LITHOLOGY, THICKNESS, AND EXTENT OF HYDROGEOLOGIC UNITS UNDERLYING THE EAST PORTLAND AREA, OREGON

By Susan V. Hartford and William D. McFarland

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CONVERSION FACTORS

For the convenience of readers who may prefer to use metric (International System) units rather than the inch-pound units used in this report, values may be converted by using the following factors:

Multiply inch-pound unit	By	To obtain metric unit
	<u>Length</u>	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	<u>Area</u>	
square foot (ft^2)	0.09294	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
acre	4,047	square meter (m^2)
acre	0.4047	hectare
	<u>Volume</u>	
cubic foot (ft^3)	0.02832	cubic meter (m^3)
gallon (gal)	0.003785	cubic meter (m^3)
gallon (gal)	3.785	liter (L)
	<u>Flow</u>	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

<u>Sea level</u>: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

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ABSTRACT

The lithology, thickness, and extent of eight distinct hydrogeologic units are described and mapped within the study area. These units underlie the East Portland area of northwestern Oregon. The thickness, extent, and top of each unit are shown on contour maps at scales of 1:24,000. Their stratigraphic relations are displayed on a diagrammatic cross section. The geologic setting and unit lithology are described in the text. A data table presents information on each well or boring that was used for determining the thickness, extent, and lithology of each hydrogeologic unit.

The hydrogeologic units range in age from late Miocene to Holocene and include several facies of the Troutdale Formation and Sandy River Mudstone, as well as Quaternary deposits of the Columbia River. From oldest to youngest, these units are referred to as: the sand and gravel aquifer, confining unit 2, Troutdale sandstone aquifer, confining unit 1, unconsolidated gravel/Troutdale gravel aquifer, Columbia River sand aquifer, Blue Lake gravel aquifer, and overbank deposits. The total thickness of these sedimentary deposits is more than 1,300 feet in the study area.

INTRODUCTION

In 1975, the City of Portland Water Bureau (PWB) began a program to study the development of ground water as an alternative to surface water from the Bull Run watershed (Willis, 1977). After drilling and testing several exploratory wells, PWB proposed development of a well field along the south shore of the Columbia River in eastern Multnomah County (fig. 1). A final design capacity of 100 million gallons per day is projected for the completed well field. In 1987, 19 production wells had been completed, as well as more than 50 test, piezometer, and exploratory wells.

The PWB drilling program generated new geologic and hydrologic data that made possible the description of eight distinct hydrogeologic units within sediments of the Portland Basin. The U.S. Geological Survey, in cooperation with the City of Portland Water Bureau, began a study to map these eight units.

Purpose and Scope

The purpose of this report is to describe the lithology, thickness, and extent of a portion of the hydrogeologic system underlying the East Portland area. Knowledge of the hydrogeologic characteristics of the system and their relation to the regional geologic setting will strengthen the understanding of how ground water flows through the system. Mapping of the thickness and extent of the aquifers will provide input for a ground-water flow model of the Portland Basin.

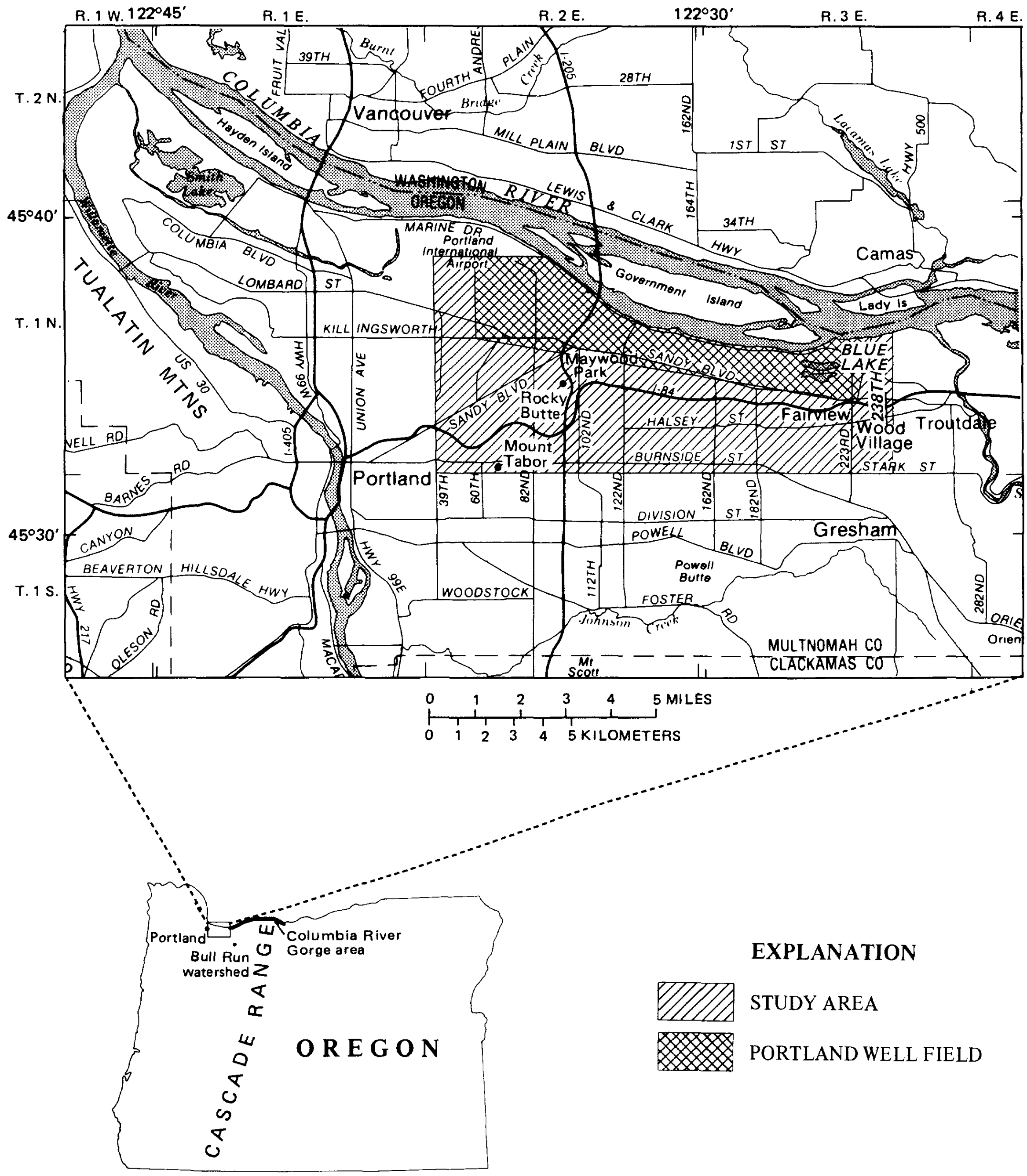

Figure 1.--Location of study area

Location

The study area includes approximately 35 square miles of eastern Multnomah County in northwestern Oregon. The contour maps center around the Portland well field area on the south shore of the Columbia River. The Columbia River forms the northern boundary of the study area. On the east, south and west, the study area is roughly bounded by N.E. 238th Avenue, S.E. Stark Street (Willamette Baseline), and N.E. 39th Avenue (fig. 1). The study boundary encloses all wells drilled by the PWB as of 1987.

Method of Investigation

Interpretation of geologic logs, natural gamma logs, aquifer test data, and selected driller reports was made to determine the altitude of the top of each unit and its thickness. These data are available in the Portland Office of the U.S. Geological Survey.

Wells drilled for the PWB and some other well owners in the study area have been field located by the U.S. Geological Survey. Wells that have not been field located are located to the nearest 40-acre quarter-quarter section as reported in drillers reports, maps, surveys provided by the well owner, or in maps published in previous reports (Foxworthy and others, 1964; Hogenson and Foxworthy, 1965; Willis, 1977 and 1978). Wells used in this study are plotted on a base map at 1:24,000 (sheet 1) and are also referenced in table 1. The altitude of land surface at the well head has either been surveyed or estimated from topographic maps (contour interval, 10 feet).

Well Designations

Designations of wells mentioned in this report are based on the official system for rectangular subdivision of public lands, referenced to the Willamette Base Line and Meridian. The well number indicates the location of the well by township, range, section, and the position of the well within the section (fig. 2). The first numeral indicates the township; the second, the range; the third, the section in which the well is located. The letters following the section number locate the well within the section. The first letter denotes the quarter section (160 acres); the second, the quarter-quarter section (40 acres); the third, the quarter-quarter-quarter section (10 acres); and the fourth, the quarter-quarter-quarter-quarter section (2.5 acres). A number following the letters indicates one or more wells in the same subdivision. For example, well number 1N/2E-29DABD1 is in the SE 1/4, NW 1/4, NE 1/4, SE 1/4, Sec. 29, T.1 N., R.2 E. and is one well drilled in this subdivision.

On the well-location map (sheet 1), the section number and a two- or four-letter section subdivision and sequence number are shown adjacent to the well symbol. The township and range grid on sheet 1 follows surveyed township, range, and section lines where possible with a solid line; the line is dashed where inferred.

Acknowledgments

The authors acknowledge the contributions of several workers who recorded the formational material recovered during PWB drilling activities during the period 1976 to 1985. These workers include F. J. Frank, Constance Taylor, and David Cole, private consultants for the City of Portland Water Bureau; William Hoffstetter and Diane Partch with the City of Portland Water Bureau; and John Cooper and Kevin Foster with Geotechnical Resources Incorporated. The authors also thank the Oregon Water Resources Department (OWRD) for allowing Susan Hartford time from her duties at OWRD to make necessary revisions to the manuscript of this report during the review process.

GEOLOGIC SETTING

The extent and boundaries of the hydrogeologic system in the East Portland area are best understood by describing its relation to the regional geologic setting. Correlation of hydrogeologic units in the East Portland area with geologic units outside the study area is possible using lithologic, geochemical, and stratigraphic comparisons.

Table 1.--Records of representative wells and borings in the East Portland area, Oregon

WELL NUMBER: See text for description of well numbering system.
ALTITUDE: Altitude of land surface at well site is in reference to sea level. Surveyed where accuracy is shown in table; otherwise interpolated from topographic maps (contour interval, 10 feet).
DEPTH OF WELL OR TUBE: Total depth drilled.
DIAMETER OF WELL OR TUBE: Diameter of outermost casing visible at land surface (diameter of boring is that diameter visible at land surface).
DEPTH OF CASING: Depth of deepest casing in the well.
FINISH: P = perforated, S = screened, X = open hole, O = open end, A = abandoned, B = backfilled. Interval shown is the open interval (except for "B" or "A"); may include several blank casing sections where numerous open intervals exist in one well.
HYDROGEOLOGIC UNITS: OB = Overbank deposits, CRSA = Columbia River sand aquifer, BLGA = Blue Lake gravel aquifer, UG/TGA = unconsolidated gravel/Troutdale gravel aquifer, CU1 = Confining unit 1, TSA = Troutdale sandstone aquifer, CU2 = Confining unit 2, SGA = sand and gravel aquifer. For explanation of units, see text.
WATER LEVEL: Those water levels that are above land surface are preceded by a minus (-) sign. Water levels are measured where accuracy is shown in table; otherwise, water levels are reported.
TYPE OF TEST: P = pump test; B = bailer test; A = air test; R = reported.
REMARKS: Owner's well number noted where known.
DATA AVAILABILITY: Dashed ("--") where data is unavailable; queried ("??") where interpretation of data is uncertain or unknown; "~" indicates approximate measurement reported on well report.
ABBREVIATIONS used: TW = test well; PW = production well; NW = northwest; N/A = not applicable; ABD = abandoned; RPT = reported; OR = Oregon; gpm = gallons per minute; ft = feet; hrs = hours; in = inches.
OTHER NOTATIONS used in table: *** = see data below for piezometer data; * = original driller's report unavailable, deepening only.

Well number	Owner	Year completed	Altitude (ft)	Depth of well or tube (ft)	Diameter of well or tube (in)	Depth of casing (ft)	Diameter of open interval (in)	Finish	Hydrogeologic units	Water level above/below land surface (ft)	Date of water-level measurement	Discharge (gpm)	Drawdown (ft)	Pumping period (hrs)	Type of test	Remarks
T. 1 N. R. 1 E.																
36ADCD1	All Saints' Church	1949	218	1700	8	375	8	P,290-375	??	170	12/11/65	213	70	8	P	Ladd well
36ADCD1	All Saints' Church	1965	220	230	10	230	10	P,182-196	??	162	11/16/65	400	15	8	P	
T. 1 N. R. 2 E.																
09CA1	Louie Chang	1924	20	110	6	107	6	X	OB	--	--	--	--	--	-	Rpt to be unused
09CB1	United Airlines	1974	23	110	20	110	8	P,96-106	OB	1.50	04/08/74	110	9	8	P	
09DBDB1	City of Portland	1985	19	423	8	418	5	S,148-203	UG/TGA	15	05/23/85	800	16	6	P	25/30 TW, test data for
								S,307-369	TSA							both intervals
09DDDC1	Port of Portland	1949	29.18	250	10	190	10	P,171-185	UG/TGA	16	08/10/49	575	96	--	P	16AA; test data for
								X,190-218	UG/TGA							both open intervals
13CDCC1	City of Portland	1980	20	571	10	569	6	S,484-559	SGA	-11.55	11/06/80	350	27	4	P	6TW
13CDCC2	City of Portland	1981	20	568	24	568	12	S,484-558	SGA	-11.55	02/03/81	2464	165	36	P	6PW
14CA1	Bert Walker	1963	10	122	6	122	6	O	CRSA?	23	11/01/63	30	47	1	B	
14CC1	NW Natural Gas	1981	20	400	10	20	8.75	X,20-400	N/A	--	--	N/A	N/A	N/A	-	Not a water well
14DDDB1	City of Portland	1981	20	600	6	582	6	S,496-575	SGA	-4.04	12/08/81	450	23	4	P	11TW; ABD 10/82
14DDDB2	City of Portland	1982	20	585	24	585	12	S,495-575	SGA	-6.50	03/30/82	2500	189	24	P	11PW
15BA4	OR Dept of Transp	1971-72	4.8	189	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Boring 50
15BA5	OR Dept of Transp	1971-72	2.9	246	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Boring 51
15BA6	OR Dept of Transp	1971-72	24	225.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Boring 52
15BA7	OR Dept of Transp	1971-72	25	241.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Boring 53
15BA8	OR Dept of Transp	1971-72	26	246.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Boring 54
15BADD1	City of Portland	1984	22.05	244	8	228	5	S,130-218	CRSA	15	09/26/84	800	25	6	P	31TW
15BADD2	City of Portland	1985	22.03	235	16	228	12	S,140-218	CRSA	11.87	03/26/85	4000	51	36	P	31PW
15BADD3	City of Portland	1985	22.14	640	8	640	5	S,490-635	SGA	-9.24	01/17/85	700	--	10	P	34TW
15BADD4	City of Portland	1985	22.13	675	24	667	12	S,480-625	SGA	-10.40	05/16/85	3200	160	24	P	34PW
15BBAC1	Candida Cereghino	1958	22	364	10	360	10	X,360-364	TSA	--	06/10/58	400	31	3	P	
15BCAC1	City of Portland	1977	23.93	328	8	328	6	S,244-320	CRSA	20	10/26/77	725	11	48	P	
15CAAC1	City of Portland	1984	14.94	84	2	79	2	S,79-84	TGA	--	--	--	--	--	-	23 Piezometer
15CBAA1	City of Portland	1985	16	460	16	431	10	S,375-421	TSA	-10.30	01/28/85	3600	186	168	P	28PW
15CBAC1	City of Portland	1976	17.00	708	18	***										15CB1, Exploratory well
189' Tube				189	1.5	186	1.5	S,186-189	UG/TGA	-6.57	09/12/79	N/A	N/A	N/A	-	
406' Tube				406	1.5	403	1.5	S,403-406	TSA	-8.40	10/15/80	N/A	N/A	N/A	-	
521' Tube				521	1.5	518	1.5	S,518-521	SGA	-14.40	10/15/80	N/A	N/A	N/A	-	
565' Tube				565	1.5	562	1.5	S,562-565	SGA	-13.86	10/15/80	N/A	N/A	N/A	-	
15CBAC2	City of Portland	1977	16.03	226	8	226	6	S,69-220	UG/TGA	9	09/24/77	702	14	48	p	15CB2, Pilot well
15CBAC3	City of Portland	1985	17.11	236	24	225	24	S,124-220	UG/TGA	5	01/04/85	6200	48	72	p	22PW
15CDAA1	City of Portland	1984	21.86	457	16	448	9.5	S,377-438	TSA	-4.62	10/01/84	1900	193	24	P	29PW
15DAAA1	City of Portland	1984	21.68	433	8	415	5	S,138-218	CRSA	14	01/04/85	6200	48	72	P	22PW
								P,325-415	TSA		08/13/84	805	30	6	P	26/32TW; test data for both intervals
15DAAA2	City of Portland	1984	21.63	272	16	270	14	S,167-260	CRSA	16	10/23/84	4000	64	24	P	32PW
15DAAD1	City of Portland	1984	21.63	448	16	421	10	S,337-411	TSA	-1.65	11/07/84	2500	105	24	P	26PW
15DBCB1	Michel Development Co	1962	20	360	8	340	6	X,340-360	TSA	--	--	--	--	--	-	ICN plant
15DBDB1	??	??	22	68	1.5	65	1.5	S,60-65	??	--	--	N/A	N/A	N/A	-	ICN monitoring well
16ABAC1	W.L. Menke	1959	23.21	345	8	345	7	P,336-345	TSA	--	--	180	35	4	P	16AB1
16ACAC1	City of Portland	1985	7	399	--	--	--	--	--	--	--	--	--	--	-	
16ADBC1	City of Portland	1977	14.56	400	8	400	6	S,347-386	TSA	-5.78	10/30/77	720	28	48	P	16AD1
16CC1	A. & R. Spada	1964	40	243	8	241	8	P,42-60	UG/TGA	32	07/31/64	400	51	4	P	Test data for both
								P,226-237	TGA							open intervals
16CD1	Cosmo Spada	1940	40	125	8	125	8	P,115-125	CRSA?	5	00/00/40	150	3	3	P	
17CA1	Louis Calcagno	1959	65	70	6	71	6	O	??	46	02/05/59	45	--	1	B	
17CA2	Bernie Calcagno	1972	65	67	8	67	8	P,45-65	??	42	08/03/72	300	.5	3	P	
17DA1	Cosmopolitan Airtel	1968	21	80	20	80	20	P,63-75	TGA?	9	06/11/68	450	36	24	P	
17DC1	Warren Northwest	1957	50	98	12	98	12	P,53-98	??	40	02/16/57	1300	--	4	P	
18CB1	John Ganien	1941	100	100	6	104	6	X,104-110	??	90	00/00/41	20	--	1	-	
18CB2	E.A. Press	1942	100	100	6	93	6	X,93-100	??	87	00/00/42	30	--	1	-	
19CD1	Rose City Cemetary	1950	248	271	8	271	8	O	??	230	04/10/50	300	255	1	P	
20AA1	Pac Rock Prod, Inc	1981	100	84	10	84	10	P,60-82	??	43	07/09/81	1200	7	8	P	
20AA2	NW Natural Gas	--	115	300	--	--	--	--	UG/TGA	--	--	N/A	N/A	N/A	-	Not a water well
20DA1	NW Natural Gas	--	155	400	--	--	--	--	UG/TGA	--	--	N/A	N/A	N/A	-	Not a water well
21CCCD1	City of Portland	1976	239.17	648	18	***										28CC exploratory well
40' Tube				40	1.5	37	1.5	S,37-40	??	--	--	N/A	N/A	N/A	-	
230' Tube				230	1.5	227	1.5	S,227-230	??	203.72	12/17/81	N/A	N/A	N/A	-	
430' Tube				430	1.5	427	1.5	S,427-430	??	202.57	12/17/81	N/A	N/A	N/A	-	
22CD1	Louis Hopwood	1969	160	180	6	180	5	P,175-179	??	131	06/12/69	30	1	1	B	
22DC1	Multnomah County	1962	135	350	8	334	8	P,133-210	??	125	04/30/62	400	4	6	P	Test data for both
								P,307-310	??							open intervals

Table 1.--Records of representative wells and borings in the East Portland area, Oregon--Continued

Well number	Owner	Year completed	Altitude (ft)	Depth of well or tube (ft)	Diameter of well or tube (in)	Depth of casing (ft)	Diameter of open interval (in)	Finish	Hydrogeologic units	Water level above/below land surface (ft)	Date of water-level measurement	Discharge (gpm)	Drawdown (ft)	Pumping period (hrs)	Type of test	Remarks
								T. 1 N. R. 2 E.								
23AACB1	Joe GrosJaques	1967	20	365	10	215	8-10	P,112-215	UG/TGA/ CU1	12.50	02/04/67	80	40	30	P	Test data for both open intervals
								B,215-365	N/A							
23BCAC1	Parkrose Water Dist	1970	30	65	34	65	24	S,41-61	UG/TGA	17	02/18/70	2325	25	26	P	3PW
23BCDB1	Parkrose Water Dist	1965	31	63	24	63	24	S,33-63	UG/TGA	24	01/22/62	2450	13	16	P	2PW
23DA1	Pierce Trainer & Eqp	1959	45	63	6	--	--	--	UG/TGA	--	--	40	10	--	B	
23DB1	George Okita	1955	40	47	6	47	6	O	UG/TGA	19	11/02/55	35	10	--	B	
24AA1	Amil Spada	1980	10	87	6	83	6	S,82-87	UG/TGA	11.50	12/16/80	85	2	2	P	
24AABC1	City of Portland	1979	25.35	520	--	--	--	A	N/A	20	10/29/79	--	--	--	-	1TW
24AABC2	City of Portland	1980	25.35	531	20	520	10	S,389-515	SGA	-11.55	07/11/80	2400	80	3	P	1PW
24AACC1	City of Portland	1977	25.13	490	8	490	6	S,425-489	SGA	-6.93	11/14/77	647	37	48	P	24AA2
24AC1	KKSN Radio	1985*	20	51	6	51	4	P,37-50	UG/TGA	5	05/29/85	50	17	1	A	
24AD1	H.A. Wagner	1960	15	60	6	61	6	O	UG/TGA	6	08/02/60	40	30	1	B	
24AD2	Harry Venema	1971	20	76	6	77	5	P,70-76	UG/TGA	13	10/09/71	--	--	--	-	
24ADCB1	City of Portland	1977	17	330	8	320	6	S,251-320	TSA	-10.16	12/16/77	730	50	48	P	24AD2
24ADCB2	City of Portland	1980	17	538	24	509	12	S,411-504	SGA	-10.40	06/21/82	3000	129	24	P	2PW
24ADCC1	City of Portland	1977	13.93	505	8	500	6	S,380-489	SGA	-13.86	08/16/77	700	14	36	P	2TW
24BA1	Roy K. Roberts	1964	20	50	6	51	6	O	UG/TGA	9	10/07/64	100	1	10	P	
24BA2	Roy K. Roberts	1976	20	104	6	104	6	O	UG/TGA	9.50	09/01/76	24	76	4	B	
24BA3	Tuhe Specialities,Inc	1985	20	280	6	268	5	S,268-278	TSA	28	07/25/85	68	76	4	P	
24BDBD1	City of Portland	1981	15	395	6	389	6	S,283-365	TSA	-3.47	09/11/81	450	27	4	P	10TW
24BDBD2	City of Portland	1982	15	375	16	375	12	S,282-365	TSA	-3.47	01/12/82	2500	196	48	P	10PW
24CA1	Shady Rest Auto Park	1941	45	54	6	54	6	O	UG/TGA	--	--	30	--	--	-	
24CA2	Pacific Equipment Co	1965	20	35	6	35	6	O	UG/TGA	2.50	07/16/65	75	3	2	P	
24CA3	J.W. Huserick	1965	28	27	6	24	6	X,24-27	UG/TGA	5	08/22/65	15	2	2	B	
24CA4	David & Adele Nelsen	1976	25	58	6	58	6	O	UG/TGA	43	07/06/76	20	2	4	B	
24CACA1	City of Portland	1983	39	568	6	562	6	S,442-552	SGA	3	05/13/83	425	45	4	P	16TW
24CACA2	City of Portland	1983	39	560	22	560	12	S,419-550	SGA	3.90	07/27/83	2500	127	24	P	16PW
24CD1	John W. Wolf	1949	45	86	6	86	6	O	UG/TGA	60	09/00/49	10	10	1	-	
24CD2	Ira Wills	1957	45	63	6	62	6	X,62-63	UG/TGA	33	07/22/57	40	--	1	B	
24CDAC1	Steve Caleagno	1971	70	90	8	90	8	P,70-85	UG/TGA	53	02/08/71	215	1	8	P	
24DA1	Eddie & Mary Wegner	1962	20	107	6	107	6	O	UG/TGA	10	08/08/62	60	50	4	B	
24DABB1	City of Portland	1976	18.40	548	18	***										24DA1, exploratory well
80' Tube			17.65	80	1.5	77	1.5	S,77-80	UG/TGA	-6.37	11/09/81	N/A	N/A	N/A	-	
270' Tube			17.96	270	1.5	267	1.5	S,267-270	TSA	-1.03	11/09/81	N/A	N/A	N/A	-	
315' Tube			17.94	315	1.5	312	1.5	S,312-315	TSA	0.94	11/09/81	N/A	N/A	N/A	-	
390' Tube			17.56	390	1.5	387	1.5	S,387-390	SGA	9.93	11/09/81	N/A	N/A	N/A	-	
430' Tube			17.60	430	1.5	427	1.5	S,427-430	SGA	9.87	11/09/81	N/A	N/A	N/A	-	
490' Tube			18.10	490	1.5	487	1.5	S,487-490	SGA	9.82	11/09/81	N/A	N/A	N/A	-	
24DD1	Parkrose Water Dist	1981	39	680	--	--	--	A	N/A	--	--	N/A	N/A	N/A	-	
25AD1	City of Portland	1981	150	500	10	29	--	X,29-500	UG/TGA/ TSA	--	--	--	--	--	-	
25BA1	Blair Holcomb	1947	95	133	8	--	--	P,47-88	UG/TGA	92.6	05/00/49	--	--	--	-	
25BA2	C.P. Springsted	1949	100	75	6	74	6	X,74-75	UG/TGA	52	00/00/49	32	--	1	-	
25BA3	Ronald Young	1962	98	70	6	66	6	X,66-70	UG/TGA	50	01/08/62	30	--	--	-	
25CBCC1	Richland Water Dist	1956	252	490	12	335	12	P,145-330	UG/TGA	145	09/12/56	220	94	4	P	NO. 2
25CC1	Pete Place	--	260	142	6	--	--	--	UG/TGA	126.81	04/26/57	--	--	--	-	
26CB1	Parkrose School Dist	1958	279	415	10	400	10	P,222-226	UG/TGA	236	07/23/58	450	9	5	P	Test data for both open intervals
								P,374-386	UG/TGA?							
26CB2	Columbia Sand & Grvl	1961	280	388	8	377	6	P,305-370	UG/TGA	203	04/15/61	140	23	24	P	
26DD1	Richland Water Dist	1947	255	400	12	388	10	P,165-383	UG/TGA	128	03/00/47	240	50	12	P	NO. 1
26DD2	Richland Water Dist	1959	260	470	12	445	8-12	P,315-440	UG/TGA	199	07/15/59	325	88	6	P	NO. 3
26DD3	Richland Water Dist	--	260	300	--	--	--	--	--	150	--	--	--	--	-	
26DD4	Richland Water Dist	1960	265	250	16	250	8	P,195-250	UG/TGA	140	05/21/60	195	51	14	P	NO. 4
27BB1	Parkrose Water Co	1952	210	265	12	265	12	P,217-247	UG/TGA	198	04/03/52	750	.63	8	P	
27DCCC1	City of Portland	1976	291.90	835	18	***										27DC1, Exploratory well
80' Tube			291.22	80	1.5	77	1.5	S,77-80	UG/TGA	--	--	N/A	N/A	N/A	-	
229' Tube			291.36	229	1.5	226	1.5	S,226-229	UG/TGA	--	--	N/A	N/A	N/A	-	
442' Tube			291.48	439	1.5	429	1.5	S,439-442	UG/TGA	249.38	10/28/81	N/A	N/A	N/A	-	
708' Tube			291.23	708	1.5	705	1.5	S,705-708	SGA	--	--	N/A	N/A	N/A	-	
780' Tube			290.83	780	1.5	777	1.5	S,777-780	SGA	254.53	10/28/81	N/A	N/A	N/A	-	
28BCBC1	Lavelle/Yett Landfill	1973	170	75	12	36		***	N/A	38.67	03/08/73	N/A	N/A	N/A	-	Piezometer well
41' Tube				41	--	--	--	--	UG/TGA	--	--	N/A	N/A	N/A	-	
72' Tube				72	--	--	--	--	UG/TGA	--	--	N/A	N/A	N/A	-	
28BCCB1	Rose City Sand & Grvl	1936	215	200	8	200	8	P,165-195	UG/TGA	--	--	~60	--	--	-	
29DA1	City of Portland	1969	205	417	12	417	10-12	P,195-416	UG/TGA	160	03/11/69	776	39	2	P	Rose City Golf Course
29DABD1	City of Portland	1976	204.43	1210	18	***										29DA1, Exploratory well
204' Tube			203.52	204	1.5	201	1.5	S,201-204	UG/TGA	152.05	05/16/84	N/A	N/A	N/A	-	
447' Tube			203.53	447	1.5	444	1.5	S,444-447	UG/TGA	159.65	05/16/84	N/A	N/A	N/A	-	
713' Tube			203.74	713	1.5	700	1.5	S,700-713	SGA	161.73	05/16/84	N/A	N/A	N/A	-	
809' Tube			203.51	809	1.5	806	1.5	S,806-809	SGA	169.10	05/16/84	N/A	N/A	N/A	-	
29CB1	City of Portland	1968	185	265	12	263	12	P,215-256	UG/TGA	141	06/21/68	990	50	6	P	
29DB1	Rose City Golf Course	1945	212	203	10	208	8	P,160-203	UG/TGA	140	09/00/45	400	--	--	-	
29DC1	NW Natural Gas Co	1983	222	298	10	250	1	--	N/A	--	--	N/A	N/A	N/A	-	Not a water well
30CC1	R.W. Mangels	1945	160	163	8	--	8	P,151-157	UG/TGA	124	08/00/45	50	14	1	P	
31CB1	Providence Hospital	1947	200	164	12	--	--	P,136-148	UG/TGA	116	02/22/62	360	8	2	P	
31CD1	William Reed	--	195	170	--	--	--	--	--	--	--	--	--	--	-	
32BD1	Fred Meyer	1961	255	295	12	295	12	P,185-280	UG/TGA	150	09/15/61	500	42	8	P	
32DD1	Montavilla Ice&Coal	~1919	258	197	6	--	--	--	--	--	--	--	--	--	-	
33DABA1	Russellville Wtr Dist	1941	287	252	12	252	12	P,243-248	UG/TGA	228	04/00/41	250	18	--	P	
33DAAB1	Russellville Wtr Dist	1941	287	304	12	304	12	P,222-290	UG/TGA	229	11/00/41	300	22	--	P	
34AB1	Hazelwood Wtr Dist	1977	290	500	12	500	8	S,415-490	UG/TGA	260	11/21/77	575	63	12	P	
34AB2	Hazelwood Wtr Dist	1982	289	500	12	400	6	S,370-484	UG/TGA	250	04/22/82	300	120	4	P	
35AC1	Multnomah County	1984	310	500	10	500	5	S,442-487	UG/TGA	226	03/23/84	500	133	4	P	
35CD1	Mobile Village	1968	305	330	14	327	8-10	P,165-324	UG/TGA	153	08/28/68	216	64	8	P	

Table 1.--Records of representative wells and borings in the East Portland area, Oregon--Continued

Well number	Owner	Year completed	Altitude (ft)	Depth of well or tube (ft)	Diameter of well or tube (in)	Depth of casing (ft)	Diameter of open interval (in)	Finish	Hydrogeologic units	Water level above/below land surface (ft)	Date of water-level measurement	Discharge (gpm)	Drawdown (ft)	Pumping period (hrs)	Type of test	Remarks
								T. 1 N. R. 3 E.								
15DD1	Sundial Tug & Barge	1963	21	103	6	96	6	X,96-103	N/A	30	04/09/63	18	32	2	B	Destroyed
19AC1	KWJJ Radio Station	1965	10	217	6	210	6	X,210-217	??	10	08/11/65	30	50	3	B	
19ADBB1	City of Portland	1982	24.98	316	10	287	6	S,198-277	TSA	10	11/24/82	400	49	4	P	15TW
19ADBB2	City of Portland	--	--	--	--	--	--	--	--	--	--	--	--	--	-	15PW; no log available
19BACD1	City of Portland	1980	23	576	6	310	6	S,369-526	SGA	-11.55	07/29/80	300	22	4	P	4TW
19BACD2	City of Portland	1980	23	534	24	534	12	S,369-523	SGA	-11.55	07/15/80	--	--	--	-	4PW
19BBCB1	City of Portland	1980	24	319	10	319	6	S,240-307	TSA	7.80	04/14/80	300	25	4	P	3TW
19BBCB2	City of Portland	1980	24	317	20	317	12	S,238-287	TSA	7	07/18/80	2400	145	62	P	3PW
19BDDC1	City of Portland	1981	23.93	500	6	486	6	S,380-476	SGA	-3.47	11/12/81	370	65	4	P	9TW
19BDDC2	City of Portland	1982	23.93	495	24	490	12	S,376-485	SGA	-3.47	03/22/82	2500	71	24	P	9PW
19CBAA1	City of Portland	1980	17	340	6	340	6	S,235-327	TSA	5	09/10/80	300	25	4	P	5TW
19CBBA2	City of Portland	1980	17	340	24	340	12	S,243-337	TSA	5	09/24/80	2430	115	4	P	5PW
20AC1	Jim Murrell	1966	20	40	6	40	6	P,23-40	TSA	14	11/07/66	50	3	1	B	
20AC2	Jim Murrell	1971	25	66	6	66	6	O	TSA	26	11/03/71	15	24	1	B	
20ADCB1	City of Portland	1978	21.83	358	8	358	6	S,288-348	SGA	7.60	01/17/78	720	55	48	P	20AD2
20ADCB2	City of Portland	1983	21.83	361	22	361	12	S,249-352	SGA	3	06/01/83	2500	175	48	P	14PW
20ADDD1	City of Portland	--	--	--	--	--	--	--	--	--	--	--	--	--	-	No log
20BC1	Joe Thacker	1958	25	84	6	82	6	P,70-80	??	8	07/22/58	15	74	1	B	
20BDBB1	City of Portland	1981	26	454	6	450	6	S,325-446	SGA	-3.47	08/10/81	479	32	4	P	7TW
20BDBB2	City of Portland	1981	26	450	20	435	10	S,325-430	SGA	1	11/17/81	2000	255	48	P	7PW
20CB1	Art Spada	1958	20	77	6	76	6	O	UG/TGA	7.5	01/14/58	60	18	1	B	
20CBDC1	City of Portland	1976	20.26	1100	18	***										20CB2, Exploratory well
180' Tube			19.12	180	1.5	177	1.5	S,177-180	TSA	4.56	07/20/81	N/A	N/A	N/A	-	
250' Tube			19.42	250	1.5	247	1.5	S,247-250	TSA	5.68	07/20/81	N/A	N/A	N/A	-	
370' Tube			19.32	370	1.5	367	1.5	S,367-370	SGA	-3.93	07/20/81	N/A	N/A	N/A	-	
490' Tube			19.39	490	1.5	487	1.5	S,487-490	SGA	-6.76	07/20/81	N/A	N/A	N/A	-	
815' Tube			19.32	815	1.5	812	1.5	S,812-815	SGA	-7.26	07/20/81	N/A	N/A	N/A	-	
1040' Tube			19.69	1040	1.5	1037	1.5	S,1037-1040	??	16.63	07/20/81	N/A	N/A	N/A	-	
20CC1	Rockwood Wtr Dist	1981	15	523	16	490	10	S,232-290	TSA	-2.21	05/19/81	1400	174	24	P	Test data for both open
								S,405-475	SGA							intervals
20CCAB1	City of Portland	1977	23.53	448	12	448	6	S,339-438	SGA	-0.50	07/25/77	679	41	48	P	20CC2
20CCAB2	City of Portland	1977	24	280	8	279	6	S,177-278	TSA	.42	08/29/77	710	71	30	P	20CC3
20CCAB3	City of Portland	1981	20	450	24	448	12	S,345-440	SGA	-.25	09/21/81	2500	266	72	P	8PW
20CCCD1	Rockwood Wtr Dist	1979	18	505	20	498	8	S,240-270	TSA	--	--	2000	143	24	P	Test data for both
								S,345-490	SGA							open intervals
21AC1	City of Portland	1978	17.43	155	8	150	6	S,44-130	TSA	7	01/09/78	730	6	48	P	Pilot well
21AC2	City of Portland	1978	23.10	36	--	--	--	--	BLGA	--	--	--	--	--	-	21BD (P1)
21AC3	City of Portland	1978	18.93	33	--	--	--	--	BLGA	--	--	--	--	--	-	21AC (P5)
21ACAB1	City of Portland	1982	42.01	304	8	***										21AC(M1)
97' Tube				97	1.5	94	1.5	S,94-97	BLGA	36.80	10/11/82	N/A	N/A	N/A	-	
183' Tube				183	1.5	180	1.5	S,180-183	BLGA	36.50	10/11/82	N/A	N/A	N/A	-	
281' Tube				281	1.5	278	1.5	S,278-281	BLGA?	37.70	10/11/82	N/A	N/A	/A	-	
21ACBB1	City of Portland	1983	25	194	36	165	31.5	S,80-160	BLGA	19	11/16/83	10000	25	24	P	17PW
21ACCA1	Multnomah County	1952	16	52	12	--	--	--	BLGA	--	00/00/52	1050	7	---	-	
21ACCA2	City of Portland	1982	15.93	123	22	123	22	S,60-118	BLGA	13	10/13/82	5000	18	191	P	12PW
21ACCD1	City of Portland	1982	17.33	250	8	***										21AC(M2)
28' Tube				28	1.5	25	1.5	S,25-28	BLGA	11.70	10/07/82	N/A	N/A	N/A	-	
93' Tube				93	1.5	90	1.5	S,90-93	BLGA	11.70	10/07/82	N/A	N/A	N/A	-	
174' Tube				174	1.5	171	1.5	S,171-174	SGA	7.30	10/07/82	N/A	N/A	N/A	-	
233' Tube				233	1.5	230	1.5	S,230-233	SGA	6.50	10/07/82	N/A	N/A	N/A	-	
21AD1	City of Portland	1978	21.22	30	--	--	--	--	BLGA	--	--	N/A	N/A	N/A	-	21AD(P1)
21ADAA1	City of Portland	1978	23.45	90	--	--	--	--	BLGA	--	--	N/A	N/A	N/A	-	21AD(P2)
21ADBC1	City of Portland	1983	15.98	300	8	245	6	S,78-231	BLGA	.75	05/10/83	400	3	4	P	18TW
21ADBC2	City of Portland	1983	15.98	195	36	193	31.5	S,88-190	BLGA	10.30	10/20/83	8500	72	24	P	18PW
21ADDC1	City of Portland	1978	17.71	19	--	--	--	--	BLGA	--	--	N/A	N/A	N/A	-	21AD(P3)
21BCBC1	City of Portland	1983	25.27	216	6	120	6	S,67-112	BLGA	10.50	04/27/83	400	2	4	P	19TW
21BCBC2	City of Portland	--	--	--	--	--	--	--	--	--	--	--	--	--	-	19 PW; no log available
21BCBD1	Multnomah County	1962	24	--	--	--	--	--	--	17.74	09/02/77	--	--	--	-	
21BD1	City of Portland	1978	24.88	25	--	--	--	--	BLGA	--	--	N/A	N/A	N/A	-	21BD(P2)
21BDBA1	City of Portland	1982	28	222	6	195	6	S,52-193	BLGA	14	07/13/82	500	4	3	P	13TW
21BDBA2	City of Portland	1983	28	171	36	169	31.5	S,85-165	BLGA	22	09/06/83	10000	24	75	P	13PW
21BDCA1	Multnomah County	1962	22	65	--	--	--	--	BLGA	--	--	--	--	--	-	No log
21CABA1	Multnomah County	1962	17	105	--	--	--	--	BLGA	11.75	09/02/77	--	--	--	-	
21CADD1	City of Portland	1981	31.66	40	--	--	--	--	TSA	--	--	N/A	N/A	N/A	-	East piezometer
21CBCD1	W. Interlocken Corp	1967	20.83	261	8	260	8	O	TSA	5	--	175	45	10	P	
21CBCD2	City of Portland	1981	44.69	50	--	--	--	--	TSA	--	--	N/A	N/A	N/A	-	West piezometer
21DABB1	Blue Lake Wtr Coop	--	--	70	--	--	--	--	TSA	15.77	09/06/77	--	--	--	-	No log
21DACB1	Robert Schloredt	1951	22	50	6	--	--	--	TSA	17	08/00/57	--	--	--	-	No log
21DBBB1	City of Portland	1982	29.60	350	8	***										21DB
33' Tube				33	1.5	30	1.5	S,30-33	BLGA	23.10	10/07/82	N/A	N/A	N/A	-	
128' Tube				128	1.5	125	1.5	S,125-128	BLGA	23.10	10/07/82	N/A	N/A	N/A	-	
226' Tube				226	1.5	223	1.5	S,223-226	SGA	18.80	10/07/82	N/A	N/A	N/A	-	
322' Tube				322	1.5	320	1.5	S,320-322	SGA ?	17.90	10/07/82	N/A	N/A	N/A	-	
21DBBB2	City of Portland	1982	17	34	--	--	--	--	BLGA	--	--	N/A	N/A	N/A	-	21DB(P1)
21DBBC1	City of Portland	1982	20	55	--	--	--	--	BLGA	--	--	N/A	N/A	N/A	-	21DB(P2)
21DBCC1	Interlachen, Inc	1941	17	109	8	109	8	O ??	??	11	00/00/41	30	59	--	R	
21DBCC2	Interlachen, Inc	1967	14	226	10	220	10	P,201-216	TSA	10	10/12/67	300	23	12	P	
21DBDC1	Donald Tuttle	1976	32	44	6	--	--	--	TSA	24.41	09/08/77	--	--	--	-	
21DD1	Columbia Acres	1956	10	265	--	--	--	--	TSA	--	--	--	--	--	-	
22AA1	Dorothy Ferris	1963	30	103	6	97	6	S,93-98	??	30	04/09/63	18	32	2	P	
22AD1	Fairview Farms, Inc	1950	20	200	--	--	--	--	??	--	--	--	--	--	-	
22BBCA1	Crown Zellerbach	--	27	96	6	--	--	--	??	31.14	09/08/77	--	--	--	-	No log
22CBCC1	James Shepherd	1958	27	310	12	--	--	--	??	26.98	09/09/77	900	--	--	-	No log

Table 1.--Records of representative wells and borings in the East Portland area, Oregon--Continued

Well number	Owner	Year completed	Altitude (ft)	Depth of well or tube (ft)	Diameter of well or tube (in)	Depth of casing (ft)	Diameter of open interval (in)	Finish	Hydrogeologic units	Water level above/below land surface (ft)	Date of water-level measurement	Discharge (gpm)	Drawdown (ft)	Pumping period (hrs)	Type of test	Remarks
								T. 1 N. R. 3 E.								
27BC1	Northwest Natural Gas	--	100	405	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A	-	Not a water well
27CB1	City of Fairview	~1927	140	150	10	150	10	P,140-150	??	35	01/00/56	--	--	--	-	Perf. at 70 ft in 1955
27CBAA1	City of Fairview	1977	110	486	12	397	10-12	P,155-208	TSA	95.50	12/02/77	370	45	38	P	Cmplt to 390 ft, FAIRVIEW #6
27CBBB1	City of Fairview	1973	117	360	16	361	16	P,270-355	TSA	96	02/14/73	800	155	24	P	FAIRVIEW #5
27CBBB2	City of Fairview	1956	117	1060	12	800	10	P,320-340	SGA	90.14	06/19/56	--	--	--	-	FAIRVIEW #3
27DACC1	City of Wood Village	1980	133	300	12	200	12	S,200-280	??	98	04/08/80	500	57	24	P	
27DC1	Gordon Coulsey	1971	142	72	6	67	6	X,67-72	UG/TGA	10	05/03/71	20	45	2	B	
28AA1	Columbia Acres	1956	22	265	12	265	10-12	P,200-265	SGA	--	05/25/56	1500	100	4	P	
28ABCD1	Ralph Watters	1950	51	92	12	92	12	P,65-90	TSA	38	08/25/50	400	36	8	P	
28AD1	J. Luscher	1951	95	165	8	140	8	X,140-165	TSA	61	00/00/51	60	--	--	R	
28BB2	Sandy Mobile Villa	1965	35	180	8	180	6	P,162-179	SGA	60	07/09/65	150	60	6	P	
28BBCC1	Ed Wade	1959	80	368	10	354	10	S,353-368	SGA	55	12/11/59	450	62	4	P	
28BC1	E.E. Willard	--	79	160	8	160	8	P,130-160	TSA	36	--	275	39	4	R	
28BC2	J. Frank Schmidt	1962	78	284	8	280	8	P,158-277	TSA/SGA	63	05/14/62	200	84	5	P	
28BC4	Glen Handy	1968	112	335	8	328	6	P,215-320	SGA	93	12/00/68	150	25	4	P	
28BC5	Ron Schomoyer	1982	75	110	6	98	6	P,70-90	TSA	68	06/25/82	30	22	1	B	
28CB1	B.E. Davis	1944	145	65	6	65	6	P,54-62	??	16	12/00/44	20	8	1	R	
28CBAB1	Jay Hoyt	1964	110	192	8	190	6	P,140-190	TSA	103	03/17/64	60	37	5	B	
28DCDD1	City of Fairview	1963	185	420	16	355	12-16	P,105-350	UG/TGA/ TSA	68	10/04/63	325	124	8	P	FAIRVIEW #4
29AA1	Joe Cereghino	1959	78	100	6	--	6	--	??	60	03/20/59	45	80	--	B	
29AA3	Kazuo Kikkawa	1956	82	103	6	100	6	X,100-103	TSA	50	03/10/56	25	5	2	B	
29AA4	Howard Angell	1971	75	180	8	180	7	P,140-180	TSA	57	09/27/71	130	--	--	-	
29AB1	Boeing of Portland	??	82	111	--	--	--	--	--	--	--	--	--	--	-	Verbal drillers log
29AC1	Boeing of Portland	1986	82	153	12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	BOP -14
29AC2	Boeing of Portland	1986	127	193	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	BOP - 13
29AC3	Boeing of Portland	1986	80	35	--	--	--	--	--	--	--	--	--	--	-	BOP - 19/C3
29AD1	F.D. Shepherd	1951	82	250	8	250	6	P,159-250	??	55	10/16/51	250	140	1	R	
29AD2	Sandy Mobile Manor	1968	85	191	8	191	6	P,152-190	TSA	60	02/23/68	140	54	6	P	
29BA1	Jean Cereghino	1985	72	96	10	96	5	P,45-96	??	29	09/07/85	10	38	3	B	
29BA2	Boeing of Portland	1986	85	70	--	--	--	--	--	--	--	--	--	--	-	BOP - 18/C2
29BA3	Boeing of Portland	1986	80	97.5	--	--	--	--	--	--	--	--	--	--	-	BOP - 8
29BB1	Cereghino Bros	1957	95	127	8	--	8	--	UG/TGA	--	03/11/57	35	90	--	R	
29BB2	Cereghino Bros	1961	95	273	10	273	8-10	P,125-273	UG/TGA/ TSA	59	10/11/71	555	65	5	P	
29BB3	Boeing of Portland	1986	75	177	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	BOP - 7
29BC1	Boeing of Portland	1986	136	230	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	BOP - 11
29BC2	Boeing of Portland	1986	90	151	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	BOP - 16
29BC3	Boeing of Portland	??	100	198	--	--	--	--	--	--	--	--	--	--	-	No log
29BD1	Electronic Specialty	1964	100	297	12	297	10-12	P,157-282	TSA	71	09/16/64	325	30	6	P	Old supply well
29BD2	Boeing of Portland	1976	112	297	16	297	8	S,247-287	TSA	96	03/03/76	425	93	24	P	Supply well
29BD3	Boeing of Portland	1986	116	152	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	BOP - 9
29BD4	Boeing of Portland	1986	135	98	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	BOP - 12
29BD5	Boeing of Portland	1986	110	51	--	--	--	--	--	--	--	--	--	--	-	BOP - 10
29BD6	Boeing of Portland	1986	84	70	--	--	--	--	--	--	--	--	--	--	-	BOP - 17/C1
29DA1	Cascade Mfg Co	1964	120	280	8	199	8	P,145-195	TSA	122	10/03/64	155	20	2	P	
29DA2	Cherry Blossom Mannor	1967	120	286	8	286	6	P,267-283	SGA	127	08/30/67	65	75	8	P	
29DCDD1	Rockwood Wtr Dist	1976	195	456	10	386	6	S,322-376	TSA	164	03/22/76	300	102	48	P	
29DCDD2	Rockwood Wtr Dist	1980	195	699	16	692	16	--	--	190	10/03/80	--	--	--	-	
30AA1	Boeing of Portland	??	100	54	--	--	--	--	--	--	--	--	--	--	-	No log
30AADB1	Richard Bottaro	1958	92	120	6	119	6	O	??	57	08/08/58	60	13	2	P	
30AD1	George Smith	1967	140	53	6	34	6	X,34-53	UG/TGA	32	02/00/67	20	1	2	B	
30BA1	Handy Nursery	1968	75	132	--	--	--	--	UG/TGA	--	--	--	--	--	-	
30CCAC1	Union PLaza	1979	205	700	8	700	6	P,475-620	TSA	155	06/04/79	70	80	3	A	
30DADD1	John Deere Co	1964	178	429	16	389	10-12	P,122-296	UG/TGA	114	08/07/64	305	140	24	P	
30DB1	Eugene Yale	1958	175	236	8	236	6	P,226-236	UG/TGA	132	10/28/58	98	73	8	P	
31CDCD1	City of Portland	1976	252.88	1000	18	***										31CD1, Exploratory well
161' Tube				161	1.5	159	1.5	S,159-161	UG/TGA	63.05	10/28/81	N/A	N/A	N/A	-	
322' Tube				322	1.5	319	1.5	S,319-322	CU1	92.98	10/28/81	N/A	N/A	N/A	-	
395' Tube				395	1.5	392	1.5	S,392-395	CU1	92.02	10/28/81	N/A	N/A	N/A	-	
568' Tube				568	1.5	565	1.5	S,565-568	TSA	194.68	10/28/81	N/A	N/A	N/A	-	
965' Tube				965	1.5	962	1.5	S,962-965	SGA	228.05	10/28/81	N/A	N/A	N/A	-	
31DD1	Mobil Oil Co	1982	246	63	4	63	4	S,53-63	??	57.50	11/03/82	--	--	--	-	Test well
32DD1	Norman Hollars	1969	242	115	6	115	6	O	UG/TGA	45	10/27/69	50	5	6	B	
32DDAB1	Northwest Natural Gas	1975	243	300	--	--	--	--	N/A	--	--	--	--	--	-	Not a water well
33ADDA1	City of Portland	1976	197.36	1128	18	***										33AD1, Exploratory well
141' Tube				144	1.5	141	1.5	S,141-144	UG/TGA	34.80	10/28/81	N/A	N/A	N/A	-	
277' Tube				280	1.5	277	1.5	S,277-280	UG/TGA	142.08	10/28/81	N/A	N/A	N/A	-	
379' Tube				382	1.5	379	1.5	S,379-382	TSA	110.83	10/28/81	N/A	N/A	N/A	-	
569' Tube				572	1.5	569	1.5	S,569-572	SGA	174.49	10/28/81	N/A	N/A	N/A	-	
679' Tube				682	1.5	679	1.5	S,679-682	SGA	176.34	10/28/81	N/A	N/A	N/A	-	
1110' Tube				1113	1.5	1110	1.5	S,1110-1113	SGA	175.84	10/28/81	N/A	N/A	N/A	-	
33BBCA1	Reynolds High School	1957	200	305	10	305	8-10	P,205-305	??	90	12/04/57	220	92	6	P	
33BD1	W. Pacific Constrctn	1981	202	60	6	60	6	P,20-60	??	5	12/04/61	100	60	2	A	
33CA1	Rogers Constrctn Inc	1957	212	213	16	199	16	P,47-185	??	9	03/12/57	600	121	16	P	
33CC1	Robert Robbins	--	235	40	6	--	6	--	??	2.25	09/09/55	--	--	--	-	No log
34AA1	Grimm	--	168	360	10	198	8	X,198-360	??	65	00/00/42	--	--	--	-	No log
34AABC1	City of Wood Village	1942	170	360	12	355	8	P,170-180 P,284-294 P,340-355	??	65	00/00/42	200	100	--	P	Wood Village #1
34BBDD1	Mult Kennel Club	1956	176	405	12	--	--	--	??	103	05/00/56	350	73	--	R	No log
34CA1	Bauman	--	285	360	10	355	8	P,170-355	??	--	--	200	165	1	R	
34CCCC1	Carl Zimmerman	1944	325	132	8	126	8	X,126-132	??	85	00/00/44	30	--	1	R	

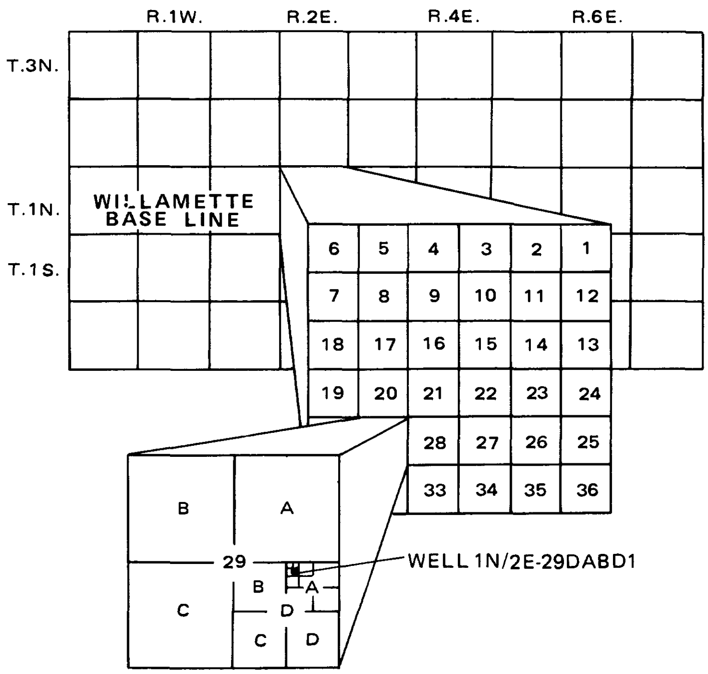

Figure 2.--Well-numbering system.

Many studies have contributed to our current understanding of the volcanic and sedimentary processes that have taken place in this region. A generalized stratigraphy of the area, as modified from the work of others (see references) and from data collected in this investigation, is summarized in figure 3. The surface geology in the study area is shown on sheet 1 (modified after Trimble, 1963), along with a diagrammatic section of the relations of the various units described in this study.

The reader is referred to the list of selected references for a more detailed discussion of the geologic history and stratigraphy of the area.

Older Rocks

Older sedimentary and volcanic rocks underlie the sedimentary hydrogeologic system described in this report and are exposed outside the study area. The older rock sequences include the Skamania Volcanics, Columbia River Basalt Group, and Rhododendron Formation. These formations range from late Eocene to late Miocene in age (fig. 3).

Deformation of these older rocks created a broad structural basin referred to informally as the Portland Basin (Beeson and others, 1985). This basin is bounded, in general, by the Tualatin Mountains to the west and the Cascade Range to the east (Trimble, 1963). The northern and southern limits of the basin are not as clearly defined. Data from deep wells indicate that the thickness of sedimentary deposits in the Portland Basin may exceed 1,300 feet. However, the shape of the basin and the thickness and extent of the older rocks are unknown.

SYSTEM	SERIES	STRATIGRAPHIC UNIT
QUATERNARY	Holocene	Alluvium
	Pleistocene	Sand, gravel, silt, and clay
		Boring Lava and Volcanic rocks of the High Cascade Range
TERTIARY	Pliocene	Troutdale Formation
	?	Sandy River Mudstone
	Miocene	Rhododendron Formation
		Columbia River Basalt group
		Skamania Volcanics
	Oligocene	
	Eocene	

Figure 3.--Generalized stratigraphic correlation chart of the regional area. Modified from Tolan and Beeson (1984, 1985); Swanson (1986), including interpretations of Trimble (1963); Wise (1970); Waters (1973); Hammond (1979, 1980); Anderson (1980); Priest and others (1982).

Skamania Volcanics are exposed northeast of the study area along the south shore of Lady Island and along the north shore of the Columbia River (Trimble, 1963). The formation may underlie the northeast portion of the study area at depths below existing wells. Rocks of generally low permeability may form part of a hydrogeologic boundary for the aquifer system described in this report.

Flows of the Columbia River Basalt Group underlie the study area, but their thickness and extent are not well defined due to a lack of deep wells in the area. The Columbia River Basalt Group is interpreted to be present at a depth of 683 feet below sea level in a well (1N/3E-27CBBB1) in the eastern part of the study area (Hogenson and Foxworthy, 1965). On the southwestern edge of the study area, Piper (1942) indicated that at least 400 feet of the Columbia River Basalt Group underlies 1,300 feet of sediments in the Ladd well (1N/1E-36ADCD1). The top of the Columbia River Basalt Group at that well is at an altitude of 1,082 feet below sea level. More than 1,100 feet of sediment younger than the Columbia River Basalt Group was logged in a well (1N/3E-20CBDC1) in the north-central part of the study area (Willis, 1977; Hoffstetter, 1984). The altitude of the bottom of the well is 1,080 feet below sea level.

Flow units of the Columbia River Basalt Group have not been utilized as aquifers within the study area because of their depth within the basin. Elsewhere, at the margins of the basin, flow units of the Columbia River Basalt Group are used as aquifers.

The Rhododendron Formation is exposed southeast of the study area in the Sandy River and Bull Run River. This formation may or may not underlie the aquifer system described in this report. Lahars present within the lower Troutdale Formation to the east of the study area have been correlated with rocks of the Rhododendron Formation (Tolan and Beeson, 1984a).

Sandy River Mudstone and Troutdale Formation

The most areally extensive hydrogeologic units in the study area occur within the Sandy River Mudstone and the Troutdale Formation. Claystone, siltstone, and sandstone beds of the Sandy River Mudstone and sandstone and conglomerate beds of the Troutdale Formation overlie flows of the Columbia River Basalt Group in the Portland Basin (Trimble, 1963). These sediments represent a large thickness of lacustrine and fluvial material, derived from sources to the east of the study area and deposited within an active structural basin (Trimble, 1963; Beeson and others, 1985). The Troutdale Formation and the Sandy River Mudstone range in age from late Miocene to Pliocene (fig. 3).

Two facies of the Troutdale Formation have been described by Tolan and Beeson (1984a). The ancestral Columbia River facies is composed chiefly of fluvial conglomerates containing foreign clasts such as quartzite and granite deposited by the Columbia River. Locally derived clasts deposited by Cascadian streams form what is termed the Cascadian stream facies. The distribution of these two facies of the Troutdale Formation is shown in figure 4.

The ancestral Columbia River facies of the Troutdale Formation has been subdivided into two distinct lithologic members, based on the onset of high-alumina basalt volcanism in the lower Columbia River Gorge area (Tolan and Beeson, 1984a). The lower member is described as primarily quartzite-bearing, basaltic conglomerates and micaceous, arkosic sand. The upper member is characterized by the presence of basaltic glass and clasts of high-alumina basalt composition (Tolan and Beeson, 1984a; Swanson, 1986). This material forms vitric-lithic sandstones and conglomerates.

Comparison of geochemical analyses of drill cuttings from the study area and analyses of outcrop samples from the lower Columbia River Gorge area indicate that the transition between upper and lower members of the ancestral Columbia River facies can be identified in the study area (Swanson, 1986). This correlation establishes the stratigraphic position of some of the hydrogeologic units described in this report.

Coarse-grained material of the Troutdale Formation generally forms good aquifers within the study area and elsewhere in the region. The Sandy River Mudstone is not generally noted for productive aquifers. However, coarse-grained layers of the Sandy River Mudstone do form aquifers in the study area. Outside the study area, detailed mapping of Troutdale Formation and Sandy River Mudstone is not presently available. Future geologic mapping may allow interpretation of their depositional relations which will provide new information on the extent and thickness location of water-yielding sediments.

Boring Lava

Boring Lava is exposed in the Portland area as numerous volcanic vents, such as Mount Tabor and Rocky Butte (fig. 1). High-alumina basalt of the Boring Lava intruded Troutdale Formation and Sandy River Mudstone sediments and was erupted onto an extensively eroded surface of the Troutdale Formation (Trimble, 1963). These volcanic vents truncate hydrogeologic units in the southwestern part of the study area (sheets 2-4). East of the study area, high-alumina basalt flows are found intercalated with and overlying the upper part of the Troutdale Formation (Williams, 1916; Lowry and Baldwin, 1952; Tolan, 1982; Tolan and Beeson, 1984a).

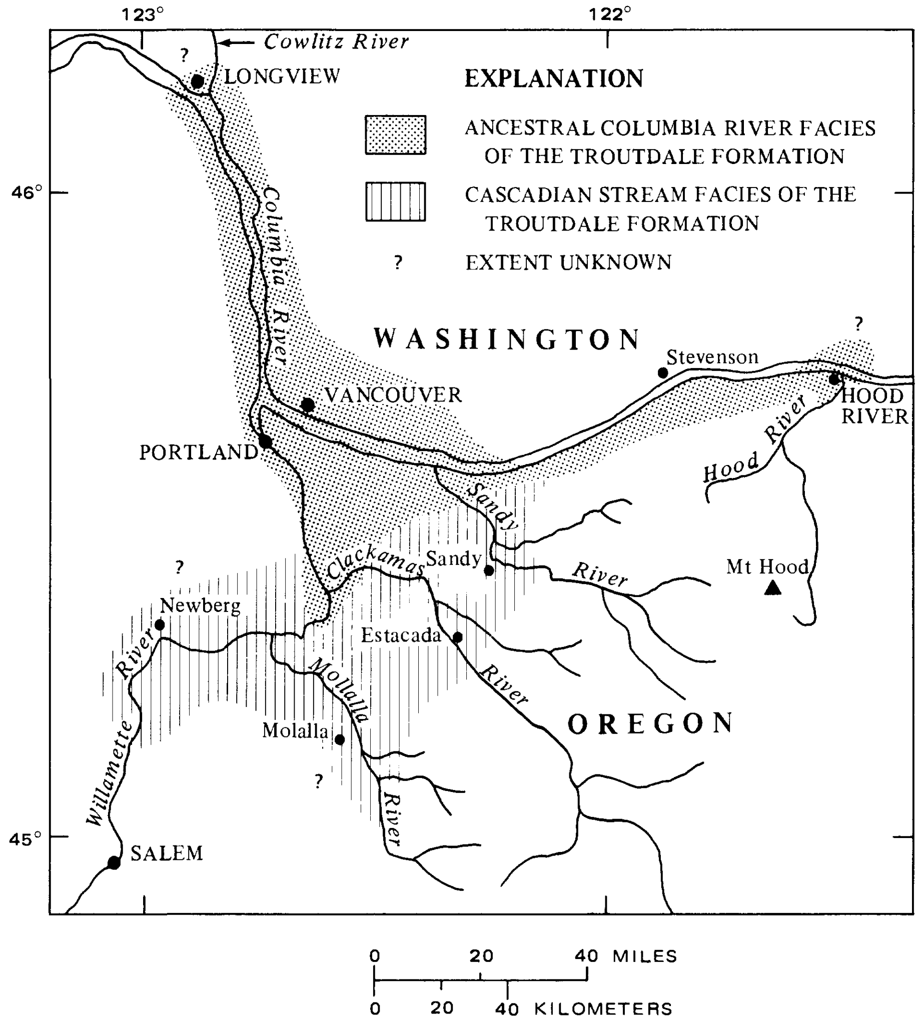

Figure 4.--Facies distribution of the Troutdale Formation (from Tolan and Beeson, 1984b).

Boring Lava of the Portland area and volcanic rocks of the High Cascade Range are informally grouped together on the basis of similar age and lithology (Peck and others, 1964). These rocks are also informally referred to as high-alumina basalt, on the basis of major-oxide analyses (Tolan and Beeson, 1984a). The age range of these high-alumina basalts is late Pliocene to Pleistocene, on the basis of stratigraphic relations and age dating of basalt flows (Tolan, 1982; Tolan and Beeson, 1984a; Wise, 1969; Hammond, 1979).

Significant amounts of vitric sand (basaltic glass) and basaltic clasts of high-alumina basalt composition (Swanson, 1986) form excellent aquifers within the upper part of the Troutdale Formation in the study area. This material was derived from interaction of high-alumina basalt flows with the ancestral Columbia River in the lower Columbia River Gorge area (Tolan and Beeson, 1984b).

Ground water in the Boring Lava occurs mainly in perched zones above the regional water table (Hogenson and Foxworthy, 1965). Wells in these zones have generally small yields. Boring Lava flows were encountered between 23 and 206 feet above sea level in a well (1N/2E-21CCCD1) just west of Rocky Butte (sheet 1). These flow units yielded no ground water.

Quaternary Deposits

The detail of recent geologic events in the Portland area is not thoroughly understood. Regional tectonic uplift, volcanic activity, interglacial changes in sea level, and failure of glacial ice dams (upstream in the Columbia River Drainage system) combined to create many periods of erosion, channel incision, and deposition during Pleistocene time. Flood deposits and terrace deposits of sand, silt, gravel, and clay have accumulated to several hundred feet in thickness in the Portland area. Mudflows and other volcanic debris were deposited from nearby volcanic centers. Weathering and erosion have modified the original surface of these Quaternary deposits.

Pleistocene channel segments, cut by the ancestral Columbia River and filled with sand and gravel deposits, have been identified on the basis of seismic reflection profiling and interpretation of well data (Willis, 1978; McFarland and others, 1982; Hoffstetter, 1984).

HYDROGEOLOGIC UNITS

In this report, the sequence of Tertiary and Quaternary sediments is divided into distinct hydrogeologic units (aquifers and confining units) on the basis of their water-bearing properties. An aquifer is defined as a water-bearing layer of rock that will yield a usable quantity of water to a well or spring. Confining units are composed of relatively fine-grained sediments which have distinctly lower permeability than adjacent aquifers. Hydrogeologic units may cross known stratigraphic boundaries where coarse or fine-grained material of two formations are grouped together, forming one aquifer or confining unit. Aquifers and confining units also may occur as local features or may exist as regionally extensive units.

Five hydrogeologic units have been identified in the East Portland study area (Willis, 1977, 1978; Hoffstetter, 1984); these units can be correlated with sediments identified as the Troutdale Formation and the underlying Sandy River Mudstone. These hydrogeologic units are informally referred to, from oldest to youngest, as the (1) sand and gravel aquifer, (2) confining unit 2, (3) Troutdale sandstone aquifer, (4) confining unit 1, and (5) unconsolidated gravel/Troutdale gravel aquifer. Only a part of the unconsolidated gravel/Troutdale gravel aquifer unit is correlative with the Troutdale Formation; see description in text. Correlation of informal unit names used in this report with those used by previous workers is shown in figure 5.

Near the area of the Columbia River floodplain, these units strike generally north-northwest and dip gently (less than 2 degrees) southwest toward the interpreted center of the basin. Complex structure on the north and east margins of the Portland Basin (Davis, 1988; and Swanson, 1986) and extensive erosion in the Blue Lake area combine to create irregular surfaces and thicknesses of the five hydrogeologic units in this area. Units may also be truncated or more steeply dipping in these areas (sheets 2 to 6). A cross section along the south shore of the Columbia River shows some of these features (sheet 1).

Hydrogeologic units included in the Troutdale Formation and Sandy River Mudstone have been exposed to erosion during periods of intermittent deposition and incision of the ancestral Columbia, Sandy, and Clackamas Rivers during Pleistocene and Holocene time (Trimble, 1963). Two paleochannel segments have been identified on the south shore of the Columbia River (Willis, 1978; McFarland and others, 1982; Hoffstetter, 1984). The deposits that fill those channel segments form aquifers of limited extent (fig. 5) and are informally referred to as the (1) Blue Lake gravel aquifer and (2) Columbia River sand aquifer.

The Columbia River floodplain is mantled with fine-grained surface deposits, which overlie hydrogeologic units of the study area. These deposits are primarily the result of intermittent flooding of the Columbia River and are informally referred to as overbank deposits in this study (fig. 5).

SYSTEM	SERIES	HYDROGEOLOGIC UNIT		
		WILLIS; 1977, 1978	HOFFSTETTER; 1984	THIS REPORT
QUATERNARY	Pleistocene	Unnamed clayey and sandy silt	Recent floodplain deposits	Overbank deposits
		Blue Lake aquifer	Blue Lake aquifer	Blue Lake gravel aquifer
		Columbia River sands	Columbia River sands aquifer	Columbia River sand aquifer
	?—?—?	Troutdale gravel aquifer	Parkrose gravel aquifer	Unconsolidated gravel/ Troutdale gravel aquifer
TERTIARY	Pliocene	Unnamed aquitard	Parkrose aquitard	Confining unit 1
		Troutdale sandstone aquifer	Troutdale sandstone aquifer	Troutdale sandstone aquifer
		Unnamed aquitard	Rose City aquitard	Confining unit 2
	?—?—? Upper Miocene	Sandy River Mudstone aquifer	Rose City aquifer Lower Rose City aquifer	Sand and gravel aquifer

Figure 5.--Correlation of informal hydrogeologic-unit names used in this study with those used by previous investigators.

Sand and Gravel Aquifer

The sand and gravel aquifer is the lowermost hydrogeologic unit in the study area and consists of a thick section of sand, silt, gravel, and clay beds. Sand and gravel predominate at the top of the unit, grading to relatively fine-grained material near the bottom. Some lenticular deposits also are present. At depth some coarse-grained material is present, on the basis of well-log data from well 1N/2E-29DABD1 in the southwestern part of the study area. The sand and gravel aquifer underlies the entire study area. This unit may have a maximum thickness in excess of 560 feet, on the basis of lithologic and aquifer-test data in the southeastern part of the study area at well 1N/3E-33ADDA1 (sheet 2).

The sand and gravel aquifer is one of the more important aquifers in the study area; however, lithologic correlation using well records is difficult because of a scarcity of wells drilled in this unit. This aquifer can be divided into two lithologic units: a relatively coarse-grained upper unit and a predominately fine-grained lower unit.

In the western part of the study area, the upper unit consists primarily of fine to medium vitric-lithic sand with minor amounts of gravel. The sand is chiefly vitric material (basaltic glass) with varying percentages of basalt and quartz sand. Minor thin lenses of greenish-blue clay to gray-brown silt and minor clasts of basaltic composition occur throughout. This upper unit is locally indurated, and thickness varies from 50-120 feet.

Toward the eastern part of the study area, the upper unit becomes thicker, more cemented, and consists primarily of basaltic clasts in a sandy matrix. These clasts consist of quartzite-bearing basaltic gravel with minor cobbles. Black vitric sand predominates near the top of the unit, forming lenses in the matrix. At depth, the sand becomes more lithic with varying percentages of quartz and basalt sand and a trace of muscovite. Minor thin lenses of gray-green clay and gray-brown silt occur near the bottom of the unit. Thickness ranges from 120 to greater than 200 feet. Cementation is common in the eastern part of the upper unit of the sand and gravel aquifer. Underlying the Blue Lake area, the upper unit of the sand and gravel aquifer has been partially eroded. The composition of the sand and gravel aquifer in this location changes over a short distance, becoming relatively fine-grained to the east. Based on limited well data, this transition may be interpreted as another type of channel fill or may represent a facies change within the sand and gravel aquifer.

In the study area, the transition between upper and lower units is gradual. In general, fine-grained material is more prevalent at depth within the sand and gravel aquifer. The lower unit is composed of lenses of fine- to coarse-grained sediment, but is predominately fine-grained. Light blue-grey sandy to silty clay layers are interbedded with layers of micaceous, quartzitic, and basaltic sand. Sand and gravel of quartzitic and basaltic composition occur in lenses throughout the lower unit, but are not common.

Correlation of basaltic glass (vitric material) in the upper unit of the sand and gravel aquifer in the study area with basaltic glass clasts from outcrops in the lower Columbia River Gorge (Swanson, 1986) suggests that the upper unit is part of the informal upper member of the ancestral Columbia River facies of the Troutdale Formation (Tolan and Beeson, 1984a). On the basis of similar lithology, the fine-grained lower unit of the sand and gravel aquifer appears to be more closely related to lacustrine sediments of the Sandy River Mudstone.

Confining Unit 2

The sand and gravel aquifer unit is overlain by fine-grained material of confining unit 2 throughout most of the study area. Along the Columbia River floodplain, confining unit 2 ranges from about 0 to 100 feet in thickness. To the south and southeast, confining unit 2 becomes more than 180 feet in thickness (well 1N/3E-31CDCD1). To the southwest, confining unit 2 thins to less than 30 feet in thickness. In the Blue Lake area, confining unit 2 dips more steeply to the west than is observed in the rest of the study area. Here confining unit 2 abruptly thins and disappears beneath the Blue Lake gravel aquifer (sheets 1 and 2). To the west, confining unit 2 dips more gently (less than 2 degrees). South of the floodplain, confining unit 2 dips generally to the south. Few wells penetrate this unit in this area. The top of confining unit 2 appears to be a heavily eroded surface (sheet 2).

Confining unit 2 acts as a leaky confining layer (Willis, 1978) between the upper unit of the sand and gravel aquifer and the overlying Troutdale sandstone aquifer. Greyish-olive clay with minor silt and thin lenses of fine- to medium-grained basaltic sand form the predominant lithology of this unit. A claystone occurs near the bottom of confining unit 2 in most of the study area. Fine-grained sediments of confining unit 2 are interpreted as lacustrine beds, deposited in a closed basin that existed for a short period of time because of local tectonic deformation (Trimble, 1963).

Troutdale Sandstone Aquifer

Sand, sandstone, and conglomerate that compose the Troutdale sandstone aquifer overlie fine-grained material of confining unit 2. The Troutdale sandstone aquifer averages about 100 feet in thickness in the study area, except where it has been partly or completely eroded. South of the floodplain area, the Troutdale sandstone aquifer dips southwest in the direction of City of Portland exploratory well (1N/2E-29DABD1); at this location the top of the Troutdale sandstone aquifer is at 387 feet below sea level. Approximately 0.5 miles north of this well, another well (1N/2E-21CCCD1) fails to penetrate the top of the Troutdale sandstone aquifer. The bottom-hole altitude is 408 feet below sea level, and it is possible that the Troutdale sandstone aquifer is present at a greater depth.

In the northeastern part of the study area, south of Blue Lake, an exposed ridge of sandstone trends west-northwest and dips about 12 to 14 degrees southwest. This ridge is interpreted to be part of the Troutdale sandstone aquifer on the basis of geochemical and lithologic similarities and stratigraphic relations. The change in dip from less than 2 degrees (west of Blue Lake) to about 12 to 14 degrees (south of Blue Lake) is interpreted as a homoclinal feature (Swanson, 1986). The Troutdale sandstone aquifer crops out south of Blue Lake and to the south and east of Fairview Lake. Complex structure and extensive erosion in this area make an interpretation of the Troutdale sandstone aquifer thickness and upper surface difficult to describe and map (sheet 3). North of Blue Lake, the Troutdale sandstone aquifer is thought to be completely removed by erosion. Large isolated sandstone blocks are seen at the surface and noted within materials of the Blue Lake gravel aquifer.

The Troutdale sandstone aquifer thins to less than half its average thickness (about 100 feet) in the area of a paleochannel segment in the northwestern part of the study area (sheet 3). Channel erosion does not appear to be a reasonable hypothesis for thinning of the Troutdale sandstone aquifer in this location because confining unit 1, which overlies the Troutdale sandstone aquifer, does not appear to have been completely removed by channel erosion leaving the Troutdale sandstone aquifer intact in this location (sheet 3). The thickness of the Troutdale sandstone aquifer in this location may be the result of numerous variables such as minor faulting or perhaps deposition on an extensively eroded surface (of confining unit 2).

The Troutdale sandstone aquifer is the most lithologically unique hydrogeologic unit in the study area; it consists of two distinct units. Sand, sandstone, and minor thin silty-clay lenses of the upper unit compose two-thirds of the Troutdale sandstone aquifer; a conglomerate, composed chiefly of basaltic gravel, forms the lower unit. At the northwestern edge of the study area, the lower unit of the Troutdale sandstone aquifer gradually becomes composed of a greater percentage of sand versus gravel-sized material.

Sand and sandstone of the upper unit consist mainly of relatively clean, moderate- to well-sorted, angular to sub-rounded black basaltic glass (sideromelane). Local alteration of sideromelane grains to palagonite (Trimble, 1963) has resulted in formation of a cementing agent in the Troutdale sandstone aquifer unit. Thin blue to blue-green silty clay lenses occur in the upper one-half of this unit.

Basaltic glass and clay of the upper unit of the Troutdale sandstone aquifer exhibit a relatively unique signature on natural gamma logs completed for some of wells in the study area. The sequence of basaltic glass-clay-basaltic glass at the top of the Troutdale sandstone aquifer correlates with corresponding low-high-low natural gamma activity. This feature is a positive correlation tool for indicating the top of the Troutdale sandstone aquifer in the study area.

The lower unit of the Troutdale sandstone aquifer consists mainly of quartzite-bearing basalt conglomerate with a silty-to-sandy matrix composed primarily of vitric-lithic material. Minor lenses of vitric-lithic sand occur, but are not as common. The cemented gravels of the basalt conglomerate are well rounded and poorly sorted.

The Troutdale sandstone aquifer unit is considered to be part of the upper member of the ancestral Columbia River facies of the Troutdale Formation, based on lithological and geochemical similarity of well cuttings in the study area to outcrop samples in the lower Columbia River Gorge (Swanson, 1986).

Confining Unit 1

The Troutdale sandstone aquifer unit is overlain by fine-grained sediments of confining unit 1, which is found throughout most of the study area, except where removed by erosion. Estimated thickness ranges from 0 to 150 feet in the study area, averaging about 100 feet west of the Blue Lake area underlying the Columbia River floodplain. The absence of confining unit 1 north and south of Blue Lake possibly is the result of erosion. In the northwestern part of the study area, confining unit 1 has been partially removed by erosion of an ancestral Columbia River as interpreted from well cuttings in that area.

At the site of well 1N/3E-33ADDA1, fine-grained material of confining unit 1 is not described in the geologic log of the well. A coarser-grained unit (indistinct from the unconsolidated gravel/Troutdale gravel aquifer acts as a confining unit between the Troutdale sandstone aquifer and unconsolidated gravel/Troutdale gravel aquifer. At this location, the confining unit 1 is noted on the contour maps as "not present," although it may be present as a coarser-grained facies (sheet 4).

Dark olive-grey to grey-brown sand, silt, and clay are the predominant lithology of confining unit 1. Black vitric sand or sandstone occurs in beds ranging from 5 to 15 feet in thickness. These vitric beds occur near the top of confining unit 1 in the east part of the study area and near the bottom of the unit to the west. Most well logs and geophysical logs in the study area indicate that a clay with relatively high natural gamma activity occurs at the bottom of this unit.

Sediments of confining unit 1 appear to be of lacustrine origin similar to the sediments observed in confining unit 2, probably deposited in a closed basin that existed for a relatively short period of time.

Unconsolidated Gravel/Troutdale Gravel Aquifer

The unconsolidated gravel/Troutdale gravel aquifer overlies confining unit 1 in most of the study area, except where it has been removed by erosion in the northwestern and northeastern parts of the study area. The unconsolidated gravel/Troutdale gravel aquifer consists of gravels of the Troutdale Formation of late Pliocene age and also younger Pleistocene gravels, which are undifferentiated in well-log data. Hogenson and Foxworthy (1965) used several criteria to distinguish Pleistocene gravels from gravels of the Troutdale Formation. Their observations indicated that, in general, unconsolidated Pleistocene gravels overlie cemented gravels of the Troutdale Formation. However, cementation appears to occur in both units in the study area (as noted in well reports and geologic logs) and therefore cannot be used to differentiate them. It has also been observed that Pleistocene gravels are composed mainly of locally derived basaltic clasts, while Troutdale gravels have been noted to consist of as much as 30 percent foreign clasts such as quartzite or granitic rocks (Trimble, 1963; Cole, 1982). In drillers' reports, clast composition is rarely recorded. Therefore, for the purposes of this study, these Pleistocene gravels are informally included in the unconsolidated gravel/Troutdale gravel aquifer.

The unconsolidated gravel/Troutdale gravel aquifer ranges in thickness from about 0 to 580 feet, gradually increasing in thickness from east to west in the area of the well field. The unconsolidated gravel/Troutdale gravel aquifer consists mainly of Troutdale gravels in the well field area; the unit strikes generally east to west. Elsewhere its thickness increases to the south, where a greater percentage of younger Quaternary terrace gravels and flood deposits are grouped with gravels of the upper part of the Troutdale Formation to form what is termed the unconsolidated gravel/Troutdale gravel aquifer. The upper surface of this unit crops out south of the Columbia River floodplain; therefore, the altitude of the top of the Troutdale gravel aquifer unit is contoured only on the floodplain (sheet 5).

The Troutdale gravels consist mainly of pebbly to cobbly clast-supported conglomerate with a silty to sandy matrix. Sixty to eighty percent of clasts are composed of sub- to well-rounded basalt, with the remainder composed of quartzite and other foreign clasts. The matrix consists of olive-gray to brown sand, silt, and clay. Thin lenses of material similar to the matrix occur intermittently throughout the unit.

Blue Lake Gravel Aquifer

The Blue Lake gravel aquifer consists of coarse channel deposits of the ancestral Columbia River. It forms an aquifer of limited extent north of Blue Lake in the northeastern part of the study area (sheet 6). An aquifer of similar lithology and extent is present beneath the north shore of the Columbia River near Camas-Washougal, Washington (Mundorff, 1964). The estimated thickness of the Blue Lake gravel aquifer ranges from about 60 to 220 feet in the study area (sheet 6).

The Blue Lake gravel aquifer is composed primarily of boulder-, cobble- and gravel-sized clasts in a minor matrix of clayey to sandy silt. The coarse gravel consists of 60- to 95-percent basalt, with the balance composed of quartzite, granite, and diorite. Minor sandstone cobbles and boulders also are present, along with traces of claystone pebbles and lenses. The unit is clast supported, averaging 80- to 95-percent gravel and 5- to 20-percent matrix. The Blue Lake gravel aquifer becomes siltier with depth.

The southern boundary of this unit is the west-northwest trending sandstone ridge south of Blue Lake. North of the ridge, older hydrogeologic units, including the confining unit 1, Troutdale sandstone aquifer, and part of confining unit 2 and the sand and gravel aquifer, are thought to have been removed by erosion. The stratigraphy of the area is difficult to interpret east of Blue Lake, because of lack of well data. Well data from approximately 2 miles east of Blue Lake have been variously interpreted as representing part of the Sandy River Mudstone and Troutdale Formation (Hogenson and Foxworthy, 1965; Willis, 1978).

Columbia River Sand Aquifer

The Columbia River sand aquifer fills the lower part of a Pleistocene channel segment of the ancestral Columbia River (McFarland and others, 1982; Willis, 1978; Hoffstetter, 1984) in the northwestern part of the study area. This paleochannel segment has a depth of more than 300 feet (Hoffstetter, 1984), and erosion has removed part of the unconsolidated gravel/Troutdale gravel aquifer and confining unit 1, as indicated by well data in the study area. More than 250 feet of this channel fill was encountered in well 1N/2E-15BCAC1. This aquifer is of limited extent and follows a general west-northwest trend near the present-day Columbia River (sheet 6).

The Columbia River sand aquifer is composed of gray to gray-brown, fine-grained, commonly quartz-rich basaltic sand that is relatively clean. Traces of silt, siltstone and sandstone fragments, muscovite flakes, wood, shells, and coarse sand and gravel occur throughout the aquifer. The unit generally becomes siltier with depth, but in some drill holes the bottom 10 to 40 feet of the Columbia River sand aquifer contains a coarse sand and gravel layer with minor boulders.

Overbank Deposits

Overbank deposits occur in the study area as the uppermost unit on the Columbia River floodplain. In general, the thickness of these fine-grained deposits is greatest near the modern shoreline of the Columbia River and thins to zero at the southern limit of the floodplain (sheet 6). This unit thickens in the area of the Columbia River sand aquifer in the northwestern part of the study area (sheet 6). Here the sandy silt deposits in the upper part of the paleochannel are unsaturated and are included in the fine-grained alluvial material of the overbank deposits.

Overbank deposits consist primarily of light olive-brown to dusky yellow-brown silty clay and brown to grey-brown fine-grained sandy silt. These deposits are chiefly the result of intermittent flooding of the Columbia River.

SUMMARY

The lithology, thickness, and extent of a hydrogeologic system within sediments of the Portland Basin are described, on the basis of interpretation of geologic logs, natural gamma logs, aquifer test data, and selected driller reports. Eight hydrogeologic units are represented and correlated with geologic units that have been mapped in the region. The thickness and extent of each hydrogeologic unit are the result of river processes and basin development. Understanding the stratigraphy of the system and its relation to the regional geologic setting strengthens the knowledge of how ground water flows through the system.

The eight hydrogeologic units are distinct and can be traced outside the study area. Units that are part of the Troutdale Formation and Sandy River Mudstone include the sand and gravel aquifer, confining unit 2, Troutdale sandstone aquifer, confining unit 1, and part of the unconsolidated gravel/Troutdale gravel aquifer. The remaining units are associated with Quaternary processes of the Columbia River and are referred to as the Blue Lake gravel aquifer, Columbia River sand aquifer, and overbank deposits.

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