



STATE OF WASHINGTON
 DEPARTMENT OF ECOLOGY
 AMENDED
 REPORT OF EXAMINATION
 Application for Water Right # G2-29849
 To Appropriate Public Waters of the State of Washington

APPLICATION DATE	APPLICATION NO.
April 26, 1999	G2-29849

NAME		
Washington Water Services		
ADDRESS/STREET	CITY/STATE	ZIP CODE
PO Box 336	Gig Harbor, WA	98335

PUBLIC WATERS TO BE APPROPRIATED

SOURCE		
Well SO 2 (Tag AAB-131)		
TRIBUTARY OF (IF SURFACE WATERS)		
MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	56 (additive)	20 (non-additive)
QUANTITY, TYPE OF USE, PERIOD OF USE		
20 ac-ft/yr (non-additive)	Multiple domestic supply	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL					
600 feet east and 920 feet south from the west quarter corner of Section 15 Township 21 North, Range 1 East.					
LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP	RANGE	WRIA	COUNTY
NW ¼ SW ¼	15	21 N.	1E.W.M.	15	Pierce
PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM		
11803220000	47° 18' 20"	122° 40' 20"	NAD 83		

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED
 [Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal.]

The area served by Washington Water Services' Kopachuck Water System located in Section 15, T. 21 N., R. 1 E. in Pierce County.

DESCRIPTION OF PROPOSED WORKS

One 8-inch diameter well 381 feet deep. Constructed with casing driven to 381 feet deep and completed as an open-bottom well.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE	COMPLETE PROJECT BY THIS DATE	WATER PUT TO FULL USE BY THIS DATE
Started	Completed	December 31, 2020

PROVISIONS

Installation and maintenance of an access port as described in Chapter 173-160 WAC is required.

The subject well has been tagged with a well identification number. This unique well number must remain attached to the well. Please reference this number when submitting data.

An approved measuring device must be installed and maintained for the well authorized by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC. Installation, operation and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements". These requirements can also be found on Ecology's internet website at <http://www.ecy.wa.gov/programs/wr/measuring/measuringhome.html>.

Water users can petition Ecology to ask for modifications to some of the metering requirements. To file a petition to request changes contact:

Metering Coordinator
Water Resource Program
Southwest Regional Office
Department of Ecology
P.O. Box 47775
Olympia, WA 98504-7775

Department of Ecology personnel, upon presentation of proper credentials, must have access at reasonable times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.

The "*Proof of Appropriation*" form should not be filed until the permanent distribution system is constructed and the quantity of water allocated by the permit (to the extent water is required), has been put to full beneficial use. The quantity of water allocated may be reduced when the *Water Right Certificate* is issued to reflect system capacity and actual usage. The *Water Right Certificate* will not be issued until a final investigation is made.

FINDINGS OF FACT AND ORDER

Upon reviewing the investigator's report, I find all facts, relevant and material to the subject application, have been thoroughly investigated. Furthermore, I find the appropriation of water as recommended will not be detrimental to existing rights or to the public interest.

Therefore, I ORDER the approval of Application No. G2-29849 subject to existing rights and the provisions specified above.

You have a right to appeal this ORDER. To appeal this you must:

- File your appeal with the Pollution Control Hearing Board within 30 days of the "date of receipt" of this document. Filing means actual receipt by the Board during regular office hours.
- Serve your appeal on the Department of Ecology within 30 days of the "date of receipt" of this document. Service may be accomplished by any of the procedures identified in WAC 371-08-305(10). "Date of receipt" is defined at RCW 43.21B.001(2).

Be sure to do the following:

- Include a copy of this document that you are appealing with your Notice of Appeal.
- Serve and file your appeal in paper form; electronic copies are not accepted.

1. To file your appeal with the Pollution Control Hearings Board:

Mail appeal to:	OR	Deliver your appeal in person to:
The Pollution Control Hearings Board PO Box 40903 Olympia WA 98504-0903		The Pollution Control Hearings Board 4224 – 6th Ave SE Rowe Six, Bldg 2 Lacey WA 98503

2. To serve your appeal on the Department of Ecology:

Mail appeal to:	OR	Deliver your appeal in person to:
The Department of Ecology Appeals & Application for Relief Coordinator PO Box 47608 Olympia WA 98504-7608		The Department of Ecology Appeals & Application for Relief Coordinator 300 Desmond Dr SE Lacey WA 98503

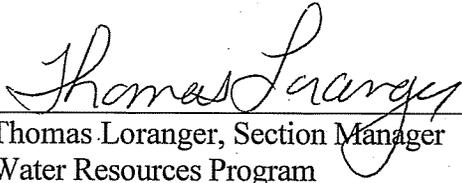
3. And send a copy of your appeal packet to:

Thomas Loranger, Section Manager
Department of Ecology
Water Resources Program
Southwest Regional Office
PO Box 47775
Olympia, WA 98504-7775

For additional information visit the Environmental Hearings Office Website: <http://www.eho.wa.gov>.

To find laws and agency rules visit the Washington State Legislature Website: <http://www.leg.wa.gov/CodeReviser>.

Signed at Olympia, Washington, this 23rd day of June 2010.



Thomas Loranger, Section Manager
Water Resources Program
Southwest Regional Office

Project Summary

This Report of Examination amends the Department of Ecology's (Ecology) previous decision to deny a permit to Washington Water Services (WWS) as requested under Application for Water Right No. G2-29849. WWS originally requested a permit to appropriate public groundwater from a well at rates of 114 gallons per minute (gpm) (additive) and 30 acre-feet/year (ac-ft/yr) (additive) for multiple domestic supply of its Kopachuck Water System. The applicant revised its request to 56 gpm (additive) and 20 ac-ft (non-additive) and provided additional information in support of its amended request.

Application for Water Right No. G2-29849 was originally processed in Ecology's Cost-Reimbursement Program, under an agreement between Ecology and Golder Associates Inc. (Golder). Under the terms of the contract, Golder reviewed available documents pertaining to this application, including site conditions, historical water use, projected water demand, existing right-holders, and seniority of pending applications potentially affected by the application.

On October 19, 2006, Ecology denied the application because additional groundwater withdrawals could potentially impair stream-flows in the area. WWS filed a timely appeal on November 17, 2006, and entered into settlement discussions with Ecology. In September 2009, the parties reached a conceptual agreement when WWS proposed only to increase the Qi. WWS was allowed to demonstrate how additional Qi could be approved without impacting surface water.

In response, WWS prepared *Kopachuck Water System Settlement for Appeal of PCHB No. 06-109 for Application G2-29849 – Technical Analysis* (Pacific Groundwater Group (PGG), 2010), for Ecology's review. WWS addressed Ecology's concerns regarding the continuity and vertical leakage of the aquitard overlying the sea-level aquifer and streamflow capture from two nearby creeks. PGG demonstrated through analytical modeling that increasing the Qi of Kopachuck Well 2, without increasing the annual amount, will not cause streamflow capture to change baseflow effects.

Based on review of this additional information, I recommend issuing a permit to allow for an increased withdrawal rate from Well 2, subject to existing rights issued for the Kopachuck system.

BACKGROUND

On April 26, 1999, the Harbor Water Company (now WWS) filed an application (No. G2-29849) for a permit to appropriate public groundwater from a well at 114 gpm (additive) and 30 ac-ft/year (additive), for multiple domestic supply of its Kopachuck Water System.

Project Description

The Kopachuck Water System serves customers in the NW ¼, SW ¼, Section 15, Township 21 North, Range 1 East on the Gig Harbor Peninsula in Kitsap County. Three wells supply the water system – sources S01, S02, and S03. The subject well is referred to as Kopachuck Well 2 (SO2) and is the southern-most of the three wells. It is about 0.6 mile northeast of the mouth of Horsehead Bay, on the southwest portion of the Gig Harbor Peninsula. Well 2 operates under the authority of Ground Water Certificate No. G2-21815, issued for 26 gpm and 20 ac-ft per year.

See Attachment #1

Kopachuck Well 2 produces 82 gpm, the most of all the wells in the Kopachuck water system. The intent of this authorization is to increase the authorized withdrawal rate for Well 2 from the currently authorized 26 gpm to 82 gpm. Water rights held by the Kopachuck Water System and pumping capacity of each well are summarized below in Table 1.

Table 1. Kopachuck Water System wells and current water rights.

<i>Water Right Cert No.</i>	<i>Well Source</i>	<i>Well ID</i>	<i>Depth (ft)</i>	<i>Pumping capacity (gpm)</i>	<i>Qi (gpm)</i>	<i>Qa additive (ac-ft/yr)</i>	<i>Q, non-additive (ac-ft/yr)</i>
<i>G2-20564</i>	Well 1 (SO1)	AAB129	351	22	32	17	
<i>G2-21815</i>	Well 2 (SO2)	AAB131	381	82	26	20	
<i>G2-28006</i>	Well 3 (SO3)	AAB130	275	35	40	13	25
Totals				139	98	50	25

Legal Requirements for Application Processing

The following items are required before a water right application can be processed:

- **Public Notice**

Notice of the application was published in *The Peninsula Gateway* on July 2, 2003 and July 9, 2003 and no formal protests were received by Ecology.

A copy of the application was sent to the Squaxin Indian Tribe Prior to publication. The Tribe responded in 1999, expressing concerns about the potential to impact surface water.

- **State Environmental Policy Act (SEPA)**

A SEPA determination evaluates if a proposed withdrawal will cause significant adverse environmental impacts. A SEPA threshold determination is required for the following conditions:

- ▶ Surface water applications for more than one cubic feet per second (cfs). For agricultural irrigation, the threshold increases to 50 cfs, if the project isn't receiving public subsidies.
- ▶ Groundwater applications requesting more than 2,250 gpm.
- ▶ Projects with several water right applications where the combined withdrawals meet the conditions listed above.
- ▶ Projects subject to SEPA for other reasons (e.g., the need to obtain other permits that are not exempt from SEPA).
- ▶ Applications that are part of several exempt actions that collectively trigger SEPA under WAC 197-11-305.

This project was determined to be exempt from SEPA.

- **Water Resources Statutes and Case Law**

Before approving a new application, RCW 90.03.290(3) requires Ecology to investigate the facts. A new appropriation must satisfy each element of this four-part test:

- ▶ Water must be available for appropriation.
- ▶ The water must be for a beneficial use.
- ▶ Existing water rights must not be impaired.
- ▶ Approving the appropriation must not be detrimental to the public interest.

The Instream Resources Protection Program (IRPP) for the Kitsap Peninsula Basin Water Resource Inventory Area (WRIA) 15 (Chapter 173-515 WAC), establishes surface water flows for many streams in the WRIA and closes others to groundwater withdrawals that would clearly have an adverse impact to the surface water system. Flows established are considered an appropriation and are senior to all permits and subsequent water right applications.

INVESTIGATION

The following information was used to evaluate this *Application for a Water Right*:

- Washington Groundwater and Surface Water Codes, administrative rules, and policies.
- Other recorded water rights in the area.
- Water well reports recorded in the Department of Ecology's Well Log Image System.
- Topographic and local area maps.
- Original Report of Examination dated October 19, 2006, denying Groundwater Application No. G2-29849.
- Technical Memorandum from Linton Wildrick (Pacific Groundwater Group) to Mike Ireland (WWS), January 11, 2010, *Kopachuck Water System Settlement for Appeal of PCHB No. 06-109 for Application G2-29849 – Technical Analysis*.

Site Conditions

The Kopachuck Water System serves customers on the Gig Harbor Peninsula, in northwestern Pierce County, in WRIA 15 (Kitsap Basin). The Gig Harbor Peninsula is in the southern Puget Lowland and connects to the larger Kitsap Peninsula to the north.

Kopachuck Well 2 sits on Kopachuck Hill at about 380 ft above mean sea level (msl), halfway between Raft Island and Hale Passage. The hill is part of a ridge that separates two surface drainages. Creek #342 is west of Well 2 and discharges to Henderson Bay, about 0.6 mile away. Creek # 342 is east of Well 2 and discharges to Horsehead Bay and Carr Inlet, about 0.4 mile east.

Well 2 is completed in the upper 62 feet of the Sea Level Aquifer, based on the geologic description on the well log. The thickness of the Sea Level Aquifer around Well 2 is unknown, because few, if any, wells penetrate the

unit in this area of the Gig Harbor Peninsula. Well construction details of Well 2 are summarized below in Table 2.

Table 2. Kopachuck Well 2 construction details.

	<i>Kopachuck Well 2 (SO2)</i>
Driller	Ramlo's Sandpoint Service
Date Drilled	1971
Well head elevation (ft above mean sea level, msl)	380
Well diameter (inches, in)	8
Completed depth (ft below ground surface, bgs)	381
Static water level (ft bgs)	313 (67 feet above msl)
Date measured	1971

Geology

The Gig Harbor Peninsula is part of an eroded glacial drift plain in the southern Puget Lowland. During the last two million years, the area experienced at least six glaciations (Kahle, 1998). The Peninsula comprises a complex vertical sequence of unconsolidated and semi-consolidated sediments, including advance and recessional outwash and till from glacial episodes, and fluvial and lacustrine sediments from interglacial episodes. The total thickness of the sedimentary sequence ranges between 1,200 and 2,000 feet (Jones, 1996). The sediments are underlain by Miocene volcanic and sedimentary bedrock (Garling, et al., 1965; Borden and Troost, 2001; Logan, et al., 2006).

The most recent surficial geology map for the area is the Fox Island 7.5-Minute Quadrangle (Logan, et al, 2006), which indicates more complex layering than previously mapped. The map also includes two geologic cross-sections that pass directly through Kopachuck Hill and the Kopachuck Water System's service area. PGG (2010) reproduced part of Logan's cross-sections A-A' and B-B', with minor modifications, including correction of surface elevations for several wells, differentiation of units Qcc and Qcf, and addition of the piezometric surface (water level) for the confined Sea Level aquifer.

Groundwater occurrence

Groundwater on the Gig Harbor Peninsula generally comes from three aquifers. Groundwater occurs in the lower parts of the upper sequence of coarse-grained sediments, including alluvial fan sediments (Qaf), Vashon recessional outwash (Qgo), advance outwash (Qga), advance sand (Qgas), advance lacustrine deposits (Qga); and pre-Vashon non-glacial sand and gravel (Qcc). Groundwater from these units provide baseflow to local creeks, but do not produce enough water to supply wells.

Below the Vashon glacial units and Qcc lies the Qcf (fine-grained pre-Vashon sediments). This unit is regionally continuous and serves as an aquitard. The Qcf was formerly identified as the Kitsap Formation (Garling, et al., 1965).

All wells on and around Kopachuck Hill tap the Sea Level aquifer (Qgp). The aquifer is composed of coarse-grained pre-Vashon sediments of unknown age (Qgp). The water level in the Qgp varies from about 100 ft above msl, to sea level at the shoreline.

Cross-sections in PGG (2010) indicate the piezometric surface in the Qgp is below the local stream beds, except near the mouth of the streams, suggesting the stream is not directly connected to the Qgp. The head distribution between the two units indicates the stream is perched above the Qgp and head loss in the Qcf results when groundwater percolates through it. As a result, the Qcf will substantially delay the propagation of pumping effects into overlying units that provide baseflow to the creeks.

Stream capture analysis

Analytical modeling by PGG (2010) indicates the Qi from Well 2 can be increased without changing flow to the two creeks near Kopachuck Hill, because the overall pumping, including seasonal variations, will not change. The amount of water that WWS is producing for this system is not changing, or exceeded existing water rights. Any minor variations in pumping distributions, such as the number of hours a particular source runs will be non-detectable given the limited continuity between the aquifer and surface water. The effects that any of the Kopachuck wells have on surface water is highly attenuated due to the intervening thick aquitard and the delayed effects of the aggregated pumping on the overlying unconfined aquifer that discharges to the creek. (PGG, 2010)

Water allocation/demand forecasting

Kopachuck Well 2 is part of the Kopachuck Water System (WDOH ID # 43065). The Water System Plan was prepared by Robischon Engineers and last approved by Washington Department of Health (WDOH) in 2003. The Kopachuck Water System has 80 active and 14 pending connections for a total commitment of 93 Equivalent

Residential Units (ERUs). The system is currently approved by WDOH to serve 100 ERU's for rural residential customers. All anticipated growth for this system is likely to occur from in-filling.

Average daily demand for the Kopachuck Water system is calculated according to WDOH guidelines using this formula:

$$ADD = \left(\frac{8000}{AAR} \right) + 200$$

Where: ADD = Average Day Demand, (gallons-per-day/ERU)

AAR = Average Annual Rainfall, (inches-per-year)

Using climatic information for Gig Harbor, the average daily demand for 100 residences should not exceed 416 gallons per day per residence. The total water demand for this project should not exceed 46.6 ac-ft per year.

The Average Daily Water consumption for this system for 80 active connections, based on 2004 to 2009 meter readings, averages about 27.5 ac-ft per year, or 0.4 ac-ft per connection. Projected annual demand for the 100 homes currently authorized is 40 ac-ft, using metering data. This is less than demand estimates using WDOH guidelines. Accordingly, adequate water rights for short-term demand have already been awarded for this system.

Impairment considerations

Potential effects to existing water users

Nearby water users whose wells are completed in the same aquifer as the new well have greatest potential to be affected by new appropriations. WAC 173-150-060 specifies only withdrawals that negatively impact qualifying withdrawal facilities fit the legal definition of impairment. Qualifying withdrawal facilities are fully penetrating wells completed in the same aquifer as the new point of withdrawal. A fully penetrating well spans the aquifer's entire saturated thickness and allows a reasonable variation in seasonal water levels. This definition allows wells to be affected, especially shallower wells, but the impacts are not considered impairment.

This application will allow withdrawals of an additional 56 gpm from a well 381 ft deep.

Ecology's Water Right Tracking System was queried to determine existing water rights in a radius of approximately one-half mile. This radius was selected to make records retrieval easier and by groundwater divides near the project area. Well logs on file at Ecology were also examined to determine the hydrogeologic conditions in the area around Well 2.

The following water rights were identified:

- Two certificates for wells completed in the Qgp up to 0.3 mile from Kopachuck Well 2.
- One certificate for a well completed in the Vashon Aquifer approximately 0.4 mile from Kopachuck Well 2.
- One certificate for a well completed a deeper aquifer below the Qgp.

According to the potentiometric surface maps (EMCON, 1992), one certificated well completed in the Qgp (G2-26672 – Richardson Water) is upgradient from Well 2 and not likely to be impaired. The second certificated well (G2-20564C – Washington Water Services) is Kopachuck Well 1, 1,000 feet downgradient from Well 2. This well is also part of the Kopachuck Water System and has not been impacted by the operation of Well 2 at the higher withdrawal rate.

Wells completed in the Vashon and aquifers below the Qgp are not likely to be affected by increased withdrawals from Well 2. A sandy clay layer between 153 and 319 ft bgs prevents direct communication with the shallower aquifer. For wells completed in aquifers below the Qgp, certificated water right holders should be able continue to withdraw allotted amounts of water without being impacted by increased pumping of Well 2.

Potential effects to surface water

Minimum instream flows were established in 1981 through Chapter 173-515-040 WAC, the Instream Resources Protection Program for the Kitsap Water Resource Inventory Area (WRIA) 15. Any groundwater withdrawals with priority dates later than the closure dates stated in the WAC must not impair instream flows.

There are two small water bodies in the vicinity of the Kopachuck water system. These creeks are on either side of Kopachuck Hill and discharge to the marine waters of Henderson Inlet. Creek #341 flows on a relatively steep gradient through a ravine on the west side of Kopachuck Hill (Figure 1). It is about 2/3 mile long with a drainage area of 0.9 square mile (Haring, 2000). Measured discharge at Warren Road (near the mouth), during August

1958, was 0.06 cfs (Garling and others, 1965). Upstream migration of anadromous fish is prevented by a hanging culvert under Warren Road, at river mile (RM) 0.25.

Creek #342 is about one mile long, with a drainage area of 2.2 square miles. Measured discharge at the road crossing at the mouth, during August 1958 was 0.64 cfs. Upstream migration of anadromous fish is prevented by a hanging culvert at river mile (RM) 0.3.

Based on PGG's assessment (2010), Qi from Well 2 can be increased without impairing flows in Creek # 341 or #342, because the overall pattern of groundwater circulation and discharge in the unconfined aquifer will not change.

Seawater Intrusion

Given the coastal nature of the Gig Harbor Peninsula, seawater intrusion is a concern. According to the Environmental Protection Agency, the recommended Secondary Maximum Contaminant Level (SMCL) allowed for chloride is 250 mg/l.

Kopachuck Well 2 has been operating for over nine years and the currently active water-right permit No. G2-21815C includes requirements for regular monitoring of chloride levels. Historical monitoring of Well 2 has not detected a change from the historic background level. Chloride data collected from Well 2 is summarized in Table 3.

Table 3. Chloride data for Kopachuck Well 2.

Chloride Concentration milligrams per liter (mg/L)	Date
6 mg/L	2/28/2002
5 mg/L	8/24/2000
5 mg/L	8/28/1997

Public Interest considerations

Approving this application is not detrimental to the public interest and is consistent with WAC 173-522 and RCW 90.54.

Consideration of protests and comments

In a letter dated August 19, 1999, the Squaxin Island Tribe expressed concerns that increased withdrawals from Well 2 have the potential to impact surface water. This area of Pierce County is part of the Tribe's Usual and Accustomed Area of fishing. Based on the potential impacts associated with allocating additional water from this well the original application was denied.

WWS has subsequently modified its request to only increase the rate of withdrawal to reflect installed system capacity. Based on the evaluation by PGG (2010), increasing the instantaneous withdrawal rate of Well 2 without increasing the annual quantity will not impair flows in either Creek #241 or Creek #242.

FINDINGS

- Chapter 173-515 WAC closes several small unnamed streams in WRIA 15 to further consumptive withdrawals. However, WAC 173-515-050 states future groundwater withdrawal proposals will not be affected by this chapter unless they would clearly have an adverse impact upon the surface water system.
- Multiple domestic supply is a beneficial use.
- Water is available for appropriation.
- This appropriation is not detrimental to the public interest.
- The issuance of this water right will not impair any senior water right holders.

RECOMMENDATIONS

Based on the above investigation and conclusions, I recommend Application No. G2-29849 be approved in the amounts and limits listed below, subject to provisions beginning on Page 2 of this Report of Examination.

Purpose of Use and Authorized Quantities

The amount of water recommended is a maximum limit and the water user may only use that amount of water within the specified limit that is reasonable and beneficial.

- 56 gpm for multiple domestic supply (additive).
- 20 ac-ft per year (non-additive).

Point of Withdrawal

- 600 feet east and 920 feet south from the west quarter corner of Section 15, T.21 N., R.1E.

Place of Use

As described on Page 1 of this Report of Examination.

Report by: 
Tammy Hall, L.H.G., Water Resources Program

6/21/2010
Date

References

- Borden, R.K. and Troost, K.G. 2001. Late Pleistocene Stratigraphy in the South-Central Puget Lowland, Pierce County, Washington. Washington Division of Geology and Earth Resources Report of Investigations 33, Washington State Department of Natural Resources.
- Drost, B. W. 1982. Water Resources of the Gig Harbor Peninsula and Adjacent Areas, Washington, U.S. Geological Survey.
- EMCON. 1992. Gig Harbor Peninsula Ground Water Management Plan Task 5 Hydrogeologic Evaluation Report.
- Garling, M. E., Dee Molenaar, and et al. 1965. Water Resources and Geology of the Kitsap Peninsula and Certain Adjacent Islands, State of Washington, Department of Conservation, Washington Division of Water Resources.
- Golder Associates. 2002. Phase II Level 1 Data Compilation and Preliminary Assessment Report. Redmond, Washington.
- Golder Associates. 2003. Kitsap Watershed Planning (WRIA 15) Water Quality Technical Assessment. Redmond, Washington.
- Golder Associates. 2004. Kitsap Watershed Planning (WRIA 15) Instream Flow Assessment Step C Final Report. Redmond, Washington.
- Jones, M. A. 1996. Thickness of Unconsolidated Deposits in the Puget Sound Lowland, Washington and British Columbia, a Contribution of the Regional Aquifer-System Analysis Program. Tacoma, Washington: U.S. Geological Survey.
- Kahle, S. C. 1998. Hydrogeology of Naval Submarine Base Bangor and Vicinity, Kitsap County, Washington, U.S. Geological Survey.

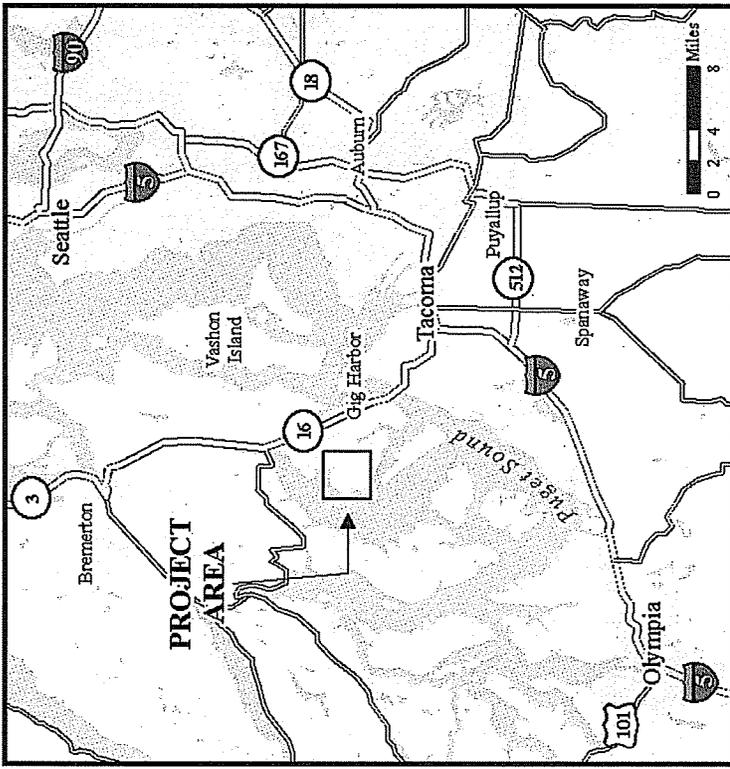
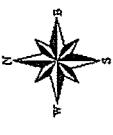
Noble, J. B. 1990. Proposed Revision of Nomenclature for the Pleistocene Stratigraphy of Coastal Pierce County, Washington, Washington Division of Geology and Earth Resources.

Pacific Groundwater Group, 2010. *Kopachuck Water System Settlement for Appeal of PCHB No. 06-109 for Application G2-29849 – Technical Analysis*. Technical Memorandum to Micheal Ireland, Washington Water Services. January 11.

If you need this publication in an alternate format, please call Water Resources Program at 360 407-6600. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

ATTACHMENT 1

Washington Water Service
 Water Right Number G2-29849
 Sec. 15 T. 21 N. R. 1 E.W.M.
 WR1A 15 - Pierce County



Legend

- WELL LOCATION (POW)
- PIERCE CO PARCELS
- ROADS
- HIGHWAYS
- SECTION LINES
- CITIES

Comments:
 Place of use, points of withdrawal/diversion are as defined on the cover sheet under the heading, 'LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED.'

Map Created 4/07/2010 ahn

