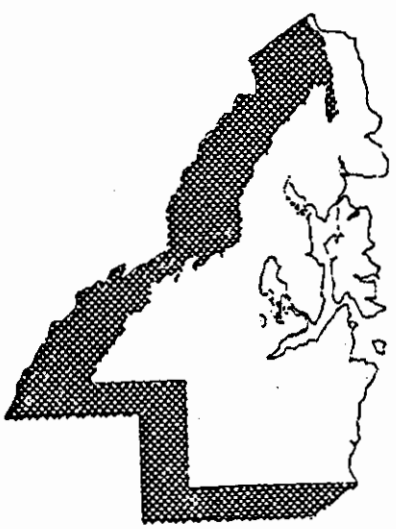
APPENDIX D



APPENDIX D

WEST KITSAP

1. DRAINAGE AND TOPOGRAPHY

The topography of the West Kitsap subarea is the most variable of any subarea. The subarea has the pervasive low rolling hills common in other subareas, but also contains the second highest point in Kitsap County, Green Mountain, elevation 1639 feet. The upland area of rolling hills is transected by numerous deep river valleys and in some places are often bordered by steep sea cliffs along Hood Canal.

The subarea contains several large drainage basins, including Big Beef, Anderson, Seabeck, and Stavis Creeks. These cumulatively drain an area of approximately 30 square miles and discharge into Hood Canal (see Volume 1, Exhibit II-7). Basins number 101 and 113 have high values of flow per unit area that suggest a large groundwater component. Basin 101, Harding Creek, has an extremely high value of discharge per unit area (3.23) which is the highest in the county. Basin 117 has a very low base flow per unit area which is believed to indicate a low groundwater component or perhaps loss to the sub-sea level groundwater systems.

2. GEOLOGY

A. Surficial Geology

Unit 5, glacial till, tends to dominate the surface geology of the upland areas of the West Kitsap Subarea (see Exhibit D-1). Areas of Unit 2 exist along the steep valley walls of the major creeks and the sea cliffs. In this area, Unit 2 is dominated by sand deposits. Large areas of Unit 7 occur at the headwater area of Big Beef Creek, possible evidence of a large ancient outwash channel. Large areas of Unit 4, mostly peat, occur in conjunction with and adjacent to this possible outwash channel material and at the base of Green and Gold mountains. The surficial geology of Green Mountain consists almost entirely of Unit 1, Tertiary volcanic bedrock.

B. Subsurface Geology

Interpretation of the subsurface geology is presented in Exhibits D-3 through 7. Exhibit D-2 shows the location of the database wells in this subarea. The most striking aspect of these cross sections is the occurrence of the Unit Tv (Tertiary bedrock). Some wells are actually

completed in the Tertiary volcanics and extract small amounts of water. There is a general lack of well log data throughout the subarea, which is reflected in the cross sections as gaps between wells. Ironically, this produces a misleading, smooth-looking stratigraphy in cross section though it is highly unlikely this is the case. There is no reason to believe the subsurface geology of this subarea is any less complex than is seen in subareas with a higher concentration of well data. Most of wells on the east side of Exhibit D-5 and the west two-thirds of Exhibit D-7 are completed in Unit Qg1a. About an equal number of wells are completed in Qg2 and in Qg3. A few wells are completed in unit Qg4 (see Exhibits D-6 and D-7). One of the most productive wells, and one of the deepest in the subarea, (Well 22A03, Exhibit D-6) is completed in what is most likely Unit Qg5. This well indicates a very large aquifer transmissivity of (150,000 gpd/ft) and is one of the key wells in the definition of the Big Beef aquifer system.

3. PRINCIPAL AQUIFERS

The West Kitsap Subarea contains only one known principal aquifer system, the Big Beef aquifer. Aquifer characteristics are presented in Table D-1 and its location can be seen on Exhibit D-8.

The Big Beef is noted in the middle of cross section Q-Q' (see Exhibit D-6) and its eastern fringe is noted on cross section S-S' (see Exhibit D-7). Several wells help define the extent of the aquifer. Some of these wells are listed in Table D-1 and two of the wells are shown on the cross sections: Well 22A03 on Q-Q' and Well 14G02 on S-S'. The aquifer is mostly sand and gravel and is encountered between 100 and 250 feet below sea level within Unit Qg4. The Big Beef aquifer is one of the most productive and least exploited aquifers in Kitsap County. The lateral extent of this aquifer is probably the most poorly defined in the study area. Though there is insufficient data to demonstrate it, it is very likely that this aquifer extends for great distances, especially to the south along a line coincident to the present day channel of Big Beef Creek (see Volume 1, Exhibit II-7).

because....?

4. GROUNDWATER FLOW SYSTEM

A groundwater elevation contour map for the shallow aquifer system in the West Kitsap Subarea is presented in Exhibit D-9. This map illustrates the general water level elevations and directions of horizontal groundwater flow in the shallow aquifer system. Areas of groundwater recharge and discharge can also be inferred from the map.

Shallow groundwater flow in the West Kitsap Subarea is primarily to the north and/or west, towards Hood Canal. The exception to this is in the southern portion of the subarea, where flow is drawn to several streams flowing south,

including the Tahuya River. One prominent feature in the southeast portion of the subarea is a large outcrop of bedrock. Although data is scarce, groundwater appears to flow in a radial pattern from the fringes of the outcropping.

Aside from the area around the bedrock outcropping, 2 recharge areas exist in the northern portion of the subarea, on either side of Big Beef Creek. A third recharge area exists in the southeastern part of the subarea, in the uplands around and south of Hintzville.

Regional discharges to Hood Canal occur via several major streams flowing north (Big Beef, Seabeck, and Stavis) and west (Anderson), along with seeps and springs adjacent to the coast.

5. WATER BALANCE AND RECHARGE

Long-term average water balance components for the West Kitsap subarea are presented in Table II-14, Volume I. Average precipitation is estimated to range between 65 and 75 inches/year; average evapotranspiration between 20 and 22 inches/year; average runoff between 18 and 21 inches/year; and average direct recharge between 27 and 32 inches/year.

Precipitation estimates are based on the analysis of U. S. Weather Bureau data and the precipitation isohyetal presented in Volume I, Exhibit II-15. Evapotranspiration was estimated using the Thornthwaite method assuming a 3- to 5-inch soil moisture holding capacity. Runoff was estimated to be approximately 25 to 30 percent of total precipitation. A relatively high runoff multiplier was applied to the west Kitsap area reflecting the lower infiltration potential of the Green and Gold Mountains (Exhibit II-13, Volume I).

6. POTENTIAL DEVELOPABLE YIELD

Estimates of potential developable yield (PDY) for the West Kitsap subarea are shown in Table II-15, Volume I. Two sets of PDY estimates are presented within the table. The low end estimate (first four columns) assumes the effective recharge area that contributes to groundwater development is confined to the principal aquifer zones. Only one major aquifer system, the Big Beef aquifer, has been identified within the West Kitsap subarea. The recharge area to this aquifer was assumed to extend approximately 0.5 miles beyond the inferred limits of the aquifers which are shown on Exhibit II-8, Volume I, (exclusive of areas that extend into Puget Sound).

The high end estimate of PDY (column 5 through column 8 of Table II-15, Volume I) assumes that the entire subarea, with the exception of the bedrock areas in vicinity of the Green and Gold Mountains and the high relief areas in vicinity of Puget Sound, contributes recharge to groundwater system which can be extracted for development.

Both estimates assume that a percentage of the total long-term average recharge within specified areas can be captured for developed with out imposing significant impacts on the hydrologic system (see Volume I, Section II.C.10) and that this recharge can be economically extracted ~~for development~~.

The estimated recharge areas and recharge rates for the Big Beef aquifers presented in Table II-15, Volume I. The PDY for this aquifer is estimated to be between 0.9 and 1.5 MGD (i.e. for C1 = 0.3 and C2 = 0.5, respectively).

The PDY for the entire subarea based on a recharge rate of 30 inches/year and a total recharge area of 64 square miles is estimated to be between 27.4 and 47.5 MGD (i.e. for C1 = 0.3 and C2 = 0.5, respectively).

Existing withdrawal (average day) from the subarea based on a 1985 water use data is approximately 0.54 MGD which is well below the low end of the range in the PDY. Groundwater development is projected to increase to approximately 1.55 MGD by the year 2040.

I agree 100% good

The PDY analysis suggests that additional groundwater supplies could likely be developed from the West Kitsap area without producing significant impacts on the hydrologic system. Additional exploration and testing of the western portions of the subarea ~~would be~~ is warranted to assess the presence and character of other principal aquifer systems.

7. LAND USE AND WATER QUALITY ANALYSIS

A. Land Use Activities

The survey of existing and historical land use in the West Kitsap subarea with potential for impacting groundwater quality are depicted in Exhibits D-10 through D-13 and are discussed according to the Office of Technology Assessment's (OTA) categories where appropriate.

(1) Category 1 - Sewered/Unsewered Areas

There are no existing or proposed sewered areas within the West Kitsap subarea. The population living in this subarea utilizes on-site sewage disposal systems.

(2) Category 2 - Landfills/Hazardous Waste Sites/Underground Storage Tanks

There are two historical landfills located within the West Kitsap subarea, the Holly dump and part of the Brem-Aire disposal site. Only one regulated hazardous waste site is located in this subarea, and Seabeck is the only community where the presence of under-

ground storage tanks has been reported. Locations of landfills, regulated hazardous waste facilities, and numbers of underground storage tanks can be found on Exhibit D-10.

(3) Category 3 - Transportation

There are no State Routes located in West Kitsap, however there are several secondary paved highways which have the potential for materials spills. In addition to materials spills, transportation corridors contain rights-of-way on which herbicides and pesticides may have been applied for weed control.

(4) Category 4 - Agricultural/Mining

The West Kitsap subarea is perhaps the most rural in nature of all the subareas within the county. There are large amounts of forest land and small, part-time farming activities. The areas with the potential to remain rural or shown in Exhibit D-11. These areas are currently classified as Rural (2.5 acre), meaning that the maximum density allowable will ultimately be only one dwelling unit for every 2.5 acres. Application of herbicides and pesticides from this type of land use might potentially affect groundwater quality. Agricultural crops grown include raspberries, Christmas trees, large areas of grass pasture, and smaller areas in vegetables. Agricultural pesticides used include dicamba, picloram, methomyl, simazine, atrazine, hexazinone, and simazine. Forest plantations throughout the county are normally sprayed with chemical herbicides once or twice during their 60-year life. This spraying occurs either during the winter while the trees are dormant, or during the early spring before the new growth has obtained three-quarters of its growth. Three surface mining sites were located and are also shown on Exhibit D-11. L these are gravel pits or borrow pits right?

(5) Category 6 - Wetlands

Wetland areas may indicate an area of groundwater-surface water interaction. Locations of wetland areas were obtained from the National Wetlands Survey completed by the Department of Interior's Fish and Wildlife Service. These locations were mapped for the West Kitsap subarea and are displayed in Exhibit D-12.

(6) Land Use/Zoning

Each of the subareas have land use policies in place which have been prepared by Kitsap County and the cities within each

subarea. Exhibit D-13 displays the future land use categories for the Poulsbo-Bremerton subarea, according to the Kitsap County Department of Community Development.

B. Water Quality Trends

Water quality trends for the indicator parameters discussed in Section II-Technical Approach and Regional Issues, were performed for data within the West Kitsap subarea. The analysis was completed separately for shallow and deep wells, using a 250 foot depth as the cutoff between shallow and deep wells. A total of 36 wells, 30 shallow and 6 deep, were used in the trending analysis. Exhibit D-14 presents the location of wells from which water quality observations above the maximum contaminant level were observed.

Data did not exist for the following indicator parameters:

Cyanide
Copper
Methylene Chloride
Tetrachloroethylene
1,1,1-Trichloroethane
Trichloroethylene
Mercury
Zinc
Boron
Phenols
PCB
Tin
BTX
TOX, TOC
Indicator Pesticides

Trend plots for the remainder of indicator parameters can be seen in Technical Appendix H. Overall, no significant trends were calculated for any of the indicator parameters from either the shallow or the deep wells. Iron and manganese levels were found to be higher than secondary standards in several of the wells

C. Sensitive Areas

Existing water quality data does not indicate any areas sensitive to land use activity in the West Kitsap Subarea, although the amount of data for trending purposes is limited. The majority of the principal aquifer zones throughout the county are ~~located at~~ relatively deep ~~depths~~ and are

protected from surface contamination sources by low permeability layers. In general however, high precipitation rates in the western portions of the county indicate higher potential recharge for this subarea.

8. WATER USE AND WATER RIGHTS

A. Population

Based on the Puget Sound Council of Governments (PSCOG), June 1988, Population and Employment Forecast, the estimated existing population for the West Kitsap subarea is approximately 6,440 (1989). Future population is estimated to increase from 10,035 in 2010 to 15,517 in 2040. These population figures are summarized on Table D-2 by Forecast Analysis Zones (FAZs). This subarea has been considered to be 100 percent rural.

B. Water Demand

(1) Municipal and Domestic

Average and peak day municipal and domestic water demand projections are population driven. Average day demands were derived based on an assumed average gpcd for three levels of development (i.e., urban, semi-urban/rural, and rural) to reflect mixes of residential, commercial, and industrial customers. Average per capita demands of 175, 140, and 100 gpd were assumed for existing conditions for urban, semi-urban/rural, and rural areas, respectively. Peak day demands were derived from average day demands by multiplying by an assumed peak to average day factor of 2.3, 3.0, and 3.0 for urban, semi-urban/rural, and rural areas, respectively. These average and peak day numbers are consistent with existing water demand experienced by utilities in Kitsap County and similar areas of the State. citation?

Average day water demand is summarized on Table D-3 and peak day demand is summarized on Table D-4. Existing average day and peak day demand is estimated to be approximately 0.6 and 1.9 MGD, respectively. Average day is projected to increase from between approximately 0.9 and 1.0 MGD in 2010 to 1.4 and 1.6 MGD in 2040. Peak day demand is projected to range between 4.2 and 4.7 MGD in 2040.

The higher consumption values assume no change in water use patterns from existing condition. The lower values assume water conservation and an increase in multi-family housing units. Conservation assumes water savings of 5 percent in 1995 and 10

percent in 2000 and thereafter for all areas. An increase in multi-family units in the urban and transitional areas only was assumed to result in a savings of 1.5 and 3.5 percent in 1995 and 3 and 7 percent in 2000 and thereafter, respectively.

(2) Other

Very little other use is estimated for this subarea. As shown on Table D-5, less than 2.7 MGD of commercial/industrial and irrigation water use is projected for 2040. Based on water right records, there is no water use for private commercial/industrial and stock watering, and approximately 2.5 MGD has been assumed for fish propagation. Commercial/industrial supplies are provided by public water supplies within the area. Irrigation has been estimated to remain at present water use estimated amount of approximately 0.05 MGD.

Irrigation water use for 1985 was based on 1982 Bureau of Census agricultural statistics data for number of acres irrigated. Irrigation water use in 2040 was based on future land use. Irrigation estimates by subarea were apportioned based on existing water right records from Department of Ecology (Ecology). The number of acres under irrigation was assumed to be irrigated at an average rate of 1.5 acre-feet per acre per year. Irrigation figures were also based on a 150-day irrigation season rather than a calendar year as with other water uses.

C. Water Rights

The groundwater right information presented on Table D-6 has been primarily derived from the water right printout records of Ecology, dated July 11, 1988. The Table is divided into two parts. The first part contains all water rights for public water supply (i.e., identified on water right records as either "domestic multiple" or "domestic municipal"). The second part includes all the remaining water rights of record. Where a water right authorizes use for public water supply and one or more other uses, the right appears in both parts of the Table.

The Table does not include claims to groundwater rights or groundwater rights that have been established under the permit exemption provisions of the State Ground Water Code.

In this subarea, public water supply groundwater rights comprise only about 27 percent of the annual authorization (acre-feet per year) under all the recorded rights. This small percentage relationship with other uses is somewhat unusual. The cause is the fact that the water right

authorization for fish propagation of 2,815 acre-feet per year is approximately 98 percent of the authorizations for all uses other than public water supply and 72 percent of total authorizations. Water rights for all uses in this subarea for other than fish propagation and public water supply are for minimal annual quantities.

Table D-1 Aquifer Characteristics Data
West Kitsap Subarea

Local Well Number	Elevation in Feet (MSL) Ground Surface	Top of Screen (1)	Bottom of Screen (2)	Static Water Level	Trans-missivity in gpd/ft (3)	Storage Coefficient (3)	Specific Capacity in gpm/ft (4)	Potential Well Yield in gpm (5)	Owner Well Name and Number
BIG BEEF									
25N/01W-22A04	42.00	-218.00	-264.00	48.00	150000	0.0005000	0.00		BIG BEEF FISHERIES TH-1, AQUIFER C
25N/01W-14E01	15.00	-109.00	-134.00	22.00			24.62	2150	WELL NO. 3
25N/01W-14G02	240.00	240.00	240.00	41.00			0.00		ROCKRIDGE
25N/01W-19B01	44.00	-154.08	-164.67	-121.40			1.88	40	SCENIC BEACH STATE PARK
25N/01W-18R01	40.00				2100				DUPAR CAMP SCENIC BEACH

NOTES:

(1) Elevation of top of upper most screen or perforated section (some wells have multiple completions).

(2) Elevation of bottom of lower most screen or perforated section.

(3) Transmissivity and storage coefficient values are obtained from relatively extensive testing of the well as part of well development investigations.

(4) Specific capacity is based on bail test or pump test data and is equal to the flow rate divided by the drawdown.

(5) Potential well yields are estimated as the product of 2/3's the available drawdown or 100 feet (whichever is less). Potential well yields of greater than 2,500 gpm are indicated as >2,500 to reflect reasonable well yields. The available drawdown is equal to the difference between the static water level and the top of the screen or perforated section of the well.

TABLE D-2

SUBAREA 4 - WEST KITSAP
POPULATION PROJECTION

FAZ NOS.	% IN SUB-AREA	YEAR 1970	1980	1985 (1)	1990	1995 (1)	2000	2010 (1)	2020	2030 (2)	2040 (2)
9005	76%	873	1,613	2,113	2,612	2,939	3,265	3,965	4,665	5,364	6,064
9006	69%	1,276	2,416	3,256	4,096	4,519	4,942	6,070	7,198	8,325	9,453
TOTAL		2,149	4,030	5,369	6,708	7,457	8,207	10,035	11,862	13,690	15,517

(1) Linearly extrapolated.
(2) Straight line projection.

Source: Puget Sound Council of Governments (PSCOG) June 1988 Population and Employment Forecasts

TABLE D-3

SUBAREA 4 - WEST KITSAP
MUNICIPAL AND DOMESTIC WATER DEMAND
AVERAGE DAY DEMAND (MGD)

SCENARIO	FAZ NOS.	WATER USE CATEGORY	GPCD	YEAR 1980	1985	1990	1995	2000	2010	2020	STRAIGHT-LINE 2030	2040
SCENARIO 1 - EXISTING CONDITION (1)												
	9005	Rural	100	0.16	0.21	0.26	0.29	0.33	0.40	0.47	0.54	0.61
	9006	Rural	100	0.24	0.33	0.41	0.45	0.49	0.61	0.72	0.83	0.95
TOTAL				0.40	0.54	0.67	0.75	0.82	1.00	1.19	1.37	1.55
SCENARIO 2 - MULTI-FAMILY INCREASE (2)												
	9005	Rural	100	0.16	0.21	0.26	0.29	0.33	0.40	0.47	0.54	0.61
	9006	Rural	100	0.24	0.33	0.41	0.45	0.49	0.61	0.72	0.83	0.95
TOTAL				0.40	0.54	0.67	0.75	0.82	1.00	1.19	1.37	1.55
SCENARIO 3 - WITH WATER CONSERVATION (3)												
	9005	Rural	100	0.16	0.21	0.26	0.28	0.29	0.36	0.42	0.48	0.55
	9006	Rural	100	0.24	0.33	0.41	0.43	0.44	0.55	0.65	0.75	0.85
TOTAL				0.40	0.54	0.67	0.71	0.74	0.90	1.07	1.23	1.40
SCENARIO 4 - CONSERVATION AND MULTI-FAMILY INCREASE (4)												
	9005	Rural	100	0.16	0.21	0.26	0.28	0.29	0.36	0.42	0.48	0.55
	9006	Rural	100	0.24	0.33	0.41	0.43	0.44	0.55	0.65	0.75	0.85
TOTAL				0.40	0.54	0.67	0.71	0.74	0.90	1.07	1.23	1.40

(1) Assumes the following average gallons per capita per day (gpcd) demand for existing conditions for each area:

Water Use Category	Average GPCD
Rural	100
Semi-Urban/Rural	140
Urban	175

(2) Assumes increase in multi-family units in both the urban, semi-urban and semi-rural areas resulting in gradual reduction in per capita water consumption of 1.5% in the urban area and 3.5% in the semi-urban/rural areas for the year 1995, up to 3% and 7%, respectively, for the year 2000 and thereafter.

(3) Assumes conservation savings in gallons per capita per day (gpcd) of 5% in 1995 up to 10% in 2000 and thereafter for all urban, semi-urban/rural, and rural areas.

(4) Combination of Scenarios 2 and 3.

TABLE D-4

SUBAREA 4 - WEST KITSAP
MUNICIPAL AND DOMESTIC WATER DEMAND
PEAK DAY DEMAND (MGD)

SUB-AREA	FAZ NOS.	WATER USE CATEGORY	PEAK/AVG FACTOR	YEAR 1980	1985	1990	1995	2000	2010	2020	STRAIGHT-LINE 2030	2040
SCENARIO 1 - EXISTING CONDITION (1)												
	9005	Rural	3.0	0.48	0.63	0.78	0.88	0.98	1.19	1.40	1.61	1.82
	9006	Rural	3.0	0.72	0.98	1.23	1.36	1.48	1.82	2.16	2.50	2.84
TOTAL				1.21	1.61	2.01	2.24	2.46	3.01	3.56	4.11	4.66
SCENARIO 2 - MULTI-FAMILY INCREASE (2)												
	9005	Rural	3.0	0.48	0.63	0.78	0.88	0.98	1.19	1.40	1.61	1.82
	9006	Rural	3.0	0.72	0.98	1.23	1.36	1.48	1.82	2.16	2.50	2.84
TOTAL				1.21	1.61	2.01	2.24	2.46	3.01	3.56	4.11	4.66
SCENARIO 3 - WITH WATER CONSERVATION (3)												
	9005	Rural	3.0	0.48	0.63	0.78	0.84	0.88	1.07	1.26	1.45	1.64
	9006	Rural	3.0	0.72	0.98	1.23	1.29	1.33	1.64	1.94	2.25	2.55
TOTAL				1.21	1.61	2.01	2.13	2.22	2.71	3.20	3.70	4.19
SCENARIO 4 - CONSERVATION AND MULTI-FAMILY INCREASE (4)												
	9005	Rural	3.0	0.48	0.63	0.78	0.84	0.88	1.07	1.26	1.45	1.64
	9006	Rural	3.0	0.72	0.98	1.23	1.29	1.33	1.64	1.94	2.25	2.55
TOTAL				1.21	1.61	2.01	2.13	2.22	2.71	3.20	3.70	4.19

(1) Assumes the following peak gallons per capita per day (gpcd) demand for existing conditions for each area:

Water Use Category	Peak GPCD
Rural	300
Semi-Urban/Rural	420
Urban	402.5

(2) Assumes increase in multi-family units in both the urban, semi-urban and semi-rural areas resulting in gradual reduction in per capita water consumption of 1.5% in the urban area and 3.5% in the semi-urban/rural areas for the year 1995, up to 3% and 7%, respectively, for the year 2000 and thereafter.

(3) Assumes conservation savings in gallons per capita per day (gpcd) of 5% in 1995 up to 10% in 2000 and thereafter for all urban, semi-urban/rural, and rural areas.

(4) Combination of Scenarios 2 and 3.

TABLE D-5

SUBAREA 4 - WEST KITSAP
SUMMARY OF WATER DEMAND PROJECTIONS
AVERAGE DAY DURING IRRIGATION SEASON

SUB-AREA	WATER USE CATEGORY		YEAR 1985	1990	1995	2000	2010	2020	STRAIGHT-LINE 2030	2040
SCENARIO 1 - EXISTING CONDITION (1)										
	Municipal	(5)	0.43	0.54	0.60	0.66	0.80	0.95	1.10	1.24
	Domestic/Single Family	(6)	0.11	0.13	0.15	0.16	0.20	0.24	0.27	0.31
	Commerical/Industrial	(7)	0	0	0	0	0	0	0	0
	Irrigation	(8)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Fish Propagation	(9)	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51
	Stock Watering	(10)	0	0	0	0	0	0	0	0
	TOTAL Scenario 1		3.10	3.23	3.31	3.38	3.57	3.75	3.93	4.11
SCENARIO 2 - WITH MULTI-FAMILY INCREASE (2)										
	Municipal	(5)	0.43	0.54	0.60	0.66	0.80	0.95	1.10	1.24
	Domestic/Single Family	(6)	0.11	0.13	0.15	0.16	0.20	0.24	0.27	0.31
	Commerical/Industrial	(7)	0	0	0	0	0	0	0	0
	Irrigation	(8)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Fish Propagation	(9)	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51
	Stock Watering	(10)	0	0	0	0	0	0	0	0
	TOTAL Scenario 2		3.10	3.23	3.31	3.38	3.57	3.75	3.93	4.11
SCENARIO 3 - WITH WATER CONSERVATION (3)										
	Municipal	(5)	0.43	0.54	0.57	0.59	0.72	0.85	0.99	1.12
	Domestic/Single Family	(6)	0.11	0.13	0.14	0.15	0.18	0.21	0.25	0.28
	Commerical/Industrial	(7)	0	0	0	0	0	0	0	0
	Irrigation	(8)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Fish Propagation	(9)	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51
	Stock Watering	(10)	0	0	0	0	0	0	0	0
	TOTAL Scenario 3		3.10	3.23	3.27	3.30	3.46	3.63	3.79	3.96
SCENARIO 4 - WITH CONSERVATION AND MULTI-FAMILY INCREASE (4)										
	Municipal	(5)	0.43	0.54	0.57	0.59	0.72	0.85	0.99	1.12
	Domestic/Single Family	(6)	0.11	0.13	0.14	0.15	0.18	0.21	0.25	0.28
	Commerical/Industrial	(7)	0	0	0	0	0	0	0	0
	Irrigation	(8)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Fish Propagation	(9)	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51
	Stock Watering	(10)	0	0	0	0	0	0	0	0
	TOTAL Scenario 4		3.10	3.23	3.27	3.30	3.46	3.63	3.79	3.96

(1) Assumes the following average gallons per capita per day (gpcd) demand for existing conditions for each area:

Water Use Category	Average GPCD
Rural	100
Semi-Urban/Rural	140
Urban	175

reduction

(2) Assumes increase in multi-family units in both the urban, semi-urban and semi-rural areas resulting in gradual reducation in per capita water consumption of 1.5% in the urban area and 3.5% in the semi-urban /rural areas for the year 1995 up to 3% and 7%, respectively, for the year 2000 and thereafter.
(3) Assumes conservation savings in gallons per capita per day (gpcd) of 5% in 1995 up to 10% in 2000 and thereafter for all urban, semi-urban/rural, and rural areas.
(4) Combination of Scenarios 2 and 3.
(5) Includes all water supplied by public water systems based on estimate of number of persons served by Class 1 - 4 water systems. Approximately 80 percent of population is presently served by public supply.
(6) Assumes remaining population (approximately 20 percent of the County) is served by individual wells.
(7) Based on existing annual water right records from Department of Ecology.
(8) Total for 1985 through 2040 based on 1982 Bureau of the Census agriculture statistic. Proportioned to subareas based on water right records from Department of Ecology. Number of acres assumed to be irrigated at 1.5 acre-feet per acre per year. Also, water use based on a 5 month irrigation period rather than average over 12 month period.
(9) Based on existing annual water right records from Department of Ecology.
(10) Based on existing annual water right records from Department of Ecology.

TABLE D-6

GROUNDWATER RIGHT INFORMATION
KITSAP COUNTY GROUNDWATER MANAGEMENT AREA
WEST KITSAP

PUBLIC WATER SUPPLY (1) WATER RIGHTS

Source I.D. (2)	Location	Control No.	GPM	MGD	AF/YR(s) (3)	Comments (4)
T24N, R01W						
Lara Lee, Inc. (Wildcat Lake)	24N 01W 02	G1-24482C	20	.03	3	C1.4-281249
Gabes Water Works	24N 01W 03M	G1-22823C	20	.03	8.1	C1.4-26940M
Miles	24N 01W 03C	G1-23115C	4.5	.01	2	
Iliad, Inc. (Green Mt. Acres)	24N 01W 04	G1-23528C	35	.05	14.5	C1.4-29594N
Symington of Seattle (Frog Pond Wtrs.)	24N 01W 05J	G1-22045L	130	.19	145.6	C1.1-26627B 2 Wells
Symington of Seattle (Frog Pond Wtrs.)	24N 01W 05P 24N 01W 05G	G1-22046C	123	.18	138	C1.1-26627B
Wilde & Eriks	24N 01W 05F	G1-24719P	120	.17	28.8	
Lara-Lee, Inc. (Camp David)	24N 01W 06R	G1-22872C	60	.09	19	C1.2-10838Y
Lara-Lee, Inc. (Camp David)	24N 01W 08C	G1-23503P	260	.37	13	C1.2-10838Y
Tahuyeh Lake Assn.	24N 01W 19A	G1*08387C	60	.09	96	C1.1-871166
Tahuyeh Lake Comm.	24N 01W 19A	G1-22639C	184	.26	154	C1.1-871166
Tahuyeh Lake Comm.	24N 01W 19A	G1-23842C	90	.13	100 (s)	C1.1-871166
Mission View Corp.	24N 01W 29	G1-21745C	60	.09	11	C1.4-553505
Subtotal			1,166.5	1.69	633	

TABLE D-6 continued

Source I.D. (2)	Location	Control No.	GPM	MGD	AF/YR(s) (3)	Comments (4)
T24N, R02W						
Harbor Water Co. (Sivo Acres)	24N 02W 14P	G1-24171C	50	.07	10	C1.4-239116
Holly Water System	24N 02W 19K	G1-21996C	60	.09	16	C1.2-33690C
Roland & Roland	24N 02W 23J	G1-23923C	50	.07	20	
Roland & Roland	24N 02W 23Q	G1-24147C	55	.08	12.5	
Subtotal			215	.31	58.5	
T25N, R01W						
Bronow	25N 01W 14N	G1-24374C	30	.04	4	
Anderson Hill Home	25N 01W 14J	G1-24778C	31	.04	4.5	C1.4-35927P
Dupar	25N 01W 15	G1*08786C	60	.09	1.5	CU (Inst.) w/I-2.25
Aarts	25N 01W 17	G1-21934C	37.5	.05	20	
Wyckoff Co.	25N 01W 17L	G1-23069C	50	.07	4	
Water Water, Inc. (Misery Point)	25N 01W 17P	G1-23404C	50	.07	10	C1.4-552902
Wash. State Parks & Rec. Comm.	25N 01W 19	G1*10162C	25	.04	5	C1.1t-SP780J
Wash. State Parks & Rec. Comm.	25N 01W 19H	G1-20821C	40	.06	15	C1.1t-SP780J
Camp Fire Girls	25N 01W 19	G1-21145C	70	.10	6	
Hood Canal Highland	25N 01W 19L	G1-23430C	95	.14	19.5	C1.4-340198
Priddy (Priddy Vista)	25N 01W 20D	G1*04622C	47	.07	56	C1.2-69350E
Wyckoff Co. (Seabeck)	25N 01W 21M	G1-23061C	50	.07	6	C1.4-76960A
Villwock	25N 01W 23F	G1-23392B	30	.04	2	CU (Inst.) w/I-5
Morris	25N 01W 23Q	G1-24076C	30	.04	6.5	
Hughes	25N 01W 23K	G1-24999P	8	.01	4.5	
Jones	25N 01W 24H	G1-23967C	12	.02	3	
Harbor Water Co. (Graystone)	25N 01W 24J	G1-24920C	100	.14	25	C1.4-36679P
Chatel	25N 01W 33K	G1-23064C	55	.08	75.6	
Jewell	25N 01W 35N	G1*11121P	200	.29	8.3	

TABLE D-6 continued

Source I.D. (2)	Location	Control No.	GPM	MGD	AF/YR(s) (3)	Comments (4)
T25N, R01W continued						
Harbor Water Co. (Freddie Lane)	25N 01W 35Q	G1-24942C	150	.22	75	C1.4-39944X
Subtotal			1,170.5	1.68	351.4	
TOTALS			2,552	3.68	1,042.9	

Footnotes:

(1) Public water supply includes all water rights recorded with a use designation of "domestic multiple" or "domestic municipal" based on Ecology water right printout dated July 11, 1988.

(2) Under Source I.D. column, the entry is generally the original water right holder. The parenthetical entry denotes the public water supply entity from DSHS records.

(3) (s) = Supplemental rights are not included in subtotal or totals.

(4) Under Comments, the class of public supply system and DSHS water facility inventory number is shown; also, CU - Common Usage (i.e. water right quantities are not broken down by use category; and CU (Inst.) - Common Usage (Instantaneous) (i.e., the instantaneous rate of withdrawal is not broken down by use category).

TABLE D-6 continued

ALL OTHER RECORDED GROUNDWATER RIGHTS

Source I.D.	Location	Control No.	Use (1)	GPM	MGD	AF/YR(s) (2)	Comments (3)
T24N, R02W							
Sweeney	24N 02W 08	G1*10867C	D	10	.01	1	
Christiansen	24N 02W 13P	G1-23437C	D	19	.03	1	
Clark	24N 02W 19	G1*08500C	D	8	.01	1	
Davis	24N 02W 20D	G1-23495C	D	4.5	.01	2	
Subtotal				41.5	.06	5	
T25N, R02W							
Gardzelewski	25N 02W 34	G1-24205C	D	15	.02	1	
Subtotal				15	.02	1	
T25N, R01W							
Bolon	25N 01W 13D	G1-20007C	D	10	.01	1	
			I-7	35	.05	14	
Wade	25N 01W 14	G1*06768C	D	260	.37	416	CU
			FP				
Gass	25N 01W 14	G1*06823C	D	20	.03	1.8	CU (Inst.)
			WP			6.2	
Sicks	25N 01W 14K	G1-20684C	D	20	.03	2	CU (Inst.)
			I-10			20	
Univ. of Wash.	25N 01W 15R	G1-22382C	FP	300	.43	480	
Dupar	25N 01W 15	G1*08786C	I-2.25			4.5	CU (Inst.) w/DM
Coll. of Fish.	25N 01W 15R	G1-23284C	D	30	.04	2	CU
			C&I				
Schlehuber	25N 01W 21R	G1*11353C	D	15	.02	1	
Univ. of Wash.	25N 01W 22G	G1-23559C	FP	1,200	1.73	1,920	
Villwock	25N 01W 23F	G1-23392B	I-5			5	CU (Inst.) w/DM
Subtotal			I-24.5	1,890	2.71	2,873.5	
TOTALS			I-24.5	1,946.5	2.79	2,879.5	

TABLE D-6 continued

Source I.D.	Location	Control No.	Use (1)	GPM	MGD	AF/YR(s) (2)	Comments (3)
GRAND TOTALS				4,498.5	6.47	3,922.4	

Footnotes:

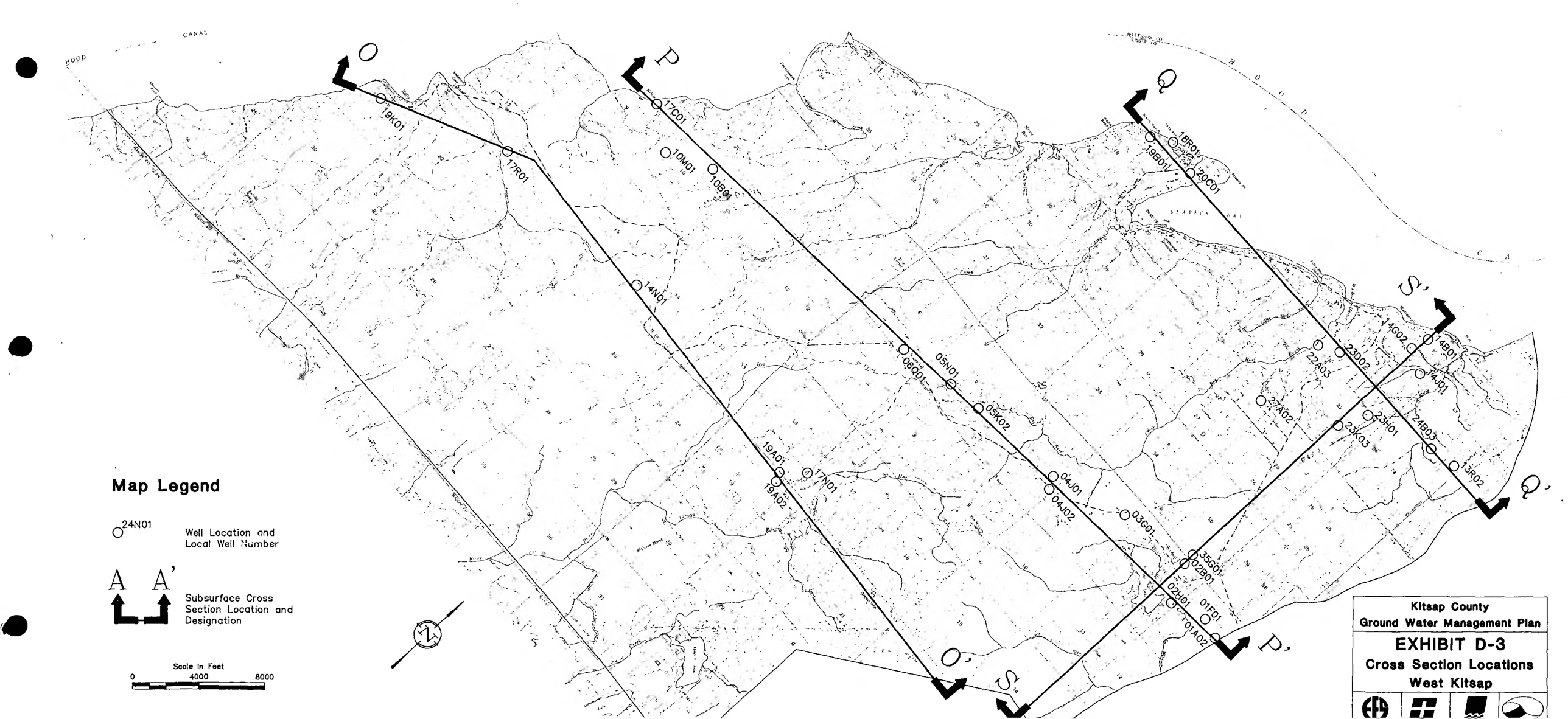
(1) Use abbreviations are as follows: D - Domestic Supply; I-____ - Irrigation-(number of acres); C&I - Commercial and/or Industrial; R&B - Recreational and/or Beautification; WP - Wildlife Propagation; FP - Fish Propagation; and S - Stockwatering.

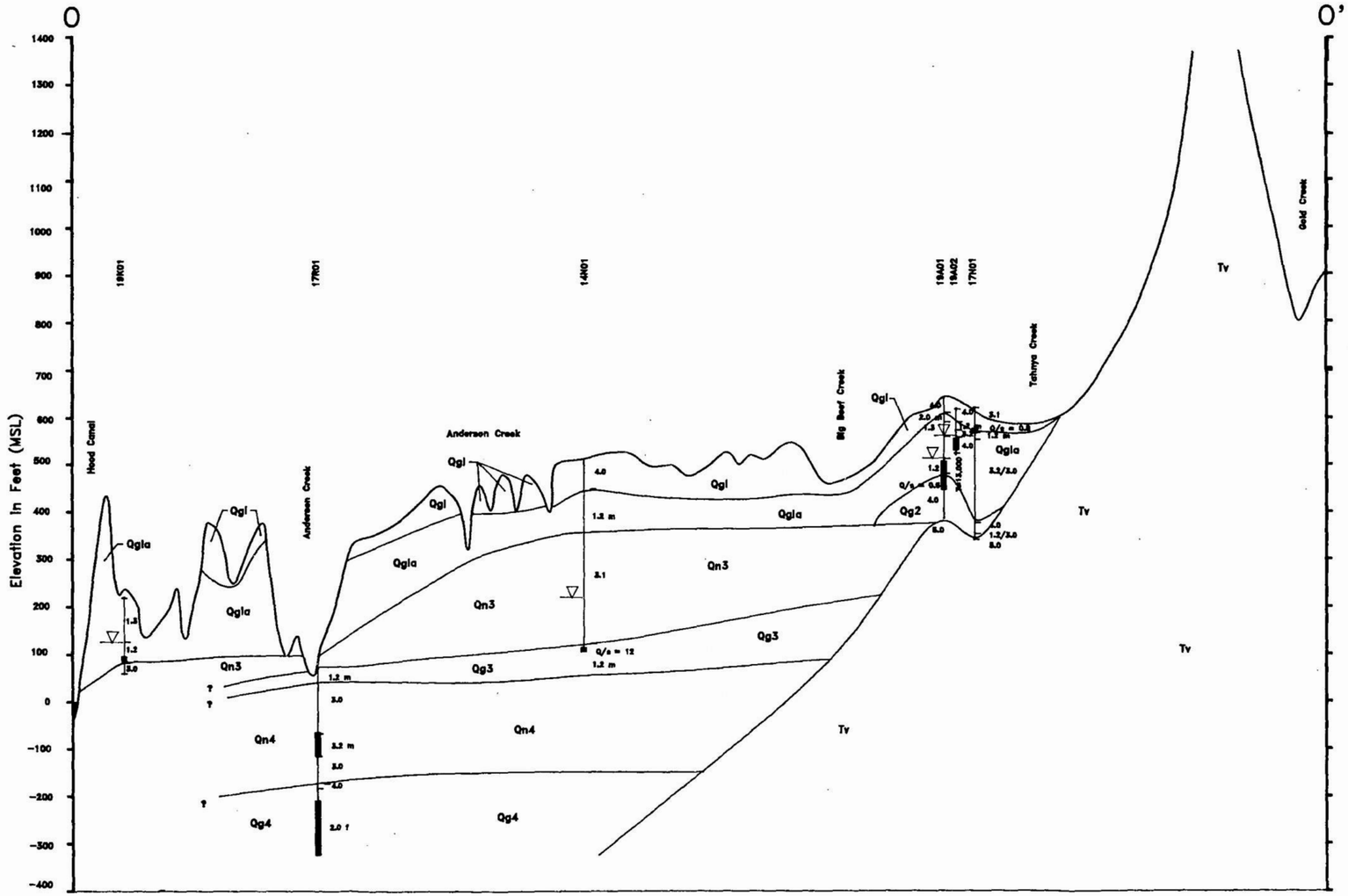
(2) (s) = Supplemental rights are not included in subtotal or totals.

(3) CU - Common Usage (i.e. water right quantities are not broken down by use category); CU (Inst.) - Common Usage (Instantaneous) (i.e. the instantaneous rate of withdrawal is not broken down by use category); and CU w/DM or CU (Inst.) w/DM means common usage with domestic multiple or domestic municipal entry in the public water supply table.


HOOD
CANAL
SPARLING BAY
Map Unit Type
Unit Characteristics
1 Bedrock Volcanic and Sedimentary Rocks
2 High Slope Steep Topography/Complex Geology
3 Lacustrine Lake and Flood Plain Sediments
4 Peat Saturated Organic Sediments
5 "Till" Poorly Sorted Glacial Deposits
6 Sands Stratified Sand Deposits
7 Gravels Gravels With Sand
8 Undifferentiated Variable Unidentified Glacial Deposits
(Based on Deeter, 1979)
Note: Refer to Volume I, Section II.4.B for descriptions of units
Scale in Feet
0 4000 8000
Kitsap County
Ground Water Management Plan
EXHIBIT D-1
Geologic Characteristics Map
West Kitsap


HOOD CANAL
Map Legend
22N01 Well Location and Number
WELL DEPTH
0 – 100 feet
100 – 300 feet
300 – 500 feet
> 500 feet
Scale In Feet
0
4000
8000
Kitsap County
Ground Water Management Plan
EXHIBIT D-2
Location of Database Wells
West Kitsap Subarea


CANAL
HOOD
O
O'
P
P'
Q
Q'
S
S'
19K01
17R01
17C01
10M01
10B01
14N01
19A01
19A02
17N01
06G01
05N01
05K02
04J01
04J02
03G01
19B01
18R01
20C01
14G02
14B01
14J01
23D02
22A03
27A02
23H01
23K03
24B03
13R02
35G01
02B01
02H01
01F01
01A02
Map Legend
24N01
Well Location and Local Well Number
A A'
Subsurface Cross Section Location and Designation
Scale In Feet
0
4000
8000
Kitsap County
Ground Water Management Plan
EXHIBIT D-3
Cross Section Locations
West Kitsap



CROSS SECTION LEGEND

28N02 — Local Well Number
Static Water Level Elev.
2.0 m — Lithologic Interval and Identifier
Perforated or Screened Interval
Aquifer Zone and Name
G–G' — Cross Section Intersect

LITHOLOGY

1.0 GRAVEL
1.2 Sandy GRAVEL (or GRAVEL and SAND)
1.3 Silty SAND and GRAVEL

2.0 SAND
2.1 Gravelly SAND
2.3 Silty SAND

3.0 SILT/CLAY
3.1 Gravelly SILT/CLAY
3.2 Sandy SILT/CLAY

4.0 GRAVEL with SAND, SILT/clay Matrix (ex TIL)

5.0 Bedrock

f,m,c Grain Size of Sand Fraction (fine, medium, coarse)

T Transmissivity (gpd/ft) calculated from controlled pumping tests

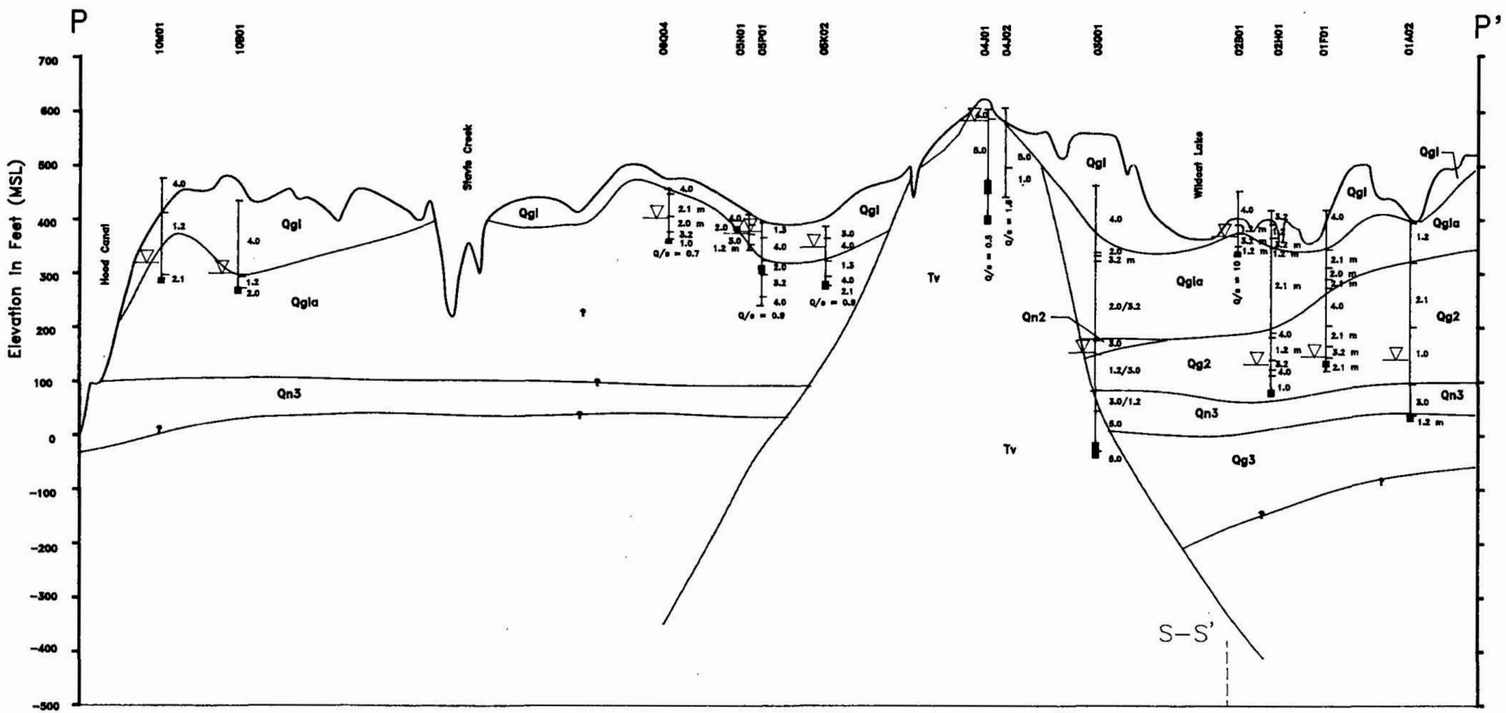
Q/s Specific Capacity (gpm/ft of drawdown), usually from drillers' records

Note: Refer to Table II-12 for descriptions of Stratigraphic Units (e.g., Qg1, Qn1)

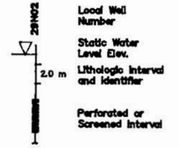
Horizontal Scale In Feet
0 4000 8000
0 200 400
Vertical Scale In Feet
Vertical Exaggeration x 20

Kitsap County
Groundwater Management Plan

EXHIBIT D-4
HYDROGEOLOGIC
CROSS SECTION O–O'



CROSS SECTION LEGEND



LITHOLOGY

1.0	GRAVEL
1.2	Sandy GRAVEL (or GRAVEL and SAND)
1.3	Silty SAND and GRAVEL
2.0	SAND
2.1	Gravelly SAND
2.3	Silty SAND
3.0	SILT/CLAY
3.1	Gravelly SILT/CLAY
3.2	Sandy SILT/CLAY
4.0	GRAVEL with SAND, Silt/Clay Matrix (or Till)
5.0	Bedrock
f,m,c	Grain Size of Sand Fraction (fine, minmedium, coarse)
T	Transmissivity (gpd/ft) estimated from controlled pumping tests
Q/s	Specific Capacity (gpm/ft of drawdown), usually from drillers' records

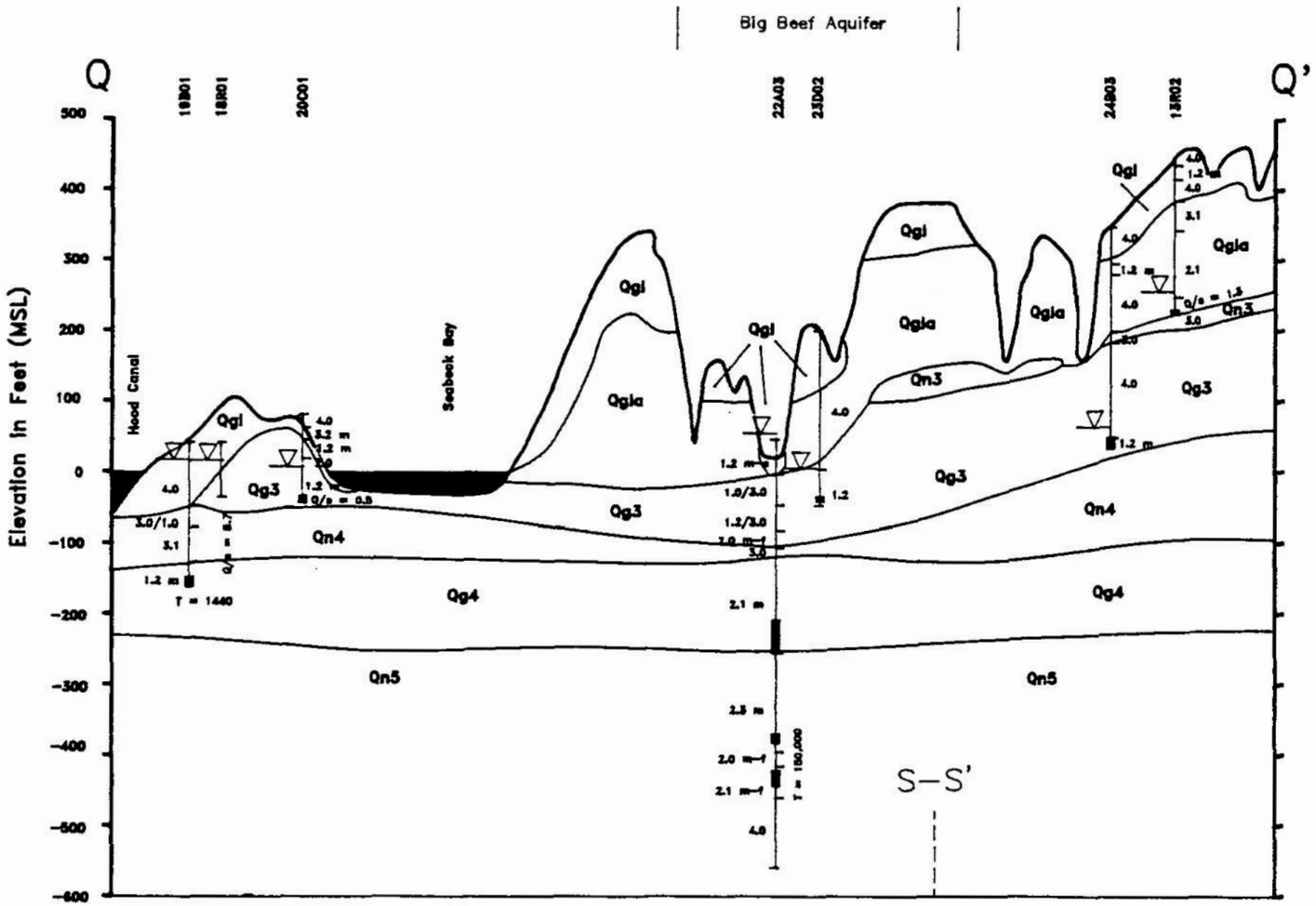
Note: Refer to Table 8-12 for descriptions of Stratigraphic Units (e.g., Qg1, Qn1)

Horizontal Scale in Feet
0 4000 8000

0 200 400
Vertical Scale in Feet
Vertical Exaggeration x 20

Kitsap County
Groundwater Management Plan

EXHIBIT D-5
HYDROGEOLOGIC CROSS SECTION P-P'



CROSS SECTION LEGEND

28N02 — Local Well Number
Static Water Level Elev.
2.0 m — Lithologic Interval and Identifier
Perforated or Screened Interval

Aquifer Zone and Name

G—G' — Cross Section Intersect

LITHOLOGY

1.0	GRAVEL
1.2	Sandy GRAVEL (or GRAVEL and SAND)
1.3	Silty SAND and GRAVEL
2.0	SAND
2.1	Gravelly SAND
2.3	Silty SAND
3.0	SILT/CLAY
3.1	Gravelly SILT/CLAY
3.2	Sandy SILT/CLAY
4.0	GRAVEL with SAND, Silt/Clay Matrix (as TIll)
5.0	Bedrock
f,m,c	Grain Size of Sand Fraction (fine, medium, coarse)
T	Transmissivity (gpd/ft) calculated from controlled pumping tests
Q/s	Specific Capacity (gpm/ft of drawdown), usually from drillers' records

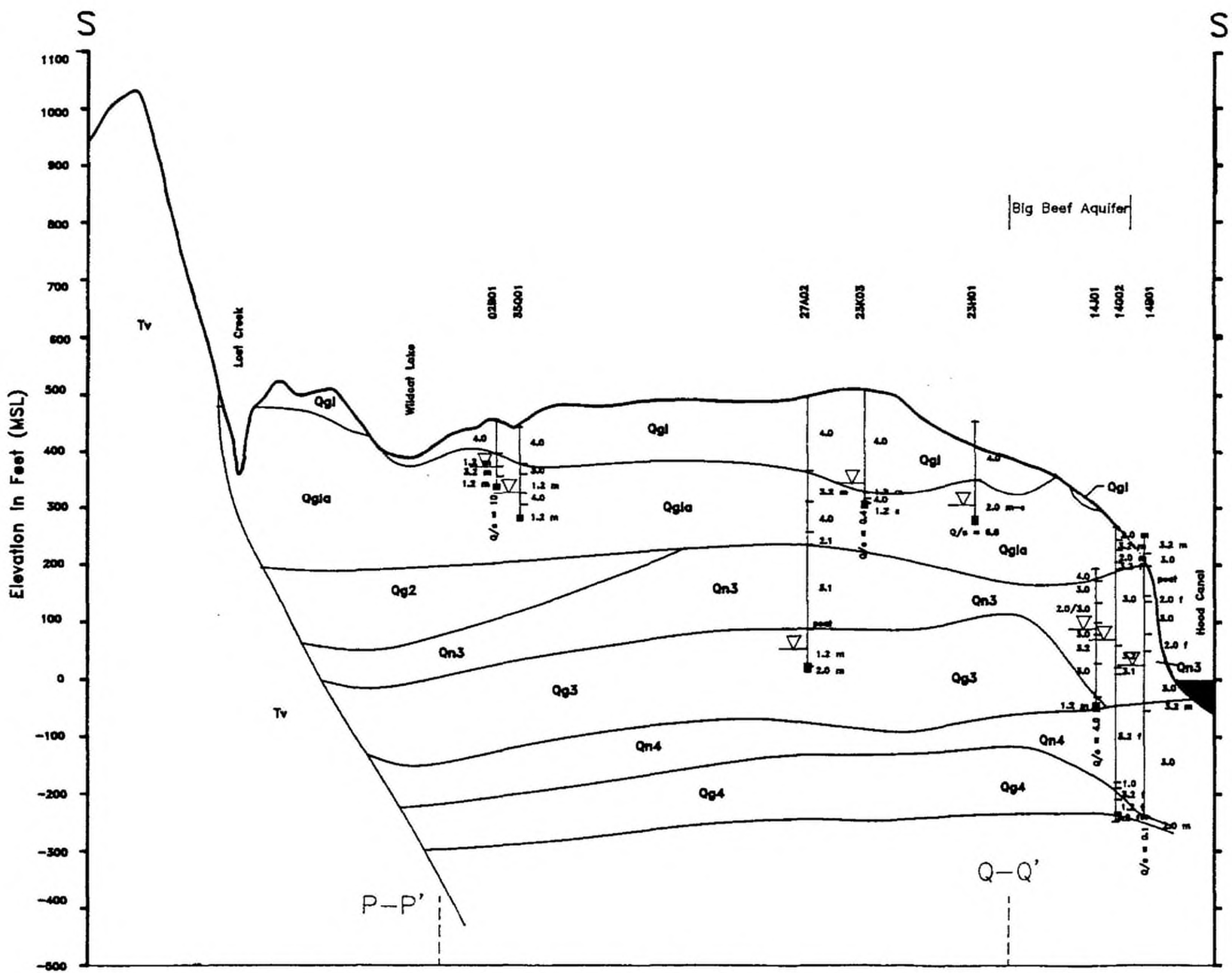
Note: Refer to Table II-12 for descriptions of Stratigraphic Units (e.g., Qg1, Qn1)

Horizontal Scale in Feet
0 4000 8000
0 200 400
Vertical Scale in Feet
Vertical Exaggeration x 20

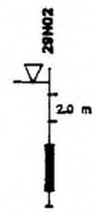
Kitsap County
Groundwater Management Plan

EXHIBIT D-6

HYDROGEOLOGIC
CROSS SECTION Q-Q'



CROSS SECTION LEGEND



Local Well Number

Static Water Level Elev.

Lithologic Interval and Identifier

Perforated or Screened Interval

Aquifer Zone and Name

G—G'

Cross Section Intersect

LITHOLOGY

1.0 GRAVEL
1.2 Sandy GRAVEL (or GRAVEL and SAND)
1.3 Silty SAND and GRAVEL

2.0 SAND
2.1 Gravelly SAND
2.3 Silty SAND

3.0 SILT/CLAY
3.1 Gravelly SILT/CLAY
3.2 Sandy SILT/CLAY

4.0 GRAVEL with SAND, Silt/Clay Matrix (as Till)

5.0 Bedrock

f,m,c Grain Size of Sand Fraction (refine, mmedium, cmocarse)

T Transmissivity (gpd/ft) calculated from controlled pumping tests

Q/s Specific Capacity (gpm/ft of drawdown), usually from drillers' records

Note: Refer to Table II-12 for descriptions of Stratigraphic Units (e.g., Qg1, Qn1)

Horizontal Scale In Feet
0 4000 8000
0 200 400
Vertical Scale In Feet
Vertical Exaggeration x 20

Kitsap County
Groundwater Management Plan

EXHIBIT D-7

HYDROGEOLOGIC
CROSS SECTION S-S'

Map Legend

Location of Principal Aquifers. Aquifer boundaries are very approximately defined. Solid lines are shown in areas where there is adequate subsurface control beyond the limits of the aquifer. Dashed lines are shown in areas where there is an absence of subsurface data with which to confirm the boundary location.

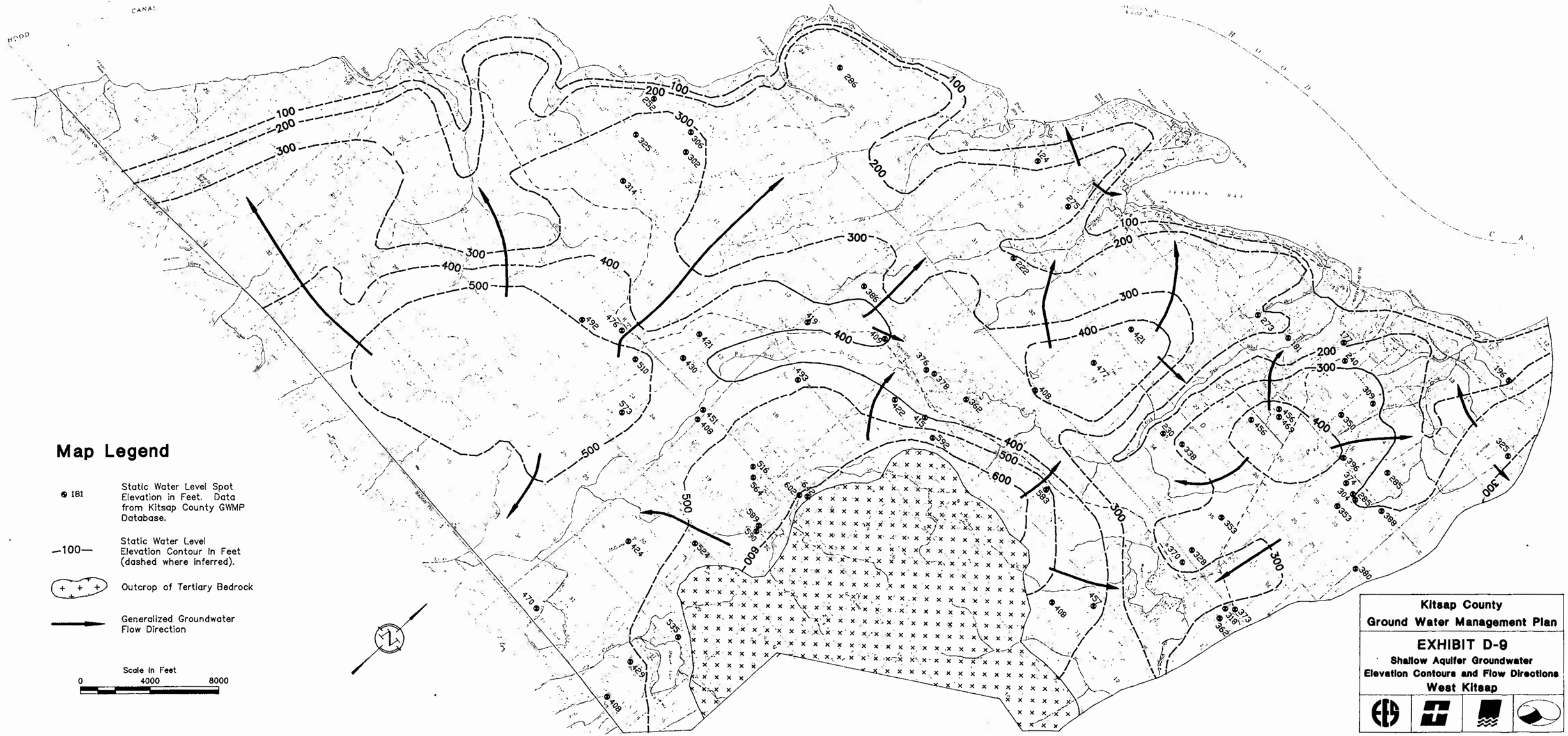
34H01 — Location of well used in defining the extent of the principal aquifers. See Appendix F for additional well information as well as aquifer characteristics data.

Scale in Feet
0 4000 8000

Kitsap County
Ground Water Management Plan

EXHIBIT D-8

Location of Principal Aquifers
West Kitsap Subarea


HOOD CANAL
DABOB BAY
100
200
300
400
500
600
Map Legend
181
Static Water Level Spot Elevation in Feet. Data from Kitsap County GWMP Database.
100
Static Water Level Elevation Contour In Feet (dashed where inferred).
Outcrop of Tertiary Bedrock
Generalized Groundwater Flow Direction
Scale In Feet
0
4000
8000
Kitsap County
Ground Water Management Plan
EXHIBIT D-9
Shallow Aquifer Groundwater Elevation Contours and Flow Directions
West Kitsap

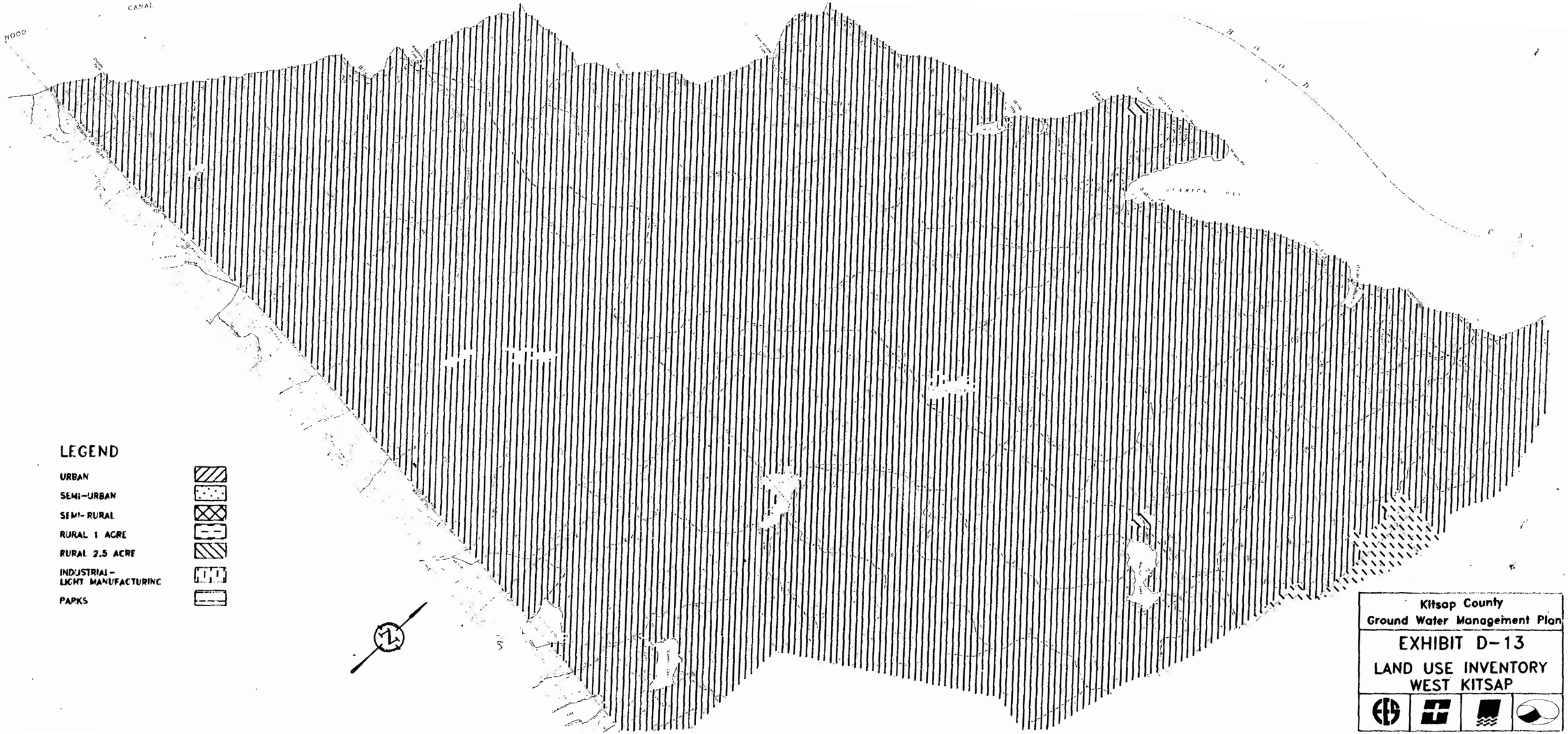
Kitsap County
Ground Water Management Plan

EXHIBIT D-10
LAND USE INVENTORY
WEST KITSAP


HOOD CANAL
LEGEND
POTENTIAL AGRICULTURAL AND FOREST AREAS
SURFACE MINES
20
N
Kitsap County
Ground Water Management Plan
EXHIBIT D-11
LAND USE INVENTORY
WEST KITSAP

Kitsap County
Ground Water Management Plan

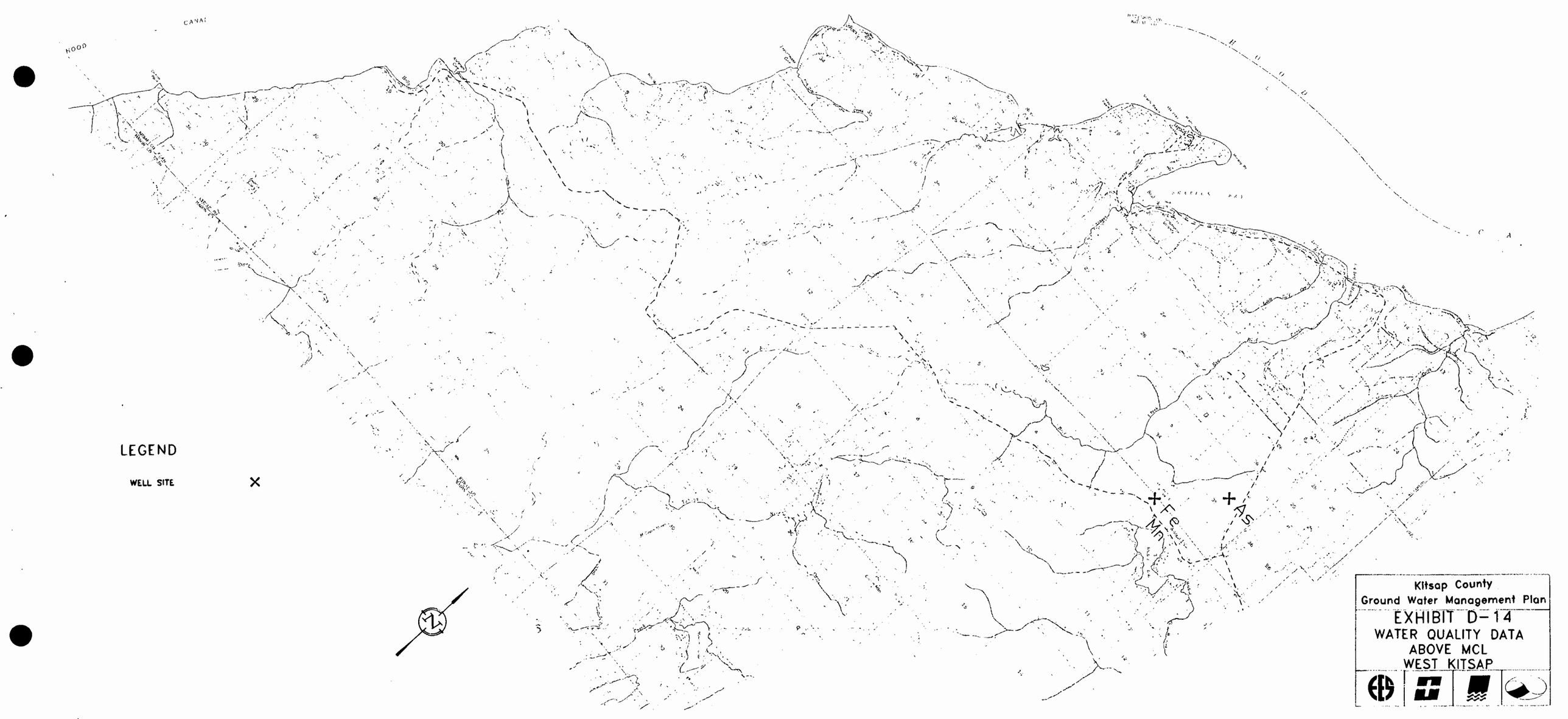
EXHIBIT D-12
LAND USE INVENTORY
WEST KITSAP



Kitsap County
Ground Water Management Plan

EXHIBIT D-13

LAND USE INVENTORY
WEST KITSAP



Kitsap County
Ground Water Management Plan

EXHIBIT D-14
WATER QUALITY DATA
ABOVE MCL
WEST KITSAP