FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES

FIT PROJECT

TASK REPORT TO THE ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. 68-01-6056

UNION PACIFIC RR TUNNEL
(TACOMA TUNNEL)

TDDS 10-8202-03A AND 10-8202-03B

FINAL REPORT

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REGION X AUGUST 1982

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063100

ABSTRACT

An abandoned railroad tunnel in the commercial area of Tacoma, Washington had been used as a garbage dump and could have received industrial waste. Water draining from the area of the tunnel and samples from three monitoring wells drilled into the tunnel were checked and found to have trace levels of some priority pollutants. No indication of the disposal of industrial waste into the tunnel was found, however. No shallow drinking water wells are known of within one mile of the site and only one deep (600 ft.) one.

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1.0 INTRODUCTION

An interagency task force of federal, state, and local officials has been studying Tacoma industrial areas for sites which could possibly have been used as dumps for industrial waste. An air shaft leading to an abandoned tunnel originally excavated by the Union Pacific Railroad has been identified as one site where "indiscriminate dumping" had occured and a field investigation and sampling of this tunnel was requested. This investigation was directed by the Environmental Protection Agnecy (EPA) and carried out by Ecology and Environment's Field Investigation Team (FIT) as required by Technical Direction Documents (TDDs) 10-8202-03A and 10-8202-03B (see Appendix A).

The objective of the first part of the study was to sample ground-water thought to be draining from the tunnel and to compare this with the water quality of runoff in the city storm drains. The results of this were used to evaluate the safety hazards of installing wells directly into the tunnel from the surface. The second part of the investigation involved locating the tunnel and drilling three wells into it in order to sample the ground-water and to determine if industrial waste might have been deposited in the tunnel.

Because of the uncertainties about direction of flow and height of the water table in the tunnel, it was decided to install at least three wells along the line of the tunnel, one above and one below the old drainage tunnel to Gallagher's Gulch and another towards the mouth of the tunnel. A French drain just outside the old north portal of the tunnel was also sampled as a possible source of drainage from the tunnel.

Because the report is short figures and tables are grouped at the end of the report with tables preceeding figures.

2.0 PHYSICAL DESCRIPTION

2.1 LOCATION AND SITE PLAN

The abandoned Union Pacific Railroad Tunnel is located within the city limits of Tacoma, Washington, entirely within Sections 7 and 8, Township 20N., Range 3E., in the Willamette Meridian (see Figure 1).

The north portal of the tunnel is close to the junction of Jefferson Avenue and 25th Street. The tunnel passes under Jefferson Avenue to its north side and remains close to Jefferson Avenue and Center Street until it converges on Center Street at a point about two blocks beyond Yakima Avenue. There is no evidence that the tunnel was excavated beyond this point, which is about level with "J" Street (see Figure 2).

2.2 CLIMATE AND WATER BUDGET

The Tacoma area has a temperate maritime climate with mild wet winters and moderately warm dry summers. Total precipitation in the area of the tunnel is about 40 inches annually (U.S. Weather Bureau) with 75 percent occuring from October 1 to March 31. The average annual lake evaporation is about 26 inches. Very little evapotranspiration will take place above the tunnel as the area is mostly a developed commercial district with little vegetation, but the roofs and paved surfaces will induce considerable runoff. The net annual infiltration rate is estimated at between 5-10 inches.

2.3 TOPOGRAPHY, DRAINAGE AND SOIL TYPES

The tunnel starts half-way up a slope leading from sea-level at the City Waterway to a low plateau of glacial

outwash and till at an elevation of 250 feet or so. It parallels a steep ravine known as Gallagher's Gulch which is south of the tunnel. About halfway along the tunnel it passes under another smaller gulch which has now been filled to a considerable depth (see Figure 3). No surface streams occur above the tunnel. The slope of the surface is largely irrelevant. The tunnel floor itself rises at a slope of about 0.8 percent. The major drainage from the tunnel appears to be through a horizontal tunnel or adit which leads across to Gallagher's Gulch and connects with the city storm drains along South Tacoma Way (see Figure 4). These in turn lead to a discharge point on the City Waterway.

Soils in the area are mostly disturbed or imported. Much of the area is paved and much of the rest is filled. The area is not covered by the County Soil Survey (USDA, 1979), but by reference to analogous areas it can be inferred that the natural soils are likely to be shallow and well drained.

2.4 GEOLOGY AND HYDROLOGY

The well logs (Appendix B) show predominantly sand and gravel with some thin layers or lenses of clay, when the well is not in surface fill or tunnel fill. The material is assumed to be largely advance outwash from the Vashon glaciation, although it may be of an earlier or later date. The tunnel fill is of sand and gravel mixed with wood, or else almost completely of wood, as in Well #1.

The rate of ground-water flow in the tunnel itself is probably rapid. The relatively steep slopes on the water table postulated between Well #1 and Well #3 suggest rapid movement, as does the fact that a considerable void has

appeared where the tunnel fill and collapsed roof material have presumably been carried out of the tunnel in the flow through the adit (see Figures 3 and 4). There is some flow from the French drain close to the North Portal of the tunnel, but this does not appear to capture a large part of the ground-water flow in the tunnel. It is evident that some water table elevations postulated in the Twelker report (Twelker, 1960) were not based on field evidence (see Figure 3, Appendix C), and so the FIT's original estimate of the probable water table was also far from accurate.

It remains true that much ground-water flow will be across the tunnel, however, since the walls and floor are excavated in relatively permeable materials. Ground-water is being recharged by flow from the upland area north and west of the tunnel, and by direct percolation from the surface. Discharge is via the storm drain system and by direct flow east towards the City Waterway in the subsurface.

2.4.1 Surface Water Use

The only surface waters within one mile of the site are Commencement Bay and the waterways of the Port of Tacoma all of which are heavily industrialized. The site can have only a slight impact on these waters.

2.4.2 Ground-Water Use

The City of Tacoma uses ground-water as a back-up for their municipal drinking water supply during the summer. This is pumped from a series of wells along the South Tacoma Channel. The nearest of these is Well #12A approximately 7500 feet west of the west end of the tunnel. This is up-gradient from the tunnel, and maximum draw down on the well

will bring the water level in the well down no higher than the top of the screen, which is at 182 feet. Since the water table in Well No. 3, at the west end of the tunnel, is at 158 feet, it is evident that even if Well 12A is pumped at full capacity it will not withdraw water from the area of the tunnel.

There is another well close to Well 12A which was formerly used for drinking water at the Darigold plant, South Tacoma Way and Fife Street. The well is at least 30 years old and no records of its depth, construction, or rates of pumping are available (Marshall, 1982).

The closest well to the tunnel is at Tacoma Ice and Cold Storage Co., at 2602 Holgate, which is close to and downgradient from the tunnel. This well is 600 feet deep, however, and it is extremely unlikely that it will be affected by any contamination in the water table aquifer (Reisinger, 1982).

2.5 LAND USE AND SENSITIVE HABITATS

The tunnel is in an industrial, commercial and residential area, largely built-up, with some small areas of parkland. The population within one mile of the tunnel exceeds 10,000.

There are no wetlands, sensitive habitats or wildlife reserves within two miles of the site.

3.0 SITE HISTORY

The tunnel was dug by what is now the Union Pacific Railroad. It was started in 1909 and work was stopped in the same year because the tunnel encountered excessive flows of ground-water. It was backfilled with cordwood and with sand and gravel in 1915 and abandoned (Whitacre, 1982). The horizontal tunnel or adit leading from the tunnel below Yakima Avenue over to Gallagher's Gulch was left open with an 18 inch pipe in it. The pipe was connected to the combined storm drains and sewer along South Tacoma Way or Wakefield Avenue as it was then. The road was subsequently regraded and about 40 feet of fill placed over the end of the pipe from the adit, but the manhole at this junction was raised to be level with the new surface (see Figure 4).

In 1960 the old combined storm drain and sewer was replaced by new sanitary sewers and storm drains. These were not as far below the surface as the adit outlet pipe and apparently this pipe was blocked off and the manhole filled. At the same time a bridge carrying Yakima Avenue over Gallagher's Gulch and Center Street was constructed, with one pier just south of the adit mouth, immediately adjacent to the site of the former manhole. To forstall a rise in ground-water which could have created unwanted hydraulic pressure around the bridge foundations, a French drain was installed. This extends more then 20 feet below the present surface and collects ground-water which it discharges into the storm drains. Part of this ground-water is undoubtedly coming from the tunnel via the adit (see Figure 4).

During the construction of the tunnel a number of air shafts were excavated. These were subsequently filled, but subsidence at one of them created a hole under a back room at

the Blue Note Tavern close to Yakima Avenue. This hole was used as a dump for bottle and cans, which would gradually disappear down the shaft and make room for more. It is evident that the flow of water in the adit at that time was sufficiently great to be eroding the fill in the tunnel and this made voids into which the cans and bottles fell. The tavern was demolished to make way for the Yakima Avenue bridge which was supported by a reinforced concrete arch extending over the tunnel and under both the bridge and its approach roads.

4.0 PRELIMINARY SITE INVESTIGATION

In February the FIT investigated the history of the tunnel (as directed by TDD 10-8202-03), and made a proposal to sample the French drain under the Yakima Avenue bridge and the storm drains above and below the bridge (Appendix C).

Samples were collected on March 9th, as directed by TDD 10-8202-03A, and analyzed for metals, pesticides, extractibles, and volatiles on the priorty pollutants list (Appendix D). The samples showed that the French drain contained a trace (<10 µg/l) of trichloroethylene. The storm drain up the hill from the French drain collects surface drainage from the South Tacoma Channel industrial area. This contained no indication of any priority pollutants at all. The discharge from the storm drain at the City Waterway contained traces of chloroform, and tetrachloroethylene. The levels of metals were low in all samples, and were below the level of detection for all metals except aluminum, iron, and zinc.

5.0 DRILLING PROGRAM

During March 1982 the FIT began subcontracting procedures and negotiations with site owners and tenants for the installation of three wells along the line of the tunnel. At the same time arrangements were made to have the City of Tacoma Public Works Department examine the historic data and survey in the center line of the tunnel and the elevations of the potential drill sites.

Four sites were selected; one above the Yakima Avenue adit, two relatively close to the adit but below it, and a third much closer to the north portal (see Figures 2 and 3). Only three sites were used. It was hoped that these would be relatively representative of the water within each part of the tunnel. At the same time it was proposed to sample the French drain at the north portal since it was assumed that some of the water in it would be from the tunnel.

The sites chosen were:

Well #1 South side of Goodwill Industries parking lot at 714 South 27th Street (below the adit but close to it).

Well #2 Southeast corner of lot 23, block 2510 of Sahm's Addition on the northwest corner of the junction of Jefferson Avenue and Fawcett Avenue (halfway between Well #1 and the north portal).

Well #3 East edge of parking lot at 825 Center Street (head of tunnel, above adit).

5.1 WELL CONSTRUCTION

A subcontract was awarded to Tacoma Pump and Drilling Company, Inc., of Graham, WA. The wells were drilled by a SS15111 Speed Star air rotary rig with a casing hammer during the period 4/29/82 to 5/5/82. The rig and casing were steam-cleaned and checked with the Century Systems Model 128 Organic Vapor Analyzer (OVA) before each hole was drilled. At FITs request the driller used vegetable oil to grease the tool joints instead of petroleum based hydrocarbons.

As the hole was drilled an 8-inch steel casing was advanced close behind the bit to hold the hole open.

Well specifications called for installation of a 4-inch PVC casing connected by stainless-steel rivets at the joints, and subsequent withdrawal of the casing (see Figure 5). The screen was to be gravel packed and a surface seal placed.

In the case of Well #3 this was done, but in Wells #1 and #2 the hole encountered a large void above the tunnel fill which indicated that the tunnel had collapsed. As it was felt that a 4-inch PVC might collapse or bend if left in the hole unsupported, the original 8-inch steel casing was left in place and perforated with a Mills knife.

After each well was completed a lockable cover was installed at the surface, and the well was developed. Each site was then restored as closely as possible to its original condition.

Well logs are included in Appendix A, and the logs and a section of the tunnel originally supplied by Union Pacific have been incorporated into a cross section (see Figure 3).

During drilling the well bore and the cuttings and water samples were screened with the organic vapor analyzer. An HNU photoionizer which is sensitive to most organics but not to methane was also available to check any OVA readings in case they might be methane. No significant indication of any organics except low levels of methane was detected.

6.0 SAMPLING PROGRAM

The field team sampled all three wells and the water from the French drain at the north portal of the tunnel on May 4-5, 1982. The samples were analyzed for the presence of priority pollutants at the Region 10, EPA laboratory in Manchester, Washington.

6.1 PRESAMPLING PROCEDURES

6.1.1 Site Safety Plan

The initial sample analysis of the ground-water draining from the tunnel area indicated a very low level of hazardous material was present (see Section 4.0). The site safety plan (Appendix C) filed with the FIT National Program Management Office in Washington, DC, required the use of level D protective clothing (rubber gloves, coveralls, boots, hardhat).

6.1.2 STORET Assignment

STORET station numbers were assigned by the Environmental Services Division of the EPA as follows:

Well 3 - Big Bros. and Sisters	11Y057
Well 2 - Jefferson and Fawcett	11Y058
Well 1 - Goodwill Parking Lot	11Y059
French Drain	11Y060

6.1.3 Laboratory Assignment

The Environmental Services Division of EPA assigned all the samples to the EPA Region 10 Laboratory in Manchester, Washington.

6.2 QUALITY ASSURANCE PROGRAM

Two sets of blanks made up of organic-free distilled water were used. The first set (the transport blank) was made up by the EPA Region 10 Laboratory. The second set (the transfer blank) was made up by the FIT sampling team in the following manner. Organic-free distilled water, supplied by the EPA Region 10 Laboratory, was poured into the cleaned bailer and from there into empty sample containers. This was done to determine if the bailer contaminated the samples. No duplicate samples were collected.

All samples were analyzed in accordance with EPA testing procedures (EPA, 1979b).

6.3 ANALYSES REQUESTED

The sampling plan called for the laboratory to analyze all samples for the priority pollutants (Appendix D) with the exception of the miscellaneous group (cyanide, phenolics and asbestos). A separate portion of sample to be analyzed for this group was not collected, but there was sufficient of one sample for the laboratory to check for cyanide and phenolics, and this was done.

Detection limits of at least 10 µg/l for the organics and 2 µg/l for metals was required.

6.4 SAMPLING PROCEDURES

Each of the three monitoring wells was sampled after completion and development. Before sampling, a volume equal to at least five times the volume of water standing in the casing was pumped out with a submersible pump. The pump was cleaned between each well by immersing it in potable water and pumping at least 50 gallons through it and the discharge line. Samples were then collected with a Teflon and glass bailer. The bailer was cleaned before each sampling with distilled water, methanol and acetone, and then dried with Grade D breathable air. The bailer was lowered into the casing with monofilament line. The line was changed between each sampling to prevent cross-contamination.

The water for each sample was transferred into the following laboratory-cleaned containers:

Extractible Organics	2 half-gallon glass jars with Teflon-lined lids
Pesticides	1 half-gallon glass jars with Teflon-lined lids
Heavy Metals	1 one-quart polyethylene cubitainer
Volatile Organics	2 40-milliliter vials with Teflon-lined lids

The bailer and the samplers' gloves were rinsed twice with the water to be analyzed. The gloves were discarded after each sampling. The outside of the sample containers were rinsed with clean water brought to the site before they were placed in an ice chest.

The surface water from the French drain was collected in a glass jar which was prepared by the laboratory. The samples were poured from this into the sample containers. The outside of the containers were rinsed with clean water before being placed in an ice chest.

All disposables were bagged and disposed of off-site. Boots were washed and coveralls bagged for cleaning later.

6.5 SAMPLE DOCUMENTATION AND PRESERVATION

All samples sent to the Laboratory were accompanied by a ziplock plastic bag containing Field Data Records, Analysis Required forms and Chain-of-Custody Record. A sample identification tag and a piece of labeling tape with the laboratory number, sample type, and preservation method written on it were attached to each sample (Appendix E).

Samples were packed inside a 4-mil plastic bag. This was then placed inside a similar bag packed with ice. The bags were placed in an ice chest and the chest was sealed with filament tape and taken to the laboratory by the field team

6.6 SAMPLE CUSTODY

All samples remained in the FIT custody until delivered to the EPA Region X Laboratory in Manchester, Washington.

7.0 RESULTS AND DISCUSSION

7.1 SUMMARY

Very low levels of a number of common synthetic organics in the priority pollutants list, including four chlorinated hydrocarbons, were found in the samples. Of the four non-priority pollutants none was chlorinated. Two were commonly used solvents and two derivatives of common chemicals.

The metals data showed levels exceeding drinking water standards in one unfiltered sample, but levels of dissolved metels were all well within drinking-water standards.

7.2 ORGANICS

Less than 5 ug/l of 1,1,1-trichloroethane, 1,2- trans-dichloroethylene and trichloroethylene were found in the wells (see Table 1). All these are common industrial solvents. Well #2 contained four non-priority pollutants. Two were again common solvents, tetrahydrofuran and acetone, the others were derivatives of tetrahydrofuran and of phenol. None of these indicates that the tunnel was used as a dump for industrial waste.

As noted above (Section 6.3), only Well #2 was checked for the miscellaneous group (cyanide and phenolics). Phenolics were detected but not quantified. It should be noted that none of the priority pollutant phenolics was detected in any sample. The cyanide level (5 ug/l) is well below any harmful level (EPA, 1979a).

The sample from the French drain just outside the north portal of the tunnel contained 15 ug/l of chlorinated solvents. Although this is higher than other samples from the tunnel it is still not high enough to suggest that industrial waste was dumped into the tunnel. The drain surfaces in a yard used by the City of Tacoma to park Public Works Department vehicles. These levels may reflect spillage of solvents associated with surface activities.

7.3 METALS

Levels of dissolved metals are all well within the levels permitted by the drinking water regulations (EPA, 1976). Total levels of arsenic, chromium, lead, nickel, and zinc in Well #3 exceeded those recommended for drinking water This sample was relatively high in sediment and the filtered sample showed marked reductions in metals (Table 2).

There is no suggestion that any of these samples are indicative of the dumping of industrial waste in the tunnel.

8.0 CONCLUSIONS

1. No significant concentrations of chemical contaminants were found in the groundwater in the Tacoma Tunnel.

2. Low-level contamination of the groundwater by a few heavy metal and organic compounds was detected.

3. With the exception of the total metals concentrations in the sample from Well #3, all the levels of contaminants found in the groundwater are well below drinking water standards. The higher metals levels in Well #3 sample are considered to be due to excessive sediment in the sample.

4. There are no known shallow drinking water wells in the vicinity of the tunnel or in the area affected by water moving through the tunnel.

TABLE 1
ORGANIC ANALYSES (ug/l)
TACOMA TUNNEL
TACOMA, WASHINGTON

COMPOUNDS DETECTED	Well 1	Well 2	Well 3	French Drain
Base/Neutral Compounds				
napthalene	---	---	<0.1	---
di-n-butyl phthalate	---	0.9	---	---
Volatiles				
1,1,1-trichloroethane	2.2	2.6	---	2.5
1,2-trans-dichloroethylene	<1	<1	<1	3.2
tetrachloroethylene	---	---	---	4.1
trichloroethylene	4.6	4.5	---	5.2
Miscellaneous				
cyanide	NA	5	NA	NA
phenolics	NA	<5000	NA	NA
Non Priority Pollutants				
butyl tetrahydrofuran	---	---	P	---
acetone	P	---	P	---
tetrahydrofuran	---	---	P	---
phenol,2,6-bis-(1,1-dimethyl ethyl)-4-methyl	---	---	P	---

--- indicates not detected
NA indicates not analyzed
P indicates detected but not quantified
< indicates detected but below the level indicated

TABLE 2
METAL ANALYSES (ug/l)
TACOMA TUNNEL
TACOMA, WASHINGTON

Metals Found	Well 1	Well 2	Well 3*	French Drain Tunnel Portal
Arsenic, total	4	4	132	<2
Barium, total	---	---	1.5	---
Cadmium, total	0.2	2.1	6.3	---
Cadmium, dissolved	---	0.4	---	---
Chromium, total	41	9.8	218	7.2
Chromium, dissolved	6.5	6.5	7.2	5.9
Copper, total	24	14	163	16
Copper, dissolved	1.6	1.6	1.6	2.5
Lead, dissolved	---	14	---	---
Mercury, total	---	0.26	0.11	0.11
Mercury, dissolved	---	0.11	0.11	0.11
Nickel, total	27	20	270	31
Nickel, dissolved	4	3	11	6
Zinc, total	420	180	1010	---
Zinc, dissolved	---	100	---	---

*Note: Sample was turbid. High total metals due to sediment.
--- indicates not detected
< indicates detected but below the level indicated

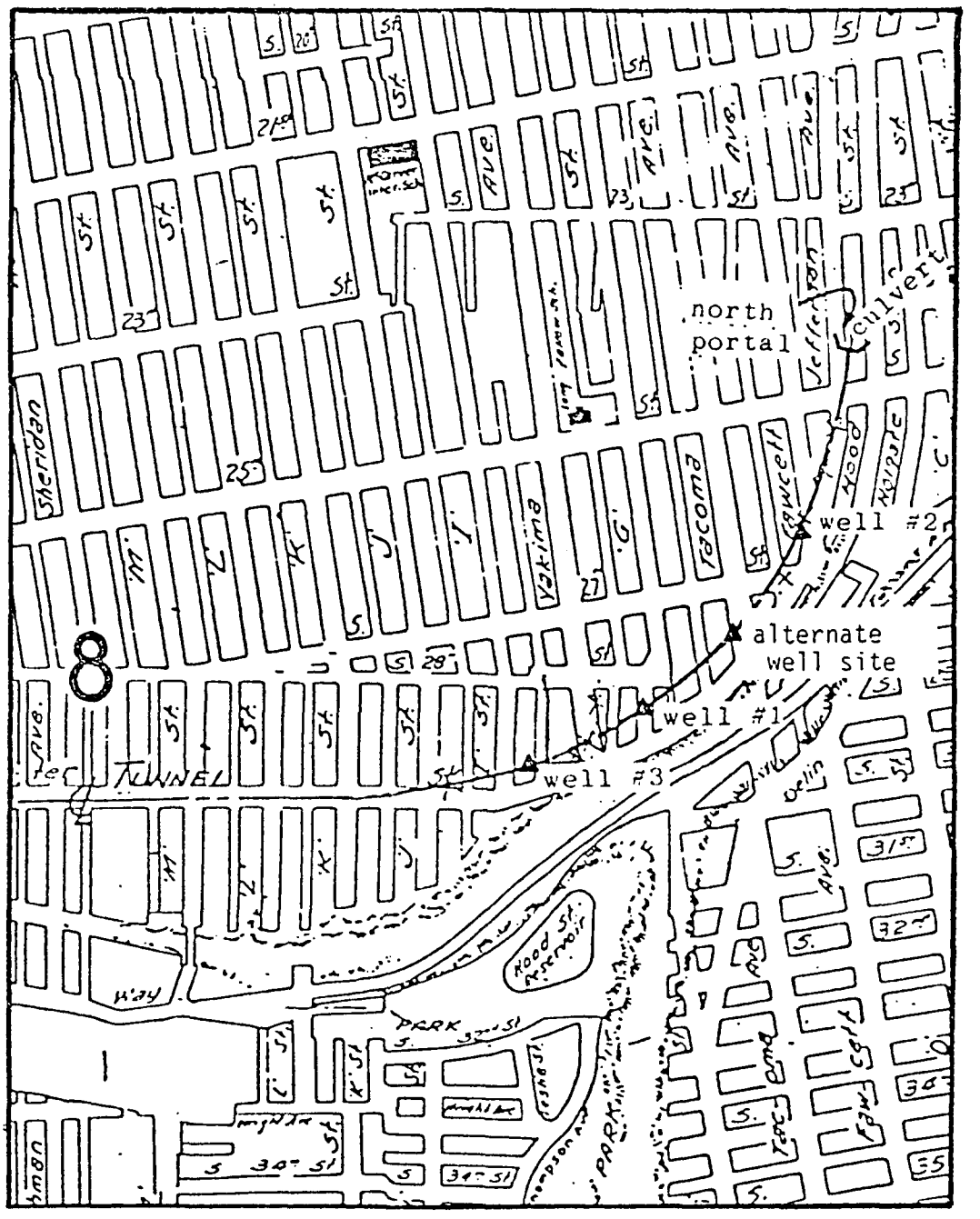
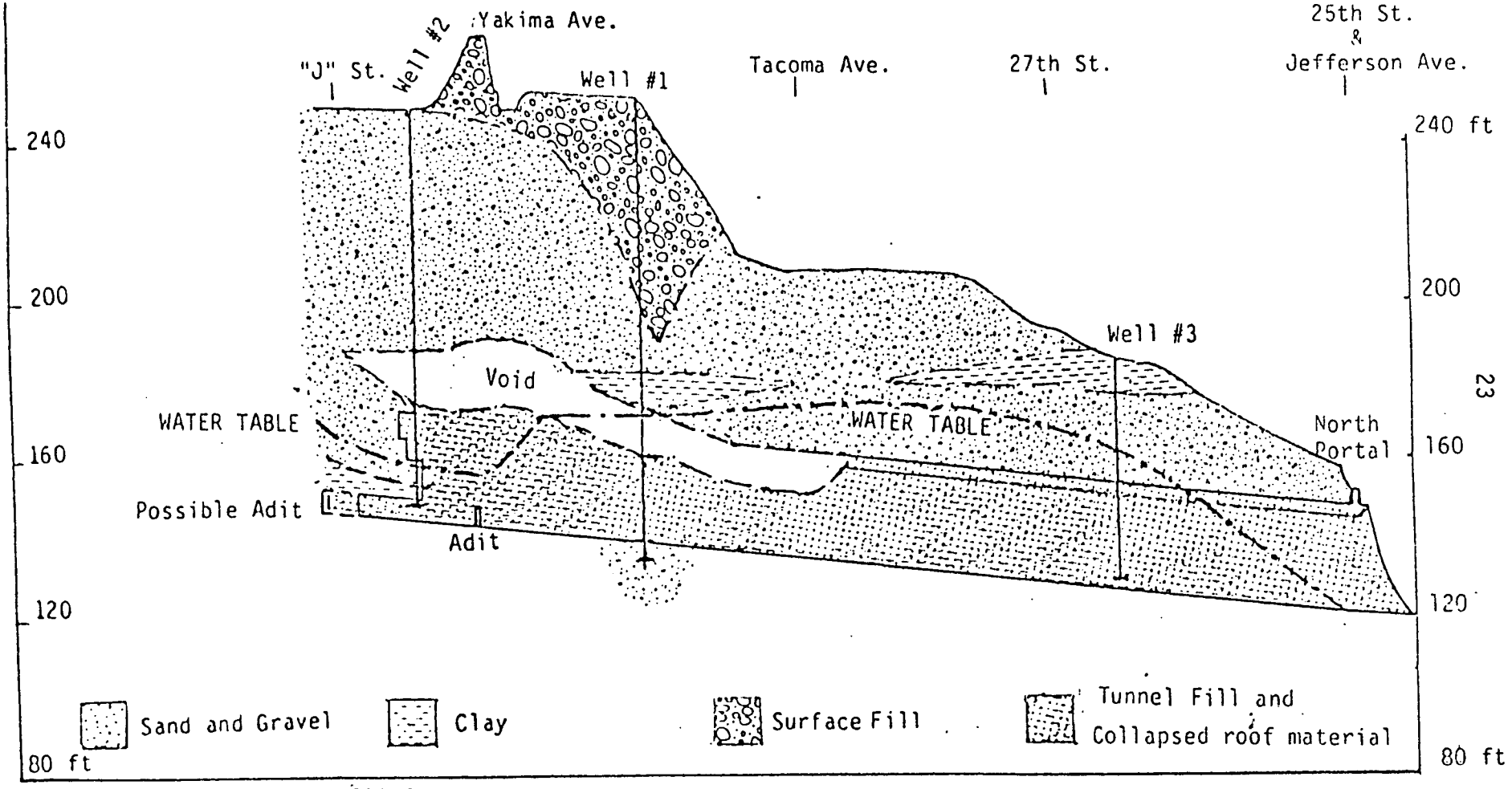


FIGURE 2
PLAN OF TUNNEL AND WELL LOCATIONS
TACOMA TUNNEL
TACOMA, WASHINGTON

recycled paper



horizontal scale 1 in. = 500 ft
vertical scale 1 in. = 40 ft

FIGURE 3
HYPOTHETICAL CROSS-SECTION*
ALONG TACOMA TUNNEL
TACOMA, WASHINGTON

*Partly from Whitaker Engineers files

recycled paper

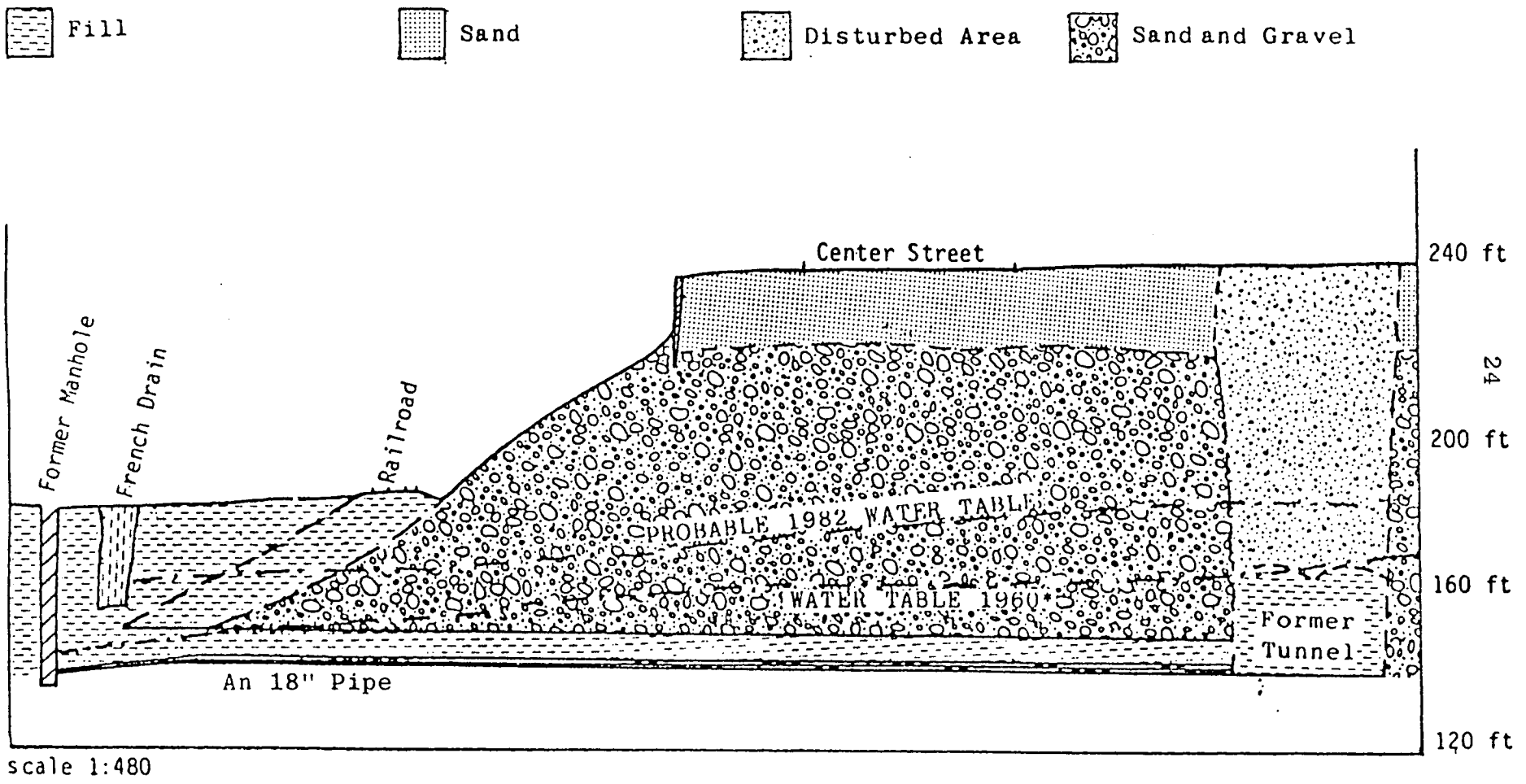


FIGURE 4
HYPOTHETICAL CROSS SECTION ALONG
ADIT FROM TUNNEL TO GALLAGHER'S GULCH
TACOMA TUNNEL
TACOMA, WASHINGTON

*Twelker, 1960

cookbooks and environments

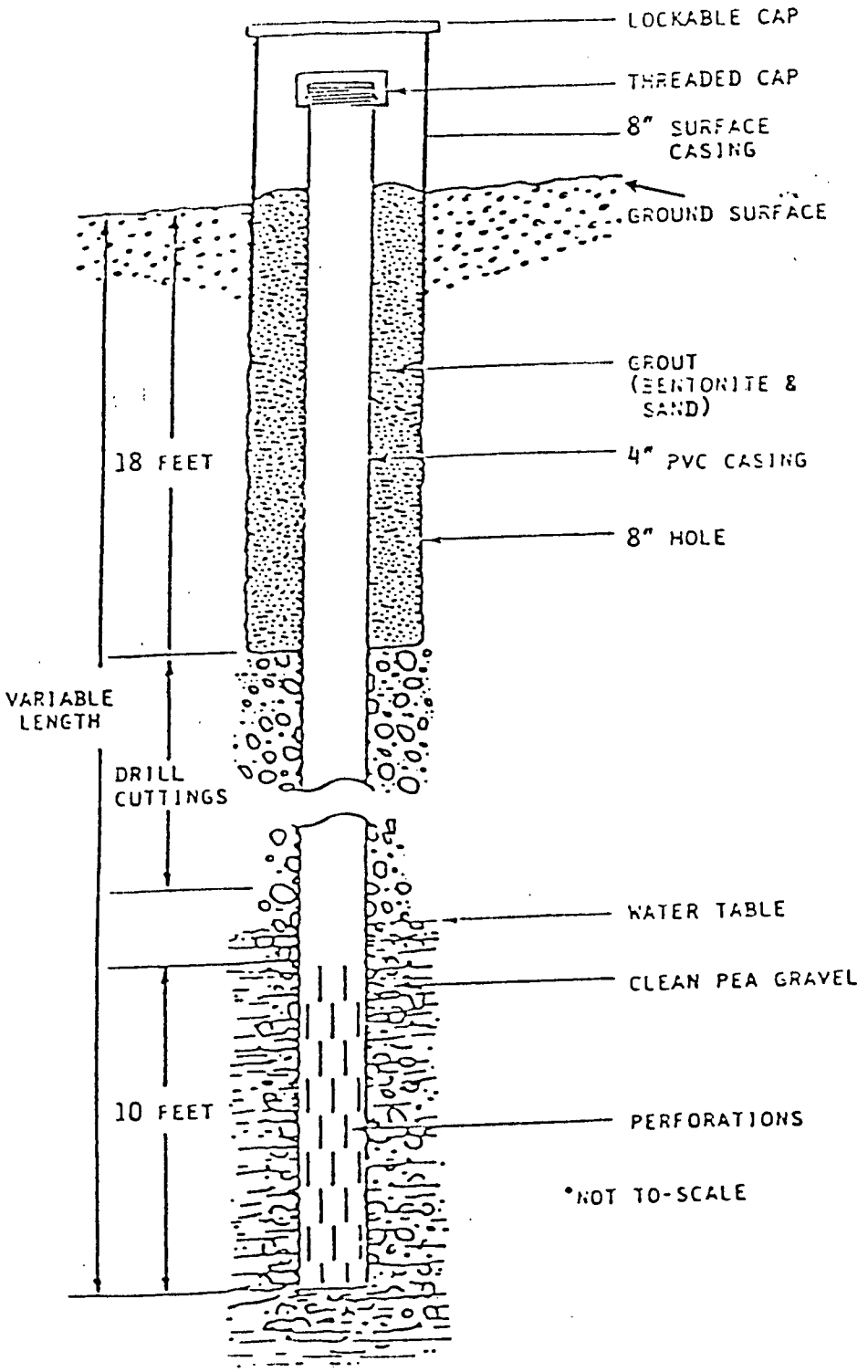


FIGURE 5
MONITORING-WELL CONSTRUCTION
TACOMA TUNNEL
TACOMA, WASHINGTON

BIBLIOGRAPHY

Gahler, A., 1982, personal communication. U.S. EPA Region X Laboratory, Manchester, Washington.

Griffen, W. C., Et al., 1962, Water Resources of the Tacoma Washington Area, Geological Survey Water-Supply Paper 1499-B.

Twelker, N. H., and Assoc., 1960, Foundation investigation for Yakima Bridge, City of Tacoma: Neil H. Twelker and Associates, Tacoma, Washington, report to Horace J. Whitacre and Associates.

Marshall, D., 1982, personal communication; 7/9/82, Consolidated Dairy Products Co. (Darigold), Seattle, Washington.

Reisinger, J., 1982, personal communication; 7/9/82, Tacoma Ice and Cold Storage Co., Tacoma, Washington.

U.S. Environmental Protection Agency (EPA), 1976, National interim primary drinking water regulations, EPA-570/9--76-003. (U.S. Government Printing Office)

_____1979a, National secondary drinking water regulations. In Federal Register; Vol. 44, No. 140, pp. 42195-42202.

_____1979b, Guidelines for establishing test procedures for analysis of pollutants: proposed regulations. In Federal Register; Vol. 44, No. 233, pp. 69463-69575.

U.S. Geological Survey (USGS), 1961 (photorev. 1968, 1973), Tacoma South, WA.: National Topography Map Series, Scale 1:24,000.

Whitacre, H. J., and Assoc. 1982, company files: Tacoma, Washington.

Zulauf, A. S., 1979, Soil survey of Pierce County Area, Washington, U. S. Department of Agriculture, Soil Conservation Service.

APPENDIX A
TDD 10-8202-03A
and
TDD 10-8202-03B

1. COST CENTER	TECHNICAL DIRECTION DOCUMENT (TDD)	2.
EP-152-10	UNCONTROLLED HAZARDOUS WASTE SITE PROJECT ecology and environment, inc.	No. 10-8202-03A

3. Priority:	4. Authorized Overtime	5. EPA Site Identification Number	6. Completion Date:	7. Reference Info:
☒ High ☐ Medium ☐ Low	☐ Yes ☒ No		4/30/82	☐ Yes ☒ No ☐ Attached ☐ Pick Up

8. General Task Description: Sample storm sewers draining the area of the abandoned Union Pacific Railroad Co. tunnel, Tacoma, WA.

9. Specific Elements:	10. Interim Deadlines
Contact Dept. of Public Works for assistance in	
locating and opening manholes	3/02/82
Check manholes with OVA and HNU photoionizer.	
Sample for priority pollutants and drinking	
water parameters	3/09/82
Draft	
Report on analytical results	*4/30/82

11. Desired Report Form: Formal Report ☐ Letter Report ☒ Formal Briefing ☐

Other (Specify):

12. COMMENTS: *Assumes laboratory ~~f~~ turn around time of 40 days or less.

13. Authorizing DPO:	14. Date:
William B. Schmidt (Signature)	3/1/82

15. Received By: ☐ Accepted ☐ Accepted with exceptions ☐ Rejected	16. Date:
Hussein Hilal (FITL Signature)	3/10/82

Exceptions Comments From (15)

Sheet 1 White – FITL Copy
Sheet 2 Canary – DPO Copy
Sheet 3 Pink – Contracting Officer's Copy (Washington, D. C.)
Sheet 4 Goldenrod – Project Officer's Copy (Washington, D. C.)
☐ Photocopy to E & E NPM (Washington, D. C.)

recycled paper

1. COST CENTER	TECHNICAL DIRECTION DOCUMENT (TDD)	2.
EP 152-10	UNCONTROLLED HAZARDOUS WASTE SITE PROJECT ecology and environment, inc.	No. 10-8202-03B

3. Priority:	4. Authorized Overtime	5. EPA Site Identification Number	6. Completion Date:	7. Reference Info:
☒ High ☐ Medium ☐ Low	☒ Yes ☐ No		6/18/82	☐ Yes ☒ No ☐ Attached ☐ Pick Up

8. General Task Description: Subcontract for and supervise the installation of wells along the line of the abandoned Union Pacific Railroad tunnel, Tacoma, WA. Sample soil and groundwater and monitor during drilling

9. Specific Elements:	10. Interim Deadlines
Draw up requests for bid and subcontract drilling	5/1/82*
Arrange with City of Tacoma for survey work	5/1/82 RA 4/16/82
Supervise drilling and monitor wells, and sample soil and groundwater	5/17/82
Write interim report	6/18/82

11. Desired Report Form: Formal Report ☒ Letter Report ☐ Formal Briefing ☐

Other (Specify):

12. COMMENTS: *Assumes rapid approval of subcontract request by EPA contracting officer.

13. Authorizing DPO: 3/16/82
William E. Schmidt
(Signature)

14. Date: 3/16/82

15. Received By: ☒ Accepted ☐ Accepted with exceptions ☐ Rejected
Thomas Aldis
(FITL Signature)

16. Date: 3/15/82

Exceptions Comments From (15)

Sheet 1 White – FITL Copy
Sheet 2 Canary – DPO Copy
Sheet 3 Pink – Contracting Officer's Copy (Washington, D. C.)
Sheet 4 recycled paper Goldenrod – Project Officer's Copy (Washington, D. C.)
☐ Photocopy to E & E NPM (Washington, D. C.)

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APPENDIX B
WELL LOGS

TACOMA TUNNEL - WELL LOGS

Ground Elevation: 252.00' (City Datum) 04-30-82

Monitoring Well #1

Location: Goodwill Industries

DEPTH	
0 - 15'	Dark brown sandy clay with gravels. (fill)
15' - 18'	Same as above with silt lenses. Silt content increase with depth. (fill)
18' - 38'	Silty clay with few gravels
38' - 55'	Sandy clay with medium to coarse gravels. Few pieces of wood are present. (fill)
55' - 64'	Sand and gravels with some clay. More sandy at 60'(wet)
64' - 70'	Generally fine sand with very few gravels. (wet)
70' - 78'	Silty clay with few gravels
78' - 92'	Void. Lost air circulation
92' - 115'	Pieces of slightly decomposed wood.
115' - 120'	Coarse sand and gravels, firm. Drilling completed at 120' below ground elevation. Base of the tunnel is 115' below ground elevation. Drilling completed at 120' below ground elevation. Water level after well completion 81'9".

TACOMA TUNNEL - WELL LOGS

Ground Elevation: 248.71' (City Datum) 05-04-82

Monitoring Well #2

Location: Big Brothers and Big Sisters property at 825 Center Street

DEPTH	
0 - 13'	Fine sand with rock fragments.
13' - 23'	Coarse sand and gravels with rock fragments.
23' - 32'	Fine sand
32' - 53'	Medium to coarse sand and gravels with occasional fine sand lenses.
53' - 55'	Fine sand with rock fragments.
55' - 60'	Medium to coarse sand.
60' - 75'	Void. Lost air circulation
75' - 95'	Medium to coarse sand and gravels with pieces of slightly decomposed wood. Hit water at 80'.
95' - 100'	Sandy clay with gravels, firm. Drilling completed at 100' below ground elevation. Water level after completion of the well 90'5" below ground elevation. Base of the tunnel is 95' below ground elevation.

TACOMA TUNNEL - WELL LOGS

Ground Elevation: ≅ 185.10' (City Datum) 05-03-82

Monitoring Well #3

Location: Jefferson and Fawcett, at the open lot

DEPTH	
0 - 10'	Mottled brown silty clay, moist, fairly plastic.
10' - 15'	Fine sand, with occasional boulders, moist.
15' - 20'	Fine sand with medium to coarse gravels, moist.
20' - 35'	Generally medium to coarse sand and gravels with clay lenses.
35' - 50'	Coarse sand and gravels with pieces of slightly decomposed wood. Wood content increases with depth. Water hit at about 35'. Rate of flow about 15 - 20 gpm.
50' - 55'	Coarse sand and gravels, firm. Base of tunnel is 53' below ground elevation. Drilling completed at 55' below ground elevation. Water level after completion of the well 24'1" below ground elevation.

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APPENDIX C
FIELDWORK PROPOSAL AND SITE SAFETY PLAN

ecology and environment, inc.
108 SOUTH WASHINGTON, SUITE 302, SEATTLE, WASHINGTON 98104, TEL. 206-624-9537
International Specialists in the Environmental Sciences

DATE: March 2, 1982

TO: John Osborn

FROM: Hussein Aldis

SUBJ: Abandoned Union Pacific Railroad Tunnel
Tacoma, Washington

REF: TDD 10-8202-03

New information has been given to the FIT by Daniel Handa, Dept. of Public Works, Tacoma. He has unearthed the construction files for projects 3010-E and 3508, 1960, concerned with the sewer and storm drain modifications made necessary by the construction of the Yakima Avenue Bridge and the regrading of South Tacoma Way.

Of the proposals suggested by the consulting soils engineers to handle the problems posed by the existance of the adit from the abandoned railroad tunnel at Yakima Avenue, the option chosen was one involving plugging and abandonment of the manhole into which the adit drained. This allowed the ground-water to rise considerably in this area up to the level of a french drain, installed around the bridge pier, that leads off to the new storm drains installed along South Tacoma Way (see Fig. 1).

The result of this information is to remove the most promising point for sampling the tunnel directly. Some ground-water that passes through the area of the tunnel will undoubtedly be collected by the french drains, but so also will surface runoff from the ditch beside the railroad (see Fig. 2).

The concrete tank mentioned by Mr. Sparling is shown in the 1960 construction drawings (see Fig. 3), and this should enable the FIT to locate the manhole we need to sample there (see attachment).

There does not seem to be any reason to sample the storm drains between Yakima Avenue and the City Waterway.

Recommendations

The following points should be sampled: (see figs. 4 & 5)

- The manhole below the former railroad reservoir near "J" St. (Fig. 3).
- The manhole on the north side of South Tacoma Way opposite station 8+70 (Fig. 1).

- o The main storm drain discharging into the City Waterway.

Even if these sample points prove negative, three wells should be installed along the line of the tunnel between "J" Street and Jefferson and 25th to determine ground-water elevations and quality.

HA:jg

Attachment

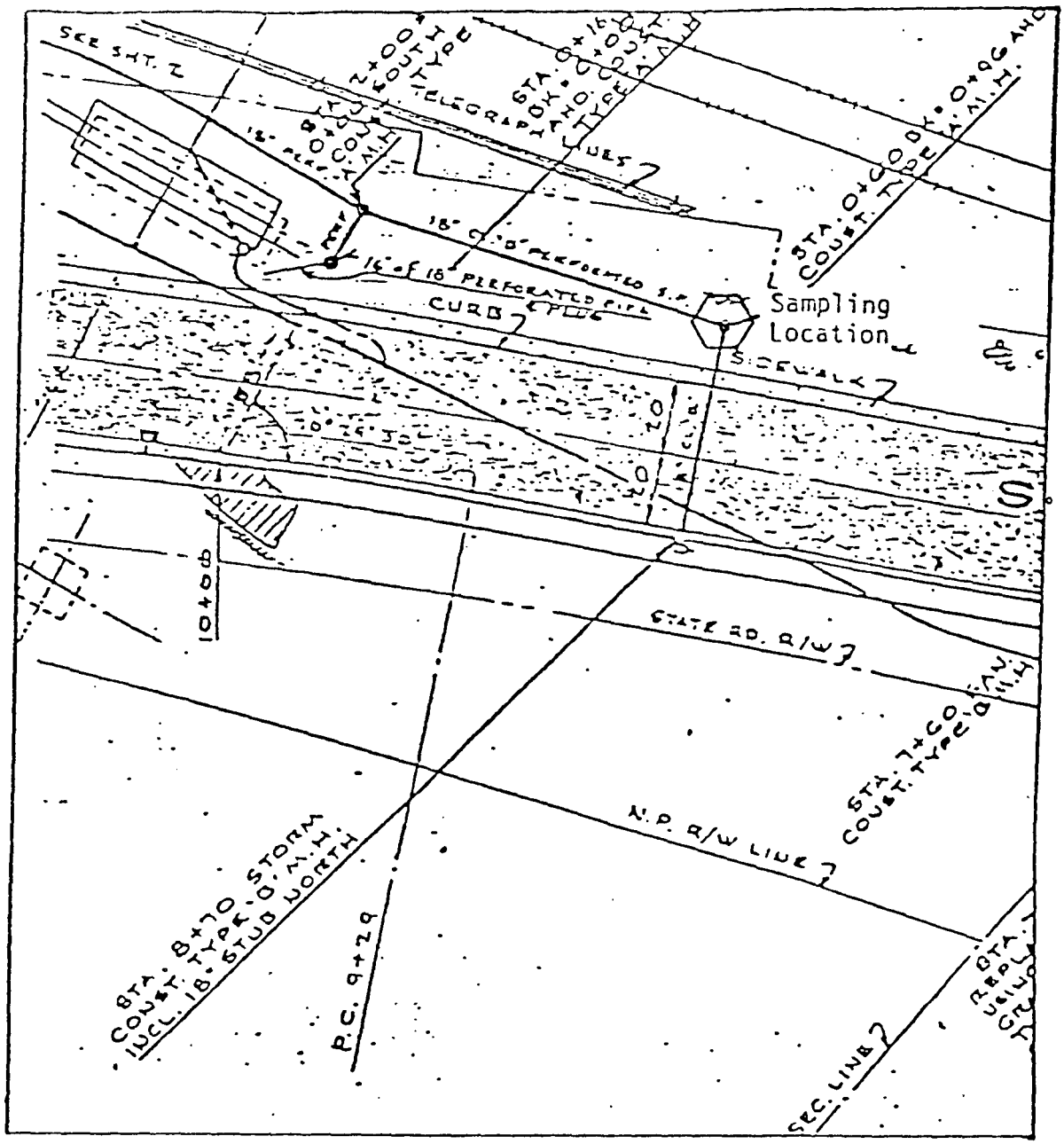

FIGURE 1
PROPOSED SAMPLING LOCATION*
ABANDONED UNION PACIFIC RAILROAD TUNNEL
TACOMA, WASHINGTON

*From Drawing 1Wb 3010-E Sheet 1 (1960)
Dept. of Public Works, Tacoma

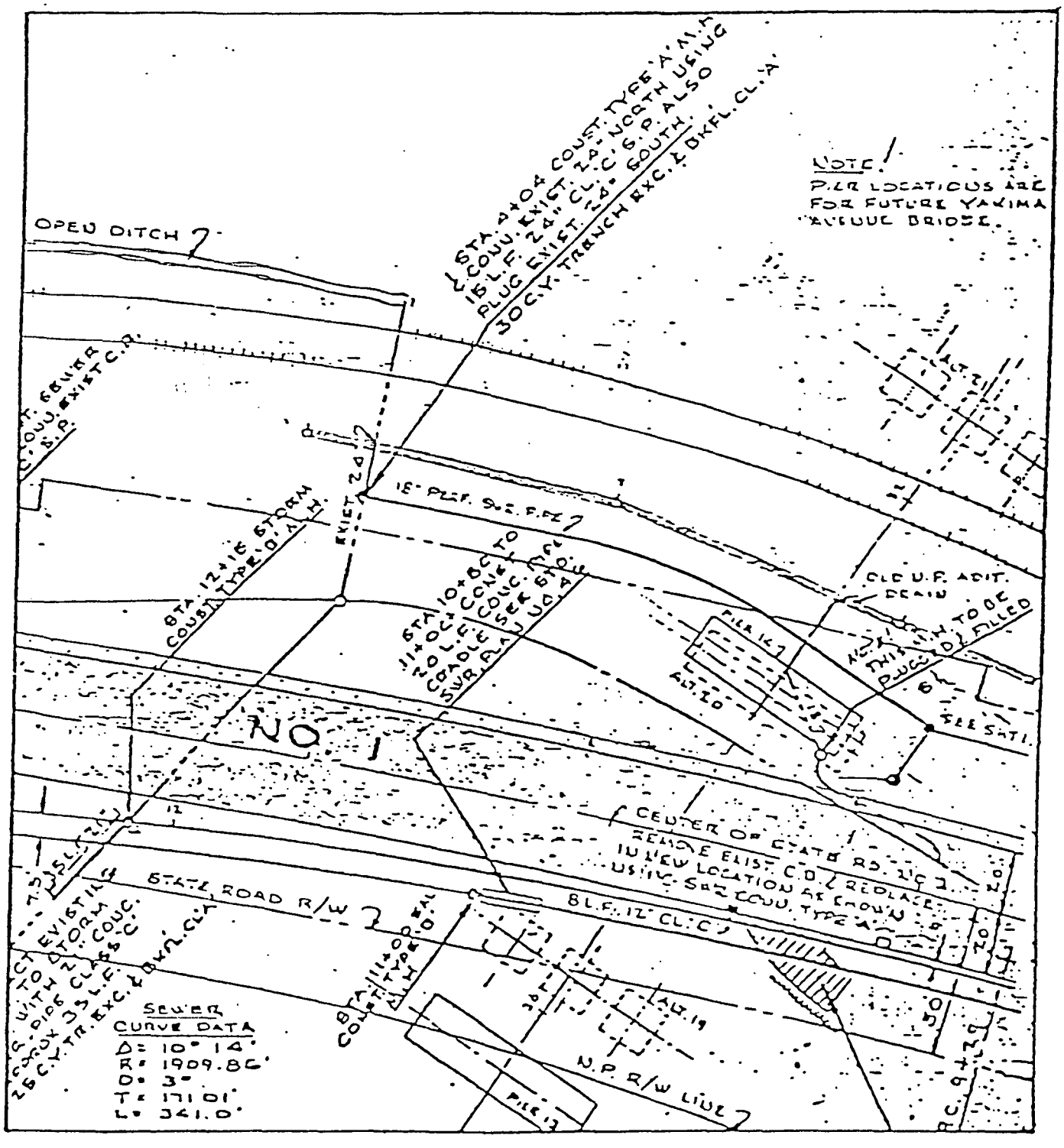

FIGURE 2
SURFACE AND STORM DRAINS BELOW YAKIMA AVENUE*
ABANDONED UNION PACIFIC RAILROAD TUNNEL
TACOMA, WASHINGTON

*From Drawing 1Wb 3010-E Sheet 2 (1960)
Dept. of Public Works, Tacoma

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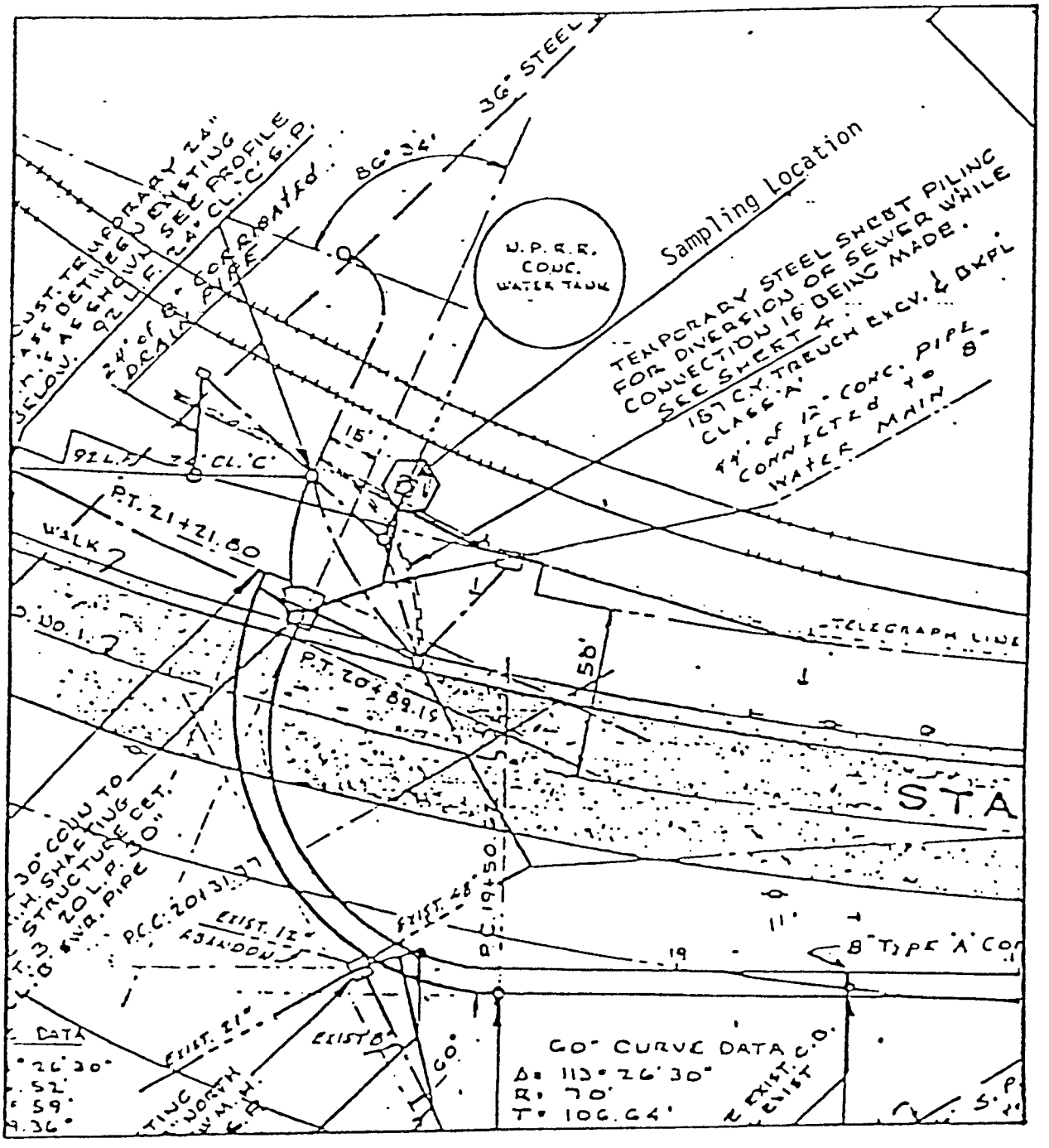

FIGURE 3
PROPOSED SAMPLING LOCATION*
ABANDONED UNION PACIFIC RAILROAD TUNNEL
TACOMA, WASHINGTON

*From Drawing 1Wb 3010-E Sheet 2 (1960)
Dept. of Public Works, Tacoma

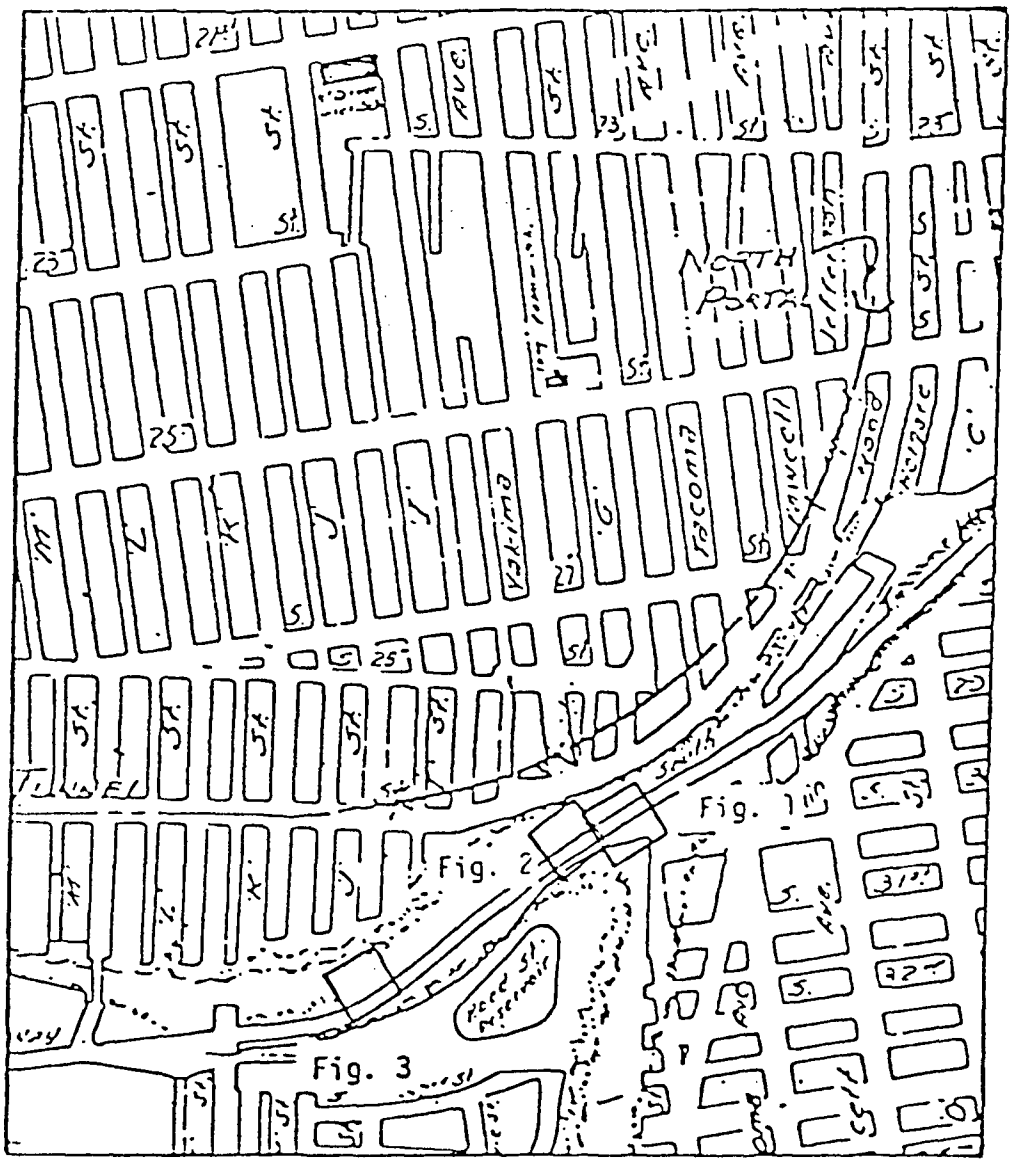

FIGURE 4
LOCATION OF FIGURE 1, FIGURE 2, AND FIGURE 3
UNION PACIFIC RAILROAD TUNNEL
TACOMA, WASHINGTON

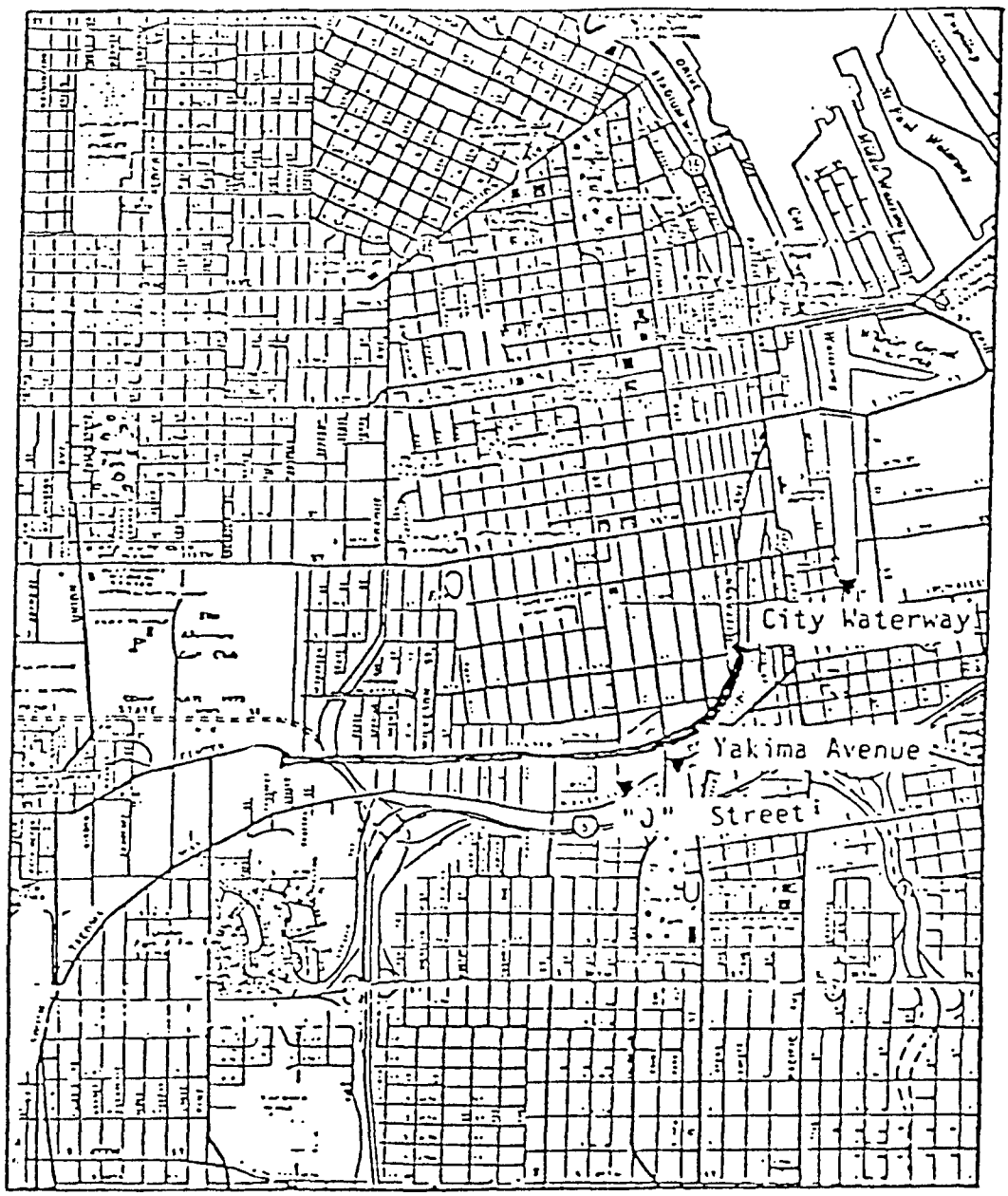

FIGURE 5
LOCATION OF PROPOSED SAMPLING POINTS
UNION PACIFIC RAILROAD TUNNEL
TACOMA, WASHINGTON

ecology and environment, inc.
108 SOUTH WASHINGTON, SUITE 302, SEATTLE, WASHINGTON 98104, TEL. 206-624-9537
International Specialists in the Environmental Sciences

April 23. 1982

TO: John Osborn
Region X EPA

FROM: James Farr James K. Farr

SUBJ: Revised Fieldwork Proposal
Tacoma Tunnel

REF: TDD 10-8202-03B

Introduction

The abandoned Union Pacific Railroad Tunnel (Tacoma Tunnel) is located entirely within sections 7 and 8, T. 20 N., R. 3 E., in the Willamette Meridian.

The eastern end of the tunnel starts from the lower North Portal close to the junction of Jefferson Avenue and 25th Street. The tunnel passes under Jefferson Avenue on its west side and remains close to it until it converges on Center Street at a point about 2 blocks beyond Yakima Avenue (see Fig. 1). There is no evidence that the tunnel was excavated beyond this point, which is about level with "J" Street.

A local newspaper article (Tacoma Tribune 1981) suggested the tunnel as a site where "indiscriminate dumping" may have taken place. Review of the files indicates that the tunnel was dug during 1909, abandoned before completion because of ground-water problems, and backfilled with sand and gravel sometime before 1915. The backfilling was evidently incomplete or the material was poorly compacted, because subsidence occurred at several places along the line of the tunnel.

One of the air shafts was used as a garbage dump at a tavern, but only bottles and cans were discarded. The shaft was near the end of a horizontal side tunnel or adit that drained the head of the tunnel into the combined city storm drain and sanitary sewer until 1960, when the drains were plugged. The flow of water in the adit may have eroded some of the tunnel fill and contributed to subsidence along the line of the tunnel as well to as the disappearance of the cans and bottles from the tavern.

On March 9, 1982, the EPA/FIT team sampled the storm drains adjacent to the tunnel along Yakima Avenue and the city outflow to Commencement Bay (see Fig. 2). The preliminary findings show traces (<2 ppb) of tetrachlorethylene; trichloroethylene; 1,2-transdichloroethylene; and 1,1 dichloroethylene (Gaylor 1982).

Ground-water flows east along the line of the tunnel and crosses the excavated portion following, in a general way, the slope of the ground (see Fig. 3).

The objective of this investigation, as required by TDD 10- 8202-03B, is to install monitoring wells along the length of the tunnel (see Fig. 4) to intersect its base. Samples will be collected from those monitoring wells to establish ground-water quality and to determine whether industrial waste was dumped into the tunnel before it was backfilled. If no ground-water is encountered at the elevation of the tunnel, the well will be extended to intersect the ground-water. In this case, water-table elevation and the ground-water quality will be established below the tunnel.

The north portal of the tunnel, at Jefferson and 25th, is on city property used for the storage of construction materials. The steep bank into which the tunnel was driven has been consistently wet and the city installed a french drain to control the flow of water. Because this water partly originated in the tunnel, the flow from the french drain will also be sampled.

Drilling Specifications

Although negotiations with the landowners and tenants at the proposed monitoring-well sites are not complete, locations have been tentatively selected (see Fig. 4).

Well 1 will be on the Big Brothers/Big Sisters property at 825 Center Street. The hole should be on the line of the tunnel, which is marked by the concrete slab in the front of the building, but it should be drilled just off the east end of the parking lot.

Well 2 may be on the south side of the Goodwill Industries parking lot about, 100 feet north of the center line of Center Street. This will be about 25 feet east of the green plywood cover of the sump just off the edge of the parking lot at the top of the steep bank leading down to Center Street. An alternative site is at 601 Center Street, 55 feet north of the property boundary of the General Electric Supply Company. This is dependent on consent from the City of Tacoma.

Well 3 is proposed for the southeast corner of the vacant lot adjacent to the Reid Printing Parking lot at 2552, Jefferson Avenue South.

The monitoring wells will be excavated either with a cable-tool drill rig or with an air-rotary drilling rig with a casing hammer. The holes will be cased with unperforated steel casing with a drive shoe. The casing will be 8 inches in diameter (see Fig. 5).

While drilling from the water table to final depth, the casing will be advanced so that the open holes do not extend more than 5 feet below the bottom of the casing. None of the wells is expected to exceed 120 feet in depth. As small a quantity of water as possible will be added to the holes during drilling.

After each hole has been excavated to the required depth, a 4-inch-diameter PVC casing with a zone of perforation at the bottom will be installed inside the steel casing. The length of the perforated section will not exceed 10 feet. The casing will be placed just above the tunnel floor at a level determined by the supervising geologist. The joints of the PVC casing will be either threaded or riveted (not glued). The annular space between the steel casing and the 4-inch PVC casing will be filled with clean pea gravel to at least 2 feet above the perforations. The site of the perforations and the grain size of the gravel will be determined by the supervising geologist.

The annular space from the top of the gravel pack to 18 feet below ground surface will be backfilled with drill cuttings. The annular space from the depth of 18 feet to ground surface will be filled with a mixture of bentonite and fine sand in accordance with Washington State DOE speciciations. The steel casing and drive shoe will be removed after the well has been constructed. This should be done in a manner that will not cause damage to the PVC casing or cause excessive caving.

At each well's completion, a length of 8-inch-diameter steel casing with a lockable cover will be installed and cemented into the ground at least 3 feet down. Keys to the cover locks will be given to the supervising geologist.

The Ecology and Environment geologist will log the soil material during drilling and supervise the entire operation. The completed wells will be developed and pumped by the subcontractor to ensure their utility as monitoring wells.

Every attempt will be made to leave the site in its original condition. The subcontractor will be required to remove excess drill cuttings and other drilling materials after they have been monitored for hazardous substances and cleared. This will be done after the completion of each well.

Decontamination

The subcontractor will be required to steam-clean all the drilling equipment and steel casing before use in order to ensure that contamination is not introduced into the wells. The subcontractor will also steam-clean all drilling equipment and steel casing between wells.

Safety Procedures

Monitoring During Drilling

A model 128 Century Systems organic vapor analyzer (OVA) will be used to monitor the presence of organic vapors during and after well installation. An HNU photoionization analyzer in conjuction with the OVA will be used to screen for methane.

The OVA will be operated in survey mode and gas chromotographic mode. The survey mode will be used to evaluate total organics present on any drilling equipment such as casings that may contaminate the wells. It will also be used to evaluate the drillers' water, if such evaluation is required. Organic-free water will be obtained from the EPA Region X laboratory for use as a blank. The survey mode also will be utilized to monitor the breathable zone above each well during installation to ensure safety to all drilling personnel. The gas chromatographic mode will be used to detect and identify the type of organic compounds present in the soil cuttings and water brought up by the drillers. This will be done for the safety of the drillers and will also indicate any vertical distribution of contaminants in each well.

Site Safety Plan

The initial sample analysis for volatile organics in the groundwater draining from the tunnel area suggests no hazardous materials are present. The sampling team, therefore, does not consider the water as hazardous material and will dispose of purged and bailed water in the field. Well cuttings will be removed by the drillers after they have been checked with the OVA.

Level D decontamination procedures will be as follows.

- The FIT equipment van will be parked at least 25 feet from the drilling area
- Sample containers for volatiles will be rinsed with distilled water before they are placed in the ice chest for shipment.
- Work coveralls will be removed and bagged for later cleaning.
- Disposables (latex disposable gloves, paper towels, miscellaneous materials) will be bagged for later off-site disposal by the FIT.

A completed site-safety plan form (see attachment 1) will be filed with Ecology and Environment's national program manager's office before sampling takes place.

Analytical Requirements

The contract laboratory will analyze all samples for those heavy metals, pesticides, acid extractibles, base/neutral extractibles, and volatiles on the priority pollutant list (see attachment 2). Detection limits of 10 g/l for the organics and 2 g/l for the heavy metals will be required.

Sampling Procedures

Each of the three monitoring wells will be sampled upon completion and development. The sample will be collected with a Teflon bailer.

The bailers will be cleaned before each sampling with distilled water, methanol, and acetone, then dried with grade D breathable air. The bailers will be lowered into the casings with monofilament line. The line will be changed between each sampling to prevent cross-contamination.

The water for each sample will be transferred into the following laboratory-cleaned containers.

For extractible organics	2 half-gallon glass jars with Teflon-lined lids.
For pesticides	1 half-gallon glass jar with Teflon-lined lids
For heavy metals	1 1-quart polyethylene cubitainer

The volatiles will be collected directly from the bailer in two 40-milliliter vials with Teflon-lined lids.

The bailer and the samplers' gloves will be rinsed two times with the media to be analyzed. The gloves will be discarded after each sampling. The outside of the sample containers will be rinsed with distilled water before the containers are placed in an ice chest.

Surface Water

Surface water from the drain will be collected in a stainless-steel bucket and poured into the sample bottles and vials. The sample containers and sample gloves will be rinsed twice with the surface water before filling the sample bottles. The sample containers will be rinsed with distilled water before the containers are placed in an ice chest.

STORET Assignment

The STORET group at the EPA Environmental Services Division will be contacted prior to sampling. They will assign a STORET number to each sampling location.

Laboratory Notification

The day before sampling the EPA/FIT team will notify the contract laboratories of the sample documentation numbers of the analyses required and confirm the number of samples to be shipped.

Quality-Assurance Program

Two sets of blanks made up of organic-free distilled water will be used. The first set (the transport blank) will be made up by the EPA Region X laboratory. The second set (the transfer blank) will be made up in the field by the EPA/FIT sampling team. Organic-free distilled water, supplied by the EPA Region X laboratory, will be transferred with the cleaned bailer into empty sample containers. This will be done to determine whether the bailer is contaminating the samples. Both sets of blanks will be sent to the contract laboratories along with the well samples. Two duplicate samples will also be collected from one of the monitoring wells.

All samples will be analyzed in accordance with EPA testing procedures (GPO 1979).

Sample Packaging and Shipment

All sample containers will be rolled in wrapping paper and packed in vermiculite inside a plastic bag. This in turn will be packed in an outer bag containing ice. The packaged containers will then be placed in an ice chest that is sealed with fiberglass tape and custody tape. Packaging will meet the NEIC requirements (NEIC 1980).

Sample Custody

All samples will remain in EPA or FIT custody until shipment by Federal Express.

JF:jg
attach: 2

FIT/4

REFERENCES

Gayler, A., 1982, personal communication: Region X Laboratory, U.S. Environmental Protection Agency.

National Enforcement Investigations Center (NEIC), 1980, Enforcement considerations for evaluation of uncontrolled hazardous waste disposal sites by contractors: Denver, Colorado, U.S. Environmental Protection Agency.

Tacoma News Tribune, 1981, news feature dated January 24: Tacoma, Washington.

Twelker, N. H., and Assoc., 1960, Foundation investigation for Yakima Bridge, City of Tacoma: Neil H. Twelker and Associates, Tacoma, Washington, report to Horace J. Whitacre and Associates.

U.S. Environmental Protection Agency (EPA), 1979, Guidelines establishing test procedures for the analysis of pollutants: Proposed regulations, in Federal register, v. 44, no. 233, p. 69463-69575: U.S. Government Printing Office.

U.S. Geological Survey (USGS), 1961 [photorev. 1968, 1973], Tacoma South, Wash.: National Topography Map Series, scale 1:24,000.

Whitacre, H. J., and Assoc. 1982, company files: Tacoma, Washington.

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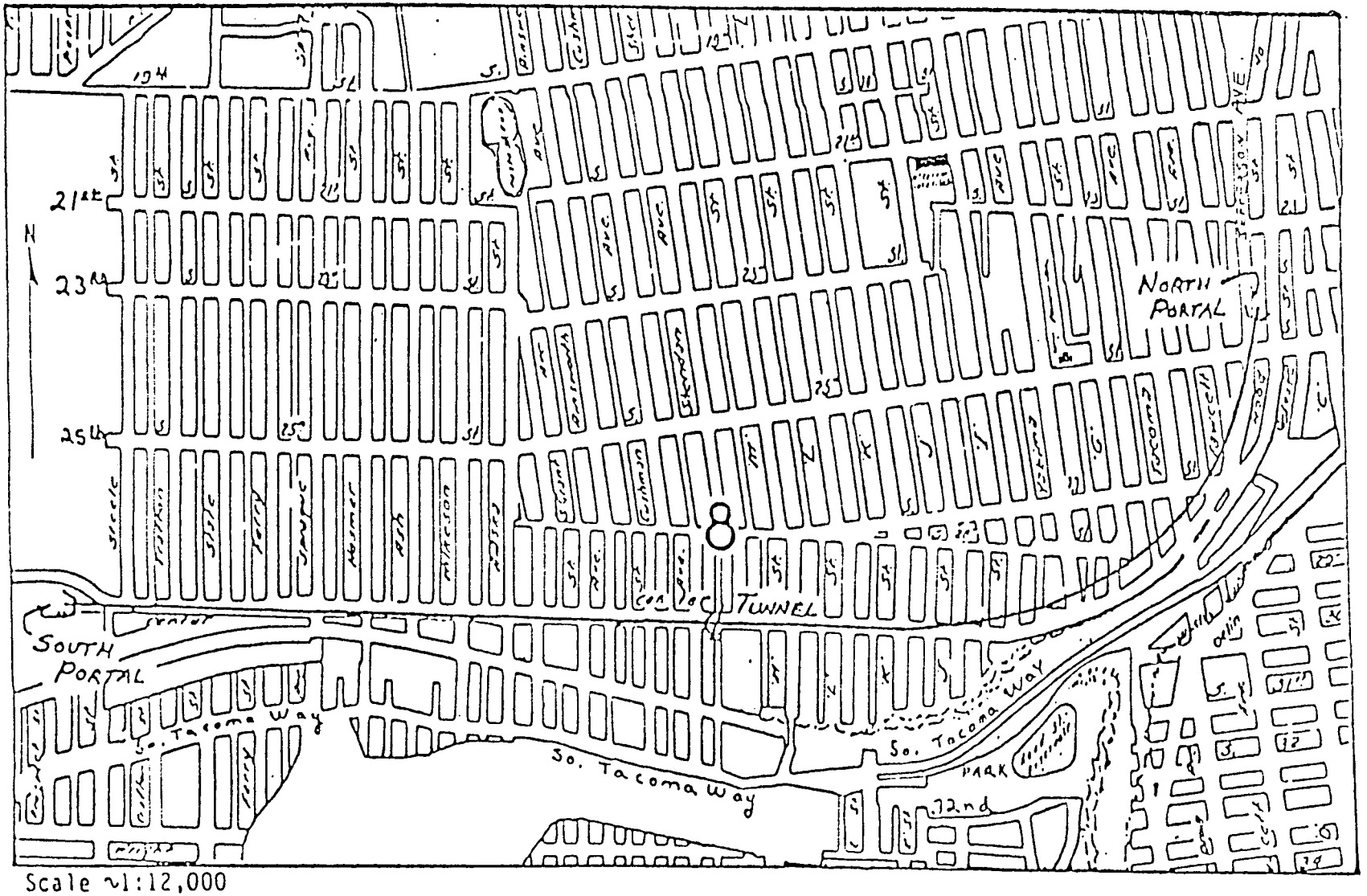

Scale ≈1:12,000

FIGURE 1*
ORIGINALLY PROPOSED LINE OF CONSTRUCTION
TACOMA TUNNEL

*Whittaker Engineers 1982

ecology and environment

Scale 1:24,000

FIGURE 2*
SAMPLING POINTS, MARCH 1982
TACOMA TUNNEL

*USGS 1961

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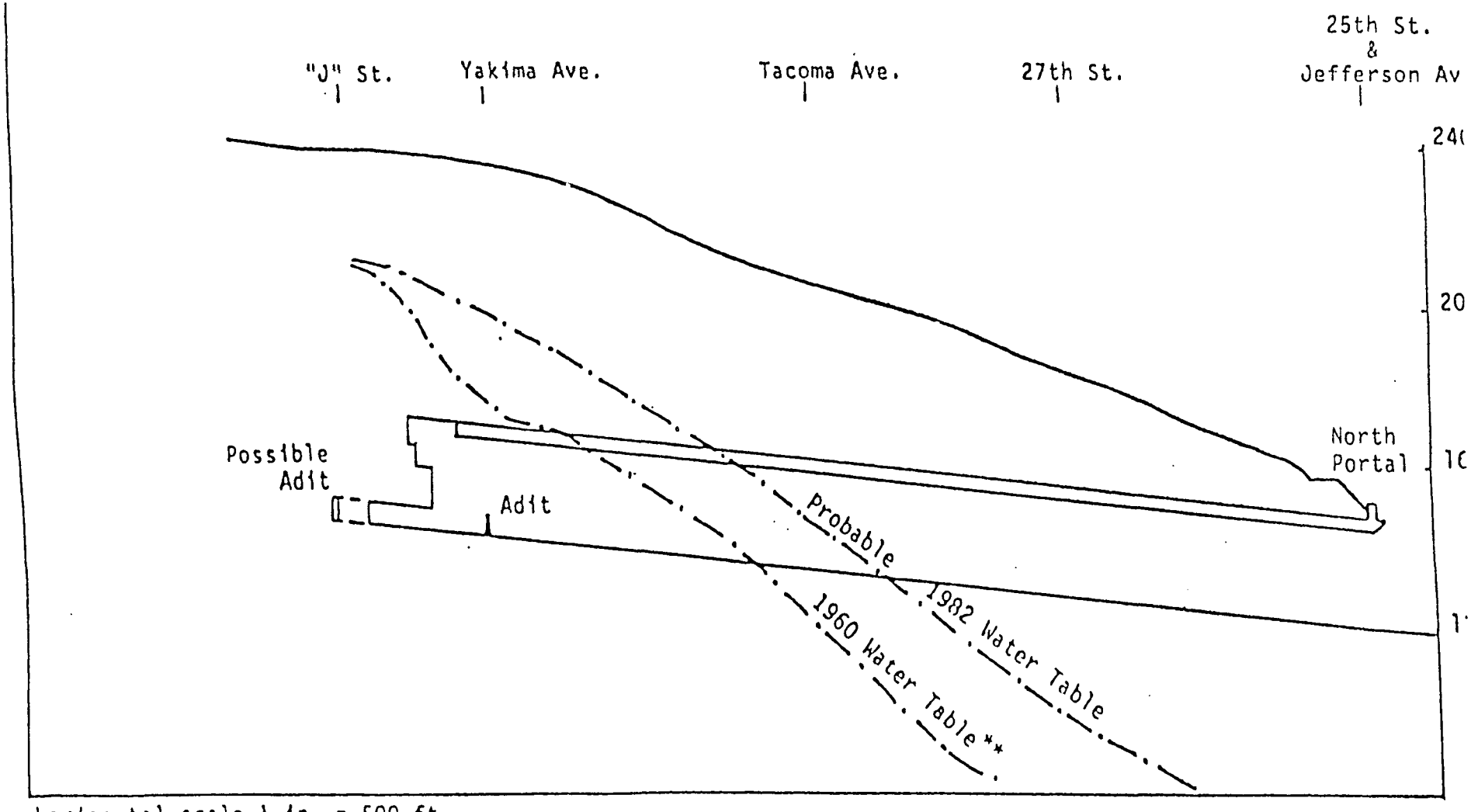

FIGURE 3*
HYPOTHETICAL CROSS SECTION ALONG TUNNEL
TACOMA TUNNEL

*Partly from Whitaker Engineers files

**Twelker (1960)

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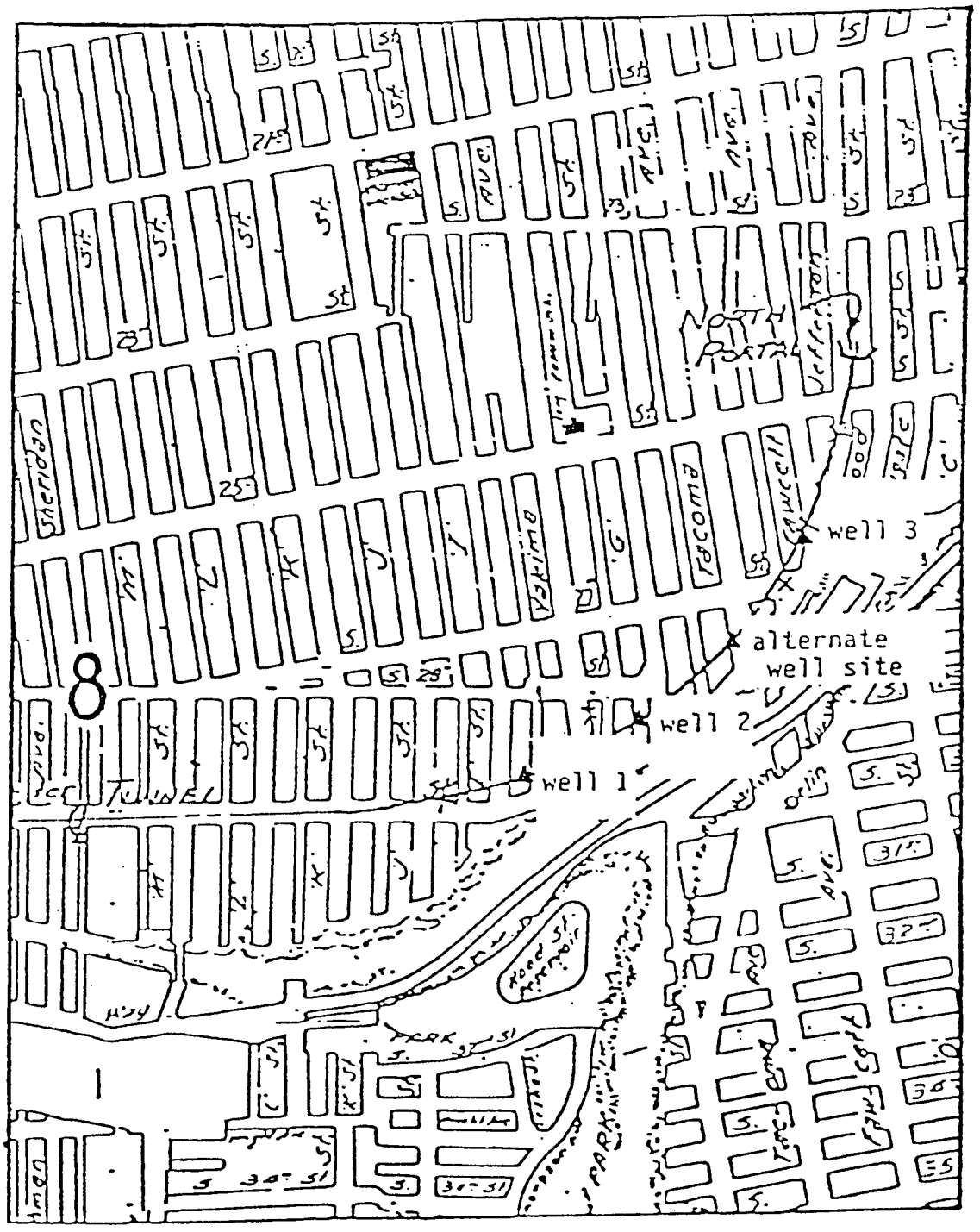

FIGURE 4
PROPOSED MONITORING-WELL SITES
TACOMA TUNNEL

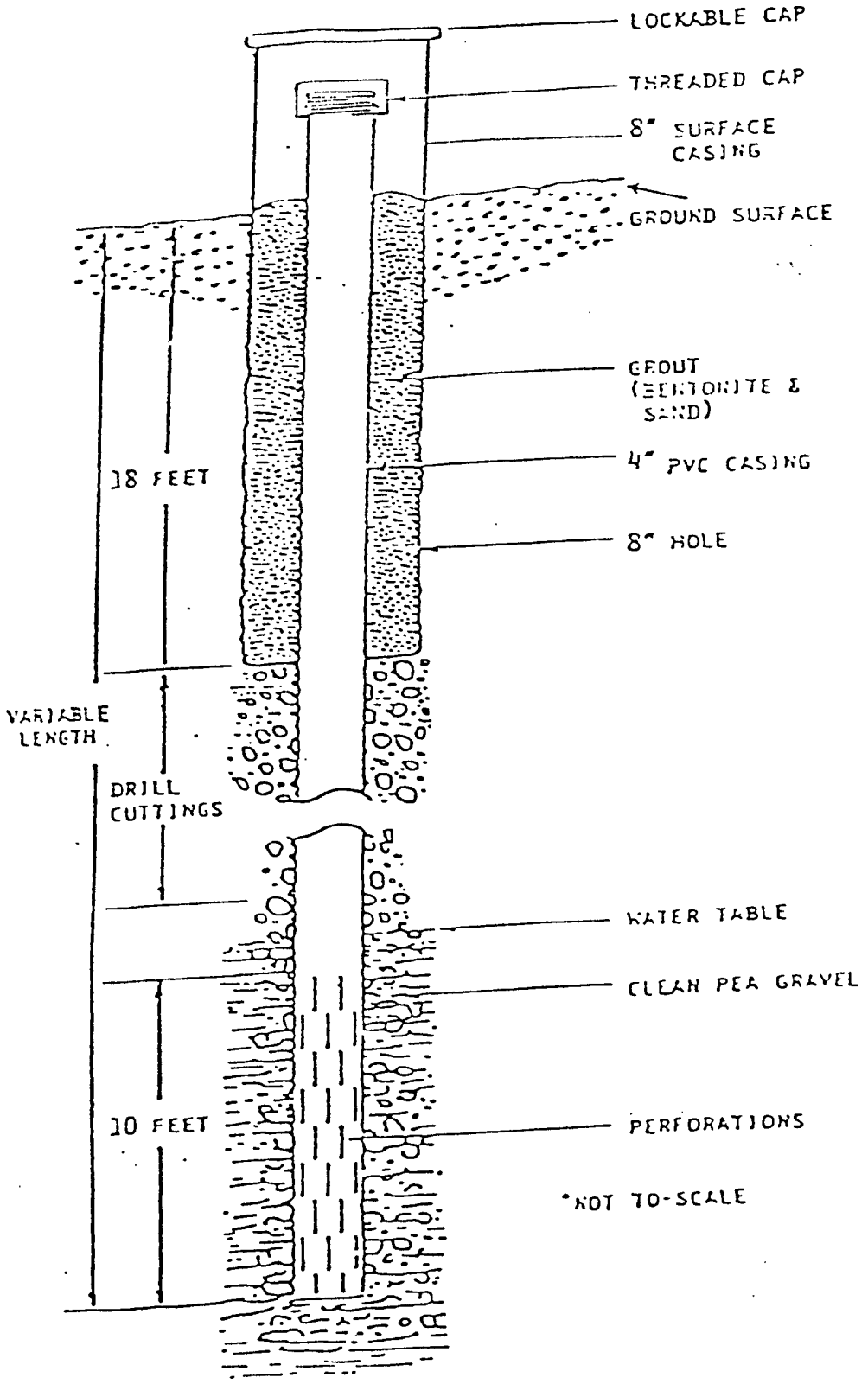

FIGURE 5
MONITORING-WELL CONSTRUCTION
TACOMA TUNNEL

FIELD INVESTIGATION TEAM
SITE SAFETY PLAN

A. GENERAL INFORMATION

SITE: Tacoma Tunnel TDD NO: 10-8202-03B

WSTS NO:

LOCATION: along Center Street/Yakima Avenue, Tacoma, Washington

PLAN PREPARED BY: Thomas Tobin, RSC DATE: April 5, 1982

APPROVED BY: Thomas Tobin, RSC DATE: April 5, 1982

OBJECTIVE(S): Install three ground-water monitoring wells to intercept the base of the tunnel and collect environmental samples from wells while drilling

PROPOSED DATE OF INVESTIGATION: April 15, 1982

BACKGROUND REVIEW: Complete: X Preliminary: ____

DOCUMENTATION/SUMMARY: OVERALL HAZARD: Serious: ____ Moderate: ____

Low: X Unknown: ____

B. SITE/WASTE CHARACTERISTICS

WASTE TYPES(S): Liquid X Solid X Sludge ____ Gas ____

CHARACTERISTIC(S): Corrosive ____ Ignitable ____ Radioactive ____

Volatile X Toxic ____ Reactive ____ Unknown ____ Other (Name) ____

FACILITY DESCRIPTION: Abandoned tunnel; never completed. Backfilled with gravel in 1915. Ground-water is draining through this tunnel.

Principal Disposal Method (type and location): Some dumping of bottles and cans into the tunnel via a hole

Unusual Features (dike integrity, power lines, terrain, etc.) ____

Status: (active, inactive, unknown) Inactive

History: (Worker or non-worker injury; complaints from public; previous agency action):

Allegation in newspapers of "indiscriminate dumping." No-one with knowledge of the tunnel alleges industrial waste dumping; only dumping of bottles and cans from a tavern.

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No hazard is alleged to exist. The FIT sampled two manholes to collect ground-water draining from the tunnel area on March 9, 1982. Tentative analyes by the EPA for those volatiles on the priority pollutants list showed only tetrachloroethylene and trichloroethylene above detection limits (<5 ppb). Because the level of organics in the tunnel sampled is very low and there does not appear to be a problem with inhalation, no respiratory protection is thought necessary while drilling and sampling. If conditions change during drilling or sampling (i.e., the OVA or HNU detect high levels of organic vapors in the respirable zone), appropriate respiratory equipment will be worn and the RPM will be contacted.

D. SITE SAFETY WORK PLAN

PERIMETER ESTABLISHMENT: Map/Sketch Attached X Site Secured? N/A

Perimeter Identified? Yes Zone(s) of Contamination Identified? No

PERSONAL PROTECTION

Level of Protection: A ___ B ___ C ___ D X

Modifications: In the event of undetermined organic vapors in the respirable zone, appropriate respiratory protection will be chosen if necessary.

Surveillance Equipment and Materials:

HNU photoionizer with 11.7 eV lamp

OVA in survey and G/C modes

Special Equipment, Facilities, or Procedures: The drilling team has been contracted by the Region X FIT and will abide by the field team leader's/on-site safety officer's recommendations.

SITE ENTRY PROCEDURES: The field team leader will brief team members prior to site entry. There will be daily safety briefings also.

Team Member	Responsibility
Kwasi Boateng	Field team leader/geologist
James Farr	OVA operator/sampling
Pete Evers	Sampler/OVA operator, alternate safety officer
Thomas Tobin	Safety officer/sampler

WORK LIMITATIONS (Time of day, etc.): None

INVESTIGATION-DERIVED MATERIAL DISPOSAL: See cover memo

LOCAL RESOURCES

Ambulance: Mercy-Yellow Ambulance 383-5416; Emergency Medical Ser. Ambulance 582-0600

Hospital Emergency Room: Puget Sound Hospital, Pacific Street, So. 36th St., 471-0561

Poison Control Center: Mary Bridge Children's Hospital, 272-1281

Police: Emergency 593-4911

Fire Department: 627-0151

Airport: N/A

Explosives Unit: Police Emergency 593-4911

EPA Contact: Fred Wolf EAD 442-0691

SITE RESOURCES

Water Supply: FIT will bring

Telephone: None on site; will locate telephone booth near drilling sites

Radio:

Other:

EMERGENCY CONTACTS

1.	Dr. Raymond Harbison (University of Arkansas) . . .	(501) 661-5766 or 661-5767 (501) 370-8263 (24 hour)
2.	Regional Safety Officer	Thomas Tobin 624-9537/524-2870
3.	FIT Leader	Hussein Aldis 624-9537
4.	FIT office	Region X; 206-624-9537
5.	Ecology and Environment, Inc. NPMO	(703) 522-6065 (24 hour; call forwarding)
6.	Regional Health Maintenance Program Contact	
7.	TAT Emergency Paging System	(716) 882-2804
8.	Chemtrex	1-800-424-9300
9.	Robert King	(703) 522-6065/281-5281
10.	David Dahlstrom	(716) 632-4491/741-2884

(Give road or other directions; Attach map)

HOSPITAL: Puget Sound Hospital: Center Street (east) to Jefferson Street and 25th Street, then east along 25th to Pacific Avenue. South on Pacific Avenue to Puget Sound Hospital on So. 36th

OTHER:

EQUIPMENT CHECKOUT

SCBA ☐ CYLINDERS ☐
APR ☐ CARTRIDGES ☐
EXPLOSIMETER ☐
O_2 INDICATOR ☐
DRAEGER PUMP ☐ TUBES ☐
RADIATION SURVEY METER ☐
RADIATION CONTAMINATION METER ☐

EYE WASH UNIT [X]
FIRST AID KIT [X]
DRINKING WATER SUPPLY [X]
PERSONAL CLOTHING [X]
DECONTAMINATION MATERIALS [X]
Dosimeter badges [X]
OVA [X]
HNU [X]

129 PRIORITY POLLUTANTS*

(WITH CHEMICAL ABSTRACT SERVICE NUMBERS)

METALS		BASE-NEUTRAL EXTRACTIBLES		ACID EXTRACTIBLES	
ANTIMONY	7440-36-0	ACENAPHTHENE	83-32-9	2-CHLOROPHENOL	95-57-8
ARSENIC	7440-38-2	ACENAPHTHYLENE	208-96-8	2,4-DICHLOROPHENOL	120-83-2
BERYLLIUM	7440-41-7	ANTHRACENE	120-12-7	2,4-DIMETHYLPHENOL	105-67-9
CADMIUM	7440-43-9	BENZIDINE	92-87-5	4,6-DINITRO-O-CRESOL	534-52-1
CHROMIUM	7440-47-3	BENZO(A)ANTHRACENE	56-55-3	2,4-DINITROPHENOL	51-28-5
COPPER	7440-50-8	BENZO(A)PYRENE	50-32-8	2-NITROPHENOL	88-75-5
LEAD	7439-92-1	BENZO(B)FLUORANTHENE	205-99-2	4-NITROPHENOL	100-07-7
MERCURY	7439-97-6	BENZO(GHI)PERYLENE	191-24-2	P-CHLORO-M-CRESOL	59-50-7
NICKEL	7440-02-0	BENZO(K)FLUORANTHENE	207-08-9	PENTACHLOROPHENOL	87-86-5
SELENIUM	7782-49-2	BIS(2-CHLOROETHOXYL) METHANE	111-91-1	PHENOL	108-95-2
SILVER	7440-22-4	BIS(2-CHLOROETHYL) ETHER	111-44-4	2,4,6-TRICHLOROPHENOL	88-06-02
THALLIUM	7440-28-0	BIS(2-CHLOROISOPROPYL) ETHER	108-60-1		
ZINC	7440-66-6	BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	VOLATILES	
		4-BROMOPHENYL PHENYL ETHER	101-55-3		
PESTICIDES		2-CHLORONAPHTHALENE	91-58-7	ACROLEIN	107-02-8
		CHRYSENE	218-01-9	ACRYLONITRILE	107-13-1
ALDRIN	309-00-2	4-CHLOROPHENYL PHENYL ETHER	7005-72-3	BENZENE	71-43-2
ALPHA BHC	319-84-6	1,2,5,6-DIBENZANTHRACENE	53-70-3	BIS(CHLOROMETHYL) ETHER	542-88-1
BETA BHC	319-85-7	1,2-DICHLOROBENZENE	95-50-1	BROMODICHLOROMETHANE	15-27-4
GAMMA BHC	58-89-9	1,3-DICHLOROBENZENE	541-73-1	BROMOFORM	75-25-2
DELTA BHC	319-86-8	1,4-DICHLOROBENZENE	106-46-7	CARBON TETRACHLORIDE	56-23-5
CHLORDANE	5103-71-9	3,3-DICHLOROBENZIDINE	91-94-1	CHLOROBENZENE	108-90-7
4,4-DDD	72-54-8	DIETHYL PHTHALATE	84-66-2	CHLOROETHANE	75-00-3
4,4-DDE	72-55-9	DIMETHYL PHTHALATE	131-11-3	2-CHLOROETHYL VINYL ETHER	110-75-8
4,4-DDT	50-29-3	DI-N-BUTYL PHTHALATE	84-74-2	CHLOROFORM	67-66-3
DIELDRIN	60-57-1	2,4-DINITROTOLUENE	121-14-2	CIS-1,3-DICHLOROPROPENE	542-75-6
ALPHA ENDOSULFAN	115-29-7	2,6-DINITROTOLUENE	606-20-2	DIBROMOCHLOROMETHANE	124-48-1
BETA ENDOSULFAN	115-29-7	DI-N-OCTYL PHTHALATE	117-81-7	DICHLOROFLUOROMETHANE	75-71-8
ENDOSULFAN SULFATE	1031-07-8	1,2-DIPHENYLHYDRAZINE	122-66-7	1,1-DICHLOROETHANE	75-34-3
ENDRIN	72-20-8	FLUORANTHENE	206-44-0	1,2-DICHLOROETHANE	107-06-2
ENDRIN ALDEHYDE	7421-93-4	FLUORENE	86-73-7	1,1-DICHLOROETHYLENE	75-35-4
HEPTACHLOR	76-44-8	HEXACHLOROBENZENE	118-74-1	1,2-DICHLOROPROPANE	78-87-5
HEPTACHLOR EPOXIDE	1024-57-3	HEXACHLOROBUTADIENE	87-68-3	ETHYLBENZENE	100-41-4
PCB 1016	12674-11-2	HEXACHLOROCYCLOPENTADIENE	77-47-4	METHYL BROMIDE	74-83-9
PCB 1221	111-042-82	HEXACHLOROETHANE	67-72-1	METHYL CHLORIDE	74-87-3
PCB 1232	111-411-65	INDENO(1,2,3-CD)PYRENE	193-39-5	METHYLENE CHLORIDE	75-09-2
PCB 1242	534-692-19	ISOPHORONE	78-59-1	1,1,2,2-TETRACHLOROETHANE	79-34-5
PCB 1248	126-722-96	NAPTHALENE	91-20-3	TETRACHLOROETHYLENE	127-18-4
PCB 1254	110-916-91	N-BUTYL BENZYL PHTHALATE	85-68-7	1,2-TRANS-DICHLOROETHYLENE	540-59-0
PCB 1260	110-968-25	NITROBENZENE	98-95-3	TRANS-1,3-DICHLOROPROPENE	10061-02-6
TOXAPHENE	8001-35-2	N-NITROSODIMETHYLAMINE	62-75-9	1,1,2-TRICHLOROETHANE	79-00-5
		N-NITROSODI-N-PROPYLAMINE	621-64-7	TRICHLOROETHYLENE	79-01-6
MISCELLANEOUS		N-NITROSODIPHENYLAMINE	86-30-6	TRICHLOROFLUOROMETHANE	75-69-4
		PHENANTHRENE	85-01-8	1,1,1-TRICHLOROETHANE	71-55-6
CYANIDE	57-12-5	PYRENE	129-00-0	TOLUENE	108-88-3
		TCDD	1746-01-6	VINYL CHLORIDE	75-01-4
		1,2,4-TRICHLOROBENZENE	120-82-1		

*LIST COMPILED BY EPA

APPENDIX D
LIST OF 129 PRIORITY POLLUTANTS

129 PRIORITY POLLUTANTS*

(WITH CHEMICAL ABSTRACT SERVICE NUMBERS)

METALS		BASE-NEUTRAL EXTRACTIBLES		ACID EXTRACTIBLES	
ANTIMONY	7440-36-0	ACENAPHTHENE	83-32-9	2-CHLOROPHENOL	95-57-8
ARSENIC	7440-38-2	ACENAPHTHYLENE	208-96-8	2,4-DICHLOROPHENOL	120-83-2
BERYLLIUM	7440-41-7	ANTHRACENE	120-12-7	2,4-DIMETHYLPHENOL	105-67-9
CADMIUM	7440-43-9	BENZIDINE	92-87-5	4,6-DINITRO-O-CRESOL	534-52-1
CHROMIUM	7440-47-3	BENZO(A)ANTHRACENE	56-55-3	2,4-DINITROPHENOL	51-28-5
COPPER	7440-50-8	BENZO(A)PYRENE	50-32-8	2-NITROPHENOL	88-75-5
LEAD	7439-92-1	BENZO(B)FLUORANTHENE	205-99-2	4-NITROPHENOL	100-07-7
MERCURY	7439-97-6	BENZO(GHI)PERYLENE	191-24-2	P-CHLORO-M-CRESOL	59-50-7
NICKEL	7440-02-0	BENZO(K)FLUORANTHENE	207-08-9	PENTACHLOROPHENOL	87-86-5
SELENIUM	7782-49-2	BIS(2-CHLOROETHOXYL) METHANE	111-91-1	PHENOL	108-95-2
SILVER	7440-22-4	BIS(2-CHLOROETHYL) ETHER	111-44-4	2,4,6-TRICHLOROPHENOL	88-06-02
THALLIUM	7440-28-0	BIS(2-CHLOROISOPROPYL) ETHER	108-60-1		
ZINC	7440-66-6	BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	VOLATILES	
		4-BROMOPHENYL PHENYL ETHER	101-55-3		
PESTICIDES		2-CHLORONAPHTHALENE	91-58-7	ACROLEIN	107-02-8
		CHRYSENE	218-01-9	ACRYLONITRILE	107-13-1
ALDRIN	309-00-2	4-CHLOROPHENYL PHENYL ETHER	7005-72-3	BENZENE	71-43-2
ALPHA BHC	319-84-6	1,2,5,6-DIBENZANTHRACENE	53-70-3	BIS(CHLOROMETHYL) ETHER	542-88-1
BETA BHC	319-85-7	1,2-DICHLOROBENZENE	95-50-1	BROMODICHLOROMETHANE	15-27-4
GAMMA BHC	58-89-9	1,3-DICHLOROBENZENE	541-73-1	BROMOFORM	75-25-2
DELTA BHC	319-86-8	1,4-DICHLOROBENZENE	106-48-7	CARBON TETRACHLORIDE	56-23-5
CHLORDANE	5103-71-9	3,3-DICHLOROBENZIDINE	91-94-1	CHLOROBENZENE	108-90-7
4,4-DDD	72-54-8	DIETHYL PHTHALATE	84-66-2	CHLOROETHANE	75-00-3
4,4-DDE	72-55-9	DIMETHYL PHTHALATE	131-11-3	2-CHLOROETHYL VINYL ETHER	110-75-8
4,4-DDT	50-29-3	DI-N-BUTYL PHTHALATE	84-74-2	CHLOROFORM	67-66-3
DIELDRIN	60-57-1	2,4-DINITROTOLUENE	121-14-2	CIS-1,3-DICHLOROPROPENE	542-75-6
ALPHA ENDOSULFAN	115-29-7	2,6-DINITROTOLUENE	606-20-2	DIBROMOCHLOROMETHANE	124-48-1
BETA ENDOSULFAN	115-29-7	DI-N-OCTYL PHTHALATE	117-81-7	DICHLOROFLUOROMETHANE	75-71-8
ENDOSULFAN SULFATE	1031-07-8	1,2-DIPHENYLHYDRAZINE	122-66-7	1,1-DICHLOROETHANE	75-34-3
ENDRIN	72-20-8	FLUORANTHENE	206-44-0	1,2-DICHLOROETHANE	107-06-2
ENDRIN ALDEHYDE	7421-93-4	FLUORENE	86-73-7	1,1-DICHLOROETHYLENE	75-35-4
HEPTACHLOR	76-44-8	HEXACHLOROBENZENE	118-74-1	1,2-DICHLOROPROPANE	78-87-5
HEPTACHLOR EPOXIDE	1024-57-3	HEXACHLOROBUTADIENE	87-68-3	ETHYLBENZENE	100-41-4
PCB 1016	12674-11-2	HEXACHLOROCYCLOPENTADIENE	77-47-4	METHYL BROMIDE	74-83-9
PCB 1221	111-042-82	HEXACHLOROETHANE	67-72-1	METHYL CHLORIDE	74-87-3
PCB 1232	111-411-65	INDENO(1,2,3-CD)PYRENE	193-39-5	METHYLENE CHLORIDE	75-09-2
PCB 1242	534-692-19	ISOPHORONE	78-59-1	1,1,2,2-TETRACHLOROETHANE	79-34-5
PCB 1248	126-722-96	NAPTHALENE	91-20-3	TETRACHLOROETHYLENE	127-18-4
PCB 1254	110-916-91	N-BUTYL BENZYL PHTHALATE	85-68-7	1,2-TRANS-DICHLOROETHYLENE	540-59-0
PCB 1260	110-968-25	NITROBENZENE	98-95-3	TRANS-1,3-DICHLOROPROPENE	10061-02-6
TOXAPHENE	8001-35-2	N-NITROSODIMETHYLAMINE	62-75-9	1,1,2-TRICHLOROETHANE	79-00-5
		N-NITROSODI-N-PROPYLAMINE	621-64-7	TRICHLOROETHYLENE	79-01-6
MISCELLANEOUS		N-NITROSODIPHENYLAMINE	86-30-6	TRICHLOROFLUOROMETHANE	75-69-4
		PHENANTHRENE	85-01-8	1,1,1-TRICHLOROETHANE	71-55-6
CYANIDE	57-12-5	PYRENE	129-00-0	TOLUENE	108-88-3
		TCDD	1746-01-6	VINYL CHLORIDE	75-01-4
		1,2,4-TRICHLOROBENZENE	120-82-1		

*LIST COMPILED BY EPA

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APPENDIX E
SAMPLE DOCUMENTATION

ample Documentation for Tacoma Tunnel (Project No. 10-8202-038)

ocation umber	STORET Station Number	Sample Containers	Date and Time	ID Tag Number	Custody Form Number	Sample Lab. Number	Sample Type (grab)	Means of Preser-vation	Analysis Requested	Destination
-1 Goodall)	11Y059	2 1/2-gal glass jars	5/5/82 0930	10-1551 10-1552	10-0074	18001	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		1 polyethylene cubitainer	5/5/82 0930	10-1553	10-0074	18001	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		2 40-ml vials	5/5/82 0930	10-1554 10-1555	10-0074	18001	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
-2 Jefferson Fawcett)	11Y058	2 1/2-gal glass jars	5/4/82 1000		10-0073	18000	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		1 polyethylene cubitainer	5/4/82 1000		10-0073	18000	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		2 40-ml vials	5/4/82 1000		10-0073	18000	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA

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Sample Documentation for Tacoma Tunnel (Project No. 10-8202-038)

Location Number	STORET Station Number	Sample Containers	Date and Time	ID Tag Number	Custody Form Number	Sample Lab. Number	Sample Type (grab)	Means of Preservation	Analysis Requested	Destination
W-3 (Big Broe. & Sisters)	11Y057	2 1/2-gal glass jars	5/5/82 1330	10-1561 10-1562	10-0074	18003	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		1 polyethylene cubitainer	5/5/82 1330	10-1563	10-0074	18003	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		2 40-ml vials	5/5/82 1330	10-1564 10-1565	10-0074	18003	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
(Culvert)	11Y060	2 1/2-gal glass jars	5/5/82 1100	10-1556 10-1557	10-0074	18002	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		1 polyethylene cubitainer	5/5/82 1100	10-1558	10-0074	18002	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA
		2 40-ml vials	5/5/82 1100	10-1559 10-1560	10-0074	18002	Aqueous	Ice	Priority Pollutants Analysis	EPA Laboratory Pt. Orchard, WA

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