Groundwater Application Review Summary Form

Application # G- 18374

GW Reviewer Gerald H. Grondin **Date Review Completed:** 20 June 2017

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:

[X] 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 **20 June 2017**

TO: **Application G- 18374**

FROM: **GW: Gerald II. Grondin**
(Reviewer's Name)

SUBJECT: Scenic Waterway Interference Evaluation

☐ YES
The source of appropriation is within or above a Scenic Waterway
☒ NO

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

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

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

DISTRIBUTION OF INTERFERENCE

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

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

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

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date **20 June 2017**

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

SUBJECT: Application G- **18374** 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: **Taylor Westside Ranches Inc.** County: **Lake**

A1. Applicant(s) seek(s) **(1660.6 gpm) 3.70** cfs from **1** well(s) in the **Goose & Summer Lakes** Basin, **Warner Lakes** subbasin Quad Map: **Hart Lake**

A2. Proposed use **Supplemental Irrigation (296 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**	1	**Basalt**	3.70	**T36S/R24E-sec 11 cbc**	**1870' N, 190' E of SW cor S 11**
2						

* 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	4475	?	**Prop *10**		**Prop 265**	**Prop 0 - 70**	**Prop +1 - 140**	**Prop None**	**Prop 90 – 140**	**Prop 1660.6**	?	**None**
2												

Use data from application for proposed wells.

A4. **Comments:**

The application requests a total maximum pumping rate of 3.70 cfs (1660.6 gpm) and a total maximum annual volume of 888 acre-feet from a single well to supplemental irrigate 296 acres (3 ac-ft per acre). The maximum pumping rate and maximum annual volume are what is typically allowed for 366.4 acres.

The application anticipates a static water level of 10 feet below land surface. Groundwater level measurements at nearby well LAKE 1839 and well LAKE 52568 on 30 March 2016 yielded groundwater elevations of 4,468.28 and 4,469.30 feet above mean sea level respectively. That converts to 5.70 to 6.72 feet below land surface at the proposed well site.

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: _____

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. 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) **7B, 7F, 7N, 7P, 7T, and** ;
   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 _____ 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 state observation well with long term data (early 1960s to 2015) closest to the proposed POA well is state observation well 377 (well LAKE 1886) located in T36S/R24E-sec 33 abb about 3.8 miles south of the proposed POA well. The water level data for the well shows long term climate influences as well as annual seasonal influences. Before the 2000, peak annual groundwater levels were generally between 15 and 17 feet below land surface at the well. After 2001, the peak annual groundwater level has often been from 17 to 20 feet below land surface at the well. Climate may be partly to entirely responsible for the lower annual peak levels after 2001. 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

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." The application proposes to obtain groundwater from the predominantly basalt unit.

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	**Basalt (proposed by application & to be required by permit)**	☐	☒
		☐	☐

Basis for aquifer confinement evaluation:

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

The groundwater system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement. Generally, lower transmissivity (lower permeability) sediment (predominantly basin-fill sediment unit) of varying thickness overlies higher transmissivity (higher permeability) basalt (predominantly basalt 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 104 feet at well LAKE 1825 located 2.3 miles northwest of the proposed POA; the depth to the top of the predominantly basalt unit is 75 feet at well LAKE 1839 located about 2.3 miles southwest of the proposed POA well; the depth to the top of the predominantly basalt unit is about 50 feet at well LAKE 52568 located about 1.3 miles southwest of the proposed POA well; the depth to the top of the predominantly basalt unit exceeds 640 feet (below well bottom) at well LAKE 4281 located about 1.9 miles southeast of the proposed POA well; and the depth to the top of the predominantly basalt unit is about 150 feet at well LAKE 1886 located about 3.8 miles southwest 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	**Un-named Lakes (ponds)**	4468	4470	300	☒	☐	☐	☒	☐
1	2	**Givens Slough**	4468	4470	175	☒	☐	☐	☒	☐
1	3	**Un-named spring (cert 70049)**	4468	4470	2010	☒	☐	☐	☐	☒
1	4	**Hart Lake**	4468	4473	5250	☒	☐	☐	☐	☒
1	5	**Miner's Draw**	4468	4515	14315	☐	☒	☐	☐	☒
1	6	**Anderson Lake**	4468	4466	17265	☒	☐	☐	☐	☒
1	7	**Honey Creek**	4468	4505	18225	☒	☐	☐	☐	☒

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 un-named lakes and the un-named spring are adjacent to a reach of Givens Slough identified as perennial. A potential for substantial interference is automatically assumed under OAR 690-09-040 given the proposed well location is less than 0.25 miles from the un-named lakes and Givens Slough and groundwater is determined to be hydraulically connected to surface water.

Miners Draw is an intermittent stream that appears to be runoff flow only. Groundwater appears to be below the stream-bed.

The average elevation of Anderson Lake, and Hart Lake (USGS map) appear nearly coincident with groundwater.

The distance to Honey Creek is to the perennial flow portion of the creek. The elevation is for the perennial portion north and west of Plush.

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?
1	1	☒	☐	N.A.	N.A.	☐	N.A.	☐	N.A.	☒
1	2	☒	☐	N.A.	N.A.	☐	N.A.	☐	N.A.	☒
1	3	☐	☐	N.A.	N.A.	☐	N.A.	☐	N.A.	☐
1	4	☐	☐	N.A.	N.A.	☐	N.A.	☐	N.A.	☐

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

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

Comments:

The proposed well location is less than 1.0 mile from the un-named lakes (ponds), Givens Slough, an un-named spring (certificate 70049), and Hart Lake.

The un-named lakes and the un-named spring are adjacent to a reach of Givens Slough identified as perennial. A potential for substantial interference is automatically assumed under OAR 690-09-040 given the proposed well location is less than 0.25 miles from the un-named lakes and Givens Slough and groundwater is determined to be hydraulically connected to surface water.

Using the Hunt (2003) to calculate stream depletion (groundwater-surface water interference) is not appropriate for these surface water bodies. This review used the Theis equation (Theis, 1935) to calculate the groundwater level drawdown at the closest un-named lake (pond), Givens Slough, the un-named spring (certificate 70049), and Hart Lake using the values below. The calculated drawdowns are shown in the table below.

Used full pumping rate = 3.70 cfs (1,660.6 gpm),
Used pro-rated pumping rate = 1.83 cfs (820.2 gpm),
Used aquifer transmissivity = 8,300 ft2/day based on specific capacity of LAKE 1779, LAKE1825, LAKE 1839, & LAKE 4070. The value is within the range noted by Sammel and Craig (1981)
Used, an intermediate storage coefficient = 0.001

In regards to the other water bodies, the proposed POA is not hydraulically connected to Miners Draw, and it is more than 1.0 mile from the Anderson Lake and Honey Creek.

Pumping Scenario	Elapsed Time (days)	Calculated Drawdown (feet)			
		Un-named Lakes	Givens Slough	Un-named Spring (certificate 70049)	Hart Lake
Continuous Full Rate (3.70 cfs)	30	26.77	30.07	15.12	9.31
	245	33.21	36.51	21.55	15.67
Continuous Pro-Rated (1.83 cfs)	30	13.22	14.85	7.47	4.60
	245	16.40	18.03	10.64	7.74

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	7	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
Well Q as CFS		0.00	0.00	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83	0.00	0.00
Interference 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
(A) = Total Interf.		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(B) = 80 % Nat. Q		5.06	6.64	12.6	41.5	53.8	26.8	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		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

(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 location is more than 1.0 mile from Honey Creek and Anderson Lake.

The Table above relates to Honey Creek only given it is the water body in the area with water availability data.

A pro-rated pumping rate of 1.83 cfs (820.2 gpm) was used for the pumping rate. The pro-rated rate is the maximum annual volume of water allowed (888.0 ac-ft) divided the total time (245 days). This distributes the pumping over the entire proposed irrigation season. Calculated results of 0.00% and 0.000 cfs indicate the calculated interference was less than 0.0005 cfs.

The values used for the Hunt (2003) calculation are:

Used pro-rated pumping rate = 1.83 cfs (820.2 gpm),
Used aquifer transmissivity = 8,300 ft2/day based on specific capacity of LAKE 1779, LAKE1825, 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 Anderson Lake using the same values above. The calculated drawdowns are shown below.

Pumping Scenario	Elapsed Time (days)	Calculated Drawdown (feet)		
			Anderson Lake	
Continuous Full Rate (4.58 cfs)	30		2.78	
	245		8.48	
Continuous Pro-Rated (2.26 cfs)	30		1.37	
	245		4.19	

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) **7B, 7F, 7N, 7P, 7T, and other (see below)**;
ii. ☐ The permit should contain special condition(s) as indicated in "Remarks" below;

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

A potential for substantial interference is automatically assumed under OAR 690-09-040 given the proposed well location is less than 0.25 miles from the un-named lakes and Givens Slough and groundwater is determined to be hydraulically connected to surface water.

Available reports indicate groundwater and surface water are connected in the Warner Lakes Valley. This review finds hydraulic connection with un-named lakes (ponds), Givens Slough, un-named spring (certificate 70049) Hart Lake, Anderson Lake, and Honey Creek).

This review does not find hydraulic connection with Miner's Draw. Miners Draw is an intermittent stream that appears to be runoff flow only. Groundwater appears to be below the stream-bed.

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

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." The application proposes to obtain groundwater from the predominantly basalt unit.

The groundwater system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement. Generally, lower transmissivity (lower permeability) sediment (predominantly basin-fill sediment unit) of varying thickness overlies higher transmissivity (higher permeability) basalt (predominantly basalt 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.

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)

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** 1 **Logid:** Not Drilled Yet

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.**

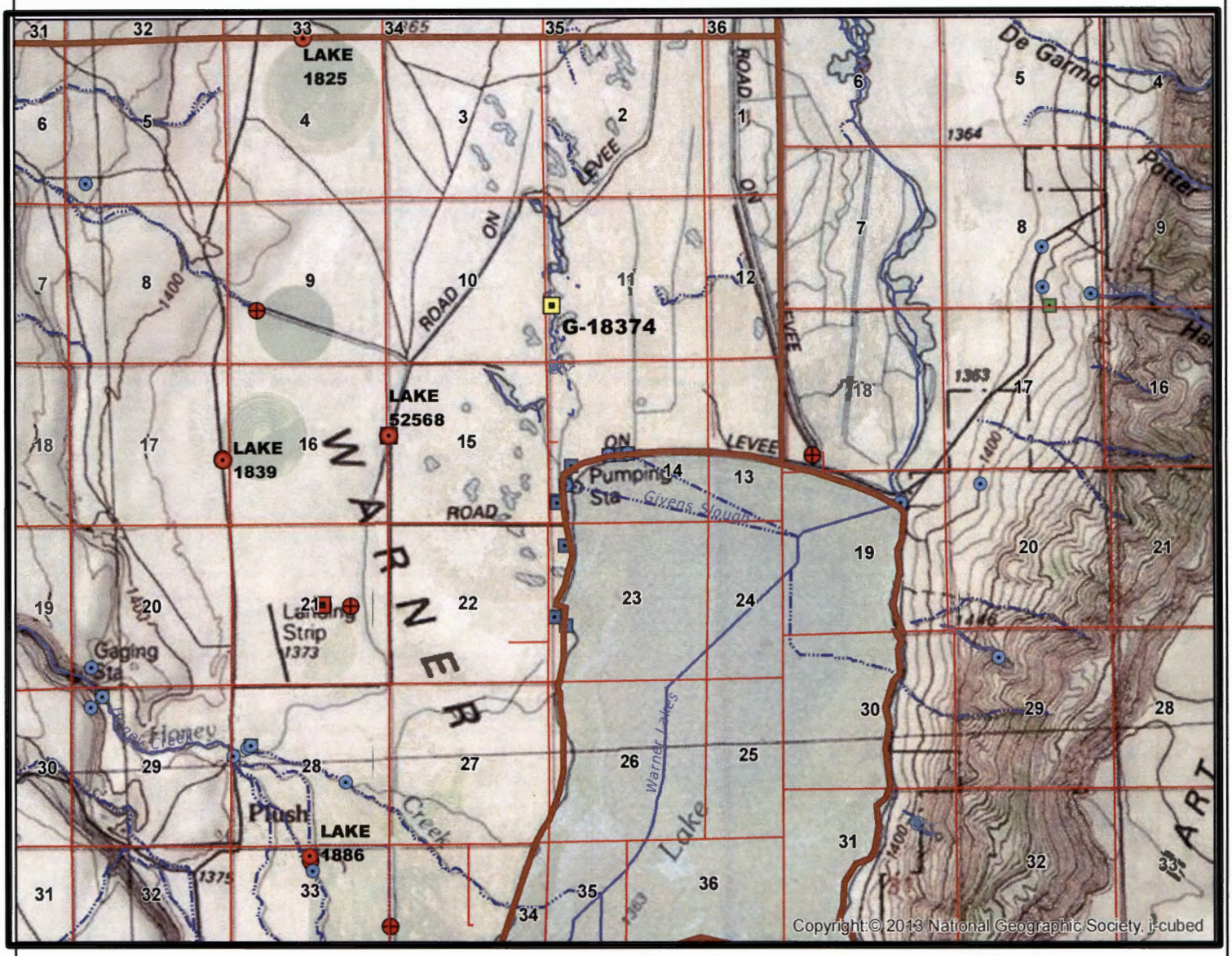
D5. ☒ **Special Condition for groundwater production: "All POA wells under this permit shall comply with existing well construction standards. Groundwater production shall occur from the predominantly basalt unit below the predominantly basin fill unit by continuous casing and continuous seal through the predominantly basin fill unit and into the predominantly basalt unit."**

Water Availability Tables (see attached)

Well Location Map (see attached)

Water-Level Trends in Nearby Wells (see attached)

Groundwater Permit Application G-18374
Taylor Westside Ranches Inc.

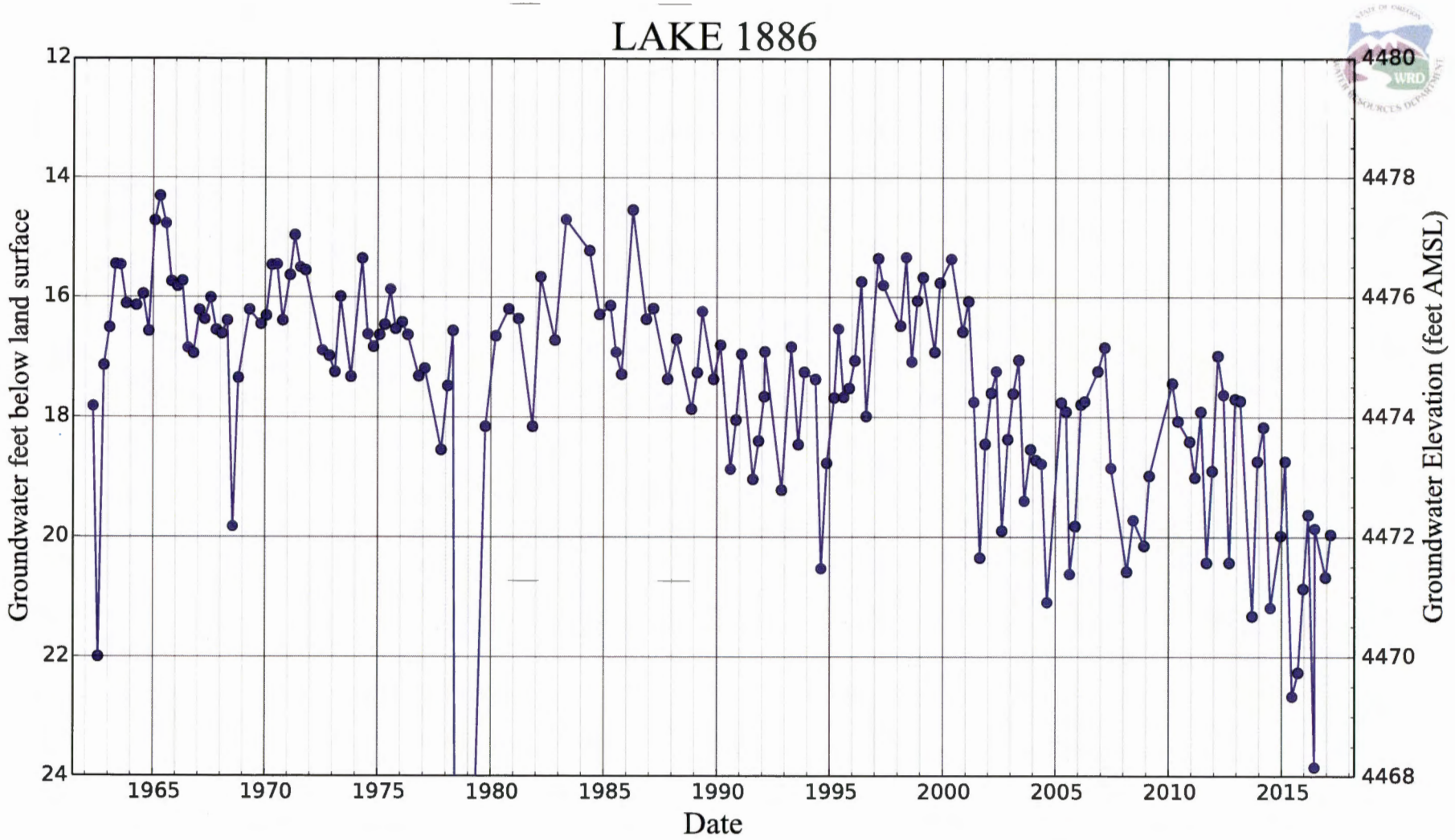


0 0.5 1 2
Miles

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

Blue and Other = surface water rights

N


LAKE 1886
Groundwater feet below land surface
Groundwater Elevation (feet AMSL)
Date
12
14
16
18
20
22
24
4480
4478
4476
4474
4472
4470
4468
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

Drawdown Calculations Using Theis Equation

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

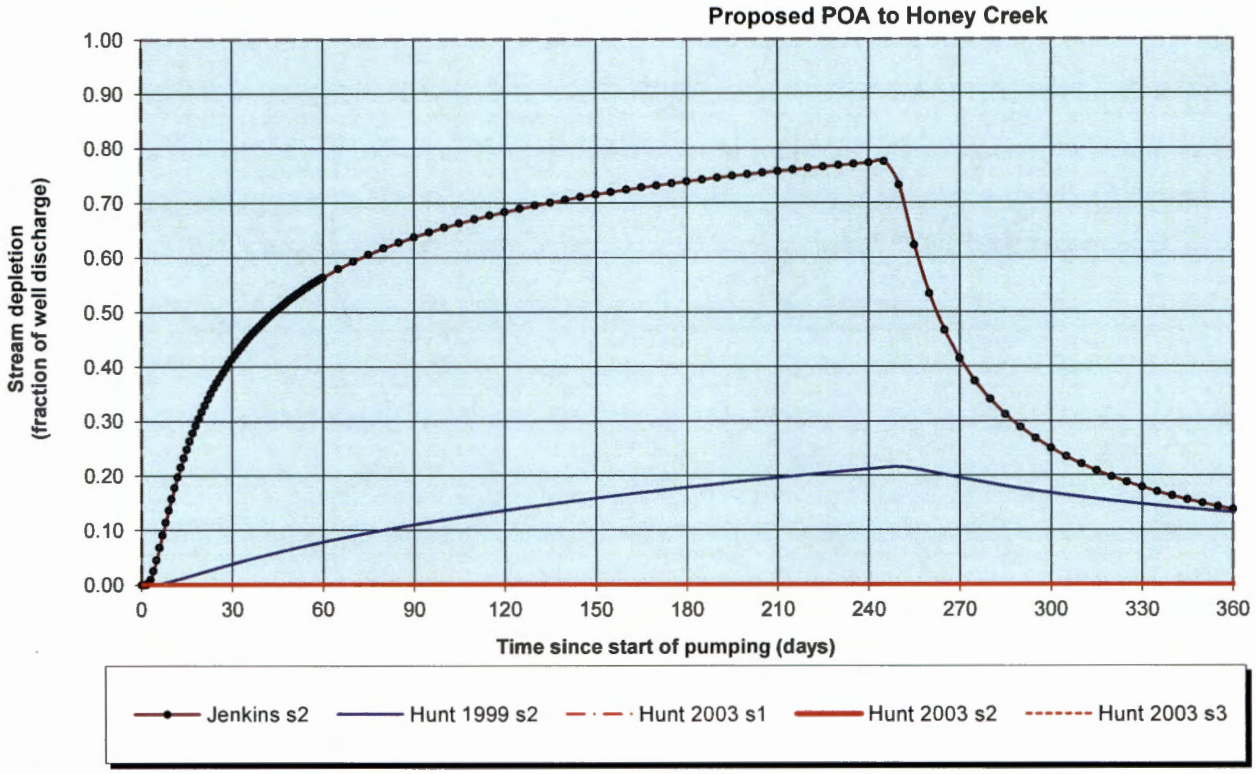
$u = (r*r*S)/(4*T*t)$

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

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 un-named lakes (Transmissivity from specific capacity data)											
62,088.32	8,300.00	0.00100	1,660.60	3.70	30.00	300.00	3.14	0.0001	8.7346	26.7700	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	1,660.60	3.70	245.00	300.00	3.14	0.0000	10.8345	33.2062	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	820.20	1.83	30.00	300.00	3.14	0.0001	8.7346	13.2222	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	820.20	1.83	245.00	300.00	3.14	0.0000	10.8345	16.4011	Pro-Rated Pumping Rate
Proposed POA Well to Givens Slough (Transmissivity from specific capacity data)											
62,088.32	8,300.00	0.00100	1,660.60	3.70	30.00	175.00	3.14	0.0000	9.8125	30.0737	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	1,660.60	3.70	245.00	175.00	3.14	0.0000	11.9125	36.5100	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	820.20	1.83	30.00	175.00	3.14	0.0000	9.8125	14.8540	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	820.20	1.83	245.00	175.00	3.14	0.0000	11.9125	18.0329	Pro-Rated Pumping Rate
Proposed POA Well to Un-named Spring (certificate 70049) (Transmissivity from specific capacity data)											
62,088.32	8,300.00	0.00100	1,660.60	3.70	30.00	2,010.00	3.14	0.0041	4.9343	15.1229	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	1,660.60	3.70	245.00	2,010.00	3.14	0.0005	7.0308	21.5483	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	820.20	1.83	30.00	2,010.00	3.14	0.0041	4.9343	7.4695	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	820.20	1.83	245.00	2,010.00	3.14	0.0005	7.0308	10.6431	Pro-Rated Pumping Rate
Proposed POA Well to Hart Lake (Transmissivity from specific capacity data)											
62,088.32	8,300.00	0.00100	1,660.60	3.70	30.00	5,250.00	3.14	0.0277	3.0376	9.3096	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	1,660.60	3.70	245.00	5,250.00	3.14	0.0034	5.1135	15.6721	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	820.20	1.83	30.00	5,250.00	3.14	0.0277	3.0376	4.5982	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	820.20	1.83	245.00	5,250.00	3.14	0.0034	5.1135	7.7407	Pro-Rated Pumping Rate
Proposed POA Well to Anderson Lake (Transmissivity from specific capacity data)											
62,088.32	8,300.00	0.00100	1,660.60	3.70	30.00	17,265.00	3.14	0.2993	0.9075	2.7812	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	1,660.60	3.70	245.00	17,265.00	3.14	0.0366	2.7655	8.4759	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	820.20	1.83	30.00	17,265.00	3.14	0.2993	0.9075	1.3737	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	820.20	1.83	245.00	17,265.00	3.14	0.0366	2.7655	4.1864	Pro-Rated Pumping Rate

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	41.4%	56.4%	63.7%	68.3%	71.5%	73.9%	75.8%	77.3%	41.4%	25.0%	17.8%	13.7%
H SD 1999	3.9%	7.8%	11.0%	13.6%	15.8%	17.8%	19.6%	21.2%	19.6%	16.7%	14.7%	13.2%
H SD 2003	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Qw, cfs	1.830	1.830	1.830	1.830	1.830	1.830	1.830	1.830	1.830	1.830	1.830	1.830
H SD 99, cfs	0.070	0.143	0.201	0.249	0.290	0.326	0.358	0.387	0.358	0.306	0.270	0.242
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	1.83	1.83	1.83	cfs
Time pump on (pumping duration)	tpon	245	245	245	days
Perpendicular from well to stream	a	18225	18225	18225	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	40.018148	40.018148	40.018148	days
Streambed factor	sbf	0.292771	0.292771	0.292771	
input #1 for Hunt's Q_4 function	t'	0.024989	0.024989	0.024989	
input #2 for Hunt's Q_4 function	K'	266.787651	266.787651	266.787651	
input #3 for Hunt's Q_4 function	epsilon'	0.005000	0.005000	0.005000	
input #4 for Hunt's Q_4 function	lamda'	0.292771	0.292771	0.292771	

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**

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Water Availability Analysis

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Water Availability Analysis

HONEY CR > HART L - AT MOUTH
GOOSE & SUMMER LAKE BASIN
Water Availability as of 6/20/2017

Watershed ID #: 31300713 (Map)
Date: 6/20/2017

Exceedance Level: 80%
Time: 10:00 AM

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 6/20/2017

Watershed ID #: 31300713 (Map)
Date: 6/20/2017

Exceedance Level: 80%
Time: 10:00 AM

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.