Water Right Conditions Tracking Slip

Groundwater/Hydrology Section

FILE ## G-17500

ROUTED TO: Water Rights - Michele

TOWNSHIP/
RANGE-SECTION: 30S/46E - 10+15

CONDITIONS ATTACHED? [✓] yes [ ] no

REMARKS OR FURTHER INSTRUCTIONS:

Reviewer: Mike Zwart

WATER RESOURCES DEPARTMENT

MEMO November 18, 2011

TO: **Application G-**17500

FROM: **GW:** Mike Zwart
(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 Ground Water 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 Ground Water 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 Owyhee 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
0.081	0.088	0.085	0.082	0.081	0.080	0.081	0.082	0.083	0.083	0.083	0.081

PUBLIC INTEREST REVIEW FOR GROUND WATER APPLICATIONS

TO: Water Rights Section Date **November 18, 2011**

FROM: Ground Water/Hydrology Section **Michael Zwart**
Reviewer's Name

SUBJECT: Application G- **17500** 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 ground water 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: **Brock Obendorf** County: **Malheur**

A1. Applicant(s) seek(s) **10.0** cfs from **3** well(s) in the **Owyhee** Basin, **Jordan Creek** subbasin Quad Map: **Jordan Valley**

A2. Proposed use: **Irrigation, 229.3 (P), 797 (S)** Seasonality: **April 1 to 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**	**Obendorf #1**	**Alluvium**	**10.027**	**30S/46E-15 NW-NE**	**500' S, 1850' W fr NE cor S 15**
2	**MALH 2428**	**Jaca #1**	**Alluvium**	**5.125**	**30S/46E-15 SE-SE**	**300' N, 140' W fr SE cor S 15**
3	**MALH 2426**	**Jaca #5**	**Alluvium**	**4.713**	**30S/46E-10 SW-SW**	**1290' N, 6500' E fr SW cor S 9**
4						
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	**4386**				**400**	**0-20**	**0-400**	**None**	**100-400**			
2	**4397**		**25**	**8/15/66**	**420**	**0-20**	**0-420**	**None**	**100-410**	**4100**	**104**	**P**
3	**4369**		**2.75**	**10/11/05**	**420**	**None**	**0-244**	**None**	**None**			

Use data from application for proposed wells.

A4. **Comments: MALH 2426 is State Observation Well #593 (not current). Well log reports no surface seal was provided.**

A5. ☒ **Provisions of the Owyhee** Basin rules relative to the development, classification and/or management of ground water hydraulically connected to surface water ☐ **are**, *or* ☒ **are not**, activated by this application. (Not all basin rules contain such provisions.)
Comments: _____

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

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

B1. **Based upon available data,** I have determined that ground water* 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 ground water 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 ground water 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 ground water resource; or

d. ☒ **will, if properly conditioned**, avoid injury to existing ground water rights or to the ground water resource:
   i. ☒ The permit should contain condition #(s) 7N;
   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 ground water production from no deeper than _____ ft. below land surface;

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

c. ☐ **Condition** to allow ground water production only from the _____ ground water 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 Ground Water 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. **Ground water availability remarks: MALH 2426 is former SOW #593. It displayed stable water levels during the entire period of record, which ended in 2005.**

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

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

Well	Aquifer or Proposed Aquifer	Confined	Unconfined
All	**Interbedded sand, gravel and clay**	☐	☒
		☐	☐
		☐	☐
		☐	☐
		☐	☐

Basis for aquifer confinement evaluation: **The water-bearing zones may be semiconfined to confined at greater depth, but the existing older well logs report no water-bearing zones and no differing water levels as drilling progressed.**

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**	**Jordan Creek**	**4370±**	**4362**	**6100**	☒	☐	☐	☐	☒
2	**1**	**Jordan Creek**	**4372±**	**4372**	**10500**	☒	☐	☐	☐	☒
3	**1**	**Jordan Creek**	**4365±**	**4358**	**4500**	☒	☐	☐	☐	☒
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation: **The wells are much closer to Sheep Spring Creek, but Watermaster Ron Jacobs recommends that this creek not be considered a surface water source for Division 9 reviews (email attached) due to intermittent flow, usually only in early spring. The wells effectively develop all water-bearing zones penetrated.**

Water Availability Basin the well(s) are located within: **Owyhee R > Snake R at mouth (31111001).**

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?
3	**1**	☐	☐			☐	**156**	☒		☒
		☐	☐			☐	**(Oct.)**	☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐

Application G-17500 continued Date: November 18, 2011

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:

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: **This section applies for wells 1 and 2. However, it is very unlikely that calculated interference after one irrigation season will be greater than 1% of the natural flow of the Owyhee River (156 cfs in October). Therefore, no calculations were made. The lack of a Water Availability Basin for Jordan Creek is problematic because natural flows there must be much less than for the Owyhee River and, if calculations were possible, they likely would disclose much greater than 1% interference.**

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 ground water use under this permit can be regulated if it is found to substantially interfere with surface water:

i. ☒ The permit should contain condition #(s) **7J**;

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

C6. **SW / GW Remarks and Conditions** **Note that the Scenic Waterway form includes calculations of interference with surface water and the results should be forwarded to staff in Hydrographics.**

References Used: **Regional geologic maps; local well logs; nearby reviews, especially file G-16654.**

Application G-17500 continued Date: November 18, 2011

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** 3 **Logid:** MALH 2426

D2. **THE WELL does not 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**:

a. ☒ constitutes a health threat under Division 200 rules;
b. ☐ commingles water from more than one ground water reservoir;
c. ☐ permits the loss of artesian head;
d. ☐ permits the de-watering of one or more ground water reservoirs;
e. ☐ other: (specify) _____

D4. **THE WELL construction deficiency is described as follows:** There is no surface seal provided.

D5. **THE WELL**

a. ☐ **was**, *or* ☐ **was not** constructed according to the standards in effect at the time of original construction or most recent modification.

b. ☒ I don't know if it met standards at the time of construction.

D6. ☒ **Route to the Enforcement Section.** I recommend withholding issuance of the permit until evidence of well reconstruction is filed with the Department and approved by the Enforcement Section and the Ground Water Section.

THIS SECTION TO BE COMPLETED BY ENFORCEMENT PERSONNEL

D7. ☐ Well construction deficiency has been corrected by the following actions: _____

_____, 200____.
(Enforcement Section Signature)

D8. ☐ **Route to Water Rights Section (attach well reconstruction logs to this page).**

Mike Zwart

From: Ron Jacobs
Sent: Thursday, November 17, 2011 2:52 PM
To: Mike Zwart
Subject: RE: Application G-17500, Obendorf

Mike,

Sheep Spring Creek is a intermittent stream, just runs in early spring from snow melt. Jordan Creek is a viable surface water sources.

Ron

-----Original Message-----
From: Mike Zwart
Sent: Wednesday, November 16, 2011 4:31 PM
To: Ron Jacobs
Subject: Application G-17500, Obendorf

Ron,

This is a large (10 cfs) filing near Jordan Valley and the wells are within one mile of Sheep Spring and/or Jordan Creek (mainstems). I need to know if you consider these to be viable surface water sources during the irrigation season. The only nearby application recently reviewed here was near Hooker Creek and the trib. to that creek was one you considered to be dry. I suspect that in this case you will consider the mainstem creeks as flowing most or a portion of the irrigation season, but I thought that it would be a good idea to check first. Thanks.

Mike Zwart

Michael J. Zwart, Hydrogeologist
Technical Services Division
725 Summer Street NE, Suite A
Salem, OR 97301
Direct Line: 503-986-0844 Fax: 503-986-0902
mike.j.zwart@wrd.state.or.us

Water Availability Analysis

OWYHEE R > SNAKE R - AT MOUTH
OWYHEE BASIN
Water Availability as of 11/16/2011

Watershed ID #: 31111001
Date: 11/16/2011

Exceedance Level: 80%
Time: 10:29 AM

Water Availability

Select any Watershed for Details

Nesting Order	Watershed ID #	Stream Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sto
1	31111001	OWYHEE R> SNAKE R- AT MOUTH	No	No	No	No	No	No	No	No	No	No	No	No	Yes

Limiting Watersheds

Monthly Streamflows in Cubic Feet per Second
Storage at 50% Exceedance in Acre-Feet

Month	Limiting Watershed ID #	Stream Name	Water Available?	Net Water Available
JAN	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-450.00
FEB	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-532.00
MAR	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-1,090.00
APR	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-849.00
MAY	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-1,100.00
JUN	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-1,370.00
JUL	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-1,200.00
AUG	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-1,080.00
SEP	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-705.00
OCT	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-304.00
NOV	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-164.00
DEC	31111001	OWYHEE R > SNAKE R - AT MOUTH	No	-266.00
ANN	31111001	OWYHEE R > SNAKE R - AT MOUTH	Yes	45,800.00

Detailed Reports for Watershed ID #31111001

OWYHEE R > SNAKE R - AT MOUTH
OWYHEE BASIN
Water Availability as of 11/16/2011

Watershed ID #: 31111001
Date: 11/16/2011

Exceedance Level: 80%
Time: 10:29 AM

Water Availability Calculation

Monthly Streamflows in Cubic Feet per Second
Storage 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	264.00	714.00	-450.00	0.00	0.00	-450.00
FEB	636.00	1,090.00	-453.00	79.40	0.00	-532.00
MAR	736.00	1,440.00	-707.00	380.00	0.00	-1,090.00
APR	1,360.00	1,750.00	-390.00	459.00	0.00	-849.00
MAY	1,190.00	2,210.00	-1,020.00	79.20	0.00	-1,100.00
JUN	518.00	1,890.00	-1,370.00	0.00	0.00	-1,370.00
JUL	298.00	1,500.00	-1,200.00	0.00	0.00	-1,200.00
AUG	230.00	1,310.00	-1,080.00	0.00	0.00	-1,080.00
SEP	170.00	875.00	-705.00	0.00	0.00	-705.00
OCT	156.00	460.00	-304.00	0.00	0.00	-304.00
NOV	232.00	396.00	-164.00	0.00	0.00	-164.00
DEC	303.00	569.00	-266.00	0.00	0.00	-266.00
ANN	694,000.00	857,000.00	106,000.00	60,000.00	0.00	45,800.00

Detailed Report of Consumptive Uses and Storage

Consumptive Uses and Storages in Cubic Feet per Second

Month	Storage	Irrigation	Municipal	Industrial	Commercial	Domestic	Agricultural	Other	Total
JAN	711.00	1.90	0.00	0.00	0.00	0.13	0.65	0.05	714.00
FEB	1,090.00	2.12	0.00	0.00	0.00	0.13	0.65	0.05	1,090.00
MAR	1,430.00	16.40	0.00	0.00	0.00	0.13	0.65	0.05	1,440.00
APR	977.00	772.00	0.00	0.00	0.00	0.13	0.65	0.05	1,750.00
MAY	382.00	1,830.00	0.00	0.00	0.00	0.13	0.65	0.00	2,210.00
JUN	181.00	1,700.00	0.00	0.00	0.00	0.13	0.65	0.00	1,890.00
JUL	52.90	1,450.00	0.00	0.00	0.00	0.13	0.65	0.00	1,500.00
AUG	39.50	1,270.00	0.00	0.00	0.00	0.13	0.65	0.00	1,310.00
SEP	29.60	844.00	0.00	0.00	0.00	0.13	0.65	0.00	875.00
OCT	145.00	315.00	0.00	0.00	0.00	0.13	0.65	0.00	460.00
NOV	389.00	5.62	0.00	0.00	0.00	0.13	0.65	0.05	396.00
DEC	565.00	2.58	0.00	0.00	0.00	0.13	0.65	0.05	569.00

Detailed Report of Reservations for Storage and Consumptive Uses

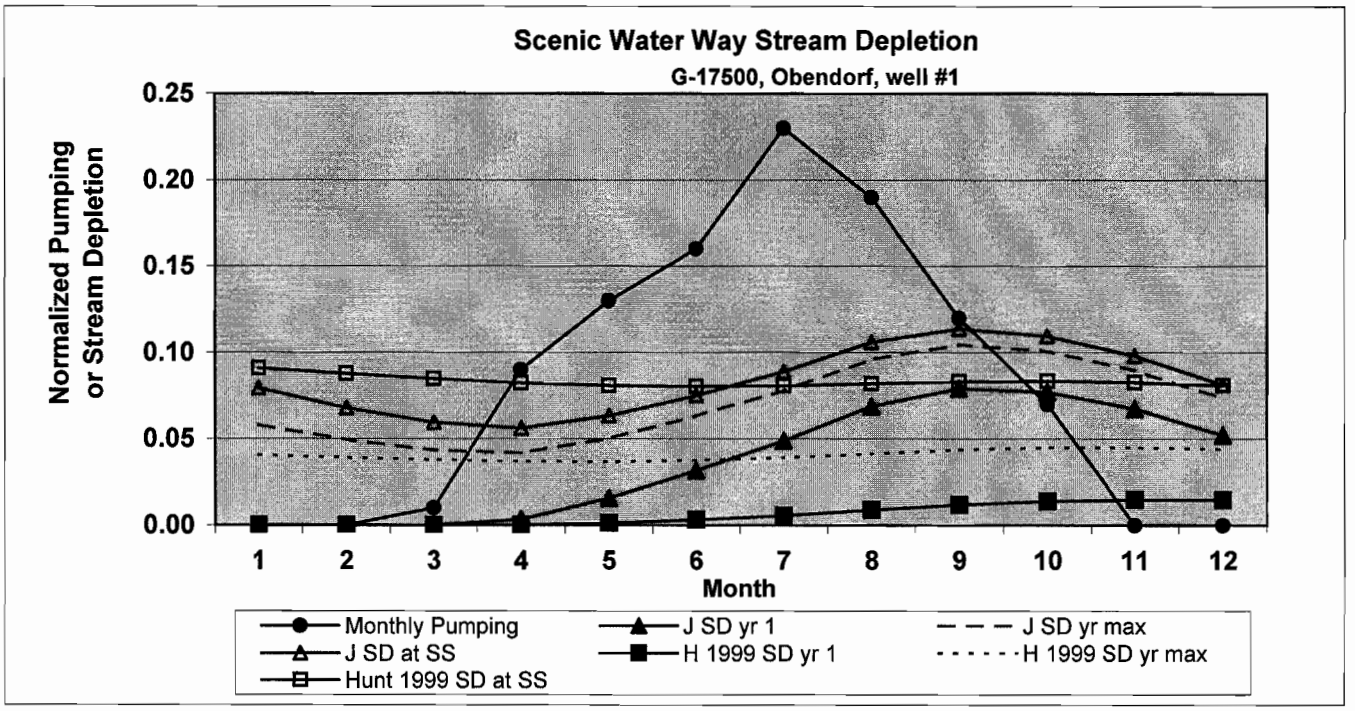
Reserved Streamflow in Cubic Feet per Second

Application #	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RN81101A	0.00	79.40	380.00	459.00	79.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**0.00**	**79.40**	**380.00**	**459.00**	**79.20**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

No instream flow requirements were found for this watershed.



Region	27	Steady state stream depletion as a fraction of pumping normalized to crop water use consumption.											
Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Resid
Qw	0.00	0.00	0.01	0.09	0.13	0.16	0.23	0.19	0.12	0.07	0.00	0.00	0.00
Jenkins SD													
yr1	0.000	0.000	0.000	0.003	0.016	0.032	0.049	0.069	0.079	0.077	0.067	0.052	0.555
yrmax-1	0.058	0.049	0.043	0.042	0.051	0.063	0.078	0.096	0.105	0.101	0.090	0.074	0.150
yrmax	0.058	0.049	0.043	0.042	0.051	0.063	0.078	0.096	0.105	0.101	0.090	0.074	0.150
yrmax-yr1	0.058	0.049	0.043	0.038	0.035	0.032	0.029	0.027	0.025	0.024	0.022	0.021	0.405
J SD SS	**0.080**	**0.068**	**0.060**	**0.056**	**0.063**	**0.075**	**0.089**	**0.106**	**0.114**	**0.110**	**0.098**	**0.081**	**0.000**
Hunt SD 1999													
yr 1	0.000	0.000	0.000	0.000	0.001	0.003	0.006	0.009	0.012	0.014	0.015	0.015	0.926
yr max-1	0.041	0.039	0.038	0.037	0.037	0.038	0.039	0.041	0.044	0.045	0.045	0.044	0.513
yr max	0.041	0.039	0.038	0.037	0.037	0.038	0.039	0.041	0.044	0.045	0.045	0.044	0.513
yrmax-yr1	0.041	0.039	0.038	0.037	0.036	0.034	0.034	0.033	0.032	0.031	0.030	0.030	0.413
H99 SD SS	**0.091**	**0.088**	**0.085**	**0.082**	**0.081**	**0.080**	**0.081**	**0.082**	**0.083**	**0.083**	**0.083**	**0.081**	**0.000**

Parameters:		Values	Units	
Maximum number of years pumped	yrmax	25	years	
Days pumped each month	tpoff	30.4375	days/month	
Perpendicular from well to stream	a	6100	ft	
Well depth	d	400	ft	
Aquifer hydraulic conductivity	K	40	ft/day	
Aquifer saturated thickness	b	500	ft	
Aquifer transmissivity	T_ft	20,000	ft*ft/day	= K*b
Aquifer transmissivity	T_gal	149,600	gpd/ft	= K*b
Aquifer storativity or specific yield	S	0.1		
Streambed conductivity (Hunt 1999)	Ks	0.4	ft/day	
Streambed thickness, Hunt 1999	bs	5	ft	
Stream width (Hunt 1999)	ws	20	ft	
Streambed conductance (lambda)	sbc	1.6000	ft/day	= Ks*ws/bs
Stream depletion factor	sdf	186.0500	days	= (a^2*S)/(T)
Streambed factor	sbf	0.4880		= sbc*a/T

Application G-17500, Brock Obendorf