Groundwater Application Review Summary Form

Application # G- 18503

GW Reviewer Aurora Bouchier **Date Review Completed:** 4/10/2018

Summary of GW Availability and Injury Review:

[ ] Groundwater for the proposed use is either over appropriated, will not likely be available in the amounts requested without injury to prior water rights, OR will not likely be available within the capacity of the groundwater resource per Section B of the attached review form.

Summary of Potential for Substantial Interference Review:

[✓] There is the potential for substantial interference per Section C of the attached review form.

Summary of Well Construction Assessment:

[ ] The well does not appear to meet current well construction standards per Section D of the attached review form. Route through Well Construction and Compliance Section.

This is only a summary. Documentation is attached and should be read thoroughly to understand the basis for determinations and for conditions that may be necessary for a permit (if one is issued).

WATER RESOURCES DEPARTMENT

MEMO April 10, 2018

TO: **Application G-** 18503

FROM: **GW:** Aurora Bouchier
(Reviewer's Name)

SUBJECT: Scenic Waterway Interference Evaluation

☐ YES
The source of appropriation is within or above a Scenic Waterway

☑ NO

☐ YES
Use the Scenic Waterway condition (Condition 7J)

☑ NO

☐ Per ORS 390.835, the Groundwater Section is **able** to calculate ground water interference with surface water that contributes to a Scenic Waterway. The calculated interference is distributed below.

☐ Per ORS 390.835, the Groundwater Section is **unable** to calculate ground water interference with surface water that contributes to a scenic waterway; **therefore, the Department is unable to find that there is a preponderance of evidence that the proposed use will measurably reduce the surface water flows necessary to maintain the free-flowing character of a scenic waterway.**

DISTRIBUTION OF INTERFERENCE

Calculate the percentage of consumptive use by month and fill in the table below. If interference cannot be calculated, per criteria in 390.835, do not fill in the table but check the "unable" option above, thus informing Water Rights that the Department is unable to make a Preponderance of Evidence finding.

Exercise of this permit is calculated to reduce monthly flows in _____ Scenic Waterway by the following amounts expressed as a proportion of the consumptive use by which surface water flow is reduced.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date April 10, 2018

FROM: Groundwater Section Aurora C Bouchier
Reviewer's Name

SUBJECT: Application G- 18503 Supersedes review of na
Date of Review(s)

PUBLIC INTEREST PRESUMPTION; GROUNDWATER

OAR 690-310-130 (1) *The Department shall presume that a proposed groundwater use will ensure the preservation of the public welfare, safety and health as described in ORS 537.525.* Department staff review groundwater applications under OAR 690-310-140 to determine whether the presumption is established. OAR 690-310-140 allows the proposed use be modified or conditioned to meet the presumption criteria. **This review is based upon available information and agency policies in place at the time of evaluation.**

A. GENERAL INFORMATION: Applicant's Name: **Benjamin Verhoeven & Kathryn Weeks** County: **Linn**

A1. Applicant(s) seek(s) 2.01 cfs from 4 well(s) in the Willamette Basin, Upper Willamette subbasin (Riverside quad)

A2. Proposed use nursery and irrigation Seasonality: year round and March 1 - October 31

A3. Well and aquifer data **(attach and number logs for existing wells; mark proposed wells as such under logid)**:

Well	Logid	Applicant's Well #	Proposed Aquifer*	Proposed Rate(cfs)	Location (T/R-S QQ-Q)	Location, metes and bounds, e.g. 2250' N, 1200' E fr NW cor S 36
1	LINN 10758	1	Alluvium	2.01	12S/4W-17 SW-SW	530' N, 550' E fr SW cor S 17
2	LINN 4107	2	Alluvium	2.01	12S/4W-17 SW-SW	110' N, 850' E fr SW cor S 17
3	proposed	3	Alluvium	2.01	12S/4W-17 SE-SW	170' N, 1350' E fr SW cor S 17
4	LINN 10738	SW	Alluvium	2.01	12S/4W-20 NW-NW	430' S, 30' E fr NW cor S 20
5						

* Alluvium, CRB, Bedrock

Well	Well Elev ft msl	First Water ft bls	SWL ft bls	SWL Date	Well Depth (ft)	Seal Interval (ft)	Casing Intervals (ft)	Liner Intervals (ft)	Perforations Or Screens (ft)	Well Yield (gpm)	Draw Down (ft)	Test Type
1	232	31	21	7/13/1989	43	0-18	-1-43	Na	32-42	100	Na	A
2	232	60	19	10/15/1993	100	0-18	-1.5-100	Na	60-73	100	5	B
3	~230				Est 120	Min 0-18	~-2-120		Est 50-110			
4	250	42	31	4/5/1977	110	0-18	-1-109	Na	98-108	88	20	B

Use data from application for proposed wells.

A4. **Comments:** The application is for up to 617.1 gpm for year round nursery use and up to 283.3 gpm irrigation from any combination of the wells. The rate is not specified by well. This review evaluates against a combined pumpage for nursery and irrigation for a total rate of 900 gpm.

A5. ☒ **Provisions of the** Willamette Basin rules relative to the development, classification and/or management of groundwater hydraulically connected to surface water ☐ **are**, *or* ☒ **are not**, activated by this application. (Not all basin rules contain such provisions.)
Comments: The wells are greater than ¼-mile from a surface water source, so the pertinent rules (OAR 690-502-0240) do not apply.

A6. ☐ **Well(s) #** _____, _____, _____, _____, _____, tap(s) an aquifer limited by an administrative restriction.
Name of administrative area: _____
Comments: _____

B. GROUNDWATER AVAILABILITY CONSIDERATIONS, OAR 690-310-130, 400-010, 410-0070

B1. **Based upon available data**, I have determined that groundwater* for the proposed use:

a. ☐ **is** over appropriated, ☒ **is not** over appropriated, *or* ☐ **cannot be determined to be** over appropriated during any period of the proposed use. * This finding is limited to the groundwater portion of the over-appropriation determination as prescribed in OAR 690-310-130;

b. ☐ **will not** *or* ☐ **will** likely be available in the amounts requested without injury to prior water rights. * This finding is limited to the groundwater portion of the injury determination as prescribed in OAR 690-310-130;

c. ☐ **will not** *or* ☐ **will** likely to be available within the capacity of the groundwater resource; or

d. ☒ **will, if properly conditioned**, avoid injury to existing groundwater rights or to the groundwater resource:
   i. ☒ The permit should contain condition #(s) **7N, large water use reporting**;
   ii. ☐ The permit should be conditioned as indicated in item 2 below.
   iii. ☐ The permit should contain special condition(s) as indicated in item 3 below;

B2. a. ☐ **Condition** to allow groundwater production from no deeper than _____ ft. below land surface;

b. ☐ **Condition** to allow groundwater production from no shallower than _____ ft. below land surface;

c. ☒ **Condition** to allow groundwater production only from the **alluvial** groundwater reservoir ~~between approximately _____ ft. and _____ ft. below land surface~~;

d. ☐ **Well reconstruction** is necessary to accomplish one or more of the above conditions. The problems that are likely to occur with this use and without reconstructing are cited below. Without reconstruction, I recommend withholding issuance of the permit until evidence of well reconstruction is filed with the Department and approved by the Groundwater Section.

Describe injury –as related to water availability– that is likely to occur without well reconstruction (interference w/ senior water rights, not within the capacity of the resource, etc): _____

B3. **Groundwater availability remarks:**

The applicant's wells 1-3 are located within the floodplain deposits of the old anastomosing channels of the Willamette River (O'Connor et al., 2001). Locally, erosion and reworking of sediment by the river has largely removed confining material. Well 4 is located on top of the slight bluff (approximately 20-feet above the field where wells 1-3 are located) where the Willamette Silt has not been eroded away. The Willamette Silt is approximately 20-feet thick at this location (Gannett et al., 1998).

The nearest observation well (LINN 10817, located approximately 4.4 miles up-gradient to the southeast) has been monitored since the early 1960's. The hydrograph for LINN 10817 shows a seasonal fluctuation of approximately 10-15 feet and no apparent decline, suggesting the aquifer is stable at the current level of use. However, there has recently been a large amount of groundwater applied for in this area.

C. GROUNDWATER/SURFACE WATER CONSIDERATIONS, OAR 690-09-040

C1. **690-09-040 (1):** Evaluation of aquifer confinement:

Well	Aquifer or Proposed Aquifer	Confined	Unconfined
1	**Alluvium – Holocene Flood Deposits**	☐	☒
2	**Alluvium – Holocene Flood Deposits**	☐	☒
3	**Alluvium – Holocene Flood Deposits**	☐	☒
4	**Alluvium of Willamette Aquifer**	☐	☒

Basis for aquifer confinement evaluation: Although the logs for the applicant's wells report static water levels above the depths at which water was first encountered, the regional confining layer (Willamette Silt) has been removed from the location of wells 1-3, and Well 4 is within 200-300 feet from the edge of the Willamette Silt. In general, the groundwater in the Holocene Flood deposit is unconfined (Conlon et al., 2005).

C2. **690-09-040 (2) (3):** Evaluation of distance to, and hydraulic connection with, surface water sources. All wells located a horizontal distance less than ¼ mile from a surface water source that produce water from an unconfined aquifer shall be assumed to be hydraulically connected to the surface water source. Include in this table any streams located beyond one mile that are evaluated for PSI.

Well	SW #	Surface Water Name	GW Elev ft msl	SW Elev ft msl	Distance (ft)	Hydraulically Connected? YES	NO	ASSUMED	Potential for Subst. Interfer. Assumed? YES	NO
1	**1**	**Muddy Creek**	**~210-222**	**~210-216**	**2,480**	☒	☐	☐	☐	☒
2	**1**	**Muddy Creek**	**~210-222**	**~210-216**	**2,820**	☒	☐	☐	☐	☒
3	**1**	**Muddy Creek**	**~210-222**	**~210-216**	**2,400**	☒	☐	☐	☐	☒
4	**1**	**Muddy Creek**	**~210-222**	**~210-216**	**3,580**	☒	☐	☐	☐	☒
1	**2**	**Willamette River**	**~210-222**	**~210-213**	**4,200**	☒	☐	☐	☐	☒
2	**2**	**Willamette River**	**~210-222**	**~210-213**	**4,100**	☒	☐	☐	☐	☒
3	**2**	**Willamette River**	**~210-222**	**~210-213**	**4,500**	☒	☐	☐	☐	☒
4	**2**	**Willamette River**	**~210-222**	**~210-213**	**3,130**	☒	☐	☐	☐	☒

Basis for aquifer hydraulic connection evaluation: Published reports describe the subsurface material of the flood plain deposits of the Willamette River as unconsolidated material consisting of highly permeable zones of "substantial groundwater flow that is likely to be well connected to the surface flow in the Willamette River and major tributaries" (O'Connor et al., 2001). Published water table maps show that groundwater flows towards, and discharges into, perennial streams and their tributaries (Woodward et al., 1998).

Water Availability Basin the well(s) are located within: 30200303 Muddy Cr> E Channel- at Mouth and 30200321 Willamette R> Columbia R- ab Periwinkle Cr at Gage 14174

C3a. **690-09-040 (4):** Evaluation of stream impacts for each well that has been determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. Limit evaluation to instream rights and minimum stream flows that are pertinent to that surface water source, and not lower SW sources to which the stream under evaluation is tributary. Compare the requested rate against the 1% of 80% *natural* flow for the pertinent Water Availability Basin (WAB). If Q is not distributed by well, use full rate for each well. Any checked ☒ box indicates the well is assumed to have the potential to cause PSI.

Well	SW #	Well < ¼ mile?	Qw > 5 cfs?	Instream Water Right ID	Instream Water Right Q (cfs)	Qw > 1% ISWR?	80% Natural Flow (cfs)	Qw > 1% of 80% Natural Flow?	Interference @ 30 days (%)	Potential for Subst. Interfer. Assumed?
1	**1**	☐	☐	**na**	**na**	☐	**14.90**	☒	<<25%	☒
2	**1**	☐	☐	**na**	**na**	☐	**14.90**	☒	<<25%	☒
3	**1**	☐	☐	**na**	**na**	☐	**14.90**	☒	<<25%	☒
4	**1**	☐	☐	**na**	**na**	☐	**14.90**	☒	<<25%	☒
1	**2**	☐	☐	**na**	**na**	☐	**2,540.00**	☐	<<25%	☐
2	**2**	☐	☐	**na**	**na**	☐	**2,540.00**	☐	<<25%	☐
3	**2**	☐	☐	**na**	**na**	☐	**2,540.00**	☐	<<25%	☐
4	**2**	☐	☐	**na**	**na**	☐	**2,540.00**	☐	<<25%	☐

C3b. **690-09-040 (4):** Evaluation of stream impacts by total appropriation for all wells determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. **Complete only if Q is distributed among wells**. Otherwise same evaluation and limitations apply as in C3a above.

	SW #		Qw > 5 cfs?	Instream Water Right ID	Instream Water Right Q (cfs)	Qw > 1% ISWR?	80% Natural Flow (cfs)	Qw > 1% of 80% Natural Flow?	Interference @ 30 days (%)	Potential for Subst. Interfer. Assumed?
			☐			☐		☐		☐
			☐			☐		☐		☐
			☐			☐		☐		☐
			☐			☐		☐		☐

Comments: The stream depletion at 30 days was estimated using the Hunt 1999 model and assuming a 3 foot clogging layer beneath the streambed. The impact to Muddy Creek was estimated using the full requested rate at Well 3 (the well closest to Muddy Creek), and to the Willamette River using the full requested rate at Well 2. Aquifer properties of hydraulic conductivity, aquifer thickness, and specific yield were selected from published values for the Holocene floodplain deposits of the Willamette River (Conlon et al., 2005). Although Well 4 is completed into alluvium of the Willamette Aquifer (middle sedimentary unit of Conlon et al., 2005 or Pre-Missoula-Flood sand and gravel Qg2 unit of O'Connor et al., 2001), it is likely the Willamette Aquifer unit has been scoured and replaced with Holocene floodplain deposits at a distance of somewhat greater than 200-300 feet from Well 4 resulting in Well 4 likely producing partial from the Holocene floodplain deposits and the Willamette Aquifer. Using published hydraulic conductivity values for either aquifer results in <<25% of streambed depletion at 30-days.

C4a. **690-09-040 (5):** Estimated impacts on **hydraulically connected surface water sources greater than one mile** as a percentage of the proposed pumping rate. Limit evaluation to the effects that will occur up to one year after pumping begins. This table encompasses the considerations required by 09-040 (5)(a), (b), (c) and (d), which are not included on this form. Use additional sheets if calculated flows from more than one WAB are required.

Non-Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
(A) = Total Interf.													
(B) = 80 % Nat. Q													
(C) = 1 % Nat. Q													

(D) = (A) > (C)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(E) = (A / B) x 100	%	%	%	%	%	%	%	%	%	%	%	%

(A) = total interference as CFS; (B) = WAB calculated natural flow at 80% exceed. as CFS; (C) = 1% of calculated natural flow at 80% exceed. as CFS; (D) = highlight the checkmark for each month where (A) is greater than (C); (E) = total interference divided by 80% flow as percentage.

Basis for impact evaluation: _____

C4b. **690-09-040 (5) (b) The potential to impair or detrimentally affect the public interest is to be determined by the Water Rights Section.**

C5. ☐ **If properly conditioned**, the surface water source(s) can be adequately protected from interference, and/or groundwater use under this permit can be regulated if it is found to substantially interfere with surface water:

i. ☐ The permit should contain condition #(s)_____;

ii. ☐ The permit should contain special condition(s) as indicated in "Remarks" below;

C6. **SW / GW Remarks and Conditions:** _____

References Used:

Application file: G-18503.

Conlon, T. D., Wozniak, K. C., Woodcock, D., Herrera, N.B., Fischer, B.J. Morgan, D.S., Lee, K.K., and Hinkle, S.R., 2005, Ground-Water Hydrology of the Willamette Basin, Oregon: U. S. Geological Survey Scientific Investigations Report 2005-5168.

Gannett, Marshall W., and Caldwell, Rodney R., 1998, Geologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington: U. S. Geological Survey Professional Paper 1424-A.

Hunt, B., 1999, Unsteady stream depletion from ground water pumping: Ground Water, v. 37, no. 1, p. 98-102.

O'Connor, J. E., Sarna-Wojcicki, A., Wozniak, K. C., Polette, Polette, J. D., and Fleck, R. J., 2001, Origin, Extent, and Thickness of Quaternary Geologic Units in the Willamette Valley, Oregon: U.S. Geological Survey Professional Paper 1620.

Woodward, Dennis BG., Gannett, Marshall W., and Vaccaro, John J., 1998 Hydrogeologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington: U. S. Geological Survey Professional Paper 1424-B.

Nearby well logs and water level data.

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** _____ **Logid:** _____

D2. **THE WELL does not appear to meet current well construction standards based upon:**

a. ☐ review of the well log;
b. ☐ field inspection by _____;
c. ☐ report of CWRE _____;
d. ☐ other: (specify) _____

D3. **THE WELL construction deficiency or other comment is described as follows:** _____

D4. ☐ **Route to the Well Construction and Compliance Section for a review of existing well construction.**

Water Availability Tables

DETAILED REPORT ON THE WATER AVAILABILITY CALCULATION

MUDDY CR > E CHANNEL - AT MOUTH

Watershed ID #: 30200303 Basin: WILLAMETTE Exceedance Level: 80
Time: 9:41 AM Date: 04/10/2018

Month	Natural Stream Flow	Consumptive Use and Storage	Expected Stream Flow	Reserved Stream Flow	Instream Requirements	Net Water Available
	Monthly values are in cfs. Storage is the annual amount at 50% exceedance in ac-ft.					
JAN	178.00	2.69	175.00	0.00	0.00	175.00
FEB	203.00	2.47	201.00	0.00	0.00	201.00
MAR	174.00	1.26	173.00	0.00	0.00	173.00
APR	91.30	1.13	90.20	0.00	0.00	90.20
MAY	52.50	1.71	50.80	0.00	0.00	50.80
JUN	35.30	2.52	32.80	0.00	0.00	32.80
JUL	26.10	3.36	22.70	0.00	0.00	22.70
AUG	20.30	2.81	17.50	0.00	0.00	17.50
SEP	14.90	1.95	12.90	0.00	0.00	12.90
OCT	15.20	0.85	14.40	0.00	0.00	14.40
NOV	29.00	1.06	27.90	0.00	0.00	27.90
DEC	113.00	2.46	111.00	0.00	0.00	111.00
ANN	114,000	1,470	112,000	0	0	112,000

DETAILED REPORT ON THE WATER AVAILABILITY CALCULATION

WILLAMETTE R > COLUMBIA R - AB PERIWINKLE CR AT GAGE 14174

Watershed ID #: 30200321 Basin: WILLAMETTE Exceedance Level: 80
Time: 9:46 AM Date: 04/10/2018

Month	Natural Stream Flow	Consumptive Use and Storage	Expected Stream Flow	Reserved Stream Flow	Instream Requirements	Net Water Available
	Monthly values are in cfs. Storage is the annual amount at 50% exceedance in ac-ft.					
JAN	10,100.00	1,370.00	8,730.00	0.00	1,750.00	6,980.00
FEB	11,600.00	4,290.00	7,310.00	0.00	1,750.00	5,560.00
MAR	11,000.00	4,560.00	6,440.00	0.00	1,750.00	4,690.00
APR	9,760.00	4,260.00	5,500.00	0.00	1,750.00	3,750.00
MAY	8,430.00	2,550.00	5,880.00	0.00	1,750.00	4,130.00
JUN	5,360.00	856.00	4,500.00	0.00	1,750.00	2,750.00
JUL	3,270.00	662.00	2,610.00	0.00	1,750.00	858.00
AUG	2,560.00	601.00	1,960.00	0.00	1,750.00	209.00
SEP	2,540.00	517.00	2,020.00	0.00	1,750.00	273.00
OCT	2,860.00	270.00	2,590.00	0.00	1,750.00	840.00
NOV	4,170.00	355.00	3,820.00	0.00	1,750.00	2,070.00
DEC	8,150.00	380.00	7,770.00	0.00	1,750.00	6,020.00
ANN	7,460,000	1,240,000	6,230,000	0	1,270,000	4,960,000

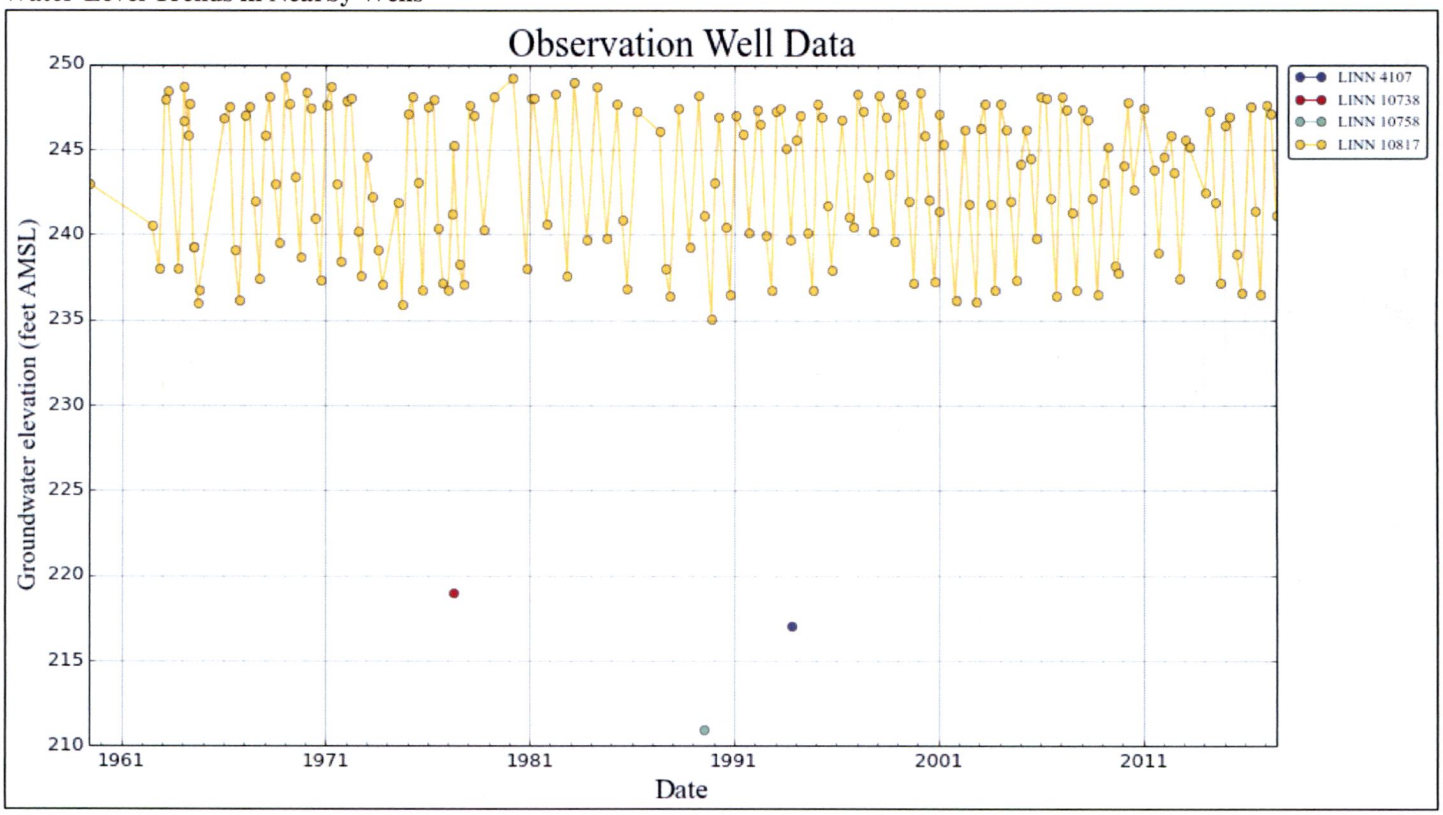
DETAILED REPORT OF INSTREAM REQUIREMENTS

WILLAMETTE R > COLUMBIA R - AB PERIWINKLE CR AT GAGE 14174

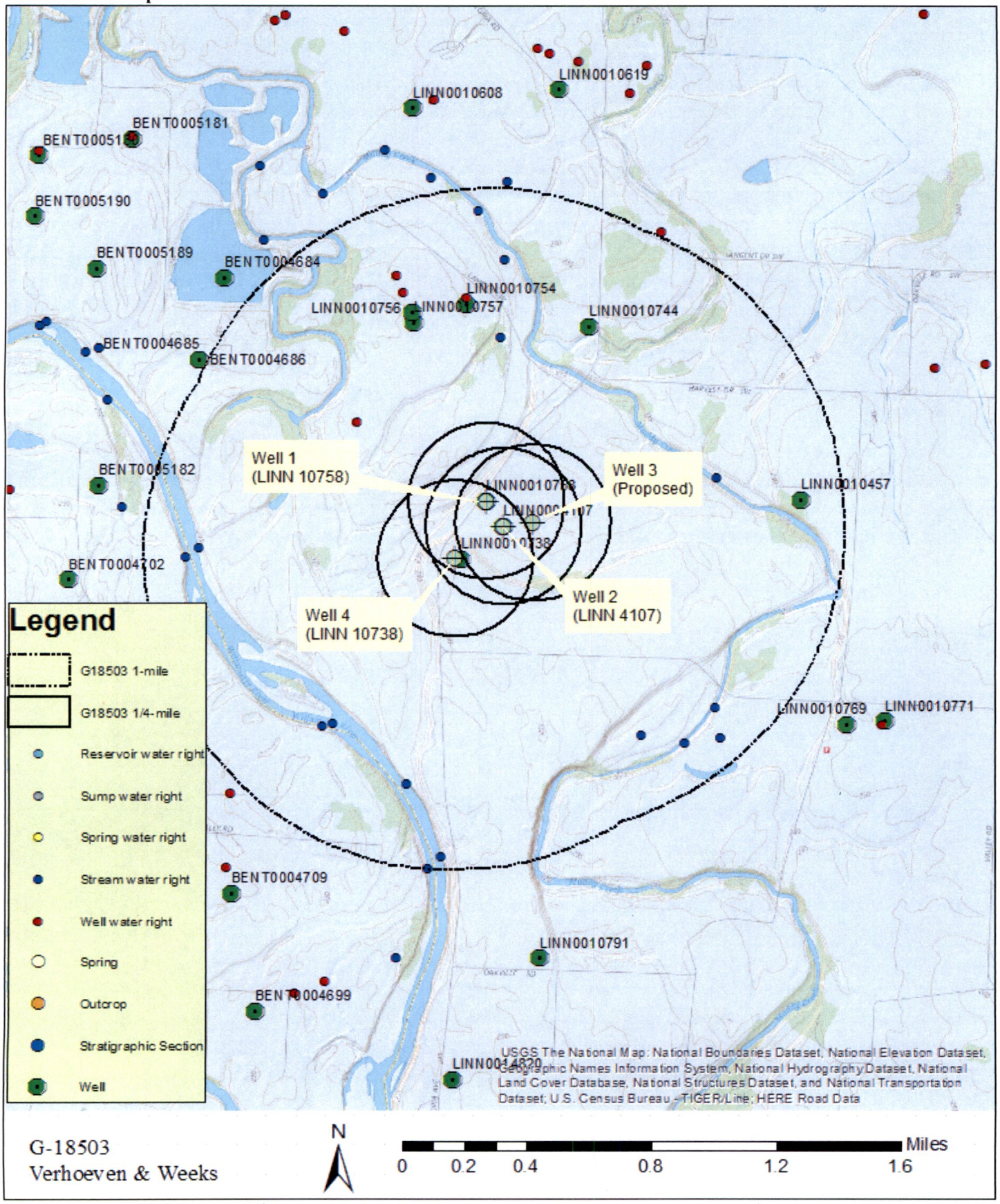
Watershed ID #: 30200321 Basin: WILLAMETTE
Time: 9:47 AM Date: 04/10/2018

Application Number	Status	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
		Monthly values are in cfs.											
MF184A	APPLICATION	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.00	1750.0
MAXIMUM		1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0

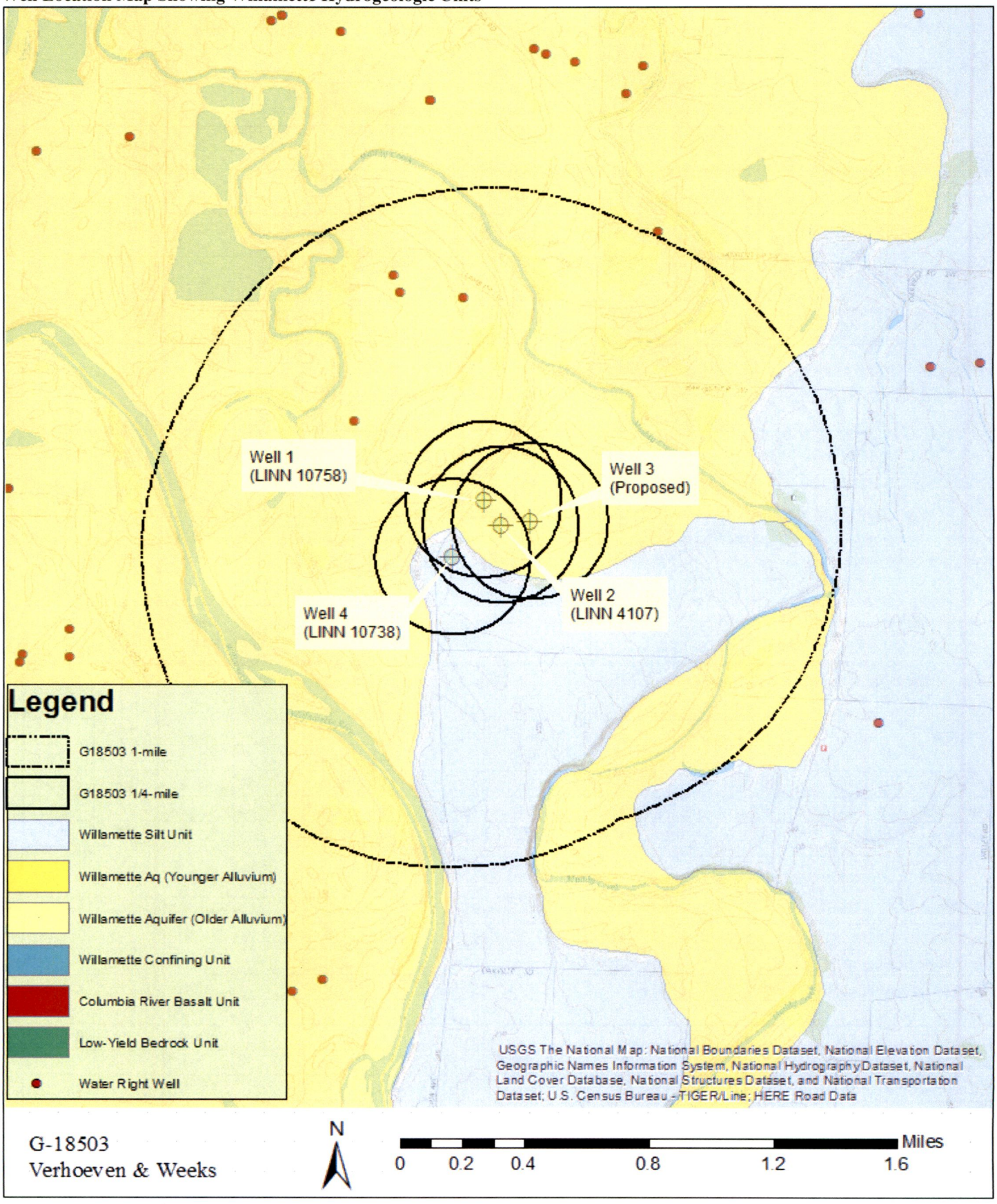
Water-Level Trends in Nearby Wells



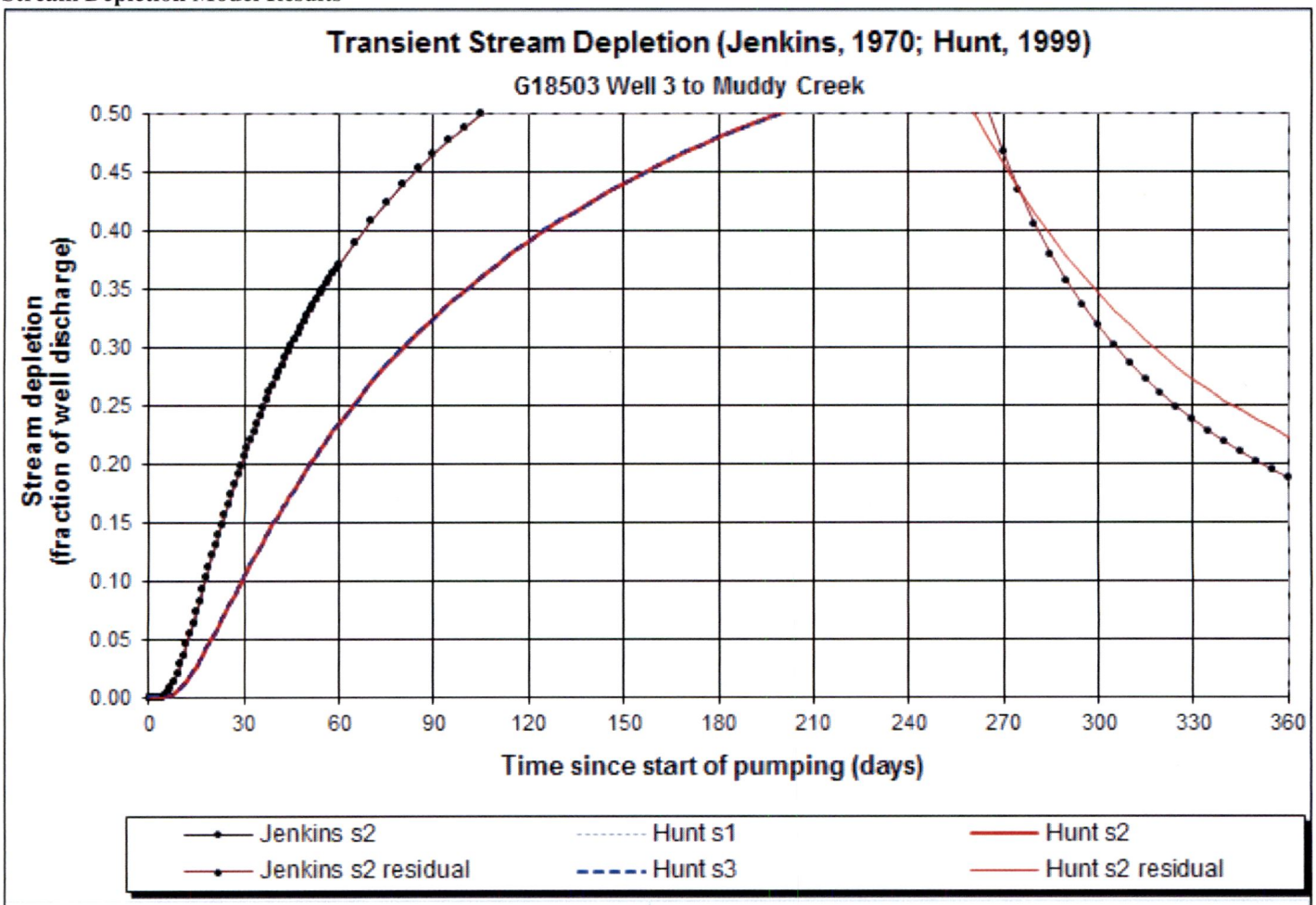
Well Location Map



Well Location Map Showing Willamette Hydrogeologic Units



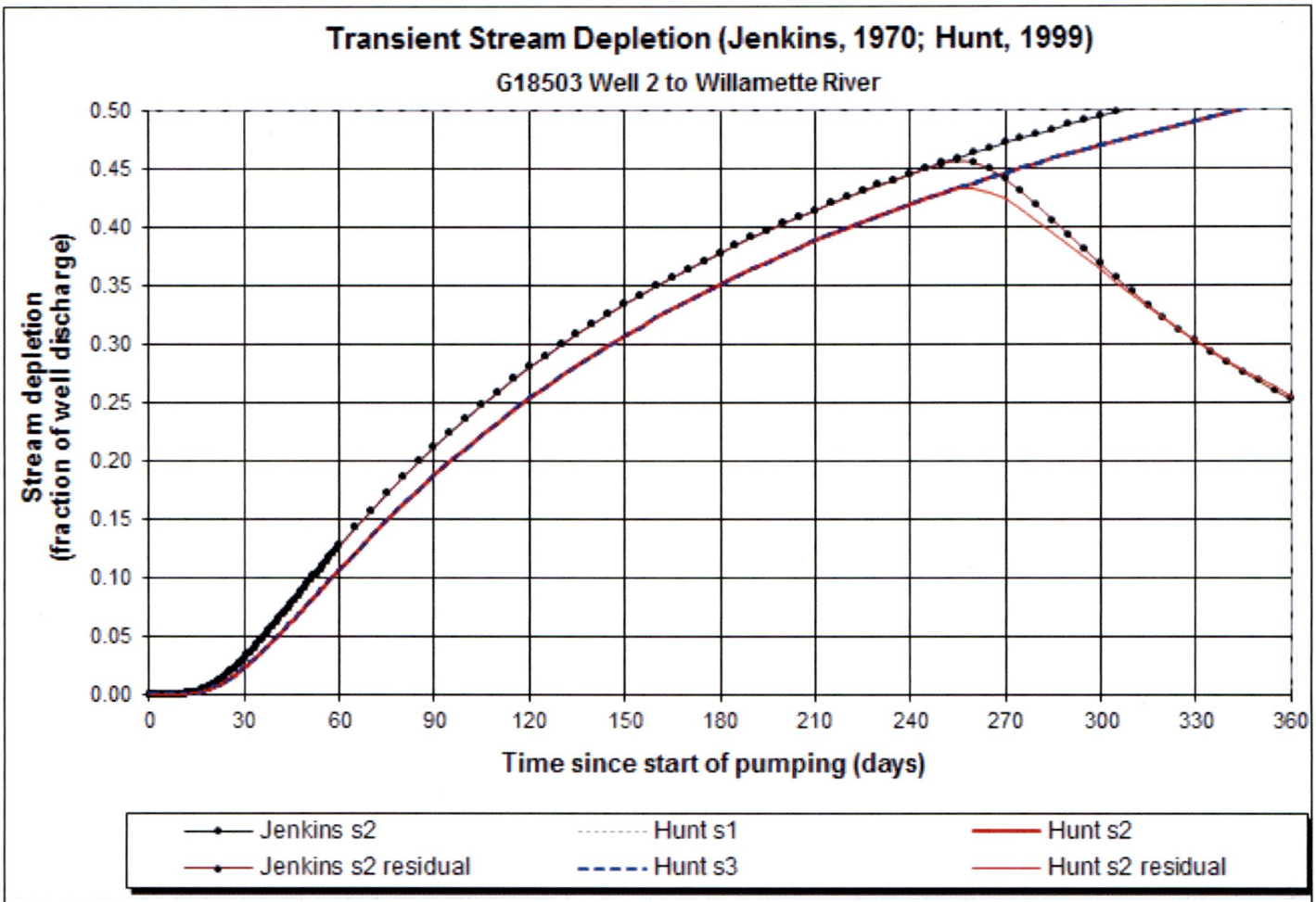
Stream Depletion Model Results



Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 240 days

Days	**30**	60	90	120	150	180	210	240	270	300	330	360
Qw, cfs	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005
Jenk SD s2 %	**20.59**	37.11	46.52	52.71	57.16	60.56	63.26	65.47	46.74	31.81	23.77	18.79
Jen SD s2 cfs	0.413	0.744	0.933	1.057	1.146	1.214	1.269	1.313	0.937	0.638	0.477	0.377
Hunt SD s2 %	**10.37**	23.50	32.54	39.06	44.01	47.94	51.14	53.82	45.73	34.57	27.26	22.28
Hunt SD s2 cfs	0.208	0.471	0.653	0.783	0.883	0.961	1.026	1.079	0.917	0.693	0.547	0.447

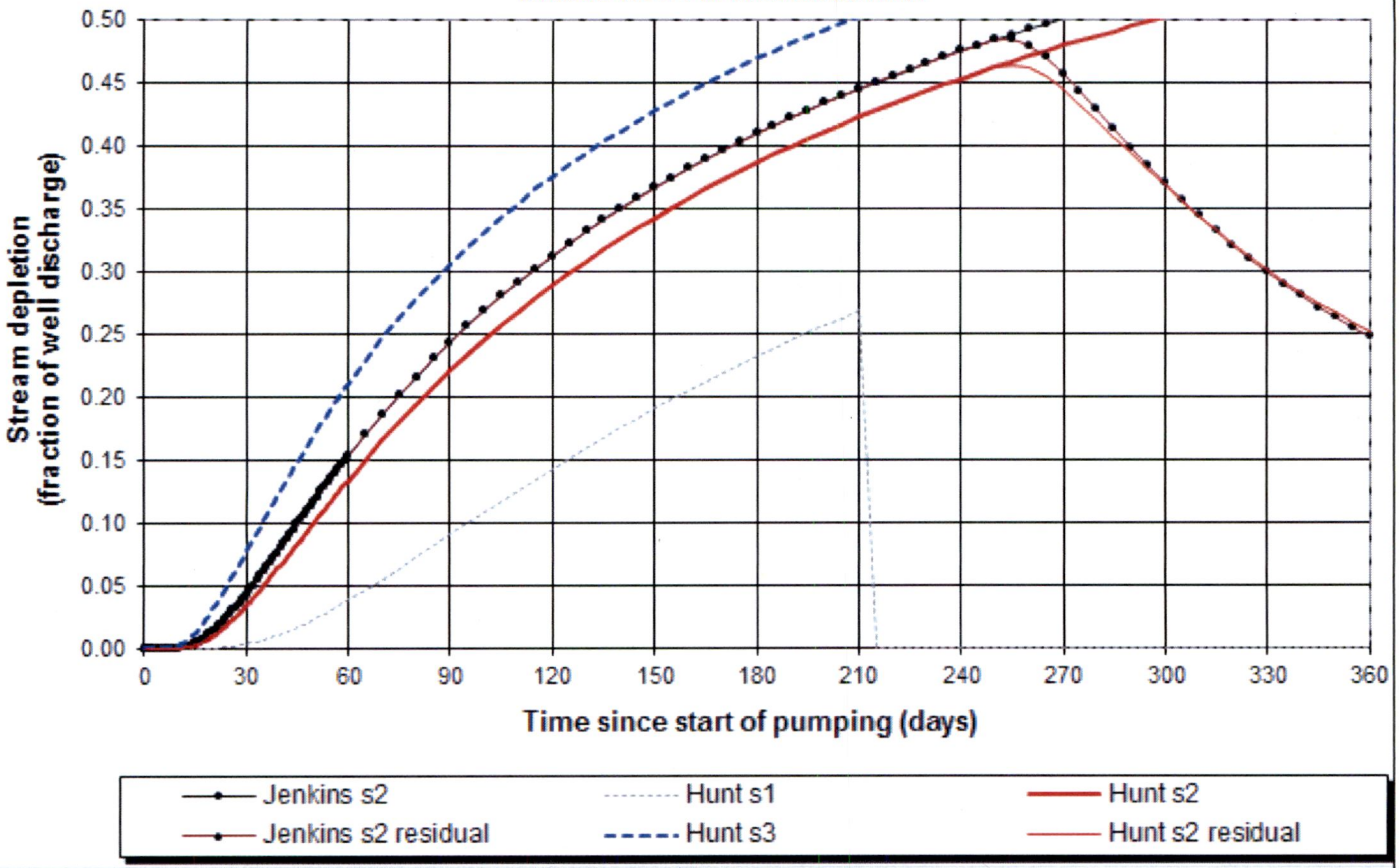
Parameters:		**Scenario 1**	**Scenario 2**	**Scenario 3**	**Units**
Net steady pumping rate	Qw	900	900	900	gpm
Distance to stream	a	2400	2400	2400	ft
Aquifer hydraulic conductivity	K	600	600	600	ft/day
Aquifer thickness	b	20	20	20	ft
Aquifer transmissivity	T	12000	12000	12000	ft*ft/day
Aquifer storage coefficient	S	0.2	0.2	0.2	
Stream width	ws	75	75	75	ft
Streambed hydraulic conductivity	Ks	1	1	1	ft/day
Streambed thickness	bs	3	3	3	ft
Streambed conductance	sbc	25	25	25	ft/day
Stream depletion factor (Jenkins)	sdf	96	96	96	days
Streambed factor (Hunt)	sbf	5	5	5	



Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 240 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Qw, cfs	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005
Jenk SD s2 %	3.07	12.65	21.22	27.99	33.39	37.77	41.41	44.49	44.06	36.79	30.25	25.28
Jen SD s2 cfs	0.062	0.254	0.425	0.561	0.669	0.757	0.830	0.892	0.884	0.738	0.607	0.507
Hunt SD s2 %	2.31	10.71	18.78	25.37	30.71	35.10	38.78	41.92	42.31	36.27	30.30	25.57
Hunt SD s2 cfs	0.046	0.215	0.377	0.509	0.616	0.704	0.778	0.841	0.848	0.727	0.608	0.513

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	900	900	900	gpm
Distance to stream	a	4100	4100	4100	ft
Aquifer hydraulic conductivity	K	600	600	600	ft/day
Aquifer thickness	b	20	20	20	ft
Aquifer transmissivity	T	12000	12000	12000	ft*ft/day
Aquifer storage coefficient	S	0.2	0.2	0.2	
Stream width	ws	300	300	300	ft
Streambed hydraulic conductivity	Ks	1	1	1	ft/day
Streambed thickness	bs	3	3	3	ft
Streambed conductance	sbc	100	100	100	ft/day
Stream depletion factor (Jenkins)	sdf	280.1666667	280.1666667	280.1666667	days
Streambed factor (Hunt)	sbf	34.16666667	34.16666667	34.16666667	



Output for Hunt Stream Depletion, Scenerio 2 (s2):						Time pump on = 240 days						
Days	**30**	60	90	120	150	180	210	240	270	300	330	360
Qw, cfs	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005	2.005
Jenk SD s2 %	**4.33**	15.31	24.34	31.24	36.62	40.95	44.51	47.50	45.73	36.98	29.90	24.73
Jen SD s2 cfs	0.087	0.307	0.488	0.626	0.734	0.821	0.893	0.953	0.917	0.742	0.600	0.496
Hunt SD s2 %	**3.45**	13.42	22.10	28.89	34.28	38.64	42.25	45.31	44.47	36.79	30.12	25.11
Hunt SD s2 cfs	0.069	0.269	0.443	0.579	0.687	0.775	0.847	0.909	0.892	0.738	0.604	0.503

Parameters:		**Scenario 1**	**Scenario 2**	**Scenario 3**	**Units**
Net steady pumping rate	Qw	900	900	900	gpm
Distance to stream	a	3130	3130	3130	ft
Aquifer hydraulic conductivity	K	200	400	600	ft/day
Aquifer thickness	b	20	20	20	ft
Aquifer transmissivity	T	4000	8000	12000	ft*ft/day
Aquifer storage coefficient	S	0.2	0.2	0.2	
Stream width	ws	300	300	300	ft
Streambed hydraulic conductivity	Ks	1	1	1	ft/day
Streambed thickness	bs	3	3	3	ft
Streambed conductance	sbc	100	100	100	ft/day
Stream depletion factor (Jenkins)	sdf	489.845	244.9225	163.2816667	days
Streambed factor (Hunt)	sbf	78.25	39.125	26.08333333	