STATE OF WASHINGTON

PROTESTED REPORT OF EXAMINATION

Application for Permit to Appropriate groundwater

Water Right Control Number G1-26266

PRIORITY DATE	APPLICATION NO.	PERMIT NO.	CERTIFICATE NO.
July 29, 1991	G1-26266		

NAME
Garrison, J B

ADDRESS/STREET	CITY/STATE	ZIP CODE
4108 South Wilkes Gary Boulevard	Camano Island, WA	98292

PUBLIC WATERS TO BE APPROPRIATED

SOURCE	WRIA	COUNTY
2 Wells	6	ISLAND

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	12	4.2

QUANTITY, PURPOSE OF USE, PERIOD OF USE
4.20 acre-feet, Multiple Domestic, Year round as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION--WITHDRAWAL
Well ER-1: 1360 feet East and 300 feet south of northwest corner of Section 25, T 30N, R 03E, W.M. Island Co.
Well RW-1: 1650 feet East and 1410 feet south of northwest corner of Section 25, T 30N, R03E, W.M. Island Co

SOURCE	PARCEL	LATITUDE	LONGITUDE	QTR/QTR	SECTION	TOWNSHIP	RANGE
Well	R33025-495-1450	Northing: 1182726	Easting: 1001421	NE 1/4 NW 1/4	25	30	03E
Well	R33025-380-1710	Northing: 1182957	Easting: 1000288	SE 1/4 NW 1/4	25	30	03E

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]

Beginning at the NW corner of Section 25 Township 30N Range 03E, thence east along the section line S 89° 4′ 10" E 1312.4ft, thence S 2° 5′ 15" W 31.6ft to the true point of beginning. Thence S 52° 39′ 47" E 401.7ft, thence S 33° 45′ 24" W 414.35ft, thence S 88° 10′ 57" E 547.9ft, thence N 1° 21′ 20" E 105.84ft, thence N 18° 25′ 51" E 546.16ft, thence S 89° 4′ 10" E 309.81ft, thence S 24° 16′ 19" E 498.22ft, thence S 2° 5′ 52" W 925.5ft, thence S 67° 52′ 26" W 713.55ft, thence southeasterly along the eastern margin of the county road 52.3ft, thence S 80° 48′ 32" W 567.8ft, thence N 6° 5′ 32" W 464.06ft, thence S 89° 24′ 12" E 251.64ft, thence N 1° 42′ 36" E 360.35ft, thence N 87° 53′ 20" W 320.47ft, thence N 1° 17′ 46" E 944.68ft to the point of beginning.

DESCRIPTION OF PROPOSED WORKS

Pressurized system with 5,000 gallon storage. Backup pump system in place. Standard service from supply.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE	COMPLETE PROJECT BY THIS DATE	WATER PUT TO FULL USE BY THIS DATE
Begun	December 31, 2019	December 31, 2022

PROVISIONS

1. **Measurements, Monitoring, Metering and Reporting**
   1.1. An approved measuring device shall 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.

   1.2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Northwest Region Office for forms to submit your data.

   1.3. WAC 173-173 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. Installation, operation and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements". http://www.ecy.wa.gov/programs/wr/measuring/measuringhome.html

1.4. In order to maintain a sustainable supply of water, pumping must be managed so that static water levels do not progressively decline from year to year. Water levels shall be measured and recorded monthly, using a consistent methodology. The length of the pumping period or recovery period prior to each measurement shall be constant, and shall be included in the record. Data for the previous year shall be submitted by January 31 to the Department of Ecology.

Static water levels data shall be submitted in digital format and shall include the following elements:

1. Unique Well ID Number
2. Measurement date and time
3. Measurement method (air line, electric tape, pressure transducer, etc.)
4. Well status (pumping, recently pumped, etc.)
5. Water level accuracy (to nearest foot, tenth of foot, etc.)
6. Description of the measuring point (top of casing, sounding tube, etc.)
7. Measuring point elevation above or below land surface to the nearest 0.1 foot
8. Land surface elevation at the well head to the nearest foot.
9. Static water level below measuring point to the nearest 0.1 foot.

2. **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, prior to beginning (or modifying) your project.

3. **Chloride Monitoring**
In January of each year, the following information shall be submitted in writing to the Department of Ecology, Northwest Region Office, Bellevue, Washington.

April and September measurements from the subject well(s) of:

- Chloride and conductivity (the chemical analysis shall be performed by a state-accredited laboratory)
- Depth to static water level (with pump off long enough to allow for stabilization)
- The chloride/conductivity sampling and the static water level measurement shall be conducted concurrently.

If chloride data exceed 100 mg/L in the well, the water quality must be retested immediately. This shall be accomplished by sampling representative formation water by purging three casing volumes, and submitting a sample, a duplicate sample, a blank, and a spike to an accredited laboratory for analysis (submit copies of all chain-of-custody to Ecology). If Ecology determines results of water quality analysis suggest an inland advance of the saltwater-freshwater interface, the permit holder will immediately file a Proof of Appropriation of water. Once a field visit and final examination of beneficial use are complete, the certificate will issue in the appropriated quantities, if any.

4. **Easement and Right-of-Way**
The water source and/or water transmission facilities are not wholly located upon land owned by the applicant. Issuance of a water right change authorization by this department does not convey a right of access to, or other right to use, land which the applicant does not legally possess. Obtaining such a right is a private matter between applicant and owner of that land.

5. **Water Use Efficiency**
Use of water under this authorization shall be contingent upon the water right holder's maintenance of efficient water delivery systems and use of up-to-date water conservation practices consistent with established regulation requirements and facility capabilities.

6. **Schedule and Inspections**
Department of Ecology personnel, upon presentation of proper credentials, shall 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 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 permit as recommended will not be detrimental to existing rights or the public welfare.

Therefore, I ORDER the requested permit under Application No. G1-26266, subject to existing rights and the provisions specified above.

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

- File your appeal with the Pollution Control Hearings 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 Coordinator P.O. Box 47608 Olympia WA 98504-7608		The Department of Ecology Appeals Coordinator 300 Desmond Dr SE Lacey WA 98503

3. And send a copy of your appeal to:

Andrew B. Dunn, LG, LHG
Section Manager
Water Resources Program -- Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008-5452

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://www1.leg.wa.gov/CodeReviser .

If you have any questions, please contact Noel Philip of Ecology at (425) 649-7044.

Signed at Bellevue, Washington, this _____ day of _____, 2009.

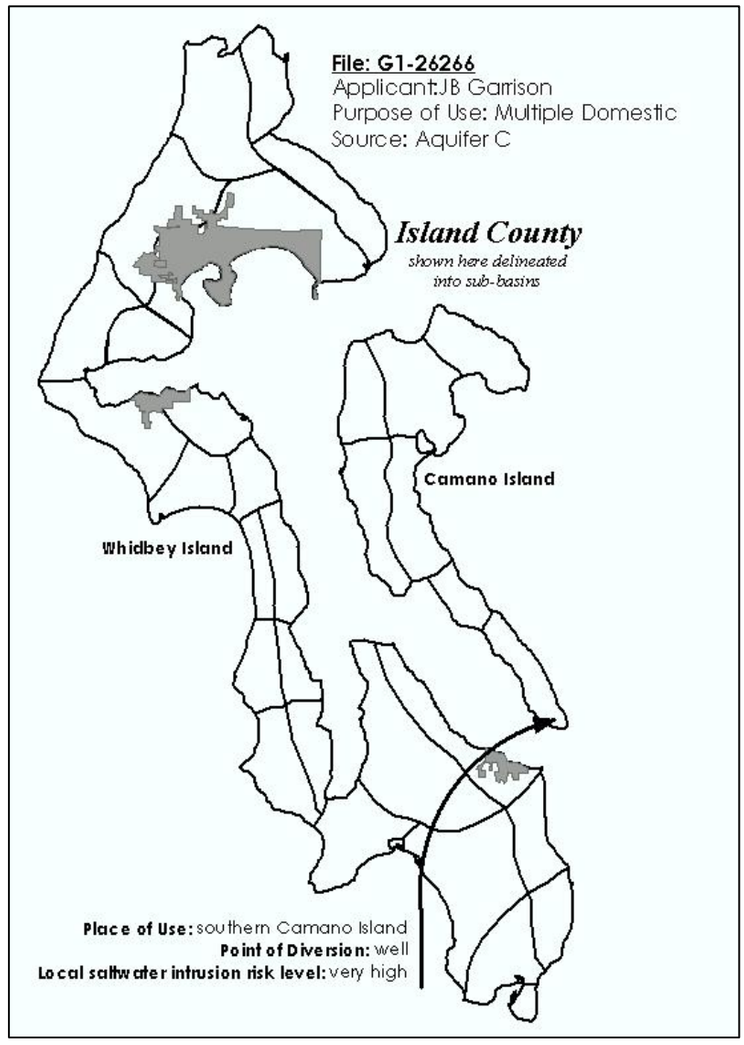
_____
Andrew B. Dunn, LG, LHG
Section Manager
Water Resources Program -- Department of Ecology

The purpose of this report is to provide a technical evaluation of the point of withdrawal, place of use, and purpose of use for the quantities of water requested in water right application G1-26266.

A point of withdrawal, as it pertains to this water right application has two critical attributes: a singular groundwater source (described in this report), and an area in which a well can be constructed, not a singular point; typically described as a quarter-quarter section, representing 40 acres.

Place of use is typically defined as those entire properties served by a water system, or withdrawal, regardless of its size or the purpose of use. For instance, domestic use occurs on the entire property upon which a home is built, not just the home itself.

Purpose of use is a category wherein uses of water are common. For example, single domestic use is for one home on a piece of property to drink, bathe, wash clothes, etc.



Background

Groundwater App. No.	G1-26266
Applicant Name:	J B Garrison
Priority Date:	July 29, 1991
Source:	Wells
Purpose of Use:	Multiple Domestic
Period of Use:	Year-round continuous
Notice of Publication:	See Attachment 2
Protests:	See Attachment 3
SEPA Compliance:	Exempt
Datum:	NAD HARN 83

J B Garrison (Garrison) submitted Groundwater Application G1-26266 to the Department of Ecology to appropriate state waters July 29, 1991. The two wells are located in the NW ¼ of Section 25, Township 30N, Range 3E, Island County. The place of use is entirely within Section 25. The application seeks a permit to serve up to 14 homes.

Originally, the application requested 84 gallons per minute (gpm) to serve 150 homes. An outpouring of public protest and attorney interaction followed and the current project requests 12 gpm (2009 publication).

Water Resources Statutes Water Resources Statutes

RCW 90.03.250 states any person, municipal corporation, firm, irrigation district, association, corporation or water users' association hereafter desiring to appropriate water for a beneficial use shall make an application to the department for a permit to make such appropriation, and shall not use or divert such waters until he has received a permit from the department as in this chapter provided.

INVESTIGATION

Hydrogeology of Camano Island:

As noted by Easterbrook (1968), Camano Island is generally composed of unconsolidated Pleistocene glacial and interglacial deposits that overlie Tertiary and older bedrock. The Island County Groundwater Management Plan, Part A, Technical Memorandum, (GWMP) describes the groundwater flow system on Camano Island as a series of discontinuous water-bearing zones (sand and gravel aquifers) surrounded by zones of lower-permeable glacial sediments (silt, clay and till aquitards). All recharge to the system originates as rain falling on the surface of the island. Groundwater generally flows downward in the inland portions of the island then outward through the

aquifers toward the coast and offshore. In these discharge areas, groundwater generally flows from deeper to shallower aquifer zones and then discharges to the sea where the aquifers intersect a cliff, beach face or ocean bottom. The series of aquifers on Camano Island is complex, resulting from the deposition and erosion patterns created by at least three glaciation and three inter-glaciation periods. Although the USGS has designated five aquifer zones, termed A (oldest) through E (youngest), these zones are laterally discontinuous, vary in depth and thickness, and may be interconnected at various locations. The degree of connection with marine waters is also likely variable. As a result, the effect of withdrawing groundwater from any particular depth and location could have widely variable impacts on nearby wells and on the potential for seawater intrusion.

Four consultant reports are associated with this application. Three are referenced in this report: Richard Threet, Ph. D., LG, LHG, EG, wrote details of his Point Allen well field analysis in 1991; Pacific Groundwater Group (PGG) published an evaluation in 1992 and 1993 of Garrison well ER-1(named PAWA Well #3) and local wells; GeoEngineers (Charles Lindsay, LG, LHG, EG) discussed testing Garrison well RW-1 and area wells in a report dated April 27, 1995.

This report attempts to summarize, correlate, and clarify the conflicting findings of past studies and the latest RW-1 pump test during which a technician measured the water level in a Point Allen well while pumping Garrison well RW-1.

Hydrogeology Near G1-26266

The elevation of wells in this report are taken from LIDAR digital elevation models surveyed by TerraPoint, LLC in 2004. The models report elevation to the nearest tenth of a foot, reflecting one-foot resolution. The values are relative to reference datum NAVD 1988 (vertical) and NAD 83 (horizontal) 1991 adjustment, and converted by GIS software to NAD HARN 83, for correlating to agency GIS layers. Statements abound in the three consultant reports suggesting the surveying of these wells, but no surveyors' reports are to be found. Further, none of the surveys used consistent methods to survey each well. Thus, LIDAR data are used for precision in elevation measurement among wells and for uniformity during analysis.

The wells were located horizontally using survey-grade GPS (1-meter accuracy, Island County, 2001), aerial photos (various sources), and parcel maps (Island County 1991, 1994). The data sources aiding in determination of same body of public groundwater in the three reports, as they pertain to the Water Right Application G1-26266, are well logs (Figures 1 and 2) and water level elevation data collected from static measurements and pump tests. Well logs are notorious for their inaccurate depth measurements and over-simplified cutting logs due to the lack of regulation requiring standardized descriptions. This is not to say they are useless, but they certainly can't be taken as data sources free of error to be used as absolute determinations of the subsurface. They are used in this report to the extent they are capable. Pump test data are described below. Well attributes are summarized in Table 1.

The well logs show the driller's interpretation of materials from the Garrison wells (Figure 1) as they were brought to the surface (Hayes Drilling, 1993-94). Correlating the stratigraphy between the two wells with absolute certainty is impossible, but generalities can be drawn. For instance, a transition between brown and grey sand occurs near 21 and 38 MSL in wells ER-1 and RW-1, respectively. A water-bearing layer comes after a gray clay silt layer in both wells, showing evidence of similar stratigraphic unit composition. Both wells are screened in a "gray gravel sand and water" layer. Water level elevations of similar elevation, approximately 7.0 and 4.1 MSL (ER-1 and RW-1, respectively), suggest the wells withdraw from the same aquifer, thus the same body of public groundwater. Reports from other wells (those near Eagle Ridge Drive) show strikingly similar stratigraphy and depth to the producing hydrogeologic unit.

Table 1. Well completion data[1,2].

Well	ER-1	RW-1	PA-2
Completion date	27-May-93	19-May-94	6-Sep-74
Top of casing (MSL[2])	400.2	322.8	203.9
Completed depth	438	375	231
Completed elevation (MSL)	-38	-52	-32
Screened interval (MSL)	-38 to -33	-52 to -42	-27 to -17
Static Water Level[4] (MSL)	6.95	4.13	43.2
Height of water column above screen	41.2	46.13	60.2
Distance to shore (nearest saltwater body)	1,875	1,525	700

Notes: (1) Time is reported in minutes unless otherwise stated

(2) Length units in feet unless otherwise stated.

(3) MSL = feet relative to mean sea level.

(4) Measurement date: 01/26/2009

Elevation data taken from LIDAR imagery accurate to one foot.

Wells located horizontally with survey grade GPS (Island County, 2002)

(10) WELL LOG

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change in formation.

MATERIAL	FROM	TO
BROWN GRAVEL SILT SAND	0	15
BROWN GRAVEL SAND	15	52
BROWN GRAVEL SAND - SEEPAGE	52	63
BROWN SAND SILT	63	67
BROWNISH-GRAY CLAY LAYERED	67	92
BROWN SAND GRAVEL	92	136
BROWN GRAVEL SAND	136	268
BROWN CLAY SILT SAND	268	273
GRAVEL	268	273
BROWN SAND SILT	273	285
GRAY SAND SILT - SEEPAGE	285	306
GRAY CLAY SILT	306	312
GRAY CLAY SILT SAND	312	320
LAYERED	312	320
GRAY SAND & WATER	320	324
GRAY CLAY SILT	324	330
BROWN SAND SILT - SEEPAGE	330	349
BROWN GRAVEL SAND & WATER	349	370
GRAY GRAVEL SAND & WATER	370	378
GRAY SAND SILT & WATER	378	

(10) WELL LOG

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change in formation.

RECEIVED JUN 18 1993 DEPT. OF ECOLOGY

MATERIAL	FROM	TO
BROWN SAND & SCATRD. GRAV	0	250
BROWN SAND	250	317
BROWN GRAVEL SAND	317	347
BROWN SAND	347	359
BROWN GRAVEL SAND CLAY	359	360
GRAY CLAY	360	363
BROWN SILT GRAY CLAY LAYERED	363	379
GRAY SAND & WATER	379	385
GRAY CLAY SILT LAYERED	385	409
BROWN SAND SILT & WOOD	409	419
GRAY CLAY SILT	419	424
GRAY GRAVEL SAND & WATER	424	

Figure 1. Garrison wells RW-1 (left) and ER-1. Modified from Department of Ecology Well log Database. No warranty of accuracy is implied.

The single well log for a nearby well serving Point Allen Water Association (PAWA), Well #2, available in the Ecology well log database (Figure 2) is not as detailed as the Garrison wells, and submitted by a different driller (Kounkel Well Drilling, 1974), making correlation among them less reliable. The screened interval (-27 to -17 MSL) in the PAWA well spans a zone of water-bearing sand underlying a semi-permeable layer of sandy clay. Comparison of stratigraphy with depth shows the PAWA well is completed approximately 6 feet higher in elevation than the highest Garrison well screen. This is not significant when perceived as a limit to the aquifer's thickness. A hydrogeologic unit could likely accommodate the 35 feet spanned by the extent of the three screened intervals (i.e. the top of the PAWA well screen and the bottom of the lowest Garrison well screen). However, the shallowest well, the PAWA well, has a static water level over 35 feet higher than the Garrison wells. This suggests the wells withdraw water from different aquifers altogether. It must also be noted the logs do not report the extent of the water-bearing layer, so the wells must all be considered to be partially penetrating the aquifer.

Well ER-1 and RW-1 are 1,780 and 920 feet from PAWA #2, respectively. The three consultant reports do not agree on the formation from which water is withdrawn by each well. They also share different opinions regarding transmissivity. One identifies the PAWA wells as tapping the Whidbey formation, and another the Double Bluff formation. Another report goes further to identify all three wells in this report as tapping the same hydrogeologic unit,

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Clayey Sand	0	20
gravel	20	32
dry sand	32	60
" gravel	60	70
" sand	70	90
Sand - water	90	97
Clayey Sand	97	166
hard pan	166	181
Sandy Clay	181	210
Med sand & water	210	231

Figure 2. Point Allen Well monitored during pump 2009 test of Garrison Well RW-1. Modified from Department of Ecology Well log Database. No warranty of accuracy is implied.

resulting in an unrealistic, while possible, potentiometric surface gradient on the order of 10^{-2} feet per foot between Garrison well RW-1 and PAWA #2. Typical values are on the order of 10^{-3}. Typical vertical gradients on the order of 10^{-2} identify changes in head between aquifers (Woessner, 2002). The reports also share different opinions regarding transmissivity.

Regardless of these inconsistencies in interpretations of data, the close proximity (>1000 feet) and laterally discontinuous nature of glacial stratigraphy in Island County, and more locally in this area, suggest these semi-discreet water-bearing hydrogeologic units are confined, at least in the vicinity of the wells, and form one source for many wells in the area.

Water Availability, Pump Test Data

Table 2. Pump test data.

Well tested (pumped)	ER-1	RW-1	RW-1
Date of test	21-Jun-93	31-Jan-95	26-Jan-09
Rate (gpm)	15	15	8
Duration[1]	1440	1440	450
Static Water Level[2] (MSL[3])	6.95	4.13[4]	3.9
Pumping Water Level (MSL)	-10.55	-6.37	326.1
Drawdown (feet)	17.5	10.5	8.1
Stabilization Time (minutes)	DNS[3]	300	270
Available Head During Pumping (feet)[5]	28.7	35.6	39
Recovery Level (MSL)	8.2	4.13	319.3
Recovery Time	36 (hours)	300	1440

Notes: (1) Time is reported in minutes unless otherwise stated

(2) Measurement date: 01/26/2009
(3) MSL = feet relative to mean sea level
(4) Measurement taken from 1995 pump test data
(5) Measured from pumping water level to top of screened interval

Elevation data taken from LIDAR imagery accurate to one foot.

Each Garrison well was individually tested at a constant rate until equilibrium (no further drawdown) was achieved. Well ER-1 on June 21, 1993 and Well RW-1 on January 31, 1995. A summary of the pump test results is presented in Table 2.

Well RW-1 pump test

Steve Chappel of Chappel Construction (Stanwood, WA) installed transducer dataloggers in the pumped well and PAWA #2 January 22, 2009, four days before the pump test. Difficulties installing the transducer thwarted an attempt at monitoring ER-1 during the RW-1 test. Chappel installed a datalogger in PAWA #2 to monitor drawdown in the well due to pumping RW-1; the closest Garrison well to the PAWA Point of Withdrawal. A barometric measurement datalogger recorded pressure changes in RW-1 for diagnostic and data correction purposes. The 8 gpm sustained withdrawal shows water is available from the well to satisfy the intent (verbal and published) of the applicant to develop the water system by serving up to 14 domestic connections, combined with additional service provided by well ER-1.

The barometric logger recorded and automatically converted atmospheric pressures to equivalent feet of water head pressure ranging from 2.84 to 2.90 during the 2009 pump test. The changes in barometric pressure were not significant (six-hundredths) enough to make well-efficiency determinations based on regression analysis performed by Microsoft Excel 2007 (Excel) when producing a trendline of the data (Figure 3). However, elevations were assumed affected by barometric pressure due to the assumption the aquifer is confined, and thus barometrically efficient to a particular degree. Plots of barometric corrected pumping water levels in RW-1 and uncorrected data are presented in Attachment 4.

Tidal efficiency describes how responsive the well is to sea level variation with tides. Tidal influence is clearly visible in RW-1 and PAWA #2 on Attachment 5 both before, during, and after the test. However, the effect on water level in the well ranges from 0.00 to 0.86 feet, small when compared to the thickness of the aquifer. A method from Dawson and Istok, 1991, produced Figure 4 showing a plot of tide level versus aquifer head. Trendlines automatically drawn with Excel (Figure 4) provide the equation of the trendline with slopes of 0.07 and 0.03 (RW-1 and PAWA #3, respectively). Slopes of this magnitude translate to tidal efficiencies of 7% and 3%, consistent with the low efficiencies of around 5% found in the consultant reports. It is worth noting the response by PAWA #2 is not as dramatic as that in RW-1, considering PAWA #2 is closer to the coast than RW-1. Twice during the test and subsequent recovery of RW-1, the transducer recorded large drops in pressure within Well #2. This is likely due to chloride sampling occurring during the pump test (Attachment 5).

Figure 3. Barometric efficiency in Garrison well RW-1 during test

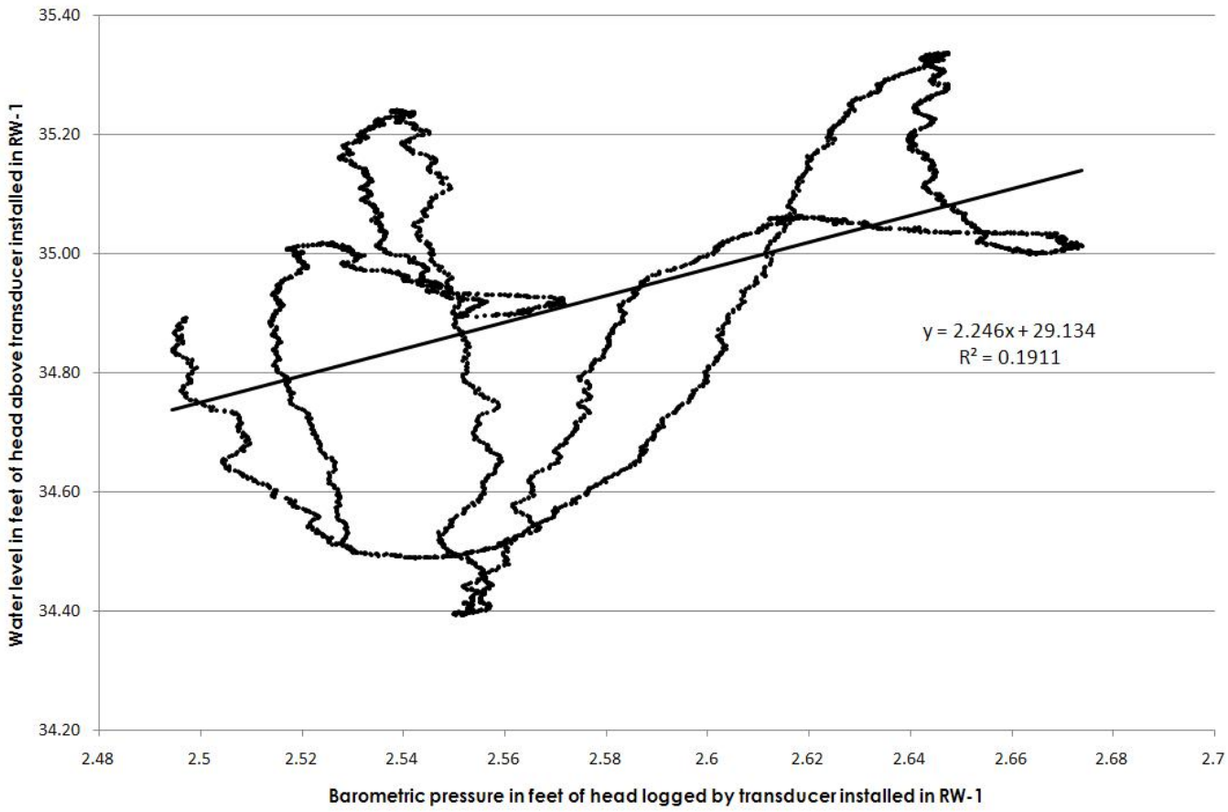
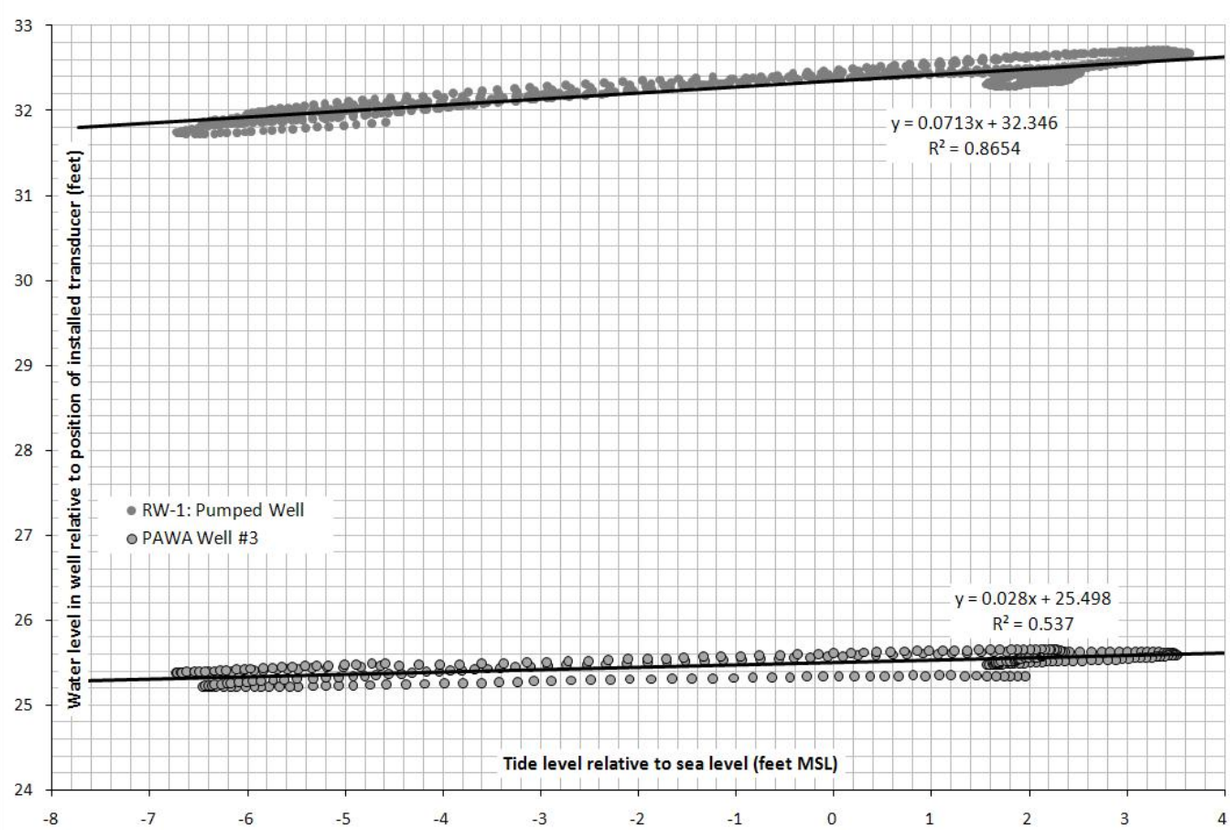


Figure 4. Water level response to tidal fluctuation in wells RW-1 and PAWA #3



These well skin effects are also responsible for understatement of transmissivity, and an inability to accurately calculate storativity (Fetter, 2001). Data submitted to the Cooper-Jacob straight-line method (Figure 5) and processed with the following equation,

$$T = \frac{2.3Q}{4\pi(h_1-h_2)}$$

Where: T = transmissivity (ft^2/d)
Q = pump rate (ft^3/d)
h_1-h_2 = change in drawdown through one log cycle (ft) (Fetter, 2001),

revealed a transmissivity of approximately 750 gpd/ft (from 100.1 ft^2/d). This understates the transmissivities calculated by GeoEngineers in 1995. The value reported is 957 gpd/ft, converted from 128 ft^2/d, calculated from recovery data measured in Garrison well ER-1. Recovery water level data are less prone to variability and pumping effects, considered more accurate in measurement during pump tests, and thus more useful in calculating aquifer properties (Fetter, 2001).
Transmissivity is used to calculate storativity. Using ER-1 monitoring well data from the GeoEngineers report, and picking 3.4 minutes as t_0 in the equation,

$$S = \frac{2.25Tt_o}{r^2}$$

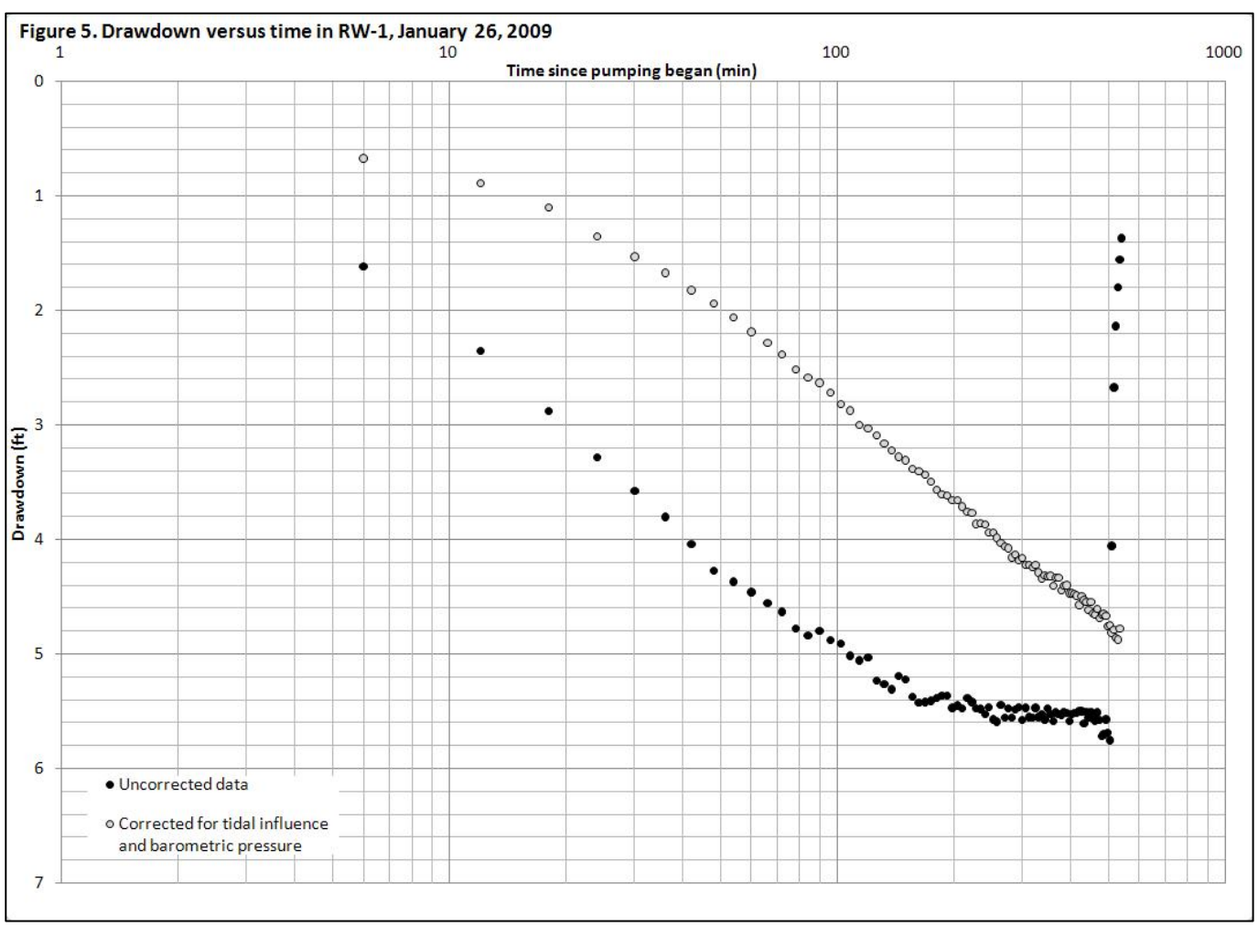
Where: S = storativity (dimensionless)
T = transmissivity (ft^2/d)
t_o= intercept of best fit line in Cooper-Jacob method (convert minutes to days)
r = distance between pumping well and observation well (feet) (Fetter, 2001),

yields a storativity value of 0.0043. This is a reasonable storativity value for a confined aquifer.

Well ER-1 pump test

Pacific Groundwater Group conducted a pump test on Well ER-1 June, 1993, at an average rate of 15.3 gpm for 24 hours. Five wells served as monitoring stations during the test. One of which was PAWA #2. The static water level is reported at 1.5 feet MSL.

Researchers made no correction for barometric efficiency, although the similar condition of constant barometric pressure throughout the test existed in 1993 as in 2009. Lindsay made no correction to the data for the linear correction, assuming negligible effects. Tidal efficiency is reported to be close to 7% in the PAWA well, similar to the results of



the 2009 RW-1 test. An attempt was also made to determine the efficiency of the well, but no value could be determined because, "the well continued to develop during the test," according to the PGG report.

Aquifer properties calculated with pumping well data are quite different at ER-1 than RW-1, reaching 407 ft^2/d, or 3,041 gpm/ft, suggesting the aquifer is more transmissive in this area than near RW-1.

The report concludes the drawdown observed in the aquifer was less than half of that suffered by the pumping well (17 feet) due to the partial penetration of the well. No drawdown was observed in any of the five wells monitored during the test. All but one well were 1,700 feet or more from the pumping well. One well was within 1,000 feet, but not completed in the same aquifer (85 feet above sea level). The specific capacity of the well is 0.8 gal/ft based on 19 feet drawdown and 15 gpm. It goes on to say the long-term yield of the well is sustainable at 5gpm, and that additional yield can be developed form the aquifer, but that additional wells are required to do so.

Potential for Seawater Intrusion

The greatest threat to groundwater in Island County is seawater intrusion. The potential for seawater intrusion relates to the elevation of the groundwater (or potentiometric surface) relative to sea level. Aquifers having little or no groundwater head above sea level are susceptible to intrusion. Other factors such as recharge rate, pumping rate, aquifer transmissivity, hydraulic gradient, seasonal variation, and the geometry of the aquifer can influence the distribution and magnitude of seawater intrusion resulting from any particular withdrawal. Increasing concentrations of chloride in groundwater can be an indication of seawater intrusion. Unaffected groundwater in Island County generally contains a chloride concentration between 10-20 mg/L. Concentrations of 100 mg/L or greater provide evidence of seawater intrusion unless other sources of chloride are present such as naturally occurring hard groundwater.

The Island County Health Department ranking system classifies the area of withdrawal as high to very high risk for seawater intrusion. While the subject wells themselves show no signs of seawater intrusion, long term pumping may encourage the advancement of the saltwater-freshwater interface throughout the lifetime of the permit, to say nothing of water use in perpetuity. Such an event could impair the use of wells along the coast. However, the pumping rates at which the wells are tested show the likelihood of short (less than 12 hours) pumping cycles causing the advance of the saltwater wedge inland to be small. Impairment is discussed in the next section.

Water quality data from samples taken throughout the test from both wells show little variation over 24 hours of pumping in well ER-1 and likewise in the few hours of pumping during the RW-1 tests. The most recent data from samples collected in 2009 show these chemistry levels in RW-1: 13 mg/L chloride, 117 mg/L hardness (as $CaCO_3$) and 293 mhos conductivity. Regular, diligent monitoring and reporting will describe the current health and help administrators and appropriators prevent degradation of the aquifer.

Impairment to Existing Water Rights and Exempt Wells

Groundwater wells at greatest risk of potential impairment are those which are completed in the same aquifer zone as the subject well, located in close proximity to the subject well, and also located hydrogeologically down-gradient from the subject well. As water in the aquifer travels toward wells located down-gradient from the subject well, the subject well may potentially capture this water and impair the production of down-gradient wells. Also, surface water diversions located within a close proximity of the subject well may potentially be impacted by the groundwater withdrawal, depending upon hydraulic continuity of the aquifer and surface water body. Typically, an arbitrarily, yet conservatively chosen area of one-half mile (1/2-mile) is used to define “close proximity.” This value is justified experimentally based on current and historical pump test data showing negligible drawdown, and therefore unlikely impairment to wells or surface water diversions, induced by groundwater withdrawal at distances of 1000 feet in most cases. Furthermore, it is widely understood the aquifer systems in Island County are not laterally continuous, suggesting physical barriers exist in addition to limiting hydraulic conditions. However, due to the convenient cartographic boundary presented by the Section 25 in Township 30, Range 03 E, W.M, covering the entire southern tip of Camano Island, this report extends the search to the area approximately the size of a quarter section (160 acres). The Department of Ecology Water Rights Application Tracking System (WRATS) and Well Log databases and the Island County Hydrogeology database (March 2003) show the existence of one (1) water right certificate, one (1) permit, and nine (9) water right claims within Section 25. Some of the wells of record found in the Ecology Well Log Database within one half mile are likely tied to many of these water rights, and some are likely exempt from the application process. Still others may be sources for existing water right certificates or claims under a different name.

A water right claim is a statement describing the beneficial use of water occurring prior to the adoption of the water right codes and is not authorized by a state-issued permit or certificate. It is unknown whether the nearby claims are valid, not valid, or once valid and now relinquished back to the state. The Department of Ecology cannot verify the validity of these claims, as water right claims can only be confirmed in an adjudication by the Washington State Superior Court. Exempt withdrawal of public groundwater is defined in RCW 90.44.050.

Washington water law does not consider drawdown to be an impairment of existing water rights, unless the affected wells fully penetrate the aquifer and can no longer produce their allocations. Therefore, impairment to any senior water rights due to pumping of the Garrison wells is unlikely.

Public Interest Considerations

Factors considered in determining whether this use of water is in the public interest include but were not limited to: consideration given to exempt wells; existing water right certificates, applications, and claims; potential impacts to the aquifer subject to withdrawal as it pertains to drawdown and water quality (i.e. sea-water intrusion); beneficial use of water as a resource defined in this report. No detriment to the public interest could be identified during the investigation of the subject application. Available data show existing wells in the area are not expected to be impaired by the anticipated operation of the subject well.

Consideration of Protests and Comments

Please see Attachment 3

CONCLUSIONS AND RECOMMENDATIONS

Partially penetrating wells tend to have greater drawdown inside the well casing than the aquifer. However, for purposes of water availability, this report assumes drawdown and recovery levels are the same in the well as the aquifer. This conservative approach errs on the safe side of water availability, to ensure the aquifer can not only provide water now, but into the future as well. These test results show the stability of these wells in their production for pumping rates at which they were tested, in the instance of RW-1 (8 gpm), and recommended, in the case of ER-1 (5 gpm). Regular monitoring of static water levels shall be necessary to promote awareness of water levels and availability because no short term aquifer test can fully describe conditions through time and variable climate throughout the year. Metering the source is also necessary, and the applicant should report the water quality and metering data yearly. If chlorides exceed 99 mg/L, immediate efforts shall be made to bring chloride levels to within 99 mg/L. If initial efforts fail, the permit will be certificated in the perfected quantity.

The annual water requirement for the JB Garrison multiple domestic use is estimated, taking the number of anticipated connections and multiplying by estimations of water use per connection. Residential water use is based on historical and current water use data from similar water systems on Whidbey Island. Presently, these data indicate that average water use per connection is approximately one-third (0.3) acre-foot per year. At this rate, the annual water quantity required by the applicant to serve 14 residential connections is 4.2 acre-feet per year.

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:

- 12 gpm
- 4.2 acre-feet per year
- Multiple Domestic

Point of Withdrawal

NW¼, Section 25, Township 30 North, Range 03 E.W.M.

Place of Use

As described on Page 1 of this Report of Examination.

Report by: _____ _____

Noel S. Philip, LG Date
Water Resources Program

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 2

J.B. Garrison, applicant for Water Right Application G1-26626 changed the attributes of the application, resulting in publication of intent two times. These publications occurred August 22 and 29, 1992, and April 7 and 14, 2009. Both publications are shown in the images below.

APPROPRIATE PUBLIC WATERS NOTICE
State of Washington
Department of Ecology
Notice of Application to
Appropriate Public Waters

TAKE NOTICE:

J.B. Garrison of Camano Island, Washington on July 29, 1991 under Application No. G126266 filed for permit to appropriate public waters, subject to existing rights, from well in the amount of 84 gallons per minute each year, for community domestic supply — continuously. The source of the proposed appropriation is lo cated within SE 1/4 of the NW 1/4 of Section 25, Township 30 N., Range 3E W.M., in Island County, being located at the southern-most tip of Camano Island.

Protests or objections to approval of this application must include a detailed statement of the basis for objection. Protests must be accompanied by a two dollar ($2.00) recording fee and filed with the Department of Ecology, Northwest Regional Office, 3190 180th S.E., Bellevue, WA 98008 within thirty (30) days from July 22, 1992.

Legal No. 244
Published in Stanwood/Camano News Aug. 5 & 12, 1992.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
NOTICE OF APPLICATION TO APPROPRIATE PUBLIC WATERS

TAKE NOTICE:

That J. Burt Garrison of Camano Island, WASHINGTON on July 29, 1991, under Application No. G1-26266 filed for permit to appropriate public waters, subject to existing rights, from two wells in the amount of 12 gallons per minute each year, for multiple domestic supply - continuously. The sources of the proposed appropriation are located in the NE 1/4 NW 1/4 of Section 25, and the SE 1/4, NW 1/4, of Section 25, Township 30 N, Range 03E, W.M., Island County.

Protests or objections to approval of this application must include a detailed statement of the basis for objections: protests must be accompanied with a fifty-dollar ($50.00) recording fee (PLEASE REMIT CHECK OR MONEY ORDER ONLY) and filed with the Department of Ecology at the address shown below, within thirty (30) days from APRIL 14, 2009.

Department of Ecology Cashiering Office: NWRO-WR PO Box 47611 Olympia, WA 98104-7611

PUBLISHED IN THE STANWOOD/CAMANO NEWS APRIL 7 & 14, 2009.

Attachment 3

This attachment to file G1-26266 is meant to serve as an index of protestants for each version of application. While only the most current intent to withdraw groundwater of the state is germane to Ecology's decision, all the protests are presented and considered. Protests received may address concerns or limitations of the requested water right that remain valid after publication of the revised intent.

The following list of people/groups protested the intent to withdraw as published in the Stanwood/Camano News August 5 & 12, 1992.

Mr. and Mrs. Ole Bakken
3718 South Pinewood Lane
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Ms. Joan Bence
3389 S. Bernie Road
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

E. P. Bowler
3269 S. West Camano Drive
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Camano Island Homeowners
Attn: M. Jane Foltz
Post Office Box 1095
Stanwood, WA 98292
Reason for protest: Availability, saltwater intrusion.

John and Julie Dean
3971 S. East Camano Drive
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Mr. Merle DeGarmo
3776 S.W. Camano Drive
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Camano Island Homeowners Association
Attn: Jane Foltz
PO Box 1095
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Mr. Arthur M. Fuller
2097 E. Gull Way
Camano Island, WA 98292
Reason for protest: saltwater intrusion.

Ms. Minnie P. Goodell
3333 177th Place NE
Arlington, WA 98223
Reason for protest: Availability, saltwater intrusion

The Preserve PRD
c/o John Willard
16398 NE 85th Ste. 201
Redmond, WA 98052
Reason for protest: Fairness.

Mr. Robert A. Hall
and Ms. Pamela J. Trojanoski
Post Office Box 1469
Stanwood, WA 98292
Reason for protest: Availability.

Mickie E. Jarville
3326 Smokey Point Dr. Ste. 202
Arlington, WA 98223
Reason for protest: Availability, saltwater intrusion.

Mr. Nels Konnerup
74 N. Sunrise Blvd.
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Mr. Rolf Laitenberger, Gaylynn Beuthein
Post Office Box 531
Stanwood, WA 98292
Reason for protest: Saltwater intrusion.

Mr. Jack C. Madison
3467 Shady Lane S.
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Mr. and Mrs. Ian Metz
3968 S. East Camano Drive
Camano Island, WA 98292
Reason for protest: Availability, saltwater intrusion.

Robin M. Oxborough
3259 S. Bernie Road
Camano Island, WA 98292
Reason for protest: Saltwater intrusion.

Point Allen Water Association
Attn: Mickie Jarville
3326 Smokey Point Drive, Ste. 202
Arlington, WA 98223
Reason for protest: SEPA violation, availability.

Mr. and Mrs. H. West
2024 E. West Camano Drive
Camano Island, WA 98292
Reason for protest: Availability.

The following list of people/groups protested the intent to withdraw as published in the Stanwood/Camano News April 7 and 14, 2009.

Mr. Jean W. Fraley
4152 Eagle Ridge Drive
Camano Island, WA 98282-8271
Reason for protest: Availability, saltwater intrusion.

The various bases for the protests are addressed together, below. While not mentioned explicitly, impairment is implied in every protest.

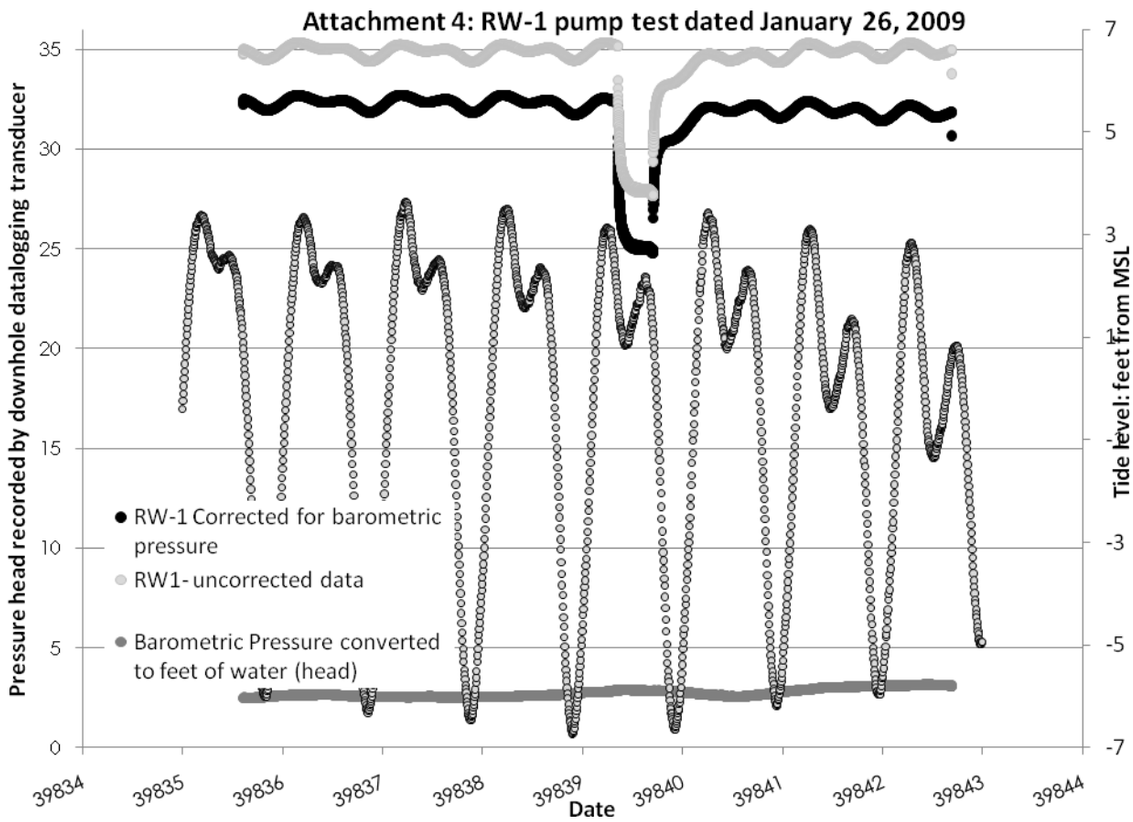
Saltwater intrusion: The historical and current data of record submitted by Garrison show background levels of chlorides. While the aquifer shows no signs of saltwater intrusion at the locations of the Garrison wells, strict provisions are attached to this report of exam mandating specific action if chloride levels climb to 100 mg/L. This is 40% of the 250 mg/L federal secondary standard for chloride concentration.

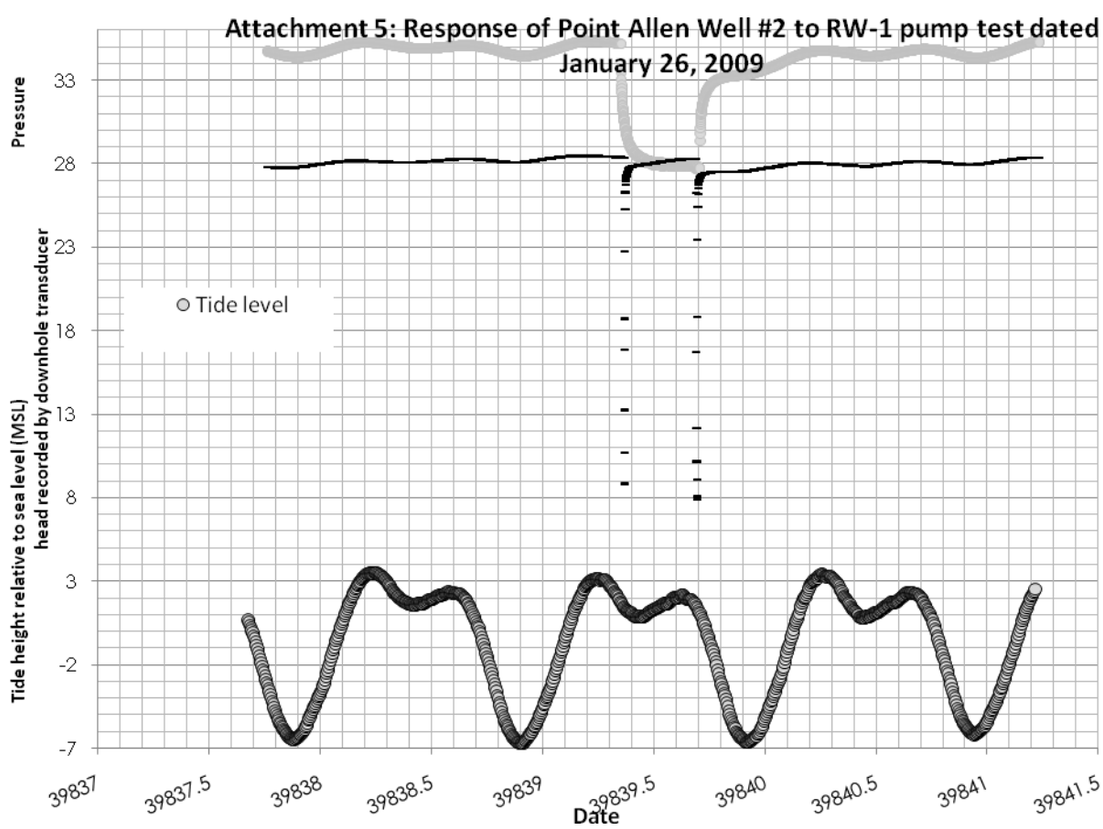
Availability: Based on pump test data, the aquifer produces water in quantities adequate to support the requested withdrawal, 12 gpm, from the wells working in unison, at pump rates for which they are capable of sustaining. Those pump rates are 5 gpm for well ER-1, and 8 gpm for well RW-1. At no time will the sum of pump rates from these two wells exceed 12 gpm. The basis for determining whether the aquifer can likely support an additional 14 homes using reasonable amounts of water is found in metering data from a certificated use southeast of the Garrison withdrawal using only half their 30 afy. This unused quantity is over three times the water permitted for Garrison.

Impairment: The pump tests show little to no influence on the Point Allen wells from pumping the Garrison well RW-1, less than 900 feet inland. A pump test of such short duration can not fully describe the affect of continuous duty over the course of a year's time or longer. However, drawdown is likely confined to a small radius around the well, and aquifer head remained substantial compared to drawdown in the well, and it's likely the nearby wells will remain capable of producing water in the amounts appropriated by those well operators.

Fairness: The Department of Ecology is a government agency, and is warranted to remain impartial in its regulation of state waters. The same general methods, best available science (which changes through time) and techniques used to make this determination are those used to make every determination at the Department of Ecology.

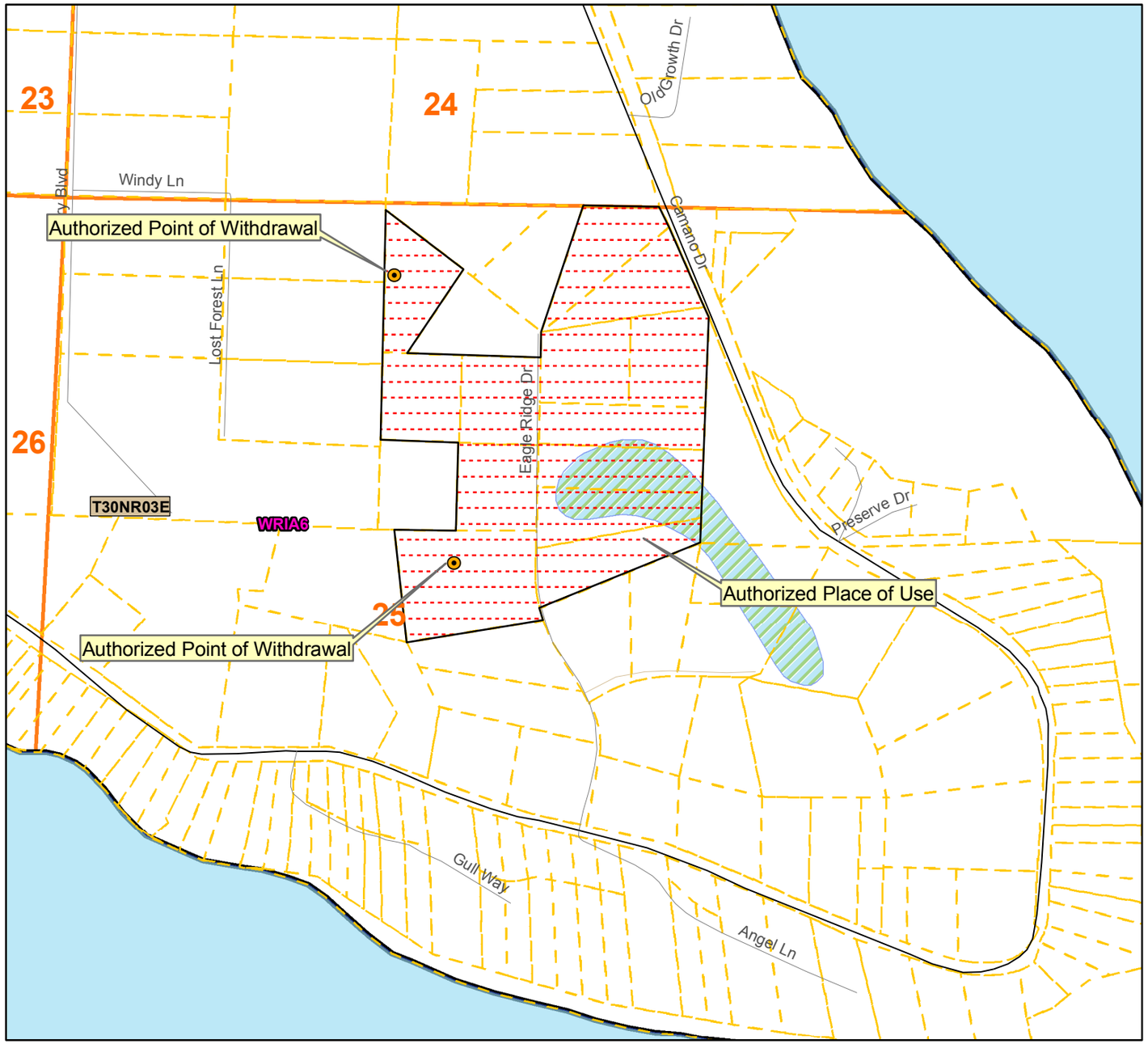
SEPA: The volume of water use as proposed by the applicant is below the threshold of SEPA and is thus exempt.


Attachment 4: RW-1 pump test dated January 26, 2009
Pressure head recorded by downhole datalogging transducer
Tide level: feet from MSL
RW-1 Corrected for barometric pressure
RW1- uncorrected data
Barometric Pressure converted to feet of water (head)
Date

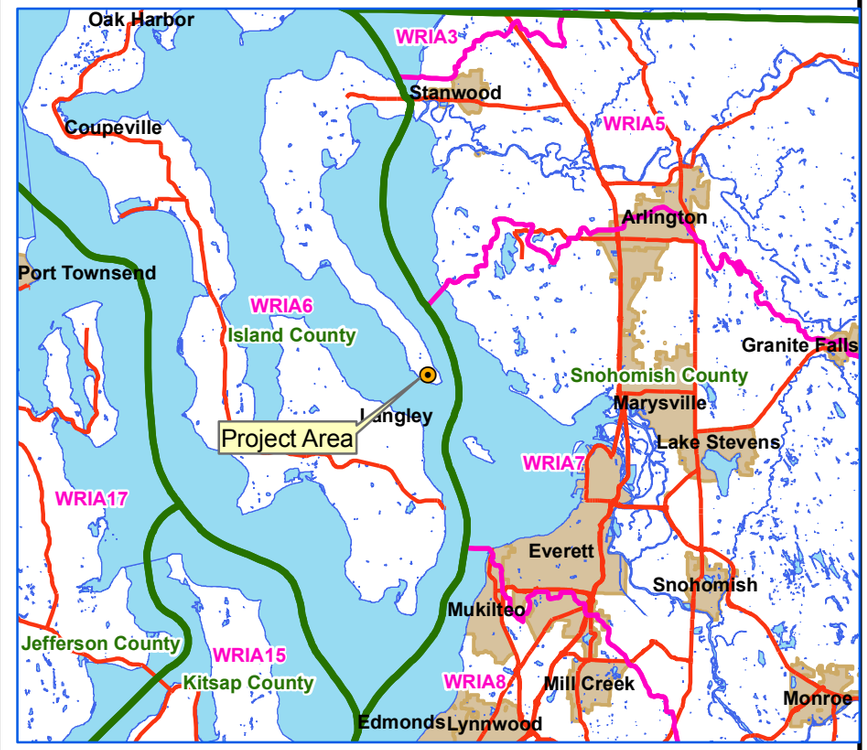

Attachment 5: Response of Point Allen Well #2 to RW-1 pump test dated January 26, 2009
Pressure
Tide height relative to sea level (MSL)
head recorded by downhole transducer
Tide level
Date

J.B. Garrison
Water Right Number G1-26266
Sec 25 T 30N R 03E W.M.
WRIA 6 - Island County

DEPARTMENT OF ECOLOGY
State of Washington



500 250 0 500 1,000 1,500 Feet



5 2.5 0 5 10 Miles

Legend

- County
- WRIA
- Highways
- Townships
- cities
- Sections
- Authorized Point of Withdrawal
- Authorized 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