Groundwater Application Review Summary Form

Application # G- _18783 re-review_

GW Reviewer _Travis Brown_ Date Review Completed: _11/21/2022_

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 **_November 21, 2022_**

TO: **Application** G-**_18783 re-review_**

FROM: **GW:** **_Travis Brown_**
(Reviewer's Name)

SUBJECT: Scenic Waterway Interference Evaluation

☐ **YES**
☒ **NO** The source of appropriation is hydraulically connected to a State Scenic Waterway or its tributaries

☐ **YES**
☒ **NO** Use the Scenic Waterway Condition (Condition 7J)

☐ 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 _[Enter]_ 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 11/21/2022
FROM: Groundwater Section Travis Brown
Reviewer's Name
SUBJECT: Application G- 18783 Supersedes review of 4/11/2019
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: **David and Nancy McKinnon** County: **Marion**

A1. Applicant(s) seek(s) 1.114 cfs from 2 well(s) in the Willamette Basin, Molalla-Pudding subbasin

A2. Proposed use Nursery Seasonality: Year round

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	MARI 2625	1	Alluvium	1.114	5S/2W-23 NW-SE	1750' N, 15' E fr S1/4 cor S 23
2	MARI 2614	2	Alluvium	1.114	5S/2W-23 SW-SE	740' N, 54' E fr S1/4 cor S 23

* 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	~189		19	3/13/1967	132	0-20	0-132			30	16	Bailer
2	~189	71	45	6/19/1989	152	0-19	+3-152		135-151	500+		Air

Use data from application for proposed wells.

A4. **Comments:** The proposed POA are less than 0.5 miles north of the City of Gervais, Oregon.

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 proposed POA would produce water from a confined aquifer; therefore, per OAR 690-502-0240, the relevant Willamette Basin rules (OAR 690-502-0140) do not apply.

A6. ☐ **Well(s) #** _____ , _____ , _____ , _____ , _____ , tap(s) an aquifer limited by an administrative restriction.
Name of administrative area: **N/A**
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 (annual measurement condition), 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 proposed POA produce water from 22 to 36 ft of sand and gravel within the alluvial Willamette Aquifer, which is overlain by 110 to 120 ft of fine-grained sediment (the "Willamette Silt") (Gannett and Caldwell, 1998). Reported static water levels compared to reported "first water" in nearby wells indicate that the Willamette Aquifer is predominantly confined in this area (see Well Statistics – Section 23, attached).

POA 2 (MARI 2614) is already an authorized POA under Certificate 89507 (which is still in the name of Edward Drescher and has not yet been assigned to the Applicant). Under Certificate 89507, POA 2 (MARI 2614) may divert groundwater for irrigation at a maximum rate of 0.48 cfs (~215 gpm) up to 95 af/year. If the requested allocation per this application were approved, POA 2 (MARI 2614) would be able to legally divert at a total maximum rate of 1.594 cfs (~715 gpm) up to 270 af/year, based on the combined rate and duty proposed in this application and authorized in Certificate 89507. At its proposed legally permissible rate, MARI 2614 could therefore pump for ~85.5 days continuously before exceeding its maximum annual volume.

Potential injury to other nearby groundwater rights was analyzed using the Theis equation for drawdown in a confined aquifer (Theis, 1935). Hydraulic parameters used for the analysis were derived from regional data and studies (Pumping Test Reports, Conlon et al., 2003, 2005; Iverson, 2002; McFarland and Morgan, 1996; Woodward et al., 1998) or are within a typical range of values for the parameter within the hydrogeologic regime (Freeze and Cherry, 1979; Domenico and Mifflin, 1965). The nearest known groundwater right to the proposed POA is MARI 2633, approximately 1,275 ft southeast of POA 2 (MARI 2614) (see Well Location Map, attached). Assuming a continuous pumping rate of 1.594 cfs (~715 gpm) for 85.5 days (the most conservative pumping scenario) under the most likely hydraulic parameters, results using the Theis equation indicate that pumping of MARI 2614 is not anticipated to affect another groundwater right such that said right would not be able to divert water to which it is legally entitled (see Theis Drawdown Analysis, attached).

Recent water levels for nearby observation wells do not indicate persistent or widespread declines in the Willamette Aquifer in this area (see Hydrograph, attached). Reported yields for nearby wells range from 20 to 700 gpm, with a median yield of 150 gpm. Although the requested rate under this application (1.114 cfs / 500 gpm) combined with the authorized rate under

Certificate 89507 (0.48 cfs / ~215 gpm) would exceed the reported yield of both MARI 2625 (30 gpm) and MARI 2614 (500 gpm) and is significantly higher than the median yield in this area, it would not be much outside the range of reported yields. Based on the preponderance of evidence, it cannot be stated that the proposed use would exceed available capacity of the groundwater resource in this area.

The conditions specified in B1(d)(i) and B2(c) are recommended to protect senior users and the groundwater resource.

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**	☒	☐
2	**Alluvium**	☒	☐

Basis for aquifer confinement evaluation: Reported static water levels for the proposed POA are above the noted water-bearing zones and within the overlying fine-grained sediments, indicating confined conditions. Reported static water levels compared to reported "first water" in nearby wells indicate that the Willamette Aquifer is predominantly confined in this area (see Well Statistics – Section 23, attached).

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**	**~155**	**~7,645**	☒	☐	☐	☐	☒
2	**1**	**Sam Brown Creek**	**~145**	**~155**	**~6,840**	☒	☐	☐	☐	☒

Basis for aquifer hydraulic connection evaluation: The nearest identified surface water source to the proposed POA is Sam Brown Creek (SW 1). Estimated surface water elevation at the perennial headwater of SW 1 is below or less than 10 ft above the estimated groundwater elevation in the proposed POA (WatershedSciences, 2009; USGS, 2013). Water table mapping in this area indicates that groundwater in the alluvial Willamette Aquifer in this area flows toward and discharges into local streams incised into the French Prairie plateau, including SW 1 (Gannett and Caldwell, 1998; Conlon et al, 2005). The available evidence is therefore sufficient to conclude hydraulic connection between the alluvial Willamette Aquifer and SW 1.

Water Availability Basin (WAB) the well(s) are located within: POA: MILL CR > PUDDING R – AT MOUTH
SW 1: PUDDING R > MOLALLA R – AB MILL CR

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: No surface water sources were identified within 1 mile of the proposed POA.

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
2	**1**	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %
Well Q as CFS		0.242	0.242	0.438	0.438	0.438	0.438	0.438	0.438	0.438	0.438	0.242	0.242
Interference CFS		<0.002	<0.002	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.002	<0.002

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.		<0.002	<0.002	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.002	<0.002
(B) = 80 % Nat. Q		1,040	1,180	1,010	787	425	224	109	71	67.3	91.6	363	957
(C) = 1 % Nat. Q		10.4	11.8	10.1	7.87	4.25	2.24	1.09	0.71	0.673	0.916	3.63	9.57
(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: Stream depletion of SW 1 due to pumping of POA 2 (MARI 2614) – being the nearest proposed POA to SW 1 – was evaluated using the Hunt 2003 analytical stream depletion model (Hunt, 2003). Hydraulic parameters used for the analysis were derived from regional data and studies (Pumping Test Reports, Conlon et al., 2003, 2005; Iverson, 2002; McFarland and Morgan, 1996; Woodward et al., 1998) or are within a typical range of values for the parameter within the hydrogeologic regime (Freeze and Cherry, 1979; Domenico and Mifflin, 1965). The pumping rate was pro-rated based on the total permissible volume and season of use proposed in this application and authorized in Certificate 89507.

Based on the Hunt 2003 model results, the depletion of SW 1 due to pumping of POA 2 (MARI 2614) within one year of pumping is anticipated to be much less than 1 percent of the proposed pumping rate. The anticipated depletion is also much less than 1 percent of the stream discharge that is equaled or exceeded 80 percent of the time as estimated for the PUDDING R > MOLALLA R – AB MILL CR WAB, which encompasses SW 1 (Sam Brown Creek) (see Water Availability Tables, attached). The low proportional rate of depletion is likely due to the significant distance between the proposed POA and SW 1 as well as the substantial quantity of low-permeability, fine-grained sediment underlying the stream channel.

Although SW 1 is the nearest identified surface water source, the proposed POA are actually located within the MILL CR > PUDDING R – AT MOUTH WAB, which has a significantly lower estimated 80 percent exceedance stream discharge (as little as 1.88 cfs). However, the nearest surface water source within that WAB is Mill Creek, located much further (greater than 11,000 ft) away from the proposed POA and at a higher elevation than SW 1, meaning that even more low-permeability, fine-grained sediment underlies Mill Creek than SW 1. As such, the anticipated depletion of Mill Creek due to pumping of the proposed POA is even less than that anticipated for SW 1, which is already less than 1 percent of the stream discharge that is equaled or exceeded 80 percent of the time as estimated for the MILL CR > PUDDING R – AT MOUTH WAB (see Water Availability Tables, attached).

Based on the preponderance of evidence and analysis, the proposed use of groundwater detailed in this application is not anticipated to substantially interfere with nearby surface water sources.

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:** **Based on the preponderance of evidence and analysis, the proposed use of groundwater detailed in this application is not anticipated to substantially interfere with nearby surface water sources.**

References Used:

Application File: G-18783

Certificate 89507

Pumping Test Files: MARI 1901, 2437, 2614, 2634, 2651, 2655, 2656, 2659, 2681, 18489, 18805, 53043

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.

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.

Domenico, P.A. and Mifflin, 1965, Water from low-permeability sediments and land subsidence: Water Resource Research, v. 1, no. 4, p. 563-576.

Freeze, R.A. and Cherry, J.A., 1979, *Groundwater*, Prentice Hall, Englewood Cliffs, New Jersey, 604 p.

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., 1999, Unsteady Stream Depletion from Ground Water Pumping: Ground Water, January-February, Vol 37, p 98-102.

Hunt, B., 2003, Unsteady stream depletion when pumping from semiconfined aquifer: Journal of Hydrologic Engineering, January/February, Vol 8, p. 12-19.

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.

McFarland, W.D., and Morgan, D.S., 1996, Description of the Ground-Water Flow System in the Portland Basin, Oregon and Washington: U.S. Geological Survey Water Supply Paper 2470-A, 58 p.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, American Geophysical Union Transactions, vol. 16, p. 519-524.

United States Geological Survey, 2013, National Elevation Dataset (NED) [DEM geospatial data]. 1/9th arc-second, updated 2013.

United States Geological Survey, 2017, *Gervais quadrangle*, Oregon [map], 1:24,000, 7.5 minute topographic series, U.S. Department of the Interior, Reston, Virginia.

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.

Watershed Sciences, 2009, LIDAR remote sensing data collection, Department of Geology and Mineral Industries, Hood to Coast 2009, Portland, OR, May 27.

D. WELL CONSTRUCTION, OAR 690-200

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

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

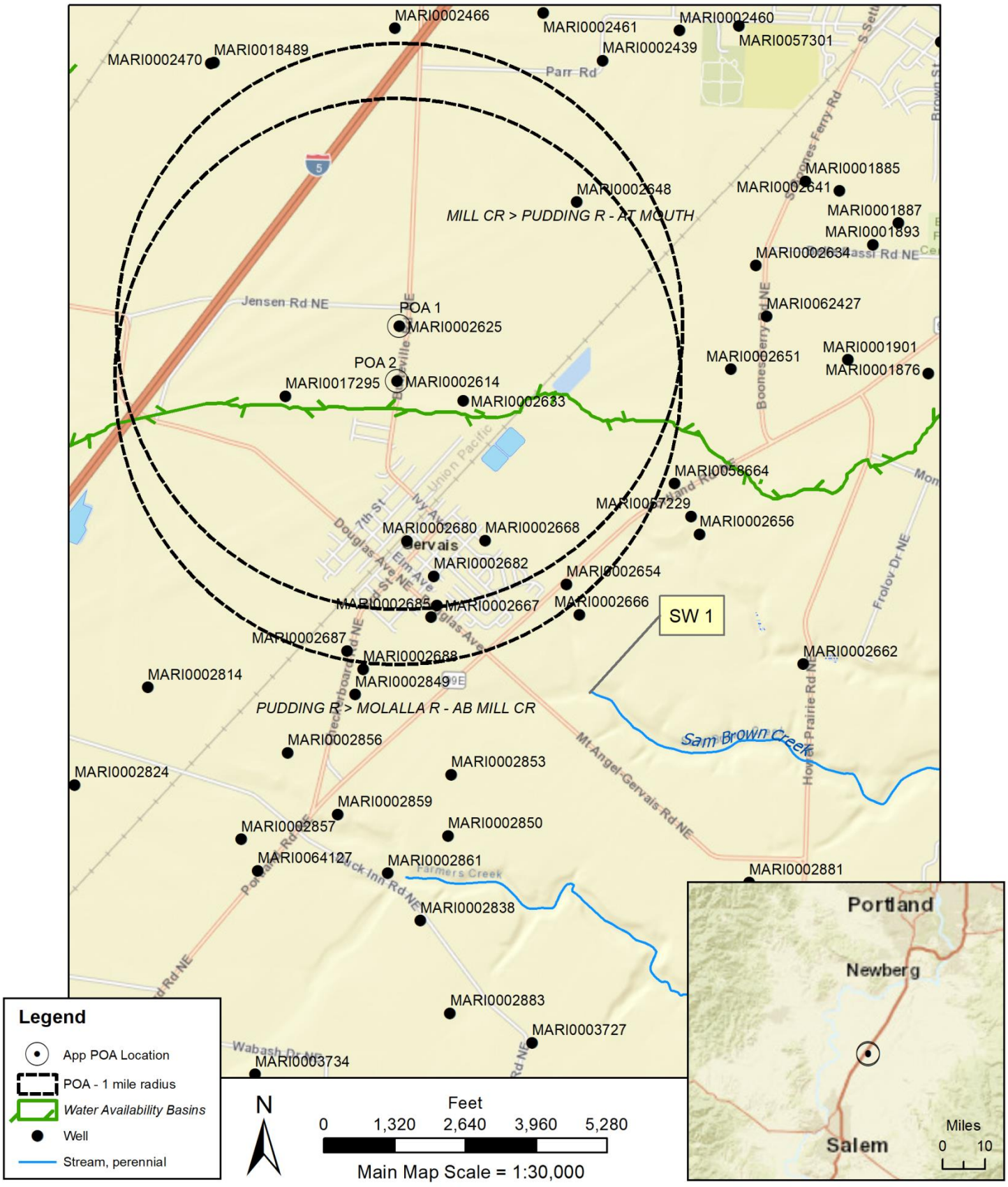
a. ☐ review of the well log;
b. ☐ field inspection by _____;
c. ☐ report of CWRE _____;
d. ☐ other: (specify) _____

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.**

Well Location Map

G-18783 McKinnon



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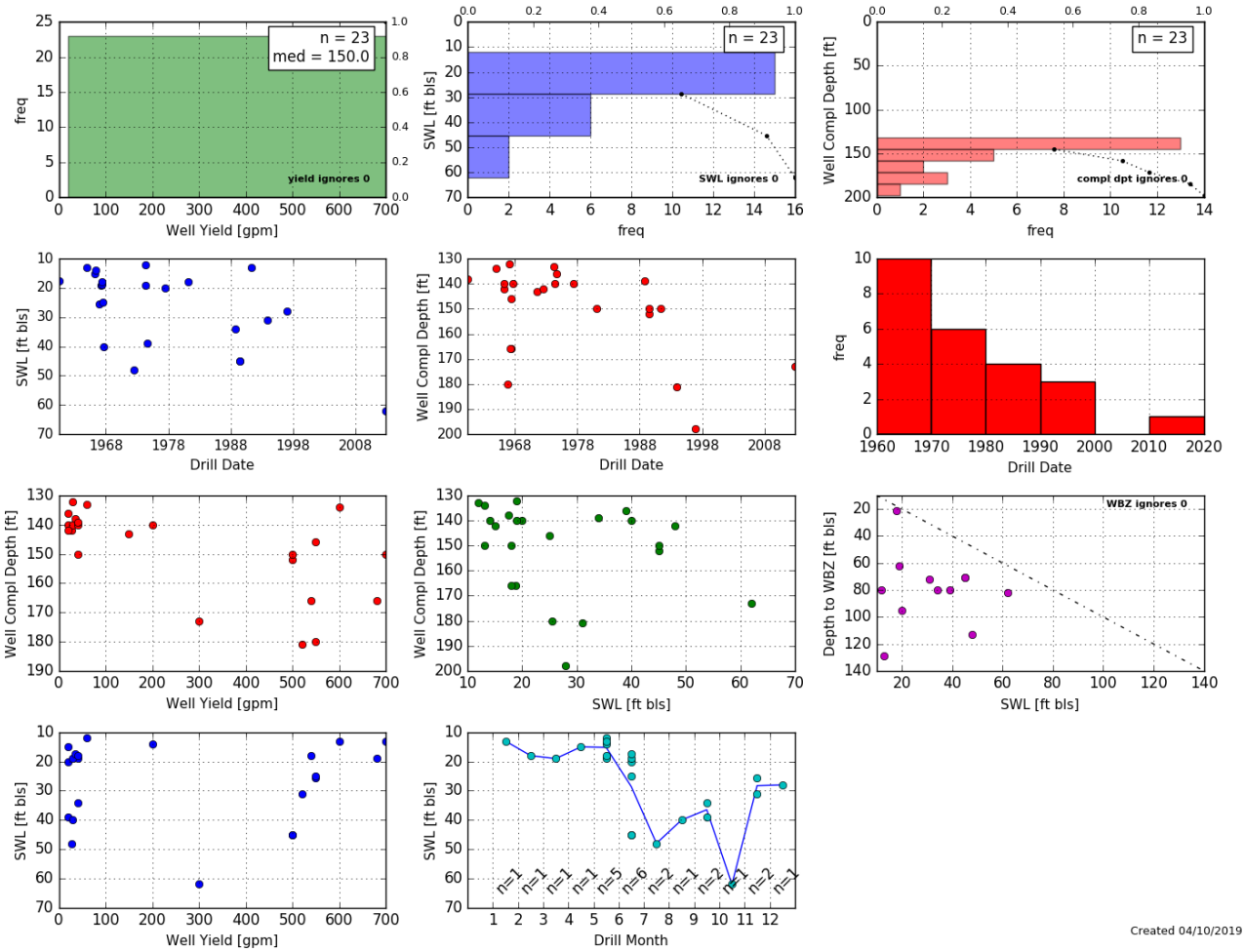
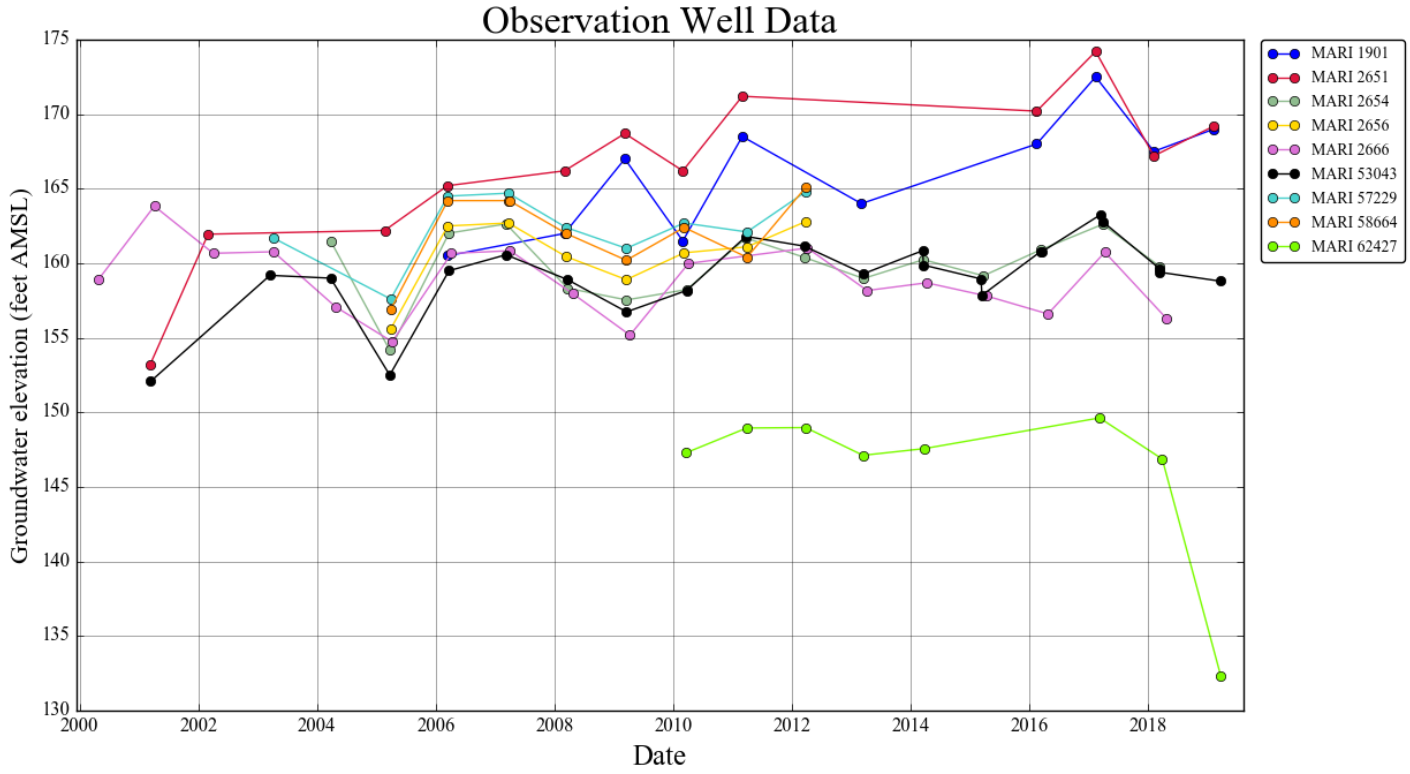
Well Statistics – Section 23



Hydrographs



Version: 05/07/2018

Water Availability Tables

Water Availability Analysis
Detailed Reports

PUDDING R > MOLALLA R - AB MILL CR
WILLAMETTE BASIN

Water Availability as of 4/11/2019

Watershed ID #: 151 (Map) Exceedance Level: 80%
Date: 4/11/2019 Time: 2:33 PM

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	49.40	376.00	0.00	36.00	340.00
JUN	224.00	70.90	153.00	0.00	36.00	117.00
JUL	109.00	112.00	-2.75	0.00	36.00	-38.70
AUG	71.00	91.60	-20.60	0.00	36.00	-56.60
SEP	67.30	52.10	15.20	0.00	36.00	-20.80
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	55,400.00	650,000.00	0.00	26,100.00	627,000.00

Water Availability Analysis
Detailed Reports

MILL CR > PUDDING R - AT MOUTH
WILLAMETTE BASIN

Water Availability as of 4/11/2019

Watershed ID #: 30200901 (Map) Exceedance Level: 80%
Date: 4/11/2019 Time: 2:33 PM

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	9.85	29.30	0.00	0.00	29.30
FEB	53.90	10.00	43.90	0.00	0.00	43.90
MAR	38.40	9.56	28.80	0.00	0.00	28.80
APR	27.60	7.13	20.50	0.00	0.00	20.50
MAY	13.70	5.68	8.02	0.00	0.00	8.02
JUN	8.72	6.93	1.79	0.00	0.00	1.79
JUL	3.79	10.60	-6.82	0.00	0.00	-6.82
AUG	2.09	8.63	-6.54	0.00	0.00	-6.54
SEP	1.88	4.71	-2.83	0.00	0.00	-2.83
OCT	2.39	1.24	1.15	0.00	0.00	1.15
NOV	6.05	7.24	-1.19	0.00	0.00	-1.19
DEC	25.90	9.66	16.20	0.00	0.00	16.20
ANN	30,000.00	5,500.00	25,300.00	0.00	0.00	25,300.00

Theis Drawdown Analysis

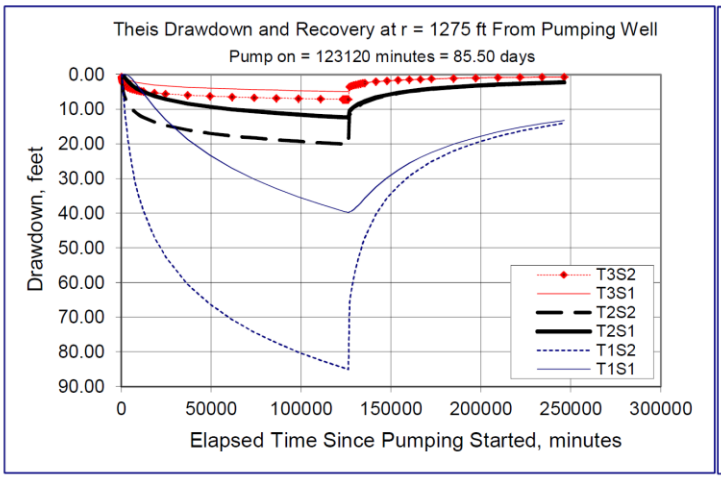
Theis Time-Drawdown Worksheet v.3.00

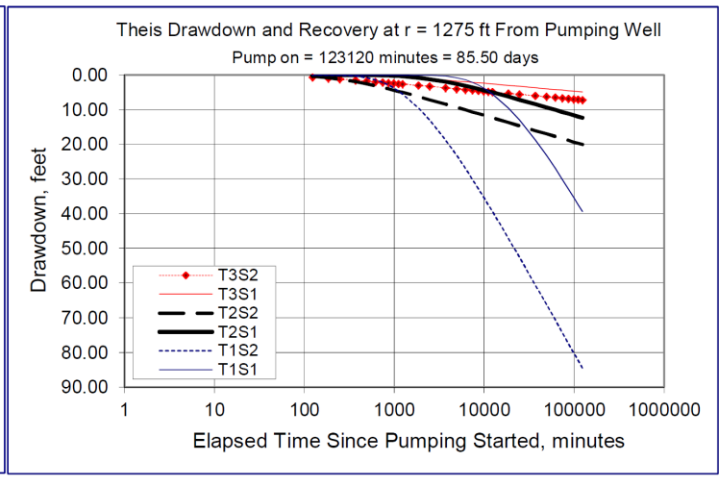
Calculates Theis nonequilibrium drawdown and recovery at any arbitrary radial distance, r, from a pumping well for 3 different T values and radial distance, r, from a pumping well for 3 different T values and 2 different S values.

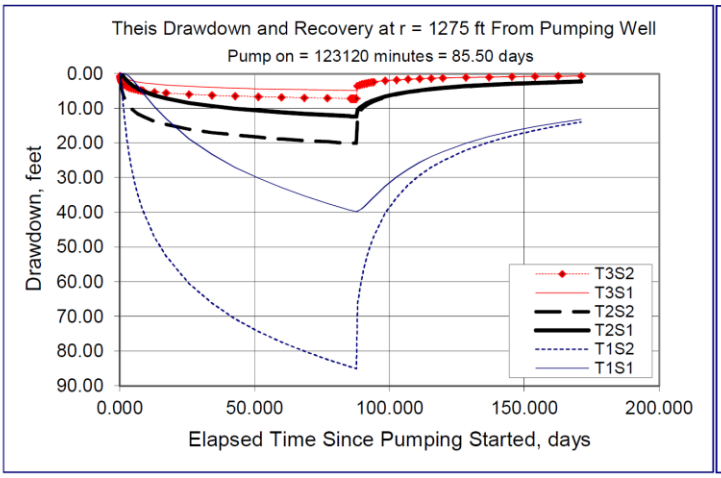
Written by Karl C. Wozniak September 1992. Last modified December 30, 2014

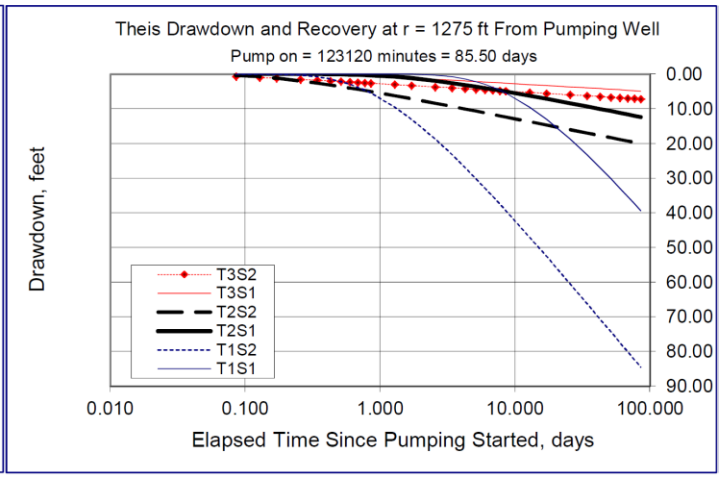
Input Data:	Var Name	Scenario 1	Scenario 2	Scenario 3	Units	
Total pumping time	t		85.5		d	
Radial distance from pumped well:	r		1275.00		ft	Q conversions
Pumping rate	Q		715.4		gpm	715.39 gpm
Hydraulic conductivity	K	14	81	275	ft/day	1.59 cfs
Aquifer thickness	b		40		ft	95.64 cfm
Storativity	S_1		0.01000			137,721.60 cfd
	S_2		0.00100			3.16 af/d
Transmissivity Conversions	T_f2pd	540	3,255	11,000	ft2/day	
	T_ft2pm	0.3750	2.2604	7.6389	ft2/min	
	T_gpdpft	4,039	24,347	82,280	gpd/ft	

Use the Recalculate button if recalculation is set to manual









Stream Depletion Analysis: POA 2 – SW 1

Application type:	G
Application number:	18783
Well number:	2
Stream Number:	1
Pumping rate (cfs):	0.242
Pumping duration (days):	365
Pumping start month number (3=March)	1

Parameter	Symbol	Scenario 1	Scenario 2	Scenario 3	Units
Distance from well to stream	a	6840	6840	6840	ft
Aquifer transmissivity	T	540	3255	11000	ft2/day
Aquifer storativity	S	0.15	0.1	0.05	-
Aquitard vertical hydraulic conductivity	Kva	0.01	0.05	0.1	ft/day
Aquitard saturated thickness	ba	90	90	90	ft
Aquitard thickness below stream	babs	85	85	85	ft
Aquitard specific yield	Sya	0.2	0.2	0.2	-
Stream width	ws	10	10	10	ft

Stream depletion for Scenario 2:

Days	10	30	60	90	120	150	180	210	240	270	300	330	360
Depletion (%)	0	0	0	0	0	0	0	0	0	0	0	0	0
Depletion (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00