# Support Document for the EPA Designation of the Cross Valley Aquifer as a Sole Source Aquifer

Office of Ground Water
U.S. EPA Region 10
Seattle, Washington 98101

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Support Document Proposing the EPA Designation
of the Cross Valley Sole Source Aquifer

# INTRODUCTION

## The Safe Drinking Water Act

The Safe Drinking Water Act, Public Law 93-523, was signed into law on December 16, 1974[1]. Section 1424(e) of the Act states:

"If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer."

## The Petition

On July 29, 1983, the Mount Forest Protection Agency and the Cross Valley Water Association, Inc. submitted a petition[2] requesting that the aquifer underlying the Cross Valley Water Association Service Area be designated as the sole drinking water source for the area.

## Receipt of Petition

The Administrator published a notice of receipt of the petition and a request for public comment in the Federal Register on September 15, 1983[3].

## Support Document

This document has been prepared to summarize available information on the petitioned area and its ground-water resources. This information has provided a basis for EPA action under Section 1424(e) of the Act. The following sections provide short descriptive summaries of each topic. For more detail the reader is advised to consult the references listed at the end of the report.

# GENERAL DESCRIPTION OF THE "CROSS VALLEY AQUIFER" AREA

## Geographic and Physical

The "Cross Valley Aquifer" is located in the Puget Sound lowland, between Puget Sound and the Cascade Mountains[4]. The area petitioned for sole source designation is mostly within the boundaries of Snohomish County, but crosses into King County to the south. Most of the area is an undulant drift plain with a north-south texture that is the result of glacial sculpturing during the latest ice advance. The Snohomish River and its extensive floodplain border the area on the north and east[5].

## Climate

The area's climate is temperate with mild temperatures throughout the year. Precipitation occurs mostly during the winter months, usually as rain; summer months are relatively dry. The average annual precipitation at Monroe, the closest weather station with a long period of record, is 46.8 inches[6].

## Population

The present total population of the proposed sole source aquifer area is approximately 15,200 people. This includes approximately 10,700 people using ground water. In addition, there are approximately 4,500 people living in the eastern and southeastern portions of the proposed sole source area. These groups of people use surface water supplied by the Alderwood and Woodinville water districts. Approximately 700 additional persons live immediately north of the proposed sole source area but are using ground water from the aquifer area supplied by the Cross Valley Water Association[7].

## Geologic Setting

The subsurface geology, to a depth of about 300 feet, is fairly well defined. At the surface is a mantle, up to 75 feet thick, of glacial till. Below the till is a region-wide deposit of outwash sand or sand and gravel with moderate permeability. This unit has been named the Esperance Sand by the U.S. Geological Survey[8].

Below the Esperance Sand is a more complex sequence of clay and firmly cemented gravels that form a till. Information is meager on the extent and hydraulic characteristics of these deposits, but it is known that some permeable zones exist in the deeper section.

Beneath the deeper glacial deposits lies bedrock composed of marine sediments and basalts. The rock surface generally dips southwesterly from exposures in the Cathcart area to a depth of about 1,000 feet near Bothell[9].

## Occurrence of Ground Water

Most wells in the area tap water in the Esperance Sand unit which is recharged by direct infiltration of precipitation. The water tends to be in a "water-table state" which means that it has no appreciable confining pressure. The Esperance Sand is generally capable of supplying yields up to 300 gpm from properly constructed wells. There is no water of regional importance in the bedrock[10].

The information available indicates that the ground water flows generally in a southerly direction in the main body of the aquifer. However, around the perimeter the flow is toward the edge of the aquifer. The ground-water table is at an elevation of about 350 feet above mean sea level, which indicates that, depending on the land surface elevation, the ground water might be as deep as 200 feet below ground surface in the higher areas. In some areas the ground water is found perched above the regional water table[11].

## Water Supply

Water for the area is supplied by the Cross Valley Water Association, Inc., from six (6) wells, each about 200 feet deep, most of which are drilled into the Experance Sand Aquifer[12]. Two additional wells will be completed during 1987. Presently the Association has over 2,600 service connections serving an estimated 7,300 people within the proposed sole source aquifer area and an additional 700 people immediately to the north of the proposed area. In addition, more than 3,300 people obtain their water from individual wells, springs and small community wells[13]. The Association pumped approximately 43.5 million cubic feet of water during 1986[14]. Total ground water use within the proposed sole source aquifer area during 1986 is estimated at 60.5 million cubic feet. Details are given in Table 1.

The Cross Valley Water Association service area is bounded by the Silver Lake Water District, Alderwood Water District, City of Snohomish, City of Everett, and the Woodinville Water District. In order to make use of water from any of the above purveyors, if available for alternate supply, major replacement and construction of new transmission, distribution, and treatment facilities would be required. Cross Valley Water estimates that this cost is in the millions of dollars and is financially unfeasible for their organization [15].

Portions of the western and southeastern ends of the proposed sole source area are served by surface water. The Alderwood Water District, using City of Everett surface water, serves parts of Sections 16, 17, 20, 21, 22, 27, 28, and 29, in T27N, R5E. In this area, approximately 3300 persons used 16.1 million cubic feet of water during 1986[16]. The Woodinville Water District serves approximately 1200 people in sections 5 and 6 of T26N, R6E. These persons used approximately 0.8 million cubic feet of water during 1986[17].

Table 1:
WATER CONSUMPTION WITHIN THE PROPOSED SOLE SOURCE AQUIFER AREA--1986

| | Volume in Million Cubic Ft. | Number of Connections | Population Served |
|---|---|---|---|
| 1. Ground Water | | | |
| Cross Valley Water Association[a] | 43.5 | 2654 | 8000[b] |
| Aqua Copia Water System[c] | 1.4 | 82 | 200 |
| Wood Lane Water System[d] | 0.8 | 36 | 130 |
| Lake Tuck Water System[e] | 0.6 | 45 | 120 |
| Individual Wells[f] (within Cross Valley Water Association service area) | 9.8 | 740 | 2000 |
| Individual Wells[g] (outside of Cross Valley Water Association service area) | 4.4 | 339 | 915 |
| Total Ground Water[h] | 60.5 | 3903 | 11385 |
| 2. Surface Water Use | | | |
| Alderwood Water District[A] | 16.1 | 945 | 3300 |
| Silver Lake Water District[B] | 0.2 | 12 | 30 |
| Cross Valley Water Association[C] | 0.4 | 33 | 90 |
| Woodinville Water District[D] | 0.8 | 400 | 1100 |
| Total Surface Water Use | 17.5 | 1390 | 4520 |
| Total Water Use | 78.0 | | |

Ground Water as a Percentage of Total Water Use in the area: 77.6 per cent

Surface Water as a Percentage of Total Water Use in the area: 22.4 per cent

Table 1 Notes:

a. Source: Personal communication, Gary Hajek, Manager Cross Valley Water Association, April 1987.

b. Population served includes approximately 700 persons living north of the proposed sole source area but served by ground water drawn from the area.

c. Sources: Personal Communication, Howard Johnson, Aqua Copia Water System, April 1987; and Washington State Department of Social and Health Services (DSHS) Water Facilities Inventory and Report Form (WFIRF), dated 10/27/85.

d. Source: Washington State DSHS WFIRF, dated 8/25/86.

e Source: The number of connections were provided by J. Phillips, Lake Tuck Water Company, personal communication, April 1987. Population and water consumption were estimated by assuming 2.7 persons per connection and consumption of 100 gallons per person per day. This consumption estimate is based on a comparison to adjoining water systems (Cross Valley, Aqua Copia, and Woodlane) in which per capita consumption ranges from 111 to 143 gallons/day.

f. Sources: Population estimates were provided by Gary Hajek, Cross Valley Water Association, and Richard Sarver, Snohomish Health District, personal communications, April 1987. The number of connections is an estimate calculated by using the population estimate and assuming 2.7 persons per connection. The volume of water used was calculated assuming consumption of 100 gallons per person per day. The boundaries of the Cross Valley Water Association service area are shown in the sole source aquifer petition.

g. The number of individual wells was estimated by counting the number of buildings shown on the relevant portions of topographic maps. Specifically, there are two areas of the proposed sole source aquifer area in which public water supplies are not available and residents rely on individual household wells. The first area is immediately west of the Cross Valley Water Association service area and encompasses parts of Sections 3,4,9,and 16 of T27N, R5E. The second area is southeast of the Water Association service area and includes parts of Sections 3 and 4 of T26N, R6E. These areas are shown respectively, on the U.S. Geological Survey Bothell (1981) and Maltby (1973) 7.5 minute quadrangles. As these maps do not reflect recent intensive development the estimated number of connections is probably much lower than the actual number. The population was estimated by assuming 2.7 persons per connection. The volume of water used was calculated assuming consumption of 100 gallons per person per day.

h. Totals reflect all uncertainties inherent in previous calculations and can thus be considered approximate.

A. Source: Number of connections and consumption were provided by J. Blunk, Alderwood Water District, personal communication, April 1987. Alderwood Water District has determined that there are approximately 3.5 persons per connection.

B. Source: The number of connections and estimates of consumption were provided by R. Heisel, Silver Lake W.D., personal communication, April 1987. The population was estimated by assuming 2.7 persons per connection.

C. Source: Number of connections was provided by G. Hajek, Cross Valley Water Association, personal communication, April 1987. Population and consumption were estimated by assuming 2.7 persons per connection and consumption of 100 gallons per person per day. These customers are served by City of Everett water (surface water) through a limited capacity intertie and are located in T28N., R5E, Section 16. This is outside of the proposed sole source aquifer area but within the Cross Valley Water Association service area.

D. Source: Information on numbers of connections and consumption provided by W. Davis, Woodinville Water District, personal communiction, April 1987. The consumption rates given are at most one-fifth of those of surrounding districts. No explanation of this difference was offered.

## Surface Water

The Snoqualmie River and the Snohomish River are situated near the eastern boundary of the "Cross Valley" Aquifer area but there are no other significant rivers or streams over the aquifer. Several small streams originate on the land surface above the aquifer and drain the land surface toward the edge of the aquifer. Several small lakes, such as Little Lake, Crystal Lake, and Echo Lake are found over the aquifer.

## Ground-Water Quality

Water in the Esperance Sand unit tends to be of satisfactory quality, but water from the deeper wells is of poorer quality. Clay and possibly some peat zones may contribute hydrogen sulfide gas and iron[18,19].

## Potential for Contamination

Since water reaches this aquifer by downward percolation of the precipitation on the plateau surface[20], contamination from any surface source can enter the aquifer by the same route. Any material spilled or disposed of in unlined sites on the surface may migrate downward, under the hydrologic conditions prevalent in the area, until it reaches the ground water. Once the ground water becomes contaminated, its usefulness as a source of drinking water could be impaired or destroyed. Assuming that the technology to remove the contaminant, or contaminants, exists and is readily available, an increased expenditure of energy and funds could still be required to make the water useable again. If the technology is not available, or if the expense for decontamination is too high, the contaminated aquifer could become practically useless as a drinking water supply and its usefulness for other purposes could be greatly impaired.

# CONCLUSION AND DISCUSSION

To be designated as sole source, an aquifer must supply 50 percent or more of the drinking water for an area. Contamination of a sole source aquifer would pose a significant hazard to public health. The Cross Valley Aquifer provides 77.6 per cent of drinking water used in the aquifer area and adjoining service area, and there are no feasible alternative sources of water. Therefore, EPA Region 10 Water Division recommends to the Regional Administrator that the aquifer be designated as a sole source aquifer. The aquifer would be designated as the Cross Valley Sole Source Aquifer, named after the largest public water system using the aquifer.

The area originally petitioned for designation is not exactly the same area that is proposed for designation for several reasons. The area petitioned is the Association service area, but the aquifer does not underlie this entire area. In the east, the service area extends only to where the bedrock is at or near the surface. In the north, the service area extends into bedrock areas and into the Snohomish River flood plain, but the designated area extends only to where the bedrock is near the surface [21,22,23]. In the south the service area extends into King County. Available information indicates that the western half of the aquifer tapers off north of the County line and the eastern half of the aquifer extends south into King County[23].

The boundary of the aquifer, which includes the recharge zone, is defined by natural landmarks where possible, and by cultural features where no such landmarks exist. The designated aquifer is the Esperance Sand Aquifer, of USGS nomenclature [25], within the land-surface boundary proposed above. The designated area is generally bounded as follows: on the east and north sides by bedrock, which is at or near land surface, on the west by the North Creek Valley, and on the south by the County line. (See Attachment A for legal description). The area proposed for designation covers approximately 36 square miles, and is given in Attachment B.

# REFERENCES


1. Safe Drinking Water Act, Public Law 93-523. 42 U.S.C. §300. et. seq.

2. Sole Source Aquifer Petition from Mount Forest Protection Association and Cross Valley Water Association to U.S. Environmental Protection Agency, Seattle, WA, dated July 29, 1983.

3. Federal Register, Volume 48, No. 180, September 15, 1983, pp. 41508-41510.

4. Newcomb, R.C., Ground-Water Resources of Snohomish County Washington, Water Supply Paper 1135, Government Printing Office, 1952, p. 7.

5. Noble, Hohn B., Ground-Water Study for Cross Valley Water Association, Inc., South Service Area, unpublished report, May 1972, p. 1.

6. Noble 1972, p.3.

7. Population estimates were made based on the following sources: (1) data given on Washington State Department of Social and Health Services 1986 Water Facilities Inventory and Report Forms for each of the relevant water purveyors: Cross Valley Water Association, Woodlane Water System, Aqua Copia Water System, Alderwood Water District, and Woodinville Water District; (2) Sole Source Aquifer Petition, page 4; (3) personal communication, Richard Sarver, Snohomish Health District, April 1987; (4) personal communications, G. Hajek, Cross Valley Water Association; P. Blunk, Alderwood Water District; and W. Davis, Woodinville Water District; all April 1987.

8. Noble 1972, p. 1.

9. Noble 1972, p. 2

10. Noble 1972, p. 2.

11. Noble, John B., Ground Water Resource Evaluation for Cross Valley Water Association, unpublished report, July 1983, plates 1 and 2.

12. Letter from Gary Hajek, Cross Valley Water Association, Inc., to Rene' Fuentes, U.S. EPA, Drinking Water Programs Branch, dated November 29, 1983. Cross Valley Water Association water supply wells are located in T27N, R5E, Sections 24, 25, and 35.

13. Sole Source Aquifer Petition, p. 4. Other small water systems within the proposed sole source aquifer area and Cross Valley Water Association service area are the Woodlane Water System, the Aqua Copia/Horse County Estates Water System, and the Lake Tuck Water System. These systems use wells installed in the Cross Valley Aquifer, and serve, respectively, populations of 130, 200, and 120. Production wells are located in T27N, R5E, Sections 14, 23, and 35 and T27N, R6E, Section 26.

14. Personal Communication, Gary Hajek, Cross Valley Water Association, Inc., April 1987.

15. Letter from Gary Hajek, Cross Valley Water Association, Inc., to Rene' Fuentes, U.S. EPA, November 29, 1983.

16. Personal Communication, J. Blunk, Alderwood Water District, April 1987.

17. Personal Communication, W. Davis, Woodinville Water District, April 1987.

18. Noble 1972, p. 2.

19. Letter from Thomas J. Farrell, Snohomish County Solid Waste Division, to Wendy Marshall, U.S. EPA, dated October 31, 1983, p. 7.

20. Newcomb, 1952, p. 41.

21. Newcomb, 1952, plate 1.

22. Noble, June 1983, "Water Well and Aquifer Summary Map."

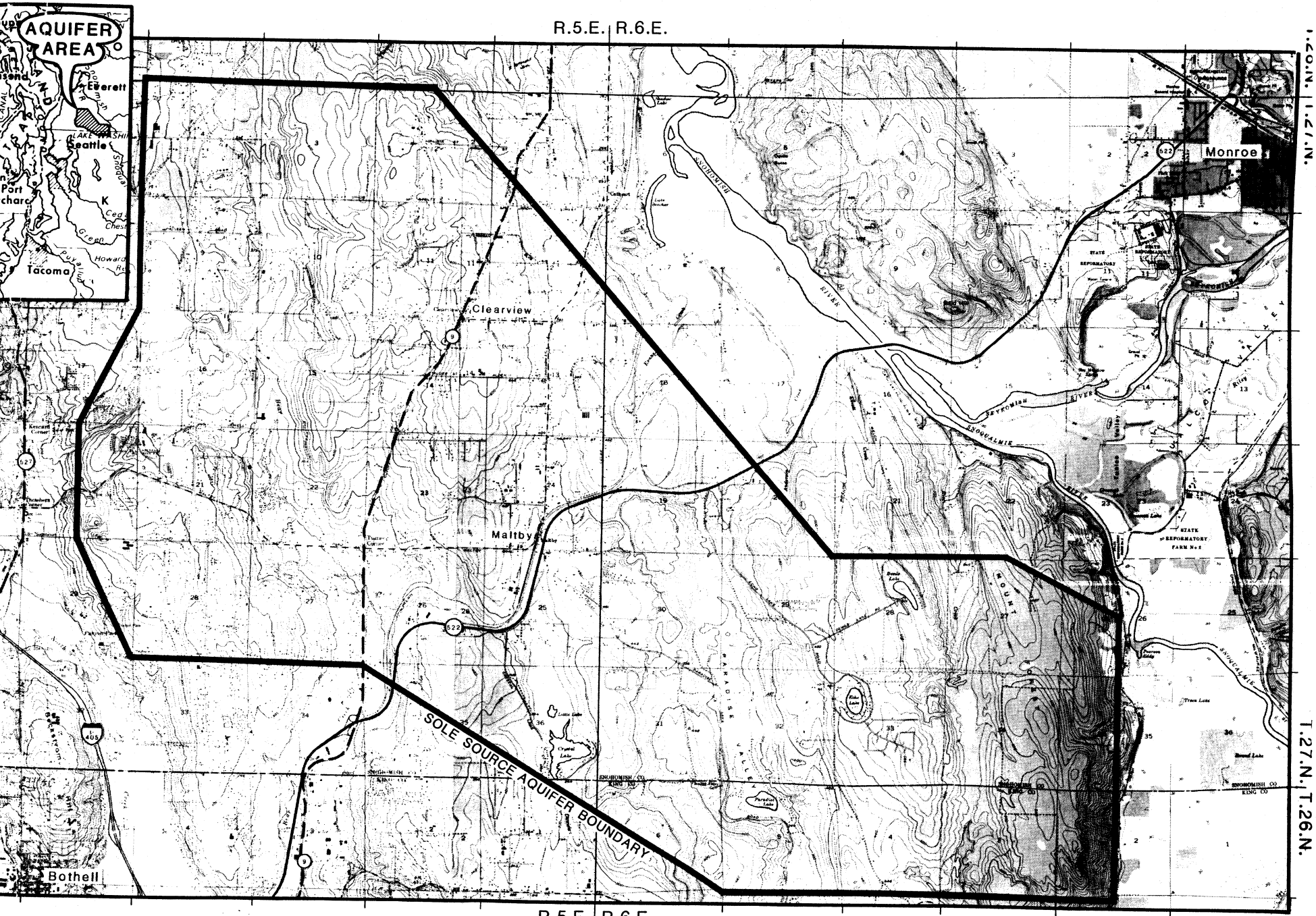
23. Earth Consultants, Inc., "Geologic, Soil, and Foundation Investigation Phase II," unpublished report prepared for Snohomish County, updated.

24. Noble, 1983, "Water Well and Aquifer Summary Map."

25. Newcomb, 1952, p. 19.

Attachment A
Cross Valley Sole Source Aquifer Area

Beginning at the N.W. corner of Section 4, T.27 N., R.5 E., Willamette Meridian, thence east along the section line to the N.W. corner of the N.E. 1/4 of Section 2, T.27 N., R.5 E., thence southeasterly to the S.E. corner of Section 20, T.27 N., R.6 E., thence east along the section line to the N.W. corner of the N.E. 1/4 of Section 27, T.27 N., R.6 E., thence southeasterly to the S.E. corner of the N.W. 1/4 of Section 26, T.27 N., R.6 E., thence south to the S.E. corner of the S.W. 1/4 of Section 2, T.26 N., R.6 E., thence west to the S.W. corner of Section 5, T.26 N., R.6 E., thence northwesterly to the S.W. corner of Section 26, T.27 N., R.5 E., thence west to the S.W. corner of Section 28, T.27 N., R.5 E., thence northwesterly to the S.W. corner of the S.E. 1/4 of Section 20, T.27 N., R.5 E., thence north to the S.W.corner of the S.E. 1/4 of Section 17, T.27 N., R.5 E., thence northeasterly to the S.E. corner of section 8, T.27 N., R.5 E., thence north along the section line to the point of beginning; being located in Snohomish and King Counties, Washington.




FEDERAL FINANCIALLY ASSISTED PROJECTS LOCATED IN
DESIGNATED AREA MUST BE DESIGNED AND CONSTRUCTED
O PROTECT THE DRINKING WATER QUALITY OF THE AQUIFER.
APPLICANTS ARE HEREBY NOTIFIED THE ENVIRONMENTAL
TECTION AGENCY, WORKING THROUGH THE FEDERAL FUNDING
NCY, MUST APPROVE PROJECTS PRIOR TO COMMITMENT
UNDS.

SIGNATED UNDER THE AUTHORITY
SECTION 1424(e) OF THE SAFE
INKING WATER ACT (PL 93-523)

# CROSS VALLEY AQUIFER

## SOLE SOURCE AQUIFER AND RECHARGE AREA

Snohomish and King Counties, Washington