WATER RESOURCES DEPARTMENT MEMO **17 November 2014**

TO: **Application G- 17914**

FROM: **Gerald H. Grondin - Groundwater Section**

SUBJECT: **Scenic Waterway Interference Evaluation**

☐ YES

☒ NO

The source of appropriation is within or above a Scenic Waterway

☐ YES

☒ NO

Use the Scenic Waterway condition (condition 7J)

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

☒ Per ORS 390.835, the Groundwater Section is unable to calculate groundwater 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 flows necessary to maintain the free-flowing character of a scenic waterway.

DISTRIBUTION OF INTERFERENCE

Calculate interference as the monthly fraction of the annual consumptive use and fill in the table below. If interference cannot be calculated, per criteria in 390.839, do not fill in the table but check the "unable" option above, thus informing the Water Rights Section that the Department is unable to make a Preponderance of Evidence finding.

Exercise of this permit is calculated to reduce monthly flows in the _____ Scenic Waterway by the following amounts, expressed as a proportion of the annual consumptive use pumped from the well.

Monthly Fraction of Annual Consumptive Use

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

Application: G-17914 **Date:** 17 November 2014

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date 17 November 2014

FROM: Groundwater Section **Gerald H. Grondin**
Reviewer's Name

SUBJECT: Application G- **17914** 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: **D. Jack Flynn** County: **Lake**

A1. Applicant(s) seek(s) **(500 gpm) 1.11** cfs from **1** well(s) in the **Goose & Summer Lakes** Basin, **Warner Lakes** subbasin Quad Map: **Plush**

A2. Proposed use **irrigation (81.3 primary acres)** Seasonality: **1 March to 31 October (245 days)**

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	Not Drilled Yet	Well 1	Basalt	1.11	36S/24E-sec 21 DBB	2639'N, 3032'E fr SW cor S 21
2						
3						

* 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	4500	N.A.	N.A.	N.A.	Est 400	Est 0-157	Est 0-157	?	?	Est 500	N.A.	N.A.

Use data from application for proposed wells.

A4. **Comments:**

The well is not drilled yet.

The application requests a total maximum pumping rate of 1.11 cfs (500 gpm) which is greater than typically allowed for 81.3 acres (1.02 cfs = 456 gpm).

The annual total volume requested (243 ac-ft) is slightly less than typically allowed for 81.3 acres (243.9 ac-ft).

The proposed aquifer is "mostly basalt." The predominantly basalt-volcanic rocks and sediment unit occurs beneath the predominantly basin-fill sediment unit in the valley. This review recommends obtaining groundwater solely from the predominantly basalt-volcanic rocks and sediment unit by constructing the proposed POA well to have continuous casing and continuous seal from land surface through the entire thickness of the predominantly basin-fill sediment unit and into the predominantly basalt-volcanic rocks and sediment unit. See recommended permit conditions in later sections of this review.

Application: G-17914 **Date:** 17 November 2014

A5. ☐ **Provisions of the** in general OAR 690-513; particularly OAR 690-513-0040 (Warner Lakes sub-basin) 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: The proposed POA well is near, but outside the mapped Honey Creek drainage.

A6. ☐ **Well(s) #** N.A. , _____ , _____ , _____ , _____ , tap(s) an aquifer limited by an administrative restriction.
Name of administrative area: _____
Comments: Currently, there is no administrative area.

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) 7B, 7F, 7N, 7P, 7T and special condition;
   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): _____

Application: G-17914 Date: 17 November 2014

B3. Ground water availability remarks:

The state observation wells with long term data (early 1960s to 2013) closest to the proposed POA well is state observation well 377 (well LAKE 1886) located in T36S/R24E-sec 33 abb. LAKE 1886 is about 1.6 miles south of the proposed POA well. The water level data shows long term climate influences as well as annual seasonal influences. Before the 1990s, peak annual groundwater levels were generally between 15 and 17 feet below land surface at LAKE 1886. After 1990, the peak annual groundwater level has often been from 17 to 19 feet below land surface at the well. Climate may be partly to entirely responsible for the lower annual peak levels after 1990. Ongoing groundwater level measurements will help that determination.

If a permit is issued, the following conditions should be included: 7B, 7F, 7N, 7P, 7T and special condition

7B is an interference condition

7F is a well location condition

7N is a groundwater level measurement and groundwater level decline condition

7P is a well tag condition

7T is a dedicated measuring tube condition

The "large" water use condition: (require a totalizing flow meter at each well. Each flow meter shall be located within 50 feet of the wellhead and adjacent to each flow meter shall be a clearly visible monument with a sign noting the flow meter. Lastly, require for every flow meter the reading, recording (monthly at minimum), and annual reporting of the flow meter data, all flow meters).

Special Condition for groundwater production: "All POA wells under this permit shall comply with existing well construction standards. Groundwater production shall occur from the predominantly basalt unit below the predominantly basin fill unit by continuous casing and continuous seal through the predominantly basin fill unit and into the predominantly basalt unit."

Application: G-17914 Date: 17 November 2014

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
1	**Basalt (as required by permit condition)**	☐	☒
		☐	☐
		☐	☐

Basis for aquifer confinement evaluation:

Walker (1973) and Walker and Repenning (1965) respectively map the surface geology at the proposed POA well as Qal (alluvial deposits: unconsolidated fluviatile gravel, sand and silt) and QTs (sedimentary deposits: lacustrine, fluviatile, and aeolian sedimentary rocks, interstratified tuff, ashy diatomite and unconsolidated clay, sand, and gravel). Basalt (Tb) is exposed in the nearby uplands west of the well.

The groundwater system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement. Generally, lower transmissivity (lower permeability) predominantly basin-fill sediment unit of varying thickness overlies higher transmissivity (higher permeability) predominantly basalt-volcanic rocks and sediment unit. Groundwater occurs in both the predominantly basin-fill sediment unit and the predominantly basalt unit. Groundwater is vertically connected within each unit and between each unit. This is based upon investigations by Sammel and Craig (1981) for Warner Valley, Morgan (1988) for Goose Lake Valley and Miller (1984 and 1986) for the Fort Rock and Christmas Valley area. Sammel and Craig (1981) particularly note the similarity of the hydrogeology in the Warner lakes Valley to the Klamath Basin.

The predominant basin-fill sediment unit thickness can vary. For example, the depth to the top of the predominantly basalt unit is about 75 feet at nearby LAKE 1839 located 1.1 miles northwest of the proposed POA; the depth to the top of the predominantly basalt unit is about 150 feet at well LAKE 1886 located about 1.5 miles south of the proposed POA well.

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	**Honey Creek**	**4475**	**4500**	**5610**	☒	☐	☐	☐	☒
1	2	**Hart Lake**	**4475**	**4473**	**7640**	☒	☐	☐	☐	☒
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation:

Available reports indicate groundwater and surface water are connected in the Warner lakes Valley, and groundwater flows from south to north in the valley.

The distance to Honey Creek is to the perennial flow portion of the creek.

Water Availability Basin the well(s) are located within: HONEY CR > HART L – AT MOUTH

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:

There is no analysis in this section given the proposed POA is more than one-mile from Honey Creek and Hart Lake.

Application: G-17914 **Date:** 17 November 2014

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	**1**	**0.6 %**	**0.6 %**	**0.0 %**	**0.1 %**	**0.1 %**	**0.2 %**	**0.2 %**	**0.3 %**	**0.4 %**	**0.4 %**	**0.5 %**	**0.5 %**
Well Q as CFS		**0.00**	**0.00**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.00**	**0.00**
Interference CFS		**0.003**	**0.003**	**0.000**	**0.000**	**0.001**	**0.001**	**0.001**	**0.001**	**0.002**	**0.002**	**0.002**	**0.003**
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													
(A) = Total Interf.		**0.003**	**0.003**	**0.000**	**0.000**	**0.001**	**0.001**	**0.001**	**0.001**	**0.002**	**0.002**	**0.002**	**0.003**
(B) = 80 % Nat. Q		**5.06**	**6.64**	**12.60**	**41.50**	**53.80**	**26.80**	**4.32**	**2.27**	**2.07**	**2.14**	**3.01**	**3.74**
(C) = 1 % Nat. Q		**0.0506**	**0.0664**	**0.1260**	**0.4150**	**0.5380**	**0.2680**	**0.0432**	**0.0227**	**0.0207**	**0.0214**	**0.0301**	**0.0374**
(D) = (A) > (C)		**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
(E) = (A / B) x 100		**0.059**	**0.045**	**0.000**	**0.000**	**0.002**	**0.004**	**0.023**	**0.044**	**0.097**	**0.093**	**0.066**	**0.080**

(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:

Analysis is done in this section given the proposed POA well is more than 1.0 mile from Honey Creek and Hart Lake.

The Table above was used for interference with Honey Creek only given it is the water body in the area with water availability data.

A pro-rated pumping rate of 0.50 cfs (224.4 gpm) was used for the pumping rate. The pro-rated rate is the maximum annual volume of water allowed (477.6 ac-ft) divided the total time (245 days). This distributes the pumping over the entire proposed irrigation season. The results of 0.00% and 0.000 cfs indicate the calculated interference was less than 0.0005 cfs.

Hunt (2003) was used to calculate the interference:

Used pro-rated pumping rate = 0.50 cfs (224.4 gpm),
Used aquifer transmissivity = 8,300 ft2/day based on specific capacity of LAKE 1779, LAKE 1825, LAKE 1839, & LAKE 4070. The value is within the range noted by Sammel and Craig (1981)
Used, an intermediate storage coefficient = 0.001
Used, sediment hydraulic conductivity Kv = 1.00 ft/day (based well LAKE 4281)
Used sediment thickness below creek = 150 feet (based on LAKE 1886 near Honey Creek)
Used stream width = 20 feet.

The Theis equation (Theis, 1935) was used to calculate the groundwater level drawdown at Hart Lake using the same values above. The calculated drawdowns are 0.96 feet 1.81 feet at the end of 30 and 245 days respectively of pro-rated pumping (0.50 cfs = 224.4 gpm) and 2.14 feet and 4.03 feet at the end of 30 and 245 days respectively of continuous pumping at the maximum requested rate (1.11 cfs = 500 gpm).

Application: G-17914 Date: 17 November 2014

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) **7B, 7F, 7N, 7P, 7T and special condition**;

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

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

The groundwater system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement. Generally, lower transmissivity (lower permeability) predominantly basin-fill sediment unit of varying thickness overlies higher transmissivity (higher permeability) predominantly basalt-volcanic rocks and sediment unit. Groundwater occurs in both the predominantly basin-fill sediment unit and the predominantly basalt unit. Groundwater is vertically connected within each unit and between each unit. This is based upon investigations by Sammel and Craig (1981) for Warner Valley, Morgan (1988) for Goose Lake Valley and Miller (1984 and 1986) for the Fort Rock and Christmas Valley area. Sammel and Craig (1981) particularly note the similarity of the hydrogeology in the Warner lakes Valley to the Klamath Basin.

If a permit is issued, the following conditions should be included: 7B, 7F, 7N, 7P, 7T and special condition

7B is an interference condition

7F is a well location condition

7N is a groundwater level measurement and groundwater level decline condition

7P is a well tag condition

7T is a dedicated measuring tube condition

The "large" water use condition: (require a totalizing flow meter at each well. Each flow meter shall be located within 50 feet of the wellhead and adjacent to each flow meter shall be a clearly visible monument with a sign noting the flow meter. Lastly, require for every flow meter the reading, recording (monthly at minimum), and annual reporting of the flow meter data, all flow meters).

Special Condition for groundwater production: "All POA wells under this permit shall comply with existing well construction standards. Groundwater production shall occur from the predominantly basalt unit below the predominantly basin fill unit by continuous casing and continuous seal through the predominantly basin fill unit and into the predominantly basalt unit."

Application: G-17914 Date: 17 November 2014

References Used:

References consulted were:

Hampton, E.R., 1964, Geologic factors that control the occurrence and availability of ground water in the Fort Rock Basin, Lake County, Oregon: USGS Professional Paper 383-B, 29 p.

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

McFarland, W.D. and Ryals, G.N., 1991, Adequacy of available hydrogeologic data for evaluation of declining ground-water levels in the Fort Rock Basin, south-central Oregon: USGS Water Resources Investigations Report 89-4057, 47 p.

Miller, D.W., 1984, Appraisal of ground-water conditions in the Fort Rock Basin, Lake County, Oregon: OWRD Open File Report, 157 p.

Miller, D.W., 1986, Ground-water conditions in the Fort Rock Basin, northern Lake County, Oregon: OWRD Ground Water Report No. 31, 196 p.

Morgan, D.S., 1988, Geohydrology and numerical model analysis of ground-water flow in the Goose Lake Basin, Oregon and California: USGS Water Resources Investigations Report 87-4058, 92 p.

Oregon Water Resources Department, 1989, Goose and Summer Lakes Basin report: OWRD Basin Report, 112 p.

Peterson, N.V. and McIntyre, J.R., 1970, The reconnaissance geology and mineral resources of eastern Klamath County and western Lake County, Oregon: DOGAMI Bulletin 66, 70 p.

Phillips, K.N. and VanDenburgh, A.S., 1971, Hydrology and geochemistry of Abert, Summer, and Goose Lakes, and other closed-basin lakes in south-central Oregon: USGS Professional Paper 502-B, 86p.

Sammel, E.A. and Craig, R.W., 1981, The geothermal hydrology of Warner Valley, Oregon: a reconnaissance study: USGS Professional Paper 1044-I, 147 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, 16 annual meeting, vol. 16, pg. 519-524.

Walker, G.W., 1963, Reconnaissance geologic map of the eastern half of the Klamath Falls (AMS) quadrangle, Lake and Klamath Counties, Oregon: USGS Mineral Investigations Field Studies Map MF-260.

Walker, G.W. and Repenning, C.A., 1965, Reconnaissance geologic map of the Adel quadrangle, Lake, Klamath, and Malheur Counties, Oregon: USGS Miscellaneous Geologic Investigations Map I-446.

Walker, G.W., 1973, Preliminary geologic and tectonic maps of Oregon east of the 121st meridian: USGS Miscellaneous Field Studies Map MF-495

Waring, G.A., 1908, Geology and water resources of a portion of south-central Oregon: USGS Water Supply Paper 220, 85 p.

Goose and Summer Lakes Basin Program rules (OAR 690-513).

State Obesrvation Wells SOW 377 (LAKE 1886).

Water well reports for wells in Township 35 & 36 South/Range 24 & 25 East

USGS Plush and Hart Lake quad maps (1:24,000 scale)

Application: G-17914 Date: 17 November 2014

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** 1 **Logid:** Proposed, not yet constructed

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:** _____

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.

Comments: _____

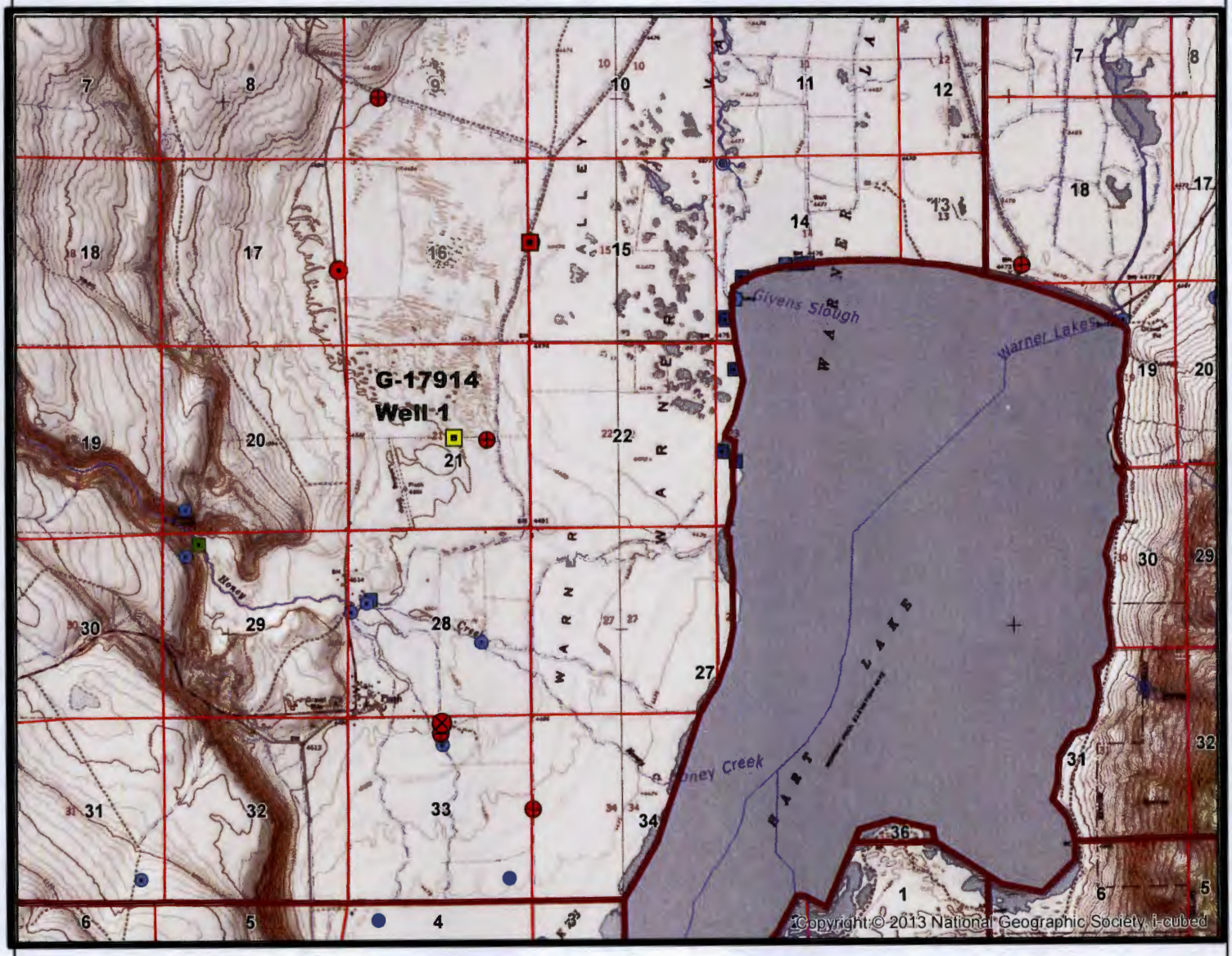
Special Condition for groundwater production: "All POA wells under this permit shall comply with existing well construction standards. Groundwater production shall occur from the predominantly basalt unit below the predominantly basin fill unit by continuous casing and continuous seal through the predominantly basin fill unit and into the predominantly basalt unit."

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.

Water Availability Tables

See attachments.

Groundwater Permit Application G-17914
D. Jack Flynn



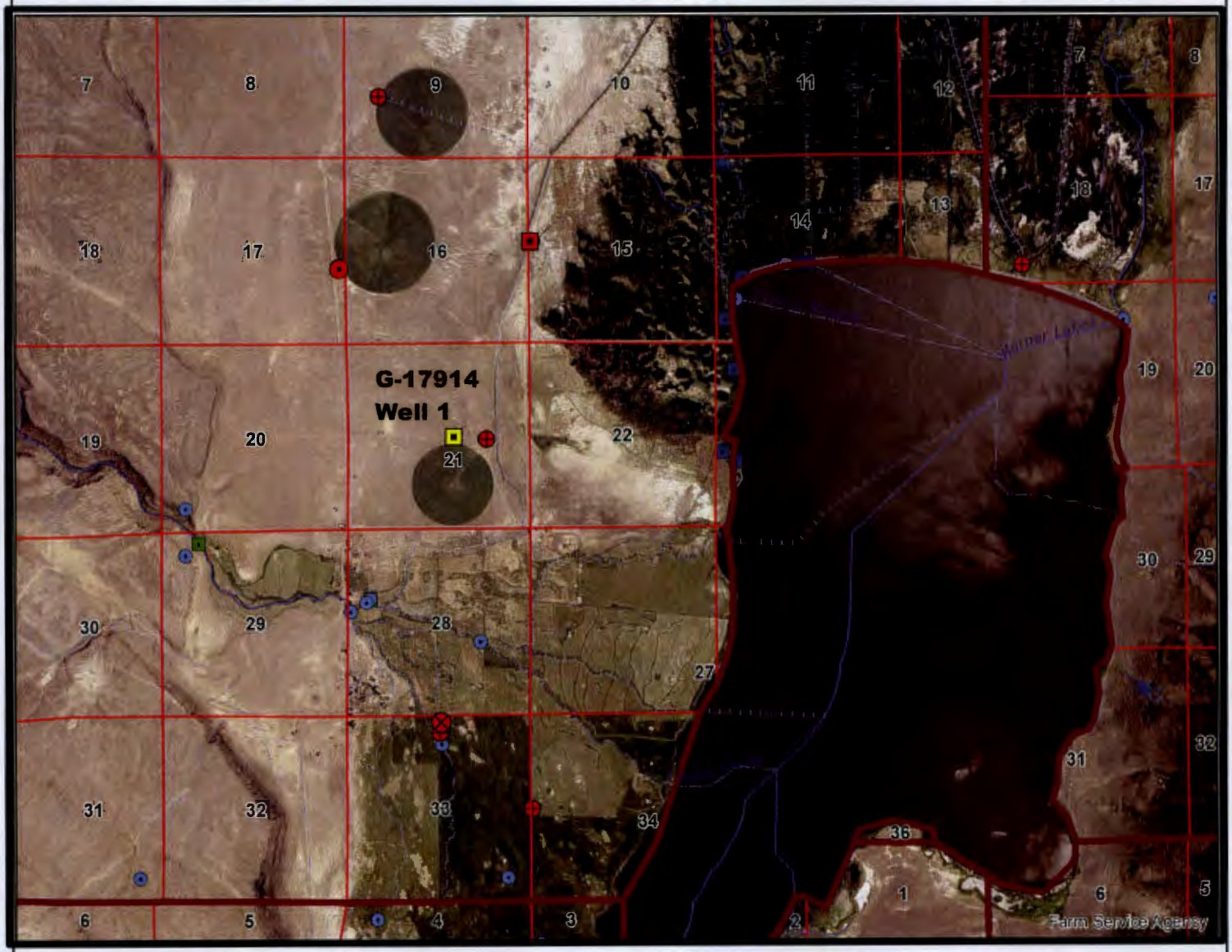
0 0.5 1 2
Miles

Yellow = Application Noted Well(s)
Red = Other Existing or Proposed Wells

Blue and Other = surface water rights

N

Groundwater Permit Application G-17914
D. Jack Flynn



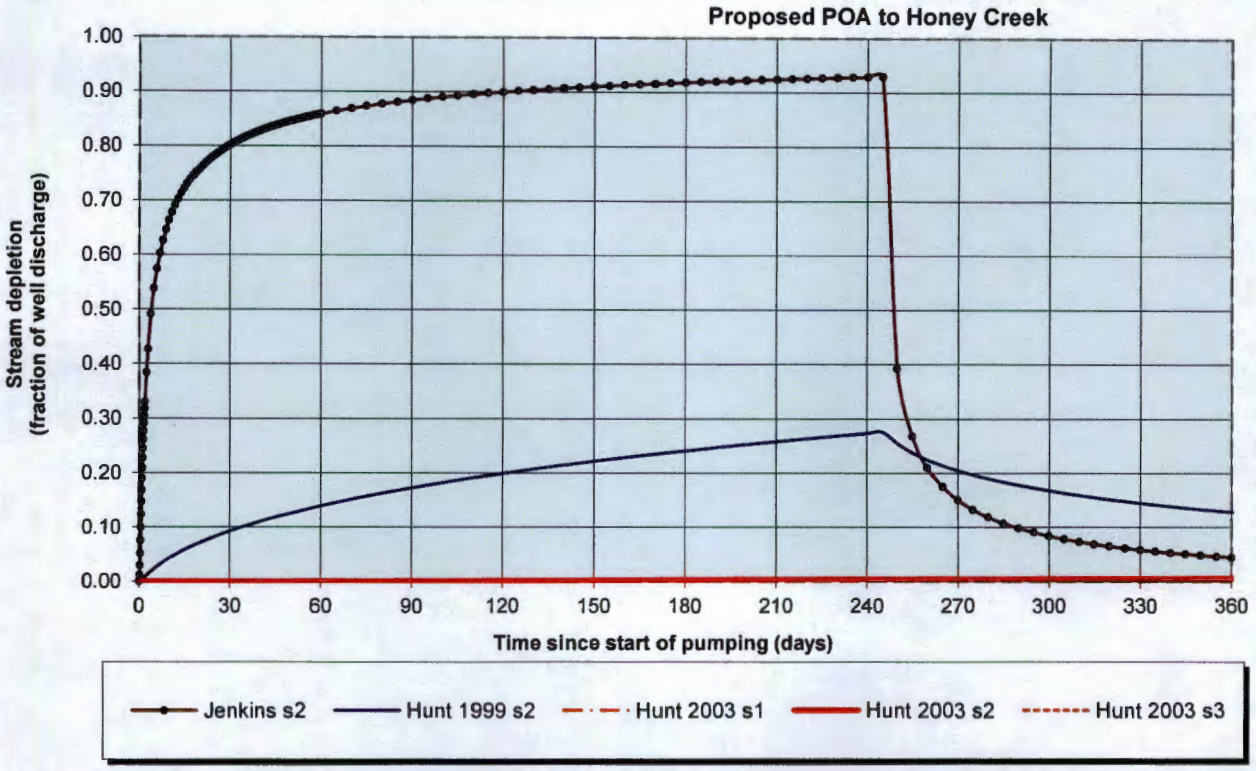
0 0.5 1 2
Miles

Yellow = Application Noted Well(s)
Red = Other Existing or Proposed Wells

Blue and Other = surface water rights

N

Transient Stream Depletion (Jenkins, 1970; Hunt, 1999, 2003)



Output for Stream Depletion, Scenerio 2 (s2):						Time pump on (pumping duration) = 245 days						
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	80.2%	85.9%	88.5%	90.0%	91.0%	91.8%	92.4%	92.9%	15.0%	8.4%	5.8%	4.4%
H SD 1999	9.3%	13.9%	17.3%	19.9%	22.2%	24.1%	25.8%	27.3%	20.5%	16.8%	14.5%	12.8%
H SD 2003	0.0%	0.1%	0.1%	0.2%	0.2%	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%
Qw, cfs	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
H SD 99, cfs	0.046	0.070	0.086	0.100	0.111	0.120	0.129	0.137	0.102	0.084	0.072	0.064
H SD 03, cfs	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	0.50	0.50	0.50	cfs
Time pump on (pumping duration)	tpon	245	245	245	days
Perpendicular from well to stream	a	5610	5610	5610	ft
Well depth	d	400	400	400	ft
Aquifer hydraulic conductivity	K	83	83	83	ft/day
Aquifer saturated thickness	b	100	100	100	ft
Aquifer transmissivity	T	8300	8300	8300	ft*ft/day
Aquifer storativity or specific yield	S	0.001	0.001	0.001	
Aquitard vertical hydraulic conductivity	Kva	1	1	1	ft/day
Aquitard saturated thickness	ba	150	150	150	ft
Aquitard thickness below stream	babs	150	150	150	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	20	20	20	ft
Streambed conductance (lambda)	sbc	0.133333	0.133333	0.133333	ft/day
Stream depletion factor	sdf	3.791819	3.791819	3.791819	days
Streambed factor	sbf	0.090120	0.090120	0.090120	
input #1 for Hunt's Q_4 function	t'	0.263726	0.263726	0.263726	
input #2 for Hunt's Q_4 function	K'	25.278795	25.278795	25.278795	
input #3 for Hunt's Q_4 function	epsilon'	0.005000	0.005000	0.005000	
input #4 for Hunt's Q_4 function	lamda'	0.090120	0.090120	0.090120	

Drawdown Calculations Using Theis Equation

Theis Equation: $s = [Q/(4*T*pi)][W(u)]$

$u = (r*r*S)/(4*T*t)$

$W(u) = (-\ln u)-(0.5772157)+(u/1*1!)-(u*u/2*2!)+(u*u*u/3*3!)-(u*u*u*u/4*4!)+...$

s = drawdown (L)
T = transmissivity (L*L/T)
S = storage coefficient (dimensionless)
pi = 3.141592654

r = radial distance (L)
t = time (T)
u = dimensionless
W(u) = well function

Transmissivity T (gpd/ft)	Transmissivity T (ft2/day)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft3/sec)	Time t (days)	Distance r (feet)	pi	u	W(u)	Drawdown s (feet)	Comments
								Note : W(u) calculation valid when u < 7.1			
Note:	yellow grid areas are where values are calculated							7.0000	1.1545E-04		W(u) calculation test
Proposed POA Well to Hart Lake (Transmissivity from specific capacity data)											
62,088.32	8,300.00	0.00100	500.00	1.11	30.00	7,640.00	3.14	0.0586	2.3175	2.1386	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	500.00	1.11	245.00	7,640.00	3.14	0.0072	4.3670	4.0299	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	224.42	0.50	30.00	7,640.00	3.14	0.0586	2.3175	0.9599	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	224.42	0.50	245.00	7,640.00	3.14	0.0072	4.3670	1.8087	Pro-Rated Pumping Rate
Proposed POA Well to Closest Water Right Well (Transmissivity from specific capacity data)											
62,088.32	8,300.00	0.00100	500.00	1.11	30.00	940.00	3.14	0.0009	6.4512	5.9532	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	500.00	1.11	245.00	940.00	3.14	0.0001	8.5505	7.8905	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	224.42	0.50	30.00	940.00	3.14	0.0009	6.4512	2.6720	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	224.42	0.50	245.00	940.00	3.14	0.0001	8.5505	3.5415	Pro-Rated Pumping Rate

Theis_Equation_specific_capacity_to_transmissivity							
Basalt							
Well County	**Well Num**	**Transmissivity**	**Transmissivity**	**Open Interval**	**Conductivity**		
		ft2/day	**gpd/ft**	**feet**	**ft/day**		
LAKE	1779	4,299.52	32,162.65				
LAKE	1825	15,338.56	114,740.40				
LAKE	1839	12,012.45	89,859.37		#DIV/0!		
LAKE	4070	1,551.71	11,607.60		#DIV/0!		
		8,300.56	**62,092.51**	**Average**		**#DIV/0!**	**ft/day**
Basin-Fill							
Well County	**Well Num**	**Transmissivity**	**Transmissivity**	**Open Interval**	**Conductivity**		
		ft2/day	**gpd/ft**	**feet**	**ft/day**		
LAKE	4281	631.62	4,724.85	640.00	0.99		
		631.62	**4,724.85**	**Average**		**#DIV/0!**	**ft/day**

Water Availability Analysis

HONEY CR > HART L - AT MOUTH
GOOSE & SUMMER LAKE BASIN
Water Availability as of 11/14/2014

Watershed ID #: 31300713 (Map)
Date: 11/14/2014

Exceedance Level: 80%
Time: 2:46 PM

Download Data

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	31300713	HONEY CR> HART L- AT MOUTH	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

Limiting Watersheds

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

Month	Limiting Watershed ID #	Stream Name	Water Available?	Net Water Available
JAN	31300713	HONEY CR > HART L - AT MOUTH	Yes	4.85
FEB	31300713	HONEY CR > HART L - AT MOUTH	Yes	6.32
MAR	31300713	HONEY CR > HART L - AT MOUTH	Yes	10.50
APR	31300713	HONEY CR > HART L - AT MOUTH	Yes	33.10
MAY	31300713	HONEY CR > HART L - AT MOUTH	Yes	33.60
JUN	31300713	HONEY CR > HART L - AT MOUTH	Yes	11.30
JUL	31300713	HONEY CR > HART L - AT MOUTH	No	0.00
AUG	31300713	HONEY CR > HART L - AT MOUTH	Yes	0.04
SEP	31300713	HONEY CR > HART L - AT MOUTH	Yes	0.06
OCT	31300713	HONEY CR > HART L - AT MOUTH	Yes	0.85
NOV	31300713	HONEY CR > HART L - AT MOUTH	Yes	2.87
DEC	31300713	HONEY CR > HART L - AT MOUTH	Yes	3.55
ANN	31300713	HONEY CR > HART L - AT MOUTH	Yes	15,400.00

Detailed Reports for Watershed ID #31300713

HONEY CR > HART L - AT MOUTH
GOOSE & SUMMER LAKE BASIN
Water Availability as of 11/14/2014

Watershed ID #: 31300713 (Map)
Date: 11/14/2014

Exceedance Level: 80%
Time: 2:46 PM

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	5.06	0.21	4.85	0.00	0.00	4.85
FEB	6.64	0.33	6.32	0.00	0.00	6.32
MAR	12.60	2.06	10.50	0.00	0.00	10.50
APR	41.50	8.36	33.10	0.00	0.00	33.10
MAY	53.80	20.20	33.60	0.00	0.00	33.60
JUN	26.80	15.50	11.30	0.00	0.00	11.30
JUL	4.32	4.32	0.00	0.00	0.00	0.00
AUG	2.27	2.23	0.04	0.00	0.00	0.04
SEP	2.07	2.01	0.06	0.00	0.00	0.06
OCT	2.14	1.29	0.85	0.00	0.00	0.85
NOV	3.01	0.14	2.87	0.00	0.00	2.87
DEC	3.74	0.19	3.55	0.00	0.00	3.55
ANN	18,800.00	3,440.00	15,400.00	0.00	0.00	15,400.00

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	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
FEB	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
MAR	0.71	1.35	0.00	0.00	0.00	0.00	0.00	0.00	2.06
APR	2.05	6.31	0.00	0.00	0.00	0.00	0.00	0.00	8.36
MAY	2.81	17.40	0.00	0.00	0.00	0.00	0.00	0.00	20.20
JUN	1.18	14.40	0.00	0.00	0.00	0.00	0.00	0.00	15.50
JUL	0.19	4.13	0.00	0.00	0.00	0.00	0.00	0.00	4.32
AUG	0.07	2.16	0.00	0.00	0.00	0.00	0.00	0.00	2.23
SEP	0.07	1.94	0.00	0.00	0.00	0.00	0.00	0.00	2.01
OCT	0.09	1.20	0.00	0.00	0.00	0.00	0.00	0.00	1.29
NOV	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
DEC	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19

Detailed Report of Reservations for Storage and Consumptive Uses

Reserved Streamflow in Cubic Feet per Second

No reservations were found for this watershed.

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

No instream flow requirements were found for this watershed.