Groundwater Application Review Summary Form

Application # G- 18383

GW Reviewer DENNIS ORLOWSKI **Date Review Completed:** 5/5/17

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).

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date 05/05/2017
FROM: Groundwater Section Dennis Orlowski
Reviewer's Name
SUBJECT: Application G- 18383 Supersedes review of
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: Linda Baumgardner* County: Marion

A1. Applicant(s) seek(s) 1.29 cfs from one well(s) in the Willamette River Basin, Mill Creek > Pudding River subbasin

A2. Proposed use Irrigation (103.1 acres) Seasonality: 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	**Proposed**	**1**	**Alluvium**	**579 gpm**	**T5S/R2W-S23 NW-SW**	**1600'N, 5' E from NNE cor DLC 54**

* 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	**185**	****NOTE**	****NOTE**	****NOTE**	****NOTE**	****NOTE**	****NOTE**	****NOTE**	****NOTE**	**TBD**	**TBD**	**TBD**

Use data from application for proposed wells.

A4. **Comments:** The proposed Well 1 location is within the French Prairie region approximately 1 mile NNW of Gervais, Oregon, and about 0.3 mile due east of interstate I-5.

*NOTE: There are multiple names listed as applicants; Linda Baumgardner is designated as the principal applicant.

****NOTE: the application does not indicate any construction details for proposed Well 1**. Only a proposed source aquifer ('sands and gravels') is listed, with a total well depth 'TBD' (see table in Section 3 of application).

The land surface area near the proposed Well 1 location is quite flat. Also, several wells within ~1 mile are completed in 'sands and gravels'; most notably, existing MARI 17295 is located near the center of this application's tax lot, approximately 1650 ft south of the proposed Well 1 location (it is understood that if this application is granted, then the permit associated with MARI 17295 (permit G-11892) will be cancelled (see affidavit dated 17 August 2016 in file)).

Because proposed construction details for Well 1 were not provided, for this review a well depth of 170 ft, with corresponding static groundwater levels, was assumed based on similarly-constructed nearby wells.

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: From the assumed well construction (discussed in Section A4), the proposed Well 1 will produce groundwater from a confined aquifer and therefore the pertinent Willamette Basin 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: Not applicable.

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 (annual measurement condition) and 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:**

In this area up to 130 feet of Willamette Silt overlies 20-30 feet of sand and gravel deposits of the Willamette Aquifer. These water-bearing sands and gravels typically occur as relatively thin (<~10 ft) interbeds within lower-permeability silts and clays. Beneath these units lie approximately 1200 ft of predominantly silt and clay of the Willamette Confining Unit. Static groundwater levels are typically 20-30 feet below land surface, within the Willamette Silt (Conlon and others, 2005; Woodward and others, 1998).

Yields from nearby wells completed in the alluvial aquifer range from moderate to moderately-high (~100-400 gpm); the well log for MARI 17295, located near the center of this application parcel, shows an estimated airlift discharge of 700 gpm (no drawdown noted). The requested allocation (1.29 cfs or 579 gpm), while greater than rates reported for other nearby wells, is not entirely unreasonable for a single well completed in the alluvial aquifer in this area.

Water level data available from nearby alluvial aquifer wells show fairly stable trends over the past 12-15 years (see attached hydrograph). However, seasonally these levels can fluctuate from 25-40 feet.

Compared to the location of MARI 17295, the proposed location for Well 1 near the northern boundary of the application parcel will place it farther away from the town of Gervais and its relatively-high concentration of alluvial wells (including two municipal wells), thus minimizing potential interference with those wells. However, the proposed Well 1 location will be about 1200 ft away from permitted irrigation well MARI 2624 (certificate 47933), also an alluvial aquifer well.

Due to the nearby POA (MARI 2624) and possibly other exempt wells, the relatively-high requested allocation, and the large seasonal range of groundwater levels, the permit conditions noted in B1 and B2 are recommended.

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**	☒	☐

Basis for aquifer confinement evaluation: Logs for nearby wells completed in alluvium obtain groundwater from water-bearing sands and gravels that are confined by approximately 90-130 ft of fine grained sediments (Willamette Silt); the USGS estimates the Willamette Silt at approximately 120 ft thick in the Gervais area (Woodward and others, 1998). In the central Willamette Valley, Conlon and others (2005) report that fine-grained deposits (silt and clay) of 'more than 40 ft' thickness typically create confined conditions in the underlying water-bearing sand/gravel deposits.

Additionally, reported static water levels for nearby alluvial wells (MARI 2570, MARI 2651 and others) are above the level of water-bearing layers within each respective well.

These factors suggest that proposed Well 1 will produce groundwater from a confined aquifer.

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**	**Sam Brown Creek**	**170**	**150**	**9000**	☒	☐	☐	☐	☒
1	**2**	**Senecal Creek**	**170**	**160**	**11,000**	☒	☐	☐	☐	☒

Basis for aquifer hydraulic connection evaluation:
There are no perennial stream reaches within 1 mile of the proposed location for Well 1.

The nearest perennial reaches of Sam Brown Creek (SW1) and Senecal Creek (SW2) are approximately 9000 ft (1.7 miles) and 11,000 ft (2.1 miles) from the proposed Well 1 location, respectively. The assumed groundwater level elevation for proposed Well 1 and the elevation ranges for both SW1 and SW2 are near enough to assume some degree of hydraulic connection. Furthermore, water table maps in the area indicate that groundwater in the alluvial aquifer system flows towards and discharges into local streams incised in the French Prairie plateau (Conlon and others, 2005; Gannett and Caldwell, 1998). These facts indicate that the alluvial aquifer and local streams are hydraulically connected.

Water Availability Basin the well(s) are located within: SW1: Pudding River > Molalla River – ab Mill Creek (WID 151)
SW2: Mill Creek > Pudding River – at mouth (WID 30200901).

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?
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐

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:
C3a: no streams within 1 mile, as discussed in C2.
C3b: not applicable because only a single well is proposed.

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
1	**2**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**
Well Q as CFS		**0**	**0**	**1.29**	**1.29**	**1.29**	**1.29**	**1.29**	**1.29**	**1.29**	**1.29**	**0**	**0**
Interference CFS		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Distributed Wells

Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
(A) = Total Interf.		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
(B) = 80 % Nat. Q		**39.20**	**53.90**	**38.40**	**27.60**	**13.70**	**8.72**	**3.79**	**2.09**	**1.88**	**2.39**	**6.05**	**25.90**
(C) = 1 % Nat. Q		**0.392**	**0.539**	**0.384**	**0.276**	**0.137**	**0.0872**	**0.0379**	**0.0290**	**0.0188**	**0.0239**	**0.0605**	**0.2590**
(D) = (A) > (C)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(E) = (A / B) x 100		**0%**	**0%**	**0%**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**	**0 %**

(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: SW1 (Sam Brown Creek) is nearer to proposed Well 1 than is SW2 (Senecal Creek) by approximately 2000 feet. However, the 80% exceedance flows are significantly lower in the SW2 WAB (Mill Creek > Pudding River – at mouth), and therefore this analysis was performed for SW2 only.

Potential depletion of SW2 (Senecal Creek) by proposed Well 1 was estimated using the Hunt 2003 analytical stream depletion model (Hunt, 2003). Aquifer parameters used for the models are typical of those reported for this hydrogeologic regime (Conlon and others, 2003, 2005; Iverson, 2002; Woodward and others, 1998); published parameter values were substantiated by derived results from a nearby pumping test (MARI 18805), which is nearest to the proposed Well 1 location and similarly completed.

The Hunt 2003 analytical modeling results indicate that stream depletion of SW2 is expected to be nearly inconsequential one year after pumping of proposed Well 1 begins. The exceptionally thick deposits of low-permeability Willamette Silt in this area, coupled with the relatively-great distance to the stream, provide an effective buffer from stream depletion effects within the period of 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:**

C1 (690-09-040 (1))
With the assumed completion details as noted, proposed Well 1 will produce groundwater from a confined aquifer.

C2 (690-09-040 (2) (3))
It is determined that proposed Well 1 will be hydraulically connected to both Sam Brown Creek and Senecal Creek.

C3a, C3b (690-09-040 (4))
No streams within 1 mile.

C4a (690-09-040 (5))
Potential stream of SW2 is expected to be nearly inconsequential one year after pumping of proposed Well 1 begins. The exceptionally thick deposits of low-permeability Willamette Silt in this area, coupled with the relatively-great distance to the stream, provide an effective buffer from stream depletion effects within the period of evaluation.

References Used:
Application file: G-18383

Conlon, T.D., Wozniak, K.C., Woodcock, D., Herrera, N.B., Fisher, 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.

Conlon, T.D., Lee, K.K., and Risley, J.R., 2003, Heat tracing in streams in the central Willamette Basin, Oregon, *in* Stonestrom, D.A. and Constantz, Jim, eds., Heat as a tool for studying the movement of groundwater near streams: U.S. Geological Survey Circular 1260, chapter 5, p. 29-34.

Gannett, M.W. and Caldwell, R., 1998, Geologic framework of the Willamette Lowland aquifer system, Oregon and Washington: U.S. Geological Survey Professional Paper 1424-A, 32 p.

Hunt, B., 2003, Unsteady stream depletion when pumping from semiconfined aquifer: Journal of Hydrologic Engineering, January/February, 2003.

Iverson, J., 2002, Investigation of the hydraulic, physical, and chemical buffering capacity of Missoula flood deposits for water quality and supply in the Willamette Valley of Oregon: Unpublished M.S. thesis, Oregon State University, 147 p.

Woodward, D.G., Gannett, M.W., and Vaccaro, J.J., 1998, Hydrogeologic framework of the Willamette Lowland aquifer system, Oregon and Washington: U.S. Geological Survey Professional Paper 1424-B, 82 p.

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

SW1 (Sam Brown Creek)

Oregon Water Resources Department
Water Availability Analysis

Main Help
Return Contact Us

Water Availability Analysis
Detailed Reports

PUDDING R > MOLALLA R - AB MILL CR
WILLAMETTE BASIN
Water Availability as of 3/21/2017

Watershed ID #: 151 (Map)
Date: 3/21/2017

Exceedance Level: 80%
Time: 9:24 AM

Water Availability Calculation | Consumptive Uses and Storages | Instream Flow Requirements | Reservations
Water Rights | Watershed Characteristics

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	1,040.00	124.00	916.00	0.00	36.00	880.00
FEB	1,180.00	114.00	1,070.00	0.00	36.00	1,030.00
MAR	1,010.00	75.70	934.00	0.00	36.00	898.00
APR	787.00	51.60	735.00	0.00	36.00	699.00
MAY	425.00	49.00	376.00	0.00	36.00	340.00
JUN	224.00	69.90	154.00	0.00	36.00	118.00
JUL	109.00	110.00	-1.00	0.00	36.00	-37.00
AUG	71.00	90.20	-19.20	0.00	36.00	-55.20
SEP	67.30	51.40	15.90	0.00	36.00	-20.10
OCT	91.60	11.00	80.60	0.00	36.00	44.60
NOV	363.00	48.30	315.00	0.00	36.00	279.00
DEC	957.00	118.00	839.00	0.00	36.00	803.00
ANN	706,000.00	55,100.00	651,000.00	0.00	26,100.00	627,000.00

SW2 (Senecal Creek)

Oregon Water Resources Department
Water Availability Analysis

Main Help
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Water Availability Analysis
Detailed Reports

MILL CR > PUDDING R - AT MOUTH
WILLAMETTE BASIN
Water Availability as of 3/21/2017

Watershed ID #: 30200901 (Map)
Date: 3/21/2017

Exceedance Level: 80%
Time: 9:32 AM

Water Availability Calculation | Consumptive Uses and Storages | Instream Flow Requirements | Reservations
Water Rights | Watershed Characteristics

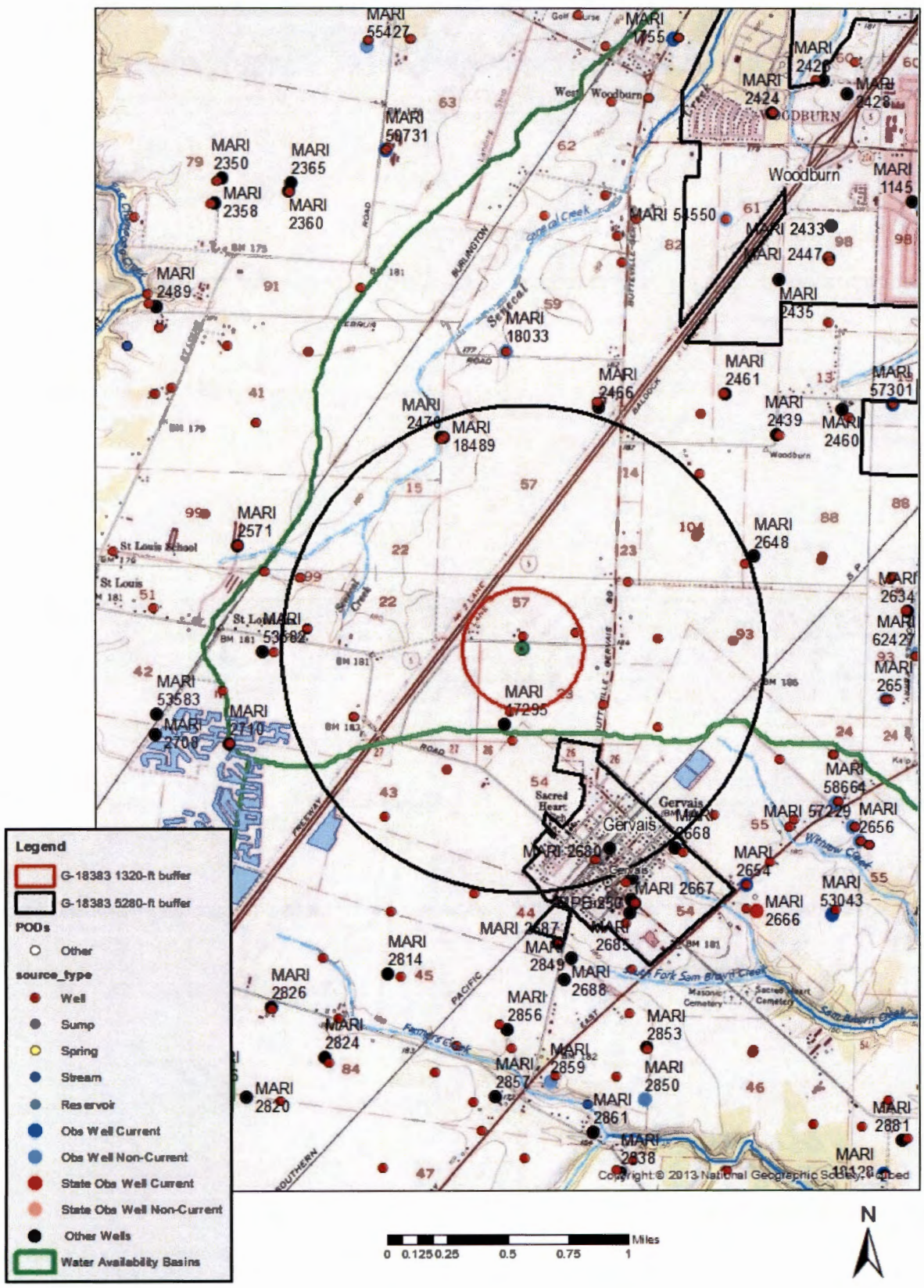
Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	39.20	9.81	29.40	0.00	0.00	29.40
FEB	53.90	9.97	43.90	0.00	0.00	43.90
MAR	38.40	9.51	28.90	0.00	0.00	28.90
APR	27.60	7.06	20.50	0.00	0.00	20.50
MAY	13.70	5.67	8.03	0.00	0.00	8.03
JUN	8.72	7.02	1.70	0.00	0.00	1.70
JUL	3.79	10.80	-6.98	0.00	0.00	-6.98
AUG	2.09	8.76	-6.67	0.00	0.00	-6.67
SEP	1.88	4.77	-2.89	0.00	0.00	-2.89
OCT	2.39	1.23	1.16	0.00	0.00	1.16
NOV	6.05	7.23	-1.18	0.00	0.00	-1.18
DEC	25.90	9.61	16.30	0.00	0.00	16.30
ANN	30,000.00	5,520.00	25,300.00	0.00	0.00	25,300.00

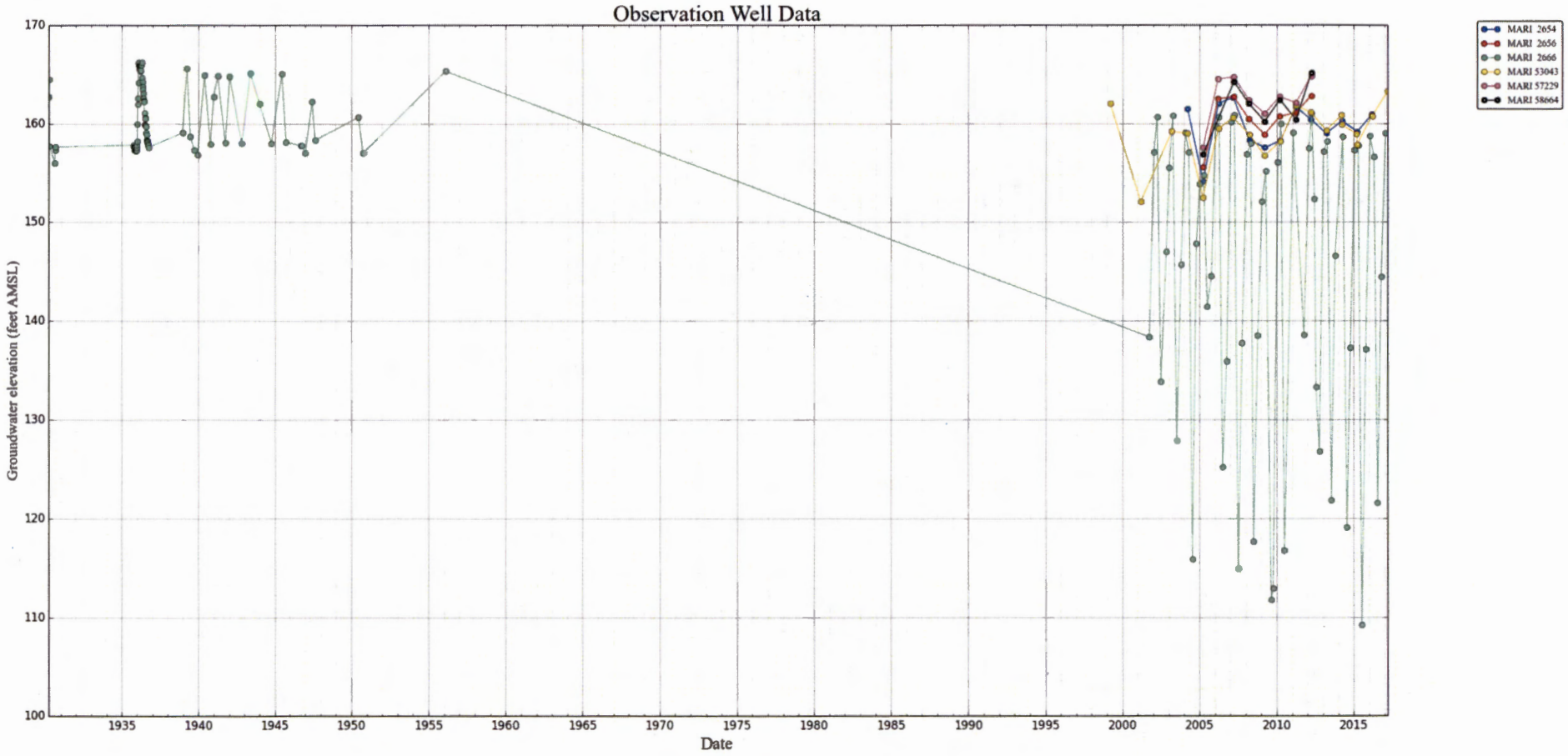
Well Location Map

Application G-18383, Baumgardner (T5S/R2W, S23)

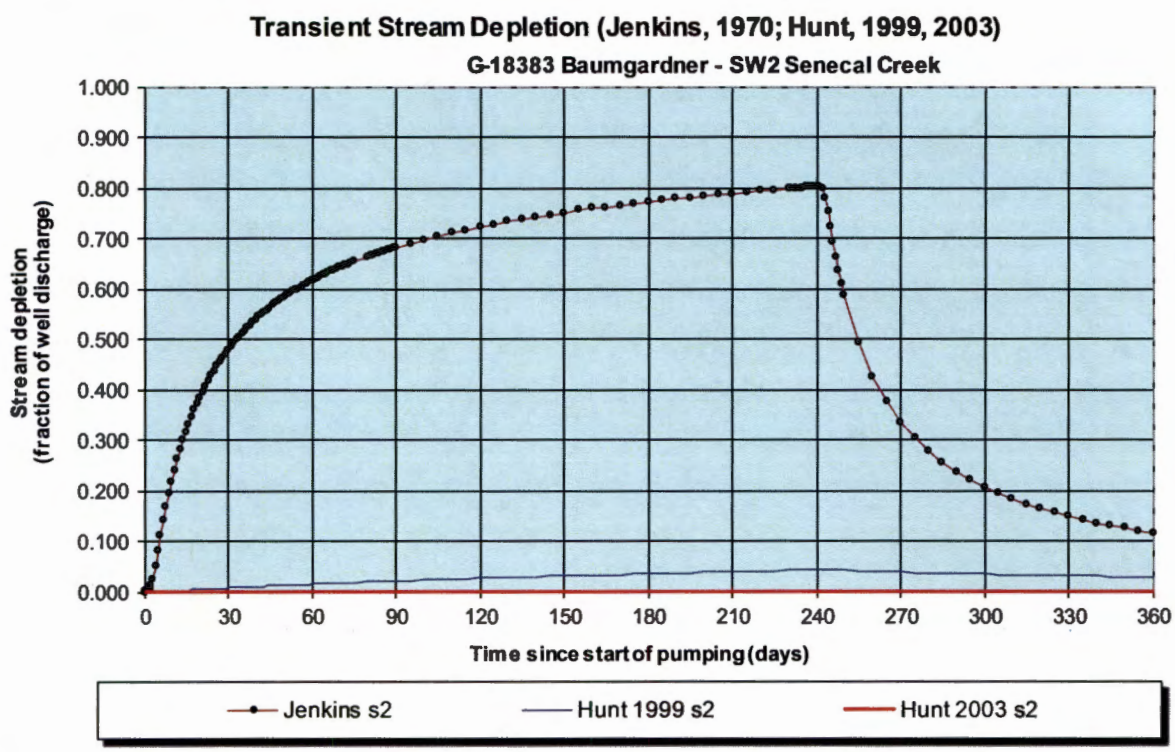


Version: 04/20/2015

Water-Level Trends in Nearby Wells – Static, Year-round



Stream Depletion Model Results



Output for Stream Depletion, Scenerio 2 (s2):						Time pump on (pumping duration) = 240 days						
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	47.8%	61.6%	68.2%	72.3%	75.1%	77.2%	78.8%	80.2%	33.5%	20.7%	14.9%	11.5%
H SD 1999	0.8%	1.5%	2.1%	2.6%	3.1%	3.5%	3.9%	4.3%	3.9%	3.4%	3.1%	2.9%
H SD 2003	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Qw, cfs	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290	1.290
H SD 99, cfs	0.010	0.019	0.027	0.034	0.040	0.046	0.051	0.055	0.050	0.044	0.040	0.037
H SD 03, cfs	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	1.29	1.29	1.29	cfs
Time pump on (pumping duration)	tpon	240	240	240	days
Perpendicular from well to stream	a	11000	11000	11000	ft
Well depth	d	170	170	170	ft
Aquifer hydraulic conductivity	K	50	100	500	ft/day
Aquifer saturated thickness	b	40	40	40	ft
Aquifer transmissivity	T	2000	4000	20000	ft*ft/day
Aquifer storativity or specific yield	S	0.001	0.001	0.001	
Aquitard vertical hydraulic conductivity	Kva	0.1	0.1	0.1	ft/day
Aquitard saturated thickness	ba	130	130	130	ft
Aquitard thickness below stream	babs	105	105	105	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	15	15	15	ft
Streambed conductance (lambda)	sbc	0.014286	0.014286	0.014286	ft/day
Stream depletion factor	sdf	60.500000	30.250000	6.050000	days
Streambed factor	sbf	0.078571	0.039286	0.007857	
input #1 for Hunt's Q_4 function	t'	0.016529	0.033058	0.165289	
input #2 for Hunt's Q_4 function	K'	46.538462	23.269231	4.653846	
input #3 for Hunt's Q_4 function	epsilon'	0.005000	0.005000	0.005000	
input #4 for Hunt's Q_4 function	lamda'	0.078571	0.039286	0.007857	