integrity without interfering with the selected remedy.

The production of methane gas at the landfill is being addressed through the installation of a gas extraction system and is being monitored using a series of gas probes installed around the landfill. The gas collected by the extraction system is burned by the combusters which meet PSAPCA's BACT requirements. Any future expansion of this system will be required to comply with these requirements. Additional gas probes will be installed in the surrounding neighborhoods to verify that the extraction system is preventing off-site gas migration. If significant concentrations of gas are found in the soils off-site, further gas extraction wells may have to be installed to collect and control these methane sources.

Because landfill gas is warmer than the ambient air, condensate collects in the gas collection line. This condensate is currently allowed to drain back into the landfill. Condensate from the flare station is collected and discharged to the sanitary sewer. As part of the remedial design, the

quantity and quality of these condensates will be determined. If significant concentrations or volume of condensates are found, the condensate shall be collected and treated appropriately. Source monitoring of the gas burners and the treatment plant system will be required.

Monitoring

Ground water monitoring wells shall be installed in locations appropriate for obtaining the following information:

- determine if the ground water extraction system is preventing the spread of the contaminant plume
- determine the extent of plume migration to the east of the site
- identify any potential impacts to Leach Creek and the Fircrest well system
- ensure there is no dense phase plume migrating away from the site in the deepest zones of the aquifer.

Ecology and EPA will review and approve of the number and location of the groundwater monitoring wells during the Remedial Design phase of the cleanup program.

Leach Creek will be monitored for both water quality and quantity. Other surface waters acting as receiving waters for either the groundwater

extraction system or the surface drainage system will be monitored for water quality. Effluent from the treatment system will also be monitored to assure that discharge limitations are not exceeded. The nature and extent of the monitoring program, including bioassays, will be developed during the Remedial Design phase of the cleanup program.

At a minimum, the private wells in the path of the plume will continue to be monitored on a quarterly basis. Fircrest wells will be sampled monthly. Any well, public or private, which becomes contaminated due to the landfill will be replaced and water will be supplied from existing City of Tacoma water supply systems. If EPA and Ecology make a determination that any well is in danger of exceeding an MCL, or a contaminant level based on an EPA risk assessment, connection to Tacoma's municipal water supply will be required. Aesthetic quality will also be a consideration in making this determination.

Tacoma, in cooperation with the Town of Fircrest, and Pierce County, will pursue the establishment of an ordinance, or other suitable methodology, to restrict drilling of water supply wells in an area from Tyler Street to Leach Creek; and from Center Street to approximately South 56th Street.

B. Statutory Determinations

The selected remedy meets all statutory requirements for the overall protection of human health and the environment. The groundwater extraction system will remove contaminated groundwater migrating from the landfill and prevent contamination from spreading in the aquifer. The movement of contamination to nearby Leach Creek should be prevented by groundwater

pumping. Treatment of the extracted water will be designed to reduce the toxicity, mobility and volume of contaminants and prevent them from returning to the groundwater or surface water environment. Nearby residents affected by contaminated groundwater, or by low water volume or flow as a result of the operation of the extraction-treatment system, will be connected to Tacoma's municipal water system.

The selected remedy must also meet all Applicable or Relevant and Appropriate Requirements (ARARs) and should address those items listed in the To Be Considered category. These are listed and their application is briefly described in Attachment A.

The laws and regulations of concern include but are not limited to the following:

1. Resource Conservation and Recovery Act (RCRA; 42 USC 6901), RCRA regulations (40 CFR 261 to 280), Washington State Dangerous Waste Regulations (WAC 173-303 and 70.105 RCW), and Washington State Minimal Functional Standards for Solid Waste Handling (WAC 173-304 and 70.95 RCW).

   Groundwater protection requirements of RCRA and Washington State Dangerous Waste Regulations will be attained by installation of the landfill cap to minimize leachate production, and operation of the groundwater extraction wells to remove contaminated groundwater. The selected remedy prevents further spread of groundwater contamination and

constitutes a Corrective Action Program as specified in 40 CFR 264.100 and WAC 173-303-645(11). Closure of the Tacoma Landfill to State Minimum Functional Standards will be evaluated to ensure consistency with RCRA landfill closure standards.

2. Safe Drinking Water Act (42 USC 300), and Primary Drinking Water Standards (40 CFR 141).

Groundwater will meet maximum contamination levels (MCLs) and appropriate health-based standards as the contaminated plume is removed and leachate generation is minimized. The selected remedy will prevent exposing the public to contaminated drinking water by monitoring residential wells for MCLs and connecting the house to Tacoma's municipal water supply when conditions require it. Any affected public water supplies also will be connected to city water. Therefore, by monitoring, providing an alternate drinking water supply, and restricting groundwater use (until the aquifer no longer exceeds these levels) in the area, the selected remedy will meet the requirements of these regulations.

3. Clean Air Act (72 USC 7401).

If an airstripping system is used, concentrations of contaminants in the air stripper off-gases will be required to meet the requirements of the Clean Air Act. The flares for the methane gas extraction system must also meet the requirements of the Clean Air Act.

4. Clean Water Act (33 USC 1251), National Pollution Discharge Elimination System (NPDES; 40 CFR 122), NPDES Permit Program (WAC 173-220), and Water Pollution Control Act (RCW 90-48).

The selected remedy treats the extracted water to meet MCLs, health-based standards, or Water Quality Criteria prior to discharge. Therefore, there will be no adverse impact on surface waters resulting from discharge of treated groundwater, and the requirements of these regulations will be attained. The landfill cap will reduce leachate generation and therefore reduce the impact on groundwater. Storm drainage will be collected and discharged either to existing storm sewers or to surface waters. Contaminated storm water runoff will meet pre-treatment regulations and will be discharged to the sanitary sewer. Groundwater extraction and treatment will further reduce the contaminant plume. Other substantive aspects of the NPDES Permit System will be met during the design phase, although no permit is actually required.

Although on-site remedial work does not require a permit, the substantive requirements of any applicable permit will be met. Federal, state, or local permits which are required for off-site activities will be obtained.

5. Rules and Regulations of the State Board of Health Regarding Public Water Systems (WAC 248-54).

The selected remedy provides standards for connection to an alternative drinking water supply for all residents who require these supplies in conformance with these regulations.

6. Protection of Withdrawal Facilities Associated with Groundwater Rights (WAC 173-150).

This regulation protects water rights both in terms of water quality and quantity. Groundwater quality will reach levels less than MCLs; therefore the selected remedy complies with that portion of the regulation. The other portion of the regulation requires that surrounding wells not be deprived of their water supply due to other groundwater removal actions. Alternative water supplies will be made available to all residents affected by groundwater removal actions to meet the requirements of this regulation.

7. Minimum Functional Standards for Landfills (WAC 173-314 and 70.95 RCW).

The technology to be applied to remediate the landfill at a minimum will meet the Washington state standards for ongoing landfill operations, closure, capping, leachate containment, and methane control.

8. Hazardous Waste Cleanup Act (70.105B RCW).

The selected remedy will be the cleanup standards established by this act.

The selected remedy meets the SARA preference for permanent solutions to the maximum extent practicable. Treatment technologies are used as a principal element of the remedy and they will effectively reduce the toxicity, mobility, and volume of the contaminants permanently. Connection of residents, as required, to the Tacoma municipal water water supply is also considered a long-term solution.

The selected remedy meets all objectives of remedial action in that it provides a safe water supply and therefore protects public health, provides a permanent solution with moderately frequent maintenance, protects the environment to the maximum extent practicable, and reduces toxicity, mobility, or volume as a principle element of treatment. The selected remedy meets the requirement of cost-effectiveness.

VII. ENFORCEMENT

On June 27, 1986, Tacoma assumed responsibility for conducting the RI/FS under a Response Order on Consent issued by Ecology. The remedial action is anticipated to be accomplished voluntarily by the responsible parties. EPA and Ecology intend to start a negotiation period after the signing of the Record of Decision and will ensure that the remedial action proceeds. Finally, EPA and Ecology are still considering the possibility of identifying additional parties who may be potentially responsible for conditions at the site. Other than the June 27, 1986 Consent Order, there has never been any enforcement action taken by the regulatory agencies (i.e., EPA or Ecology) regarding the Tacoma Landfill site. If the responsible parties decline to implement the selected remedy as described in the Record of Decision, however, EPA and Ecology will seek appropriate enforcement action.

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VIII COMMUNITY RELATIONS

Community relations activities conducted at the Tacoma Landfill site to date include the following:

- In 1983, the Tacoma landfill was included as part of the South Tacoma Channel site on the National Priorities List under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

- In May 1985, Ecology and Black & Veatch began Remedial Investigation (RI) Phase I.

- In December 1985, Ecology and Black & Veatch began implementing the RI Project Work Plan and Sampling Plan Phase I.

- In 1985, a community relations plan was developed by Black & Veatch and Hall and Associates for Ecology.

- From May 1985 to the present, the City of Tacoma maintained correspondence with interested local residents and well owners by providing notification of quarterly sampling and outlining analytical results.

- In May 1986, the City of Tacoma issued a fact sheet discussing management of methane gas at the landfill.

- On May 13, 1986, U.S. EPA, in cooperation with the City of Tacoma and Ecology, conducted a public meeting to discuss well water quality of private wells surrounding the landfill.

- In July 1986, the City of Tacoma issued a press release and letter to residents discussing background and scope of the RI.

- In July 1986, the City of Tacoma and Ecology signed a consent agreement establishing guidelines for the RI/FS.

- In August 1986, the City of Tacoma began sampling 13 private wells located near the landfill.

- In February 1987, the Phase I Sampling Plan, Phase II Sampling Plan and Phase I RI Report were completed and made available to the public through Tacoma City and County libraries.

- On April 16, 1987, Ecology, in cooperation with the City of Tacoma and EPA , conducted a public meeting and provided a fact sheet discussing progress of the RI/FS.

- In January, 1988 a public notice was published in the Tacoma News Tribune announcing the availability of the RI and FS Reports and a public meeting to be held February 11, 1988.

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- On February 11,1988, Ecology, in cooperation with EPA and the City of Tacoma, conducted a public meeting to discuss alternatives for cleaning up the groundwater and controlling methane gas at the landfill, including the agencies' preferred plan.

- From February 4 through March 4, 1988, public comments on the RI/FS were accepted and documented.

- In February and March 1988 the the Responsiveness Summary and Record of Decision were written.

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APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A. FEDERAL LAWS AND REGULATIONS

- Resource Conservation and Recovery Act (RCRA) (42 USC 6901), Subtitle C:

  - Protection of groundwater (40 CFR 264, Subpart F) Closure and post-closure of landfills (40 CFR 264, Subpart G) [Note: These are administered by Ecology under Dangerous Waste Regulations, WAC 173-303]

- Safe Drinking Water Act (SWDW) (42 USC 300):

  - Drinking Water Standards (40 CFR 141). Enforceable Maximum Contaminant Levels (MCLs), Which are relevant and appropriate at this site. [NOTE: This is administered by the Department of Social and Health Services under WAC 248-54-175 for public water supplies]

- Clean Water Act (CWA) (33 USC 1251):

  - National Pollutant Discharge Elimination System (NPDES) (40 CFR

122) [Note: NPDES program is administered by Ecology under WAC 173-220]

- Water Quality Criteria (EPA440/5-86-001).

o Clean Air Act (CAA) (72 USC 7401):

- National Emission Standards for Hazardous Air Pollutants (NESHAPS) [Note: NESHAPS Program is administered by Ecology and Puget Sound Air Pollution Control Agency under WAC 173-403].

o OSHA 29 CFR 1910:

- governs worker safety at hazardous waste sites.

B. WASHINGTON STATE LAWS AND REGULATIONS

- Dangerous Waste Regulations, WAC 173-303: established standards for handling and disposal of hazardous waste.

- Minimum Functional Standards for Solid Waste Handling, 70.95 RCW and WAC 173-304: requirements for operation and closure of solid waste disposal facilities.

- Hazardous Waste Cleanup, Chapter 70.105B RCW: standards for the cleanup of hazardous waste sites.

- Water Quality Standards for Waters of the State of Washington, WAC 173-201: Standards for discharge to Flett Creek, or Leach Creek, or surface waters of the state.

- Submission of Plans and Reports for Construction of Wastewater Facilities, WAC 173-240: standards for the design, operation and maintenance of waste water treatment systems.

- National Pollutant Discharge Elimination System Permit Program, WAC 173-220: Discharge limitations if treated water is discharged into surface waters.

- Underground Injection Control Program, WAC 173-218: discharge standards for reinjection of treated water into the ground.

- State Waste Discharge Permit Program, WAC 173-216: Standards for the discharge to the sanitary sewer or groundwater (except by injection).

- Washington Clear Air Act, RCW 70.94: applicable for discharging pollutants into the atmosphere from a new source.

- General Regulations for Air Pollution Sources, WAC 173-400.

- Implementation of Regulations for Air Contaminant Sources, WAC 173-403.

- Emission Standards and Controls for Sources Emitting Volatile Organic Compounds, WAC 173-490.

- Instream Resources Protection Program - Chambers-Clover Creeks Basin, WAC 173-512: governs minimum water flow and levels requirements.

- Protection Associated with Groundwater Rights, WAC 173-150-100: applicable to activities that would degrade water quality.

- Minimum Standards for Construction and Maintenance of Water Wells, WAC 173-160: governs design of extraction and monitoring wells.

- Water Well Construction Act, RCW 18.104: provides for the regulation of water well construction.

- Water Pollution Control Act, RCW 90.48: standards for the protection of surface water and groundwater.

- Management of Waters of the State, RCW 90.54.020: provides for the protection of state water quality.

TO BE CONSIDERED

- Ecology New Source Review Guidelines for Toxic Air Contaminants in the State of Washington, September 1986.

- EPA Policy Statement - Groundwater Protection Strategy.

- Washington Department of Ecology Final Cleanup Policy: (Technical memorandum dated July 10, 1984) used for guidance in establishing cleanup levels.

- State Water Code, RCW 90.03 and Water Rights, RCW 90.14: establishes water rights permits necessary for water withdrawals, including groundwater extraction.

- State Environmental Policy Act (SEPA), WAC 197-11: covers all actions which may have significant environmental impact.

- State Protection of Upper Aquifer Zones, WAC 173-154: restricts activities that would impair senior groundwater rights, including water level lowering and water quality degradation.

- Protection of Withdrawal Facilities Associated with Groundwater Rights, WAC 173-150: restricts activities that would impair senior groundwater rights, including water levels lowering and water quality degradation.

- City of Tacoma Code, Chapter 12.08: pre-treatment regulations which govern discharge to the sanitary sewer.

- Pierce County Storm Drainage Ordinance 86-60: provides guidelines for the report criteria, analysis and design of public and private storm drainage systems.

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APPENDIX B

RESPONSIVENESS SUMMARY

This community relations responsiveness summary is divided into the following sections:

Section 1.0 Overview. This section reviews the U.S. Environmental Protection Agency s (EPA) preferred alternative for corrective action, and likely public reaction to this alternative.

Section 2.0 Background on Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during remedial planning activities at the Tacoma Landfill site.

Section 3.0 Summary of Major Comments Received During the Public Comment Period and Agency Responses to the Comments. Both written and oral comments are categorized by relevant topics. EPA's responses to these major comments are also provided.

Section 4.0 Remaining Concerns. This section describes remaining community concerns that EPA and Ecology should consider in conducting the remedial design and remedial action at the Tacoma Landfill site.

Community relations activities conducted during remedial response activities at the Tacoma Landfill site are listed in Attachment A to this summary.

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1.0 OVERVIEW

The City of Tacoma, under a Response Order on Consent issued by the Washington State Department of Ecology, completed a Remedial Investigation/Feasibility Study (RI/FS) for the Tacoma Landfill site, located south of Tacoma, Washington. From 1960 through the 1980s, the landfill has received refuse and garbage from the city's collection service. Hazardous materials were part of the refuse. Contaminants were discovered in nearby drinking water wells at levels high enough to cause public health concerns. The cleanup alternative recommended by Ecology to EPA, was to intercept the advance of contaminants by extracting the contaminated water, treating it, and discharging the cleaned water. This alternative is described in more detail in the Feasibility Study (Chapter 4; Black & Veatch 1987) and in the Selected Remedial Alternative section of the Record of Decision (Section VI).

In this summary, concerns of the local community about problems at the site, the recommended cleanup alternative, and the study process itself are described. Public comment also indicates that residents hope the cleanup will be as quick and thorough as possible, and not raise additional problems through its implementation. Only one potentially responsible party, the City of Tacoma, has been identified to date although an investigation to identify others has been initiated. The identified responsible parties will share cleanup costs. Residents are concerned about the funding to perform the cleanup and any adverse impact upon refuse collection rates.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Community interest in the Tacoma Landfill began as early as 1968 when local residents complained of poor water quality in their private wells. This condition continued throughout the 1970s. The residents are currently concerned about leachate from the landfill contaminating their private wells, and methane gas entering their homes.

Early in the Remedial Investigation/Feasibility Study (RI/FS) process (1985), Hall and Associates interviewed local residents and government officials and compiled a list of community concerns regarding the landfill. The following is a compilation of community concerns in 1985:

- Lack of interest and unwillingness to provide water testing by the public health agency.
- Lack of candor by government officials, particularly relating to contamination of wells in University Place during the late 1970s.
- Quality of drinking water.
- Health of small children in the neighborhood and recent miscarriages.
- Cost of replacing private wells and connecting residences to the city's water system.

- Inconvenience associated with using bottled water

- Need to be kept informed of landfill related activities.

The City of Tacoma and Ecology developed a community relations plan in an effort to keep the public informed of RI/FS activities. The City of Tacoma has addressed public concerns by holding meetings with residents to discuss RI/FS activities and public health concerns. Attachment A summarizes the community relations activities conducted at the South Tacoma Landfill. The following is a record of those activities:

1) In 1968, the City of Tacoma Department of Public Works began receiving complaints of contamination of the Home Builder's Association well, located at South 40th and Orchard Streets.

<u>Actions</u>: The City of Tacoma conducted a chemical analysis of the well water. Results revealed the water contained a high iron content, was discolored, and had a slight odor. The city installed a leachate collection system comprised of a gravel drain and dike. The dike diverted leachate flow to the drain that discharged to a perforated manhole connected to the city sewer system. An additional cover placed over the fill promoted surface water drainage, inhibited infiltration of water, and reduced leachate production. The Home Builder's Association was eventually connected to the city's water system.

2) In the late 1970s, wells owned by the University Place Water Company located west of the landfill, were found to contain elevated levels of iron and manganese. Residents complained of unappealing water taste, color, and odor.

Actions: An investigation conducted by Ecology indicated that well water contamination could have resulted from surface water or groundwater from the landfill, or from water migration through material containing high levels of iron and manganese. Residents served by these wells were eventually connected to the city's water system and these wells have not yet been abandoned in accordance with State requirements.

3) In 1985, prior to the RI, groundwater samples were collected from wells near the landfill and analyzed for U.S. EPA priority pollutant volatile organic compounds. Four private wells located in the vicinity of the landfill were found to contain priority pollutant volatile organic compounds.

Actions: In June 1985, vinyl chloride was detected in the (b)(6) well and they were connected to the city's water system. Vinyl chloride was detected in the (b)(6) 's well and they were connected to the city's water system in June 1986. Although vinyl chloride was not detected in the remaining two wells (those of the (b)(6) r and (b)(6) residences), the city supplied these residences with bottled water for drinking. The (b)(6) and (b)(6) residences were later connected to the city's water system in October and December 1986, respectively. In 1987, the (b)(6) and (b)(6) residences were connected to the city's water system because vinyl chloride contaminated their wells.

4) Early in 1986, local citizens were becoming concerned about the quality of water from their private wells.

Actions: Ecology, in cooperation with the City of Tacoma and EPA, conducted a public meeting on May 13, 1986 to discuss affects of potential leachate migration to private wells. The meeting was open exclusively to private well owners. Twenty citizens and ten city, state, and federal representatives attended. At this time, Black & Veatch was still acting as a consultant for Ecology. A description and history of the site was outlined, the affects of methane gas migration were discussed, and an agenda and fact sheet were distributed.

5) In May 1986, local residents voiced concern about lateral methane gas migration at the City of Tacoma municipal landfill.

Actions: The city hired a consultant (Mandeville Associates) to investigate gas production and the extent of off-site migration prior to the release incident. The city conducted field surveys using portable explosimeters and found methane gas had migrated beyond the landfill boundaries. As a result of these findings, a gas extraction system comprised of 128 gas extraction wells with gas probes at 66 locations was installed. Initial efforts focused on controlling gas in businesses located southwest of the site. A flare station with permanent flares was installed in November 1986. The city implemented a gas monitoring program for structures surrounding the landfill. Both ambient and point sources were measured.

6) As early as 1983, local residents were voicing concerns about potential groundwater contamination from leachate migrating from the landfill.

Actions: In June 1986, the City of Tacoma, under the direction of Ecology, assumed responsibility for conducting an RI/FS. Quarterly groundwater monitoring activities were established to identify hazardous contaminants. The city continued contact with specific residents by notifying them of sampling dates and reporting analytical results. Public involvement in landfill issues is maintained by Ecology conducting public meetings and providing fact sheets on recent landfill activities and studies.

7) As the RI progressed in 1987, local citizens continued to voice concerns and questions.

Actions: Ecology, in cooperation with the City of Tacoma and EPA, conducted a public meeting on April 16, 1987 to discuss the progress of the RI/FS. Groundwater well monitoring procedures and analytic results were addressed. At that time, three to four residences had been connected to the city's water supply. Methane gas migration and monitoring were discussed. Dr. Branchflower, a consultant to the City of Tacoma, discussed risk assessment at the landfill site. Black & Veatch, acting as consultants to the city, provided graphical representation of well locations and migration pathways. An agenda and fact sheet were distributed.

8) After the RI/FS was made public in February 1988, citizens had concerns and unanswered questions.

Actions: On February 11, 1988, Ecology, in cooperation with EPA and the City of Tacoma, conducted a public meeting to discuss remedial alternatives for cleaning up leachate and methane gas at the landfill. Questions relating to the RI/FS were answered and public comments were recorded.

3.0 SUMMARY OF MAJOR COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES TO THE COMMENTS

The public comment period was open from February 4 through March 4, 1988. Ecology held a public meeting in Tacoma on February 11, 1988 to explain the study and the remedial alternatives. Formal comments received at that meeting concerned providing an alternate water supply, coordinating planning, evaluating alternative design options, and implementing new landfill operations including recycling and ash disposal. The last comment is considered beyond the scope of the FS.

Comments from members of the public, primarily Tacoma area residents, regarding the FS report are summarized below. Questions were addressed to U.S. EPA, Ecology, the Tacoma-Pierce County Health Department (TPCHD), and City of Tacoma representatives and their consultants.

FORMAL COMMENTS

Four participants from the public presented formal comments during the public hearing. Those comments are summarized below.

1) Provision of an alternative water supply for residents whose wells have been contaminated regardless of the chosen alternative was a concern of one participant.

Response: The preferred alternative includes provision of an alternate, unthreatened water supply (municipal water) to any resident whose water supply is adversely impacted as further describes in the ROD by contamination emanating from the landfill.

2) One comment addressed the need to incorporate long-term planning in future studies. The speaker noted that seven years ago, many of today's problems connected with the landfill were not known and not planned for. Another comment addressed the need for more coordination in the planning process between the consultants and agencies connected with landfill studies.

Response: Long term planning of the landfill operation is conducted at the local level with assistance and review by the state. Selection of the preferred alternative under CERCLA/SARA included analysis of long-term needs. Long-term planning is part of the studies. Ecology and EPA agree that more coordination is needed and have incorporated this into ongoing community relation activities.

3) Several design options were offered by one participant who felt that they should have been considered during the evaluation of remedial alternatives. These options are as follows:

- An aeration facility to remove volatile material from the groundwater.
- A system of wells completely encircling the landfill to intercept and retrieve contaminated groundwater.

- Incorporation of removable pumps and sequencing pumping to optimize groundwater retrieval.

- Discharge of treated groundwater to the Simpson pulp mill or other use of treated groundwater as a water supply.

- Use of extracted methane to produce electricity.

  Response: Ecology and EPA will take note of these suggestions and they will be evaluated during the Remedial Design phase as appropriate.

4) A comment was received concerning the potential threat to public health caused by heat generation from spontaneous combustion of materials in the proposed sealed landfill. Such conditions might lead to an explosion that would endanger nearby apartments and their inhabitants, and taxpayers would be obligated to pay for the damage.

Response: The landfill will be continuously monitored so that spontaneous combustion problems should not occur. Should a problem occur, the landfill has a contingency plan and an emergency response plan in place.

5) Several comments were received concerning the feasibility of a recycling program and landfill operations.

Response: The subject of the public meeting was cleanup of the landfill, not implementation of a recycling program or operation of the landfill. However, landfill operations have been addressed in the selected remedy. Tacoma will be required to submit an Operations and Closure Plan pursuant to State Minimum Functional Standards for Landfills (WAC 173-304) which will address waste reduction measures. These measures include: increased recycling including a program to exclude hazardous waste from the landfill; incineration of the light fraction of shredded waste at the Tacoma City Light Cogeneration plant and; pyrolysis of the heavy fraction of shredded waste at an on-site facility.

QUESTIONS AND COMMENTS

Questions from the audience as a whole, and responses from the appropriate government representative, are summarized below.

1) The efficacy of the cap was questioned because of the potential for prolonging methane gas production. The source of material for the cap was questioned. The discharge point for pumped water and the applicable discharge standard was requested. Some participants were concerned that hazardous material would remain in the landfill. The adequacy of the design because of changing site hydraulic conditions (e.g., drought) and nearby pumping was questioned.

Response: State regulations require landfills to be capped to limit leachate migration, and address any subsequent increase in methane gas migration. An appropriate material will be evaluated for technical merit and feasibility and utilized for a cap. Water discharged into the sewer, should that treatment option be selected, will be treated before in enters the sewer to a level consistent with pre-treatment requirements. Water discharged to surface water will be treated to drinking water standards, or Water Quality Criteria (for fresh water), whichever is more stringent. For those contaminants for which no drinking water standard or Water Quality Criteria exist, a methodology has been established in the Record of Decision (ROD) for the Tacoma landfill to establish the appropriate treatment levels. These levels will be reviewed and approved by EPA and Ecology. The exact point of discharge (sewer or stream) will be evaluated during the Remedial Design phase and has not yet been determined. A technology to treat the hazardous material remaining in the landfill has not been developed, although removal has been considered but ruled out because of the large volume. The preferred alternative is believed to be the most cost and technically effective means of dealing with the problem.

Changing hydraulic conditions may impact the configuration of the contaminant plume. However, sufficient monitoring will be done to evaluate such a change. The City of Tacoma will be required to contain the plume regardless of its location.

2) A number of questions concerned disposal and classification of ash from the proposed incinerator. If ash is classified as non-hazardous, it may be placed in the landfill.

Response: No hazardous waste will go into the landfill. Disposal of ash in the landfill would be contrary to the goal of maintaining the landfill for as long as possible because ash would take up space and reduce the expected operating life of the landfill. The state is developing an ash regulation to determine if an ash should be classified as hazardous or non-hazardous and is also determining the appropriate requirements for disposal and monitoring.

3) Several questions and comments were made concerning operation of the Refuse Derived Fuel Plant (RDF) and the incinerator.

Response: The purpose of the public meeting was cleanup of the landfill. While questions and comments concerning the RDF plant are not relevant to the meeting agenda, they are duly noted as a point of public interest and concern and passed on to the appropriate agencies.

4) Methane production within the landfill was questioned by a number of participants. Reuse of the southwestern area of the landfill was questioned because it may aggravate the methane problem. Provisions for the continued methane gas migration to depth should be made.

Response: It is believed that the gas extraction system will sufficiently control methane release throughout the landfill. Seventy-four new wells to contain deep methane will be installed by mid April. The Selected Remedy has required the placement of off-site probes (shallow and deep) to monitor the effectiveness of the system. There will be adequate monitoring at the probes and in the neighborhood to ensure the system is working appropriately.

5) Public health, monitoring procedures, and health standards were addressed by several members of the audience. The need for expediency in the cleanup was noted because of unhealthy conditions in the area. The confidence associated with no adverse health effects from the methane gas and water pollution was questioned. Development of apartments and houses for local residents if methane was known to be a problem was also questioned. Onerous odors have been noted in the morning near the landfill. The availability of data from monitoring programs and the extent of the methane monitoring program was questioned. One participant asked where her well water could analyzed for chemicals. Another asked if any microbiological analysis was performed.

Response: In response to these concerns, the TPCHD responded in the meeting with these perspectives:

> Construction standards for recently completed apartments and regular monitoring increase the confidence that there will be no adverse health effects. Concentration of gas measured in houses has not approached explosive levels anywhere. The odors come from

by-products of the rotting garbage, not necessarily from methane gas. No adverse health effects are caused by these by-products. The health department monitors the incidence of disease, and data do not indicate that landfill gas is making people sick. All houses around the landfill have been monitored in the past. Occupants of the houses are given the instrument readings if they wish at least once a year. The health department analyzes for all hazardous organic compounds in wells downgradient of the landfill once a year. Private laboratories can provide the same analyses. Only total coliforms are analyzed for during microbiological monitoring.

Ecology and EPA perspectives:

The agencies recognize the need for expediency in implementing the cleanup. However, the major exposure pathway is via groundwater which is spreading contamination very slowly. With the addition of the cap, and the completion of the gas extraction system, odor problems should be substantially reduced. EPA and Ecology recognize the need for further community education regarding the methane gas collection system and monitoring program.

6) Provision of an alternate water supply for residents whose wells are contaminated or become dry because of the groundwater extraction was a concern of two people. One person questioned why discharged water was not being made available to area residents.

<u>Response</u>: The preferred alternative contains provisions for an unthreatened water supply (e.g., municipal water) for all residents whose

wells are contaminated. Similar arrangements will be provided for any resident whose water volume is affected by the operation of a groundwater extraction system.

7) The cost of cleanup and the source of funding were addressed by a number of people. Increases in refuse collection fees were also a concern.

Response: The estimated cost of the preferred alternative is 24 million dollars. It is expected the customers of the refuse utility may be paying for this expense. Refuse collection fees may be increased by the City of Tacoma 8-16 percent to provide sufficient funds, or funding may be available to offset costs to the City. There is a toxics control account available through Ecology's Solid and Hazardous Waste Program.

8) Confidence placed on findings of the RI/FS and the need for contingency plans were questioned. The comprehensiveness of the studies was also questioned. If the preferred alternative fails, will action be taken?

Response: The studies were performed with oversight by Ecology and EPA following guidelines provided by EPA (CERCLA). Although 100 percent assurance is probably impossible to attain, the consensus of opinion is that problems at the site have been identified sufficiently that a remedial action (preferred alternative) can be identified. Further work needed for design will be completed during the Remedial Design phase. Intensive groundwater monitoring and placement of additional wells and gas probes will provide the necessary information to monitor the

effectiveness of the selected remedy. Connection to city water (should a problem immediately occur) is part of the selected remedy. The Tacoma-Pierce County Health Department has an action plan for responding to elevated methane gas levels (which includes evacuation, if necessary).

9) Several questions concerning the site conditions relative to geology and hydrology were asked. These questions concerned permeability, thickness, and depth of geologic units underlying the site.

Response: The requested information was provided at the meeting and is contained in the transcript of the public meeting.

10) There was a question on why sampling for inorganic constituents in the groundwater was not performed. The effect of seasonal variations upon sampling results was also questioned. The speaker noted that a previous study had revealed a very dramatic seasonal change during low flow periods.

Response: Sampling for inorganic constituents (e.g., metals) has been conducted. Monitoring wells near the landfill are monitored quarterly, allowing for observation of seasonal variations in groundwater chemistry. The data collected to date do not indicate such a seasonal variation. Low flow periods are normally associated with surface water conditions. The Remedial Investigation was not designed to evaluate conditions and seasonal variation in Leach Creek.

11) Written comments concerning a variety of subjects were received at the public meeting from one individual. The comments concerned alternative design options, the operation of the groundwater extraction and treatment system, use of discharged water as a water supply, public health, and recycling of materials in refuse.

Response: The majority of these comments have been addressed in previous responses since they were presented orally at the meeting. Those comments concerning recycling of materials ordinarily disposed of at the landfill are not within the scope of the RI/FS, and therefore are not relevant to the final cleanup of the landfill.

12) Written comment was submitted during the designated comment period by the National Oceanic and Atmospheric Administration (NOAA). The comments focused on concern that the freshwater environment of Leach Creek could be impacted, and should be evaluated by bioassay and benthos sampling.

Response: Since there are existing water rights for domestic use of Leach Creek, the selected remedy has set standards to minimize degradation. Ecological effects via contamination of Leach Creek and its downstream tidal wetlands is a recognized concern by both Ecology and EPA. Sampling of indicator benthos from the intertidal area would be worthwhile, and bioassays of Leach Creek samples would also be advisable at key intervals prior to and after cleanup efforts. It is further

described in the selected remedy that the applicable EPA ambient Water Quality Criteria (WQC) for either protection of human health, or aquatic life, will be used, whichever is lower.

Evaluation of conditions, sediment contamination, seasonal variation in Leach Creek, etc., was not the original intent of the Remedial Investigation.

4. REMAINING CONCERNS

The following issues have been discussed but have not yet been resolved:

- What will be the point of discharge for extracted groundwater?
- What process will be used to bring extracted groundwater into compliance with discharge standards or requirements?
- Will alternative uses of treated water be identified?

Response: The point of discharge will be decided during the Remedial Design phase of the cleanup process. If the point of discharge is the city sanitary sewer, the treated water must meet the city of Tacoma's pre-treatment standards. If discharge is to surface water, the Record of Decision identifies appropriate treatment levels for the identified contaminants of concern, and establishes a methodology for identifying treatment levels for the other volatile organic compounds and metals in the groundwater.

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Attachment A

Community relations activities conducted at the Tacoma Landfill site to date include the following:

- In 1983, the Tacoma landfill was included as part of the South Tacoma Channel site on the National Priorities List under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

- In May 1985, Ecology and Black & Veatch began Remedial Investigation (RI) Phase I.

- In December 1985, Ecology and Black & Veatch began implementing the RI Project Work Plan and Sampling Plan Phase I.

- In 1985, a community relations plan was developed by Black & Veatch and Hall and Associates for Ecology.

- From May 1985 to the present, the City of Tacoma maintained correspondence with local residents and well owners by providing notification of quarterly sampling and outlining analytical results.

- In May 1986, the City of Tacoma issued a fact sheet discussing management of methane gas at the landfill.

- On May 13, 1986, U.S. EPA, in cooperation with the City of Tacoma and Ecology, conducted a public meeting to discuss well water quality of private wells surrounding the landfill.

- In July 1986, the City of Tacoma issued a press release and letter to residents discussing background and scope of the RI.

- In July 1986, the City of Tacoma and Ecology signed a consent agreement establishing guidelines for the RI/FS.

- In August, 1986, the City of Tacoma began sampling 13 private wells located near the landfill.

- In February 1987, the Phase I Sampling Plan, Phase II Sampling Plan and Phase I RI Report were completed and made available to the public through Tacoma City and County libraries.

- On April 16, 1987, Ecology, in cooperation with the City of Tacoma and EPA , conducted a public meeting and provided a fact sheet discussing progress of the RI/FS.

- In January 1988 a public notice was published in the Tacoma News Tribune announcing the availability of the RI and FS Reports and a public meeting to be held February 11, 1988.

- On February 11, 1988, Ecology, in cooperation with EPA and the City of Tacoma, conducted a public meeting to discuss alternatives for cleaning up the groundwater and controlling methane gas at the landfill, including the agencies' preferred plan.

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- From February 4 through March 4, 1988, public comments on the RI/FS were accepted and documented.

- In February and March 1988 the Responsiveness Summary and Record of Decision were written.

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APPENDIX C

INDEX TO ADMINISTRATIVE RECORD

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 1.1 000012	1.1 General Information	Letter in response to concern regarding the presence of phenol in the water system with attached distribution list	7/25/78	3	Moe R. Batra Department of Social and Health Services	(b) (6) R.B. Bourglaze, University Place Water Company	
AR 1.1 000013	1.1 General Information	Cover letter attached to copy of analytical results of water samples collected from the water system and attached distribution list.	7/27/78	3	Moe R. Batra Department of Social and Health Services	(b) (6) R.B. Bourglaze, University Place Water Company Mr. (b) (6) Russ Hulet, Suburban Times	
AR 1.1 000014	1.1 General Information	Letter regarding assignation of water rights to the City of Tacoma with attached list of University Place Water Company water rights and attached contract between the City of Tacoma and the University Place Water Company	2/26/79	9	John A. Roller Department of Public Utilities	Walt Bergstrom, WDOE	
AR 1.1 000015	1.1 General Information	Cover letter regarding attached Draft Environmental Impact Statement for the South Tacoma Flood Control Facilities on Flett Creek	4/9/79	126	Phillip M. Ringrose Department of Public Works City of Tacoma	EPA	
AR 1.1 000016	1.1 General Information	1980 Annual Report Solid Waste Management	12/31/80	61	City of Tacoma Public Works Department, Refuse Utilities		
AR 1.1 000017	1.1 General Information	Cover letter regarding attached Preliminary Geotechnical Site Evaluation, Tacoma Landfill Site	9/24/82	14	Dennis R. Stettler, Hart-Crowser & Assoc, Inc.	Mr. Harry Berry The Berry and Berry Associates	
AR 1.1 000018	1.1 General Information	State of Washington Public Water Supply System Listing of Pierce County wells	11/5/82	4	Department of Public Utilities		
AR 1.1 000019	1.1 General Information	Statement regarding Leach Creek Survey with attached map of Leach Creek holding basin and attached copy of envelope		3	Tacoma Pierce County Health Dept	Chuck Shenk, EPA	
AR 1.1 000020	1.1 General Information	Draft Appendix C - General plan of landfill operations (Part V.B-Disposal Sites-Design and Operation of Application Form)	unknown	7	unknown		

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INDEX TO ADMINISTRATIVE RECORD FOR TACOMA LANDFILL

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
Section 1.0	BACKGROUND						
AR 1.1 000001	1.1 General Information	Cover letter regarding attached report to City of Tacoma Department of Public Works on Test Operation Well #20/2-13D1 and cover letter regarding attached report to City of Tacoma Department of Public Works on Investigation Of Ground Water Geology Pollution And Potential Vicinity Of Proposed Orchard Street Sanitary Landfill Site Extension.	05/29/63	25	Byron I. Larsen B.I. Larsen & Associates	Mr. (b) (6) Mr. John Bronnow Department of Public Works, City of Tacoma	
AR 1.1 000002	1.1 General Information	Groundwater Contamination South 40th & Orchard Street Control and Prevention Report.	12/69	12	City of Tacoma, Department of Public Works, Engineering		
AR 1.1 000003	1.1 General Information	Water well report	10/2/70	22	Mr. Richardson Richardson Well Drilling Company, Inc.		
AR 1.1 000004	1.1 General Information	Department of Ecology Inspection Report	8/6/75	1	WDOE		
AR 1.1 000005	1.1 General Information	Solid Waste Management Statistical and Cost Data, Refuse Utility	12/31/75	31	City of Tacoma Public Works Department		
AR 1.1 000006	1.1 General Information	Draft Environmental Impact Statement for Operation of the City of Tacoma's Solid Waste Disposal Site and Resource Recovery System.	7/16/76	69	Refuse Utility Division	Department of Public Works	
AR 1.1 000007	1.1 General Information	Memo regarding Environmental Impact Statement Review	7/20/76	1	Walter D. Jaspers, EPA	Tobias A. Hegdahl, EPA	
AR 1.1 000008	1.1 General Information	Memo regarding review of Draft Environmental Impact Statement	8/4/76	1	Tobias A. Hegdahl, EPA	Walt Jaspers, EPA	
AR 1.1 000009	1.1 General Information	Letter regarding EPA review of Draft Environmental Impact Statement	8/9/76	2	Walter D. Jaspers, EPA	Ronald M. Button, Department of Public Works	
AR 1.1 000010	1.1 General Information	Sanitary Landfill Site Engineering Report	9/14/76	33	City of Tacoma, Public Works Department	WDOE	
AR 1.1 000011	1.1 General Information	Telephone report regarding well contamination from landfill	4/19/78	1	Mr. Bourgaize University Place Water Company	WDOE	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 1.1 000021	1.1 General Information	Newspaper article entitled, "Is The Tacoma Landfill Ruining Our Water?"	6/85	3	Peter Andrews Tacoma/Pierce County Review		
AR 1.1 000022	1.1 General Information	Application for disposal site permit	8/15/85	12	City of Tacoma Refuse Utility	WDOE	
AR 1.2 000001	1.2 Site Evaluation Sampling Data	Chemical analysis summary for Pierce County	4/72	3	U.S. Geological Survey		
AR 1.2 000002	1.2 Site Evaluation Sampling Data	Table 1 - records of selected wells (contains some unverified)	1929-1976	4	Unknown		
AR 1.2 000003	1.2 Site Evaluation Sampling Data	Report of analysis on well water from University Place Water District well #3-1	3/17/77		Bennetts Chemical Laboratory, Inc.	University Place Water Company	
AR 1.2 000004	1.2 Site Evaluation Sampling Data	Priority pollutants data report	7/3/78	8	Unknown		
AR 1.2 000005	1.2 Site Evaluation Sampling Data	Water sample information for standard complete chemical analysis	4/23/73	3	Moe Batra Department of Social and Health Services	University Place Water System	
AR 1.2 000006	1.2 Site Evaluation Sampling Data	Analysis report regarding sample #7104	6/30/78	1	Michael J. Etchingham AT am test inc.	(b) (6)	
AR 1.2 000007	1.2 Site Evaluation Sampling Data	Priority Pollutants Data Report	7/3/78 & 7/17/78	3	Unknown		
AR 1.2 000008	1.2 Site Evaluation Sampling Data	Field sample data sheets and general purpose data sheet	7/17/78	3	J. Gedlund Department of Social and Health Services	EPA	
AR 1.2 000009	1.2 Site Evaluation Sampling Data	Letter regarding attached transmittal of analytical results for water samples collected from the University Place Water Company	7/26/78	2	William A. Mullen, EPA	Bob Leaver Department of Social and Health Services	
AR 1.2 000010	1.2 Site Evaluation Sampling Data	Transmittal for Treatment Plants Routing regarding sewage overflow with attached memo regarding Leach Creek water quality analysis	8/4/78	3	Hufford, Sewer Utility Division	Dean Wood	
AR 1.2 000011	1.2 Site Evaluation Sampling Data	Olympia Laboratory data summary, with attached handwritten note, telephone report regarding well contamination problem, request for analysis and memo regarding resampling of wells	8/22/78	11	WDOE		
AR 1.2 000012	1.2 Site Evaluation Sampling Data	Letter regarding analytical results of water samples collected from the University Place Water Company	9/13/78	1	William A Mullen, EPA	Moe Batra Department of Social and Health Services	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 1.2 000013	1.2 Site Evaluation Sampling Data	Letter regarding Pierce County University Place Water System Wells University #11, #3-1, Fircrest, and Jones	10/27/78	2	Moe R. Batra Department of Social and Health Services	Dean Wood, WDOE	
AR 1.2 000014	1.2 Site Evaluation Sampling Data	Data summary for metals - sample source, the Atlas Foundry, Tacoma Landfill	Unknown	1	WDOE		
AR 1.2 000015	1.2 Site Evaluation Sampling Data	Data summary for well at Purdy Landfill in Pierce County	5/23/80		G. Freeman, WDOE		
AR 1.2 000016	1.2 Site Evaluation Sampling Data	Table III-8, Water chemical analysis for the town of Fircrest	9/3/81	1	Water Management Associates, Inc.		
AR 1.2 000017	1.2 Site Evaluation Sampling Data	Sample results for inorganic and organic analyses, Case #1477/SAS 373J and attached memo regarding additional sampling at Tacoma Landfill with additional sampling results	1/12/83		ChemTech	Unknown	
AR 1.2 000018	1.2 Site Evaluation Sampling Data	Organic and inorganic analyses for Tacoma Landfill Case 1477/SAS 373J	1/12/83	12	ChemTech		
AR 1.2 000019	1.2 Site Evaluation Sampling Data	Organic and inorganic analyses for Tacoma Landfill	4/26/83	9	EPA Lab, Manchester		
AR 1.2 000020	1.2 Site Evaluation Sampling Data	Organic and inorganic analyses for Tacoma Landfill	4/26/83	7	EPA Lab, Manchester		
AR 1.2 000021	1.2 Site Evaluation Sampling Data	Metal Analysis Required - Water report form	4/26/83	1	EPA Region 10 Laboratory		
AR 1.2 000022	1.2 Site Evaluation Sampling Data	Results of standard analyses with attached tentatively identified compounds and sample results for inorganic and organic analyses	4/26/83	18	EPA Laboratory; ChemTech		
AR 1.2 000023	1.2 Site Evaluation Sampling Data	Metal data-AA-HGA 2100(water) and Metal data-sediments-vegetation-tissue; HGA 2100	4/27/83	28	EPA	(b) (6)	
AR 1.2 000024	1.2 Site Evaluation Sampling Data	EPA Region 10 Laboratory metal analysis required-water report form, attached results of standard analyses and specifically identified compounds	6/13/83	8	EPA Region 10 Laboratory		
AR 1.2 000025	1.2 Site Evaluation Sampling Data	Memo regarding review of Tacoma TCDD contract data	9/20/83	1	J. N. Blazevich, EPA	Dr. (b) (6)	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
Section 2.0	SITE IDENTIFICATION						
AR 2.1 000001	2.1 Preliminary Assessment Report	Potential hazardous waste site log regarding site identified by "Eckhardt Report" 11/27/79	1	P.L. Wheeler, EPA			
AR 2.1 000002	2.1 Preliminary Assessment Report	Potential hazardous waste site log regarding Center and Mullen Sanitary Landfill	11/27/79	4	P.L. Wheeler, EPA		
AR 2.1 000003	2.1 Preliminary Assessment Report	Potential hazardous waste site identification and preliminary assessment form re Tacoma Landfill	4/80	4	Phil Wong, EPA		
AR 2.1 000004	2.1 Preliminiary Assessment Report	Potentital hazardous waste site identification and preliminary assessment form re Tacoma Landfill	4/80	4	Neil Thompson, EPA		
AR 2.1 000005	2.1 Preliminary Assessment Report	Potential hazardous waste site identification and preliminary assessment regarding Center and Mullen sanitary landfill	4/80	4	Neil Thompson, EPA		
AR 2.1 000006	2.1 Preliminary Assessment Report	Potential hazardous waste site final strategy determination form regarding Tacoma City Landfill	6/80	2	Neil Thompson, EPA		
AR 2.1 000007	2.1 Preliminary Assessment Report	Hazardous waste sites evaluation of section 311 clean-up requirements, environmental emergency section, EPA-Region 10	6/2/80	2	E.E.S.		
AR 2.2 000001	2.2 Site Investigation Report	Potential hazardous waste site inspection report	4/80	11	Phillip Wong, EPA		
AR 2.2 000002	2.2 Site Investigation Report	Memo regarding hazardous waste site investigation with attached summary report of the waste site investigation	5/13/80	3	Phillip Wong, EPA	Ben Eusbio John Barrett EPA	
AR 2.2 000003	2.2 Site Investigation Report	Proposed co-municipal landfill reconnaissance study	10/15/82	1	EPA		
AR 2.2 000004	2.2 Site Investigation Report	Memo regarding request for ESD support on Tacoma Municipal Landfill preliminary field investigation	11/8/82	2	Chuck Shenk, EPA	William B. Schmidt, EPA	
AR 2.2 000005	2.2 Site Investigation Report	Preliminary field investigation plan, Tacoma Municipal Landfill (refuse utility), with attached list of attendees at the 10/26/82 Tacoma Landfill meeting	11/12/82	4	EPA		

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 2.2 000006	2.2 Site Investigation Report	Memo regarding development of a Tacoma Landfill sampling plan with attached city plans for Tacoma Landfill groundwater survey	1/7/83	5	Roy R. Jones, EPA	William A. Mullen, EPA	
AR 2.2 000007	2.2 Site Investigation Report	Memo regarding additional sampling at the Tacoma Landfill	4/14/83	1	Chuck Shenk	William Schmidt, EPA	
AR 2.2 000008	2.2 Site Investigation Report	Memo regarding site inspection and orientation	6/12/85	3	Donald Leske, WDOE	File	
AR 2.2 000009	2.2 Site Investigation Report	Memo regarding site inspection and orientation with attached figure of site utilities and drainage and photographs of University Place wells	6/12/85	8	Donald Leske, WDOE	File	
AR 2.3 000001	2.3 Site Identification	Memorandum regarding request for authorization to proceed with Remedial Investigation/Feasibility Study at the Tacoma Municipal Landfill - Action Memorandum	4/20/82	3	William N. Heedman for Gene A. Lucero, EPA	Rita Lavelle, EPA	
AR 2.3 000002	2.3 Site Identification	Letter regarding EPA water sampling studies with information regarding sample location	unknown	2	John F. Newland, EPA	Robert Sparling City of Tacoma, Department of Public Utilities	
AR 2.3 000003	2.3 Site Identification	Letter to citizen regarding laboratory analyses and quality data evaluation of domestic water	4/26/83	1	John F. Newland, EPA	(b) (6)	
AR 2.3 000004	2.3 Site Identification	Letter regarding laboratory analyses and quality data evaluation for the town of Fircrest water wells No. 2 and No. 8.	4/26/83	1	John F. Newland, EPA	(b) (6) Town of Fircrest	
AR 2.3 000005	2.3 Site Identification	Letter regarding laboratory analyses and quality data evaluation for the golf course irrigation well.	4/26/83	1	John F. Newland, EPA	(b) (6), Fircrest Golf Club	
AR 2.3 000006	2.3 Site Identification	Letter regarding laboratory analyses and quality data evaluation of analytical data for domestic well.	4/26/83	1	John F. Newland, EPA	(b) (6)	
AR 2.3 000007	2.3 Site Identification	Letter regarding EPA Water Sampling Study at the City of Tacoma Landfill and in the immediate vicinity, with information regarding sample locations.	4/29/83	2	Chuck Shenk, EPA	Doug Pierce, Tacoma Pierce County Health Department	
AR 2.3 000008	2.3 Site Identification	Letter regarding EPA Water Sampling Study at the City of Tacoma Landfill and in the immediate vicinity, with information regarding sample locations.	4/29/83	2	Chuck Shenk, EPA	Robert James, Department of Social and Health Services	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 2.3 000009	2.3 Site Identification	Letter regarding EPA Water Sampling Study at the City of Tacoma Landfill with information regarding sample locations.	4/29/83	2	Chuck Shenk, EPA	Frank Monahan, WDOE	
AR 2.3 000010	2.3 Site Identification	Letter regarding EPA second round of water and sediment sampling in and around the Tacoma Landfill with information regarding sample locations.	9/2/83	2	Chuck Shenk, EPA	(b) (6), City of Tacoma	
Section 3.0	INTERIM REMEDIAL MEASURES						
AR 3.1 000001	3.1 Well Owners - Correspondence	Letter regarding the results of tests and analysis of water supply with attached comments and sample results.	4/10/85	5	Derek I. Sandison, Tacoma/Pierce County Health Department	(b) (6)	
AR 3.1 000002	3.1 Well Owners - Correspondence	Letter regarding attached comments and results of sample testing on water supply.	4/10/85	5	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000003	3.1 Well Owners - Correspondence	Letter regarding attached comments and sampling results from testing of domestic water supply.	4/11/85	4	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000004	3.1 Well Owners - Correspondence	Letter regarding well sampling activity with attached summary of results for the inorganic analysis.	4/11/85	2	Derek I. Sandison, Pierce County Health Department		
AR 3.1 000005	3.1 Well Owners - Correspondence	Letter regarding well sampling activity as part of a groundwater quality survey with attached inorganic chemical test results.	4/11/85	2	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000006	3.1 Well Owners - Correspondence	Letter regarding preliminary test data based upon domestic well water sampling.	6/21/85	1	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000007	3.1 Well Owners - Correspondence	Letter regarding detection of materials in water supply.	6/23/85	2	Derek I. Sandison, Tacoma/Pierce County Health Department		
AR 3.1 000008	3.1 Well Owners - Correspondence	Letter regarding well sampling activity conducted as part of Landfill's remedial investigation. Attached list of Tacoma Landfill wells.	10/3/86	2	Phillip M. Ringrose, City of Tacoma, Refuse Utilities Division		
AR 3.1 000009	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached testing results for halognated volatile organic compounds and description of TOX method.	2/18/87	5	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Mr. and Mrs. (b) (6)	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 3.1 000010	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached laboratory testing results for halognated volatile organic compounds and description of TOX method.	2/18/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000011	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached laboratory testing results for halognated volatile organic compounds and description of TOX method.	2/18/87	4	Phillip Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000012	31. Well Owners - Correspondence	Letter regarding well water sampling activity with attached laboratory testing results for halognated volatile organic compounds and description of TOX method.	2/20/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Mr. and Mrs. (b) s (6)	
AR 3.1 000013	3.1 Well Owners - Correspondence	List of well owners who were sent the attached letter regarding Total Organic Halides or Tox analysis.	2/24/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000014	3.1 Well Owners - Correspondence	List of well owners with attached letter regarding well water sampling activity and Total Organic Halides analysis.	2/25/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(b) (6)	
AR 3.1 000015	3.1 Well Owners - Correspondence	Letter regarding well water sampling activity with attached results for Total Organic Halides analysis and description of TOX method.	2/25/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Mr. and Mrs. (b)	
AR 3.1 000016	3.1 Well Owners - Correspondence	Letter regarding Black & Veatch's quarterly conducting of sampling and testing of wells with attached list of well owners' addresses.	6/11/87	4	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	(see attached list)	
AR 3.1 000017	3.1 Well Owners - Correspondence	Letter regarding Black & Veatch's conducting of quarterly sampling and testing of wells.	10/12/87	1	Phillip M. Ringrose, City of Tacoma, Refuse Utility Division	Well Owner	
AR 3.2 000001	3.2 Water Supplied to Residents	Preliminary health assessment of Tacoma wells.	8/29/85	1	Pat Storm, EPA		
AR 3.2 000002	3.2 Water Supplied to Residents	Memo regarding drinking water data, Tacoma Landfill Superfund site.	12/13/85	1	Agency for Toxic Substances and Disease Registry (ATSDR)	Joel Mulder, EPA	
AR 3.2 000003	3.2 Water Supplied to Residents	Memo regarding water samples, Tacoma Landfill and proposed meeting.	9/16/86	1	Jane Hedges, Solid Waste Program	Derek, Bob, Don, and Al	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 3.2 000004	3.2 Water Supplied to Residents	Letter regarding alternative water supply for residences.	9/26/86		Fred Gardner, WDOE	Fred Thompson, City of Tacoma, Department of Public Works	
AR 3.2 000005	3.2 Water Supplied to Residents	Letter regarding alternative water service to the (b) (6) residence.	10/10/86	2	Phillip M. Ringrose, City of Tacoma, Refuse Utilities Division	Fred Gardner, WDOE	
AR 3.2 000006	3.2 Water Supplied to Residents	Letter in response to request to connect the (b) (6) residences to city water.	10/10/86	1	Fred A. Thompson Tacoma Department of Public Works	Fred Gardner, WDOE	
AR 3.2 000007	3.2 Water Supplied to Residents	Letter regarding WDOE position in response to City of Tacoma decision not to supply water to several additional residences near Tacoma Landfill.	10/10/86	2	Fred Gardner, WDOE	Fred Thompson, Tacoma Department of Public Works	
AR 3.2 000008	3.2 Water Supplied to Residents	Letter regarding water wells near Tacoma Landfill and the steps taken to protect public health	10/31/86	2	Al Allen Tacoma/Pierce County Health Department	Joe Stortini, Tacoma/Pierce County Board of Health Doug Southerland, Tacoma/Pierce County Board of Health	
AR 3.2 000009	3.2 Water Supplied to Residents	Memorandum regarding meeting with Dr. (b) (6)	10/31/86	2	Patricia C. Storm, EPA	File	
AR 3.2 000010	3.2 Water Supplied to Residents	Letter in response to Fred Gardner's letter of 10/20/86 concerning connection of the (b) and the (b) (6) residences to city water.	11/3/86	2	Fred A. Thompson Tacoma Department of Public Works	Fred Gardner, WDOE	
AR 3.2 000011	3.2 Water Supplied to Residents	Letter regarding Tacoma Landfill RI/FS progress report 9/27/86-10/26/86	11/10/86	2	Philip M. Ringrose City of Tacoma, Refuse Utility Division	Fred Gardner, WDOE	
AR 3.2 000012	3.2 Water Supplied to Residents	Letter requesting information and agency assistance in researching the health affects of exposure to vinyl chloride	12/29/86	1	Donald L. Oliver Tacoma/Pierce County Health Department	Ms. Pat Storm, EPA	
AR 3.2 000013	3.2 Water Supplied to Residents	Tacoma drinking water wells health assessment.	Unknown	1	WDOE		
AR 3.3 000001	3.3 Methane Gas Danger	Letter regarding 10/17/85 meeting which discussed minimum functional standards regarding geohydrological study and compliance with the new regulations.	1/6/86	2	Jane Hedges Tacoma/Pierce County Health Department	W.J. Larson Tacoma Refuse Utility	

CITY CLERK CONTRACT/AGREEMENT NO. 9060

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 3.3 000002	3.3 Methane Gas Danger	Letter regarding excessive methane gas levels from the landfill and monitoring requirement.	5/14/86	2	Russell S. Post Tacoma/Pierce County Health Department	Phil Ringrose Refuse Utility Division, City of Tacoma	
Section 4.0	REMEDIAL INVESTIGATION-STATE LEAD/ECOLOGY						
AR 4.1 000001	4.1 Correspondence	Letter regarding future WDOE hazardous waste actions at the Tacoma Landfill site.	10/8/84	2	Fred Gardner, WDOE	Mr. Gene Olive Southeast Tacoma Neutral Water Company	
AR 4.1 000002.	4.1 Correspondence	Letter requesting EPA assistance in the sampling of five domestic wells on Orchard Street.	3/4/85	1	Jane A. Hedges Tacoma/Pierce County Health Department	Roy Jones, EPA	
AR 4.1 000003	4.1 Correspondence	Letter regarding domestic well survey.	7/5/85	1	Jane Hedges Tacoma/Pierce County Health Department	Fred Gardner, WDOE	
AR 4.1 000004	4.1 Correspondence	Letter regarding city counsel approval on the consent order for the city to do the remedial investigation/feasibility study.	6/17/86	1	Fred Gardner, WDOE	Bob Sparling Public Utilities Department	
AR 4.2 000001	4.2 Handwritten Notes	Handwritten notes regarding well contamination.	1/22/85	1	Derek Sanderson	P. Kmet, WDOE	
AR 4.3 000001	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase I.	11/21/84	20	Paul D. McRoberts Black & Veatch, Prepared for WDOE		
AR 4.3 000002	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase I.	12/7/84	47	Paul D. McRoberts Black & Veatch, Prepared for WDOE		
AR 4.3 000003	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase II.	4/10/85	37	Black & Veatch, Prepared for WDOE		
AR 4.3 000004	4.3 Work Plan	Project Work Plan for Conceptual-Feasibility Studies.	12/10/85	18	Black & Veatch, Prepared for WDOE		
AR 4.3 000005	4.3 Work Plan	Project Work Plan for Remedial Investigation/Phase II.	12/12/85	19	Black & Veatch, Prepared for WDOE		
AR 4.4 000001	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Quality Assurance Plan - Tacoma Landfill Well Water Sampling (Drinking Water) EPA/WDOE/TPSCH	Unknown	5	EPA, Contract Laboratory Program		
AR 4.4 000002	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Draft Quality Assurance Project Plan Remedial Investigation B&V Project #11889.201	7/26/85	129	Black & Veatch, Prepared for WDOE		

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.4 000003	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Draft Appendices for Quality Assurance Project Plan B&V Project #11889.201.	8/30/85	172	Black & Veatch, Prepared for WDOE		
AR 4.4 000004	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Sampling Plan for Remedial Investigation Phase II.	12/20/85	30	Black & Veatch, Prepared for WDOE		
AR 4.4 000005	4.4 Sampling and Analysis Plans, Quality Assurance Project Plans	Quality Assurance Project Plan Remedial Investigation B&V Project #11889.201.	3/21/86	256	Black & Veatch, Prepared for WDOE		
AR 4.5 000001	4.5 Sampling and Analysis Data	Table A-1 through A-7a water quality analysis - Sample dates 1970-1983, University Place Wells.	Unknown	37	Unknown		
AR 4.5 000002	4.5 Sampling and Analysis Data	Letter regarding well water sampling activities in the town of Fircrest.	1/23/84	2	Don Anderson Water Management Associates, Inc.	Tim Kane Town of Fircrest Water Department	
AR 4.5 000003	4.5 Sampling and Analysis Data	Water samples in the vicinity of the Tacoma Landfill	6/30/84-8/12/84	3	Unknown		
AR 4.5 000004	4.5 Sampling and Analysis Data	Water bacteriological analysis.	7/22/84	1	Washington Department of Social and Health Services		
AR 4.5 000005	4.5 Sampling and Analysis Data	Water bacteriological analysis.	7/24/84	1	Washington Department of Social and Health Services		
AR 4.5 000006	4.5 Sampling and Analysis Data	Water bacteriological analysis.	8/12/84	1	Washington Department of Social and Health Services		
AR 4.5 000007	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85 & 1/31/85	1	Washington Department of Social and Health Services	Tacoma-Pierce County Health Department	
AR 4.5 000008	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85 & 1/28/85	1	Washington Department of Social and Health Services		
AR 4.5 000009	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85	1	Washington Department of Social and Health Services		
AR 4.5 000010	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/24/85 & 4/17/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000011	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000012	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000013	4.5 Sampling and Analysis Data	Field sampling data/chain of custody, Orchard Street sampling.	1/28/85	5	Sweet, Edwards & Associates, Inc.	Tacoma/Pierce County Health Department	
AR 4.5 000014	4.5 Sampling and Analysis Data	Sampling data.	1/28/85	1	Brown & Caldwell, Weyerhauser		
AR 4.5 000015	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85	1	Unknown		
AR 4.5 000016	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85 & 3/5/85	1	Brown & Caldwell, Weyerhaeuser, City Laboratory		
AR 4.5 000017	4.5 Sampling and Analysis Data	Residential sampling data and attached preliminary health assessment of Tacoma wells and attached EPA Region 10 Lab Management Systems sample project analysis results. Sample dates - 1/28/85, 3/5/85, 6/18/85, and 6/19/85.	1/28/85 & 3/5/85	21	Unknown		
AR 4.5 000018	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85 & 1/31/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000019	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85 & 1/31/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000020	4.5 Sampling and Analysis Data	Cover memo regarding attached PLU student data on groundwater quality near Tacoma Landfill.	1/31/85	14	Tom Rutherford	Fred Gardner, WDOE	
AR 4.5 000021	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85 & 3/5/85	1	Brown & Caldwell, Weyerhaeuser, City Laboratory		
AR 4.5 000022	4.5 Sampling and Analysis Data	Interdepartmental communications memo regarding Orchard Street well water analysis with sampling results.	2/19/85 & 3/19/85	2	Christopher L. Getchell Waste Water Lab, City of Tacoma	William J. Larson Refuse Utility, City of Tacoma	
AR 4.5 000023	4.5 Sampling and Analysis Data	Cover letter regarding attached report of analytical results for the Orchard Street wells.	2/25/85	4	Molly Adolfson Brown & Caldwell Consulting Engineers	Derek Sandison Tacoma/Pierce County Health Department	
AR 4.5 000024	4.5 Sampling and Analysis Data	EPA Region 10 Lab Management System sample/project analysis results for well drinking water.	3/5/85	6	EPA Lab, Manchester		

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000025	4.5 Sampling and Analysis Data	General purpose data sheet, determination SO4.	3/12/85	1	J. Beckner, EPA Lab	Roy R. Jones	
AR 4.5 000026	4.5 Sampling and Analysis Data	EPA Region 10 Laboratory metal analysis required-water.	3/5/85	1	Roy R. Jones		
AR 4.5 000027	4.5 Sampling and Analysis Data	EPA Region 10 Laboratory general analysis required-water.	3/5/85	1	Roy R. Jones		
AR 4.5 000028	4.5 Sampling and Analysis Data	General purpose data sheets, determination purgeables, halocarbons-water, attached field sample data and chain of custody sheets.	3/8/85	4	Roy R. Jones		
AR 4.5 000029	4.5 Sampling and Analysis Data	Chain of custody record.	3/5/85	1	Roy R. Jones	EPA	
AR 4.5 000030	4.5 Sampling and Analysis Data	General purpose data sheets, determination purgeables, halocarbons-water, attached field sample data and chain of custody sheets.	3/5/85	4	EPA Lab	Roy R. Jones	
AR 4.5 000031	4.5 Sampling and Analysis Data	General purpose data sheets, determination purgeables, halocarbons-water.	3/17/85	4	EPA Lab Region 10	Roy R. Jones	
AR 4.5 000032	4.5 Sampling and Analysis Data	General purpose data sheet determination, purgeable halocarbons-water, attached field sample data and chain of custody sheets.	3/7/85	4	EPA Region 10 Laboratory	Roy R. Jones	
AR 4.5 000033	4.5 Sampling and Analysis Data	General purpose data sheet, determination purgeable halocarbons-water, attached field sample data and chain of custody sheets.	3/8/85	4	EPA Region 10 Laboratory	Roy R. Jones	
AR 4.5 000034	4.5 Sampling and Analysis Data	General purpose data sheet, determination chloride.	3/12/85	1	EPA Region 10 Laboratory	Roy R. Jones	
AR 4.5 000035	4.5 Sampling and Analysis Data	General purpose data sheet, determination conductivity.	3/6/85	1	EPA Region 10 Laboratory	Roy R. Jones	
AR 4.5 000036	4.5 Sampling and Analysis Data	Water bacteriological analysis.	3/5/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000037	4.5 Sampling and Analysis Data	Water bacteriological analysis.	3/5/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		

CITY CLERK CONTRACT/AGREEMENT NO. 96060

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000038	4.5 Sampling and Analysis Data	Water bacteriological analysis.	3/5/85	1	Washington Department of and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000039	4.5 Sampling and Analysis Data	Handwritten notes regarding sampling data: attached general purpose data sheet, determination for chloride, SO4, and conductivity.	3/12/85	4	EPA Region 10 Laboratory	Roy R. Jones	
AR 4.5 000040	4.5 Sampling and Analysis Data	Letter of transmittal regarding attached scan for Orchard Street wells and quantitation reports.	3/13/85	29	Brown & Caldwell	Patricia Storm, EPA	
AR 4.5 000041	4.5 Sampling and Analysis Data	Handwritten note regarding attached handwritten letter regarding quality assurance and lab data.	4/5/85	2	(b) (6)	(b) (6)	
AR 4.5 000042	4.5 Sampling and Analysis Data	Residential sampling data.	1/28/85	12	(b) (6)	Tacoma/Pierce County Health Department	
AR 4.5 000043	4.5 Sampling and Analysis Data	Water bacteriological analysis.	1/28/85 & 5/16/85	1	Washington Department of Social and Health Services, Tacoma-Pierce County Health Department		
AR 4.5 000044	4.5 Sampling and Analysis Data	Cover letter regarding attached QA/QC data for the Pierce County/Tacoma groundwater analysis using EPA methods 624, data includes scan and services quantitation report.	5/13/85	28	James C. Hein Brown & Caldwell	Pat Storm, EPA	
AR 4.5 000045	4.5 Sampling and Analysis Data	Region 10 Management System sample/project analysis results.	6/18/85	3	EPA Region 10 Lab		
AR 4.5 000046	4.5 Sampling and Analysis Data	Cover letter regarding attached sample results for well water.	7/5/85	5	Jane Hedges Tacoma/Pierce County Health Department	Fred Gardner, WDOE	
AR 4.5 000047	4.5 Sampling and Analysis Data	Cover letter regarding water system analysis, attached water sample information for inorganic chemcial analyses.	7/1/85	15	Cheryl L. Bergener Washington Department of Social and Health Services	Tacoma/Pierce County Health Department	
AR 4.5 000048	4.5 Sampling and Analysis Data	Acid/Base/Neutral compounds sampling data.	8/12/85	11	(b) (6)	EPA Lab Region 10	
AR 4.5 000049	4.5 Sampling and Analysis Data	Typically identified compounds sheets.	8/14/85	2	Gerry Muth, EPA Lab Region 10		
AR 4.5 000050	4.5 Sampling and Analysis Data	Tentatively identified compounds sheets attached organic analysis data sheets, sample #251575 through 251590.	8/14/85	21	Gerry Muth, EPA Region 10 Lab		

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.5 000051	4.5 Sampling and Analysis Data	Transmittal sheet regarding attached Tacoma Landfill data from 3/85 by EPA Region 10 Lab Management System sample/project analysis results.	9/18/85	9	Joyce Crosson, EPA	Patricia Storm, EPA	
AR 4.5 000052	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #1 Sample numbers 85100650 through 85100654	3/5/85	4	EPA		
AR 4.5 000053	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #2 Sample numbers 85100655 through 85100659	3/5/85	4	EPA		
AR 4.5 000054	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #3 Sample numbers 85100660 through 85100664	3/5/85	4	EPA		
AR 4.5 000055	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #4 Sample numbers 85100665 through 85100669	3/5/85	4	EPA		
AR 4.5 000056	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis results Site #5 Sample numbers 85100670 through 85100674	3/5/85	4	EPA		
AR 4.5 000057	4.5 Sampling and Analysis Data	EPA Sample/Project Analysis Results. Sample number 85251575 through 85251590	3/5/85	4	EPA		
AR 4.6 000001	4.6 Remedial Investigations-Phase I Description of Current Situation	Remedial Investigations-Phase I Description of Current Situation.	5/29/85	78	Mark G. Snyder Paul C. McRoberts Black & Veatch, Prepared for WDOE		
AR 4.7 000001	4.7 Preliminary Health and Safety Assessment	Preliminary Health and Safety Assessment of Tacoma Landfill Remedial Investigation.	no date	17	Elizabeth A. Taylor Phoenix Safety Associates, Ltd., Prepared for Black & Veatch on behalf of WDOE		
Section 5.0	REMEDIAL INVESTIGATION POTENTIALLY RESPONSIBLE PARTY LEAD, CITY OF TACOMA.						
AR 5.1 000001	5.1 Correspondence-General	Letter regarding responsibilities for negotiations with PRP.	6/23/86	2	Patricia C. Storm, EPA	Fred Gardner, WDOE	
AR 5.1 000002	5.1 Correspondence-General	Memo regarding water samples, Tacoma Landfill and proposed meeting.	9/16/86	1	Jane Hedges Solid Waste Program	Derek, Bob, Don & Al	
AR 5.1 000003	5.1 Correspondence-General	Memo regarding site visit, Tacoma Landfill	10/6/86	1	Bill Myers, WDOE	Fred Gardner, WDOE	

CITY CLERK CONTRACT/AGREEMENT NO. 10620

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.1 000004	5.1 Correspondence-General	Memo regarding wells near Tacoma Landfill.	10/28/86	1	Don Oliver Director of Environmental Health Tacoma/Pierce County Health Department	Al Allen Director of Health Tacoma/Pierce County Health Department	
AR 5.1 000005	5.1 Correspondence-General	Memo regarding water wells near Tacoma Landfill.	10/31/86	2	Al Allen Director of Health Tacoma/Pierce County Health Department	The Honorable Joe Stortini, Tacoma/Pierce County Board of Health The Honorable Doug Southerland, Tacoma/Pierce County Board of Health	
AR 5.1 000006	5.1 Correspondence-General	Letter regarding utility operation and the Feasibility Study Report for Tacoma Landfill.	1/27/87	2	Fred Gardner, WDOE	Fred Thompson City of Tacoma, Department of Public Works	
AR 5.1 000007	5.1 Correspondence-General	Memorandum regarding Tacoma Landfill site visit, January 28, 1987.	1/30/87	1	Bill Myers, WDOE	Fred Gardner, WDOE	
AR 5.1 000008	5.1 Correspondence-General	Memo regarding discharge of acquifer test water.	1/30/87	1	Michael P. Price City of Tacoma	Philip M. Ringrose City of Tacoma	
AR 5.1 000009	5.1 Correspondence-General	Memo regarding inspection of work at Tacoma Landfill.	2/2/87	1	Bill Myers, WDOE	Fred Gardner, WDOE	
AR 5.1 000010	5.1 Correspondence-General	Letter regarding Tacoma Landfill Remedial Investigation Feasibility Study.	4/9/87	1	Philip M. Ringrose City of Tacoma	Fred Gardner, WDOE	
AR 5.1 000011	5.1 Correspondence-General	Letter regarding discharges to the sanitary sewer from Tacoma Landfill pump testing.	4/13/87	1	Carol Kraege, WDOE	Chan Odell Central Treatment Plant, Tacoma	
AR 5.1 000012	5.1 Correspondence-General	Letter regarding approval to discharge pump test water from the City of Tacoma Landfill.	4/20/87	1	Michael P. Price City of Tacoma	Carol Kraege, WDOE	
AR 5.1 000013	5.1 Correspondence-General	Memo regarding Tacoma Landfill central area development design report.	4/23/87	3	Carol Kraege, WDOE	Jim Knudson, WDOE	
AR 5.1 000014	5.1 Correspondence-General	Letter regarding groundwater portion of the Remedial Investigation of the Tacoma Landfill.	5/15/87	2	Glenn Bruck, EPA	Thair Jorgenson City of Tacoma	
AR 5.1 000015	5.1 Correspondence-General	Letter regarding groundwater portion of the Remedial Investigation of the Tacoma Landfill.	5/15/87	2	Glenn Bruck, EPA	Thair Jorgenson City of Tacoma	
AR 5.1 000016	5.1 Correspondence-General	Cover letter regarding attached specifications for the oil mat access road at Tacoma Landfill.	5/19/87	3	Phillip M. Ringrose City of Tacoma	Fred Gardner, WDOE	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.1 000017	5.1 Correspondence-General	Memo regarding additional site characterization needs at Tacoma Landfill.	6/8/87	2	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000018	5.1 Correspondence-General	Memo regarding evaluation of pumping test results from PW8A.	7/13/87	2	Bill Myers, WDOE	Tacoma Landfill File Fred Gardner, WDOE	
AR 5.1 000019	5.1 Correspondence-General	Memo regarding deep exploration boring at Tacoma Landfill.	7/27/87	1	R.C. Prior Hart Crowser	Bill Myers, WDOE	
AR 5.1 000020	5.1 Correspondence-General	Letter regarding deep exploration boring, Tacoma Landfill.	7/29/87	1	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000021	5.1 Correspondence-General	Letter regarding deep exploration boring, Tacoma Landfill.	7/29/87	1	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000022	5.1 Correspondence-General	Letter regarding new deliverable date for Remedial Investigation Report.	9/9/87	2	Glynis Stumpf, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000023	5.1 Correspondence-General	Letter regarding ecology review and comment on the Draft Remedial Investigation Report for Tacoma Landfill.	10/13/87	3	Peter Kmet, WDOE Glynis Stumpf, WDOE	Thair Jorgensen, City of Tacoma	
AR 5.1 000024	5.1 Correspondence-General	Responses to ecology comments on the draft Remedial Investigation Report.	10/13/87	16	Unknown	Unknown	
AR 5.1 000025	5.1 Correspondence-General	Schedule for Tacoma Landfill.	11/18/87	1	Unknown	Unknown	
AR 5.1 000026	5.1 Correspondence-General	Ecology review and comment on the Draft Feasibility Study Report for Tacoma Landfill.	11/12/87	3	Glynis A. Stumpf, WDOE	Thair Jorgensen, City of Tacoma	
AR 5.1 000027	5.1 Correspondence-General	Letter regarding Tacoma Landfill Remedial Investigation/Feasibility Study.	11/13/87	2	Thair Jorgensen City of Tacoma	Glynis Stumpf, WDOE	
AR 5.1 000028	5.1 Correspondence-General	Letter regarding Tacoma comments to ecology remedial investigation comments.	11/24/87	1	Glynis A. Stumpf, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000029	5.1 Correspondence-General	Letter regarding methane gas monitoring program and installation of shallow gas probes.	12/16/87	2	Peter Kmet, WDOE	Thair Jorgensen City of Tacoma	
AR 5.1 000030	5.1 Correspondence-General	Letter regarding methane gas generation and migration and installation of shallow gas probes.	12/16/87	2	Peter Kmet, WDOE	Jody Snyder, Tacoma-Pierce County Health Department	
AR 5.2 000001	5.2 Handwritten Notes	Inspection report for Tacoma Landfill.	2/24/87	1	Bill Myers, WDOE	Unknown	
AR 5.2 000002	5.2 Handwritten Notes	Inspection report for Tacoma Landfill	4/28/87	1	Bill Myers, WDOE	Unknown	
AR 5.2 000003	5.2 Handwritten Notes	Memo regarding Tacoma Landfill pumping procedure.	4/28/87	1	(b) (6)	Fred Gardner, WDOE	

CITY CLERK CONTRACT/AGREEMENT NO. 10260

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.2 000004	5.2 Handwritten Notes	Inspection report regarding Tacoma Landfill.	5/1/87	1	Bill Myers, WDOE	Unknown	
AR 5.2 000005	5.2 Handwritten Notes	Memo regarding Tacoma Landfill drilling.	1987	2	Fred Gardner, WDOE	(b) (6)	
AR 5.3 000001	5.3 Work Plans	Attachment A Tacoma Landfill Remedial Investigation/Feasibility Study Scope of Work Phase I with attached map of proposed sampling locations.	6/1/86	13	Black & Veatch		
AR 5.3 000002	5.3 Work Plans	Cover letter attached RI/FS scope of work Phase I.	6/19/86	13	Phillip Ringrose City of Tacoma	Fred Gardner, WDOE	
AR 5.3 000003	5.3 Work Plans	Document outlining data management plan for RI.	9/26/86	10	USEPA	Unknown	
AR 5.3 000004	5.3 Work Plans	Attachment A to Amendment No. 3 to the Agreement for Engineering Serivces between Black & Veatch, Engineers-Architects and the City of Tacoma for the Tacoma Landfill RI/FS and Central Area Development Project.	1/27/87	22	Black & Veatch	Unknown	
AR 5.4 000001	5.4 Sampling and Analysis Plans	Letter regarding attached memorandum, modifications to sampling plan, and draft groundwater quality monitoring program, for private wells near Tacoma Landfill.	11/19/86	26	Thomas L. Rutherford Black & Veatch	Patricia Storm, USEPA	
AR 5.4 000002	5.4 Sampling and Analysis Plans	Sampling plan regarding gorundwater quality monitoring program for existing wells near the Tacoma Landfill and attached Table I re Groundwater Sample Locations and Analyses.	12/15/86	3	Black & Veatch	Uknown	
AR 5.4 000003	5.4 Sampling and Analysis Plans	Sampling plan for Tacoma Landfill Remedial Investigation Phase II.	1/30/87	35	Black & Veatch Engineers/Archtitects for the City of Tacoma	Unknown	
AR 5.4 000004	5.4 Sampling and Analysis Plans	Letter regarding deep exploration boring at Tacoma Landfill.	7/29/87	1	Bill Myers, WDOE	Thair Jorgensen City of Tacoma	
AR 5.4 000005	5.4 Sampling and Analysis Plans	Memo regarding attached revisions to the sampling plan for Tacoma Landfill Phase II Round III.	11/12/87	4	T.L. Ruthorford Black & Veatch for the City of Tacoma	D. Yamamoto, EPA	
AR 5.5 000001	5.5 Sampling and Analysis Data	Appendix B including Map with Well locations, well data, groundwater flow shallow aquifer, groundwater flow deeper aquifer, geohydrologic section.	5/29/85	8	Black & Veatch	Unknown	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000002	5.5 Sampling and Analysis Data	Landfill gas samples volatile organic compounds.	6/25/86	2	Unknown	Unknown	
AR 5.5 000003	5.5 Sampling and Analysis Data	Description of Tacoma Landfill investigation landfill gas samples, attached landfill gas sample, and volatile organic compound data.	6/25/86	3	Unknown	Unknown	
AR 5.5 000004	5.5 Sampling and Analysis Data	Sample report form, project code 877, attached request for analysis.	6/27/86	4	Merly McMall, WEOE Jeff Bauman, METRO		
AR 5.5 000005	5.5 Sampling and Analysis Data	Organic sample narrative, METRO sample #268501, attached GCMS organic analysis data report for volatiles scans, and quantitation reports, METRO A-B-N extraction scheme for water, METRO pesticide extraction scheme for water.	6/27/86	19	METRO	Unknown	
AR 5.5 000006	5.5 Sampling and Analysis Data	Organic sample narrative, METRO sample #248503, attached GCMS organic analysis data report for volatiles scans, and quantitation reports, METRO A-B-N extraction scheme for water, METRO pesticide extraction scheme for water.	6/27/86	19	METRO	Unknown	
AR 5.5 000007	5.5 Sampling and Analysis Data	Organic sample narrative, METRO sample #268502, attached GCMS organic analysis data report for volatiles scans, and quantitation reports, METRO A-B-N extraction scheme for water, METRO pesticide extraction scheme for water.	6/27/86	19	METRO	Unknown	
AR 5.5 000008	5.5 Sampling and Analysis Data	Organic sampling narrative METRO sample #MB86VII01, attached GCMS organic analysis data report, quantitation reports and scans.	7/1/86	16	METRO	Unknown	
AR 5.5 000009	5.5 Sampling and Analysis Data	GCMS organic analysis data reports, sample #MB860701, attached scans and quantitation reports.	7/9/86	16	METRO	Unknown	
AR 5.5 000010	5.5 Sampling and Analysis Data	Cover letter regarding attached proposed schedule of sampling activities, sample container requirements, and sample preservatives, a list of contract laboratory program protection limits, and a list of additional parameters for analysis.	7/11/86	13	Michael L.R. Housley Black & Veatch	Mr. Christoph Getchell City of Tacoma Public Works	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000011	5.5 Sampling and Analysis Data	Letter regarding analytical results on gas samples collected on 6/25/86 at Tacoma Landfill, attached letter regarding time weighted average and short-time exposure limits.	7/18/86	5	T.L. Rutherford Black & Veatch	Phil Ringrose City of Tacoma Refuse Utility	
AR 5.5 000012	5.5 Sampling and Analysis	Cover letter regarding attached averages and short-term exposure limits.	7/28/86	2	Michael L.R. Housley Black & Veatch	Phil Ringrose City of Tacoma Refuse Utility	
AR 5.5 000013	5.5 Sampling and Analysis Data	Letter regarding time weighted averages and short-term exposure limits, attached organic sample narrative METRO sample #268500, attached GCMS organic analysis data report for volatiles, quantitation reports, and scans.	7/28/86	21	Michael L.R. Housley Black & Veatch	Phil Ringrose City of Tacoma Refuse Utility	
AR 5.5 000014	5.5 Sampling and Analysis Data	Olympic Environmental Laboratory data summary, Leach Creek, Tacoma.	9/25/86	1	WDOE	Unknown	
AR 5.5 000015	5.5 Sampling and Analysis Data	Groundwater samples, volatile organic compounds	8/86 & 10/86	4	Unknown	Unknown	
AR 5.5 000016	5.5 Sampling and Analysis Data	Groundwater samples, inorganic compounds.	8/86, 10/86 & 11/86	2	Unknown	Unknown	
AR 5.5 000017	5.5 Sampling and Analysis Data	Subsurface soil samples, volatile.	8/86 & 9/86	1	Unknown	Unknown	
AR 5.5 000018	5.5 Sampling and Analysis Data	Sediment samples, volatile organic compounds, semivolatile organic compounds.	7/86 & 8/86	4	Unknown	Unknown	
AR 5.5 000019	5.5 Sampling and Analysis Data	List of sampling activies for Tacoma Landfill wells.	8/86, 10/86 & 11/86	1	Unknown	Unknown	
AR 5.5 000020	5.5 Sampling and Analysis Data	Surface water leachate and sewer samples, semivolatile organic compounds.	7/86-10/86	2	Unknown	Unknown	
AR 5.5 000021	5.5 Sampling and Analysis Data	Cover letter regarding attached priority pollutant analysis results.	9/9/86	5	Michael L.R. Housley Black & Veatch	Mr. Thair Jorgenson City of Tacoma Refuse Utility	
AR 5.5 000022	5.5 Sampling and Analysis Data	Cover memo regarding organic analysis of Leach Creek water samples, attached organic analysis data sheets for semivolatile compounds and volatile compounds.	9/22/86	8	Dick Huntamer, WDOE	Bill Myers, WDOE	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000036	5.5 Sampling and Analysis Data	Olympia Environmental Laboratory data summary.	12/5/86	1	WDOE	Unknown	
AR 5.5 000037	5.5 Sampling and Analysis Data	Organic sample narrative METRO sample #477062, attached GCMs organic analysis data report, GCMs organic data report for volatiles, quantitation reports and scans.	11/21/86	28	METRO	Unknown	
AR 5.5 000038	5.5 Sampling and Analysis Data	Remedial Investigation Phase I Field Investigation Data, Preliminary.	12/2/86	134	Black & Veatch, Hart-Crowser & Associates, Inc. Prepared for City of Tacoma		
AR 5.5 000039	5.5 Sampling and Analysis Data	Letter regarding attached data sheets for private well samples, revised tables 1 and 2, 12/19/86 sampling plan, summary table of the volatile organic compounds detected in the total organic halogen (TOX) values, and tables listing volatile organic compounds.	1/30/87	15	Thomas L. Rutherford Black & Veatch	Thair Jorgenson, City of Tacoma, Refuse Utility	
AR 5.5 000040	5.5 Sampling and Analysis Data	Landfill gas samples, volatile organic compounds, groundwater samples, halogenated organic compounds, metals analyses, groundwater samples, solid waste regulations and treatment parameters.	2/87 & 3/87	9	Unknown	Unknown	
AR 5.5 000041	5.5 Sampling and Analysis Data	Cover letter regarding attached data sheets for volatile organic compounds for private wells near the landfill.	4/8/87	24	Michael L.R. Housely Black & Veatch	City of Tacoma Refuse Utility	
AR 5.5 000042	5.5 Sampling and Analysis Data	Pumping test data, project TFS hydrologist: CTE, Job #1775.01.	5/2/87	10	Unknown	Unknown	
AR 5.5 000043	5.5 Sampling and Analysis Data	Memo regarding attached samples collected during Round 1 of Phase II of the Tacoma Landfill's Remedial Investigation.	5/8/87	6	Black & Veatch	City of Tacoma	
AR 5.5 000044	5.5 Sampling and Analysis Data	Memo regarding quality assurance report #3.	5/13/87	17	Black & Veatch	City of Tacoma	
AR 5.5 000045	5.5 Sampling and Analysis Data	Letter regarding Tacoma Landfill Remedial Investigation/Feasibility Study and attached lab results for volatile organic compounds, priority pollutants and hazardous substances.	5/14/87	5	Phillip M. Ringrose City of Tacoma Refuse Division	Fred Gardner, WDOE	
AR 5.5 000046	5.5 Sampling and Analysis Data	Data sheets from 5/14/87 Technical Progress Report regarding volatile organic compounds, priority pollutants, and hazardous substance list.	3/20/87	3	Black & Veatch	Unknown	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000023	5.5 Sampling and Analysis Data	Cover memo regarding attached organic analysis of Leach Creek, Tacoma Landfill water and soil samples.	9/22/86	14	Dick Huntamer, WDOE	Bill Myers, WDOE	
AR 5.5 000024	5.5 Sampling and Analysis Data	Request for analysis, Manchester Environmental Laboratories.	9/24/86	2	Bill Myers, WDOE	Unknown	
AR 5.5 000025	5.5 Sampling and Analysis Data	Request for analysis, Manchester Environmental Laboratories.	9/24/86	2	Bill Myers, WDOE	Unknown	
AR 5.5 000026	5.5 Sampling and Analysis Data	Request for analysis, Manchester Environmental Laboratories.	9/26/86	2	Bill Myers, WDOE	Unknown	
AR 5.5 000027	5.5 Sampling and Analysis Data	Summary of detected volatile compounds, attached list of existing well sampling locations and analytical data for priority pollutants, volatile and organic compounds and inorganic compounds.	8/86	31	Black & Veatch	Unknown	
AR 5.5 000028	5.5 Sampling and Analysis Data	Letter regarding analytical results of groundwater samples.	10/2/86	2	Thomas L. Rutherford Black & Veatch	Thair Jorgensen City of Tacoma Refuse Utility	
AR 5.5 000029	5.5 Sampling and Analysis Data	Letter regarding attached analytical results for priority pollutant volatile compounds, priority pollutant metals, major ions and drinking water parameters.	10/2/86	36	Thomas L. Rutherford Black & Veatch	Mr. Thair Jorgenson City of Tacoma Refuse Utility	
AR 5.5 000030	5.5 Sampling and Analysis Data	Olympia Environmental Laboratory data summary.	11/4/86	1	WDOE	Unknown	
AR 5.5 000031	5.5 Sampling and Analysis Data	Environmental Laboratory data summary metals.	1/21/87	2	WDOE	Unknown	
AR 5.5 000032	5.5 Sampling and Analysis Data	Organic sample narrative METRO sample #437859, attached GCM organic analysis report for volatiles, pesticide compounds quantitation reports and scans.	10/23/86	18	METRO	Unknown	
AR 5.5 000033	5.5 Sampling and Analysis Data	Cover letter regarding attached volatile organic analysis data sheet and map of South Tacoma channel.	10/29/86	3	Thomas L. Rutherford Black & Veatch	Patricia C. Storm, EPA	
AR 5.5 000034	5.5 Sampling and Analysis Data	Letter regarding landfill groundwater study and connection of residences to city water.	11/3/86	2	Fred A Thompson City of Tacoma, Department of Public Works	Fred Gardner, WDOE	
AR 5.5 000034a	5.5 Sampling and Analysis Data	Memo regarding Tacoma Landfill update - related health department issues.	11/6/86	3	Fred Gardner, WDOE	Phil Johnson	
AR 5.5 000035	5.5 Sampling and Analysis Data	Environmental Laboratory data summary, metals.	2/26/87	2	WDOE	Unknown	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000047	5.5 Sampling and Analysis Data	Water level data regarding South Tacoma Swamp wells.	6/1/87	1	Hart-Crowser & Associates, Inc.	Unknown	
AR 5.5 000048	5.5 Sampling and Analysis Data	P.W.-8A production well constant rate pumping test drawdown and recovery data measured in TL-8A through 8C observation wells.	6/87	3	Hart-Crowser & Associates, Inc.	Unknown	
AR 5.5 000049	5.5 Sampling and Analysis Data	Groundwater sample data sheets for volatile organic compounds and for halogenated organic compounds.	6/87	7	Unknown	Unknown	
AR 5.5 000050	5.5 Sampling and Analysis Data	Table 3 solid waste regulation parameters, *Remedial Investigation* Phase II, Round 2 monitoring well samples.	6/87	1	Unknown	Unknown	
AR 5.5 000051	5.5 Sampling and Analysis Data	Surface water samples, halogenated organic compounds.	6/16/87	1	Unknown	Unknown	
AR 5.5 000052	5.5 Sampling and Analysis Data	Solid waste regulation parameters in Remedial Investigation Phase II, Round 2 surface water samples.	6/16/87	1	Unknown	Unknown	
AR 5.5 000053	5.5 Sampling and Analysis Data	Leachate samples, volatile organic compounds-EPA Method 624.	6/17/87	1	Unknown	Unknown	
AR 5.5 000054	5.5 Sampling and Analysis Data	Table 4 solid waste regualtion parameters Remedial Investigation Phase I, Round 2, private well samples.	6/87	1	Unknown	Unknown	
AR 5.5 000055	5.5 Sampling and Analysis Data	Solid waste regulation parameters Remedial Investigation Phase II, Round 2, leachate samples.	6/18/87	1	Unknown	Unknown	
AR 5.5 000056	5.5 Sampling and Analysis Data	Landfill gas samples, volatile organic compounds, halogenated compounds, groundwater samples, solid waste regulation and treatment parameters.	2/87 & 3/87	9	Unknown	Unknown	
AR 5.5 000057	5.5 Sampling and Analysis Data	Memo regarding quality assurance *report #3.*	5/13/87	8	Black & Veatch	City of Tacoma	
AR 5.5 000058	5.5 Sampling and Analysis Data	Memo regarding samples collected during Round 1 of Phase II of the Tacoma Landfill Remedial Investigation, attached revised tables 6 through 10 from the sampling plan.	5/8/87	6	Black & Veatch	City of Tacoma	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 000059	5.5 Sampling and Analysis Data	Letter report regarding information collected during pumping test performed at Tacoma Landfill on 5/2/87.	6/18/87	22	Russell C. Prior Charles T. Ellingson Hart-Crowser, Inc.	Thomas Rutherford Black & Veatch	
AR 5.5 000060	5.5 Sampling and Analysis Data	Table 5 regarding dissolved iron and manganese concentrations for RI Phase II, Round 2, private well samples.	6/18/87 & 6/19/87	1	Black & Veatch	Unknown	
AR 5.5 000061	5.5 Sampling and Analysis Data	Memo regarding evaluation of pumping test results from PW8A.	7/14/87	1	Bill Myers, WDOE	Fred Gardner, WDOE	
AR 5.5 000062	5.5 Sampling and Analysis Data	Environmental Laboratory data summary, metals, Leach Creek, Tacoma.	10/16/87	1	WDOE	Unknown	
AR 5.5 000063	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 surface water samples.	7/30/87	2	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00064	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 leachate samples.	7/30/87	2	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00065	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 groundwater samples.	8/4/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser	
AR 5.5 00066	5.5 Sampling and Analysis Data	Letter regarding attached analysis sheets for private wells, volatile organic compounds, priority pollutants, halogenated organic compounds, memo regarding Phase II, Round 2 leachate samples, and memo regarding Phase II, Round 2 surface water samples.	8/6/87	41	Thair Jorgenson City of Tacoma Refuse Utility Division	Glynis Stumpf, WDOE	
AR 5.5 000067	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 groundwater samples.	8/16/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.5 00068	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 leachate samples.	8/18/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00069	5.5 Sampling and Analysis Data	Memo regarding Phase II, Round 2 surface water samples.	8/17/87	1	Black & Veatch	Thair Jorgensen, City of Tacoma Refuse Utility Mark Snyder Black & Veatch Charles Ellingson Hart-Crowser Richard Branchflower	
AR 5.5 00070	5.5 Sampling and Analysis Data	Letter regarding resampling of Holly and Fircrest wells. Attached data sheets regarding volatile organic compounds.	9/4/87	3	Thomas L. Rutherford Black & Veatch	Thair Jorgensen City of Tacoma Refuse Utility	
AR 5.5 000071	5.5 Sampling and Analysis Data	Private well analyses Tacoma Landfill RI-Phase II, Round 3 Draft.	11/17/87	2	Black & Veatch	Unknown	
AR 5.5 000072	5.5 Sampling and Analysis Data	List of private wells.	no date	1	Unknown	Unknown	
AR 5.5 000073	5.5 Sampling and Analysis Data	Table 1, field paramters and total organic carbon for groundwater samples collected during Phase II, Round 2 Tacoma Landfill RI.	no date	2	Black & Veatch	Unknown	
AR 5.5 000074	5.5 Sampling and Analysis Data	Table 2 tentatively identified compounds from the groundwater samples collected from landfill monitoring wells during Phase II, Round 2 of the Tacoma Landfill RI.	no date	1	Black & Veatch	Unknown	
AR 5.6 000001	5.6 Remedial Investigation/Draft Reports and Comments	Draft Remedial Investigation Report, Vol. 1.	9/1/87	209	Black & Veatch, Prepared for City of Tacoma		
AR 5.6 000002	5.6 Remedial Investigation/Draft Reports and Comments	Draft Remedial Investigation Report Vol. 2, appendices.	9/1/87	598	Black & Veatch, Prepared for City of Tacoma		
AR 5.6 000003	5.6 Remedial Investigation/Draft Reports and Comments	Letter regarding EPA agency review of Draft Remedial Investigation Reports.	9/14/87	1	Phillip M. Ringrose City of Tacoma Refuse Utility Division	Debbie Yamamoto, EPA	
AR 5.6 000004	5.6 Remedial Investigation/Draft Reports and Comments	Figures 4-20 through 4-23 regarding groundwater contamination submitted with city progress reports.	9/21/87	4	City of Tacoma	Unknown	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 5.6 000005	5.6 Remedial Investigation/Draft Reports and Comments	Memo regarding Tacoma Landfill Remedial Investigation/Feasibility Study Risk Assessment, attached calculation of risk from vinyl chloride in groundwater.	11/16/87	4	Thomas L. Rutherford Black & Veatch	City of Tacoma	
AR 5.6 000006	5.6 Remedial Investigation/Draft Reports and Comments	Specific comments by Ecology, Tacoma Landfill Remedial Investigation report.	no date	17	WDOE	Unknown	
AR 5.6 000007	5.6 Remedial Investigation/Draft Reports and Comments	Specific comments to Tacoma Remedial Investigation comments.	no date	2	WDOE	Unknown	
AR 5.7 000001	5.7 Remedial Investigation/Final Report	Remedial Investigation Final Report, Vol. 1.	12/18/87	250	Black & Veatch, Prepared for City of Tacoma		
AR 5.7 000002	5.7 Remedial Investigation/Final Report	Remedial Investigation Final Report, Vol. 2, Appendices	12/18/87	440	Black & Veatch, Prepared for City of Tacoma		
AR 5.7 000003	5.7 Remedial Investigation/Final Report	Remedial Investigation Final Report, Vol. 3, Appendices	12/18/87	340	Black & Veatch Prepared for the City of Tacoma, Washington.	Unknown	
Section 6.0	FEASIBILITY STUDY, POTENTIALLY RESPONSIBLE PARTY LEAD						
AR 6.1 000001	6.1 Preliminary Screening of Remedial Technology Alternatives	Cover letter regarding attached Draft Preliminary Remedial Technology Screening Report.	3/3/87	30	Black & Veatch Engineers/Architects, Prepared for the City of Tacoma, Washington.	Mr. Thair Jorgenson City of Tacoma Refuse Utility	
AR 6.1 000002	6.1 Preliminary Screening of Remedial Technology Alternatives	Cover letter regarding attached Remedial Action Alternative Development and Initial Screening Report, Review draft.	6/11/87	99	Thomas L. Rutherford Black & Veatch, Engineers/Architects	Ms. Patricia C. Storm U.S. Environmental Protection Agency	
AR 6.2 000001	6.2 Feasibility Study, Draft and Comments	Draft Feasibility Study Report, Tacoma Landfill, Vol. 1, including cover letter.	9/26/87	234	Thomas L. Rutherford Black & Veatch	Ms. Glynis Stumpf, WDOE	
AR 6.2 000002	6.2 Feasibility Study, Draft and Comments	Draft Feasibility Study Report, Tacoma Landfill, Vol. 2 Appendices.	9/23/87	184	Black & Veatch Engineers/Architects	Ms. Glynis Stumpf, WDOE	
AR 6.2 000003	6.2 Feasibility Study, Draft and Comments	Letter concerning copies of the agency review draft of Tacoma Landfill Remedial Investigation.	9/14/87	1	Phillip M. Ringrose, Public Works Utility Services, City of Tacoma	Debbie Yamamoto, EPA	
AR 6.2 000004	6.2 Feasibility Study, Draft and Comments	Letter regarding copies of the Agency review draft of Feasibility Study Report, Tacoma Landfill.	10/1/87	1	Phillip M. Ringrose, Public Works Utility Services, City of Tacoma	Debbie Yamamoto, EPA	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 6.2 000005	6.2 Feasibility Study, Draft and Comments	Specific comments by Washington Department of Ecology regarding Tacoma Landfill Feasibility Study Report.	Unknown	6	WDOE	Unknown	
AR 6.3 000001	6.3 Feasibility Study, Final Reports	Feasibility Study Final Report Vol. 1	12/22/87	256	Black & Veatch, Engineers/Architects Prepared for the City of Tacoma, Washington	Unknown	
AR 6.3 000002	6.3 Feasibility Study, Final Reports	Feasibility Study Final Report, Tacoma Landfill, Vol. 2 Appendices.	12/22/87	196	Black & Veatch, Engineers/Architects. Prepared for the City of Tacoma, Washington	Unknown	
AR 6.4 000001	6.4 Applicable Relevant and Appropriate Requirements	Letter concerning the Superfund Amendments and Reauthorization Act requirements regarding the ARARs specifically for the Tacoma Landfill site Feasibility Study.	3/2/87	2	James L. Bradford, Black & Veatch	Mr. Fred Gardner, WDOE	
Section 7.0	RECORD OF DECISION						
AR 7.1 000001	7.1 Correspondence	Memo re Review of ROD Table and Health-Based numbers. Attached Table re Performeance Levels for Treatement System/Discharge to Surface Water.	3/25/88	3	Michael Watson, Regional Toxicologist U.S. EPA	Deborah Yamamoto, Superfund Program, U.S. EPA Region X	
AR 7.1 000002	7.1 Correspondence	Memo re brief review of "ROP," Tacoma Landfill, Black and Veatch.	3/25/88	3	Michael Watson, Regional Toxicologist, U.S. EPA Region X	Deborah Yamamoto, Superfund Program, U.S. EPA Region X	
AR 7.1 000003	7.1 Correspondence	Telephone Record re Central Cell Timer.	10/9/87	1	Mark Synder, Black & Veatch	Jim Oberlander, WDOE	
AR 7.1 000004	7.1 Correspondence	Handwritten memo re attached handout from a Geosynthetic 87 Conference in New Orleans, USA.	11/10/87	13	Pete Kmet, WDOE	Carol Kraege, Glynis Stumpf, Jim Oberlander; WDOE	
AR 7.1 000005	7.1 Correspondence	Telephone Record re possible methane gas problems.	12/16/87	1	Tom Henderson, Inpsector, Tacoma Fire Department	J. Oberlander, WDOE	
AR 7.1 000006	7.1 Correspondence	Routing slip re attached telephone record concerning landfill cell manholes.	1/11//88	2	Pete Kmet, WDOE	Glynis Stumpf, WDOE	
AR 7.1 000007	7.1 Correspondence	Memo re recording barograph.	1/27/88	1	Jim Oberlander, HWCP, WDOE	Darrel Weaver, Air Programs, WDOE	
AR 7.2 000001	7.2 Review of Tacoma Landfill Closure Plan	Cover letter re attached reviews of Tacoma Landfill: Draft Operations Plan and Draft Closure Plan and appendix re proposed additional monitoring wells and map re well locations.	3/21/88	8	Pete Kmet, WDOE	Doug Pierce, Tacoma-Pierce County Health Department	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 7.3 000001	7.3 Inspection Reports	Inspection Report re New Cell and Attached report re New Cell Construction.	9/17/87	5	J. Oberlander, WDOE	File	
AR 7.3 000002	7.3 Inspection Reports	Inspection Report re New Cell Construction.	9/22/87	6	J. Oberlander, WDOE	File	
AR 7.3 000003	7.3 Inspection Reports	Inspection Report re Central Pit Area where geomembrane was being installed.	9/24/87	2	P. Kmet and J. Oberlander, WDOE	File	
AR 7.3 000004	7.3 Inspection Reports	Inspection Report re liner and leachate trench.	9/24/87	1	C. Kraege, G. Stumpf, WDOE	File	
AR 7.3 000005	7.3 Inspection Reports	Inspection Reports re Central Cell Construction.	9/25/88	2	J. Oberlander, WDOE	File	
AR 7.3 000006	7.3 Inspection Reports	Inspection Reports re New Central Cell.	9/26/87	1	S. Milham, J. Oberlander, WDOE	File	
AR 7.3 000007	7.3 Inspection Reports	Inspection Report re New Cell.	9/28/87	1	J. Oberlander, WDOE	File	
AR 7.3 000008	7.3 Inspection Reports	Inspection Report re site visit.	9/29/87	1	Carol Kraege, WDOE	File	
AR 7.3 000009	7.3 Inspection Reports	Inspection Report re New Central Lined Cell.	9/30/87	1	Boose, Oberlander, WDOE	File	
AR 7.3 000010	7.3 Inspection Reports	Inspection Report re New Cell.	10/2/87	1	Oberlander, WDOE	File	
AR 7.3 000011	7.3 Inspection Reports	Inspection Report re Central Cell.	10/9/87	1	Brady, Oberlander, WDOE	File	
AR 7.3 000012	7.3 Inspection Reports	Inspection Report re liner installation.	10/12/87	2	P. Kmet and J. Oberlander, WDOE	File	
AR 7.3 000013	7.3 Inspection Reports	Inspection Report re New Central Cell.	10/15/87	2	J. Knudson, J. Oberlander, WDOE	File	
AR 7.3 000014	7.3 Inspection Reports	Inspection Report re New Central Cell.	10/22/87	2	J. Oberlander, WDOE	File	
AR 7.3 000015	7.3 Inspection Reports	Inspection Report re vacuum test.	11/6/87	2	Cummings, Kraege, Oberlander; WDOE	File	
AR 7.3 000016	7.3 Inspection Reports	Inspection Report re Central Cell Project.	11/13/87	1	M. Duerr, J. Oberlander, WDOE	File	
AR 7.3 000017	7.3 Inspection Reports	Inspection Report re liner area, leachate detection and collection manhole. Attached map.	12/17/87	3	John Coate, Jim Oberlander, WDOE	File	
AR 7.3 000018	7.3 Inspection Reports	Inspection Report re Central Cell Toe drain leachate flows. Attached Table re ranges of variation in leachate characteristics and photos	1/21/88	4	Sara Brallier, TPCHD; Oberlander, WDOE	File	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 7.4 000001	7.4 Record of Decision	Transmittal memo re attached Record of Decision, Remedial Alternative Selection, Final Remedial Action, Commencement Bay-South Tacoma Channel, Tacoma Landfill. Attached Appendices re: Applicable or Relevant and Appropriate Requirements, Responsiveness Summary, Index to Administrative Record and State Concurrence Letter.	3/30/88	151	Charles E. Findley, Director Hazardous Waste Division, U.W. EPA Region X	Robie G. Russell, Regional Administrator, U.S. EPA Region X	
Section 8.0	STATE COORDINATION						
AR 8.1 000001	8.1 Correspondence	Letter re: State concurrence with Record of Decision	3/30/88	1	Andrea Beatty Riniker, Director WDOE	Robie Russell, Regional Administrator, U.S. EPA Region X	
Section 9.0	ENFORCEMENT						
AR 9.1 000001	9.1 Notice Letters and Responses	Notice letter regarding potential liability for federal actions at the Tacoma Landfill site.	10/16/85	1	Randall F. Smith for Charles E. Findley, Director Hazardous Waste Division, U.S. Environmental Protection Agency	Erling Mork, City Manager, City of Tacoma	
AR 9.1 000002	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. Erling Mork, City Manager, City of Tacoma	
AR 9.1 000003	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. William Larsen Refuse Utility Division, City of Tacoma	
AR 9.1 000004	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. Bob Myrick, Water Division, City of Tacoma	
AR 9.1 000005	9.1 Notice Letters and Responses	Notice letter regarding potential liability for remedial activities necessary at the Tacoma Landfill site.	1/10/86	2	Fred Gardner, WDOE	Mr. Roger Sparling, Solid Waste Utility Manager, City of Tacoma	
AR 9.2 000001	9.2 Endangerment Assessment	Cover letter regarding attached Endangerment Assessment Report Outline.	4/3/87	4	Phillip M. Ringrose, Refuse Utility Division, City of Tacoma	Fred Gardner, WDOE	
AR 9.3 000001	9.3 Response Order by Consent	Response Order by Consent in the matter of Tacoma Landfill.	6/27/86	35	WDOE		

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 9.3 000002	9.3 Response Order by Consent	Request for Resolution for the City Council meeting of Tuesday, July 1, 1986 concerning the Remedial Investigation at the Tacoma Landfill site.	6/17/86	4	R. D. Sparling, Refuse Utility Public Works Department, City of Tacoma		
AR 9.4 000001	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Notification of Hazardous Waste site and a telephone use report regarding sample information.	6/3/81	9	Ronald West, Chemical Processors, Inc.	U.S. EPA Hooker Chemical Co., Operations Division W. J. Larsen, City of Tacoma Public Works	
AR 9.4 000002	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Memo regarding landfill reconnaissance strategy for Commencement Bay, City of Tacoma.	9/8/82	2	Robert A. Poss for James M. Evert, Toxic Substances Control Branch, United States Environmental Protection Agency	Alexandra B. Smith, Air and Waste Management Division, U.S. EPA	
AR 9.4 000003	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Memorandum on research of waste sources with attached table on physical characteristics of potential landfill contaminants and compounds detected in landfill gas.	12/2/86	11	Thomas L. Rutherford, Black & Veatch	Thair Jorgenson, City of Tacoma Refuse Utility	
AR 9.4 000004	9.4 Potentially Responsible Party Information, Waste Quantities, Types, etc.	Technical Progress Report detailing physical characteristics of potential landfill contaminants and compounds detected in landfill gas.	12/10/86	3	Black & Veatch	Unknown	
AR 9.5 000001	9.5 Landfill Operating Permit	Letter outlining conditions regarding the attached 1987 conditional operating permit for City of Tacoma Landfill.	5/14/87	4	Jody L. Snyder, R.S. Tacoma-Pierce County Health Department	Phillip Ringrose, Refuse Utility Division, City of Tacoma	
Section 10.0	HEALTH ASSESSMENT						
Section 11.0	NATURAL RESOURCE TRUSTEES						
AR 11.1 000001	11.1 Correspondence	Cover letter re concern for salmon habitat at Leach Creek and attached comments on the Remedial Investigation Report.	3/4/88	5	Lew Consiglieri, Coastal Resource Coordinator, U.S. Department of Commerce, National Oceanic and Atomospheric Administration	Deborah Yamamoto, EPA Region X	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
Section 12.0	CONGRESSIONAL HEARINGS/INQUIRIES						
Section 13.0	PUBLIC PARTICIPATION/STATE LEAD						
AR 13.1 000001	13.1 Community Relations Plan	Community Relations Plan for the Tacoma Landfill Preliminary Investigation.	5/6/85	42	Susan Hall, Hall & Associates	Fred Gardner, WDOE	
AR 13.2 000001	13.2 Meeting Notices - General Correspondence	Letter regarding meeting concerning reconnaissance level investigation of the Tacoma Municipal Landfill portion of the Commencement Bay Site.	10/21/82	1	Robert A. Poss, EPA	Jim Valentine, Town Administrator, Fircrest, Washington	
AR 13.2 000002	13.2 Meeting Notices - General Correspondence	General updated information regarding Tacoma Landfill situation, well location map, and selected and monitoring well data.		7	WDOE	Unknown	
AR 13.2 000003	13.2 Meeting Notices - General Correspondence	Two letters regarding information repositories established for the Tacoma Landfill Remedial Action Program.	5/24/85	3	Lawrie G. Robertson, Hall & Associates	Fred Gardner, WDOE Kenneth Harvey, Tacoma Public Library	
AR 13.2 000004	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation with attached Information Repository Index	6/5/85	3	Mark G. Snyder, Black & Veatch	Ms. Pat Devine, U.S. EPA Regional Library	
AR 13.2 000005	13.2 Meeting Notices - General Correspondence	Two letters regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation, with attached Information Repository Index.	6/5/85	5	Mark G. Snyder, Black & Veatch	Mr. Derek Sandison Tacoma-Pierce County Health Department Mr. Wilbur Larson, City of Tacoma Department of Public Works	
AR 13.2 000006	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation, with attached Information Repository Index.	6/5/85	3	Mark G. Snyder, Black & Veatch	Mr. Dean Hampton, Pierce County Library	
AR 13.2 000007	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Department of Ecology's Tacoma Landfill Remedial Investigation with attached Information Repository Index and memo regarding Information Repositories.	6/5/85	4	Mark G. Snyder, Black & Veatch	Mr. Kenneth Harvey, Tacoma Public Library	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 13.2 000008	13.2 Meeting Notices - General Correspondence	Memo regarding Tacoma Landfill Information Repository with attached list of repositories, index form, initial correspondence to the repository personnel, and draft letter.	4/10/86	7	Lawrie Robertson, Hall & Associates	Claire Ryan, WDOE	
AR 13.2 000009	13.2 Meeting Notices - General Correspondence	Letter regarding information file on the Tacoma Landfill.	5/1/86	1	Claire Ryan, WDOE	Ms. Pat Divine, U.S. EPA Regional Library	
AR 13.2 000010	13.2 Meeting Notices - General Correspondence	Agenda for Tacoma Landfill informational meeting at Fircrest Recreation Center.	5/15/86	1	WDOE	Unknown	
AR 13.2 000011	13.2 Meeting Notices - General Correspondence	Attendance register from the Tacoma Landfill informational meeting at Fircrest Recreational Center.	5/13/86	2	WDOE	Unknown	
AR 13.2 000012	13.2 Meeting Notices - General Correspondence	Letter regarding packet information sent to residents near Tacoma Landfill.	5/15/86	1	Claire Ryan, WDOE	(b) (6) , Tacoma	
AR 13.3 000001	13.3 Press Releases/Fact Sheets	News release regarding funding and study of Tacoma Landfill.	9/28/84	2	Kathy Davidson, U.S. EPA	Press	
AR 13.3 000002	13.3 Press Releases/Fact Sheets	Fact sheet regarding preliminary test results on drinking water well contamination.	6/25/85	2	Fred Gardner, WDOE	Unknown	
AR 13.3 000003	13.3 Press Releases/Fact Sheets	Well contamination fact sheet	4/15/85	5	Derek Sandison, Tacoma-Pierce County Health Department Fred Gardner, WDOE	Unknown	
AR 13.3 000004	13.3 Press Releases/Fact Sheets	Fact sheet regarding drinking water well contamination.	6/25/85		WDOE	Unknown	
AR 13.3 000005	13.3 Press Releases/Fact Sheets	Fact sheet regarding well contamination, with attached map.	4/15/85	3	Fred Gardner, WDOE	Unknown	
AR 13.3 000006	13.3 Press Releases/Fact Sheets	Press release regarding the Remedial Investigation and Feasibility Study for Tacoma Landfill.	4/5/86	1	Dave Frutiger and Thair Jorgenson, City of Tacoma, Refuse Utility Division	Unknown	
AR 13.4 000001	13.4 Comments and Responses	Letter re Public Meeting on February 11, 1988 and request for alternate water supply for residents on 53rd Street West.	2/20/88	4	C.L. Kelly, Jr. Citizen of Tacoma, Washington	Ms. Glynis Stumpf, WDOE	
AR 13.4 000002	13.4 Comments and Responses	Letter re comments on proposed Tacoma Landfill Cleaning and the Public Meeting on February 11, 1988. Attached newspaper article "The EPA essens its fear of toxins."	2/26/88	3	Kenneth F. Olson, Tacoma Public Utilities	Ms. Glynis Stumpf, WDOE	

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 13.4 000003	13.3 Comments and Responses	Responsiveness Summary	3/88	25	U.S. EPA Region 10, WDOE	File	
AR 13.5 000001	13.5 Public Meeting Transcripts	Transcript of Proceedings, Public Meeting February 11, 1988	2/11/88	87	Carol Kraege, Glynix Stumpf, Bill Myers, WDOE; Deborah Yamamoto, EPA Region X	File	
Section 14.0	PUBLIC PARTICIPATION - POTENTIALLY RESPONSIBLE PARTY LEAD						
AR 14.1 000001	14.1 Meeting Notices - General Correspondence	Letter regarding Tacoma Landfill general information with attached memo from the Office of the Governor.	6/19/86	2	Andrea Beatty-Rinker, WDOE	Mr. (b) (6), Tacoma	
AR 14.1 000002	14.1 Meeting Notices - General Correspondence	Letter regarding Remedial Investigation/Feasibility Study.	7/21/86	1	Fred Gardner, WDOE	Mr. (b) (6), Tacoma	
AR 14.1 000003	14.1 Meeting Notices - General Correspondence	Letter to residents regarding general information on Tacoma Landfill clean-up.	7/28/86	1	Claire Ryan, Hazardous Waste Cleanup Program, WDOE	Residents near Tacoma Landfill	
AR 14.1 000004	14.1 Meeting Notices - General Correspondence	Cover letter regarding hazardous waste cleanup program's active files.	7/29/86	1	Terese Neu Richmond, Office of the Attorney General	(b) (6) Seattle	
AR 14.1 000005	14.1 Meeting Notices - General Correspondence	Letter regarding Department of Ecology's information repository.	10/6/86	1	Mimi Sheridan, Hall & Associates	Fred Gardner, WDOE	
AR 14.1 000006	14.1 Meeting Notices - General Correspondence	Letter regarding information repository for groundwater contamination at Tacoma Landfill.	10/6/86	1	Mimi Sheridan, Hall & Associates	Dean Hampton, Pierce County Library	
AR 14.1 000007	Meeting Notices - General Correspondence	Letters regarding information repository materials for Tacoma Landfill.	2/26/87	3	Phillip M. Ringrose, City of Tacoma	Dave Palmer, Tacoma Public Library Russell Post, Tacoma-Pierce County Health Department Dean Hampton, Pierce County Library	
AR 14.1 000008	14.1 Meeting Notices - General Correspondence	Letter regarding Tacoma Landfill Remedial Investigation/Feasibility Study, and upcoming meeting for Tacoma area residents.	4/10/87	2	Phillip M. Ringrose, City of Tacoma	Residents near Tacoma Landfill	
AR 14.1 000009	14.1 Meeting Notices - General Correspondence	Agenda for well owners' meeting with attached charts, maps and tables.	4/16/87	10	City of Tacoma, WDOE	Tacoma area well owners	

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Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 14.1 000010	14.1 Meeting Notices - General Correspondence	Letter from resident regarding specific health concerns due to well contamination.	Unknown	3	(b) (6) Tacoma	Unknown	
AR 14.1 000011	14.1 Meeting Notices - General Correspondence	Listing of general information repositories.	Unknown	1	Unknown	Unknown	
AR 14.1 000012	14.1 Meeting Notices - General Correspondence	Meeting Notice for the Washington Department of Ecology public meeting on the Tacoma Landfill site.	2/11/88	1	WDOE	Unknown	
AR 14.2 000001	14.2 Press Releases/Fact Sheets	Press release regarding seeping methane gas in Tacoma.	5/20/86	2	Joseph Turner, The News Tribune, Tacoma	Unknown	
AR 14.2 000002	14.2 Press Releases/Fact Sheets	Routing and transmittal slip with attached draft news release regarding Tacoma Landfill investigation plans.	7/7/86	2	WDOE	Pat Storm, EPA	
AR 14.2 000003	14.2 Press Releases/Fact Sheets	Press release regarding Remedial Investigation/Feasibility Study for Tacoma Landfill.	Unknown	1	Dave Frutiger, Thair Jorgenson, Refuse Utility, City of Tacoma	Press	
AR 14.2 000004	14.2 Press Releases/Fact Sheets	Fact sheet regarding the proposed Tacoma Landfill clean-up with figure site map, landfill cross section, and summary of detailed evaluation.	1988	8	Glynis Stumpf, WDOE	Unknown	
15.0	TECHNICAL SOURCES AND GUIDANCE DOCUMENTS						
AR 15.1 000001	15.1 Technical Sources and Guidance Documents	Report regarding chemical analysis of public water supplies.	11/72	37	Washington State Department of Social and Health Services	Unknown	
AR 15.1 000002	15.1 Technical Sources and Guidance Documents	Cover letter with attached geological survey concerning preliminary evaluation of hydrology and water quality near the Tacoma Landfill.	3/19/85	41	Philip J. Carpenter United States Department of Interior with WDOE	Mr. Chuck Shenk, EPA	
AR 15.1 000003	15.1 Technical Sources and Guidance Documents	Memorandum regarding additional air quality modeling.	12/23/86	12	Dan Nelson Black & Veatch - Kansas City	Mark Snyder Black & Veatch - Seattle	
AR 15.1 000004	15.1 Technical Sources and Guidance Documents	Summary regarding Chambers/Clover Creek Aquifer Sole Source Petition	6/87	3	Deborah Yamamota, EPA	File	
AR 15.1 000005	15.1 Technical Sources and Guidance Documents	Reference Section from Remedial Investigation Final Report Vol. 1	12/87	3	Black & Veatch Prepared for the City of Tacoma		Publicly Available
AR 15.1 000006	15.1 Technical Sources and Guidance Documents	Reference Section from Feasibility Study Final Report Vol. 1	12/87	1	Black & Veatch Prepared for the City of Tacoma		Publicly Available

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
	15.1 Technical Sources and Guidance Documents	Tacoma-Pierce County Health Department Sole Source Aquifer Petition Chambers/Clover Creek Aquifer	6/87		Alfred M. Allen, Director of Health, Tacoma/Pierce County Health Department	Robie Russell Regional Administrator, U.S. EPA	Tacoma-Pierce County Health Department
AR 15.2 000001	15.2 Maps, Graphics, Photos	Cover letter with attached water level contours, and base map.	8/7/87	6	Bill Myers Hazardous Waste Clean-up Program, WDOE	Mr. Glenn Bruck, U.S. EPA	
AR 15.2 000002	15.2 Maps, Graphics, Photos	Appendix D: Support Drawings for Landfill.	Unknown	7	Unknown	Unknown	
AR 15.2 000003	15.2 Maps, Graphics, Photos	Maps of Leachate sample locations and surface water sample locations.	Unknown	4	Unknown	Unknown	
AR 15.2 000004	15.2 Maps, Graphics, Photos	List of Photos, Maps and Graphics. Actual maps, graphics and photos located at WDOE (Site) File	no date	2			

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INDEX TO CONFIDENTIAL PORTION OF TACOMA LANDFILL ADMINISTRATIVE RECORD

Doc. #	File	Type/Description	Date	# Pages	Author/Organization	Addressee/Organization	Location of Document
AR 4.3 000002	4.3 Work Plans	Project Work Plan for RI Phase I - Contract Pricing Proposal Tables, Remedial Action Section Work Assignment.	12/7/84	10	Black & Veatch Prepared for WDOE		
AR 4.3 000003	4.3 Work Plans	Project Work Plan for RI Phase II - Table 6.1 Project Budget Summary, Table 6.3-1 Direct Labor Hours	4/10/85	2	Black & Veatch Prepared for WDOE		
AR 4.3 000004	4.3 Work Plans	Project Work Plan for Conceptual Feasibility Study, Table 4-1 Conceptual Cost Estimated, Table 6.3-2 Direct Labor Hours, Table 6.3-3 Direct Labor Costs, Table 6.4-1 Other Direct Costs, Table 6.4-2 Other Direct Costs, Table 6.4-3 Other Direct Costs.	12/10/85	6	Black & Veatch Prepared for WDOE		

CITY CLERK CONTRACT/AGREEMENT NO. 40160

APPENDIX D

STATE CONCURRENCE LETTER

ANDREA BEATTY RINIKER
Director

CITY CLERK CONTRACT/AGREEMENT NO. 4060

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

March 30, 1988

Mr. Robie Russell
Regional Administrator
U.S. EPA - Region 10
1200 Sixth Avenue
Seattle, WA 98101

Re: Record of Decision (ROD) for the Tacoma Landfill Site, Tacoma, Washington

Dear Mr. Russell:

The Washington State Department has completed its review of the Tacoma Landfill ROD. Based on this review, the State concurs with the selected remedy. The major elements the remedy provides for are:

1. Prevention of further groundwater contamination via a groundwater extraction/treatment system.

2. Reducing the future production of leachate by constraints on site operations and by proper grading and capping of the landfill.

3. Elimination of off-site gas migration through operation of an existing gas control system and expansion of this system, if necessary.

4. Further protection of public health and the environment via monitoring of groundwater, surface water, gas and air emmissions, and provision of alternate water supplies where necessary.

I know Ecology and EPA staff have been working long hours and in close cooperation to complete this ROD in a timely manner. We look forward to successful consent decree negotiations with the City of Tacoma to implement the ROD.

Sincerely,

Andrea Beatty Riniker.
Director

MC:sjm

cc: Mike Rundlett

CITY CLERK CONTRACT/AGREEMENT NO. 4060