



State of Washington
PROTESTED
 REPORT OF EXAMINATION
 FOR WATER RIGHT CHANGE

File NR CG1-*02042CWRS
 WR DOC ID 4563384

Add or Change Purpose of Use Change Place of Use Add Point of Withdrawal
 Change Season of Use Add Irrigation Acres Well Consolidation

PRIORITY DATE July 9, 1951	WATER RIGHT NUMBER Ground Water Certificate (GWC) 5917-A
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MAILING ADDRESS CITY OF BLAINE 1200 YEW AVENUE BLAINE WA 98230	SITE ADDRESS (IF DIFFERENT)
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Total Quantity Authorized for Withdrawal		
WITHDRAWAL RATE	UNITS	ANNUAL QUANTITY (AF/YR)
320	GPM	448

Purpose						
PURPOSE	WITHDRAWAL RATE			ANNUAL QUANTITY (AF/YR)		PERIOD OF USE
	ADDITIVE	NON-ADDITIVE	UNITS	ADDITIVE	NON-ADDITIVE	(mm/dd)
Municipal	320		GPM	448		01/01 - 12/31

ADDITIVE	IRRIGATED ACRES		PUBLIC WATER SYSTEM INFORMATION	
	NON-ADDITIVE		WATER SYSTEM ID	CONNECTIONS
			07300	

Source Location			
COUNTY	WATERBODY	TRIBUTARY TO	WATER RESOURCE INVENTORY AREA
Whatcom	Groundwater		1-Nooksack

SOURCE FACILITY/DEVICE	PARCEL	WELL TAG	TWN	RNG	SEC	QQ Q	LATITUDE	LONGITUDE
Well 7 (Existing well)	410131361032	ABB959	41N	01E	31	SWSE	48.99433	-122.73501
Well 8.1 (Additional)	410131513090	BAM401	41N	01E	31	SESE	48.99619	-122.72949

Datum: NAD83/WGS84

Place of Use (See Attached Map)

LEGAL DESCRIPTION OF AUTHORIZED PLACE OF USE

The place of use of this water right is the service area described in the Water System Plan approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

Proposed Works

An additional 16- to 12-inch well drilled to a depth of 760 feet and distribution system required to supply water to municipal water supply customers.

Development Schedule

BEGIN PROJECT	COMPLETE PROJECT	PUT WATER TO FULL USE
Started	December 31, 2013	December 31, 2021

Measurement of Water Use

How often must water use be measured?	Weekly
How often must water use data be reported to Ecology?	Annually (by January 31)
What volume should be reported?	Total Annual Volume
What rate should be reported?	Highest total instantaneous rate

Provisions

Wells, Well Logs and Well Construction Standards

All wells constructed in the state must meet the construction requirements of WAC 173-160 titled "Minimum Standards for the Construction and Maintenance of Wells" and RCW 18.104 titled "Water Well Construction". Any well which is unusable, abandoned, or whose use has been permanently discontinued, or which is in such disrepair that its continued use is impractical or is an environmental, safety or public health hazard must be decommissioned.

All wells must be tagged with a Department of Ecology unique well identification number. If you have an existing well and it does not have a tag, please contact the well-drilling coordinator at the regional Department of Ecology office issuing this decision. This tag must remain attached to the well. If you are required to submit water measuring reports, reference this tag number.

Installation and maintenance of an access port as described in WAC 173-160- 291(3) is required.

Measurements, Monitoring, Metering and Reporting

An approved measuring device must be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173, which describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition the Department of Ecology for modifications to some of the requirements.

Recorded water use data shall be submitted via the Internet. To set up an Internet reporting account, contact the Northwest Regional Office. If you do not have Internet access, you can still submit hard copies by contacting the Northwest Regional Office for forms to submit your water use data.

Water Level Measurements

In order to maintain a sustainable supply of water and ensure that your water source is not impaired by future withdrawals, static water levels should be measured and recorded monthly using a consistent methodology. Static water level is defined as the water level in a well when no pumping is occurring and the water level has fully recovered from previous pumping. Static water level data should include the following elements:

Unique Well ID Number

Measurement date and time

Measurement method (air line, electric tape, pressure transducer, etc.)

Measurement accuracy (to nearest foot, tenth of foot, etc.)

Description of the measuring point (top of casing, sounding tube, etc.)

Measuring point elevation above or below land surface to the nearest 0.1 foot

Land surface elevation at the well head to the nearest foot.

Static water level below measuring point to the nearest 0.1 foot.

Department of Health Requirements

Prior to any new construction or alterations of a public water supply system, the State Board of Health rules require public water supply owners to obtain written approval from the Office of Drinking Water of the Washington State Department of Health. Please contact the Office of Drinking Water at Northwest Drinking Water Operations, 20435 72nd Avenue S, Suite 200, K17-12, Kent, WA 98032-2358, (253) 396-6750.

No Impairment of Existing Rights

This authorization to make use of public waters of the state is subject to existing rights, including any existing rights held by the United States for the benefit of Tribes under treaty or settlement. If impairment does occur, the City will be required to diminish or cease pumping, or mitigate for this impairment.

Proof of Appropriation

The water right holder must file the notice of Proof of Appropriation of water (under which the superseding certificate of water right is issued) when the permanent distribution system has been constructed and the quantity of water required by the project has been put to full beneficial use. The superseding certificate will reflect the extent of the project has been perfected. Elements of a proof inspection may include, as appropriate, the source(s), system instantaneous capacity, beneficial use(s), annual quantity, place of use, and satisfaction of provisions.

Schedule and Inspections

Department of Ecology personnel, upon presentation of proper credentials, will have access at reasonable times, to the project location, and to inspect at reasonable times, records of water use, wells, diversions, measuring devices and associated distribution systems for compliance with water law.

Findings of Facts

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 change of water right as recommended will not be detrimental to existing rights or the public interest.

Therefore, I ORDER approval, subject to existing rights and the provisions specified above, of the requested change to add a point of withdrawal under Change Application No. CG1-*02042CWRIS (for Ground Water Certificate 5917-A).

Your Right To Appeal

You have a right to appeal this Order to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do the following within 30 days of the date of receipt of the Order.

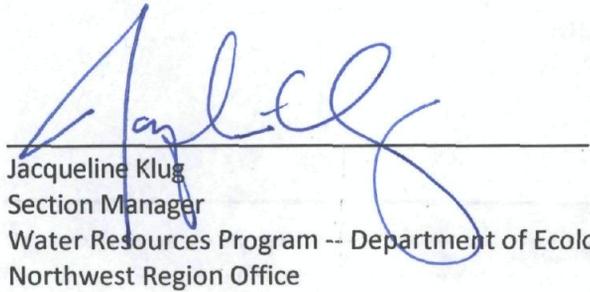
- File your appeal and a copy of this Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Order on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

Address and Location Information

Street Addresses	Mailing Addresses
<p>Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503</p>	<p>Department of Ecology Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608</p>
<p>Pollution Control Hearings Board 111 Israel RD SW STE 301 Tumwater, WA 98501</p>	<p>Pollution Control Hearings Board PO Box 40903 Olympia, WA 98504-0903</p>

Signed at Bellevue, Washington, this 1st day of June, 2011.



Jacqueline Klug
Section Manager
Water Resources Program -- Department of Ecology
Northwest Region Office

INVESTIGATOR'S REPORT

Buck Smith, LG, LHG, Senior Hydrogeologist

Department of Ecology – Water Resources Program

Water Right Control Number CG1-*02042CWRIS (GWC 5917-A)

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BACKGROUND

The subject application for change was processed under an expedited cost-reimbursement agreement (CRA Project No.9RB7) signed on February 1, 2011. The City of Blaine (City), in partnership with the Birch Bay Water & Sewer District (District), has reimbursed the Department of Ecology (Ecology) the full cost of processing this application. There were no competing water right change applications located within the same body of public groundwater.

Description and Purpose of the Proposed Change

This report was written in response to the City's application for change, filed on December 16, 2008, to include Production Well 8.1 (PW-8.1) as an additional point of withdrawal under Ground Water Certificate (GWC) 5917-A. Prior to this request GWC 5917-A was only approved for a single point of withdrawal (PW-7). PW-8.1 is currently authorized as an additional point of withdrawal under a different certificate (GWC 6916-A). This was accomplished through a "showing of compliance form" (see RCW 90.44.100(3)) submitted by the City to Ecology on June 3, 2008. Prior to that GWC 6916-A (300 gpm, 288 af/yr) was only approved for a single point of withdrawal (PW-8). Having PW-8.1 included as an additional point of withdrawal under both GWC 5917-A and GWC 6916-A will give the City additional operational flexibility for both water quantity and water quality management.

Attributes of the Existing Water Right and Proposed Change

Attributes	Existing Right	Proposed Change
Name	City of Blaine	Same
Priority Date	July 9, 1951	Same
Instantaneous Quantity	320 gpm	Same
Annual Quantity	448 af/yr	Same
Purpose of Use	Municipal supply	Same
Period of Use	Year-round	Same
Place of Use	Area served by the City of Blaine	Same

Proposed Additional Point of Withdrawal

Source Name	Parcel #	WellTag	Tw	Rng	Sec	QQ Q	Latitude	Longitude
PW-8.1	410131513090	BAM401	41N	01E	31	SE SE	48.99619	-122.72949

Existing Point of Withdrawal

Source Name	Parcel #	WellTag	Twn	Rng	Sec	QQ Q	Latitude	Longitude
PW-7	410131361032	ABB959	41N	01 E	31	SW SE	48.99433	-122.73501

Legal Requirements for the Proposed Change

RCW 90.44.100

(1) After an application to, and upon the issuance by the department of an amendment to the appropriate permit or certificate of groundwater right, the holder of a valid right to withdraw public groundwaters may, without losing the holder's priority of right, construct wells or other means of withdrawal at a new location in substitution for or in addition to those at the original location...

(2) An amendment to construct an additional well at a location outside of the location of the original well shall be issued only after publication of notice of the application and findings as prescribed in the case of an original application. Such amendment shall be issued by the department only on the conditions that:

- a) the additional well shall tap the same body of public groundwater as the original well;
- b) the original well may continue to be used, but the combined total withdrawal from the original and additional well shall not enlarge the right conveyed by the original certificate; and
- c) other existing rights shall not be impaired.

(3) Findings prescribed in the case of the original application include:

- a) the public interest must not be impaired;
- b) water must be available; and
- c) water must be put to a beneficial use.

(4) In addition, all protests must be considered and addressed.

Public Notice

A public notice of the application must be published in a local newspaper once a week for two consecutive weeks (RCW 90.03.280). Public notice of the subject application was published in *The Bellingham Herald* on February 21 and 28, 2009.

In addition, a general notice of an upcoming expedited cost-reimbursement process must be posted on Ecology's web site and published in a newspaper of general circulation in the area where affected properties are located (RCW 90.44.540). The general notice for this

project was posted on Ecology's web site on February 3, 2011 through April 3, 2011. The general notice also was published in *The Bellingham Herald* on February 8, 2011. Ecology received no comments or requests by other applicants to join in the process.

State Environmental Policy Act (SEPA)

A water right application is subject to a SEPA threshold determination (i.e., an evaluation whether there are likely to be significant adverse environmental impacts) if any one of the following conditions are met.

- (1) It is a surface water right application for more than 1 cubic feet per second, unless that project is for agricultural irrigation, in which case the threshold is increased to 50 cubic feet per second, so long as that irrigation project will not receive public subsidies.
- (2) It is a groundwater right application for more than 2,250 gallons per minute.
- (3) It is an application that, in combination with other water right applications for the same project, collectively exceeds the amounts above.
- (4) It is a part of a larger proposal that is subject to SEPA for other reasons (e.g., the need to obtain other permits that are not exempt from SEPA).
- (5) It is part of a series of exempt actions that, together, trigger the need to do a threshold determination, as defined under WAC 197-11-305.

Because this application does not meet any of these conditions, it is categorically exempt from SEPA and a threshold determination is not required.

INVESTIGATION

The City and District currently provide municipal water to 13,270 people (Associated Earth Sciences, Inc. (AESI), 2008). Of this population, 5,550 are located within the City's service area, 7,350 are located within the District service area, and 420 in the Bell-Bay Jackson Water Association service area. The City has estimated that the population base of the three combined water systems will approximately double within the next 20 years to 24,000 people (AESI, 2008).

Project Location

PW-8.1 is located adjacent to a gravel access road in the City's Lincoln Park. It is located approximately 1,950 feet northeast of PW-7 and approximately 190 feet west of PW-8. Lincoln Park lies on the far western flank of what is referred to as the Boundary Upland. The Boundary Upland is an east-west trending upland area located along the USA/Canada border that extends from near the City of Blaine to near the City of Lynden.

To the south and west of the Boundary Upland lies generally flat to gently sloping topography at elevations of between 0 and 100 feet above sea level. The topography of Lincoln Park is gently sloping to the southwest and ranges from a high elevation of approximately 190 feet above sea level in the northeast to an approximate elevation of 100 feet along the southernmost park boundary.

History of the Existing Water Right

The original water right application (Ground Water Application No. 2042) for what is now known as GWC 5917-A was received by the Department of Water Resources (DWR), a predecessor agency, on July 9, 1951. The original request was for 350 gallons per minute (gpm) and 448 acre-feet per year (af/yr) for municipal supply from the well that is now known as PW-7. The City's request was subsequently approved, and the report of examination (ROE) and the permit (Ground Water Permit No. 1861) issued for 350 gpm and 448 af/yr for municipal supply purposes. On September 27, 1967, DWR received a Proof of Appropriation form from the City. It attested to a reduced instantaneous rate of 320 gpm. On January 11, 1968, DWR issued GWC 5917-A for 320 gpm and 448 af/yr for municipal supply purposes. In accordance with RCW 90.03.330(3) this right is in good standing.

PW-7 Construction Details and Geological Interpretations

The following is a summary of the construction details and geological interpretations for PW-7 (the currently authorized point of withdrawal for GWC 5917-A) as provided by AESI.

- PW-7 was drilled to a total depth of 247 feet in 1929. The wellhead is located within a small well house on 12th Street at an approximate elevation of 65 feet. The well has an Ecology well tag identification number of ABB959.
- The well driller encountered yellow and blue clay extending from the ground surface to a depth of approximately 159 feet. The clay unit is interpreted to be Everson-age glaciomarine drift.
- The glaciomarine drift was underlain by a sequence of cemented gravel and clay that extended to a depth of approximately 170 feet. The gravel and clay unit is interpreted to be representative of Vashon-age glacial sediments.
- The Vashon glacial sediments were underlain by a complex mixture of sand with lenses of silt and clay to the completion depth of the boring (247 feet).
- A 12-inch diameter steel casing was installed to a depth of 177 feet.

- Twenty-three feet of well screen was installed in the well between depths of 177 and 200 feet. The diameter and slot size of the well screen is not known.
- Representatives of the City have indicated that there is a strong odor of hydrogen sulfide in the PW-7 discharge water. Hydrogen sulfide in ground water is usually associated with the decay of organic material within the aquifer matrix. Organic material does not generally accumulate in glacial sediments. Therefore, it is likely that the silty/clayey sand sediments encountered in PW-7 below a depth of approximately 170 feet are representative of Olympia non-glacial deposits.
- The static water level in PW-7 is unknown. However, representatives of the City have indicated that the well flows at the well head during portions of the year.
- As noted above, the Proof of Appropriation form submitted by the City attested that PW-7 produced at a perfected rate of 320 gpm in 1967. Current information indicates the well is now capable of producing at a reduced rate of 250 gpm.

PW-8.1 Construction Details and Geological Interpretations

The following is a summary of the construction details and geological interpretations for PW-8.1 (the requested additional point of withdrawal for GWC 5917-A) as provided by AESI.

- PW-8.1 was drilled to a total depth of 760 feet by Holt Drilling in 2007. The wellhead is at an approximate elevation of 165 feet.
- 16-inch diameter steel casing was installed to a depth of 400 feet, and 12-inch diameter steel casing was installed to a depth of 760 feet during the drilling operations.
- The well encountered gray to blue silt and clay with some lenses of sand and gravel to a depth of approximately 115 feet. This upper unit is interpreted to be Everson-age glaciomarine drift.
- The glaciomarine drift was underlain by a sequence of gravel and sand with minor amounts of silt to a depth of approximately 198 feet. The sand and gravel unit is interpreted to be representative of Vashon-age glacial sediments. The glacial sediments were water-bearing (aquifer).
- The Vashon-age glacial sediments were underlain by a water-bearing sequence of brown to gray silty sand with some gravel and occasional fragments of wood to a depth of roughly 380 feet. This unit is interpreted to be Olympia-age non-glacial sediments.

- The non-glacial sediments were underlain by a thick, non-water bearing sequence of gray to brown silt with minor lenses of fine sand that extended to the final depth of the boring (760 feet).
- A complex screen assemblage was ultimately installed in the well between depths of 135 and 280 feet. The screen assemblage consisted of 80 feet of well screen and 65 feet of tail pipe, riser pipe, and blank sections.
- A graded sand-pack was placed around the well screen assemblage, and the screen was developed using surge and bail methods.
- The static water level in PW-8.1 was measured at a depth of approximately 87.5 feet on August 23, 2007.
- Pump testing of PW-8.1 indicates that the well is capable of safely producing approximately 525 gpm for at least 24 hours.

PW-8.0 Construction Details and Geological Interpretations

The following is a summary of the construction details and geological interpretations for PW-8.0 as provided by AESI. This well is not included in the subject change of GWC 5917-A, but this summary is being included here because PW-8.0 was monitored during aquifer testing of PW-8.1.

- PW-8 was drilled to a total depth of 200 feet in 1969 by Richardson Well Drilling Company of Tacoma, Washington. The wellhead is located at an approximate elevation of 185 feet. The well has an Ecology well tag identification number of AGK376.
- 12-inch diameter steel casing was installed in the boring to a depth of approximately 174 feet. Eleven feet of 12-inch diameter, 20-slot size well screen was installed in the well between depths of 174 and 185 feet. An additional 15 feet of 12-inch diameter, 25-slot size well screen was installed in the well between depths of 185 and 200 feet.
- The well encountered blue clay with some boulders and sand to a depth of approximately 136 feet. The blue clay unit is interpreted to be Everson-age glaciomarine drift.
- The clay unit was underlain by a sequence of sand and gravel with lenses of silt and clay to a depth of approximately 197 feet. The sand and gravel unit is interpreted to be representative of Vashon-age glacial sediments.

- The Vashon glacial sediments were underlain by what was described as clay-coated gravel. This lower unit is interpreted to be representative of Olympia-age non-glacial sediments.
- The static water level in PW-8 was measured at a depth of approximately 94 feet shortly after the well was completed in October of 1969. The static water level in PW-8 was measured at a depth of approximately 106.5 feet on August 23, 2007, by representatives of AESI.
- PW-8 was pump tested at a rate of 250 gpm for a period of 3 hours with an estimated drawdown of 70 feet in October 1969.

PW-8.1 Aquifer Test Descriptions

AESI conducted a five-hour, stepped-pumping rate test and a 24-hour, constant-pumping rate test in PW-8.1 between August 22 and 24, 2007. The tests were performed to determine pertinent aquifer and well characteristics. A submersible pump was installed in PW-8.1 to a depth of approximately 145 feet. The static water level in PW-8.1 prior to the stepped-rate test was approximately 87.5 feet below the ground surface. At the time of the aquifer tests, the City's nearby production wells (PW-7 and PW-8) had not been operating for several days.

Discharge water generated during the aquifer tests was conveyed through closed pipe and fire hose to the City's stormwater system located near H Street in the southern portion of Lincoln Park. The discharge rate during the aquifer tests was determined using an inline meter.

PW-8.1 Stepped-Pumping Rate Test Results

The stepped-pumping rate test was conducted on August 22, 2007, to estimate a safe pumping rate for PW-8.1 during the subsequent constant-rate test. The pumping rate was increased at 60-minute time intervals for 5 hours until a maximum pumping rate of approximately 596 gpm was obtained. During each step of the test, the water level drawdown in PW-8.1 was relatively stable prior to increasing the pumping rate for the next step. A summary of the water levels measured in PW-8.1 during the stepped-pumping rate test is presented Table 1. Aquifer testing field data sheets for the stepped- and constant-rate tests are on file with AESI.

Table 1: Stepped-Pumping Rate Test Results (AESI)

Step	Duration (minutes)	Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
1	60	105	7.82	13.43
2	60	192	12.38	15.51
3	60	403	26.06	15.46
4	60	516	32.84	15.71
5	60	596	39.67	15.02

gpm = gallons per minute

gpm/ft = gallons per minute per foot of water level drawdown

Roughly 15 feet of water column was left above the pump after pumping PW-8.1 at a rate of 596 gpm for 1 hour. The water level in PW-8.1 was dropping at a rate approximately 1 foot per hour near the end of the stepped-pumping rate test. Based on the results of the stepped-pumping rate test, AESI concluded that PW-8.1 could be safely pumped at a rate of approximately 525 to 550 gpm for the constant-rate test without dewatering the pump.

PW 8.1 Constant-Pumping Rate Test Results

AESI conducted the constant-pumping rate test in PW-8.1 on August 23 and 24, 2007. The well was pumped at an average rate of 525 gpm for approximately 24 hours. Water level drawdown and recovery data were obtained from PW-8.1 during the constant-rate aquifer test using a pressure transducer and data logger system installed at the wellhead. Water level drawdown and recovery data was also obtained from PW-8 using a water level indicator probe. AESI representatives were unable to access PW-7 to measure water levels during the aquifer tests. A summary of the water level drawdown observed in PW-8.1 and PW-8 is presented in Table 2. Plots of water level drawdown and recovery versus time, and a summary of the aquifer parameter calculations for PW-8.1 and PW-8 are presented on Figures 1 and 2.

Table 2: Summary of Water Level Drawdown and Aquifer Data (AESI)

Well No.	Distance from Pumping Well (feet)	Direction from Pumping Well	Total Water Level Drawdown (feet)	Aquifer Transmissivity (ft ² /d)	Aquifer Storativity
PW-8	190	East	19.21	3,056 ⁽¹⁾ /3,361 ⁽²⁾	0.000153
PW-8.1	0	--	40.06	3,089 ⁽¹⁾ /2,908 ⁽²⁾	--

ft²/d = square feet per day.

(1) Calculated using the Cooper-Jacob method for confined aquifers.

(2) Calculated using the Theis method for confined aquifers using water level recovery data.

--Indicates either not applicable or not calculated.

PW-8.1 Testing Results

PW-8.1 had a measured (by AESI) static water level of approximately 90.48 feet below the well head (approximately 87.6 feet below ground surface) shortly before the start of the constant-rate test. The water level was lowered to a depth of approximately 128 feet below the static water level after approximately 10 hours of pumping. The water level dropped an additional 2.5 feet to a final depth of 130.54 feet over the next 14 hours (Figure 1). The water level in PW-8.1 dropped at an average rate of approximately 0.2 feet per hour over the last 2 hours of the constant rate test. The water level drawdown versus time curve for PW-8.1 plots in a straight line on a semi-log scale (Figure 1). This indicates that PW-8.1 was performing in the classic manner of a confined aquifer under non-equilibrium conditions.

Water level recovery was recorded in PW-8.1 for approximately 24 hours following the constant-rate test (Figure 1). The water level had recovered to within 91 percent of pre-pumping static water conditions in PW-8.1 within the 12 hours following the aquifer test. The water level had recovered to within 94 percent of pre-pumping static water conditions at 24 hours past the end of the aquifer test.

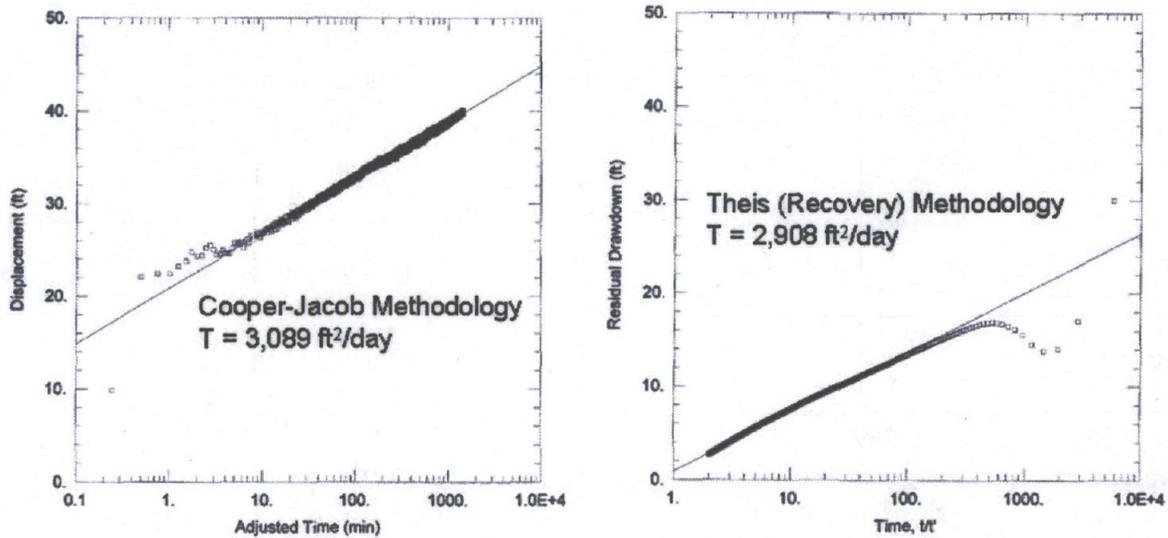


Figure 1. Water Level Drawdown and Recovery in PW-8.1

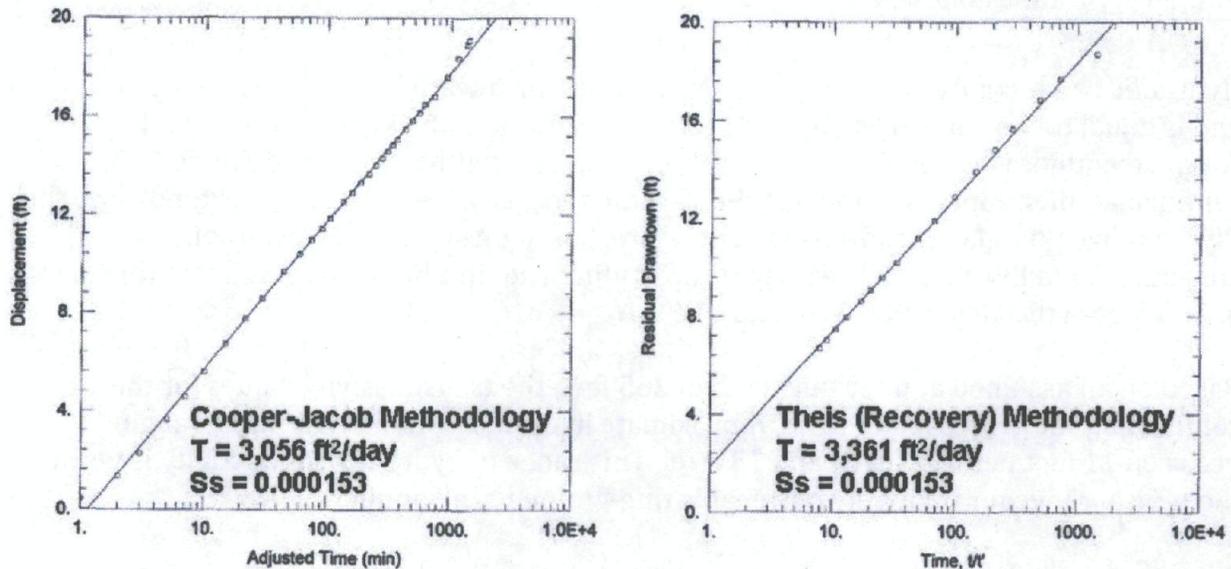
PW-8 Monitoring Results

PW-8 had a measured (by AESI) static water level of approximately 107.62 feet below the well head (approximately 106.5 feet below ground surface) shortly before the constant-rate test was conducted in PW-8.1. The static water level in PW-8 declined approximately 16.5 feet after 10 hours of pumping in PW-8.1. The water level declined an additional 2.7 feet to a maximum depth of 19.21 feet over the final 14 hours of the aquifer test (Figure 2). The water level in PW-8 dropped at an average rate of approximately 0.2 feet per hour over the last 2 hours of the constant rate test.

The water level drawdown versus time curve for PW-8 plots in a relatively straight line on a semi-log scale (Figure 2). However, there was slight increase in the drawdown slope at approximately 930 minutes into the aquifer test (Figure 1). This break in slope indicates the potential presence of a barrier boundary a short distance away from PW-8 and PW-8.1. A barrier boundary is an edge of the aquifer, where it terminates, either by thinning or abutting a lower permeability formation, or where it has been eroded away. It is possible that the slight increase in slope noted in the drawdown curve for PW-8 indicates the thinning of the Vashon-age glacial sediments in the direction of PW-7.

Water level recovery was recorded in PW-8 for approximately 210 minutes following the constant-rate test (Figure 2). The water level had recovered to within 65 percent of pre-pumping static water conditions in PW-8 within 210 minutes following the aquifer test.

Figure 2. Water Level Drawdown and Recovery in PW-8



PW-8.1 Well Specific Capacity

The specific capacity of a production well is the volume of water the well is able to produce per unit length of water level drawdown in the well. The static water level in PW-8.1 was at a depth of approximately 90.48 feet prior to starting the constant-rate test. The water level dropped to a depth of approximately 130.54 feet at the conclusion of the test. Dividing the pumping rate (525 gpm) by the total drawdown (40.06 feet), the calculated specific capacity of PW-8.1 is approximately 13.1 gpm/foot of water level drawdown. Based on the constant-rate test, PW-8.1 is capable of producing approximately 13.1 gpm for each foot of drawdown below the static water level, up to the available water level drawdown above the pump.

Aquifer Transmissivity

Transmissivity is a measure of the amount of water that can be transmitted horizontally by the full saturated thickness of the aquifer under a hydraulic gradient (slope) of 1. Transmissivity values for the confined aquifer were estimated by the Cooper-Jacob and Theis methodologies for confined aquifers using the aquifer drawdown and recovery data recorded in PW-8 and PW-8.1. The Cooper-Jacob and Theis analyses indicated aquifer transmissivities ranging from approximately 2,910 square feet per day (ft²/d) to 3,090 ft²/d near PW-8.1 (Figure 1), and approximately 3,060 ft²/d to 3,360 ft²/d near PW-8 (Figure 2).

Aquifer Hydraulic Conductivity

Hydraulic conductivity is a measure of the rate at which water can move through an aquifer and is equal to the transmissivity divided by the saturated thickness of the unit. The confined aquifer was encountered in PW-8.1 between depths of 115 and 380 feet. The confined aquifer appears to include the Vashon-age glacial sediments and extends into the Olympia-age non-glacial sediments. Therefore, based on subsurface conditions encountered in PW-8.1, it appears that the confined aquifer has an approximate thickness of 265 feet in the vicinity of PW-8 and PW-8.1.

Based on an assumed aquifer thickness of 265 feet, the transmissivity values for the confined aquifer correspond to an approximate hydraulic conductivity value ranging between 11 feet per day (ft/d) and 13 ft/d. This range of hydraulic conductivity is within the typical range for relatively permeable fine-grained sand aquifers.

Specific Storage

Specific storage is the amount of water per unit volume of a saturated formation that is expelled from storage as a result of compression of the confined aquifer and expansion of water when the aquifer is pumped. Specific storage is dimensionless and for confined aquifers generally ranges from highly confined conditions ($<10^{-5}$) to semi-confined conditions ($>10^{-3}$). The specific storage of the subject confined aquifer is approximately 1.53×10^{-4} , indicating that the aquifer is confined.

Well Efficiency

Theoretical well efficiency is the ratio of the specific capacity at the designed yield after pumping to the maximum specific capacity possible, as calculated from formation characteristics and well geometry. In practice, well efficiency is based on a comparison between the water level in the well at a specified pumping rate and the water level in the aquifer immediately adjacent to the well at the same pumping rate. The water levels inside and outside a pumping well would be equal in a 100 percent efficient well. The efficiency of a well can be affected by several factors including well screen design, improperly designed filter pack, and inadequate well development.

AESI used the Theis methodology to estimate the total water level drawdown that would be observed in a 100-percent efficient well that was completed in an aquifer having transmissivity (3,105 ft²/d) and specific storage (1.53×10^{-4}) values similar to those estimated from the PW-8 and PW-8.1 drawdown and recovery data (Figures 1 and 2, Table 2). The Theis methodology indicated a theoretical water level drawdown of 36.80 feet in the pumping well under 100-percent efficient conditions. A total water level drawdown of 40.06 feet was observed in PW-8.1 at the end of the constant-rate test. Therefore, the

efficiency of PW-8.1 at a pumping rate of 525 gpm is estimated at 92 percent ($36.80/40.06 = 0.92$).

Well Radius of Influence

The radius of influence (cone of water level depression) for a well is generally estimated by analyzing total drawdown in two or more nearby observation wells completed in the same aquifer at the conclusion of a constant-pumping rate test. The water level drawdown in the pumping well can be used as a substitute for an observation well as long as the water level drawdown is corrected for well efficiency. A water level drawdown of approximately 19.2 feet was observed in PW-8, located approximately 190 feet to the east of PW-8.1. The maximum water level drawdown in the pumping well PW-8.1 was 40.06. Assuming that the pumping well was 92% efficient, as discussed previously, results in a corrected water level drawdown of 36.8 feet. The measured water level drawdown in these two wells indicates a radius of influence for PW-8.1, at a pumping rate of 525 gpm, of approximately ten miles. It should be noted that the distance-drawdown relationship also indicates a total water level drawdown of less than 5 feet approximately less than 3 miles from the pumping well.

PW-8.1 Safe Yield

AESI aquifer testing data and calculations indicate that PW-8.1 can be safely pumped at a sustained rate of at least 525 gpm. At a pumping rate of 525 gpm, approximately 40 feet of water level drawdown was observed in PW-8.1, and the water level was at a depth of approximately 130 feet after approximately 24 hours of pumping. The pumping water level at the end of the constant-rate test was approximately 20 feet above the first screened interval in the well. Furthermore, the 24-hour constant-rate test indicated that near steady-state conditions were achieved in the well by the end of the test.

Well Interference

The constant-rate pumping test in PW-8.1 resulted in a measured interference water level drawdown of approximately 19 feet in PW-8 (Table 2). The distance-drawdown relationship between PW-8 and PW-8.1 indicates that operating PW-8.1 at a rate of 525 gpm would result in a potential interference drawdown of roughly 10 feet in PW-7, located approximately 1,950 feet southwest of PW-8.1. The City currently does not have any reliable information regarding the pump and/or pumping water levels in PW-7 and PW-8. However, the wells have consistently been pumped at rates of approximately 250 gpm and 100 gpm for many years with no apparent problems. It is probable that the interference water level drawdown in PW-7 and PW-8 from pumping PW-8.1 will require either lowering the pumps or reducing the pumping rates in these two wells, if the City wishes to use them concurrently with PW-8.1.

The instantaneous withdrawal rates for PW-7 and PW-8 under water right certificates 5915-A and 6916-A are a combined 620 gpm. AESI estimates that the operation of PW-8 at a pumping rate of 100 gpm and PW-7 at a rate of 250 gpm would result in a total combined interference drawdown of approximately 10 feet in PW-8.1. Therefore, it appears that some combination of pumping from PW-7, PW-8, and PW-8.1 should be able to meet the combined PW-7/PW-8 certificated instantaneous pumping rate. It also appears that it may be possible to pump PW-8.1 at the PW-7/PW-8 total certificated water right of 620 gpm, assuming that PW-7 and PW-8 are not in operation at the same time.

Other Water Rights in the Vicinity

A search of Ecology's Water Rights Tracking System (WRTS) showed there are no water right permits or certificates (other than the City's) in the general vicinity (one mile radius) of PW-8.1. However, there are seven water right claims. They are as follows:

Township 41 North, Range 1 East, Section 31

- Water Right Claim G1-112487CL filed by Agnes Waylett on June 24, 1974, for domestic supply. This is a short form claim for groundwater. It does not contain the instantaneous rate and annual volume claimed.
- Water Right Claim G1-017930CL filed by Thane Ohler on August 18, 1972, for domestic supply. This is a long form claim for groundwater. The instantaneous rate claimed is 10 gpm. The annual volume claimed is 2 af/yr. The claimed first date of use is April 20, 1948.

Township 41 North, Range 1 East, Section 32

- Water Right Claim G1-156781CL filed by George Stephenson on June 26, 1974, for domestic, stockwatering, and irrigation supply. This is a short form claim for groundwater. It does not contain the instantaneous rate and annual volume claimed.
- Water Right Claim S1-116195CL filed by Jane Mary Brown on June 17, 1974, for domestic supply. This is a long form claim for surface water. The instantaneous rate claimed is 10 gpm. The annual volume claimed is 1 af/yr. The claimed first date of use is April 1, 1968.

Township 40 North, Range 1 East, Section 5

- Water Right Claim G1-123651CL filed by Carl Lindberg on May 7, 1974, for irrigation supply. This is a short form claim for groundwater. It does not contain the instantaneous rate and annual volume claimed.
- Water Right Claim G1-046464CL filed by Joe Bettelli on October 16, 1973, for domestic and stockwater supply. This is a short form claim for groundwater. It does not contain the instantaneous rate and annual volume claimed.

Township 40 North, Range 1 East, Section 6

- Water Right Claim G1-053931CL filed by Rodney Jacobson on January 14, 1974, for domestic, stockwatering, and irrigation supply. This is a short form claim for groundwater. It does not contain the instantaneous rate and annual volume claimed.

LEGAL EVALUATIONS

As stated on page 8 of this report, Ecology must make the following evaluations when considering a groundwater application of change to allow for an additional point of withdrawal.

Same Body of Public Groundwater

The original authorized point of withdrawal (PW-7.0) and the requested new point of withdrawal (PW-8.1) are located approximately 1950 feet from each other and both are completed within the Olympia non-glacial deposits. It is therefore concluded that these wells tap the same body of public groundwater.

The Additional Well Shall Not Enlarge the Right

No additional instantaneous rate or annual volume of water was requested or approved. Approval of the requested additional point of withdrawal will give the City operational flexibility in order to better serve their system.

Impairment Considerations

There are seven water right claims within an approximate one mile radius of PW-8.1. There is very little information available (especially on the short form claims) regarding the validity of these claims, whether or not they are still in use, the quantities pumped, or details on their well depths and construction. For the most part, these details can only be determined in a Superior Court adjudication of these claims.

Approval of the requested additional point of withdrawal is not expected to impair the availability of water to any adequately constructed wells in the vicinity. However, the City must be cognizant of the fact that pumping PW-8.1 must not cause impairment of existing rights. Any impairment must be mitigated or pumping of PW-8.1 must cease or be diminished as to not cause impairment.

In addition, the following will be included in the provisions section of this report and any subsequent documents issued under this water right:

This authorization to make use of public waters of the state is subject to existing rights, including any existing rights held by the United States for the benefit of Tribes under treaty or settlement. If impairment does occur, the City will be required to diminish or cease pumping, or mitigate for this impairment.

Public Interest Considerations

A water right change authorization cannot be detrimental to the public interest. It is not necessary that approval of a change application advance the public interest, but it cannot be adverse to it. While the public interest is not explicitly defined in statute, various statutes contain expressions of the public interest and constitute factors that are suitable for consideration in determining whether there would be detriment to the public interest.

The following considerations were examined during this investigation:

- Due to its location more than one mile from the shoreline, and low chloride levels (2.8 mg/l), no seawater intrusion is anticipated from the pumping of the requested additional point of withdrawal (PW-8.1).
- No impacts to perennial base flows, closed stream reaches, aquatic habitat, recreation, or navigation uses are anticipated.
- The use is considered consistent with water resource fundamental principles of chapter 90.54 RCW.

Water Availability

The decision on the original application for water rights determined water was available for this appropriation. Approval of this request for an additional point of withdrawal does not change that determination.

Beneficial Use

Municipal supply is considered a beneficial use in accordance with RCW 90.54.020.

Consideration of Protest

In a letter dated February 11, 2009, the Lummi Indian Business Council (LIBC) protested the subject application. The LIBC expressed concern about impacts on tribal rights. This concern is understandable, but the subject water right is an existing right that is legally eligible for change. No additional withdrawals over and above the currently certificated quantities will be allowed.

Conclusions

In conclusion, the request to add an additional point of withdrawal to GWC 5917-A meets all the legal requirements under RCW 90.03 and RCW 90.44.

RECOMMENDATIONS

Based on the above investigation and conclusions, I recommend that the request for change to GWC 5917-A be approved in the amounts and within the limitations listed below and subject to the provisions beginning on Page 2, et seq.

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:

- 320 gallons per minute
- 448 acre-feet per year
- Municipal supply - year-round

Points of Withdrawal

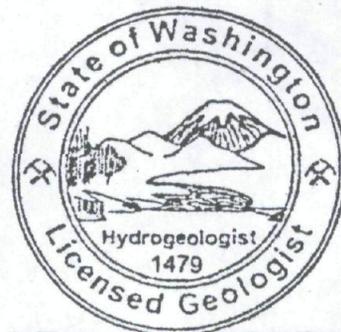
PW-7.0 - SW $\frac{1}{4}$ SE $\frac{1}{4}$, Section 31, Township 41 North, Range 1 East, W.M.
PW-8.1 - SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 31, Township 41 North, Range 1 East, W.M.

Place of Use

As described on Page 1 of this Report of Examination.

Report by: Buck Smith
Buck Smith, LG, LHG

May 31, 2011
Date



J. R. "BUCK" SMITH

Licensed Hydrogeologist No. 1479

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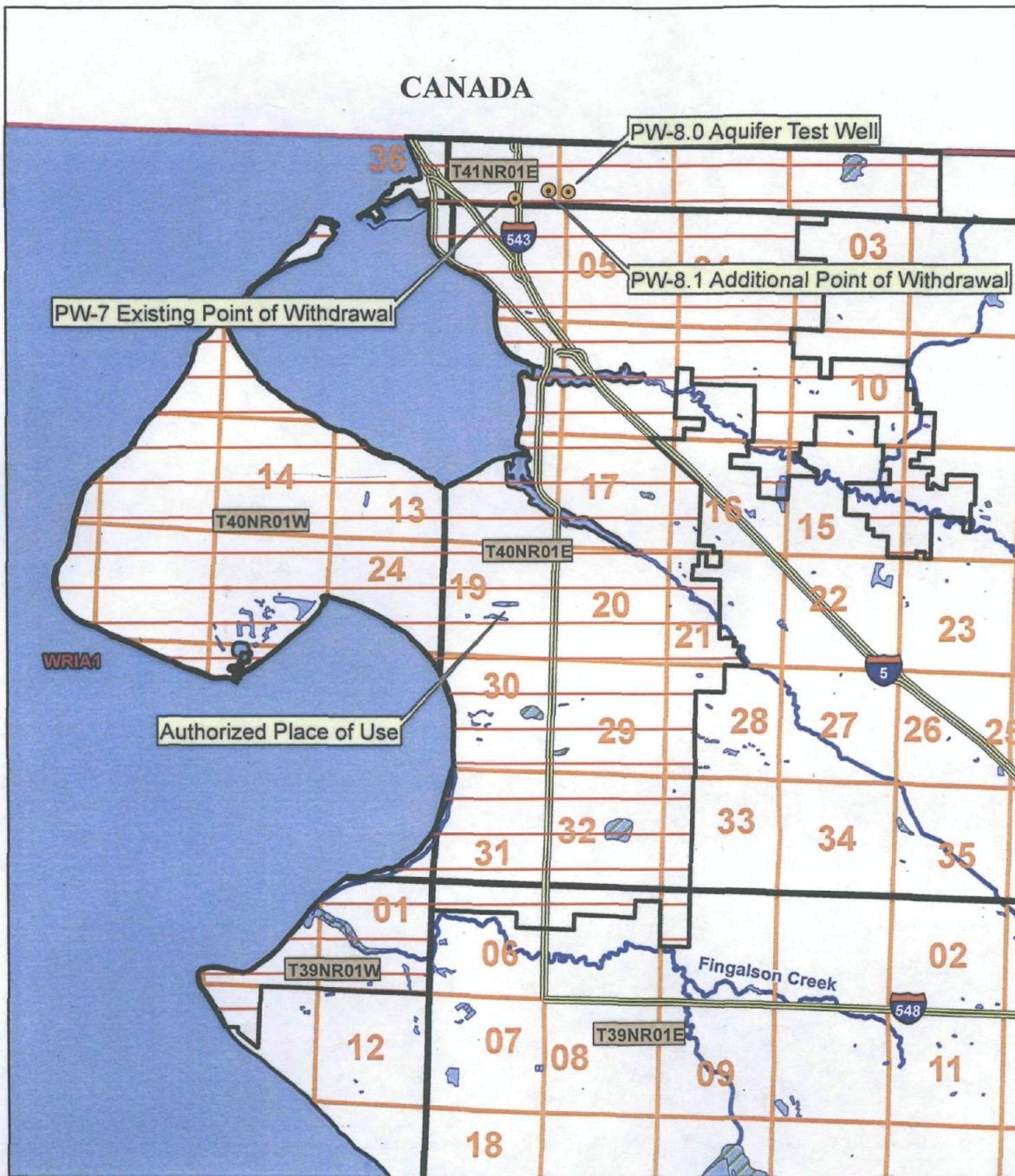
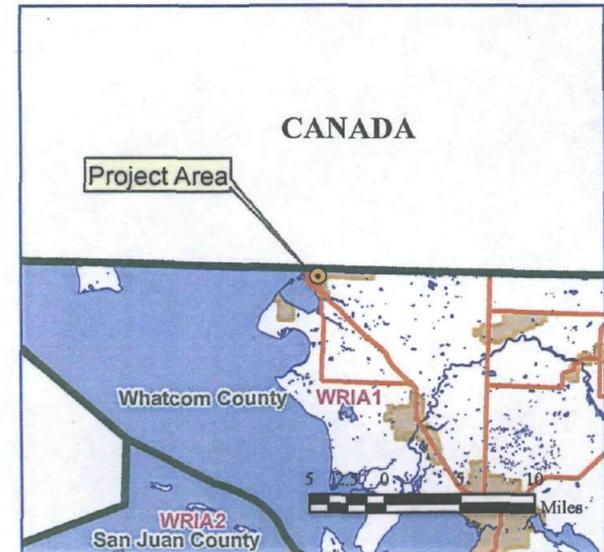
REFERENCES

AESI (Associated Earth Sciences, Inc.), 2007a, Installation and Testing of Production Well PW-8.1: Prepared for City of Blaine Public Works Department and Birch Bay Water and Sewer District, October 24.

AESI, 2008, Technical Report, City of Blaine Ground Water Management Area: Prepared for the City of Blaine Public Works Department and the Birch Bay Water and Sewer District, October 28.



City of Blaine
 Water Right Number CG1-*02042CWRIS
 Sec. 31 T 41N R 01E-W.M.
 WRIA 1- Whatcom County

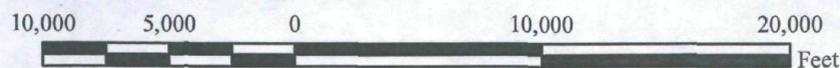


Legend

- WRIA
- Highways
- Townships
- Sections
- cities
- Major Water Bodies
- Marsh/wetland
- Authorized Point of Withdrawal
- Seasonal Place of Use
- Certificated Place of Use



Place of use and point(s) of diversion/withdrawal are as defined on the cover sheet under the headings, 'LOCATION OF DIVERSION/WITHDRAWAL' and 'LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED.'



Attachment 1