Lake Oswego to Portland Transit Project

Geology, Soils, and Seismic Hazards Technical Report

November 2010

TriMet and Metro

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The preparation of this report was financed in part by the U.S. Department of Transportation, Federal Transit Administration. The opinions, findings and conclusions expressed in this report are not necessarily those of the U.S. Department of Transportation, Federal Transit Administration.

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1. INTRODUCTION

This report contains the detailed analysis and documentation that is the basis for the Chapter 3, Section 3.7 on Geology, Soils, and Seismic Hazards in the Lake Oswego to Portland Transit Project (LOPT) Draft Environmental Impact Statement (DEIS) published by the Federal Transit Administration in December 2010. This chapter of the report includes a summary of the project background, the Purpose and Need, the alternatives/options considered and the description of the alternatives analyzed.

1.1 Project Background

Transit improvements in the Lake Oswego to Portland corridor have been studied several times in recent history. In the 1970s and 80s, a light rail alignment through Johns Landing was studied as part of the Westside Corridor Alternatives Analysis, and in the 1990s potential light rail alignments through Johns Landing were studied as part of the South/North Corridor Study.

The Willamette Shore Line right of way was first established in 1885-1887 as the Portland and Willamette Valley Railroad, which began operation in July 1887. The Southern Pacific Railroad (SPRR) later purchased the railway in 1914. The railroad had a major impact on the development of southwest Portland. Initially, 14 trains operated between Portland and Oswego (as it then was known), and it became the main transportation link for developing residential communities along the route. The line was electrified in 1914 and passenger traffic hit its peak in 1920 with SPRR running 64 daily trains between Portland and Oswego. Passenger service ended on October 5, 1929, while freight service continued until 1983.

In August of 1984, the Interstate Commerce Commission granted SPRR permission to abandon the line. In 1988, the Willamette Shore Line Consortium (the Consortium) purchased the 6.3-mile-long line from SPRR for approximately $2 million. The Consortium, comprised of the City of Lake Oswego, City of Portland, Oregon Department of Transportation (ODOT), Clackamas County, Multnomah County, Metro, and TriMet, purchased the line to preserve it for future passenger rail transit use. TriMet holds title for the Consortium and the City of Lake Oswego provides maintenance services funded by the Consortium.

In 2005, with the endorsement of the Joint Policy Advisory Committee on Transportation, the Metro Council directed staff to initiate the Lake Oswego to Portland Transit and Trail Alternatives Analysis. The alternatives analysis focused on improving the ability to serve travel demand in the corridor through improved transit service and development of a multi-use pathway.

1.2 Purpose and Need

The **Purpose** of the project is to optimize the regional transit system by improving transit within the Lake Oswego to Portland transit corridor, while being fiscally responsive and supporting regional and local land use goals. The project should maximize, to the extent possible, regional resources and economic development opportunities, and garner broad public support. The project should build on previous corridor transit studies, analyses, and conclusions and should be environmentally sensitive.

The **Need** for the project results from:

- Historic and projected increases in traffic congestion in the Lake Oswego to Portland corridor due to increases in regional and corridor population and employment;
- Lengthy and increasing transit travel times and deteriorating public transportation reliability in the corridor due to growing traffic congestion;
- Increasing operating expenses, combined with increasingly scarce operating resources and the demand for more efficient public transportation operations;
- Local and regional land use and development plans, goals, and objectives that target the corridor for residential, commercial, retail, and mixed-use development to help accommodate forecast regional population and employment growth, and previous corridor transit studies, analyses, and conclusions;
- The region's growing reliance on public transportation to meet future growth in travel demand in the corridor;
- The topographic, geographic, and built-environment constraints within the corridor that limit the ability of the region to expand the highway and arterial infrastructure in the corridor; and
- Limited options for transportation improvements in the corridor caused by the identification and protection of important natural, built, and socioeconomic environmental resources in the corridor.

1.3 Alternatives/Options Considered

Metro's 2004 Regional Transportation Plan (RTP) identified the need for a refinement plan for a high capacity transit option for the corridor, which included an analysis of several modal alternatives. Metro initiated the corridor refinement plan in July 2005 and issued the *Lake Oswego to Portland Transit and Trail Alternatives Analysis Evaluation Summary Public Review Draft* in June 2007.

On December 13, 2007, after reviewing and considering the alternatives analysis report, public comment, and recommendations from the Lake Oswego to Portland Transit and Trail Project Citizen Advisory Committee (CAC), the Lake Oswego to Portland Transit and Trail Project Management Group (PMG), Steering Committee, and partner jurisdictions and agencies, the Metro Council approved Resolution No. 07-3887A. The resolution adopted the *Lake Oswego to Portland Transit and Trail Alternatives Analysis: Alternatives to be Advanced into a Draft Environmental Impact Statement and Work Program Considerations* (December 13, 2007). (See Section 2.1 for additional detail on the process used to identify and narrow alternatives.) It also selected the No-Build, Enhanced Bus, and Streetcar alternatives to advance into the project's DEIS for further study, and directed staff to conduct a refinement study to identify design options in the Johns Landing Area and terminus options to advance into the project's DEIS. The resolution called for further refinement of the trail component to move forward as a separate process.

1.3.1 Alternatives Analysis

The project's alternatives analysis process developed a wide range of alternatives for evaluation and early screening, which included: a no-build alternative, widening of Highway 43, reversible lanes on Highway 43, river transit (three options), bus rapid transit (BRT) (three options), commuter rail, light rail, and streetcar (a wide range of alignment alternatives and terminus alternatives and options).

Through a screening process that assessed the ability of the alternatives to meet the project's Purpose and Need, the initial range of possible alternatives was narrowed. Appendix C of the DEIS provides a

summary of the technical evaluation of the alternatives and options considered during the alternatives analysis phase.

The following alternatives were selected for further study through the alternatives analysis phase: 1) No-Build Alternative, 2) Bus Rapid Transit Alternative, and 3) Streetcar Alternative. Following is a description of those alternatives as they were studied in the alternatives analysis (see the *Lake Oswego to Portland Transit and Trail Study Evaluation Summary Public Review Draft* for more information).

- **No-Build Alternative.** Similar to the project's current No-Build Alternative, described in Section 1.4.1.

- **Bus Rapid Transit Alternative.** The Bus Rapid Transit Alternative would operate frequent bus service with Line 35 on Highway 43 between downtown Portland and downtown Lake Oswego, generally in mixed traffic, with bus station spacing that would be longer than TriMet typically provides for fixed-route bus service. Transit queue bypass lanes would be constructed at congested intersections, where feasible.

- **Streetcar Alternative.** The Streetcar Alternative would extend the existing Portland Streetcar line, which currently operates between NW 23rd Avenue and SW Lowell Street, to downtown Lake Oswego. Study of this alternative includes an evaluation of whether the Willamette Shore Line right of way would be used exclusively of whether it would be used in combination with SW Macadam Avenue or other adjacent roadways.

1.3.2 Scoping/Project Refinement Study

This section describes the alignment and terminus options developed, evaluated, and screened in 2009 as a part of the project's scoping and refinement study phase. In November 2010, Metro published the *Lake Oswego to Portland Transit Project Refinement Report*, which detailed the study's results and summarized public comment. This phase focused on refinements in two areas: 1) alignment options for the Johns Landing area; and 2) terminus options in the Lake Oswego area. In summary, the project's Purpose Statement during the refinement phase was to:

- Optimize the regional transit system;
- Be fiscally responsive and maximize regional resources;
- Maximize the economic development potential of the project;
- Be sensitive to the built and social environments; and
- Be sensitive to the natural environment.

The options, evaluation measures, and results of the Johns Landing streetcar alignment refinement process and the Lake Oswego terminus refinement processes are summarized below.

A. Johns Landing Streetcar Alignment Refinement. For the refinement of streetcar design options within the Johns Landing area, the project used the following criteria: streetcar operations, streetcar performance, financial feasibility, traffic operations, accessibility and development potential, neighborhood sustainability, and adverse impacts to the natural environment. Measures for each of the criteria were developed and applied to each of the alignment options studied, which included:

- Hybrid 1: Macadam Avenue In-Street
- Hybrid 2: East Side Exclusive
- Hybrid 3: Macadam Avenue with New Northbound Lane
- Willamette Shore Line
- Full Macadam In-Street

B. Lake Oswego Terminus Option Refinement. For the refinement of terminus options in the Lake Oswego area, the project used the following criteria: expansion potential and regional context, streetcar operations, streetcar performance, financial feasibility, traffic operations, accessibility and development potential, and neighborhood sustainability. Measures for each of the criteria were developed and applied to each of the alignment options studied, which included: a) Safeway Terminus Option; b) Albertsons Terminus Option; and c) Trolley Terminus Option.

On June 1, 2009, in consultation with FTA and based on the findings of the analysis, public and agency comment and recommendations from the Lake Oswego to Portland Transit Project Management Group, the Lake Oswego to Portland Transit Project Steering Committee selected the following options in the Johns Landing area to advance into the DEIS: Willamette Shore Line; Hybrid 1 – Macadam Avenue In Street (Boundary Street to Carolina Street); and Hybrid 3: Macadam Avenue with New Northbound Lane (Boundary Street to Carolina Street).

1.4 Description of Alternatives Analyzed in this Technical Report and the DEIS

This section summarizes the roadway and transit capital improvements and transit operating characteristics for the No-Build, Enhanced Bus, and Streetcar alternatives. Table 1-1 provides a summary of the transit capital improvements associated with the three alternatives, and Table 1-2 summarizes the operating characteristics of the alternatives. A more detailed description of the alternatives may be found in the *Lake Oswego to Portland Transit Project Detailed Definition of Alternatives Report* (Metro/TriMet: January 2010). Detailed drawings of the Streetcar Alternative, including the various design options, can be found in the *Streetcar Plan Set,* November 2009.

1.4.1 No-Build Alternative

This section describes the No-Build Alternative, which serves as a reference point to gauge the benefits, costs, and effects of the Enhanced Bus and Streetcar alternatives. In describing the No-Build Alternative, this section focuses on: 1) the alternative's roadway, bicycle and pedestrian, and transit capital improvements; and 2) the alternative's transit operating characteristics. This description of the No-Build Alternative is based on conditions in 2035, the project's environmental forecast year.

1.4.1.1 Capital Improvements

Following is a brief description of the roadway, bicycle and pedestrian, and transit capital improvements that would occur under the No-Build Alternative (see Table 1-1). Figure 1-1 illustrates the location of those improvements.

- **Roadway Capital Improvements**. The No-Build Alternative includes the existing roadway network in the corridor, with the addition of roadway capital improvements that are listed in the financially constrained road network of Metro's 2035 RTP.[1] Following is a list of the roadway projects that would occur within the corridor by 2035.
  - *Moody/Bond Avenue Couplet* (create couplet with two lanes northbound on SW Bond Avenue and two lanes southbound on SW Moody Avenue);
  - *South Portal* (Phases I and II to extend the SW Moody Avenue/SW Bond Avenue couplet to SW Hamilton Street and realign SW Hood Avenue to connect with SW Macadam Avenue at SW Hamilton Street);
  - *I-5 North Macadam* (construct improvements in the South Waterfront District to improve safety and access); and
  - *Macadam Intelligent Transportation Systems* (install system and devices in the SW Macadam Avenue corridor to improve traffic flow).

[1] Metro, 2035 Regional Transportation Plan, approved Dec. 13, 2007.

Table 1-1 Transit Capital Improvements for the No-Build, Enhanced Bus, and Streetcar Alternatives (2035)

Capital Improvements	No-Build	Enhanced Bus	Streetcar[1]
New Streetcar Alignment Length[2]	N/A	N/A	5.9 to 6.0
One-Way Streetcar Track Miles			
Portland Streetcar System	15.7	15.7	26.2 to 27.0
Proposed Lake Oswego to Portland Project	0	0	10.5 to 11.3
Streetcar Stations			
Portland Streetcar System	69	69	79
Proposed Lake Oswego to Portland Project	0	0	10[3]
Streetcars (in service/spares/total)			
Portland Streetcar System	17/5/22	17/5/22	27/6/33
Proposed Lake Oswego to Portland Project	N/A	N/A	10/1/11
Streetcar Operations and Maintenance (O&M) Facilities			
Number of Facilities[4]	1	1	2
Maintenance Capacity (number of Streetcars)	36	36	36
Storage Capacity (number of Streetcars)	25	25	33
Line 35 Bus Stops			
Line 35 Bus Stops (Lake Oswego to SW Bancroft St.)	26	13	0
Buses (in service/spares)			
TriMet Systemwide	607/712	619/725	601/704
Difference from No-Build Alternative	N/A	13	- 8
Transit Centers[5]	1	1	1
Park-and-Ride Facilities			
Joint Use Surface – Lots/Spaces	3/76	3/76	3/76
Surface – Lots/Spaces	0/0	0/0	1/100
Structured – Lots/Spaces	0/0	1/300	1/300

Note: LO = Lake Oswego; O&M = operating and maintenance.

[1] The transit capital improvements of the Streetcar Alternative summarized in this table would not vary by design option, except when shown as a range and as noted for new streetcar alignment length and one-way track miles. The first number listed is under the Willamette Shore Line design option and the second number listed is under the Macadam design options (in the Johns Landing Segment).

[2] Under the No-Build and Enhanced Bus alternatives, the Portland Streetcar System would include two streetcar lines: a) the existing Portland Streetcar Line, between NW 23rd Avenue and SW Bancroft Street, and b) the Portland Streetcar Loop, which is currently under construction and will be completed when the Milwaukie Light Rail and Streetcar Close the Loop project are constructed. The Streetcar Alternative would extend the existing Portland Streetcar line south, from SW Bancroft Street to Lake Oswego. One-way track miles are calculated by multiplying the mileage of double-tracked sections and adding that to the mileage of single-track sections. Alignment length and one-way track miles are presented as a range, because they would vary by design option. The number of streetcar stations, streetcars in service or as spares and the number and size of streetcar O&M facilities would not change by streetcar design option.

[3] Two optional stations are also being considered for inclusion in the Streetcar Alternative (see Figure 1-5 and Figure 1-6): 1) the Pendleton Station under the Macadam In-Street and Macadam Additional Lane design options in the Johns Landing Segment; and the E Avenue Station in the Lake Oswego Segment.

[4] There is an existing streetcar operations and maintenance (O&M) facility at NW 16th Avenue, between NW Marshall and NW Northrup streets; under the Streetcar Alternative, additional storage for eight vehicles would be provided along the streetcar alignment under the Marquam Bridge. There would be no change in the number or size of bus O&M facilities under any of the alternatives or design options. Bus stops are those that would be served exclusively by Line 35 between Lake Oswego and SW Bancroft Street

[5] Under the No-Build and Enhanced Bus alternative, the Lake Oswego Transit Center would remain at its current location (on 4th Street, between A and B avenues); under the Streetcar Alternative, the transit center would be moved to be adjacent to the Lake Oswego Terminus Station.

Source: TriMet, January 2010.

Table 1-2 Streetcar and Bus Network Operating Characteristics of No-Build, Enhanced Bus, and Streetcar1 Alternatives (2035)

Operating Characteristics by Vehicle Mode	No-Build	Enhanced Bus	Streetcar
Streetcar Network Operating Characteristics[1]			
Weekday Streetcar Vehicle Miles Traveled			
Systemwide	2,180	2,180	3,200 or 3,230
Difference from No-Build Alternative	N/A	0	1,020 or 1,050
Weekday Streetcar Revenue Hours			
Systemwide	267	267	326 or 332
Difference from No-Build Alternative	N/A	0	59 or 65
Corridor Weekday Streetcar Place Miles[2]	N/A	N/A	89,000 or 91,320
Corridor Streetcar Round-Trip Time[3]	N/A	N/A	37 or 44 minutes
Corridor Streetcar Headways[4]			
Lake Oswego to PSU	N/A	N/A	7.5 / 7.5 minutes
Bus Network Operating Characteristics			
Weekday Bus Miles Traveled			
Systemwide	76,560	77,560	75,520
Difference from No-Build Alternative	N/A	1,000	-1,040
Weekday Bus Revenue Hours			
Systemwide	5,300	5,400	5,210
Difference from No-Build Alternative	N/A	100	-90
Line 35 (bus) Weekday Place Miles[2]	37,000	57,840	0
Line 35 (bus) Headways[4]			
Lake Oswego to Downtown Portland	15 / 15 min.	6 / 15 min.	N/A
Oregon City to Lake Oswego	15/15 min.	15/15 min.	15/15 min.

Note: N/A = not applicable; LO = Lake Oswego; O&M = operating and maintenance; PSU = Portland State University.

[1] The operating characteristics of the Streetcar Alternative summarized in this table would not vary by design option, except when shown as a range and as noted for streetcar vehicle miles traveled, place miles, and round-trip time. The first number listed is under the Willamette Shore Line Design Option and the second number listed is under the Macadam design options (in the Johns Landing Segment).

[2] Place miles are a measure of the passenger carrying capacities of the alternatives, similar to airline seat miles. Place miles = transit vehicle capacity (seated and standing) of a vehicle type, multiplied by the number vehicle miles traveled for that vehicle type, summed across all vehicle types. The No-Build Alternative bus place miles are based on lines 35 and 36.

[3] Round-trip run time for the proposed streetcar line would include in-vehicle running time from SW Bancroft Street to the Lake Oswego Terminus Station and back to SW Bancroft Street; it does not include layover time at the terminus.

[4] Headways are the average time between transit vehicles per hour within the given time period that would pass by a given point in the same direction, which is inversely related to frequency (the average number of vehicles per hour in the given time period that would pass by a given point in the same direction). Weekday peak is generally defined as 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m.; weekday off-peak is generally defined as 5:00 to 7:00 a.m., 9:00 a.m. to 4:00 p.m. and 6:00 p.m. to 1:00 a.m. There would be streetcar service every 12 minutes between SW Bancroft Street and the Pearl District (via PSU) under the No-Build and Enhanced Bus alternatives. The peak headways shown for the No-Build Alternative are the composite headways for Lines 35 and 36.

Source: TriMet – January 2010.

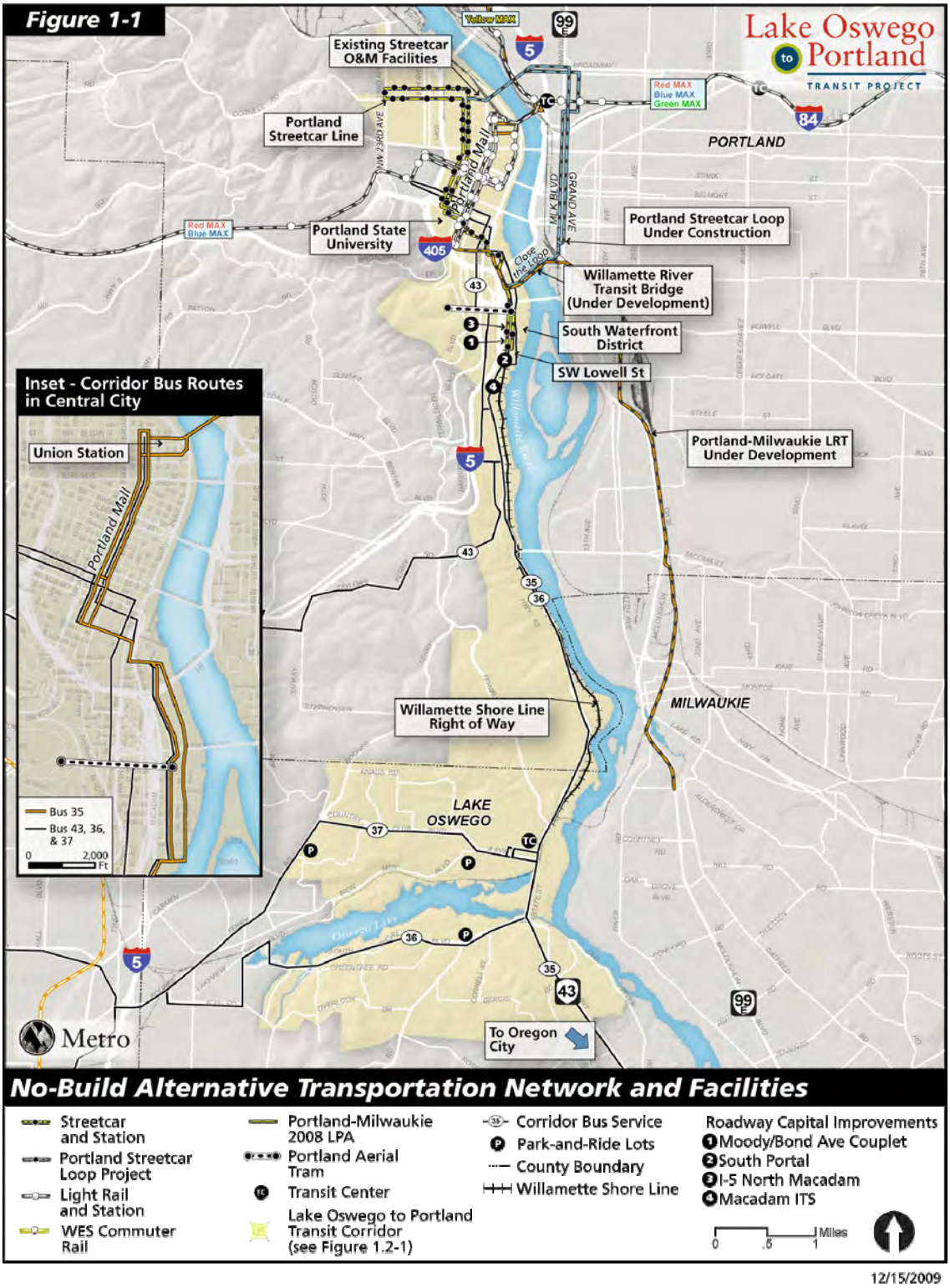


FIGURE 1-1 NO-BUILD ALTERNATIVE TRANSPORTATION NETWORK AND FACILITIES

- **Bicycle and Pedestrian Improvements**. The No-Build Alternative includes the existing bicycle and pedestrian network in the corridor, with the addition of bicycle and pedestrian capital improvements that are listed in the financially constrained road network of Metro's 2035 RTP. Following is a list of the bicycle and pedestrian projects that are proposed to occur within the corridor by 2035.
  - *Lake Oswego to Portland Trail* (extension of a multiuse path between Lake Oswego and Portland);
  - *I-5 at Gibbs Pedestrian/Bicycle Overcrossing* (construct a bicycle and pedestrian bridge over I-5 in the vicinity of SW Gibbs Street); and
  - *Tryon Creek Bridge* (construct a new pedestrian/bicycle bridge near the mouth of Tryon Creek).

- **Bus Capital Improvements.** There are currently two primary bus capital facilities in the corridor: *Lake Oswego Transit Center* (on 4th Street, between A and B avenues); and *Portland Mall* (bus and light rail lanes and shelters on NW/SW 5th and 6th avenues between NW Glisan Street and SW Jackson Street). These bus facilities would remain as-is under the No-Build Alternative. (The financially constrained transit project list of the RTP includes relocation of the Lake Oswego Transit Center to be adjacent to the Lake Oswego to Portland Streetcar alignment, which is also in the financially constrained project list. Neither would occur under the No-Build Alternative.) No additional bus capital improvements are planned for the corridor under the No-Build Alternative by 2035.

- **Light Rail Capital Improvements.** Under the No-Build Alternative, TriMet's existing Yellow Line light rail service would continue to operate on the Portland Mall (with a station at PSU added), across the Steel Bridge and into North Portland. Yellow Line facilities and service would be extended north from the existing Expo Center Station, across the Columbia River into Vancouver, Washington, and south from the Portland Mall, generally via SW Lincoln Street, across the Willamette River to Milwaukie, Oregon. In addition, downtown Portland would be served by the following TriMet light rail lines: Blue Line (Gresham to Hillsboro); Red Line (Beaverton to Portland International Airport); and Green Line (downtown Portland to Clackamas Town Center).
- **Excursion Trolley Capital Facilities.** Under the No-Build Alternative there would be no changes to the existing excursion trolley capital facilities that are located or operate within the corridor. Those excursion trolley capital facilities include approximately six miles of single-tracked Willamette Shore Line tracks and related facilities; stations at SW Bancroft and Moody streets and at N State Street at A Avenue; a trolley barn at approximately N State Street at A Avenue; and typically one vintage and/or other trolley vehicle propelled by externally attached diesel units.

- **Streetcar Improvements and Vehicles.** Under the No-Build Alternative, the existing Portland Streetcar Line would continue to operate between NW 23rd Avenue and SW Lowell Street. In addition, the No-Build Alternative includes the Eastside Streetcar Project (currently under construction), which would extend streetcar tracks and stations across the Broadway Bridge, serving NE and SE Portland on N and NE Broadway and NE and SE Martin Luther King Boulevard and Grand Avenue to OMSI. With the Close the Loop Project, the Eastside Streetcar will be extended across the Willamette River, to complete the planned Streetcar Loop, via a new transit, bicycle, and pedestrian bridge to be constructed under the Milwaukie Light Rail Project, connecting to the Streetcar line in the South Waterfront District. Under the No-Build Alternative

in 2035, there would be 22 streetcars in the transit system (including spares), an increase of 11 compared to existing conditions.

- **Park-and-Ride Facilities.** Under the No-Build Alternative, the park-and-ride facilities in the corridor would be those that currently exist: a shared-use 30-space park-and-ride lot at Christ Church (1060 SW Chandler Road); a shared-use 34-space park-and-ride lot at Lake Oswego United Methodist Church (1855 South Shore Boulevard); and a shared use 12-space park-and-ride lot at Hope Church (14790 SW Boones Ferry Road).

- **Operations and Maintenance Facilities.** Under the No-Build Alternative, there would be one operations and maintenance facility within the corridor, which would be the existing streetcar maintenance building and storage yard on NW 16th Avenue under I-405. With the Streetcar Loop and Close the Loop Projects, the storage yard could accommodate 25 streetcars and the maintenance facility would have the capacity to service 36 streetcars (an increase in capacity of 13 and 18 vehicles, compared to existing conditions, respectively).

1.4.1.2 Transit Operations

This section summarizes the transit operating characteristics that would occur under the No-Build Alternative, focusing on bus and streetcar operations (see Table 1-2). Figure 1-1 illustrates the transit network for the No-Build Alternative in the vicinity of the corridor.

- **Bus Operations.** Bus operations under the No-Build Alternative would be similar to TriMet's existing fixed-route bus network with the addition of improvements included in the 2035 RTP's 20-year financially constrained transportation system (see Figure 1-1). Transit service improvements within the No-Build Alternative would be limited to those that could be funded using existing and readily-foreseeable revenue sources. Systemwide, those bus operations improvements would include: 1) increases in TriMet bus route frequency to avoid peak overloads and/or maintain schedule reliability; 2) increases in run times to maintain schedule reliability; and 3) incremental increases in TriMet systemwide bus service hours consistent with available revenue sources and consistent with the 2035 RTP's 20-year financially-constrained transit network, resulting in annual increases in service hours of approximately 0.5 percent per year. Specifically, the No-Build Alternative would include the operation of the TriMet bus route Line 35 between downtown Portland and Lake Oswego (continuing south to Oregon City).

- **Streetcar Operating Characteristics**. Under the No-Build Alternative, the City of Portland, through an operating agreement with the Portland Streetcar, Inc. (PSI), would continue to operate the existing Portland Streetcar line between Northwest Portland and the South Waterfront District, via downtown Portland (see Figure 1-1). On average weekdays in 2035, the Streetcar line would operate every 12 minutes during the peak and off-peak periods. Further, the City of Portland would operate the Streetcar Loop Project, serving downtown Portland, the Pearl District, northeast and southeast Portland, OMSI and the South Waterfront District. Frequency on the line for an average weekday in 2035 would be every 12 minutes during the peak and off-peak periods.

1.4.2 Enhanced Bus Alternative

This section describes the roadway, bicycle and pedestrian, and transit capital improvements and transit operating characteristics under the Enhanced Bus Alternative, generally compared to the No-

Build Alternative. The intent of the Enhanced Bus Alternative is to address the project's Purpose and Need without a major transit capital investment.

1.4.2.1 Capital Improvements

This section summarizes the transit, bicycle and pedestrian, and transit capital improvements that would occur under the Enhanced Bus Alternative, compared to the No-Build Alternative (see Table 1-1 and Figure 1-2).

- **Roadway Capital Improvements.** Except for the addition of a two-way roadway connection between the proposed 300-space park-and-ride lot and Foothills Road, there would be no change in roadway improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Bicycle and Pedestrian Improvements.** There would be no change in bicycle and pedestrian improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Bus Capital Improvements.** Under the Enhanced Bus Alternative, the 26 bus stops that would be served by Line 35 between downtown Lake Oswego and SW Bancroft under the No-Build Alternative would be consolidated into 13 bus stops, which would continue to be served by the Line 35 (the other 13 bus stops would be removed). The bus stops served by Line 35 between Lake Oswego and Oregon City would be unchanged under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Light Rail Capital Improvements.** There would be no change in light rail capital improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Excursion Trolley Capital Improvements.** There would be no change in excursion trolley capital improvements under the Enhanced Bus Alternative, from the No-Build Alternative.

- **Streetcar Improvements and Vehicles.** There would be no change in streetcar improvements and vehicles under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Park-and-Ride Facilities.** In addition to the park-and-ride facilities included under the No-Build Alternative, the Enhanced Bus Alternative would include a 300-space structured park-and-ride lot that would be located at Oswego Village Shopping Center on Highway 43 in downtown Lake Oswego. The park-and-ride lot would be served by Lines 35 and 36.

- **Operations and Maintenance Facilities.** There would be no changes to the region's operations and maintenance facilities under the Enhanced Bus Alternative, compared to the No-Build Alternative, except that the capacity of TriMet's bus operating and maintenance facilities at either the Center or Powell facility would be expanded to accommodate the additional 13 buses under the Enhanced Bus Alternative (see the *Detailed Definition of Alternatives Report* for additional information).

1.4.2.2 Transit Operations

This section summarizes the corridor's transit operations under the Enhanced Bus Alternative, focusing on bus and streetcar operations. Figure 1-2 illustrates the transit network for the Enhanced Bus Alternative in the vicinity of the corridor.

- **Bus Operations.** Except for changes to the routing, frequency, and number of stops of Line 35 and the elimination of Line 36 service between downtown Portland and downtown Lake Oswego, bus operations under the Enhanced Bus Alternative would be identical to the bus operations under the No-Build Alternative. Under the Enhanced Bus Alternative, Line 35's routing between Oregon City and Lake Oswego would remain unchanged relative to the No-Build Alternative. Further, between Lake Oswego and downtown Portland there would be two routing changes to Line 35, compared to the No-Build Alternative: 1) the bus would be rerouted to serve the new park-and-ride lot at the Oswego Village Shopping Center; and, 2) in downtown Portland, Line 35 would be rerouted to serve SW and NW 10th and 11th avenues, generally between SW Market and Clay streets and NW Lovejoy Street/Union Station to address the travel markets.

- **Streetcar Operating Characteristics.** Under the Enhanced Bus Alternative, there would be no change in streetcar operating characteristics, compared to the No-Build Alternative.

1.4.3 Streetcar Alternative

This section describes the roadway, bicycle and pedestrian, and transit capital improvements and transit operating characteristics under the Streetcar Alternative, generally compared to the No-Build Alternative.

1.4.3.1 Capital Improvements

This section summarizes the transit, bicycle and pedestrian, and transit capital improvements that would occur under the Streetcar Alternative, generally compared to the No-Build Alternative (see Table 1-1 and Figure 1-3). This section provides a general description of the capital improvements that would occur under the Streetcar Alternative, independent of design option, and it highlights the differences between design options within three of the corridor's segments.

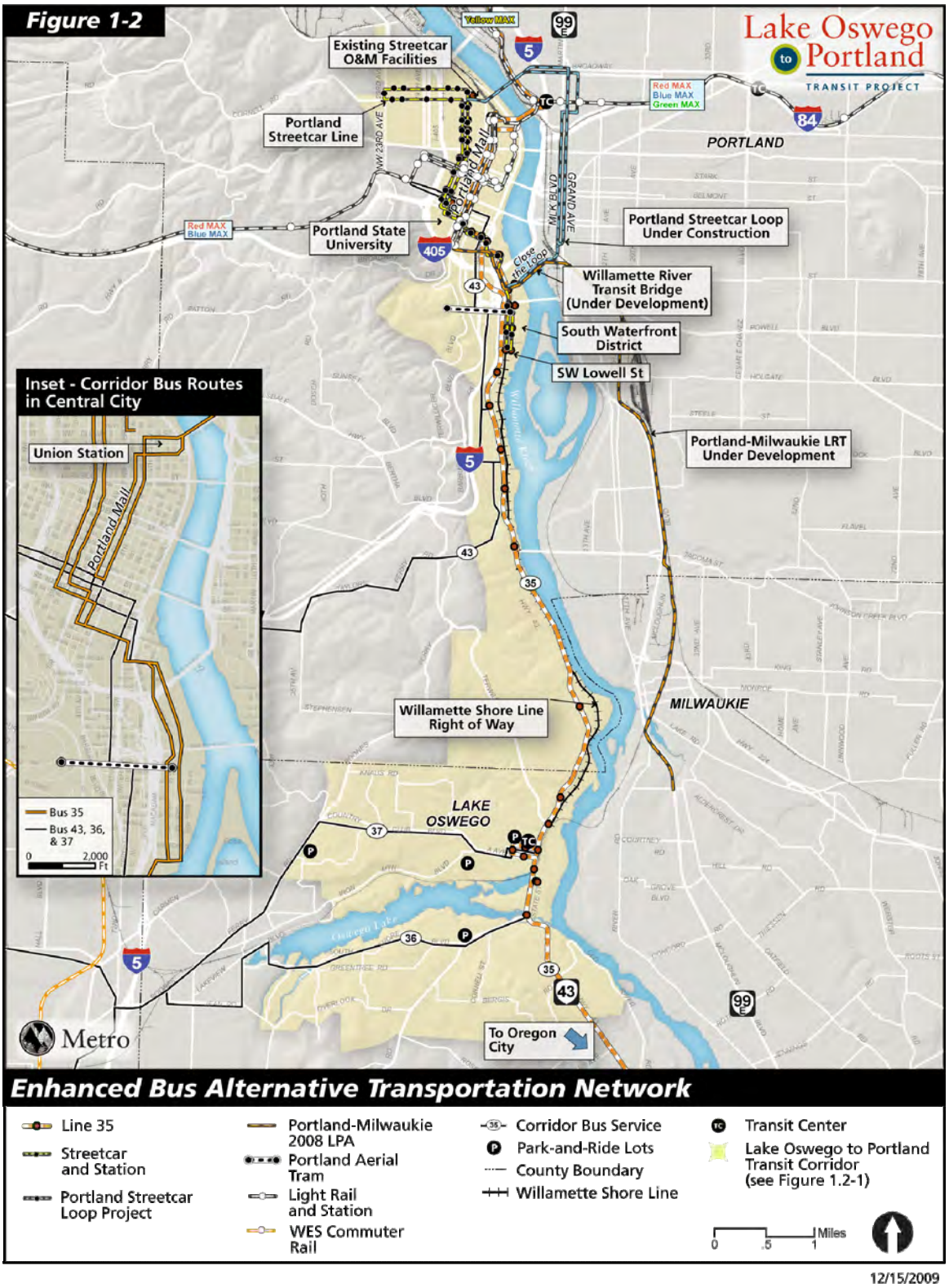


FIGURE 1-2 ENHANCED BUS ALTERNATIVE TRANSPORTATION NETWORK

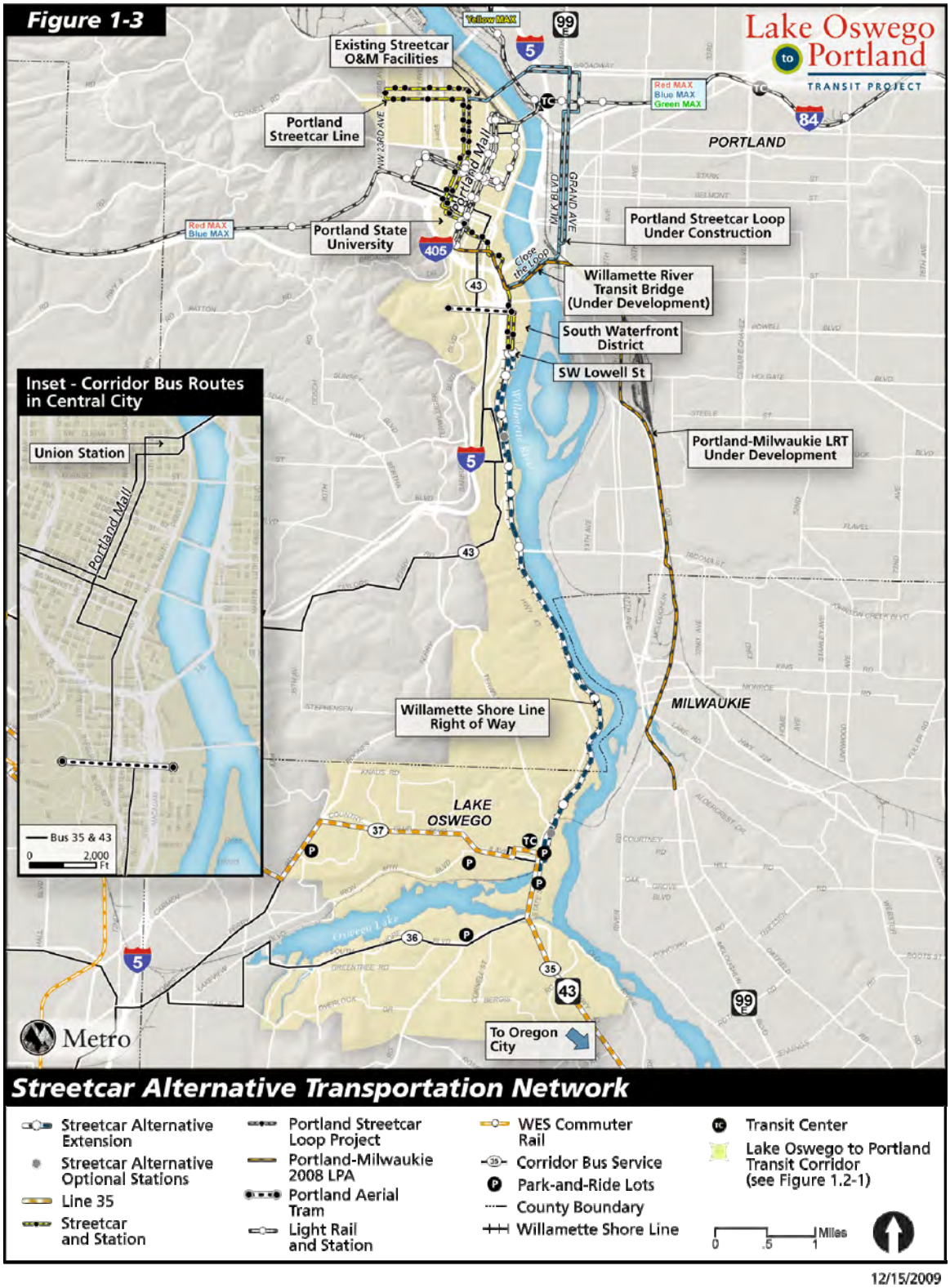


FIGURE 1-3 STREETCAR ALTERNATIVE TRANSPORTATION NETWORK

A. Summary Description

Following is a general description of the roadway, bicycle and pedestrian, and transit improvements that would occur under the Streetcar Alternative. The next section provides a description of differences in capital improvements for design options that are under consideration in three of the project's six segments. See Figure 1-4 for an illustration of the project segments and the design options under consideration.

- **Roadway Capital Improvements.** There would be no roadway improvements under the Streetcar Alternative in the following corridor segments: 1) Downtown Portland; and 2) South Waterfront. The roadway capital improvements that would occur under the other corridor segments are described below for those segments. Changes to traffic controls at signalized and non-signalized intersections would occur throughout the corridor to accommodate the safe and efficient operation of the streetcar and local traffic. The *Detailed Definition of Alternatives Report* and the *Streetcar Plan Set* provide additional details on changes to traffic operations at intersections under the Streetcar Alternative.

- **Bicycle and Pedestrian Improvements.** There would be no change in bicycle and pedestrian improvements under the Streetcar Alternative, compared to the No-Build Alternative, except as noted in the following segment-by-segment description.

  Bus Capital Improvements. Under the Streetcar Alternative, all 26 bus stops that would be served by Line 35 on Highway 43 between downtown Lake Oswego and the Sellwood Bridge and on SW Macadam Boulevard north of SW Corbett Street under the No-Build Alternative would be removed, because Line 35 service would be replaced in the corridor by streetcar service. The bus stops served by Line 35 between Lake Oswego and Oregon City would be unchanged under the Streetcar Alternative, compared to the No-Build Alternative. In addition, under the Streetcar Alternative, the Lake Oswego Transit Center would be relocated to be adjacent to the Lake Oswego Terminus Station, from its existing location on 4th Street, between A and B avenues. The changes to the bus capital improvements under the Streetcar Alternative would not vary by any of the design options under consideration.

- **Light Rail Capital Improvements.** There would be no change in light rail capital improvements under the Streetcar Alternative, compared to the No-Build Alternative.

- **Interim Excursion Trolley Capital Improvements.** Under the Streetcar Alternative, there would no longer be an operating and maintenance agreement between the City of Lake Oswego and the Willamette Shore Line Consortium that would allow for the operations of the excursion trolley between SW Bancroft Street and Lake Oswego. Further, the Oregon Electric Railway Historical Society would no longer operate the vintage excursion trolley on the Willamette Shore Line alignment under agreement with the City of Lake Oswego, as they currently do and as they would under the No-Build and Enhanced Bus Alternatives.

- **Streetcar Improvements and Vehicles.** The Streetcar Alternative would extend streetcar tracks and stations south from the existing Portland Streetcar line that operates between NW 23rd Avenue and SW Bancroft Street. Compared to existing conditions and the No-Build Alternative, the Streetcar Alternative would add approximately 5.9 to 6.0 one-way miles of new streetcar tracks and catenary (overhead electrical wiring and support) and ten new streetcar stations

between SW Bancroft Street and Lake Oswego. Except when crossing over waterways, roadways, or freight rail lines or through an existing tunnel, the new streetcar line would generally be at the same grade as existing surface streets. Of the approximately six miles of new streetcar tracks, 5.3 miles would be double-tracked (i.e., two one-way tracks) and 0.7 miles would be single-tracked (i.e., inbound and outbound streetcars would operate on the same tracks; see Figure 1-4 for an illustration of the location of single and double-track segments). The new streetcar stations would be of a design similar to the existing streetcar stations in downtown Portland and the Pearl District.

- **Park-and-Ride Facilities.** In addition to the park-and-ride facilities included under the No-Build Alternative, the Streetcar Alternative would include: a) a 100-space surface park-and-ride lot served by the proposed streetcar line at the B Avenue Station; and b) a 300-space structured park-and-ride lot that would be served by the proposed streetcar line at the Lake Oswego Terminus Station. The size and location of these park-and-ride lots would not vary by any of the design options under consideration.

- **Operations and Maintenance Facilities.** With the Streetcar Alternative, a new storage facility that would accommodate eight streetcars would be located adjacent to the streetcar alignment under the Marquam Bridge. The size and location of the streetcar operating and maintenance facilities would not vary by any of the design options under consideration.

B. Segment by Segment Description and Design Option Differences

For the purposes of description and analysis, the Lake Oswego to Portland Corridor has been divided into six segments for the Streetcar Alternative – those segments and design options within four of the segments are illustrated schematically in Figure 1-4. Figure 1-3 illustrates the proposed roadway improvements, streetcar alignment, stations, and park-and-ride lots that would occur in the corridor under the Streetcar Alternative. Figures 1-5 and 1-6 provide more detailed illustrations of the streetcar design options currently under study.

1. Downtown Portland Segment. There would be no roadway or bicycle and pedestrian improvements within the Downtown Portland Segment under the Streetcar Alternative, compared to the No-Build Alternative. Under the Streetcar Alternative, a connection would be added between westbound streetcar tracks on SW Market Street to southbound tracks on W 10th Avenue, which would allow inbound streetcars from Lake Oswego to turn back toward Lake Oswego, providing increased operational flexibility. There are no streetcar alignment design options within this segment and there would be no new streetcar stations within this segment.

2. South Waterfront Segment. The South Waterfront Segment extends between SW Lowell Street to SW Hamilton Court. Streetcar tracks would be extended south of their existing southern terminus at SW Lowell Street, within the right of way of the planned Moody/Bond Couplet extension, to SW Hamilton Street. There would be two new streetcar stations within this segment (Bancroft and Hamilton stations).

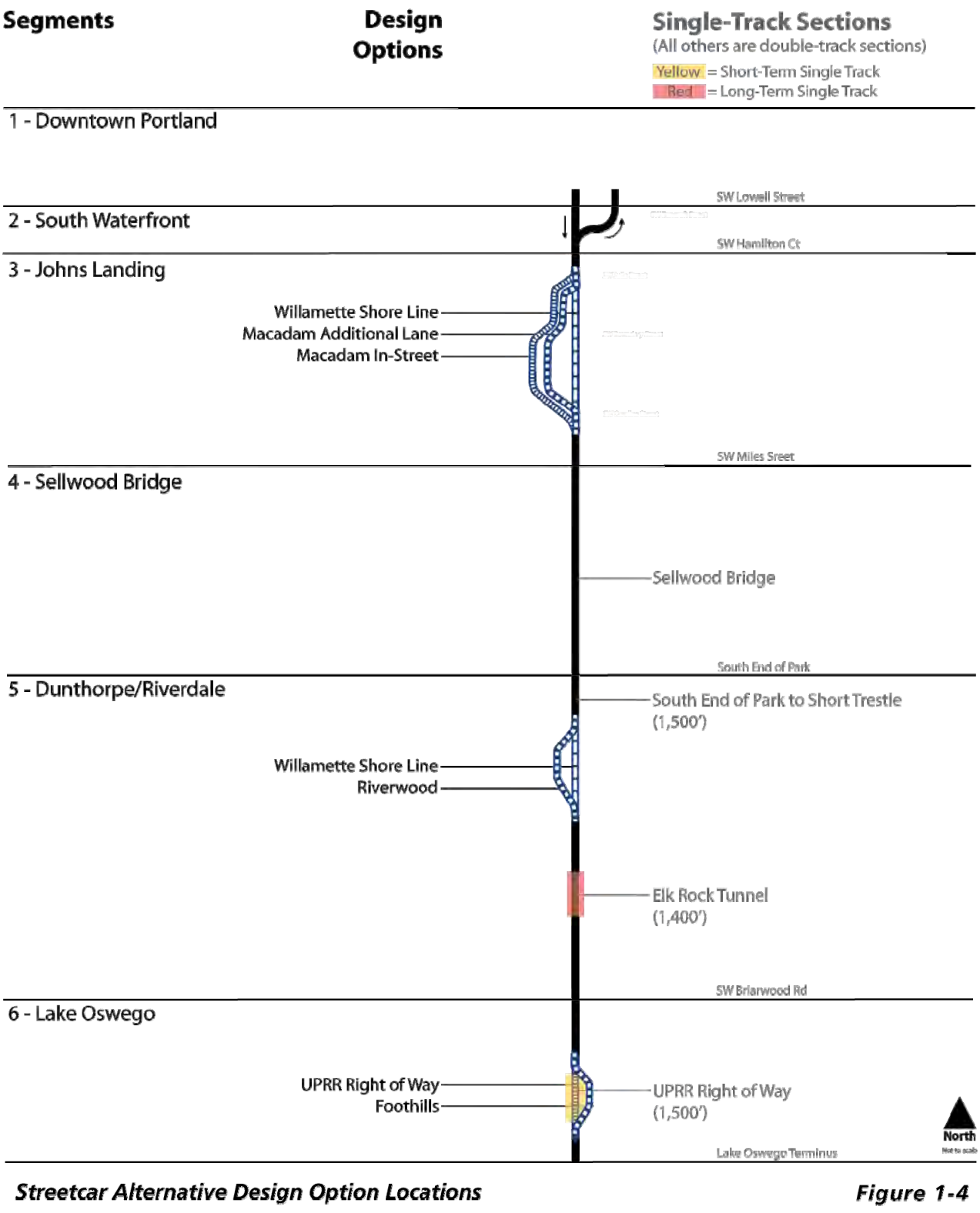
3. Johns Landing Segment. The Johns Landing Segment extends between SW Hamilton Court to SW Miles Street. This segment includes three design options: Willamette Shore Line; Macadam In-Street; and Macadam Additional Lane. Under all options, the streetcar alignment would extend south from SW Hamilton to near SW Julia Street, generally within the existing Willamette Shore Line right of way. The three design options would include two new streetcar stations at varying locations,

described below. To the south, all three options would share a common alignment between SW Carolina and SW Miles Street, generally via the existing Willamette Shore Line right of way, and they would share one common station at SW Nevada. Following is a description of how the design options would differ:

a. ***The Willamette Shore Line Design Option*** would continue the extension of streetcar tracks south within the existing Willamette Shore Line right of way from SW Julia Street to SW Carolina Street (extending to SW Miles Street). There would be three new streetcar stations (Boundary, Nebraska, and Nevada stations).

b. ***The Macadam In-Street Design Option*** would locate the new streetcar tracks generally within the existing outside lanes of SW Macadam Avenue, approximately between SW Boundary and Carolina streets. Between approximately SW Julia and Boundary streets, the streetcar alignment would be within the right of way of SW Landing Drive, which would be converted from a private to a public street. There would be three new streetcar stations (Boundary, Carolina, and Nevada stations). An optional station at Pendleton Street is also under consideration.

c. ***The Macadam Additional Lane Design Option*** would be similar to the Macadam In-Street Design Option, except that the new northbound streetcar tracks would be located within a new traffic lane just east of the existing general purpose lanes – streetcars would share the new lane with right-turning vehicles. Between approximately SW Julia and Boundary streets, the streetcar alignment would be within the right of way of SW Landing Drive, which would be converted from a private to a public street. There would be three new streetcar stations (Boundary, Carolina, and Nevada stations). An optional station at Pendleton Street is also under consideration.



Streetcar Alternative Design Option Locations ***Figure 1-4***

FIGURE 1-4 STREETCAR ALTERNATIVE DESIGN OPTION LOCATIONS

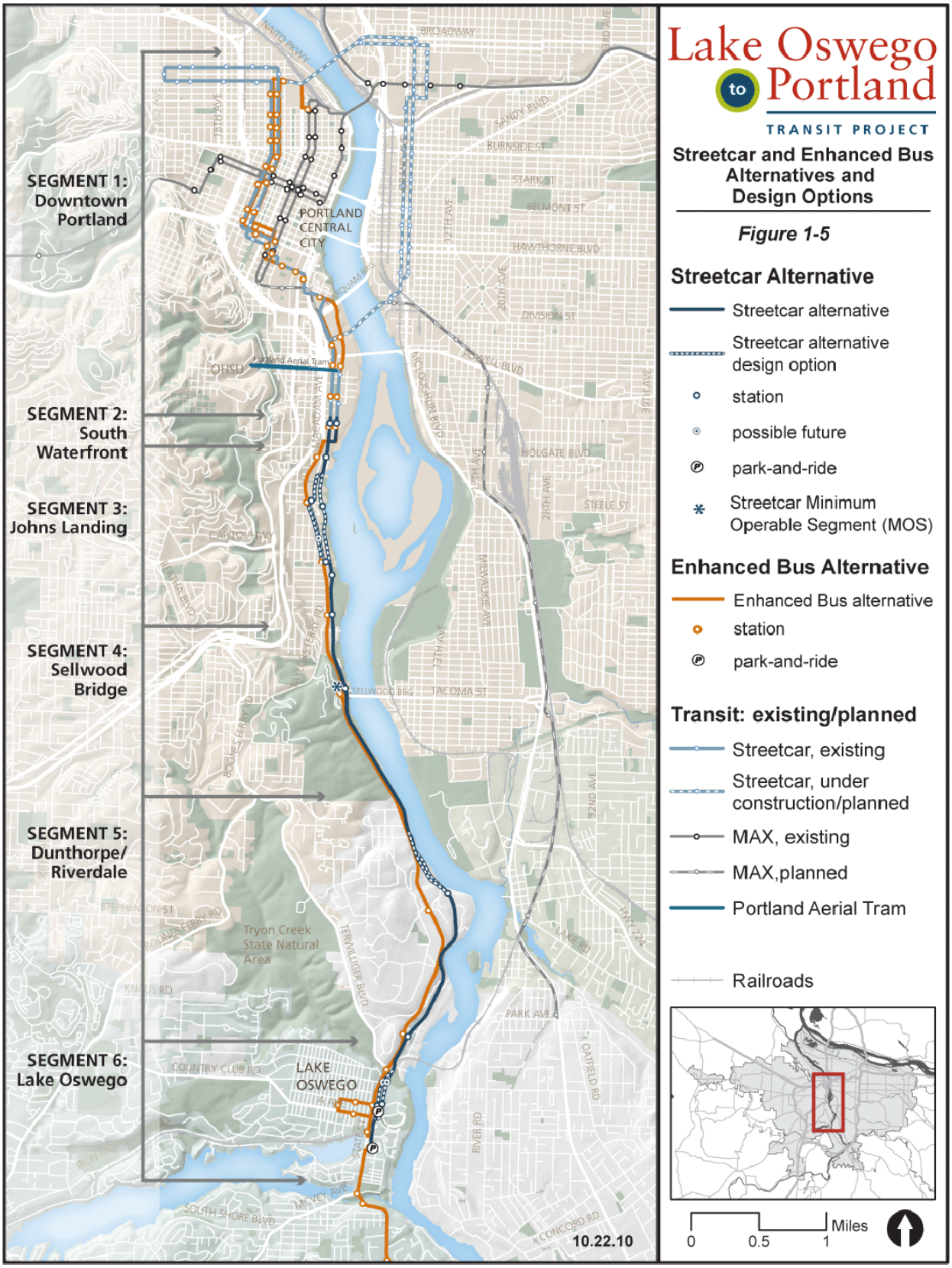


FIGURE 1-5 STREETCAR AND ENHANCED BUS ALTERNATIVES AND DESIGN OPTIONS

FIGURE 1-6 STREETCAR ALTERNATIVE DESIGN OPTION DETAILS

4. Sellwood Bridge Segment. The Sellwood Bridge Segment extends from Miles Street to the southern end of Powers Marine Park. Generally, the streetcar alignment would be located in the Willamette Shore Line right of way, except for the area between Stephens Creek and approximately 1,200 feet south of the Sellwood Bridge. In this area, the streetcar alignment would be constructed in conjunction with the planned west interchange improvements with the Sellwood Bridge (the streetcar would be located slightly east of the existing Willamette Shore Line right of way). The design and construction of the streetcar alignment under this design option would be coordinated with the design and construction of the new interchange for the Sellwood Bridge. There would be one new streetcar station within this segment (Sellwood Bridge Station).

5. Dunthorpe/Riverdale Segment. The Dunthorpe/Riverdale Segment extends between the southern end of Powers Marine Park and SW Briarwood Road. There are two design options in this segment: Willamette Shore Line Design Option and Riverwood In-Street Design Option. Both options would share a common alignment within the Willamette Shore Line right of way, generally north of where SW Riverwood Road intersects with Highway 43 and generally south of the intersection of SW Military Road and SW Riverwood Road. One new streetcar station is proposed within this segment, generally common to both design options (Riverwood Station). Following is a description of how the design options would differ:

a. ***The Willamette Shore Line Design Option*** would generally locate the new streetcar alignment in the existing Willamette Shore Line right of way between the intersections of SW Riverwood Road and Highway 43 and SW Riverwood Road and SW Military Road.

b. ***The Riverwood Design Option*** would locate the new streetcar alignment generally adjacent to Highway 43, north of SW Riverwood Road, and within the right of way of SW Riverwood Road, generally between where it intersects with Highway 43 (that intersection would be closed) and where it intersects SW Military Road. Except for the closure of the Highway 43 and SW Riverwood Road intersection, SW Riverwood Road would remain open to traffic (with joint operation with streetcars).

6. Lake Oswego Segment. The Lake Oswego Segment extends between SW Briarwood Road and the Lake Oswego Terminus Station. There are two design options within this segment: the UPRR ROW design option and the Foothills design option. Both options would generally be the same in two sections: 1) the new streetcar line alignment would extend south from SW Briarwood Road to where the alignment would cross under the existing UPRR tracks; and 2) the new streetcar alignment would be located within a new roadway that would extend south from SW A Avenue to the alignment's terminus near the intersection of N State Street and Northshore Road. Both options would provide for a new bicycle and pedestrian connection under the existing UPRR tracks. There would be two stations within this segment, one that would be common to the two design options (Lake Oswego Terminus Station). An optional station at E Avenue is also under consideration.

This segment would include two park-and-ride lots, both of which would be generally common to the two design options. Following is a description of how the design options would differ:

a. ***The UPRR ROW Design Option*** would extend the streetcar alignment south, generally in the UPRR right of way, from its under crossing of the existing UPRR tracks to SW A Avenue. The B Avenue Station would be located on the west side of the 100-space surface park-and-ride lot.

b. ***The Foothills Design Option*** would extend the streetcar alignment south from its under crossing of the UPRR tracks to SW A Avenue generally within the right of way of a new general purpose roadway (Foothills Road), which would be built as part of the Streetcar Alternative.

1.4.3.2 Transit Operations

This section describes transit operations under the Streetcar Alternative, generally compared to the No-Build Alternative (see Table 1-2). Figure 1-3 provides an illustration of the transit lines in the vicinity of the corridor under the Streetcar Alternative. There would be no difference in transit operations under any of the design options under consideration.

The Streetcar Alternative would extend the existing Portland Streetcar line from its current southern terminus at Lowell Street to the Lake Oswego Terminus Station in downtown Lake Oswego, expanding the streetcar length from 4 miles to 9.9 to 10 miles (depending on design option). The total round trip running time of the streetcar line between 23rd Avenue and downtown Lake Oswego (10 miles) in 2035 would be 105 or 112 minutes, excluding layover (based on the Willamette Shore Line and Macadam design options in the Johns Landing Segment, respectively). In comparison, under the No-Build Alternative the round trip running time for the streetcar line between 23rd Avenue and Lowell Street (4 miles) would be 68 minutes.

With the extension of streetcar service to Lake Oswego, Line 35 service between Lake Oswego and downtown Portland would be eliminated. The remainder of Line 35 between Oregon City and Lake Oswego would be combined with Line 78, in effect to create a new route between Oregon City and Beaverton. The new bus route and other TriMet transit routes serving downtown Lake Oswego would be rerouted to serve the relocated Lake Oswego Transit Center, which would be adjacent to Lake Oswego Terminus Station.

1.4.3.3 Construction Phasing Options

This section summarizes Streetcar Alternative construction phasing options currently under consideration – neither the No-Build Alternative nor the Enhanced Bus Alternative include construction phasing options. Currently, there are two types of construction phasing options or scenarios under consideration: 1) finance-related and 2) external project related. The Streetcar Alternative evaluated in this Technical Report and the DEIS is as Full-Project Construction. Should the Streetcar Alternative with phasing be selected as the Locally Preferred Alternative, during preliminary engineering (PE) additional analysis of environmental impacts resulting from the interim project alignment (as opposed to Full-Project Construction) will be conducted and additional opportunity for public review and comment may be required.

A. Finance-Related Phasing Options

Following is a description of the two finance-related phasing options currently under consideration.

- **Full-Project Construction.** Under the first construction phasing option, the project would be constructed and opened in its entirety as described within Section 2.2.2.

- **Sellwood Bridge Minimum Operable Segment (MOS).** Under the Sellwood Bridge MOS phasing option, the Streetcar Alternative would be initially constructed between SW Lowell Street and the Sellwood Bridge, with a second construction phase between the Sellwood Bridge

and the Lake Oswego Terminus Station occurring prior to 2035. Under this construction phasing option, there would be no additional park-and-ride facilities in the corridor, compared to existing conditions. Under this phasing option, Line 35 would operate between Oregon City and the Nevada Street Station; frequencies would be adjusted to meet demand. Service and bus stops served exclusively by Line 35 would be deleted between the Nevada Station and downtown Portland.

B. External Project Coordination Related Phasing Options

Following is a description of phasing options related to the coordination of the Streetcar Alternative, if it is selected as the LPA, and other external projects. These external project coordination related phasing options represent interim steps in the construction process that would be taken to implement the Streetcar Alternative.

- **South Waterfront Segment Phasing Options.** If the planned and programmed South Portal roadway improvements are not in place or would not be constructed concurrently with the Streetcar Alternative, there would be two options for proceeding with construction of the streetcar alignment in the segment: 1) a different streetcar alignment using the Willamette Shore Line right of way would be initially constructed within the South Waterfront Segment; or 2) the streetcar alignment and its required infrastructure improvements would be constructed consistent with the alignment under the Full-Project Construction phasing option, but other non-project roadway improvements would be constructed at a later date by others. If the Willamette Shore Line right of way were to be used, then, when the South Portal roadway improvements were made, the streetcar alignment would be reconstructed consistent. The transit operating characteristics of the Streetcar Alternative would not be affected by this phasing option.

- **Sellwood Bridge Segment Phasing Options**. The Sellwood Bridge Segment includes two phasing options for the Streetcar Alternative that reflect two potential phasing options or scenarios for construction of the project in relationship to construction of a proposed new interchange that is planned to occur with the Sellwood Bridge replacement project. If the new interchange is constructed prior to or concurrently with the Streetcar Alternative, the initial and long-term streetcar alignment would be based on the new interchange design. The new interchange design is the basis for the analysis in this technical report and the DEIS. If the proposed interchange is constructed after the Streetcar Alternative, then the initial streetcar alignment to be constructed would be in the Willamette Shore Line right of way. Subsequently, when the proposed interchange is constructed, the Sellwood Bridge replacement project would relocate the streetcar alignment with the new interchange design. Therefore, the long-term streetcar alignment would be the new interchange and the Willamette Shore Line phasing option would only be implemented as an interim alignment. Therefore, the two design options in this segment do not constitute a choice of alignments – instead they represent two construction phasing scenarios, dependent upon how external conditions transpire.

    - The Foothills Design Option. The Foothills design option of the Streetcar Alternative is based on roadway improvements that would occur under the City of Lake Oswego's Foothills redevelopment project. If those roadway improvements are not constructed prior to or concurrently with construction of the streetcar alignment, then the Lake Oswego to Portland Transit Project would construct the streetcar alignment and required infrastructure improvements using the same alignment and the roadway improvements would be added at a later date by others.

2. EVALUATION METHODS

2.1 Introduction

The purpose of this section is to describe the methodology and data sources that have been used to investigate the existing geologic, hydrogeologic, soil and seismic conditions for the Lake Oswego to Portland Transit Project (Project). Information obtained in this investigation has been used to identify geologic conditions that may affect project design, schedule and costs for the proposed alternatives. The study has also investigated the affect of the Project on local geologic conditions.

2.2 Related Laws and Regulations

Laws or regulations pertaining specifically to geology that are applicable to the Project area are addressed through industry practices established by the Oregon Department of Transportation (ODOT) Environmental Procedures Manual (2002).

2.3 Contacts, Coordination and Consultation

State and Local agencies and municipalities were contacted to obtain existing soil and geologic reports and maps along the project corridor. The following agencies were contacted:

- Oregon Department of Geology and Mineral Industries (DOGAMI)
- Oregon Department of Transportation (ODOT)
- Multnomah County
- The City of Portland
- The City of Lake Oswego

2.4 Data Collection

The primary data used for the analyses were collected from existing maps, publications and reports. Data sources included the following:

- U.S. Army Corps of Engineers (USACE)
- U.S. Geological Survey (USGS)
- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)
- Oregon Department of Transportation (ODOT)
- Oregon Department of Geology and Mineral Industries (DOGAMI)
- Oregon Water Resources Department (OWRD)
- Portland State University
- Metro
- City of Portland
- Previous data developed by URS within the Project area.

In addition to reviewing this data, personnel performed field reconnaissance across the project area to identify potential impacts and adverse geologic conditions. Field reconnaissance was limited to visual observation of the surface conditions along the project alignment. Site-specific subsurface investigation and analyses were not performed for this analysis. Detailed subsurface investigation is typically performed during preliminary and final design phases of the project.

2.5 Affected Environment Profile

The data collected ranged from regional geologic maps to site specific geotechnical investigations and water well data providing detailed soil and groundwater information in localized areas. Over 200 Geotechnical and water well records from the Oregon Water Resourced Department were reviewed for geologic and hydrogeologic data with in the study area. Selected geotechnical and water well reports are presented in Appendix A. This data was reviewed and integrated with field observations to develop an understanding of the existing geologic conditions for the project area. The data provided information such as predominant soil types, depths to rock, regional groundwater conditions and geologic hazards.

2.6 Impact Assessment Analysis Methods

The soil and geologic conditions of the project area have been evaluated with regard to their affect on the project alternatives. Soil and geologic conditions may affect the cost and feasibility of alternatives. Aspects of the project may also adversely affect the existing geologic conditions. Certain geologic conditions may require mitigation to maintain the safety and integrity of the project.

Existing groundwater conditions were assessed through hydrogeologic resource studies and review of Willamette River data. The impacts of groundwater on the alternatives (for example, special construction methods may be required where groundwater is near-surface) as well as the affect of the project on groundwater resources (for example, cutting and filling may alter regional groundwater flow patterns) were investigated.

Seismic hazards were assessed by review of USGS and DOGAMI publications for the project area. Site ground motions based on USGS probabilistic methods were determined. Using ground motion data and the geologic model developed for the site, potential seismic hazards such as liquefaction and slope instability have been identified. The impacts of these hazards with respect to the project have been assessed. Peak ground acceleration (PGA) calculations and Probabilistic Seismic Hazard (PSH) analyses are presented in Appendix B.

The direct, indirect, and cumulative effects of the project were evaluated with regard to the site geologic and hydrogeologic conditions, as well as the seismic and geologic hazards.

2.7 Mitigation Measures

A range of potential project impacts have been identified during the completion of this assessment. General mitigation measures have been developed to address these impacts. These measures range from avoidance of the impact to engineered modifications to the existing conditions. Mitigation measures will be coordinated with state and local government requirements and with other technical disciplines.

2.8 Documentation

The geology, soils and seismic analyses have documented the existing conditions within the project area, impacts of the study alternatives, potential mitigation measures and information sources used in the assessment. A summary of the analyses is included in Chapter 3 of the Draft Environmental Impact Statement.

3. CONTACTS, COORDINATION AND CONSULTATION

Data used in support of this Technical Report were primarily obtained through published information and record searches on Federal, State, and Local web-based data depositories. State and Local agencies were contacted to obtain detailed information relating to geotechnical investigations for specific projects within the Lake Oswego to Portland Transit study area.

3.1 State Agency Coordination

Various Oregon State agencies and divisions were contacted via telephone and email during development of this Report. Geologic, geotechnical, seismic hazard and hydrogeologic information was obtained through ODOT Rail Division, ODOT Region 1, OWRD, and DOGAMI.

3.3 Local Agency Coordination

The City of Portland, Bureau of Environmental Services was contacted to request information related the West Side Combined Sewer Overflow project. Multnomah County was contacted to obtain information related to the Sellwood Bridge replacement project.

4. AFFECTED ENVIRONMENT

This section provides a description of the primary geologic and groundwater conditions and geologic hazards within the project's study area.

4.1 Geologic, Soil and Groundwater Conditions

The Lake Oswego to Portland Transit project is located in the northern Willamette Valley physiographic province, an elongated north-south trending alluvial valley that lies between the Oregon Coastal Mountain Range and the Cascade Mountain Range to the west and east, respectively (Orr and Orr, 2000). Specifically, the site is positioned along the western side of the Portland Basin, a northwest trending structural basin bounded by the Portland Hills to the west and the foothills of the Cascade Mountains to the east.

Much of the Portland basin is mantled with late Pleistocene-aged silt, sand, gravel, cobbles, and boulders deposited during repeated catastrophic glacial outburst flood events that originated from Pleistocene Lake Missoula, which was located in eastern Idaho and western Montana. Locally, particularly near the Willamette River and its tributary drainages, alluvial deposits consisting primarily of silt and sand, are present. Historically placed fill deposits are present in areas of human development; primarily within the lowland areas near the Willamette River and its tributaries. The fill is commonly composed of sand, silt and clay with varying amounts of gravel, debris and wood waste (Beeson et al., 1989, 1991).

Throughout the study area, the near surface flood deposits, alluvium and artificial fill are generally underlain by completely weathered to fresh, basaltic volcanic rocks of the Eocene Waverly Heights Volcanics and the Miocene Columbia River Basalt Group. The basaltic rocks are generally deeply weathered to depths of 30 feet or greater, except where streams, rivers, Pleistocene glacial outburst flooding, and human activity have removed the weathered rock.

The Northern Willamette Valley has undergone substantial structural deformation, resulting in the Portland fold belt as defined by Unruh et al. (1994). The tectonic underpinnings of the Portland Fold Belt are not well understood and are further complicated by the fact that this area lies in a transition zone between the rotating Coast Range forearc block and the continental interior (Wells et al, 1998). The most prominent structural feature associated with the western edge of the Portland Basin is the Portland Hills Fault (PHF), which includes a series of northwest-trending subsurface faults that

extend for a distance of about 40-km along the eastern margin of the Portland Hills (Geomatrix, 1995; Madin, 1990). The trace of the PHF is inferred to cross the Willamette River from northwest to southeast between the west end of the Ross Island Bridge and the Oaks Bottom area (Beeson et al., 1989).

The Oatfield Fault has been mapped through the western Tualatin Mountains and the northern Willamette Valley. The Oatfield Fault has been located based on northeast-facing escarpments in volcanic rocks of the Miocene Columbia River Basalt Group, gravity studies, aeromagnetic data (Blakely et al., 1995), and mapped traces within light rail tunnels west of downtown Portland (Blakely et al., 2000). The mapped trace of the Oatfield Fault crosses the Lake Oswego to Portland Transit corridor near SW Briarwood Road (Wong et al., 200). The geology of the study area, as excerpted from Beeson et al., (1989) is shown on Figure 4-1.

The United States Department of Agriculture Natural Resources Conservation Service (NRCS) has mapped and described 10 soil map units within the project study area. A large percentage of the corridor is mapped by the NRCS as *Urban Land*, indicating considerable human modification of the near-surface soils. The soils identified on the NRCS maps consist predominantly of loams with varying sand, silt, clay and gravel contents. Predominant soils in the project area are within hydrologic class C or D and, therefore, have low rates of infiltration.

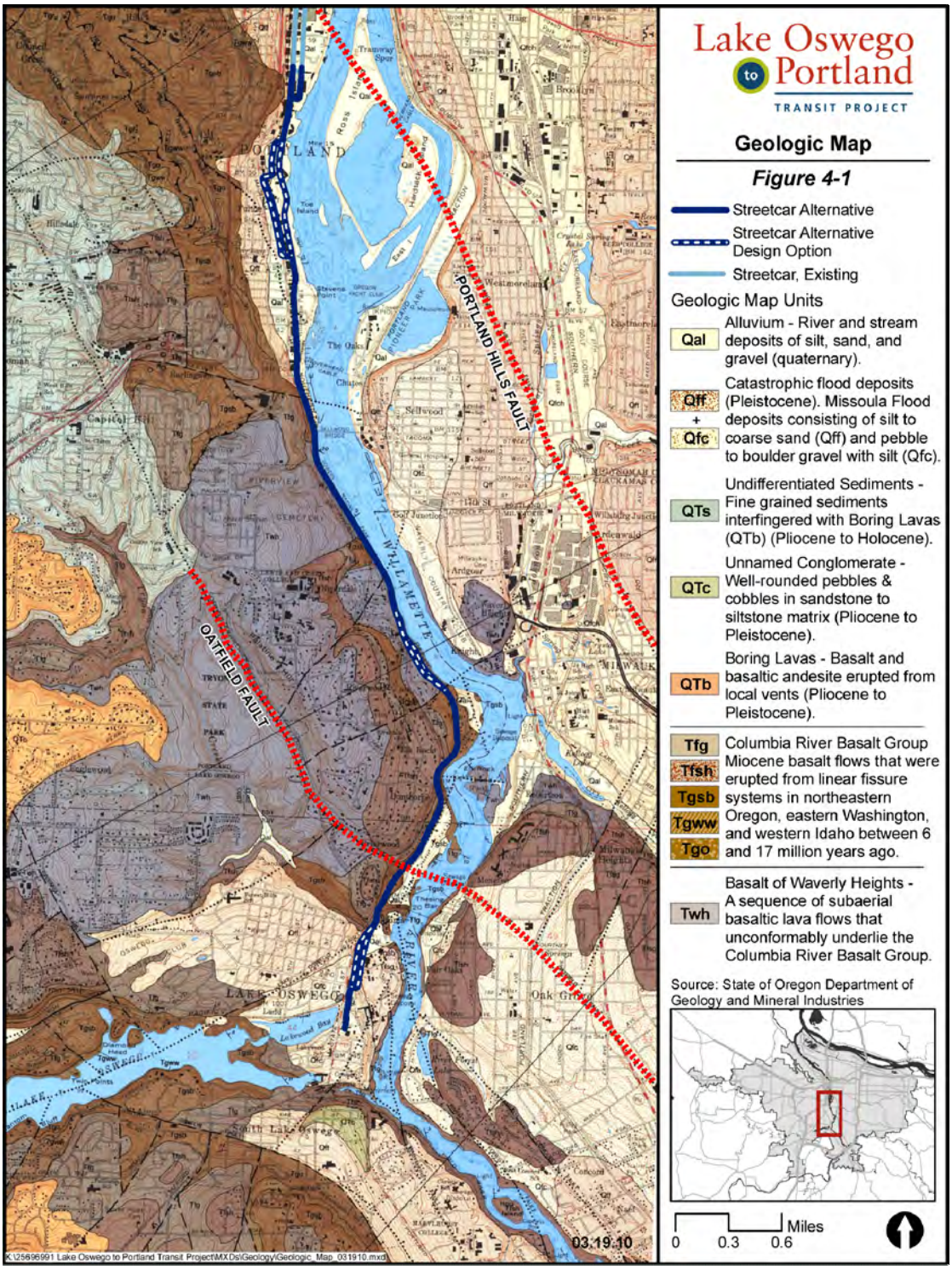


FIGURE 4-1 GEOLOGIC MAP

Groundwater levels within the LAKE OSWEGO TO PORTLAND study area are influenced by the Willamette River stage as well as groundwater flow from upland sources to the west of the proposed alignment. Groundwater data from existing wells in the project vicinity indicate depths to groundwater vary seasonally and spatially from within a few inches of the surface (near the Willamette River – especially north of the Sellwood Bridge) to tens of feet below the surface. A search of Oregon Water Resources Department (OWRD) water well records did not return any active potable water wells within the immediate vicinity of any of the Lake Oswego to Portland Transit alignment options.

Locally, the highly to completely weathered bedrock underlying the surficial sediments can create perched conditions due to the relatively low permeability of the clayey residual soils associated with the weathered basalt. Groundwater flow within the basalt bedrock underlying the Lake Oswego to Portland Transit corridor is controlled mainly by fractures and volcanic flow boundaries within the rock mass. Perched groundwater conditions are also possible within the basalt units where low-permeability, soil-like volcanic flow boundaries are present.

Excavations associated with construction of the Lake Oswego to Portland Transit project in areas of shallow groundwater may require temporary groundwater control (dewatering), especially during wetter fall through spring periods.

4.2 Geologic Hazards

A. Seismic Hazards

Seismic hazards can include the primary effects of an earthquake such as surface rupture or ground shaking, as well as secondary responses such as liquefaction or seismically induced landslides. In preparation of this Technical Report, URS has conducted limited peak ground acceleration and probabilistic seismic hazard analyses for the South Waterfront and Lake Oswego segments of the Lake Oswego to Portland Transit. These analyses are presented in Appendix B of this report.

Liquefaction is the drastic loss of soil strength that can accompany ground shaking during a moderate to strong seismic event. During ground shaking, cyclic earthquake loading on the soil increases pore water pressure to a point where the effective stress on the soil is zero or even negative, resulting in suspension of soil particles in the water. Loose, granular soils located below the water table are generally susceptible to liquefaction. Liquefaction itself does not pose a risk to soil deposits. But, phenomena accompanying liquefaction, such as settlement and lateral spreading can severely damage structures situated in or on the soil.

The Pacific Northwest has four principle types of seismic sources. These sources include (1) the Cascadia Subduction Zone megathrust, which represents the boundary (interface) between the downgoing Juan de Fuca plate and the overriding North American plate; (2) faults located within the Juan de Fuca plate (referred to as the intraplate or intraslab region); (3) crustal faults located principally within the North American plate; and (4) volcanic sources associated with Cascade Range volcanic centers (Wong and Silva, 1998). Of these four sources, intraplate and crustal faults have produced damaging earthquakes in the Pacific Northwest during the relatively short history following European settlement of the area. The 1993 Scotts Mills M_W 5.6 earthquake is an example of a crustal source earthquake event, while the 2001 M_W 6.8 Nisqually earthquake is an example of an intraplate event. Megathrust earthquakes, while capable of producing earthquakes of moment magnitude (M_W) 8.0 to 9.0, occur at greater distance and with less frequency than intraplate and crustal source quakes. Based on geologic evidence along the Pacific Northwest coast, and historic tsunami records from

Japan, the most recent megathrust earthquake along the Cascadia Subduction Zone occurred in 1700 (Atwater et al, 1995; Satake et al, 1996).

Because of their proximity, crustal faults are typically the most significant seismic sources to inland sites. Studies by Pezzopane (1993) and Geomatrix Consultants (1995) show that at least 70 crustal faults with earthquake potential exist in Oregon. Many of these faults were unknown or not recognized as being seismogenic until recently. Although the largest known crustal earthquake in western Oregon is only about M_W 6.0 (Wong and Bott, 1995), potential exists for events of M_W 6½ or greater along several recognized faults including the Portland Hills and the East Bank faults in Portland and the Gales Creek - Mt. Angel fault zone (Wong et al., 2000). The Mt. Angel fault is considered a possible source of the 1993 Scotts Mills M_W 5.6 earthquake.

Crustal faults occur in the vicinity of the Lake Oswego to Portland Transit corridor that are either active or potentially active. These faults are possible sources of strong motion that may affect the performance of the Lake Oswego to Portland Transit project. Due to the proximity to the project, the length, and the newly discovered evidence of a potential higher degree of activity along the Portland Hills Fault system, this fault is the most critical source for seismic hazard analyses for the Lake Oswego to Portland Transit project. The Portland Hills Fault zone includes a series of northwest-trending subsurface faults that extend for a distance of about 25 miles along the eastern margin of the Portland Hills (Geomatrix Consultants, 1995; Madin, 1990). Extension of the fault toward the southeast, beyond the Portland Hills, based on aeromagnetic gravity (Blakely et al., 1995) and high-resolution seismic reflection imaging (Pratt et al., 2001), provides a total estimated fault length of about 38 miles. The closest approach of the Portland Hills fault to the site is approximately 0.5 miles. Based on a maximum estimated length of 38 miles (Wong et al., 2000), which includes projection of the fault to the south of the Portland Hills through and beyond the Rowe Middle School area, an estimated Maximum Credible Earthquake (MCE) with M_W 6.8 is calculated for the Portland Hills fault.

The Oatfield Fault, which crosses the Lake Oswego to Portland Transit corridor approximately 1 mile north of the Lake Oswego Terminus, has been incorporated into the probabilistic ground motion data. Other crustal faults such as the East Bank Fault do exist within a few miles of the project site. These faults have also been incorporated into the probabilistic ground motion data available from the USGS (Appendix B).

The Oregon Department of Geology and Mineral Industries (DOGAMI) Relative Earthquake Hazard Maps (Mabey et al, 1995, 1997) for the Portland Metropolitan area show the relative hazards throughout the area based on a combination of liquefaction potential, earthquake-induced slope instability, and amplification of ground motion during an earthquake. The rating system is divided into four categories or zones ranging from the greatest relative hazard (Zone A) to the least relative hazard (Zone D). The Lake Oswego to Portland Transit project alignment options are located primarily within Zone A to the north of the Sellwood Bridge and Zone B to the south of the bridge. The primary contributing factors to the relatively high seismic hazards are elevated liquefaction and amplification potential to the north of the bridge and a combination of steep slopes and amplification to the south. The relative earthquake hazards of the study area as excerpted from Mabey, et al, (1995) are shown on Figure 4-2.

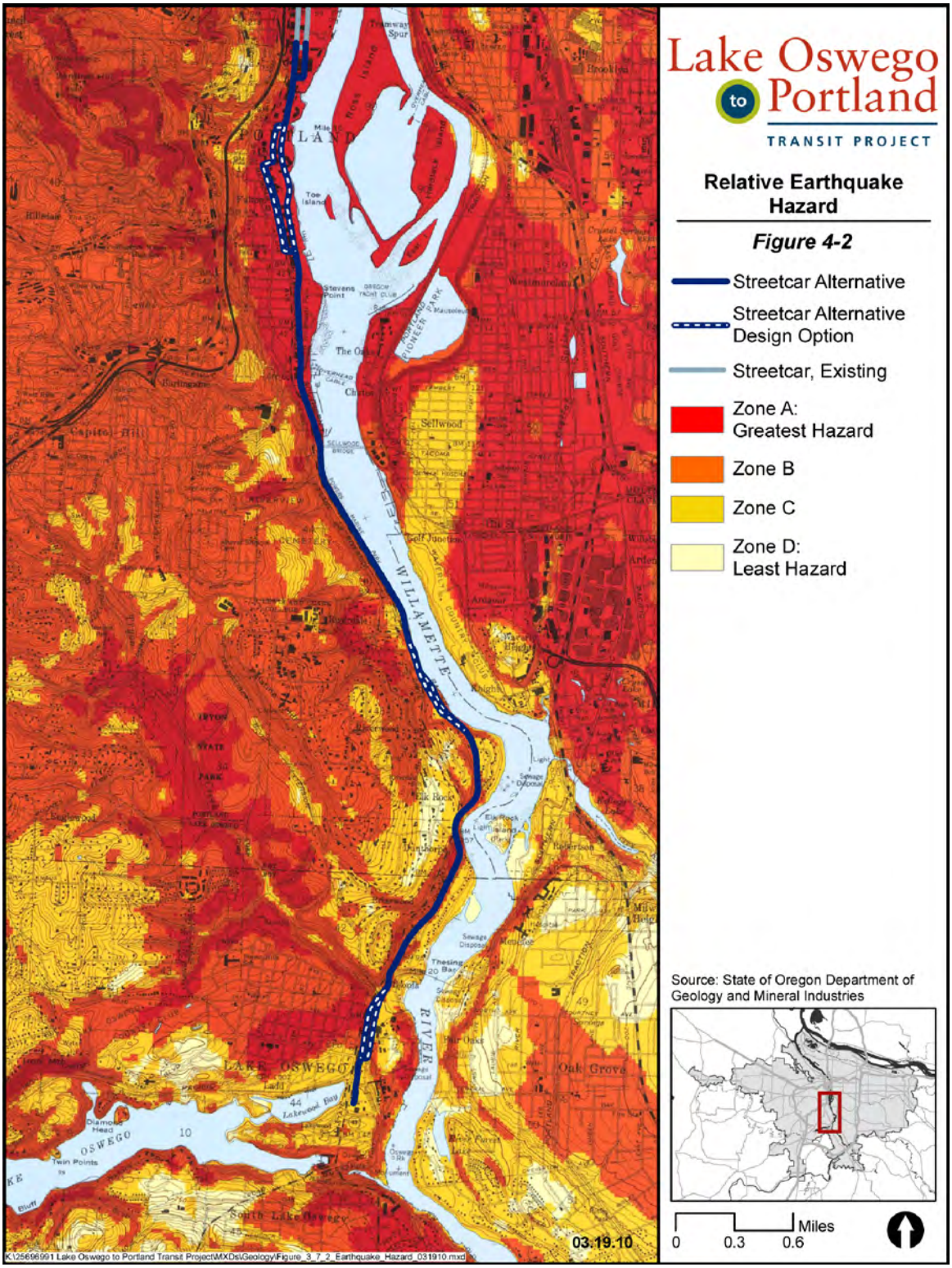


FIGURE 4-2 RELATIVE EARTHQUAKE HAZARD

B. Volcanic Hazards

The primary volcanic hazards posed to the project by active Cascade volcanoes are ash fall and flooding of the Willamette River. Ash fall exceeding 1 to 5 centimeters (0.4 to 2 inches) can disrupt transportation, including operation of bus and street car facilities. Flooding due to rapid melting of snow and generation of large debris flows as a result of eruptions in Willamette tributary headwaters could cause shoreline inundation of the Willamette River and its tributary streams within the Lake Oswego to Portland Transit project area.

According to the United States Geological Survey (USGS, 1999) the annual probability of ash fall exceeding 1 centimeter (0.4 inches) within the Lake Oswego to Portland Transit project corridor is between 0.02 and 0.1 percent (1 in 5,000 to 1 in 1,000). The annual probability of ash fall exceeding 10 centimeters (4 inches) is between 0.01 and 0.02 percent (1 in 10,000 to 1 in 5,000). The low annual probabilities are due to the relative rarity of moderate to large volcanic eruptions coupled with the project location up-gradient of the Cascade Range axis relative to prevailing winds.

C. Landslides

The most common types of landslides in the Pacific Northwest include rock falls, topples, rotational-translational slides, earthflows, debris slides, and debris flows. Most slope failures are complex combinations of these distinct types, but the generalized groupings enable the investigator to communicate the types of hazards anticipated and observed.

Landslides can be initiated in marginally stable slopes by a number of natural and human disturbances. Processes and conditions that can trigger slope failure include earthquake shaking, volcanic eruption, deforestation, intense rainfall, and rapid snowmelt. Two of the most common triggering events in northwest Oregon are intense rainfall and human alterations to the topography. The Pacific Northwest is subject to severe rainfall storm events, particularly in the wet winter and spring months of November through April. These relatively high-precipitation storm events can trigger slope failures through a number of mechanisms. Water infiltration into zones of weakness can trigger failures by reducing the frictional resistance to sliding, increasing pore pressures within slope masses and adding weight acting downslope. Typically, all three mechanisms combine during longer duration, heavy precipitation or rain on snow events to trigger slope stability problems.

Landslide hazards were assessed as part of the public document review, aerial photograph investigation, field reconnaissance, and Light Distance and Ranging (LiDAR) image analysis. All of these studies indicate that the primary areas of concern with regards to slope instability are located adjacent to, and south of the Sellwood Bridge. The elevated slope stability hazard at the bridge is due to an existing ancient landslide, referred to as the Sellwood Landslide (CH2MHill, 2009). South of the Sellwood Landslide, the Lake Oswego to Portland Transit corridor traverses relatively steep terrain, which is more susceptible to slope instability.

As part of the ongoing Sellwood Bridge Project, Multnomah County has conducted a geotechnical investigation of the Sellwood Landslide (CH2MHill, 2009). Movement of the Sellwood Landslide has historically damaged the western abutment of the bridge as a portion of the landslide reactivated following construction of the bridge. Construction of the new Sellwood Bridge will require mitigation of the Sellwood Landslide to prevent future movement of the landslide and resultant damage to the new bridge structure. Mitigation performed for the Sellwood Bridge project will stabilize the western approaches to the bridge, including the area to be occupied by the proposed Lake Oswego to Portland Transit project.

LiDAR imagery reveals a large, arcuate-shaped topographic low located west (upslope) of the alignment between SW Riverwood Rd and SW Radcliffe Rd (approximate Lake Oswego to Portland Transit project stations 2047+00 and 2075+00). The northern boundary of this topographic feature is very well defined as a steep, linear escarpment oriented approximately perpendicular to the Willamette River. The western boundary is also sharply defined and is oriented roughly parallel to the river. The southern boundary of the feature is poorly-defined. This feature may represent a large, dormant, ancient landslide or may be an erosional feature related to differential erosion of weaker rock. There is no evidence of recent damage to structures that cross the feature (existing rail, roads, utilities, buildings) so, if the feature is an ancient landslide, it is assumed to be historically stable. This feature has been identified as a landslide on DOGAMI's Statewide Landslide Information Database for Oregon (SLIDO).

Steep slopes are defined as having an inclination greater than 20 degrees (37 percent). The proposed alignment of the Streetcar Alternative would traverse several steep slopes, some in excess of 30 degrees (60 percent). Hazards associated with steep slopes include higher susceptibility to landslides, rock fall and erosion.

5. ENVIRONMENTAL CONSEQUENCES

This section summarizes the long-term direct, indirect and cumulative affects on geology and soils that would occur due to the No-Build, Enhanced Bus and Streetcar alternatives, focusing on estimates of required cut and fill material and length of new retaining wall and on the potential of the alternatives to increase the risk of geologic and soils hazards. In geologic and soil science terms, the design options are not substantially different and are not individually assessed. Rather, the geologic and soil characteristics of the alternatives – No-Build, Enhanced Bus and Streetcar are analyzed in this document.

There would be no additional cumulative impacts due to the project alternatives beyond the described direct and indirect impacts, because the project's analysis is based on adopted state, regional and local land use plans and transportation project lists, which are the reasonably-foreseeable activities within the project vicinity that could also affect geology and soils. There are no prime or unique farmlands and soils within the project corridor as defined under the Farmlands Protection Policy Act.

A. No-Build Alternative

There would be no direct effects related to geology, hydrogeology and seismic hazards associated with the No-Build Alternative. Indirectly, without any planned construction activities within the existing Willamette Shore Line right of way, the No-Build Alternative would generally allow the continuing degradation of soils and stability within existing right of way. On-going regional development would use existing groundwater and rock resources.

B. Enhanced Bus Alternative

Long term direct and indirect effects of the Enhanced Bus Alternative would be similar to those resulting from the No-Build Alternative. Design of the 300-space structured park-and-ride lot at the Lake Oswego Village Shopping Center under the Enhanced Bus Alternative would comply with applicable earthquake design standards for the site. There would be no cut and fill of soil under the Enhanced Bus Alternative.

C. Streetcar Alternative

The proposed Streetcar Alternative would require the construction of cut slopes and placement of engineered fill to accommodate the track and associated structures. Table 5-1 shows total estimated cut and fill volumes and estimated volume of export (excess cut material) for the various Streetcar Alternative options. In summary, the Streetcar Alternative would result in the excavation of approximately 76,350 to 95,100 cubic yards of material (depending on the design options). Approximately 11,820 to 45,850 cubic yards of the excavated material would be used as fill within the project's alignment, while approximately 37,580 to 76,200 cubic yards of excavated material would be removed from the project site, which would require locating and filling an off-site disposal area and/or identifying and contracting with other projects that could use the excess excavated material.

The majority of the engineered cuts and fills under the Streetcar Alternative would be supported by retaining walls. The Streetcar Alternative would result in approximately 22,050 to 27,450 linear feet of new retaining wall, generally along the proposed streetcar alignment, depending on the design options. Through the use of appropriate design standards, the Streetcar Alternative would avoid increasing geologic hazards, which would include the following: areas of undocumented fill and/or shrink-swell soils may be encountered, which could require additional excavation and replacement with suitable fill material; and potential rehabilitation of the Elk Rock Tunnel and associated portal

structures, which would provide improved stability of the rock within the tunnel and the rock slopes in the vicinity of the portals.

Engineered bridges and structures included in the Streetcar Alternative would be designed to withstand a major seismic event by using current applicable design standards based on site specific geologic and seismic criteria. The Streetcar Alternative would not increase the likelihood or severity of geologic or soils hazards in the project vicinity. However, through the addition of improvements along the existing Willamette Shore Line right of way, the Streetcar Alternative would lead to increased soil stability and reduced soil erosion due to the introduction of new improvements, such as new retaining walls, the mitigation of unstable soils and improved drainage.

Compared to the No-Build Alternative, the Streetcar Alternative could use additional rock resources for fill if the project's cut material does not provide acceptable fill for the project. In contrast, the excess excavated material could be used for fill for other projects, which could reduce the demand for rock generally equivalent to the amount of excess cut from the project that could be used.

Table 5-1 Estimated Cubic Feet of Cut and Fill and Linear Feet of Retaining Wall for the Streetcar Alternative By Segment and Design Option

Segment/*Design Option*	Cubic Yards of Cut	Cubic Yards of Fill	Cubic Yards of Excess Cut[1]	Linear Feet of Retaining Wall
1 – Downtown Portland	0	0	0	0
2 – South Waterfront	4,000	8,000	(4,000)	1,200
3 – Johns Landing				
Willamette Shore Line	16,350	90	16,260	5,150
Macadam In-Street	6,400	30	6,370	3,250
Macadam Additional Lane	4,600	10	4,590	2,000
4 – Sellwood Bridge	24,000	110	23,890	6,450
5 – Dunthorpe/Riverdale				
Willamette Shore Line	24,400	250	24,150	8,100
Riverwood	27,750	3,950	23,800	8,850
6 – Lake Oswego				
UPRR	19,350	3,450	15,900	4,300
Foothills Realignment	23,000	33,700	(10,700)	5,800
Total (range)	76,350 – 95,100	11,820 – 45,850	37,580– 76,200	22,050 – 27,450

[1] Excess cut material would be exported from the project site.
Source: *Lake Oswego to Portland Transit Project Streetcar Plan Set*, November 9, 2009.

Following is a summary of how the approximate volume of cut and fill material and approximate length of new retaining wall would differ by Streetcar design option, by segment.

- **Segment 3, Johns Landing.** In Segment 3, Johns Landing, the Willamette Shore Line Design Option would result in the greatest volume of cut and excess cut material (16,350 and 16,260 cubic yards, respectively) and the greatest length of new retaining wall (5,150 linear feet). There would be 6,370 and 4,590 yards of excess cut material under the Macadam In-Street and Macadam Additional Lane design options, respectively. The Macadam In-Street and Macadam Additional Lane design options would also result in 3,250 and 2,000 feet of new retaining wall, respectively.

- **Segment 5, Dunthorpe/Riverdale.** In Segment 5, Dunthorpe/Riverdale, the Riverwood Design Option would result in the greater volume of cut material (27,750 cubic yards), but the lower volume of excess cut material (23,800 cubic yards), because it would require the greater volume of fill (3,950 cubic yards), which could be supplied from the cut material. In comparison, the Willamette Shore Line Design Option would result in 24,400 and 24,150 cubic yards of cut and excess cut material, respectively. The Riverwood Design Option would result in the greater length of new retaining wall (8,850 linear feet).

- **Segment 6, Lake Oswego.** In Segment 6, Lake Oswego, the Foothills Realignment Design Option would result in the greater volume of cut material (23,000 cubic yards), but the lower volume of excess cut material (a deficit of 10,700 cubic yards), because it would require the greater volume of fill (33,700 cubic yards), which could be supplied from the cut material in this and one or more segments. In comparison, the UPRR Design Option would result in 19,350 and 15,900 cubic yards of cut and excess cut material, respectively. The Foothills Design Option would result in the greater length of new retaining wall (5,800 linear feet).

6. POTENTIAL MITIGATION MEASURES

A. Seismic Hazards

The primary seismic hazards that could affect the Lake Oswego to Portland Transit project include: liquefaction-related phenomena such as lateral spread and settlement; seismically-induced slope instability; strong ground motion; and surface fault rupture. Mitigation of these potential hazards could be achieved with one or more of the following techniques, depending upon the situation:

- Avoidance of the susceptible area(s);
- Densification of the subsurface soils through in-situ treatment including compaction or cement/chemical grout treatment;
- Removal of the liquefiable material and replacement with select backfill;
- Placement of retaining walls and/or rock-fall catchment zones or structures; and
- Improvement of rock slopes using mechanical reinforcement.

B. Landslides

Should landslides be identified through site-specific geotechnical investigations during subsequent phases of the project, stability analyses would be performed. Mitigation of landslide hazards could be accomplished using one or more of the following techniques:

- Mechanical retaining structures such as cantilevered walls, tied back walls, soil nail walls;
- Construction of shear keys and / or placement of earth buttresses at the landslide toe;
- Removal of driving forces in the upper portion of the landslide; and
- Installation of enhanced drainage facilities to redirect surface water and / or remove groundwater

C. Steep Slopes

Mitigation options for steep slope areas could include:

- Construction of retaining walls in areas of cuts (below ascending slopes) or fills (above descending slopes);
- Improvement of rock slopes using mechanical reinforcement such as rock bolts, steel mesh, shotcrete and drainage;
- If blasting is necessary to excavate rock slopes, controlled, pre-split blasting techniques should be employed to minimize damage to the finished rock cut face

D. Shrink/Swell and Hydric Soils

Hydric soils in areas of shallow groundwater may be encountered. Mitigation techniques for these soil types generally involve removal and replacement with engineered fill having properties that will provide a stable foundation for the Lake Oswego to Portland Transit facilities. Additional mitigation related to wetlands impacts may be necessary in areas where soft soils are encountered and treated (see Section 3.9 for additional information on wetlands and hydrology). If zones are encountered that involve very large volumes of unsuitable soils, it may not be economical to remove and replace all of the unsuitable base material. Other mitigation options include:

- Partial removal and replacement with a combination of geogrid or geofabric and specified rock to bridge soft and/or wet zones;
- soil treatment using amendments to improve the soil structure; and
- Permanent drainage facilities to lower the groundwater.

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APPENDIX A: SELECT OREGON WATER RESOURCES DEPARTMENT GEOTECHNICAL HOLE REPORTS WITH LOCATIONS

RECEIVED

DEC 3 0 1996

WATER RESOURCES DEPT.
SALEM, OREGON

MULT
52608

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-1

Name AT&T Wireless Services

Address 11600 SW 4th Ave.

City Portland State OR Zip 97201

(2) TYPE OF WORK

☑ New ☐ Deepening ☐ Alteration (repair/recondition) ☑ Abandonment

(3) CONSTRUCTION:

☐ Rotary Air ☐ Hand Auger ☑ Hollow Stem Auger

☐ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:

☑ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE:

Geotechnical

(6) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☐ No Depth of Completed Hole ____ ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
			n/a			

Backfill placed from ____ ft. to ____ ft. Material ____

Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
		n/a			☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability ____ Yield ____ GPM ____

Conductivity ____ PH ____

Temperature of water n/a °F/C Depth artesian flow found ____ ft.

Was water analysis done? ☐ Yes ☐ No

By whom? ____

Depth of strata analyzed. From ____ ft. to ____ ft.

Remarks:

Redmond #1598

(9) LOCATION OF HOLE by legal description:

County Multo Latitude ____ Longitude ____

Township 1 N or (S) Range 1 (E) or W. WM.

Section 15 SE 1/4 NE 1/4

Tax Lot 200 Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) 5700 SW macadam Portland, OR

Map with location indentified must be attached

(10) STATIC WATER LEVEL:

7 ft. below land surface. Date 10/26/96

Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:

Ground Elevation ____

Material Description	From	To	SWL
Asphalt & aggregate rock	0'	8"	
Native: DK gray-brown to olive brown, wet med. stiff, clayey, sandy silt.	8"	6'	
Same but, silty f. sand.	6'	12'	
DK gray-brown, silty, f. to med. sand., med. dense, silty to slightly silty.	12'	20'	

Date Started 10/26/96 Date Completed 10/26/96

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite chips & Native.	0'	20'	3 sacks

Date started 10/26/96 Date Completed 10/26/96

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10013

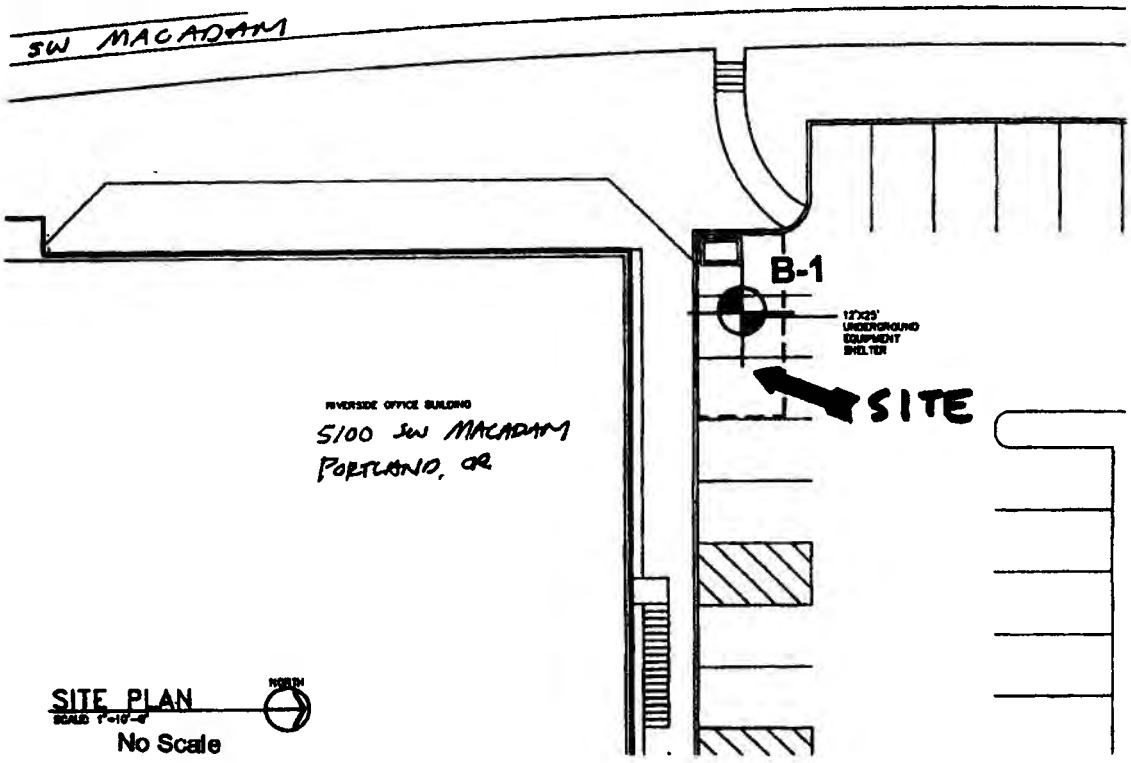
Signed Randy L. Cusman Date 11/26/96

Affiliation Cusman Drilling, Inc

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

AT&T Wireless Services
1600 SW 4th Ave
Prtld, OR 97201



Legend

B-1 Indicates approximate location of exploratory drilled boring

SITE EXPLORATION MAP

Project No. 110.069.G	PROPOSED JOHNS LANDING VAULT SITE	Figure No. 2

T1S, R1E, S15

RECEIVED

APR 15 1997

WATER RESOURCES DEPT.
SALEM, OREGON

mult
53367

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-1

Name VPT Realestate Court c/oDouglas Cornelius Mult.

Address Exchange Plate

City Boston State MA Zip 02109

(2) TYPE OF WORK

☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:

☐ Rotary Air ☐ Hand Auger ☒ Hollow Stem Auger

☐ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:

☒ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE:

Geotechnical-soil formations

(6) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☐ No Depth of Completed Hole ____ ft.

HOLE			SEAL			
Diameter	From	To	Material	From	To	Sacks or pounds
			N/A			

Backfill placed from ____ ft. to ____ ft. Material ____

Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
			N/A		☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability ____ Yield ____ GPM ____

Conductivity ____ PH ____

Temperature of water N/A °F/C Depth artesian flow found ____ ft.

Was water analysis done? ☐ Yes ☐ No

By whom? ____

Depth of strata analyzed. From ____ ft. to ____ ft.

Remarks: Redmond #1676

(9) LOCATION OF HOLE by legal description:

County Mult. Latitude ____ Longitude ____

Township 1S N or S Range 1E E or W. WM.

Section 15 SE 1/4 NE 1/4

Tax Lot 2000 Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) 5100 SW Macadam Ave.
Portland, OR

Map with location indentified must be attached

(10) STATIC WATER LEVEL:

17.0 ft. below land surface. Date 02/05/97

Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:

Ground Elevation ____

Material Description	From	To	SWL
Hard rock	0'	5'	
Brown silts.	5'	20'	
Brown silty sand.	20'	31.5'	

Date Started 02/05/97 Date Completed 02/05/97

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite chips & native.	0'	31.5'	4 sacks

Date started 02/05/97 Date Completed 02/05/97

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10374

Signed ____ Date 04/10/97

Affiliation Crisman Drilling, Inc.

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

LAKE OSWEGO QUADRANGLE
OREGON
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 OREGON CITY 15' QUADRANGLE

SCALE 1:24 000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

SITE VICINITY MAP

Project No: 278.001.G	PROPOSED SLAVIN ROAD ROWHOUSES	Figure No. 1

STATE OF OREGON

GEOTECHNICAL HOLE REPORT

MULT 54175

Received date

(as required by OAR 690-240-035)

(1) OWNER/PROJECT

Hole No. 1

Co.Job No. 624

Name AND LARRY'S WHO SONG
WHO SON AND LARRY'S

Street 4850 SW MACADAM

City PORTLAND State OR Zip 97201

(2) TYPE OF WORK

☒ New ☐ Alter (Recondition) ☐ Alter (Repair)

☐ Deepening ☐ Abandonment

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☒ Hollow Stem Auger

☐ Rotary Mud ☐ Cable Tool ☐ Push Probe Other

(4) TYPE OF HOLE

☒ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stabilit Other

(5) USE OF HOLE

(6) BORE HOLE CONSTRUCTION

Special Standards ☐ Depth of completed well 30 ft.

HOLE

Diameter	From	To
8.00	0	30

SEAL

From	To	Material	Amount	Seal Grout Weight	Units
0	30	BE	600		P

Backfill placed from ft. TO ft. Material

Filter pack placed from ft. TO ft. Size in.

(7) CASING/SCREEN

Screen ☐

(8) WELL TEST

Permeability Yield GPM

Conductivity PH

Temperature of water 58 °F/C Depth artesian flow found ft.

Was water analysis done? ☐

By Whom? WEST COAST

Depth of strata to be analyzed. From ft. to ft.

Remarks

Name of supervising Geologist/Engineer

(9) LOCATION OF HOLE By legal description

County Multnomah Latitude Longitude

Township 1.00 S Range 1.00 E

Section 15 NE 1/4 NW 1/4

Tax lot Lot Block Subdivision

Legal desc:

Street Address of Well (or nearest address)
SAME

MAP with location indentified must be attached

(10) STATIC WATER LEVEL

20.0 Ft. below land surface. Date 8/24/1997

Artesian Pressure lb/sq. in. Date

(11) SUBSURFACE LOG

Ground Elevation ft.

Material	From	To	SWL
SILTS & CLAY	0	20	
SATURATED SAND	20	30	

Date started 8/24/1997 Completed 8/24/1997

(12) ABANDONMENT LOG

Date started Completed

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

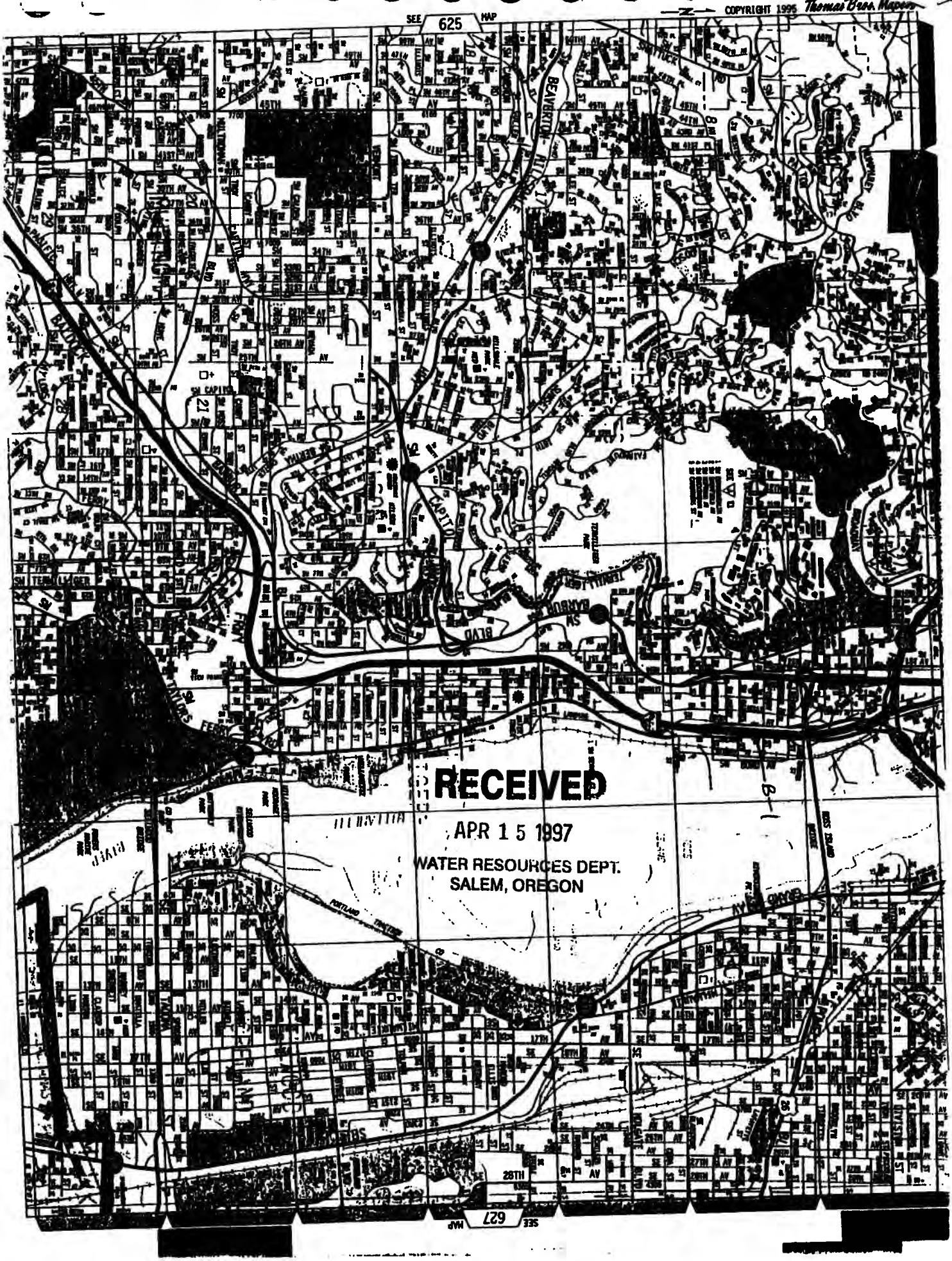
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10408

Signed By PETE LARSEN Date

Affiliation GEO-TECH EXPLORATIONS

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK



RECEIVED

APR 15 1997

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON

GEOTECHNICAL HOLE REPORT

MULT 54178

Received date

(as required by OAR 690-240-035)

(1) OWNER/PROJECT

Hole No. 4
Co.Job No. 624

Name AND LARRY'S WHO SONG
WHO SONG AND LARRY'S
Street 4850 SW MACADAM
City PORTLAND State OR Zip 97201

(2) TYPE OF WORK

☒ New ☐ Alter (Recondition) ☐ Alter (Repair)
☐ Deepening ☐ Abandonment

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☒ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☐ Push Probe Other

(4) TYPE OF HOLE

☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stabilit Other

(5) USE OF HOLE

(6) BORE HOLE CONSTRUCTION

Special Standards ☐ Depth of completed well 30 ft.

HOLE

Diameter	From	To
8.00	0	30

SEAL

From	To	Material	Amount	Seal Grout Weight	Units
0	30	BE	600		P

Backfill placed from ft. TO ft. Material
Filter pack placed from ft. TO ft. Size in.

(7) CASING/SCREEN

Screen ☐

(8) WELL TEST

Permeability Yield GPM
Conductivity PH
Temperature of water 57 °F/C Depth artesian flow found ft.
Was water analysis done? ☐
By Whom? WEST COAST
Depth of strata to be analyzed. From ft. to ft.
Remarks

Name of supervising Geologist/Engineer

(9) LOCATION OF HOLE By legal description

County Multnomah Latitude Longitude
Township 1.00 S Range 1.00 E
Section 15 NE 1/4 NW 1/4
Tax lot Lot Block Subdivision
Legal desc:

Street Address of Well (or nearest address)
SAME

MAP with location indentified must be attached

(10) STATIC WATER LEVEL

20.0 Ft. below land surface. Date 8/24/1997
Artesian Pressure lb/sq. in. Date

(11) SUBSURFACE LOG

Ground Elevation ft.

Material	From	To	SWL
SILTS & GRAVELS	0	20	
SATURATED SAND	20	30	

Date started 8/24/1997 Completed 8/24/1997

(12) ABANDONMENT LOG

Date started Completed

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10408

Signed By PETE LARSEN Date

Affiliation GEO-TECH EXPLORATIONS

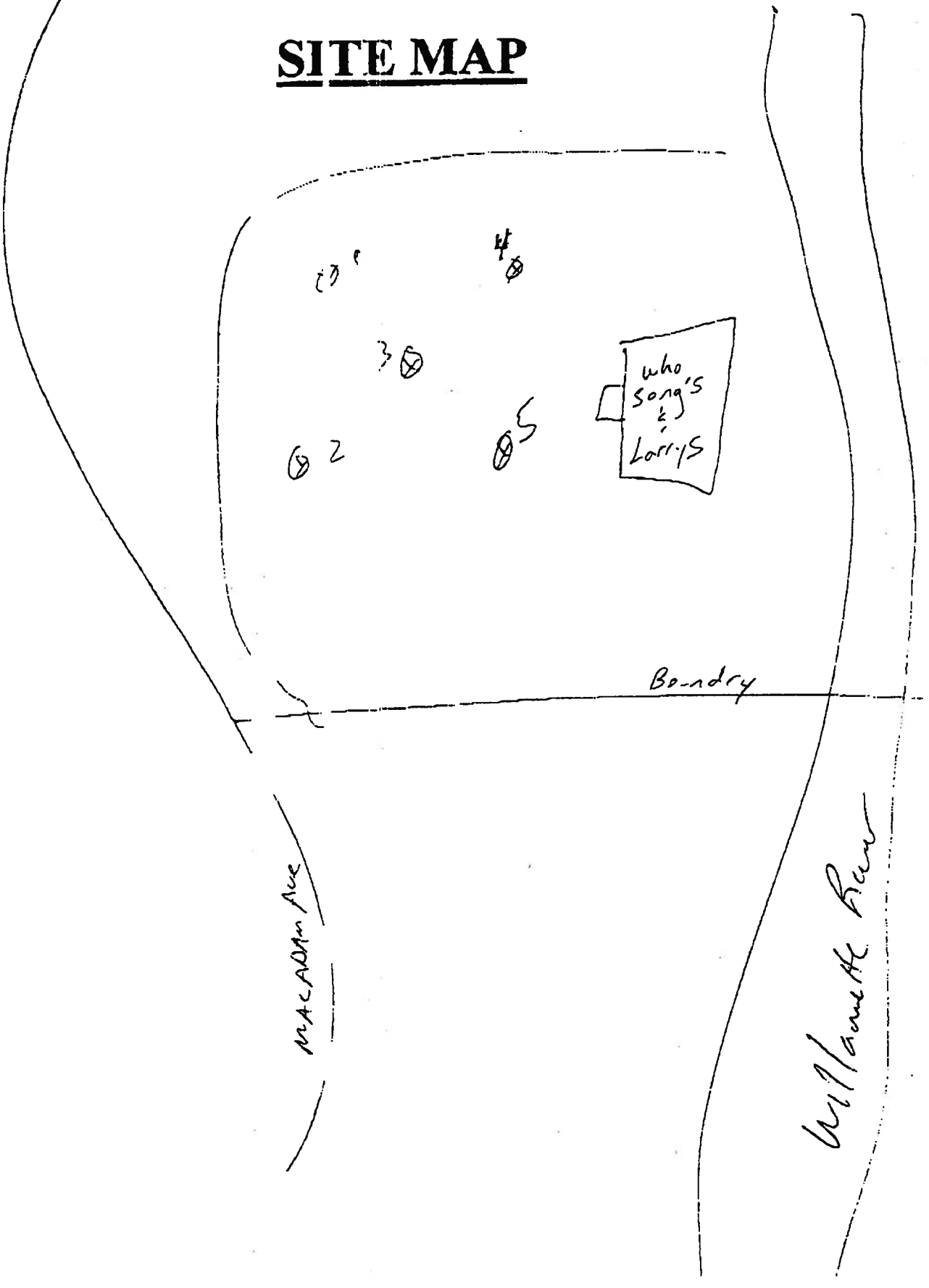
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

PDX, OR

NA

T 3N
S 4175 - S-4179

SITE MAP



1" = 50'

RECEIVED

FEB - 2 1998

WATER RESOURCES DEPT.
SALEM, OREGON

MULT 55006

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-1

Name Barry R. Smith Architect

Address 621 SW Morrison St, # 1237

City Portland State OR Zip 97205

(2) TYPE OF WORK

☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) CONSTRUCTION:

☐ Rotary Air ☐ Hand Auger ☒ Hollow Stem Auger

☐ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:

☒ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE:

Geotechnical - SPT Sampling

(6) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 21.5 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
6 in	0	20	N/A			
2 in	20	21.5				

Backfill placed from ____ ft. to ____ ft. Material ____

Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN: N/A

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST: N/A

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability ____ Yield ____ GPM ____

Conductivity ____ PH ____

Temperature of water ____ °F/C Depth artesian flow found ____ ft.

Was water analysis done? ☐ Yes ☐ No

By whom? ____

Depth of strata analyzed. From ____ ft. to ____ ft.

Remarks: ____

(9) LOCATION OF HOLE by legal description:

County Multnomah Latitude ____ Longitude ____

Township 1 N or S Range 1 E or W. WM.

Section 22 NW 1/4 NW 1/4

Tax Lot ____ Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) 6932 SW Macadam Ave, Portland, OR

Map with location indentified must be attached

(10) STATIC WATER LEVEL:

20 ft. below land surface. Date 1-20-98

Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:

Ground Elevation 36 ft

Material Description	From	To	SWL
Fill - Gray silt w/gravel	0	3	
Brown silt	3	7	
Brown silty Sand	7	17.5	
Gray Coarse Gravel	17.5	21.5	20

Date Started 1-20-98 Date Completed 1-20-98

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite Chips	0	21.5	6 sacks

Date started 1-20-98 Date Completed 1-20-98

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 61610 MWC 10081

Signed Curtis C Ehler Date 1-29-98

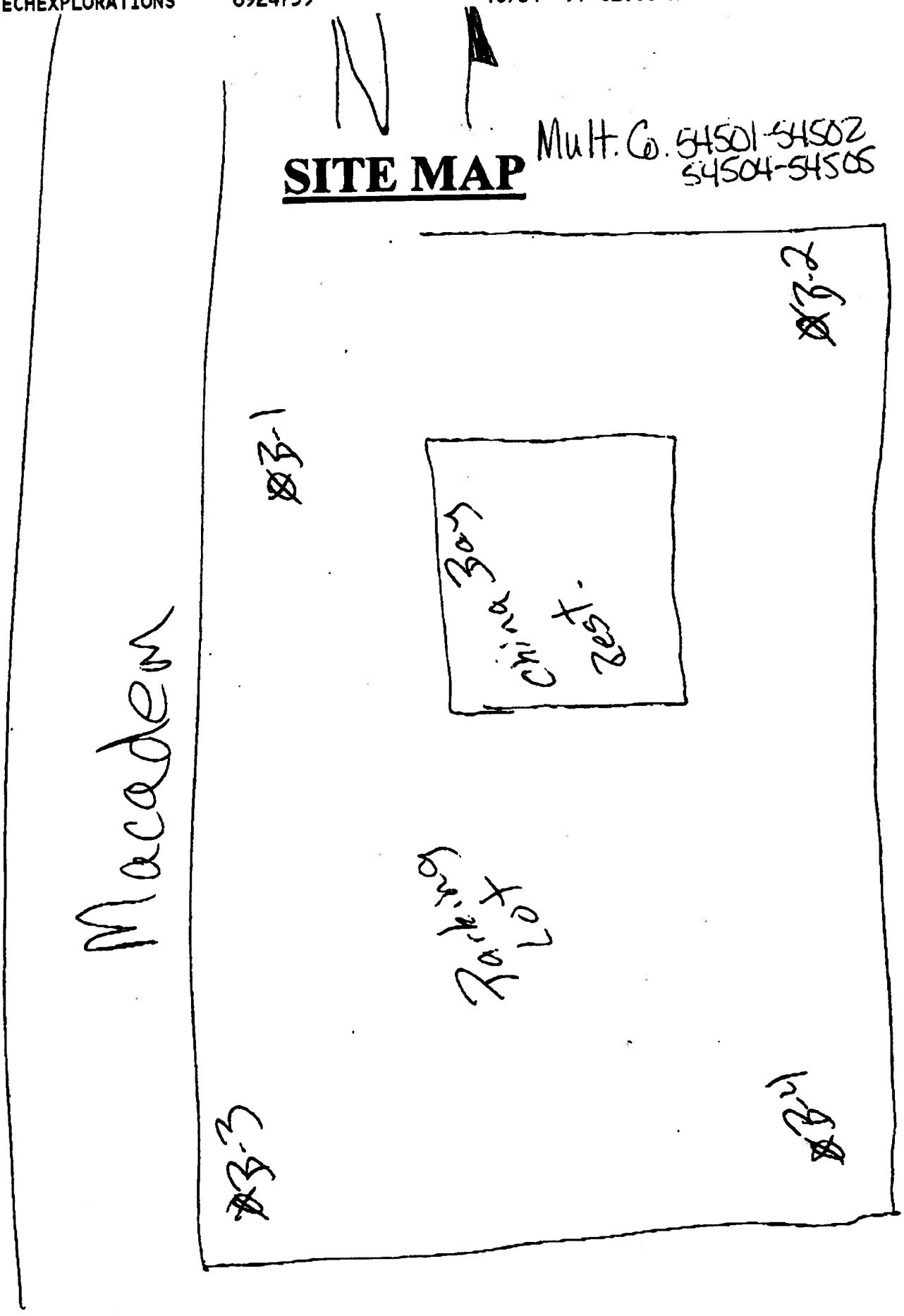
Affiliation Braun Interter Corp.

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

SITE MAP

Mult. Co. 54501-54502
54504-54506



794

STATE OF OREGON

GEOTECHNICAL HOLE REPORT

MULT 57557

Received date 03/04/1999

(as required by OAR 690-240-035)

(1) OWNER/PROJECT

Hole No.

Co.Job No. B-1

Name PAUL BRENNEKE

Street PO BOX 6059

City PORTLAND State OR Zip 97228

(2) TYPE OF WORK

☒ New ☐ Alter (Recondition) ☐ Alter (Repair)

☐ Deepening ☐ Abandonment

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger

☒ Rotary Mud ☐ Cable Tool ☐ Push Probe Other

(4) TYPE OF HOLE

☒ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stability Other

(5) USE OF HOLE

GEOTECHNICAL STUDY

(6) BORE HOLE CONSTRUCTION

Special Standards ☐ Depth of completed well 24 ft.

HOLE

Diameter	From	To
5.00	0.00	24

SEAL

From	To	Material	Amount	Seal Grout Weight	Units
0.00	24.00	Bentonite	3.00		S

Backfill placed from ft. TO ft. Material

Filter pack placed from ft. TO ft. Size in.

(7) CASING/SCREEN

Screen ☐

(8) WELL TEST

Permeability Yield GPM

Conductivity PH

Temperature of water 54 °F/C Depth artesian flow found ft.

Was water analysis done? ☐

By Whom? GRI

Depth of strata to be analyzed. From ft. to ft.

Remarks

Name of supervising Geologist/Engineer

(9) LOCATION OF HOLE By legal description

County Multnomah Latitude Longitude

Township 1.00 S Range 1.00 E

Section 15 1/4 1/4

Tax lot Lot Block Subdivision

Legal desc:

Street Address of Well (or nearest address)

4630 SW MACADAM AVE

MAP with location indentified must be attached

(10) STATIC WATER LEVEL

Ft. below land surface. Date

Artesian Pressure lb/sq. in. Date

(11) SUBSURFACE LOG

Ground Elevation ft.

Material	From	To	SWL
GRAVELS	0	2	
SILT	2	22	
BEDROCK	22	24	

Date started 02/04/1999 Completed 02/04/1999

(12) ABANDONMENT LOG

Date started Completed

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

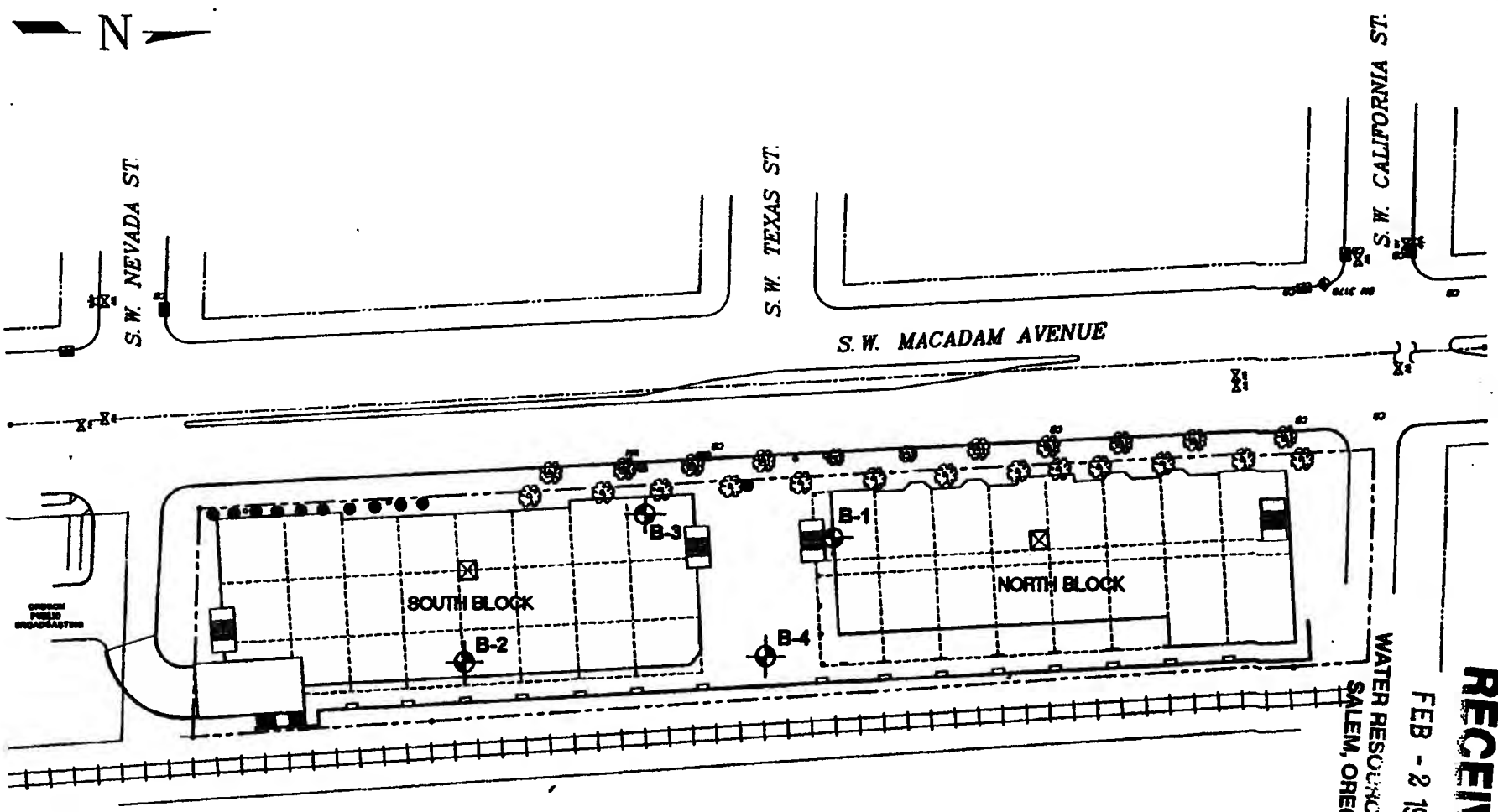
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10452

Signed By LARRY INSELMAN Date

Affiliation GEO TECH EXPLORATIONS

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK



REFERENCE: BARRY R. SMITH, NCARB, PC, ARCHITECT – PRELIMINARY SITE PLAN

BRAUN INTERTEC

BORING LOCATIONS
WILLAMETTE PARK PLACE
S.W. MACADAM AVENUE & TEXAS STREET
PORTLAND, OREGON

DRAWN BY: R.F.
JOB NO: EAAX-98-0105
DATE: 1-29-98
DRAWING NO: 1 OF 1
FIGURE NO: 2
SCALE: 1"=60'

STATE OF OREGON

GEOTECHNICAL HOLE REPORT

MULT 57558

Received date 03/04/1999

(as required by OAR 690-240-035)

(1) OWNER/PROJECT

Hole No.

Co.Job No. B-2

Name PAUL BRENNEKE

Street PO BOX 6059

City PORTLAND State OR Zip 97228

(2) TYPE OF WORK

☒ New ☐ Alter (Recondition) ☐ Alter (Repair)

☐ Deepening ☒ Abandonment

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger

☒ Rotary Mud ☐ Cable Tool ☐ Push Probe Other

(4) TYPE OF HOLE

☒ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stability Other

(5) USE OF HOLE

GEOTECHNICAL STUDY

(6) BORE HOLE CONSTRUCTION

Special Standards ☐ Depth of completed well 16 ft.

HOLE

Diameter	From	To
5.00	0.00	16

SEAL

From	To	Material	Amount	Seal Grout Weight	Units
0.00	16.00	Bentonite	2.00		S

Backfill placed from ft. TO ft. Material

Filter pack placed from ft. TO ft. Size in.

(7) CASING/SCREEN

Screen ☐

(8) WELL TEST

Permeability Yield GPM

Conductivity PH

Temperature of water °F/C Depth artesian flow found ft.

Was water analysis done? ☐

By Whom?

Depth of strata to be analyzed. From ft. to ft.

Remarks

Name of supervising Geologist/Engineer

(9) LOCATION OF HOLE By legal description

County Multnomah Latitude Longitude

Township 1.00 S Range 1.00 E

Section 15 SW 1/4 NE 1/4

Tax lot Lot Block Subdivision

Legal desc:

Street Address of Well (or nearest address)

4630 SW MACADAM

MAP with location indentified must be attached

(10) STATIC WATER LEVEL

Ft. below land surface. Date

Artesian Pressure lb/sq. in. Date

(11) SUBSURFACE LOG

Ground Elevation ft.

Material	From	To	SWL
GRAVELS	0	2	
SILT	2	15	
BEDROCK	15	16	

Date started 02/04/1999 Completed 02/04/1999

(12) ABANDONMENT LOG

Date started Completed

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10452

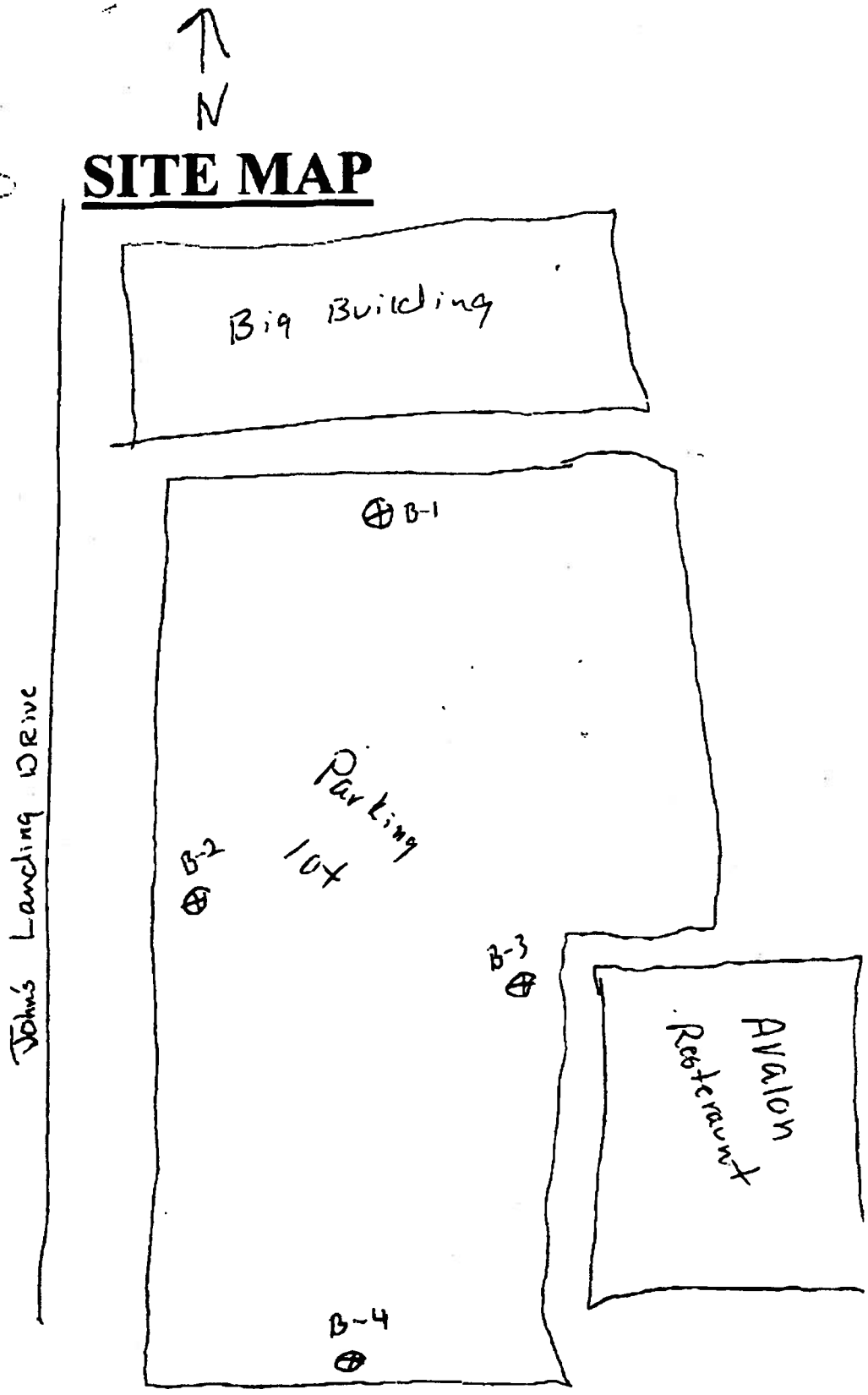
Signed By LARRY INSELMAN Date

Affiliation GEO TECH EXPLORATIONS

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Multnomah
57557 - 57560

SITE MAP



STATE OF OREGON

GEOTECHNICAL HOLE REPORT

MULT 57559

Received date 03/04/1999

(as required by OAR 690-240-035)

(1) OWNER/PROJECT

Hole No.

Co.Job No. B-3

Name PAUL BRENNEKE

Street PO BOX 6059

City PORTLAND State OR Zip 97228

(2) TYPE OF WORK

☒ New ☐ Alter (Recondition) ☐ Alter (Repair)

☐ Deepening ☒ Abandonment

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger

☒ Rotary Mud ☐ Cable Tool ☐ Push Probe Other

(4) TYPE OF HOLE

☒ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stability Other

(5) USE OF HOLE

GEOTECHNICAL STUDY

(6) BORE HOLE CONSTRUCTION

Special Standards ☐ Depth of completed well 19 ft.

HOLE

Diameter	From	To
5.00	0.00	19

SEAL

From	To	Material	Amount	Seal Grout Weight	Units
0.00	19.00	Bentonite	3.00		S

Backfill placed from ft. TO ft. Material

Filter pack placed from ft. TO ft. Size in.

(7) CASING/SCREEN

Screen ☐

(8) WELL TEST

Permeability Yield GPM

Conductivity PH

Temperature of water °F/C Depth artesian flow found ft.

Was water analysis done? ☐

By Whom?

Depth of strata to be analyzed. From ft. to ft.

Remarks

Name of supervising Geologist/Engineer

(9) LOCATION OF HOLE By legal description

County Multnomah Latitude Longitude

Township 1.00 S Range 1.00 E

Section 15 SW 1/4 NE 1/4

Tax lot Lot Block Subdivision

Legal desc:

Street Address of Well (or nearest address)

4630 SW MACADAM

MAP with location indentified must be attached

(10) STATIC WATER LEVEL

Ft. below land surface. Date

Artesian Pressure lb/sq. in. Date

(11) SUBSURFACE LOG

Ground Elevation ft.

Material	From	To	SWL
GRAVELS	0	2	
SILT	2	18	
BEDROCK	18	19	

Date started 02/04/1999 Completed 02/04/1999

(12) ABANDONMENT LOG

Date started Completed

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10452

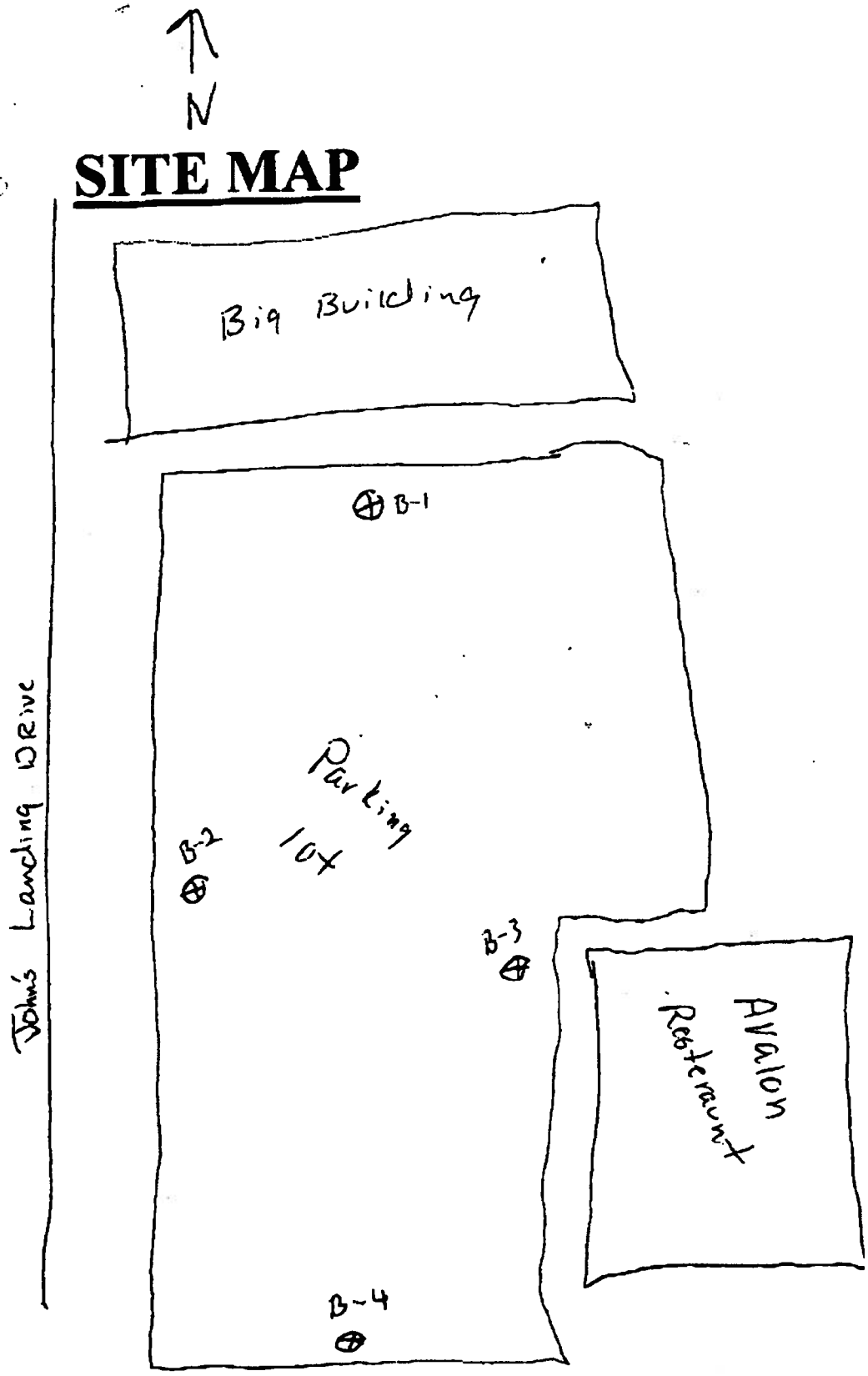
Signed By LARRY INSELMAN Date

Affiliation GEO TECH EXPLORATIONS

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Multnomah
S7557 - S7560

SITE MAP



STATE OF OREGON

GEOTECHNICAL HOLE REPORT

MULT 60298

Received date 03/14/2000

(as required by OAR 690-240-035)

(1) OWNER/PROJECT

Hole No.

Co.Job No. BH-12

Name CITY OF PORTLAND; DEPARTMENT OF TRANSPO

Street 1120 SW 5TH AVE, STE 800

City PORTLAND State OR Zip 97204

(2) TYPE OF WORK

☒ New ☐ Alter (Recondition) ☐ Alter (Repair)

☐ Deepening ☐ Abandonment

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☒ Hollow Stem Auger

☐ Rotary Mud ☐ Cable Tool ☐ Push Probe Other

(4) TYPE OF HOLE

☐ Uncased Temporary ☐ Cased Permanent

☐ Uncased Permanent ☐ Slope Stability Other VIBRATING PIEZOMETER

(5) USE OF HOLE

VIBRATING PIEZOMETER

(6) BORE HOLE CONSTRUCTION

Special Standards ☐ Depth of completed well 35 ft.

HOLE

Diameter	From	To
8.00	0.00	35

SEAL

From	To	Material	Amount	Seal Grout Weight	Units
0.00	1.00	Concrete	2.00		S
1.00	30.00	Bentonite	19.00		S
30.00	35.00	Other	4.00		S

Backfill placed from ft.

Filter pack placed from ft. TO ft. Size in.

(7) CASING/SCREEN

Screen ☐

(8) WELL TEST

Permeability Yield GPM

Conductivity PH

Temperature of water °F/C Depth artesian flow found ft.

Was water analysis done? ☐

By Whom?

Depth of strata to be analyzed. From ft. to ft.

Remarks

Name of supervising Geologist/Engineer

(9) LOCATION OF HOLE By legal description

County Multnomah Latitude Longitude

Township 1.00 S Range 1.00 E

Section 22 SE 1/4 SW 1/4

Tax lot Lot Block Subdivision

Legal desc:

Street Address of Well (or nearest address)

SW VIRGINIA & SW NEVADA

MAP with location indentified must be attached

(10) STATIC WATER LEVEL

Ft. below land surface. Date

Artesian Pressure lb/sq. in. Date

(11) SUBSURFACE LOG

Ground Elevation ft.

Material	From	To	SWL
SILTY SANDS	0	35	

Date started 02/23/2000 Completed 02/23/2000

(12) ABANDONMENT LOG

Date started Completed

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10076

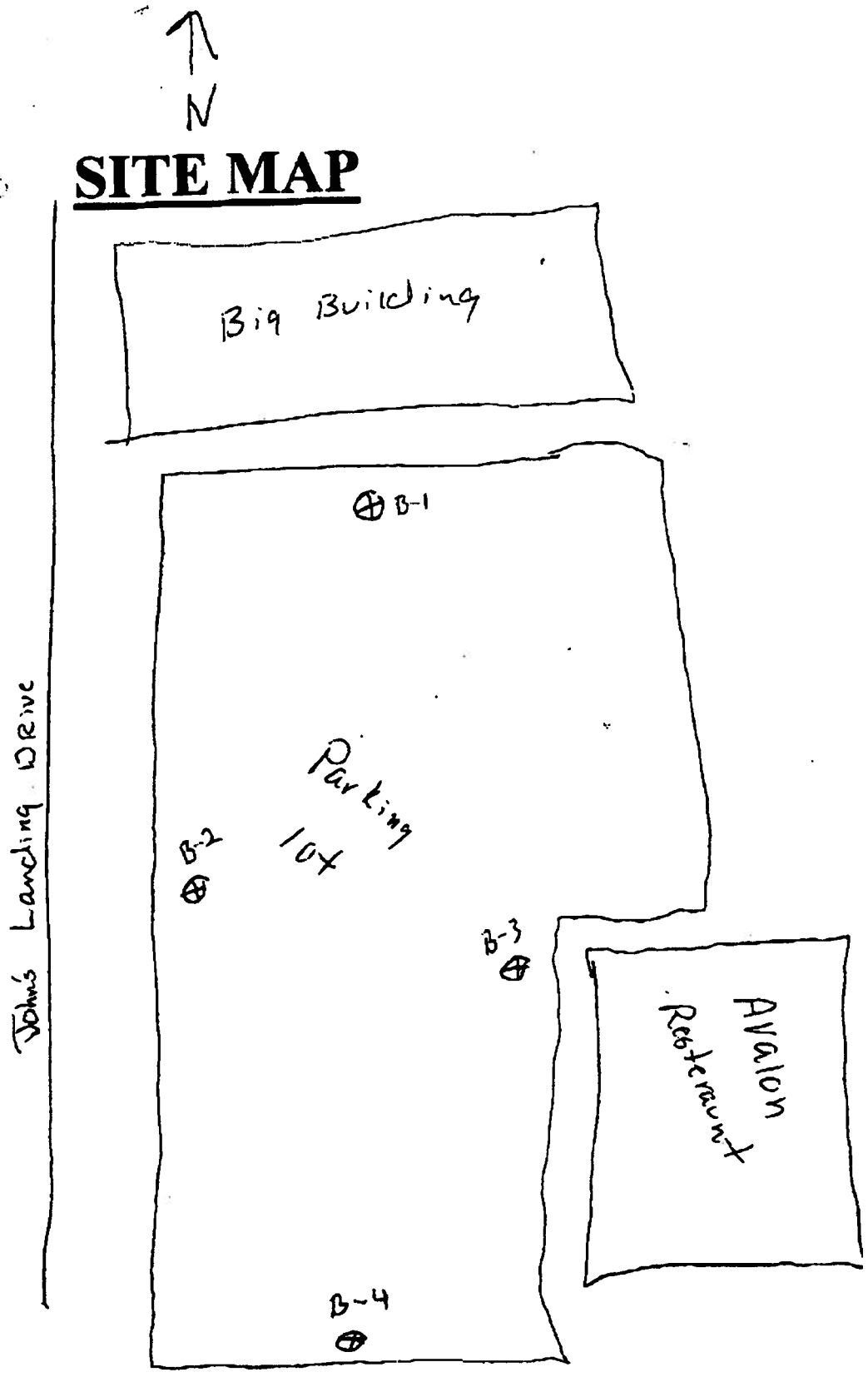
Signed By BRADLEY WIEBERDINK Date

Affiliation GEO TECH EXPLORATIONS

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Multnomah
5755.7 - 57560

SITE MAP



MULT 63611

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-3
Name City of Portland
Address 1120 SW Fifth Ave
City Portland State OR Zip 97204

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(5) CONSTRUCTION:
[ ] Rotary Air [ ] Hand Auger [X] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [ ] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[X] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE:
Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Hole 23 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
8	0	23				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
		N/A			[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Screen:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water 51 °F/C Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [X] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Mult Latitude ____ Longitude ____
Township 1S N or (S) Range 1E (E) or W. WM.
Section 15 NW 1/4 NW 1/4
Tax Lot R&W Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) SW Slavin

Map with location identified must be attached

(10) STATIC WATER LEVEL:
8 ft. below land surface. Date 4/3/01
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Sandy Silts	0	9	8
Basalt	9	23	

Date Started 4/3/01 Date Completed 4/3/01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	23	11 bags

Date started 4/3/01 Date Completed 4/3/01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

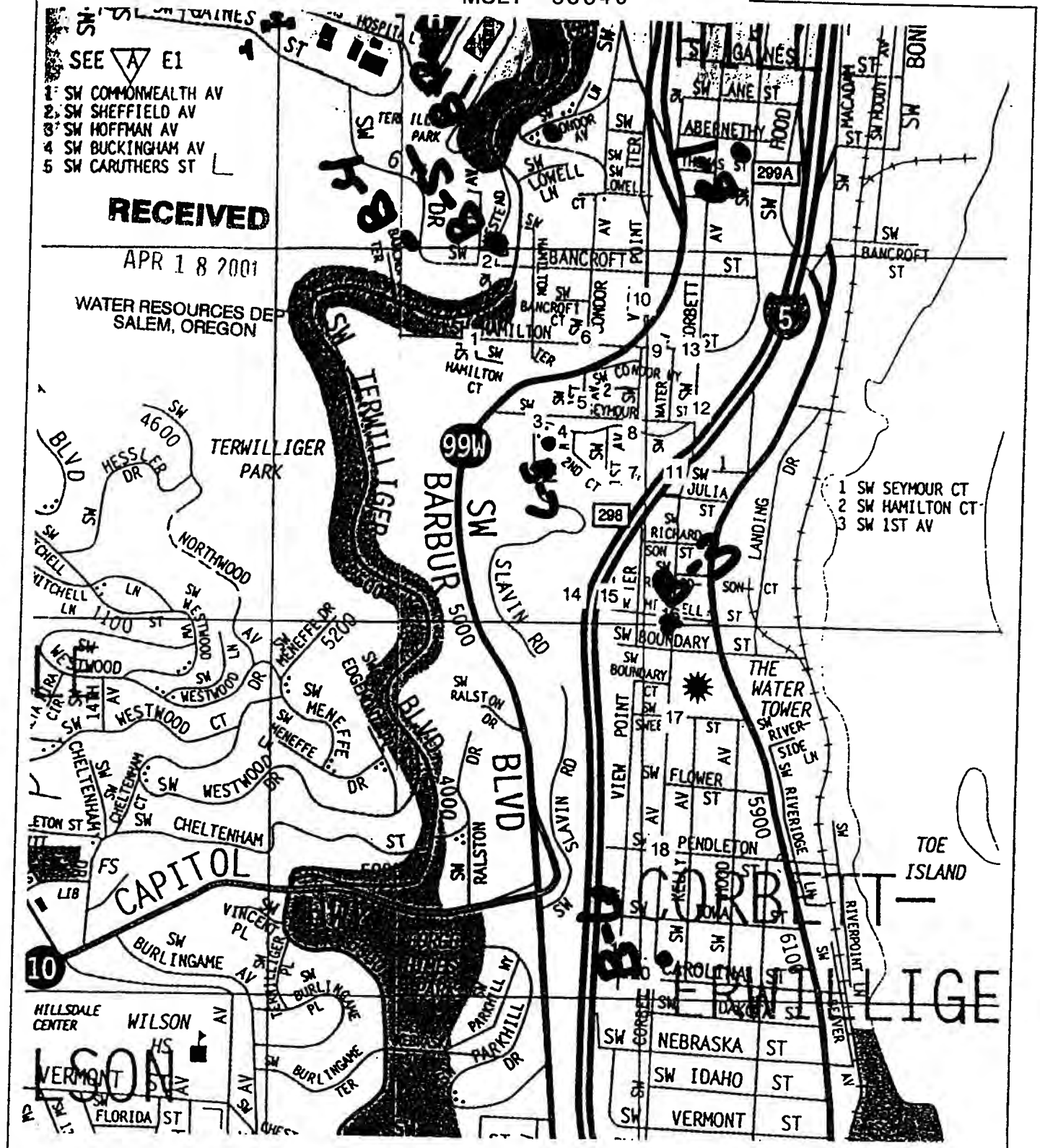
I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10225
Signed David Abernathy Date 4/26/01
Affiliation Geo-Tech Explorations, Inc.

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

MULT 63549



1 inch = ~~200~~ 450 feet

N

From 2000 Thomas Guide

Carolina Basin Stream Diversion
Portland, Oregon

BOREHOLE LOCATION MAP

March 2001 F-3145 01

FUJITANI HILTS & ASSOCIATES
Geotechnical Consultants
Portland, Oregon

FIG. 1

RECEIVED MULT 64539

AUG 2 0 2001

WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number GP-1
Name Jiffy Oil
Address 2737 W. Commodore Way
City Seattle State WA Zip 98199

(2) TYPE OF WORK
☑ New ☐ Deepening ☐ Alteration (repair/recondition) ☑ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☑ Push Probe ☐ Other

(4) TYPE OF HOLE:
☑ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE: Check Soil Quality

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☑ No Depth of Completed Hole 20 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
2"	0'	20'	Asphalt Patch	0'	8"	
			Bent. Chips	8"	20'	40#s

Backfill placed from 8" ft. to 20 ft. Material Bent. Chips
Filter Pack placed from ____ ft. to ____ ft. Size of pack N/A

(7) CASING/SCREEN.

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
		N/A			☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water N/A °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☐ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1S N or S Range 1E E or W. WM.
Section 15 NW 1/4 NE 1/4
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 5235 SW Macadam Ave Portland, OR

Map with location identified must be attached

(10) STATIC WATER LEVEL:
N/A ft. below land surface. Date July 27, 2001
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Asphalt	0'	3"	N/A
Med Brown Silty Sand	3"	20'	

Date Started July 27, 2001 Date Completed July 27, 2001

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Asphalt Patch	0'	8"	
Bentonite Chips	8"	20'	40#s

Date started July 27, 2001 Date Completed July 27, 2001

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 1043
Signed B. R. Gatbuth Date July 27, 2001
Affiliation CASCADE DRILLING, INC-OREGON

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

OR1116

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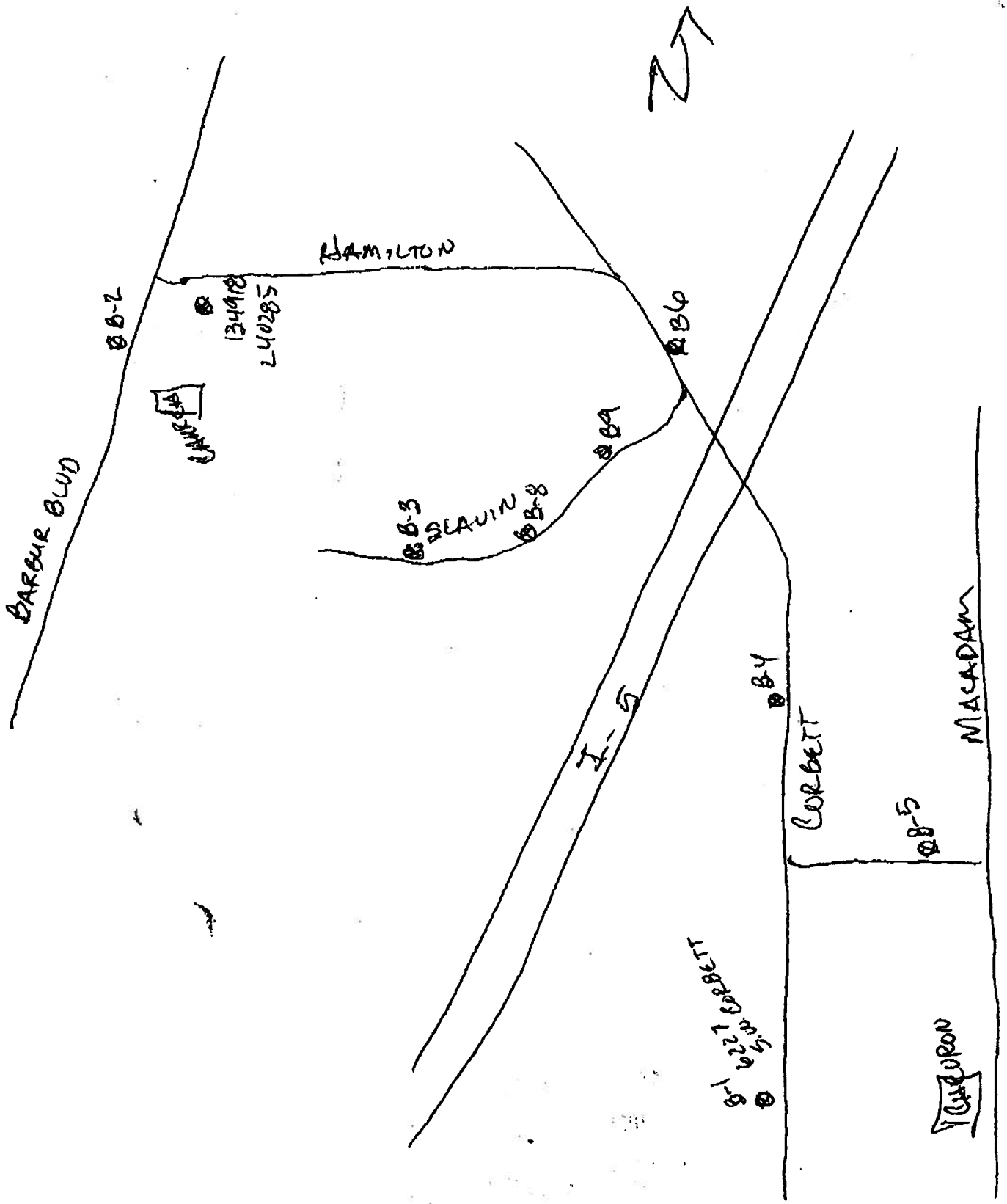
HAMILTON
B-2
B-1
B-6
B-4
B-3
B-8
B-5
BARBUR BLVD
I-5
SLAVIN
CORBETT
MACADAM

MULT 64542

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WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

Hole Number GP-4

(1) OWNER/PROJECT:
Name Time Oil
Address 2737 W. Commodore Way
City Seattle State WA Zip 98199

(2) TYPE OF WORK
☑ New ☐ Deepening ☐ Alteration (repair/recondition) ☑ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☑ Push Probe ☐ Other

(4) TYPE OF HOLE:
☑ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE: Check Soil Quality

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☑ No Depth of Completed Hole 28 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
2"	0'	28'	Asphalt Patch	0'	8"	
			Bent. Chip's	8"	28'	50 #'s

Backfill placed from 8" ft. to 28' ft. Material Bent. Chip's
Filter Pack placed from ____ ft. to ____ ft. Size of pack N/A

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:		N/A			☐	☐	☐	☐
Screen:					☐	☐	☐	☐

Slot size

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water 56° °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☐ No
By whom?
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks:

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1S N or S Range 1E E or W. WM.
Section 15 NW 1/4 NE 1/4
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 5235 SW Macadam Ave Portland, OR

Map with location identified must be attached

(10) STATIC WATER LEVEL:
26.5 ft. below land surface. Date July 27, 2001
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
ASPHALT	0'	3"	
MAD. BROWN SILTY SAND	3"	24'	
MAD. BROWN MAD. SAND	24'	28'	26.5

Date Started July 27, 2001 Date Completed July 27, 2001

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
ASPHALT PATCH	0'	8"	
BENTONITE CHIP'S	8"	28'	50 #'s

Date started July 27, 2001 Date Completed July 27, 2001

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10443
Signed B R. Gottselig Date July 27, 2001
Affiliation CASCADE DRILLING, INC-OREGON

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

OR1116

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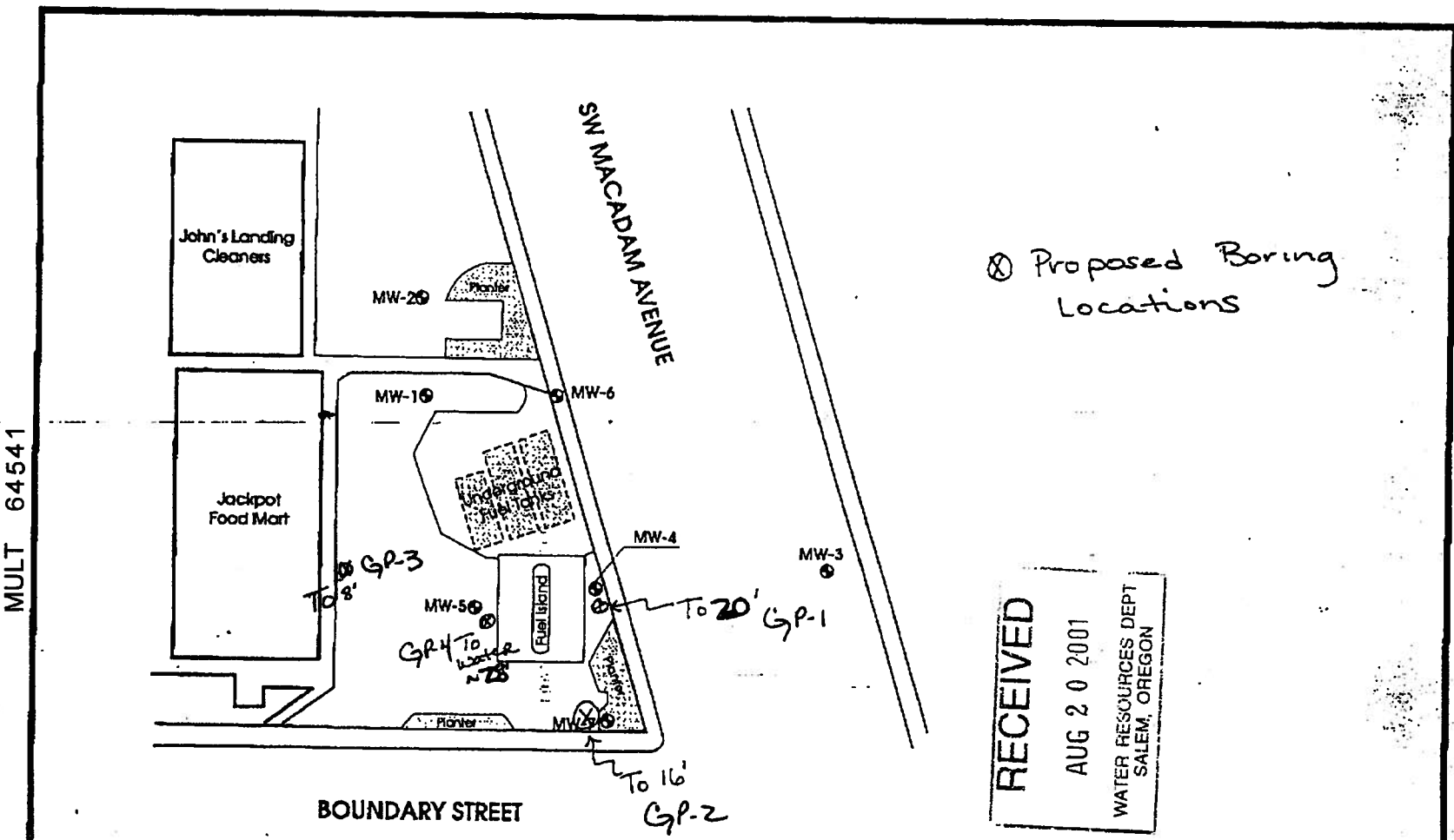
MULT 64541



0 40 80
APPROXIMATE SCALE:
1 INCH = 40 FEET

KLEINFELDER

LA2001\Projects\60536705\Gfx101\536705Q1F2.cdr 02/01 KDL

TIME OIL FACILITY #03-074
5235 SW MACADAM AVENUE
PORTLAND, OREGON

Project # 60-5367-05

FIGURE

MULT 64953

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number P-1
Name Roger Pollack
Address 6932 S.W. Macadam Ave
City Portland State OR Zip 97219

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(3) CONSTRUCTION:
[ ] Rotary Air [ ] Hand Auger [ ] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [X] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE: Soil Samples

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Hole 20 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
2	0	20				
				X		

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
			X		[ ]	[ ]	[ ]	[ ]
Screen:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water 51 °F/C Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [X] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or S Range 1 E or W. WM.
Section 22 NE 1/4 NE 1/4
Tax Lot 500 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____
Same

Map with location identified must be attached

(10) STATIC WATER LEVEL:
19 ft. below land surface. Date 8/28/01
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Gravelly Sands	0	20	19

Date Started 8/28/01 Date Completed 8/28/01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	20	31 55

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SALEM, OREGON

Date started 8/28/01 Date Completed 8/28/01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10357
Signed ____ Date 9/20/01
Affiliation Geo-Tech

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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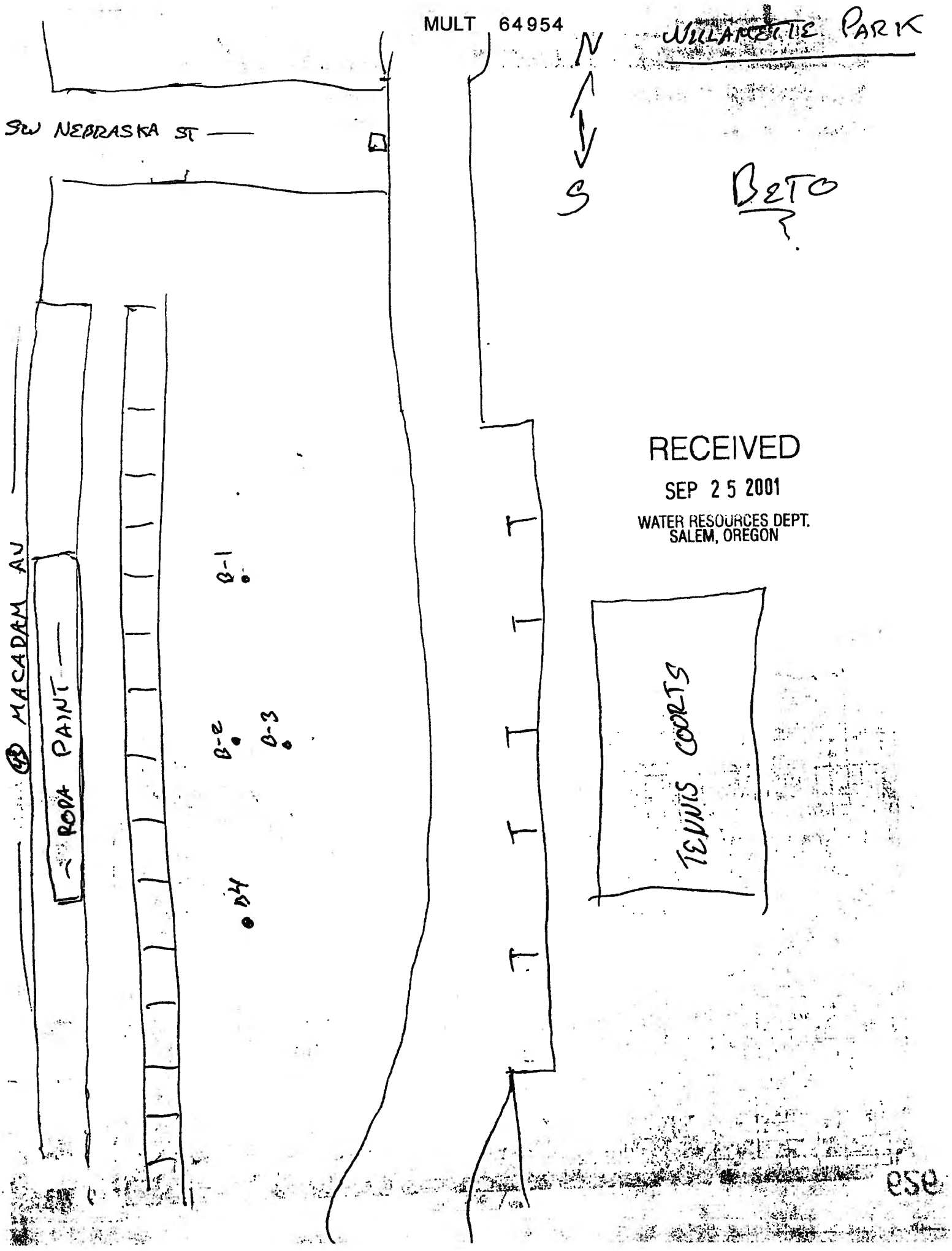
MULT 64954



ESE

MULT 64956

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number P-4
Name Roger Pollack
Address 6932 S.W. Macadam Ave.
City Portland State OR Zip 97219

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(3) CONSTRUCTION:
[ ] Rotary Air [ ] Hand Auger [ ] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [X] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE:
Soil Samples

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Hole 20 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
2	0	20				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
				X	[ ]	[ ]	[ ]	[ ]
Screen:				X	[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water 51 °F/C Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [X] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 22 NE 1/4 NE 1/4
Tax Lot 500 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____
Same

Map with location identified must be attached

(10) STATIC WATER LEVEL:
19 ft. below land surface. Date 8/28/01
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Gravels & Sands	0	20	19

Date Started 8/28/01 Date Completed 8/28/01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	20	31 lbs

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WATER RESOURCES DEPT.
SALEM, OREGON

Date started 8/28/01 Date Completed 8/28/01

Professional Certification
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I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10357
Signed ____ Date 9/20/01
Affiliation Geo-Tech Explorations

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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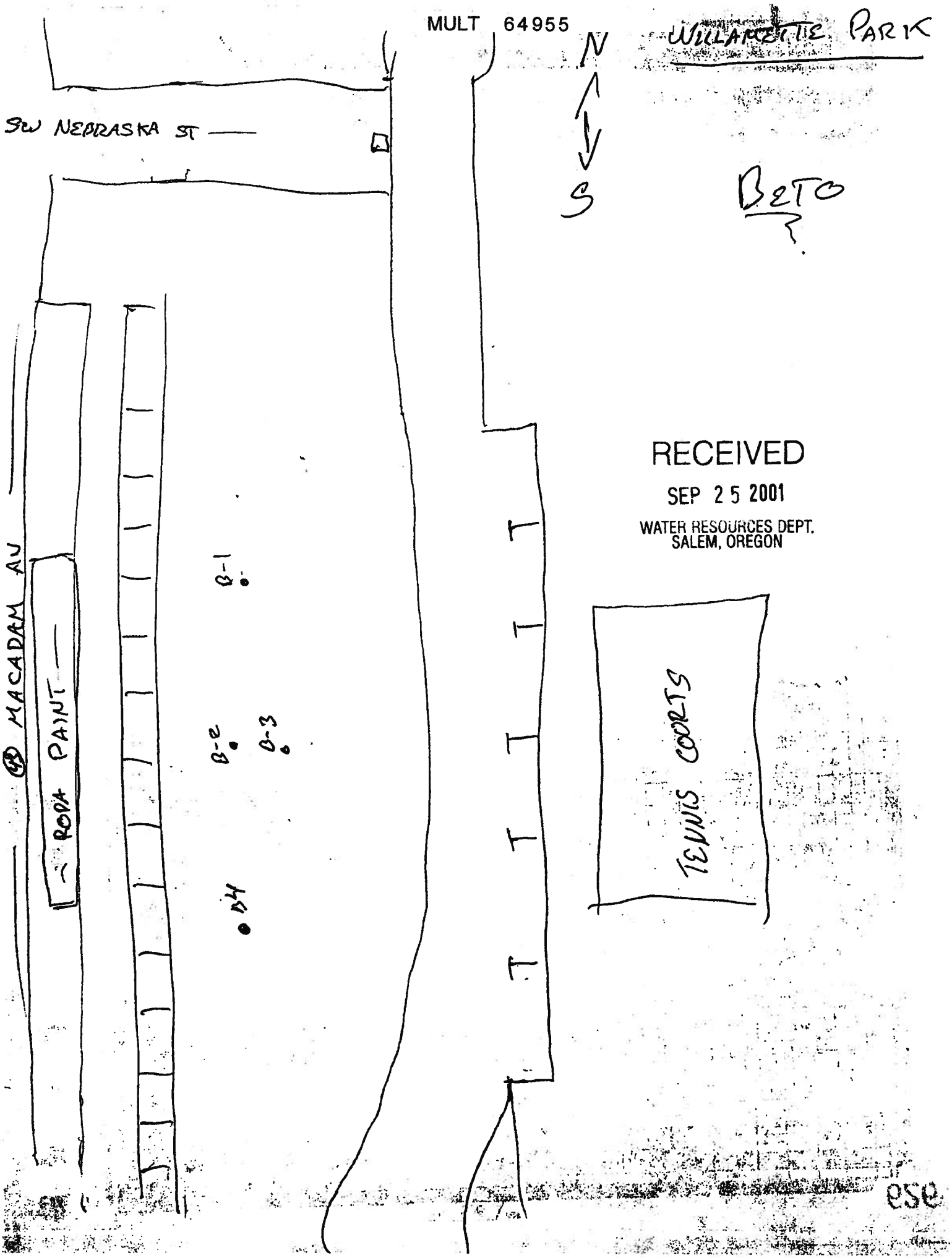
MULT 64955
WILLAMETTE PARK
SW NEBRASKA ST
N
S
BETO
MACADAM AV
ROAD PAINT
B-1
B-2
B-3
B-4
TENNIS COURTS
RECEIVED
SEP 25 2001
WATER RESOURCES DEPT.
SALEM, OREGON
ESE

MULT 65088

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-8
Name ODOT Dist 2
Address 5440 S.W. Westgate Dr Ste 350
City Portland State OR Zip 97221

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(3) CONSTRUCTION:
[ ] Rotary Air [ ] Hand Auger [X] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [ ] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE: Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Hole 20 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
4 1/4	0	20				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Screen:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water ____ °F/C Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [ ] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 15 NE 1/4 NW 1/4
Tax Lot R&W Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) SW Pendleton & SW Corbett

Map with location identified must be attached

(10) STATIC WATER LEVEL:
____ ft. below land surface. Date ____
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Asphalt	0	1	
Sand	1	20	

Date Started 10/1/01 Date Completed 10/01/01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	20	6 bags

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WATER RESOURCES DEPT
SALEM, OREGON

Date started 10/01/01 Date Completed 10/01/01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 1046Z
Signed ____ Date 10/16/01
Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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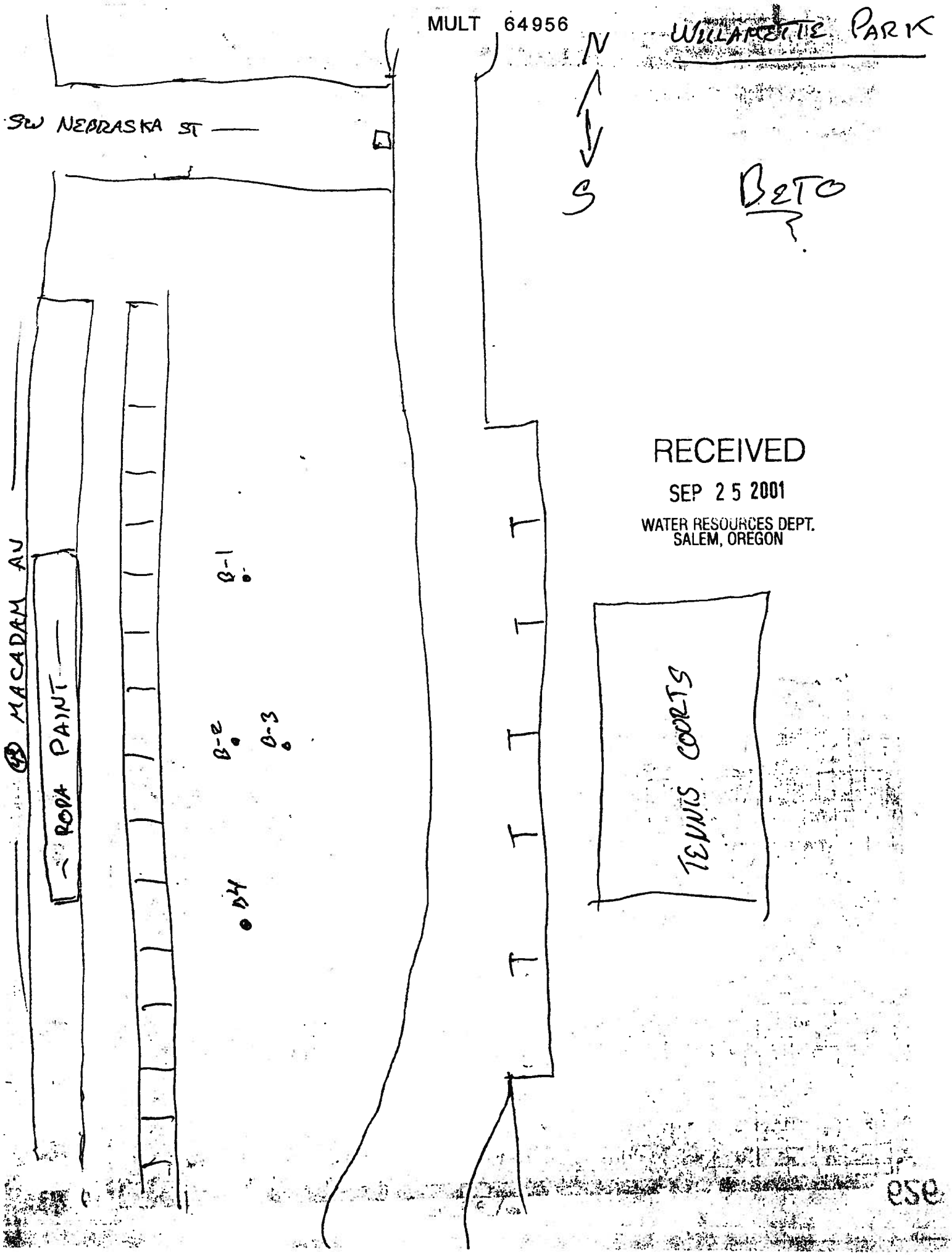
MULT 64956
WILLAMETTE PARK
N
S
BETO
SW NEBRASKA ST
MACADAM AV
ROSA PAINT
B-1
B-2
B-3
B-4
TENNIS COURTS
RECEIVED
SEP 25 2001
WATER RESOURCES DEPT.
SALEM, OREGON
ESE

MULT 65090

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-30
Name ODOT, Dist. 2
Address 5440 SW Westgate Dr, Ste 300
City Portland State OR Zip 97221

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☒ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE:
Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 20 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
4"ø	0	20				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water ____ °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☐ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or S Range 1 E or W. WM.
Section 16 NE 1/4 NW 1/4
Tax Lot Row Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) SW Flower St & SW

Map with location identified must be attached

(10) STATIC WATER LEVEL:
____ ft. below land surface. Date ____
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Asphalt	0	1	
Sand	1	20	

Date Started 10/1/01 Date Completed 10/1/01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	20	7 bags

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OCT 18 2001
WATER RESOURCES DEPT
SALEM, OREGON

Date started 10/1/01 Date Completed 10/1/01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 1062
Signed ____ Date 10/16/01
Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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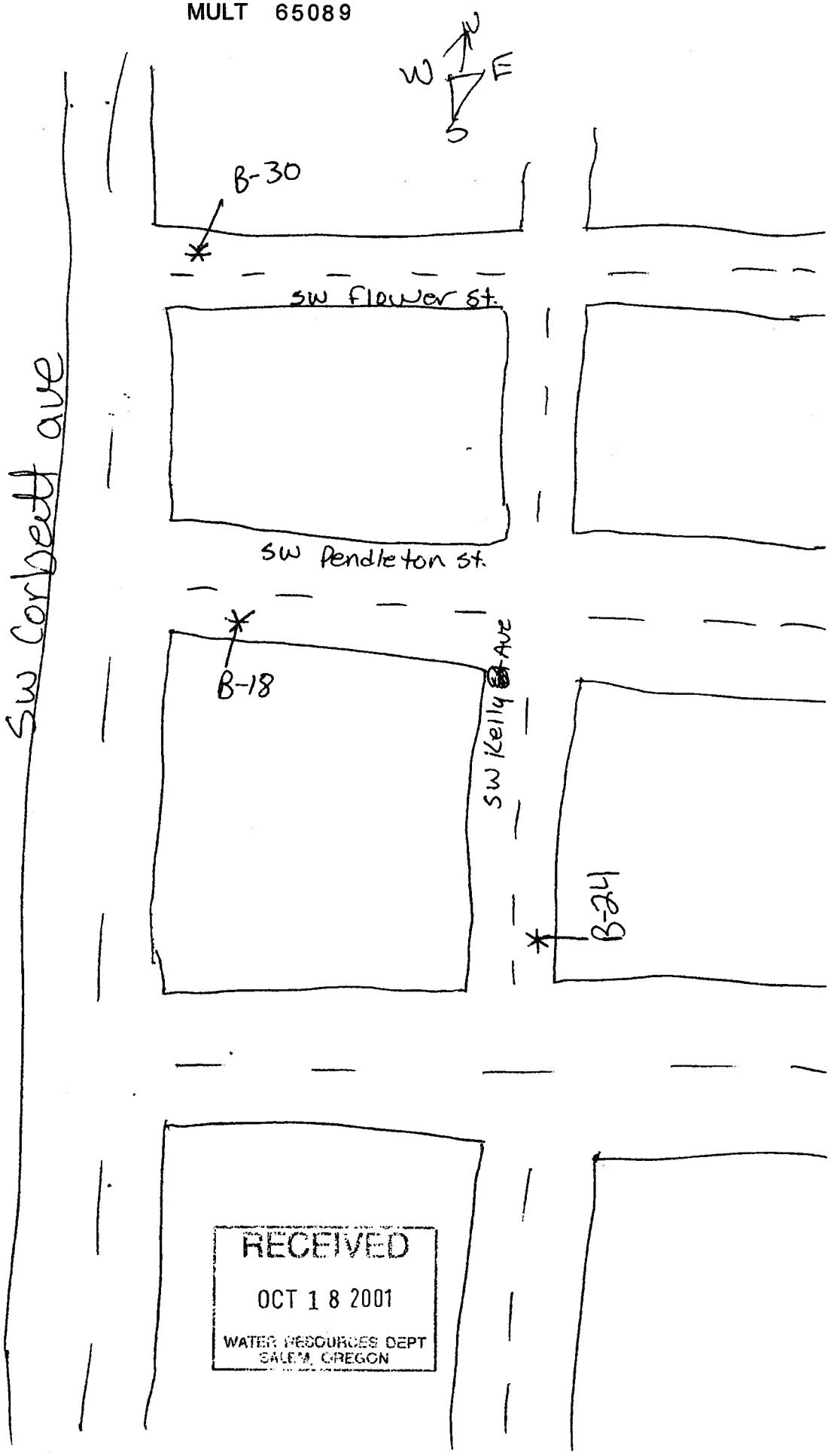
MULT 65089



MULT 65559

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-2
Name Willamette Landing Associates, LLC
Address 1325 NW Flanders St.
City Portland State OR Zip 97209

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☒ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE: Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 30 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
5	0	30				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water 48 °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☒ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 15 SE 1/4 NW 1/4
Tax Lot 600 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 5310 SW Macadam

Map with location identified must be attached

(10) STATIC WATER LEVEL:
21 ft. below land surface. Date 11/28/01
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Asphalt	0	0.4	
Baserock	0.4	1.5	
Silty Gravel w/ Wood	1.5	6	
Sand & Silty Gravels	6	18	
Sand Gravels Cobbles	18	30	

Date Started 11/28/01 Date Completed 11/28/01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	30	6 bags

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WATER RESOURCES DEPT
SALEM, OREGON

Date started 11/28/01 Date Completed 11/28/01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10033
Signed ____ Date 12/20/01
Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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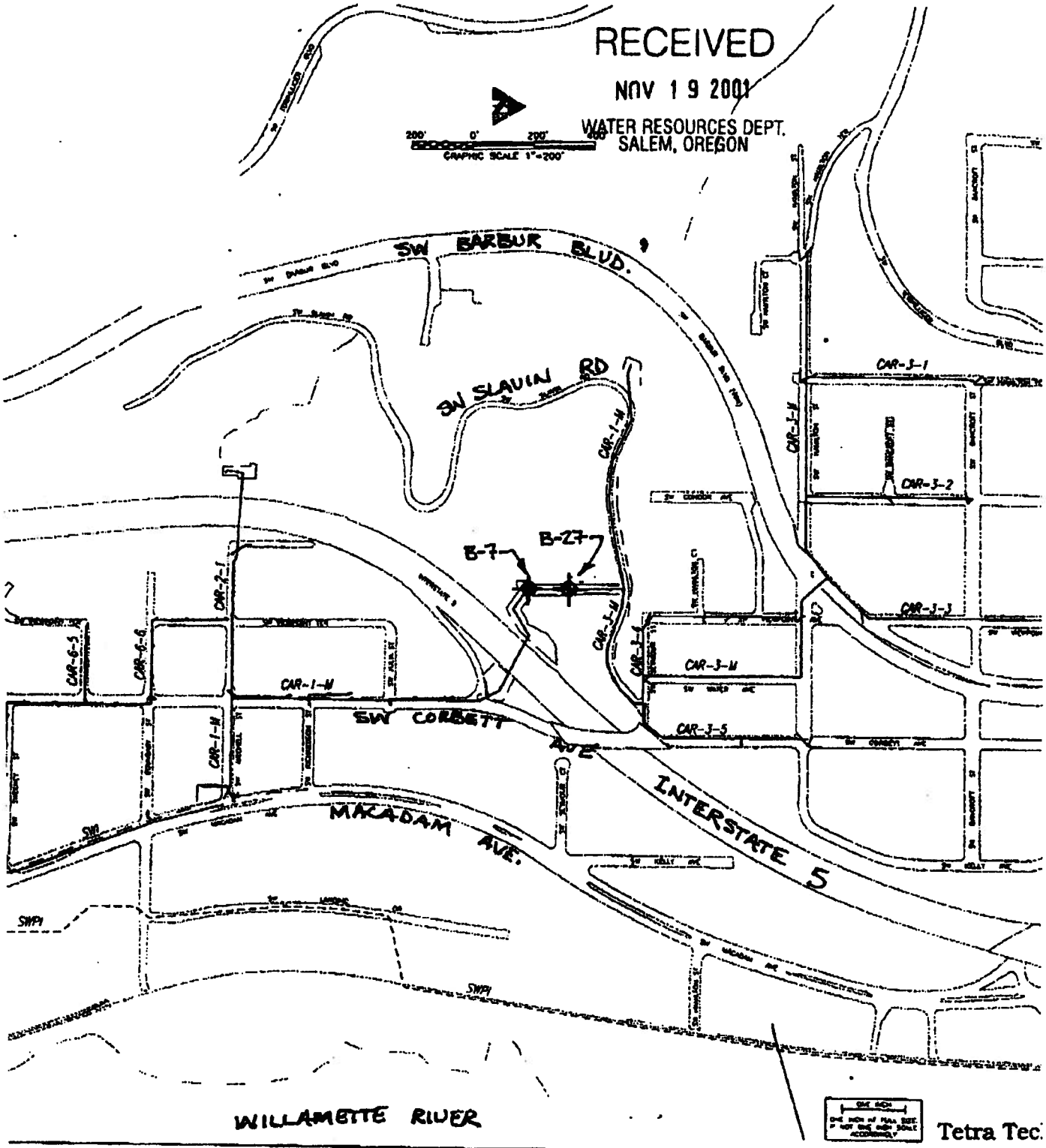

Tetra Tec

OF PORTLAND
RONMENTAL SERVICES

60% DESIGN

CAROLINA BASIN
STREAM DIVERSION PRC

SEWER KEY MAP

** TOTAL PAGE.02 **

MULT 65562

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-1
Name Willamette Landing Associates, LLC
Address 1325 NW Flanders St.
City Portland State OR Zip 97209

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☒ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE:
Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 35 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
5	0	35				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water 48 °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☒ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or S Range 1 E or W. WM.
Section 15 SE 1/4 NW 1/4
Tax Lot 600 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____
5310 SW Macadam

Map with location identified must be attached

(10) STATIC WATER LEVEL:
8 ft. below land surface. Date 11/28/01
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Silty-Gravelly-Cobbles-Wood	0	8	
Silty Gravels	8	12	8
Silt w/ organics & wood	12	14	
Sand w/ fine gravels	14	22	
Sand, gravels & Cobbles	22	35	

Date Started 11/28/01 Date Completed 11/28/01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	35	7 bags

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WATER RESOURCES DEPT
SALEM, OREGON

Date started 11/28/01 Date Completed 11/28/01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10033
Signed Steven Van Bergen Date 12/20/01
Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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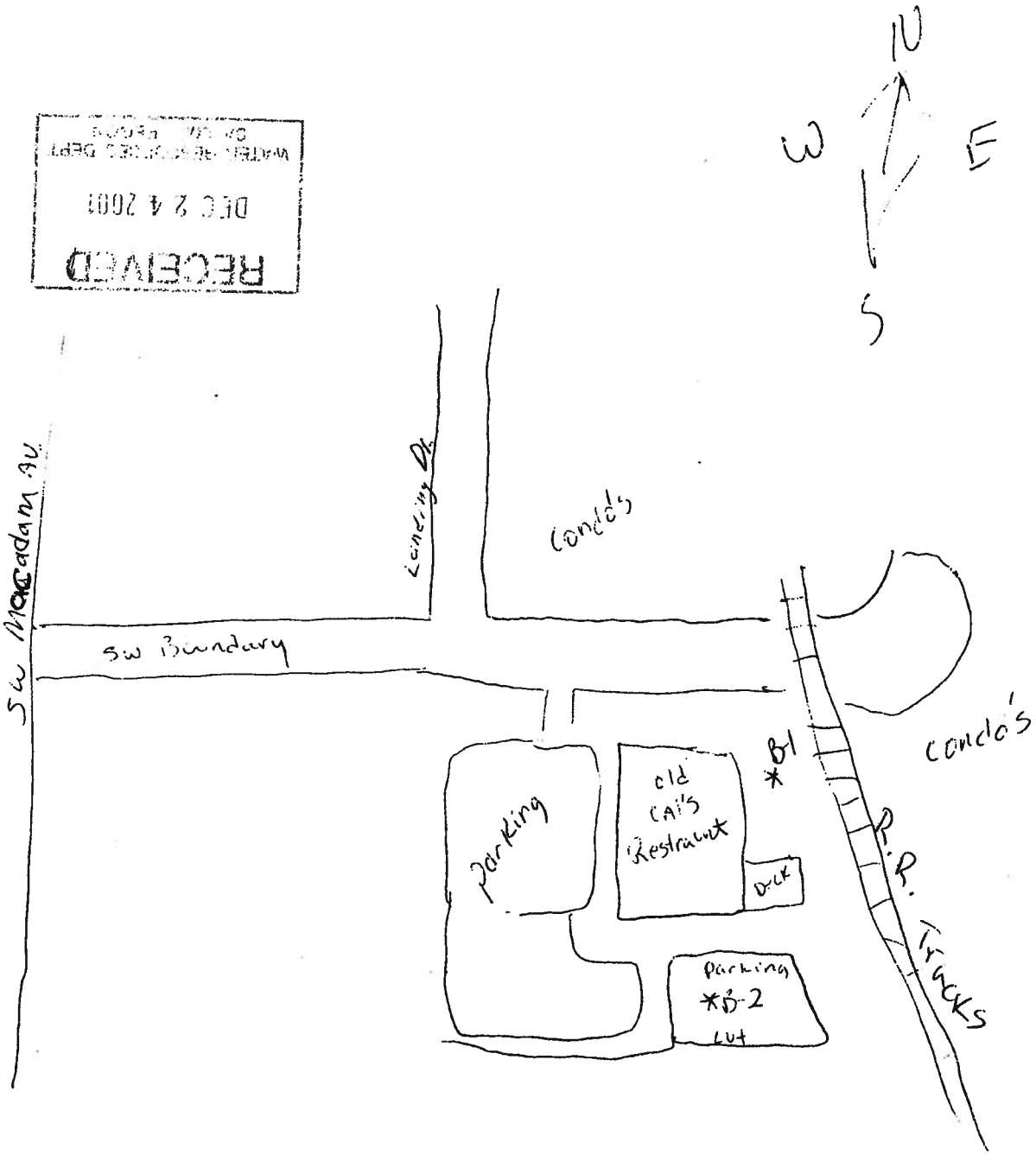
MULT 65559



SITE MAP

MULT 65669

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number BH1
Name Sunset Fuel Company
Address 2944 S.E Powell Boulevard
City Portland State OR Zip 97242

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(3) CONSTRUCTION:
[X] Rotary Air [ ] Hand Auger [ ] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [ ] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE: Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Hole 30 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
6	0	30				
				X		

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
			X		☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water ____ °F/C Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [X] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 15 SW 1/4 SE 1/4
Tax Lot 100 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____
6230 S.W. Macadam Ave.

Map with location identified must be attached

(10) STATIC WATER LEVEL:
____ ft. below land surface. Date ____
Artesian pressure X lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Brown-Grey Silt	0	8	
Sandy Gravels	8	30	

Date Started 12-17-01 Date Completed 12-19-01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	30	8 bags

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WATER RESOURCES DEPT.
SALEM, OREGON

Date started 12-17-01 Date Completed 12-19-01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10453
Signed ____ Date 01-11-02
Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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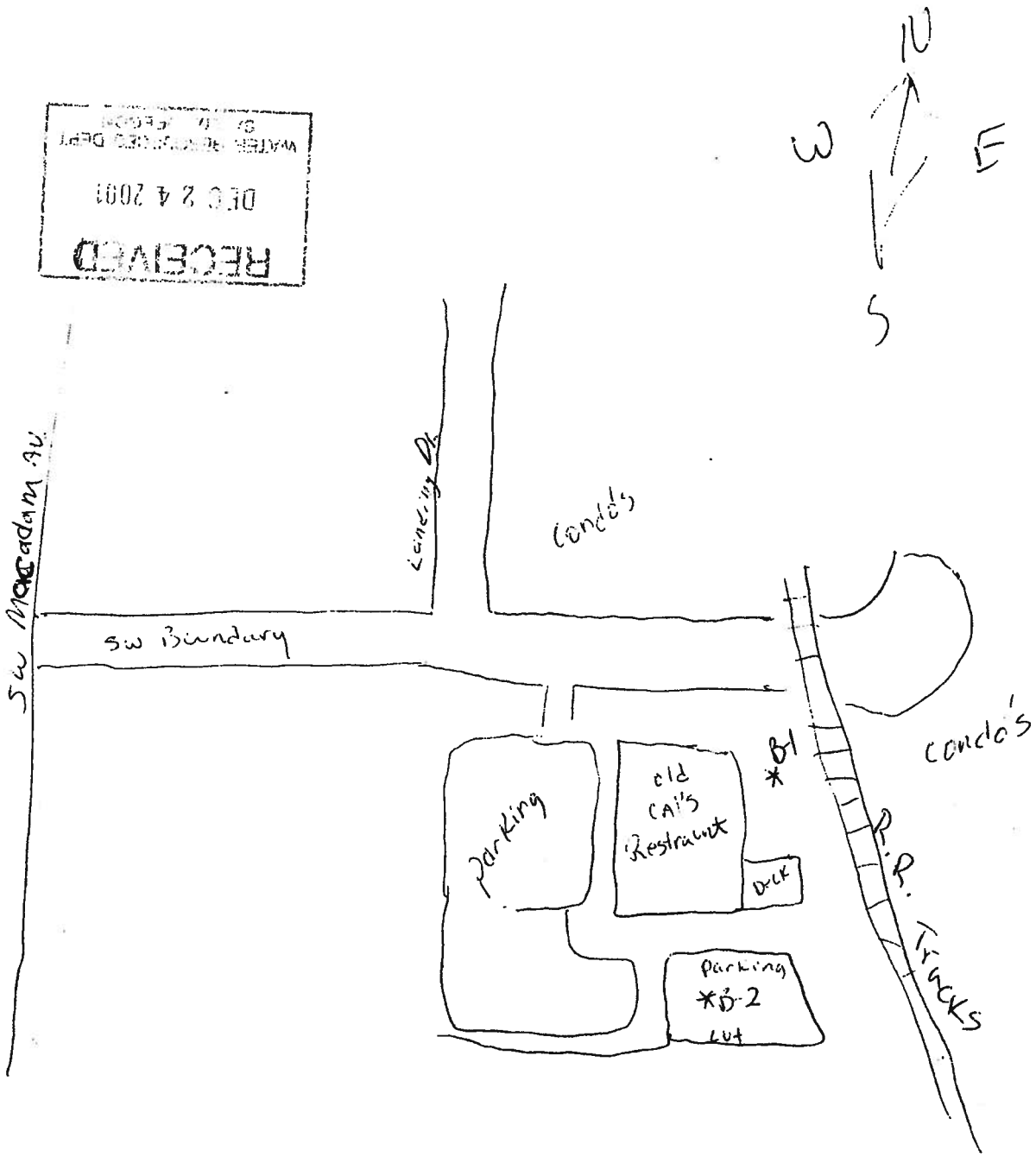

SITE MAP

MULT 65673

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number BH-5
Name Sunset Fuel Company
Address 2944 S.E. Powell Boulevard
City Portland State OR Zip 97242

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(3) CONSTRUCTION:
[X] Rotary Air [ ] Hand Auger [ ] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [ ] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE:
Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Hole 30 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
6	0	30				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Screen:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water ____ °F/C Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [ ] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 15 SW 1/4 SE 1/4
Tax Lot 100 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 6230 SW Macadam Ave

Map with location identified must be attached

(10) STATIC WATER LEVEL:
____ ft. below land surface. Date ____
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Brown-Grey Silt	0	8	
Sandy Gravels	8	30	

Date Started 12-17-01 Date Completed 12-19-01

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	30	8 bags

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WATER RESOURCES DEPT.
SALEM, OREGON

Date started 12-17-01 Date Completed 12-19-01

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10453
Signed [signature] Date 01-11-02
Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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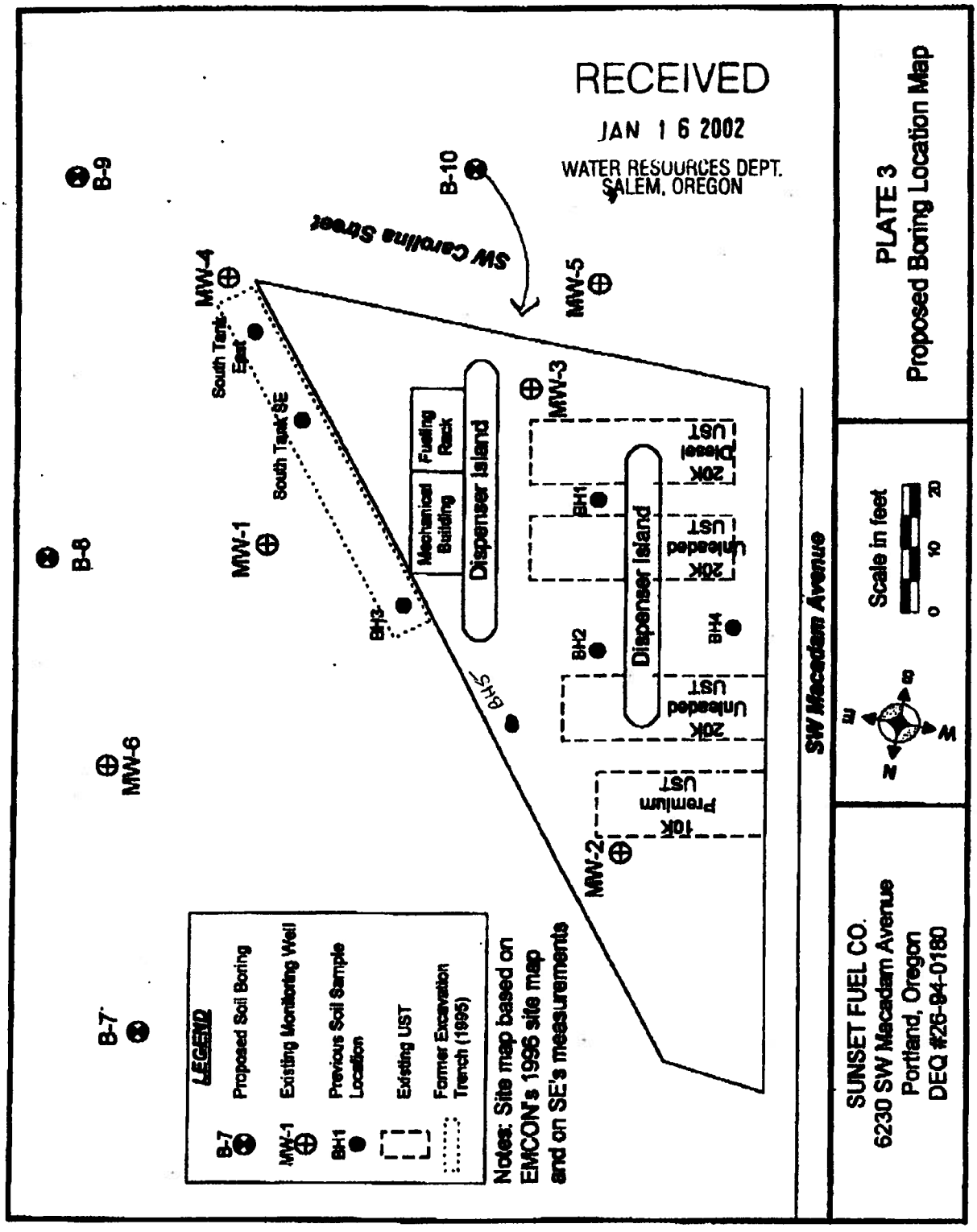
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SALEM, OREGON
PLATE 3
Proposed Boring Location Map
SUNSET FUEL CO.
6230 SW Macadam Avenue
Portland, Oregon
DEQ #26-84-0180
Scale in feet
0 10 20
N
SW Macadam Avenue
SW Carolina Street
B-7
B-8
B-9
B-10
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
South Tank East
South Tank SE
Mechanical Building
Fueling Rack
Dispenser Island
Dispenser Island
BH1
BH2
BH3
BH4
BH5
10K Premium UST
20K Unleaded UST
20K Unleaded UST
20K Diesel UST
LEGEND
Proposed Soil Boring
Existing Monitoring Well
Previous Soil Sample Location
Existing UST
Former Excavation Trench (1995)
Notes: Site map based on EMCON's 1996 site map and on SE's measurements

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FEB 07 2002

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number 1

Name Willamette Landing Associates, LLC

Address 1325 N.W. Flanders St

City Portland State OR Zip 97209

(2) TYPE OF WORK

[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(3) CONSTRUCTION:

[ ] Rotary Air [ ] Hand Auger [X] Hollow Stem Auger

[ ] Rotary Mud [ ] Cable Tool [ ] Push Probe [ ] Other

(4) TYPE OF HOLE:

[X] Uncased Temporary [ ] Cased Permanent

[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE: Soil Samples

(6) BORE HOLE CONSTRUCTION:

Special Construction approval [ ] Yes [X] No Depth of Completed Hole 30 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
8	0	30				

Backfill placed from ____ ft. to ____ ft. Material ____

Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Screen:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:

[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Permeability ____ Yield ____ GPM ____

Conductivity ____ PH ____

Temperature of water 48 °F/C Depth artesian flow found ____ ft.

Was water analysis done? [ ] Yes [X] No

By whom? ____

Depth of strata analyzed. From ____ ft. to ____ ft.

Remarks: ____

(9) LOCATION OF HOLE by legal description:

County Multnomah Latitude ____ Longitude ____

Township 1 N or (S) Range 1 (E) or W. WM.

Section 15 SE 1/4 NW 1/4

Tax Lot 600 Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) ____

S3109 Macadam

Map with location identified must be attached

(10) STATIC WATER LEVEL:

19 ft. below land surface. Date 1/14/02

Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:

Ground Elevation ____

Material Description	From	To	SWL
Brownish Grey Silt	0	15	
Gravels with Sand	15	30	

Date Started 1/14/02 Date Completed 1/14/02

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	30	41 lbs

Date started 1/14/02 Date Completed 1/14/02

Professional Certification

(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 1041 02

Signed ____ Date 2/5/04

Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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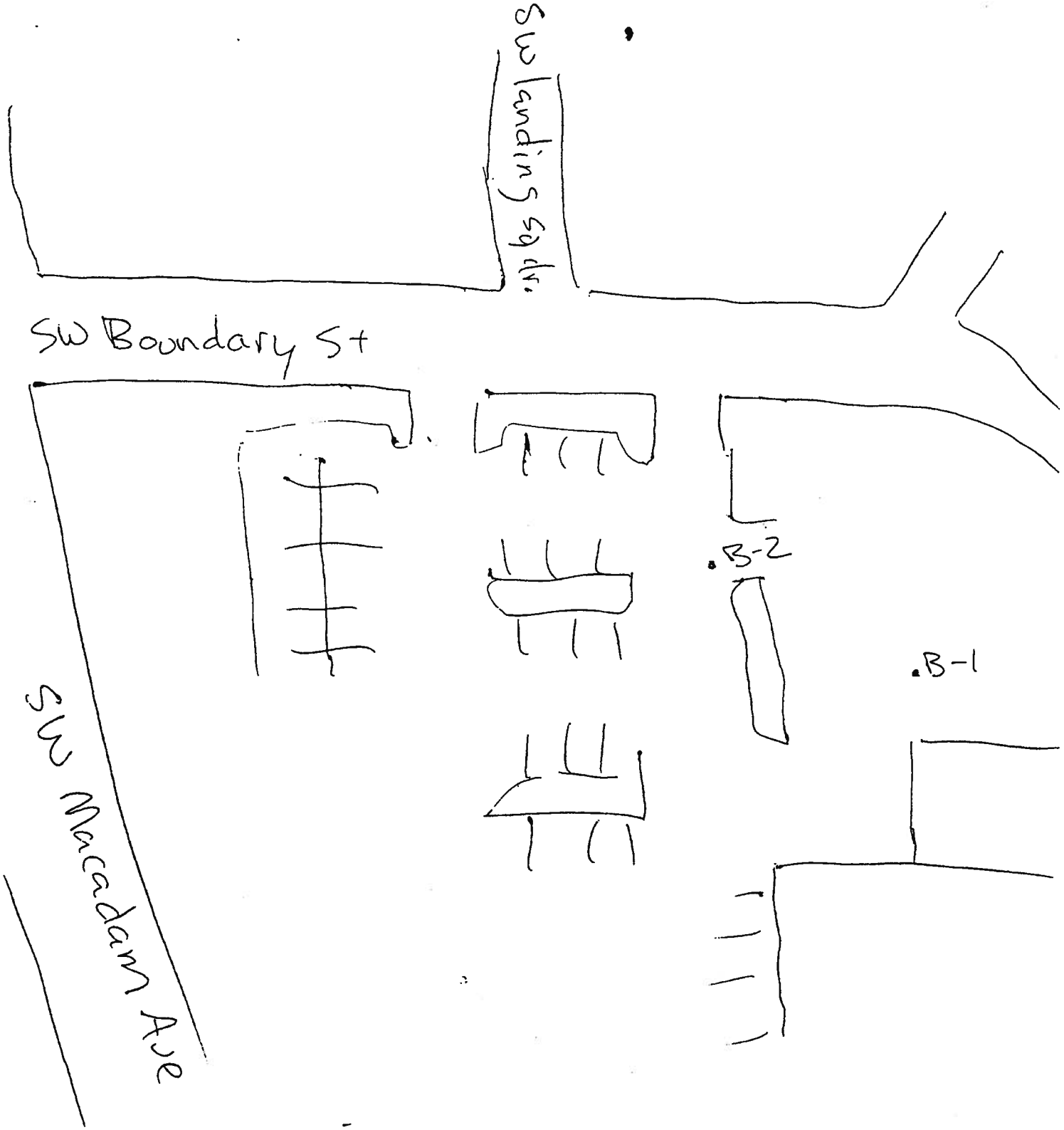
WATER RESOURCES DEPT.
SALEM, OREGON

SITE MAP



MULT 65752

FEB 07 2002

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number 2
Name Willamette Landing Associates, LLC
Address 1325 N.W. Flanders St.
City Portland State OR Zip 97209

(2) TYPE OF WORK
[X] New [ ] Deepening [ ] Alteration (repair/recondition) [X] Abandonment

(3) CONSTRUCTION:
[ ] Rotary Air [ ] Hand Auger [X] Hollow Stem Auger
[ ] Rotary Mud [ ] Cable Tool [ ] Push Probe [ ] Other

(4) TYPE OF HOLE:
[X] Uncased Temporary [ ] Cased Permanent
[ ] Uncased Permanent [ ] Slope Stability [ ] Other

(5) USE OF HOLE:
Geotechnical Study

(6) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Hole 30 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
8	0	30				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Screen:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Slot size ____

(8) WELL TEST:
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water 48 °F/C Depth artesian flow found ____ ft.
Was water analysis done? [ ] Yes [X] No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Multnomah Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 15 SE 1/4 NW 1/4
Tax Lot 600 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____
5310 S.W. Macadam

Map with location identified must be attached

(10) STATIC WATER LEVEL:
22 ft. below land surface. Date 1/14/02
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Brownish Gray Silt	0	15	
Gravels with Sand	15	30	

Date Started 1/14/02 Date Completed 1/14/02

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Bentonite	0	30	4/165

Date started 1/14/02 Date Completed 1/14/02

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10462
Signed ____ Date 2/5/04
Affiliation ____

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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WATER RESOURCES DEPT.
SALEM, OREGON

SITE MAP

RECEIVED MULT 80467

STATE OF OREGON
GEOTECHNICAL HOLE REPORT NOV 14 2005
(as required by OAR 690-240-035)
WATER RESOURCES DEPT
SALEM, OREGON

(1) OWNER/PROJECT: Hole Number B-1

Name Willamette Development Group
Address 7935 SE Lake Rd
City Milwaukie State Or Zip 97267

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☒ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other ____

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other ____

(5) USE OF HOLE: Geo Technical

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 35 ft.

HOLE			SEAL			
Diameter	From	To	Material	From	To	Sacks or pounds
5"	0'	35'				

Backfill placed from 0' ft. to 35' ft. Material AC/Bentonite
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water NA °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☐ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Mult Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 15 NW 1/4 NE 1/4
Tax Lot 500 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 5950 SW Macadam Blvd

Map with location identified must be attached

(10) STATIC WATER LEVEL:
Not Observed ft. below land surface. Date ____
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Aphalt	0	.4'	
Gravel	.4	1'	
Silty Sand	1'	15'	
Sandy Gravel	15'	35'	
Gravel			

Date Started 10/18/05 Date Completed 10/18/05

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Asphalt	0	1	1/2
Bentonite Chips	1	35'	7

Date started 10/18/05 Date Completed 10/18/05

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10559

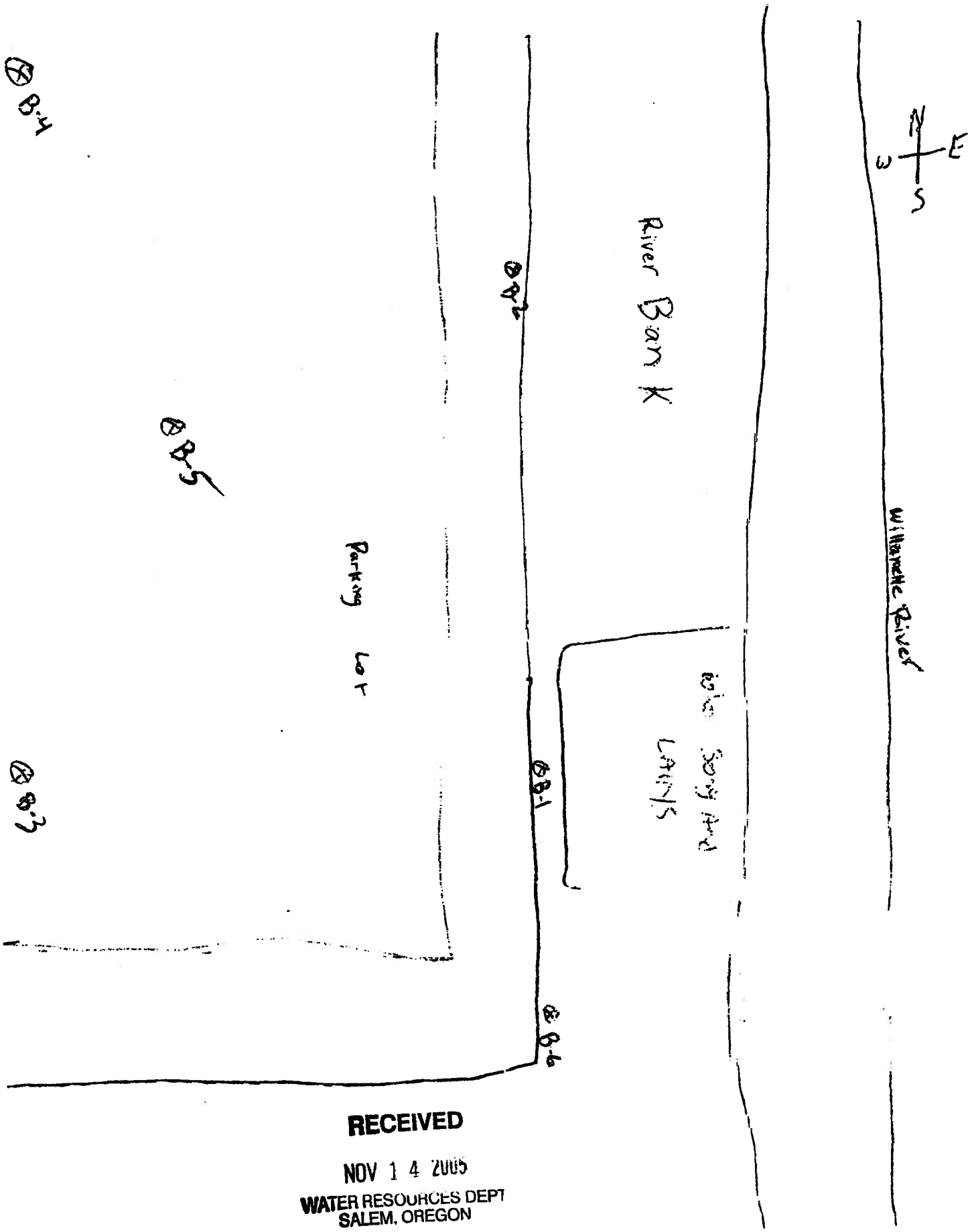
Signed [signature] Date 11/10/05

Affiliation Geo Tech Explorations

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

MULT 80467



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NOV 14 2005

WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-6
Name Willamette Development Group
Address 7935 SE Lake Rd
City Milwaukie State Or Zip 97267

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☒ Rotary Mud ☐ Cable Tool ☐ Push Probe ☐ Other

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE: Geo Technical

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 50 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
5"	0'	50				

Backfill placed from 0' ft. to 50 ft. Material AC/Bentonite
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
Screen:					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water NA °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☐ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

(9) LOCATION OF HOLE by legal description:
County Mult Latitude ____ Longitude ____
Township 1 N or (S) Range 1 (E) or W. WM.
Section 15 NW 1/4 NE 1/4
Tax Lot 500 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 9550 SW
Macadam Blvd
Map with location identified must be attached

(10) STATIC WATER LEVEL:
Not Observed ft. below land surface. Date ____
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Asphalt	0	.4	
Gravel	.4	1	
Gravel Fill	1	5	
Sandy Gravel	5	45	
Basalt	45	50	

Date Started 10/21/05 Date Completed 10/21/05

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Asphalt	0	1	1/2
Bentonite Chips	1	50	10

Date started 10/21/05 Date completed 10/21/05

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10559
Signed ____ Date 11/10/05
Affiliation Geo Tech Explorations

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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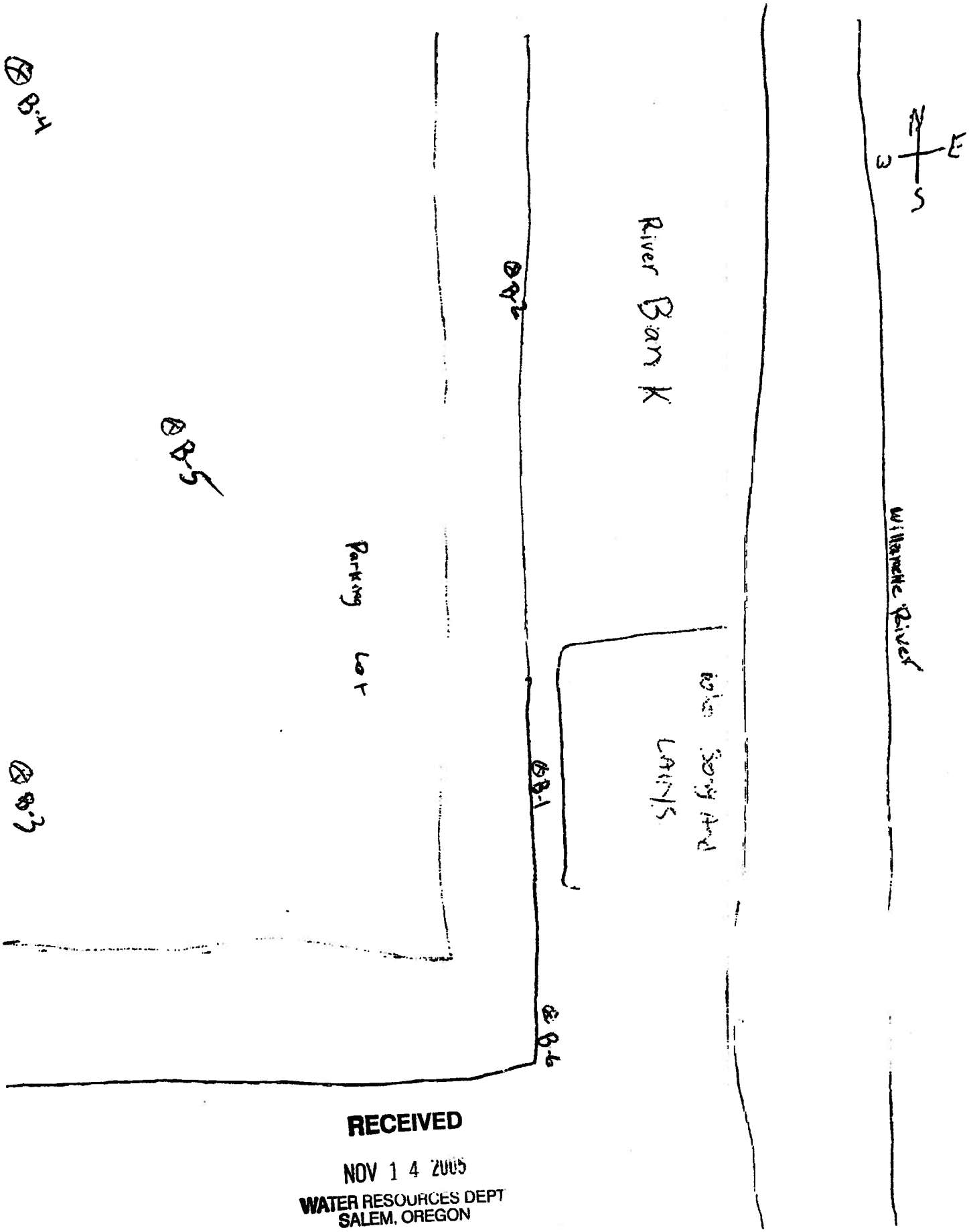
MULT 80474



MULT 81037

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-1
Name Willamette Development Group
Address 7935 SE Lake Rd
City Milwaukie State Or Zip 97267

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☒ Push Probe ☐ Other

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE: Soil Samples

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 20 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
2.188"	0'	20'				

Backfill placed from 0' ft. to 20 ft. Material Ground Bentonite
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water N/A °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☒ No
By whom? ____
Depth of strata analyzed. From ____ ft.
Remarks: ____

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SALEM, OREGON

(9) LOCATION OF HOLE by legal description:
County Mult Latitude ____ Longitude ____
Township 1 N or S Range 1 E or W. WM.
Section 15 NE 1/4 NW 1/4
Tax Lot 500 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 4850 SW Macadam Portland

Map with location identified must be attached

(10) STATIC WATER LEVEL:
Not Observed ft. below land surface. Date —
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Black Sandy Silt with Fill Material (Gravels Asphalt & Concrete)	0'	20'	—

Date Started 11/9/05 Date Completed 11/10/05

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Gravel	0'	1'	4
Bentonite Chips	1'	20'	23

Date started 11/10/05 Date Completed 11/10/05

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

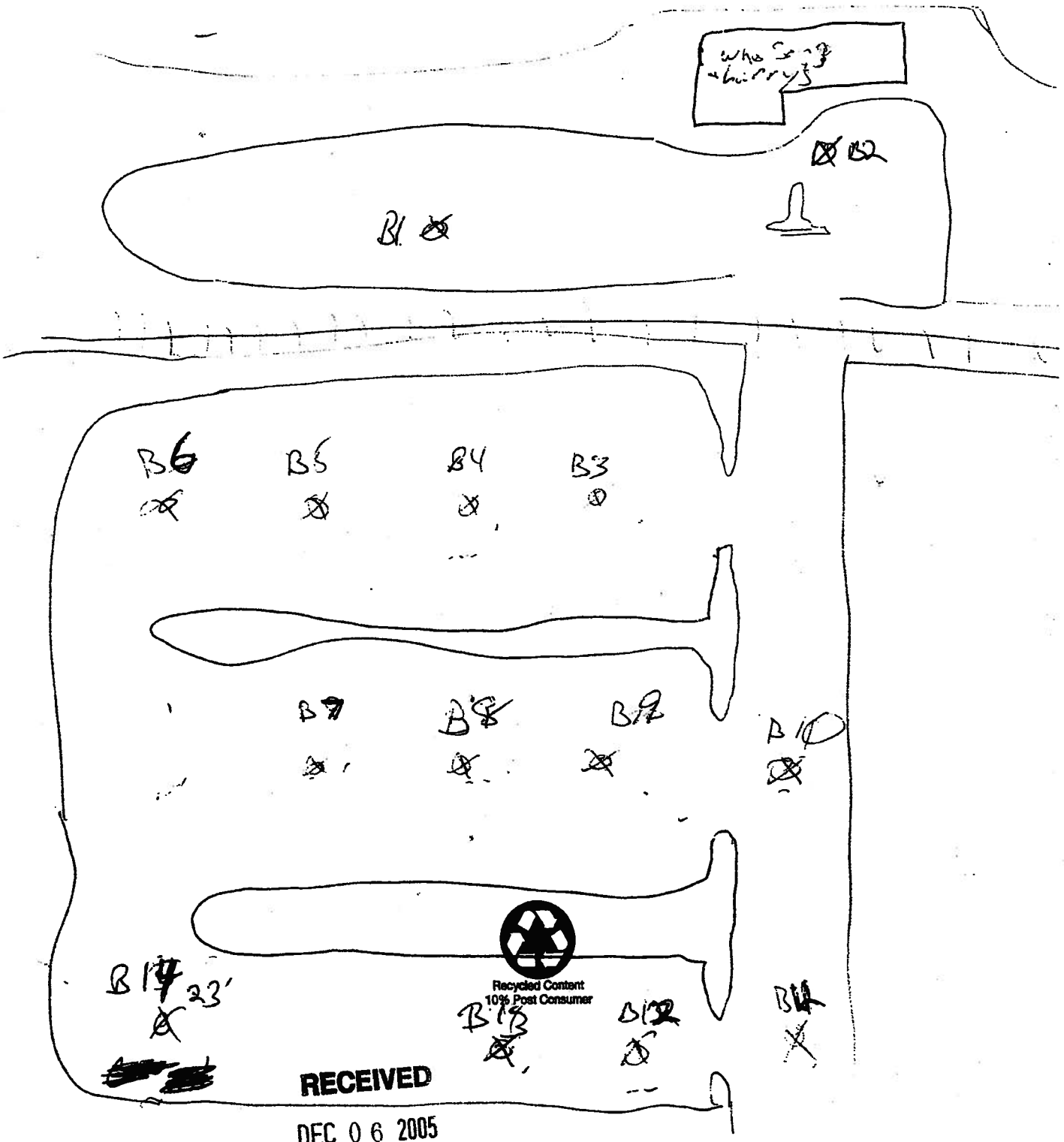
I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 1054B
Signed ____ Date 12/2/05
Affiliation Boart Longyear Company

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

MULT 81037



MULT 81050

81050

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-035)

(1) OWNER/PROJECT: Hole Number B-14
Name Willamette Development Group
Address 7935 SE Lake Rd
City Milwaukie State Or Zip 97267

(2) TYPE OF WORK
☒ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION:
☐ Rotary Air ☐ Hand Auger ☐ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☒ Push Probe ☐ Other

(4) TYPE OF HOLE:
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE: Soil Samples

(6) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Hole 23 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
2.188"	0'	23'				

Backfill placed from 0 ft. to 23 ft. Material Gravel Bentonite
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☒
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water N/A °F/C Depth artesian flow found ____ ft.
Was water analysis done? ☐ Yes ☒ No
By whom? ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

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WATER RESOURCES DEPT
SALEM, OREGON

(9) LOCATION OF HOLE by legal description:
County Mult Latitude ____ Longitude ____
Township 1 N or ☒ S Range 1 ☐ E or W. WM.
Section 15 NE 1/4 NW 1/4
Tax Lot 500 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 4850 SW Macadam Portland

Map with location identified must be attached

(10) STATIC WATER LEVEL:
Not Observed ft. below land surface. Date ____
Artesian pressure ____ lb. per square inch. Date ____

(11) SUBSURFACE LOG:
Ground Elevation ____

Material Description	From	To	SWL
Black Sandy Silt with Fill Material (Gravels Asphalt & Concrete)	0'	23'	—

Date Started 11/9/05 Date Completed 11/10/05

(12) ABANDONMENT LOG:

Material Description	From	To	Sacks or Pounds
Gravel	0'	1'	3
Bentonite Chips	1'	23'	26

Date started 11/10/05 Date Completed 11/10/05

Professional Certification
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 1054B
Signed ____ Date 12/2/05
Affiliation Boart Longyear Company

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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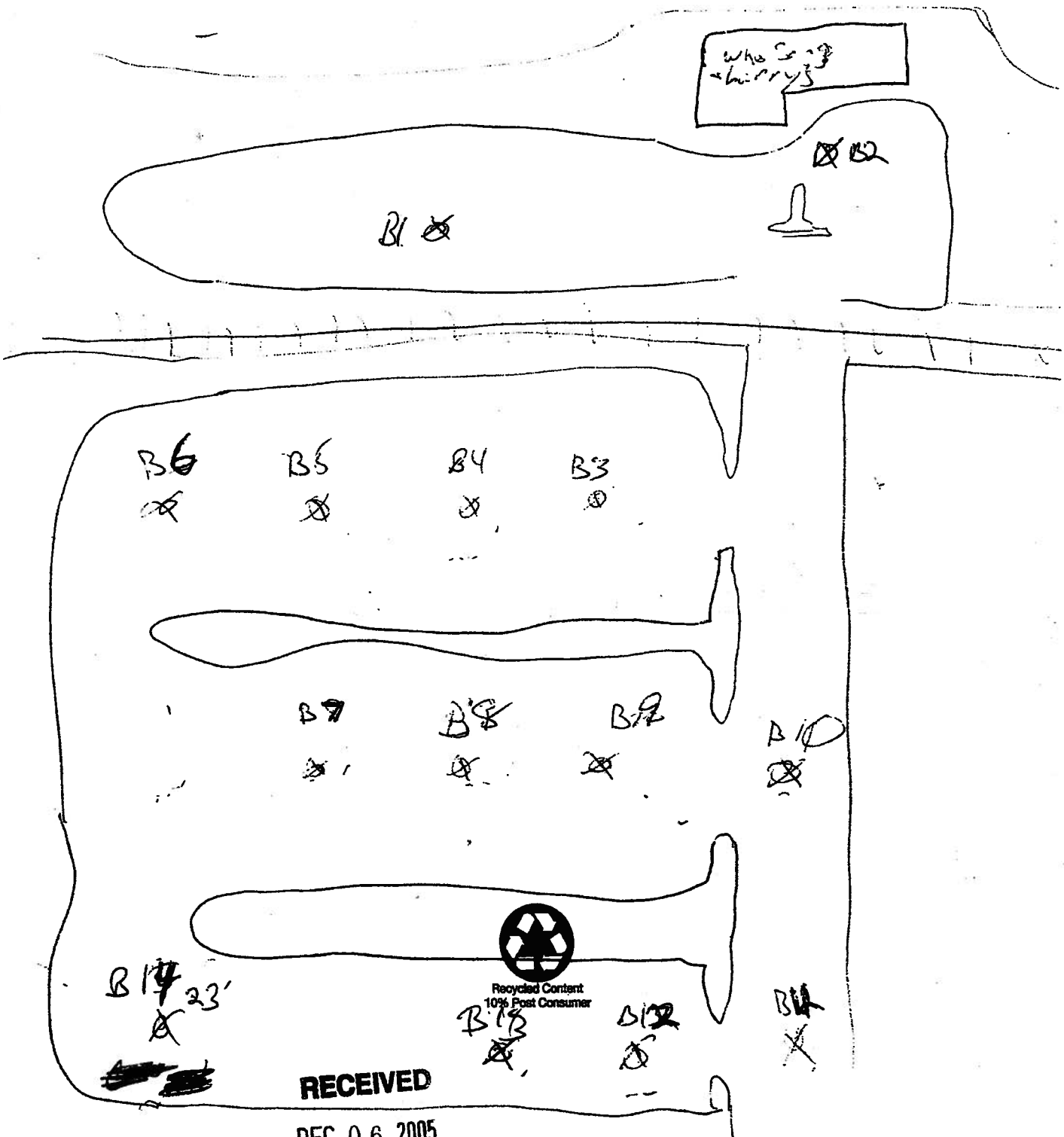

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WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-0035)

MULT 82170
02-10-2006

(1) OWNER/PROJECT

Hole Number B-1

First Name _____ Last Name _____
Company Willamette Waterfront Limited Partnership
Address 2545 SW Terwilliger #1222
City Portland State OR Zip 97201

(2) TYPE OF WORK

☒ New ☐ Deepening ☒ Abandonment
☐ Alteration (repair/recondition)

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☐ Hollow stem auger
☒ Rotary Mud ☐ Cable ☐ Push Probe
☐ Other _____

(4) TYPE OF HOLE:

◉ Uncased Temporary ○ Cased Permanet
○ Uncased Permanent ○ Slope Stablity
○ Other
Other: _____

(5) USE OF HOLE

Soil Samples

(6) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)
Depth of Completed Hole 40.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
5	0	40					

Backfill placed from 0 ft. to 40 ft. Material Bentonite
Filter pack from _____ ft. to _____ ft. Material _____ Size _____

(7) CASING/SCREEN

Casing	Screen	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(8) WELL TESTS

○ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration(hr)

Temperature _____ °F Lab analysis ☐ Yes By _____
Supervising Geologist/Engineer _____
Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF HOLE (legal description)

County Multnomah Twp 1.00 S N/S Range 1.00 E E/W WM
Sec 15 NW 1/4 of the NW 1/4 Tax Lot 1110
Tax Map Number _____ Lot _____
Lat ° 0 ' " or _____ DMS or DD
Long ° 0 ' " or _____ DMS or DD
◉ Street address of hole ○ Nearest address
5310 SW Macadam Ave, Portland, OR 97239

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well				

Flowing Artesian? ☐
WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) SUBSURFACE LOG

Ground Elevation _____

Material	From	To
Silt & Caly	0	14.5
Loose Sand & Gravel	14.5	26
Cemented Gravel	26	40

Date Started 02-09-2006 Completed 02-09-2006

(12) ABANDONMENT LOG:

Material	From	To	Amt	sacks/ lbs
Bentonite	0	40	6.81	S

Date Started 02-08-2006 Completed 02-08-2006

Professional Certification (to be signed by an Oregon licensed water or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, deepening, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License/Registration Number 10076 Date _____
Electronically Submitted
First Name Brad Last Name Wieberdink
Affiliation Boart Longyear Company

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.35

Map of Hole

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-0035)

MULT 84614
07-14-2006

(1) OWNER/PROJECT

Hole Number B-6

First Name _____ Last Name _____
Company Oregon Medical Association
Address 5210 SW CORBETT AVE
City PORTLAND State OR Zip 97239

(2) TYPE OF WORK

☒ New ☐ Deepening ☒ Abandonment
☐ Alteration (repair/recondition)

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☐ Hollow stem auger
☐ Rotary Mud ☐ Cable ☒ Push Probe
☐ Other _____

(4) TYPE OF HOLE:

◉ Uncased Temporary ○ Cased Permanet
○ Uncased Permanent ○ Slope Stablity
○ Other
Other: _____

(5) USE OF HOLE

Soil Samples

(6) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)
Depth of Completed Hole 20.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
2	0	20					

Backfill placed from 0 ft. to 20 ft. Material Bentonite
Filter pack from _____ ft. to _____ ft. Material _____ Size _____

(7) CASING/SCREEN

Casing	Screen	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(8) WELL TESTS

○ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration(hr)

Temperature _____ °F Lab analysis ☐ Yes By _____
Supervising Geologist/Engineer _____
Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF HOLE (legal description)

County Multnomah Twp 1.00 S N/S Range 1.00 E E/W WM
Sec 15 SE 1/4 of the NW 1/4 Tax Lot 4000
Tax Map Number _____ Lot _____
Lat ° 0 ' " or _____ DMS or DD
Long ° 0 ' " or _____ DMS or DD
◉ Street address of hole ○ Nearest address
5210 SW CORBETT AVE
PORTLAND, OR 97239

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well				

Flowing Artesian? ☐
WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) SUBSURFACE LOG

Ground Elevation _____

Material	From	To
Sandy Silt	0	20

Date Started 06-14-2006 Completed 06-14-2006

(12) ABANDONMENT LOG:

Material	From	To	Amt	sacks/ lbs
Bentonite	0	20	.54	S

Date Started 06-14-2006 Completed 06-14-2006

Professional Certification (to be signed by an Oregon licensed water or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, deepening, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

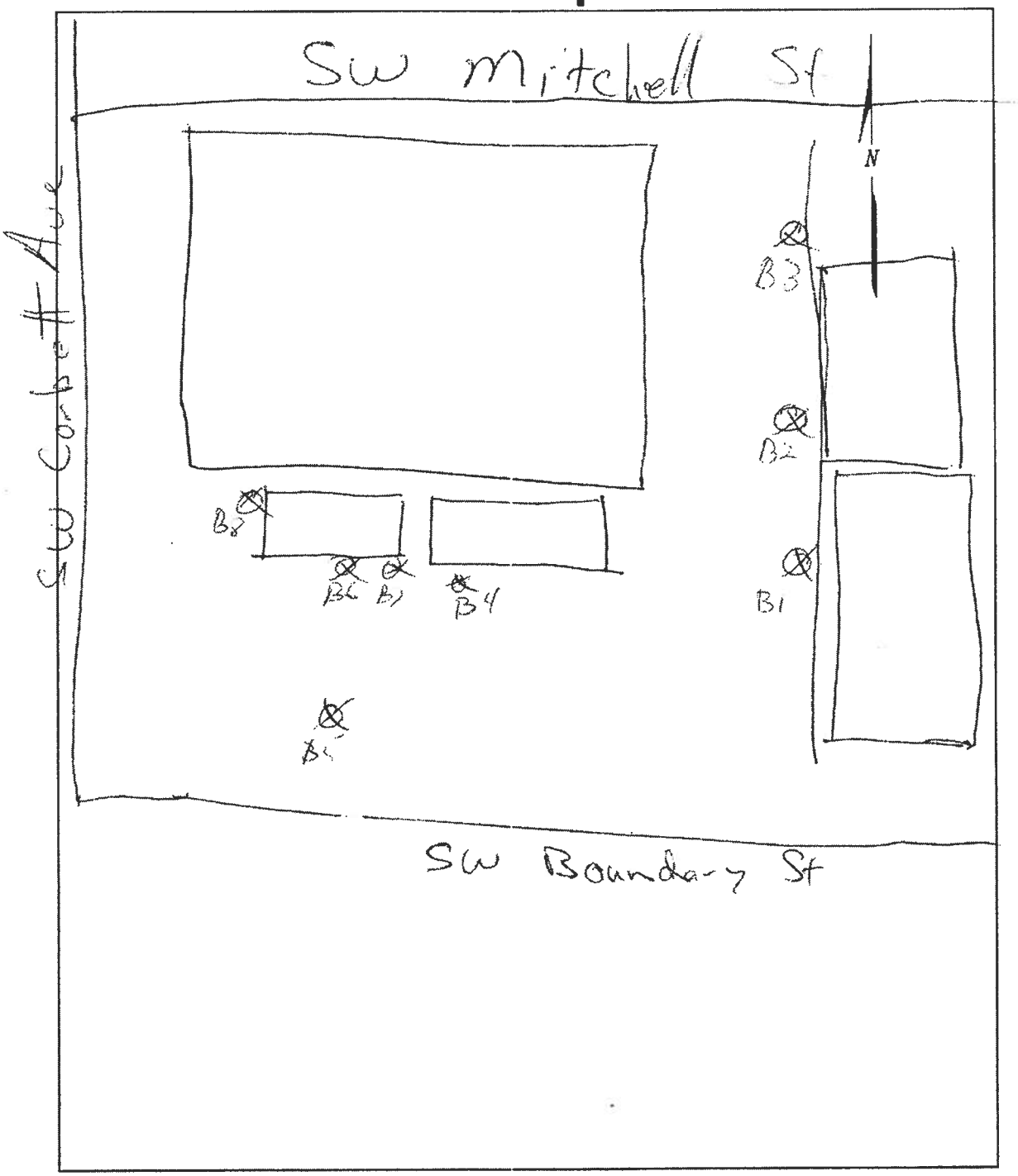
License/Registration Number 10548 Date _____
Electronically Submitted
First Name Marc Last Name Chalona
Affiliation Geo-Tech Explorations Div. of Boart Longyear Co.

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.36

Map of Hole

Site Map



STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-0035)

MULT 85062
08-17-2006

(1) OWNER/PROJECT

Hole Number B-2

First Name _____ Last Name _____
Company MATIN REALTY INVESTORS, LLC
Address PO BOX 69
City LAKE OSWEGO State OR Zip 97034

(2) TYPE OF WORK

☒ New ☐ Deepening ☒ Abandonment
☐ Alteration (repair/recondition)

(3) CONSTRUCTION

☐ Rotary Air ☐ Hand Auger ☐ Hollow stem auger
☒ Rotary Mud ☐ Cable ☐ Push Probe
☐ Other _____

(4) TYPE OF HOLE:

◉ Uncased Temporary ○ Cased Permanet
○ Uncased Permanent ○ Slope Stablity
○ Other
Other: _____

(5) USE OF HOLE

SOIL SAMPLES

(6) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)
Depth of Completed Hole 30.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
5	0	30					

Backfill placed from 0 ft. to 30 ft. Material BENTONITE
Filter pack from _____ ft. to _____ ft. Material _____ Size _____

(7) CASING/SCREEN

Casing	Screen	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
○	○						○	○		
○	○						○	○		
○	○						○	○		
○	○						○	○		
○	○						○	○		

(8) WELL TESTS

○ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration(hr)

Temperature _____ °F Lab analysis ☐ Yes By _____
Supervising Geologist/Engineer _____
Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF HOLE (legal description)

County Multnomah Twp 1.00 S N/S Range 1.00 E E/W WM
Sec 15 NE 1/4 of the NW 1/4 Tax Lot 601
Tax Map Number _____ Lot _____
Lat ° 0 ' " or _____ DMS or DD
Long ° 0 ' " or _____ DMS or DD
◉ Street address of hole ○ Nearest address

4949 SW MACADEM AVE, PORTLAND, OR 97239

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well				

Flowing Artesian? ☐
WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) SUBSURFACE LOG

Ground Elevation _____

Material	From	To
ASPHALT	0	.16
GRAVEL	.16	1
SILT, GRAVEL	1	3
SILT, CLAY	3	20
GRAVEL	20	27
BED ROCK	27	30

Date Started 07-28-2006 Completed 07-28-2006

(12) ABANDONMENT LOG:

Material	From	To	Amt	sacks/ lbs
Bentonite	0	30	5.11	S

Date Started 07-28-2006 Completed 07-28-2006

Professional Certification (to be signed by an Oregon licensed water or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, deepening, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

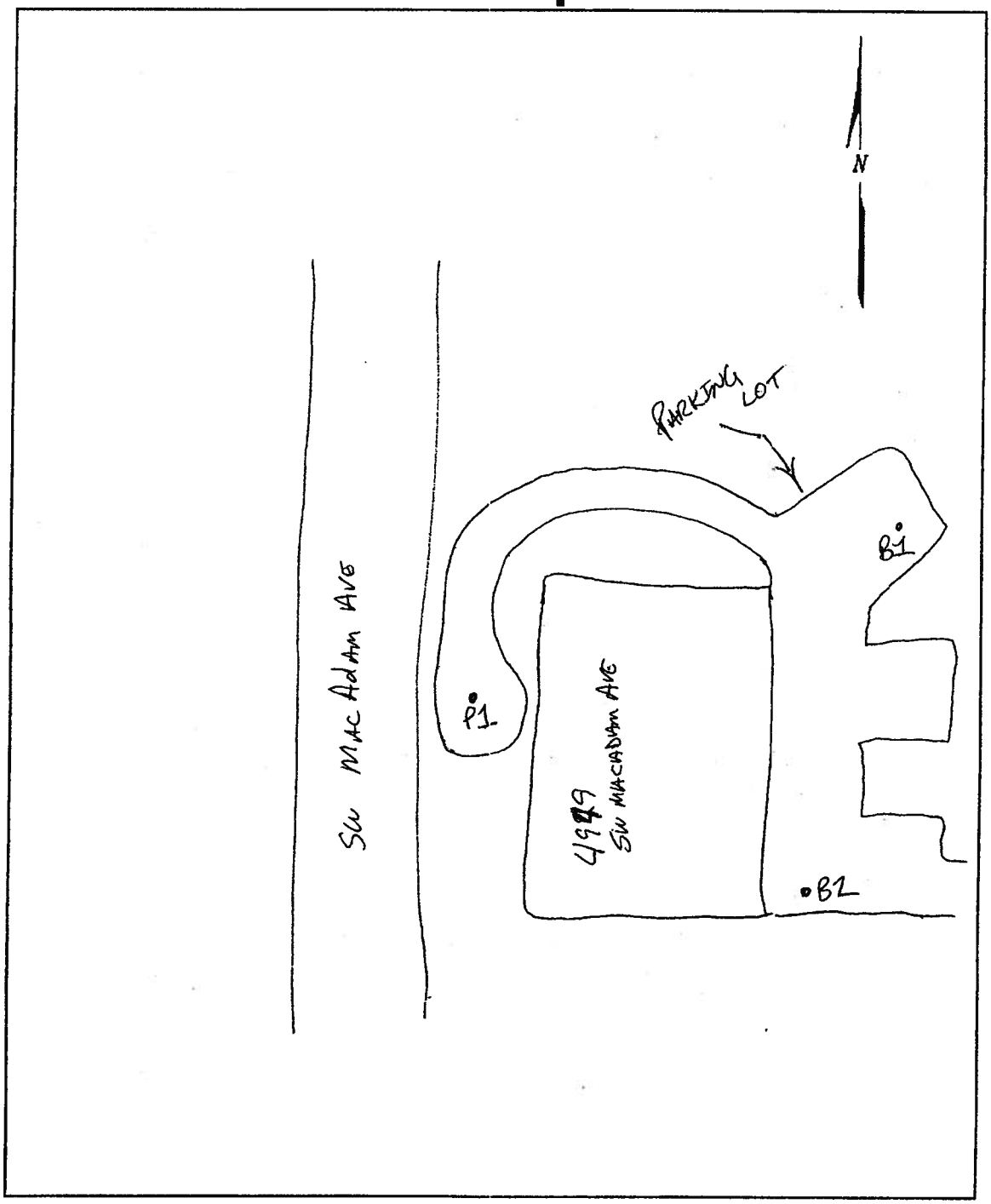
License/Registration Number 10511 Date _____
Electronically Submitted
First Name PAUL Last Name SMITH
Affiliation Geo-Tech Explorations a Div. of Boart Longyear Co.

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.36

Map of Hole

Site Map



MULT 90451

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-0035)

(1) OWNER/PROJECT
Hole Number 1
First Name _____ Last Name _____
Company Carlson Geotechnical (Owner's Rep)
Address 7185 SW SANDBURG ST STE 110
City TIGARD State OR Zip 97223

(2) TYPE OF WORK
☒ New ☐ Deepening ☒ Abandonment
☐ Alteration (repair/recondition)

(3) CONSTRUCTION
☐ Rotary Air ☐ Hand Auger ☐ Hollow stem auger
☒ Rotary Mud ☐ Cable ☐ Push Probe
☒ Other Core

(4) TYPE OF HOLE:
◉ Uncased Temporary ○ Cased Permanent
○ Uncased Permanent ○ Slope Stablity
○ Other
Other: _____

(5) USE OF HOLE
Geo-tech

(6) BORE HOLE CONSTRUCTION
Special Standard ☐ (Attach copy)
Depth of Completed Hole 30 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt (sacks)	lbs
5"	0	24	[redacted]				
3"	24	30	3/8 holeplug	30	0	6	

Backfill placed from 30 ft. to 0 ft. Material 3/8 holeplug
Filter pack from _____ ft. to _____ ft. Material _____ Size _____

(7) CASING/SCREEN
NONE

Casing	Screen	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(8) WELL TESTS
○ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration(hr)

Temperature _____ °F Lab analysis ☐ Yes
Supervising Geologist/Engineer _____
Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

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SEP 14 2007
WATER RESOURCES DEPT
SALEM OREGON

(9) LOCATION OF HOLE (legal description)
County MULTNOMA Twp 1.00 S N/S Range 1.00 E E/W WM
Sec 22 NE 1/4 of the NE 1/4 Tax Lot ROW
Tax Map Number _____ Lot _____
Lat ° ' " or _____ DMS or DD
Long ° ' " or _____ DMS or DD
○ Street address of hole ◉ Nearest address
In front of 0407 SW Nevada St Portland

(10) STATIC WATER LEVEL
NONE

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well				

Flowing Artesian? ☐
WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) SUBSURFACE LOG
Ground Elevation _____

Material	From	To
Top Soil	0	1
Silt	1	20'
Sand	20	24'
decomposed basalt	24	30'

Date Started 9/12/07 Completed 9/12/07

(12) ABANDONMENT LOG:

Material	From	To	Amt (sacks)	lbs
3/8 holeplug	30	0	6	

Date Started 9/12/07 Completed 9/12/07

Professional Certification (to be signed by an Oregon licensed water or monitoring well constructor, or Oregon registered geologist or civil engineer).

I accept responsibility for the construction, deepening, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License/Registration Number 10563 Date 9/12/07
First Name Ford Last Name Stigall
Affiliation Western States Soil Conservation, Inc.

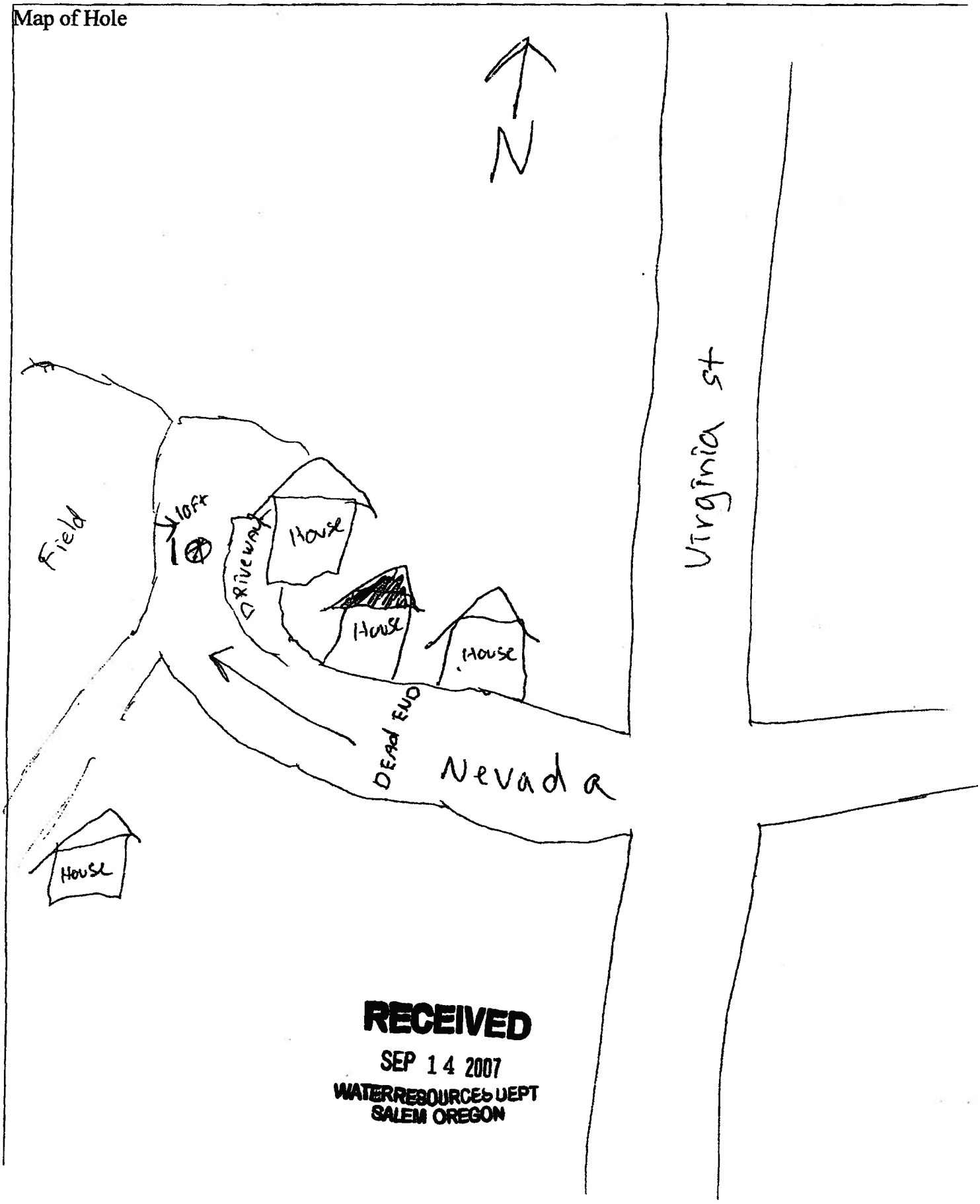
ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.36

MULT 90451

GEOTECHNICAL HOLE REPORT -
Map with location identified must be attached and shall include an approximate scale and north arrow

Map of Hole



MULT 98682

D07460-1873

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-0035)

Instructions for completing this report are on the last page of this form.

(1) OWNER/PROJECT Hole Number TB-14449-32
Name ODOT
Address 123 NW FLANDERS 3RD FLOOR
City PORTLAND State OR Zip 97209

(2) TYPE OF WORK
☑ New ☐ Deepening ☐ Alteration (repair/recondition) ☒ Abandonment

(3) CONSTRUCTION
☐ Rotary Air ☐ Hand Auger ☑ Hollow Stem Auger
☐ Rotary Mud ☐ Cable Tool ☐ Push Probe ☒ Other HQ-3

(4) TYPE OF HOLE
☒ Uncased Temporary ☐ Cased Permanent
☐ Uncased Permanent ☐ Slope Stability ☐ Other

(5) USE OF HOLE GEOTECHNICAL STUDY

(6) BORE HOLE CONSTRUCTION
Special Construction approval: ☐ Yes ☑ No Depth of Completed Well 50 ft.

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or Pounds
8"	0	20				
3.5"	20	50				

Backfill placed from ____ ft. to ____ ft. Material ____
Filter Pack placed from ____ ft. to ____ ft. Size of pack ____

(7) CASING/SCREEN

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
			N/A		☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Screen:					☐	☐	☐	☐
					☐	☐	☐	☐

Slot size ____

(8) WELL TEST
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ____ Yield ____ GPM ____
Conductivity ____ PH ____
Temperature of water NA °F/C Depth artesian flow found ____ ft.
Was a water analysis done? ☐ Yes ☐ No
By whom ____
Depth of strata analyzed. From ____ ft. to ____ ft.
Remarks: ____

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APR 02 2009
WATER RESOURCES DEPT
SALEM, OREGON

(9) LOCATION OF HOLE (legal description)
County MULTNOMAH
Tax Lot ROW Lot ____
Township 1S N or S Range 1E E or W WM
Section 15 SW 1/4 SW 1/4
Lat ___° ___' ___" or ___ (degrees or decimal)
Long ___° ___' ___" or ___ (degrees or decimal)
Street Address of Well (or nearest address) SLAVIN RD

Map with location identified must be attached.

(10) STATIC WATER LEVEL
NA ft. below land surface. Date ____
Artesian pressure ____ lb. per square inch Date ____

(11) SUBSURFACE LOG
Ground Elevation ____

Material Description	From	To	SWL
Silt	0	11	
Silty Gravel	11	20	
Weathered Basalt	20	50	

Date Started 2/13/08 Completed 2/14/08

(12) ABANDONMENT LOG

Material Description	From	To	~~Sacks or~~ Pounds
Bentonite Chips	0	50	12

Date Started 2/14/08 Completed 2/14/08

PROFESSIONAL CERTIFICATION
(to be signed by a licensed water supply or monitoring well constructor, or Oregon registered geologist or civil engineer.)

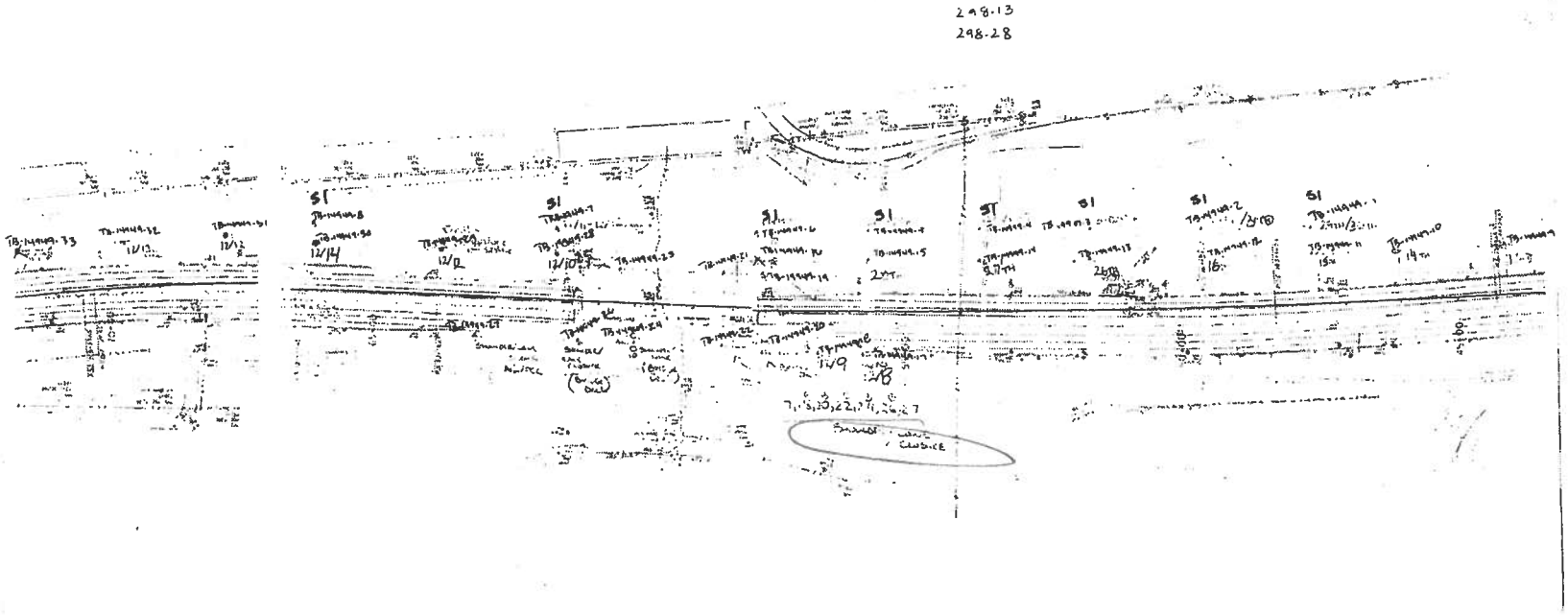
I accept responsibility for the construction, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon's geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License or Registration Number 10328
Signed ____ Date 4/3/08
Affiliation Cascade Drilling, Inc. P07460

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER 08/17/2005

MULT 98682

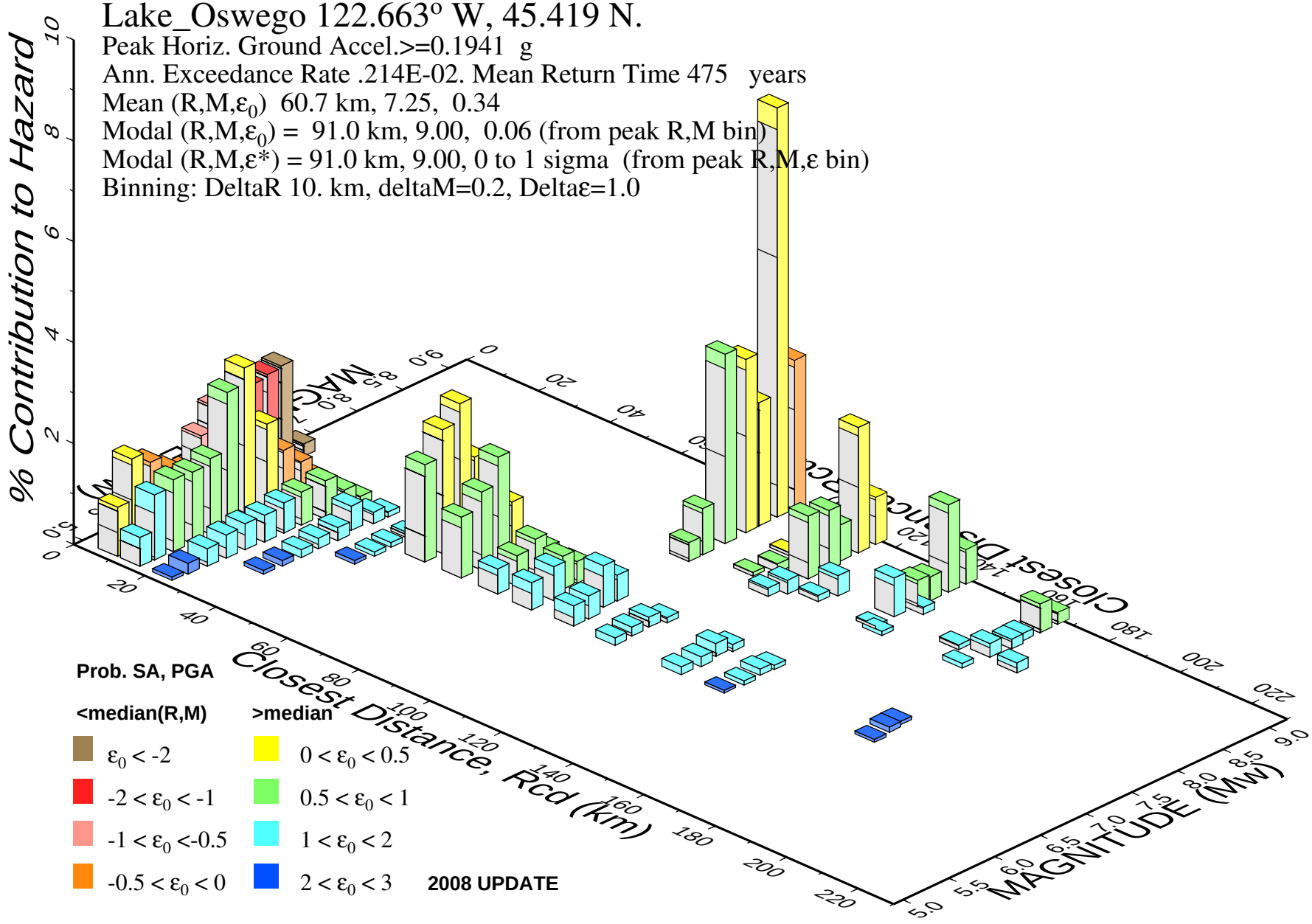


ODOT
PO 7460-1873

APPENDIX B: PEAK GROUND ACCELERATION AND PROBABILISTIC SEISMIC HAZARD ANALYSES FOR SOUTH WATERFRONT AND LAKE OSWEGO

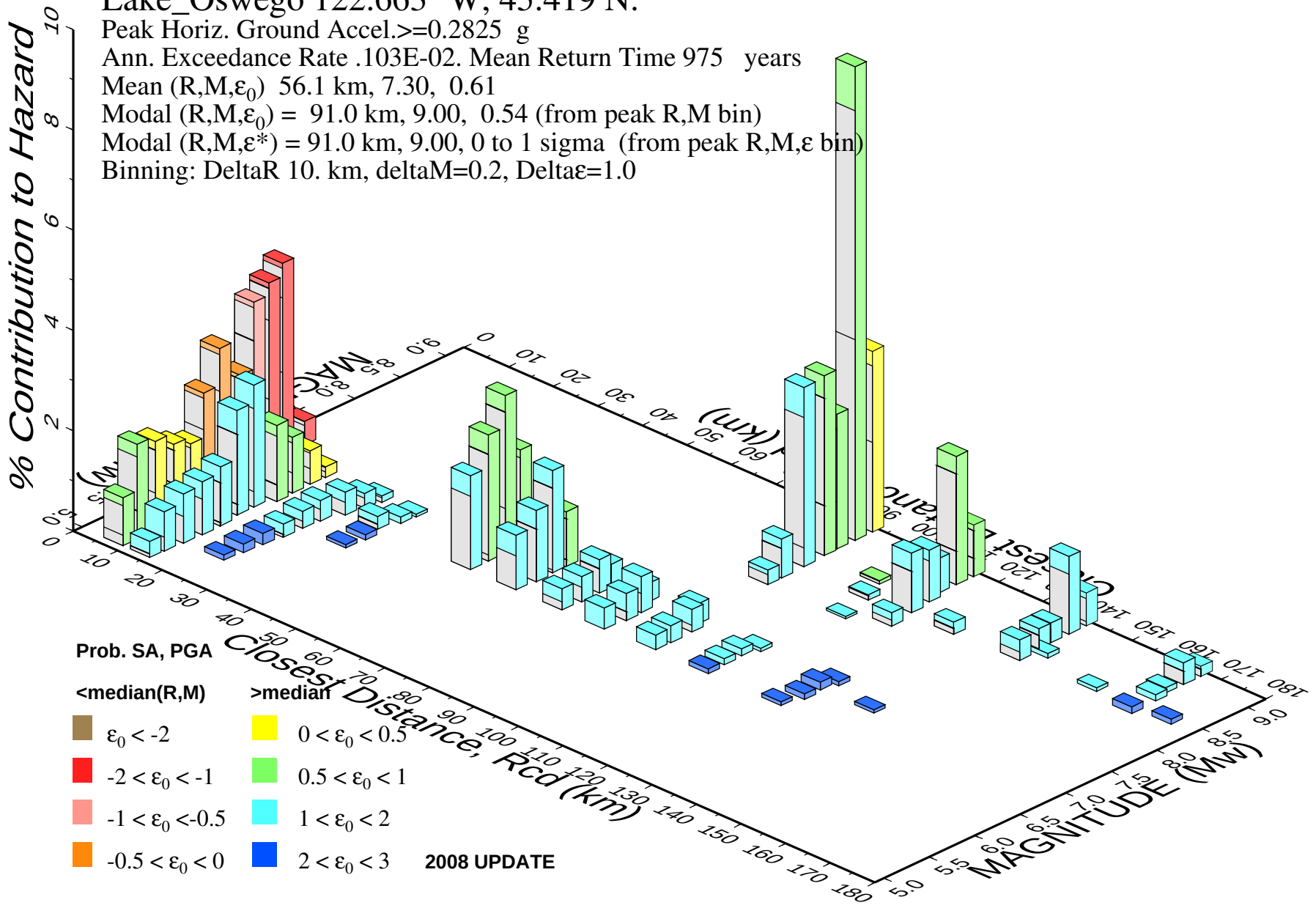
PSH Deaggregation on NEHRP BC rock
Lake_Oswego 122.663º W, 45.419 N.

Peak Horiz. Ground Accel.>=0.1941 g
Ann. Exceedance Rate .214E-02. Mean Return Time 475 years
Mean (R,M,ε_0) 60.7 km, 7.25, 0.34
Modal (R,M,ε_0) = 91.0 km, 9.00, 0.06 (from peak R,M bin)
Modal (R,M,ε*) = 91.0 km, 9.00, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



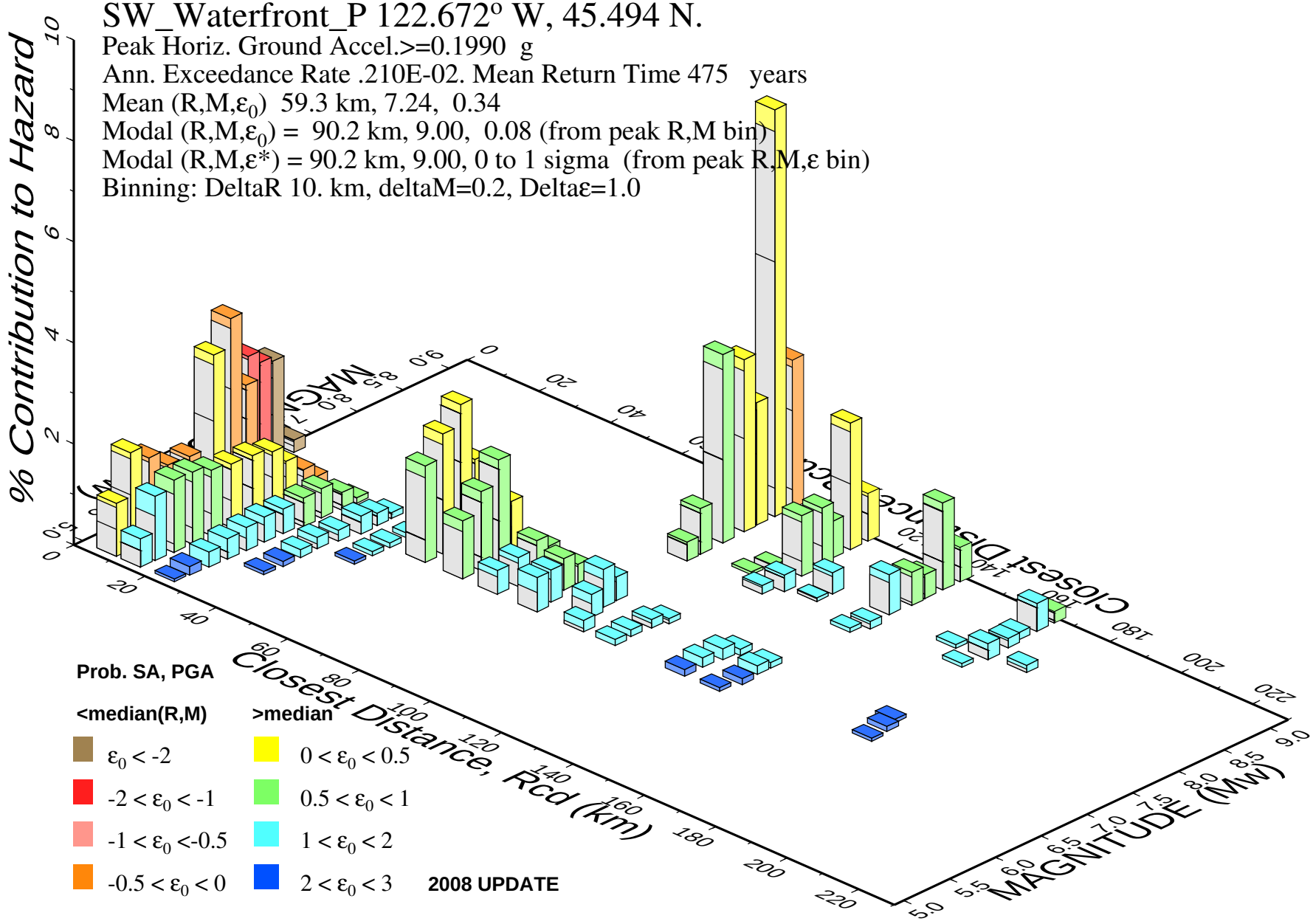
PSH Deaggregation on NEHRP BC rock
Lake_Oswego 122.663º W, 45.419 N.

Peak Horiz. Ground Accel.>=0.2825 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 years
Mean (R,M,ε_0) 56.1 km, 7.30, 0.61
Modal (R,M,ε_0) = 91.0 km, 9.00, 0.54 (from peak R,M bin)
Modal (R,M,ε*) = 91.0 km, 9.00, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



PSH Deaggregation on NEHRP BC rock
SW_Waterfront_P 122.672º W, 45.494 N.

Peak Horiz. Ground Accel.>=0.1990 g
Ann. Exceedance Rate .210E-02. Mean Return Time 475 years
Mean (R,M,ε_0) 59.3 km, 7.24, 0.34
Modal (R,M,ε_0) = 90.2 km, 9.00, 0.08 (from peak R,M bin)
Modal (R,M,ε*) = 90.2 km, 9.00, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



PSH Deaggregation on NEHRP BC rock
SW_Waterfront_P 122.672º W, 45.494 N.

Peak Horiz. Ground Accel.>=0.2883 g
Ann. Exceedance Rate .102E-02. Mean Return Time 975 years
Mean (R,M,ε_0) 54.6 km, 7.28, 0.61
Modal (R,M,ε_0) = 90.2 km, 9.00, 0.55 (from peak R,M bin)
Modal (R,M,ε*) = 90.2 km, 9.00, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0