

Technical Memorandum

To: Ann Soule, Clallam County
From: Tad Cline & Russ Prior, Pacific Groundwater Group
Re: Installation of monitoring wells and staff gages in the lower Dungeness watershed
Date: 9/30/2008

The purpose this memorandum is to document of the work completed to install monitoring wells and staff gages (stations) in the lower Dungeness watershed as part of Clallam County's aquifer storage and recovery grant project. The stations were installed to enable groundwater and surface water elevation monitoring by Clallam County (the County) during aquifer testing and over the long term. Work was conducted according to contract 100511-08-PGG and Amendments 1 and 2 between the County and Pacific Groundwater Group (PGG). This memorandum comprises the final project deliverable.

PGG work included

- Assisting with property access authorizations from the landowners where work would be conducted;
- Subcontracting drilling, well construction and surveying;
- Overseeing the drilling and monitoring well construction at locations indicated by the County; and
- Installing staff gages at locations indicated by the County.

Work began in April 2008 contacting property owners for site access. Field work was conducted in two phases. The first phase occurred between May 28 and June 4, 2008. The second phase began August 19 and was finished August 22, 2008. In all, 13 monitoring wells (labeled P2 through P14) were installed using a push rig operated by Environmental Services Network (ESN) from Olympia, Washington. PGG also installed ten stream gages (labeled G1 through G10) in side channels and tributaries to the Dungeness River downstream of the Railroad Bridge Park. Locations are shown in Figure 1. Station information is summarized in Table 1.

Subsurface conditions (likely cobbles) prevented installation of well P1 at the Railroad Bridge Park (west side of Dungeness). Thirteen attempts were made to install P1 during work Phases 1 and 2 along the public trail between the bench west of the bridge and the parking area and kiosk to the west. None of the attempts were successful.

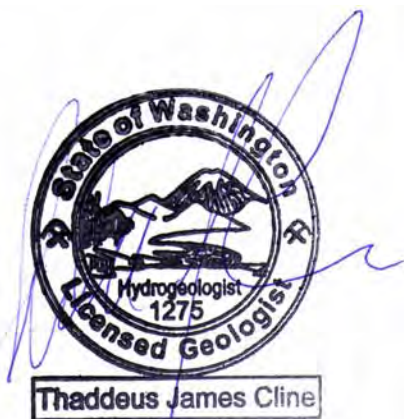
Monitoring wells were installed by State-licensed drillers according to WAC 173-360¹.with flush completions protected by steel monuments set in concrete and locks. In general, wells were constructed of one-inch nominal diameter schedule 80 PVC with 20-slot screen. The filter pack is composed of 10-20 silica sand across the screened interval to about two feet above the screen. The top of casing was set at approximate grade and was fitted with a locking cap. Bentonite Hydro-plug #8 was used for well seals from the top of sand pack to within one-foot of grade. Monuments were set slightly above-grade and in about one-foot of concrete.

Stream gages were installed in suitable locations as agreed by the County. To the extent possible, efforts were made to set the gages where banks were stable, and in straight and uniform reaches free from vegetative growth. Some clearing was done at some locations and likely will need to be repeated periodically. Locations were also selected to facilitate reading from the shoreline and where flow was most likely to occur year-round. The County provided the measuring gage plates (USGS Style A, markings to hundredths of a foot, Rickly Hydrological Company of Columbus, Ohio). Six-foot steel fence posts were driven plumb into the stream bed at least two feet and the plates were then attached with aluminum clips.

David Cummins & Associates of Sequim provided surveying for locations and elevations of measuring points on all piezometers and gages. Survey data is provided in Table 1 and Attachment A contains the survey report.

Photographs of the locations and work were provided to the County at the conclusion of each phase of the work.

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JP0805



¹The State makes a variance for push probe rigs such as used for this project. Instead of four inches of filter pack around an installed well, one-inch suffices. Also, the State limits push rigs to work shallower than 30 feet. On this project, two monitoring wells were completed deeper than 30 feet: P7 and P8. ESN obtained variances from the State for both these locations.

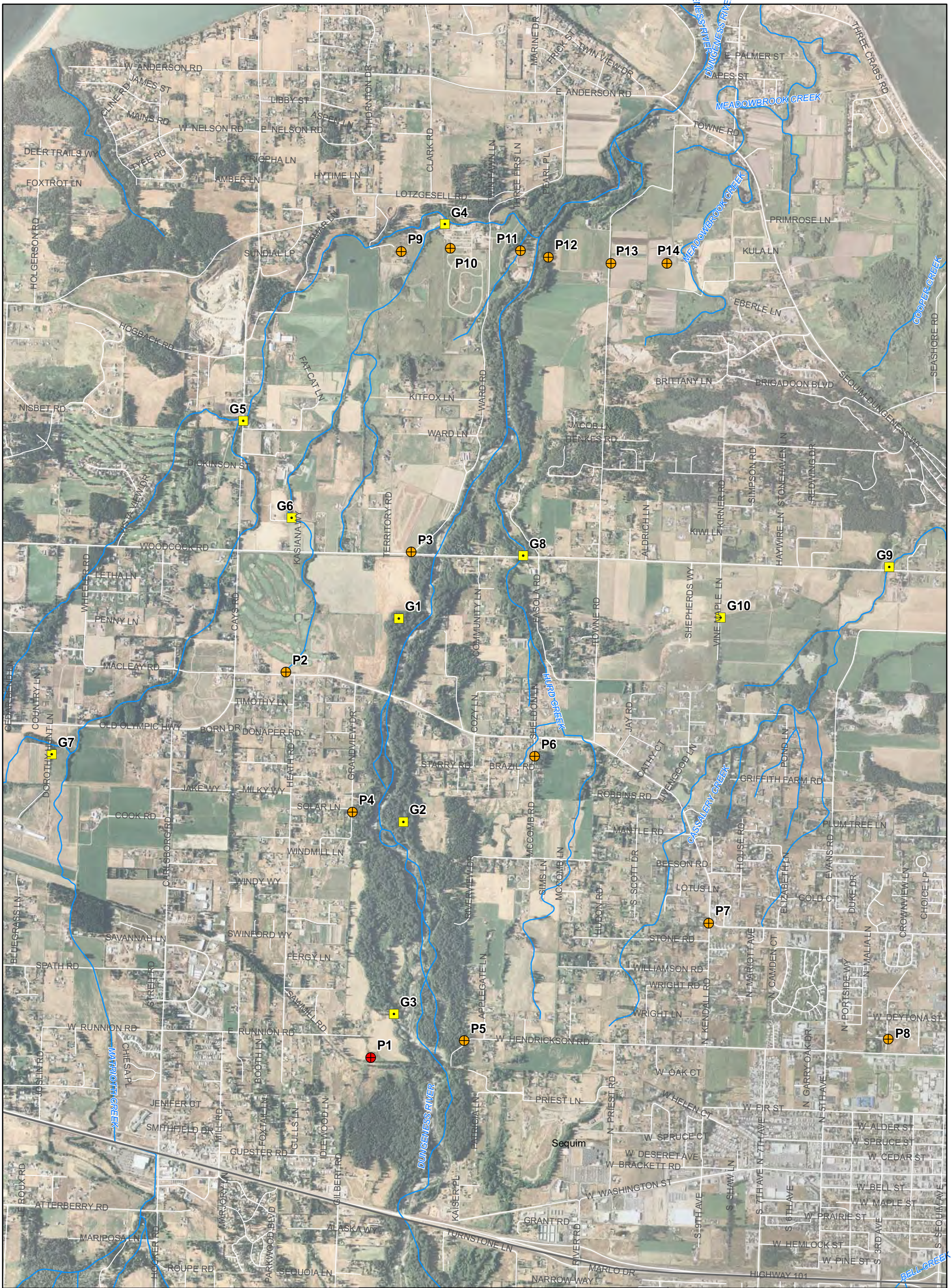
Table 1. Well and Gage Details.

Type	Location	Measurements & Dimensions								Survey Data (feet relative to datums) ²			Calculated Elevations (feet relative to datums) ²				
		Property Owner & General Location	Install Date	Ecology ID	Water Level ¹	Bottom of Casing (feet BGS)	Bottom of Hole (feet BGS)	Bentonite Seal (feet BGS)	Screen Interval (feet BGS)	Northing	Easting	Measuring Point Elevation ³	Water Surface	Mid-point of Screen	Top of Screen	Bottom of Screen	
Well	P2	Pederson-- Old Olympic Highway at Heath	6/3/2008	APJ131	10.6	18	18	1-7	8	18	413059.78	1071427.51	110.19	99.6	97	102	92
	P3	County--Woodcock & Ward	6/4/2008	APJ132	10.2	18	18	1-7	8	18	415692.36	1074178.66	91.94	81.7	79	84	74
	P4	Bates--Grandview Dr. & Solar Lane	8/20/2008	BAF223	12.5	18	18	1-7	8	18	409646.67	1072865.75	144.14	131.6	131	136	126
	P5	Jamestown S'Klallam Tribe-- Railroad Bridge Park	6/3/2008	APJ130	10.2	15	15	1-4	5	15	404954.25	1075347.05	201.30	191.1	191	196	186
	P6	Quinn--McComb Rd	6/4/2008	APJ133	17.5	25	25	1-14	15	25	411170.24	1076904.64	129.50	112.0	110	115	105
	P7	County--Old Olympic Highway & Kendall	8/21/2008	BAF224	32.6	40	40	1-26	30	40	407550.76	1080757.55	161.68	129.1	127	132	122
	P8	Bridge--Beverage and Turn Here Lane	8/21/2008	BAF225	31.7	36	38	1-25	26	36	405159.11	1084688.30	162.38	130.7	131	136	126
	P9	N. Conservation Farm--Jim Lotzgesell Road	8/20/2008	BAF220	4.2	13	13	1-2	3	13	422409.13	1073949.75	45.80	41.6	38	43	33
	P10	Corral	8/20/2008	BAF221	2.4	12	12	0.5-1.5	2	12	422420.64	1075032.00	41.14	38.7	34	39	29
	P11	Olympic Game Farm--Burro area	8/20/2008	BAF222	2.3	12	12	0.5-1.5	2	12	422362.15	1076597.75	38.33	36.1	31	36	26
	P12	Olympic Game Farm-- East levee	8/22/2008	BAF226	11.4	23	28	1-8	13	23	422054.74	1077176.26	50.16	38.8	32	37	27
	P13	PCC Farm Land Trust	8/22/2008	BAF227	2.8	15	16	1-3	5	15	422113.77	1078571.99	36.43	33.6	26	31	21
	P14	PCC Farm Land Trust	8/22/2008	BAF228	3.9	13	14	1-2	3	13	422072.42	1079781.33	35.05	31.2	27	32	22
	Staff Gage	G1	Gagnon--Dungeness west side channel upstream of Woodcock Bridge	6/3/2008		1.14						414223.89	1073915.74	86.80	87.9		
G2		Bates--Dungeness east side channel	5/29/2008		2.36						409742.34	1074092.46	153.95	156.3			
G3		Jamestown S'Klallam Tribe-- Railroad Bridge Park	6/4/2008		2.00						404788.45	1074116.22	194.50	196.5			
G4		Olympic Game Farm-- Lotzgesell Creek	5/28/2008		1.18						422921.64	1074906.50	52.18	53.4			
G5		Miller-- Matriotti Creek	6/2/2008		1.24						418599.72	1070509.36	64.48	65.7			
G6		Unspecified developer, Kasiana-- Lotzgesell Creek	5/29/2008		0.84						416439.65	1071547.78	77.41	78.3			
G7		County?--Bear/Owl Creek (tributary to Matriotti Creek).	6/2/2008		1.49						411363.11	1066227.57	124.79	126.3			
G8		State Fish & Wildlife, Hurd Creek, north of Woodcock	5/28/2008		1.42						415644.70	1076635.95	76.14	77.6			
G9		Mansfield/Leeds-- Cassalery Creek, Woodcock	6/2/2008		0.42						415367.44	1084728.81	51.89	52.3			
G10		Dickenson/Martin--Cassalery Creek, Vine Maple Lane	6/2/2008		1.08						414277.59	1081011.49	88.56	89.6			

Notes

- 1 For piezometers, water levels are depth to groundwater from the top of casing measuring point upon construction (feet)
For gages, water levels are as-read from the gage demarkations after installation
- 2 The coordinates in this report were derived by GPS observations using a Leica 1250X smart rover, receiving real time corrections from the RGPS network provided by Kukar-Rankin, Inc.
Some positions may have been derived with standard traverse methodology. Coordinates are provided in Washington zone North State plane coordinates, 1996 adjustment, using the 03 Geoid Model, WGS 84 ellipsoid.
See Attachment A for the surveyor's report.
- 3 Measuring point on piezometers: ink mark on top of casing; measuring point on gages: the 0.00 mark
BGS below ground surface





- Stream Gages
- Monitoring Well - Installed
- Monitoring Well - Refusal (Not Installed)

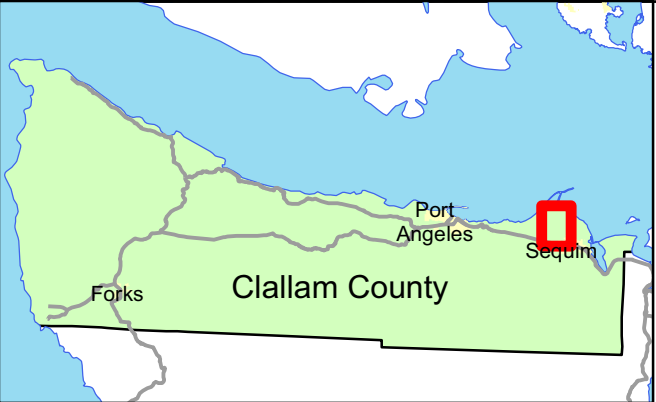
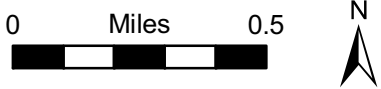


Figure 1
Locations of Stream Gages & Monitoring Wells

ATTACHMENT A: Survey Report

David Cummins & Associates	9/24/2008	"SURVEYING YOUR CORNER OF THE WORLD"
P.O. Box 120	Off: (360) 683-2344	E-address: davidonna@olypen.com
Sequim, WA. 98382	Fax: (360) 683-9492	346 N. Sequim Ave., Sequim Wa. 98382

ID	NORTHING	EASTING	ELEVATION
G1	414223.89	1073915.74	88.80FT @ 2.0MARK
G2	409742.34	1074092.46	155.95FT @ 2.0MARK
*G3	404788.45	1074116.22	196.50FT @ 2.0MARK
G4	422921.64	1074906.50	54.18FT @ 2.0MARK
G5	418599.72	1070509.36	68.48FT @ 2.0MARK
G6	416439.65	1071547.78	79.41FT @ 2.0MARK
*G7	411363.11	1066227.57	126.79FT @ 2.0MARK
G8	415644.70	1076635.95	78.14FT @ 2.0MARK
G9	415367.44	1084728.81	53.89FT @ 2.0MARK
G10	414277.59	1081011.49	88.56FT @ 2.0MARK

P2	413059.78	1071427.51	110.19 FT
P3	415692.36	1074178.66	91.94 FT
*P4	409646.67	1072865.75	144.14 FT
P5	404954.25	1075347.05	201.30 FT
P6	411170.24	1076904.64	129.50 FT
P7	407550.76	1080757.55	161.68 FT
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P10	422420.64	1075032.00	41.14 FT
P11	422362.15	1076597.75	38.33 FT
*P12	422054.74	1077176.26	50.16 FT
P13	422113.77	1078571.99	36.43 FT
P14	422072.42	1079781.33	35.05 FT

* Position between 80ft.- 800ft. from calc making it very difficult to locate them

The coordinates in the report have been derived by GPS observations using a Lieca 1250X smart rover, receiving real time corrections from the RGPS network provided by Kukar-Rankin Inc., some positions may have been derived with standard traverse methodology. Coordinates are provided in Washington zone North State plane coordinates, 1996 adjustment, using the 03 Geoid Model, WGS 84 ellipsoid.

