WATER RESOURCES DEPARTMENT MEMO **1 December 2014**

TO: **Application G- 17931**

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

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 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-17931 **Date: 1 December 2014**

PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date **1 December 2014**

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

SUBJECT: Application **G- 17931** 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: **James W. Votto** County: **Lake**

A1. Applicant(s) seek(s) **(825 gpm) 1.84** cfs from **1** well(s) in the **Goose & Summer Lakes** Basin, **Thomas Creek watershed in the Goose Lake** subbasin Quad Map: **Lakeview NW**

A2. Proposed use **Irrigation (54 acres primary, 93 acres supplemental)**
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	LAKE 52538	1	Basin-Fill Sediments	1.84	39S/19E-sec 14 ABA	132'S, 1850'W fr NE cor S 14
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	4775	58	5.85	7/22/2014	387	0-56	+2-56	56-387	247-387	1500	?	A

Use data from application for proposed wells.

A4. **Comments:**

The proposed maximum rate of 1.84 cfs (825 gpm) is consistent with the maximum rate often allowed for 147 acres (1/80 cfs per acre). The proposed maximum annual volume is 441 acre-feet. That equals 3.0 acre-feet of water per acre, which is often the maximum acre-feet of water per acre allowed.

The water well report (well-log) for well LAKE 52538 indicates the productive water bearing zone(s) tapped by the well is solely within the predominantly basin-fill sedimentary unit that overlies the predominantly volcanic-basalt rock and sediments unit. The well's liner is perforated from 247 to 387 feet depth adjacent to layers of sands and gravels and some layers of clay and fractured claystone.

Geologic maps (Morgan 1988, Walker 1963, and others) indicate basin-fill sedimentary deposits at the proposed POA well. The well is located between Cottonwood Creek and Thomas Creek. Morgan (1988) shows the well location adjacent to a divide in the surficial geology with fluvial terrace and lacustrine deposits (Qlo) to the west and alluvial deposits (Qal) to the east. Walker (1963) mapped the surface geology at the well site as sedimentary deposits (QTs) that includes lacustrine, fluviatile, and Aeolian sedimentary rocks, interstratified tuff, ashy diatomite, and unconsolidated clay, sand, silt, and gravel, mostly in pluvial basins that correlates to water laid volcanic deposits of Wells and Peck (1961). Walker (1963) mapped nearby surface geology as alluvium (Qal) described as unconsolidated fluviatile gravel, sand, and silt. In places, it can include talus, fanglomerate, lakebed deposits, and wind-blown sand. Both Morgan (1988) and Walker (1963) show ash-flow tuffs, tuffaceous sedimentary rocks, tuff breccias, andesite and basalt flows (Tv) in the uplands that surround the Goose lake Valley. These underlie the basin-fill sedimentary deposits in the valley.

Data indicate groundwater at the well is below the elevation of Cottonwood Creek at the closest reach to the west and above Cottonwood Creek at a lower reach to the south. The data also indicates groundwater at the well is above the elevation of Thomas Creek.

A5. ☒ **Provisions of the Goose & Summer Lakes** 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:

OAR 690-513-0030 (Goose Lake Subbasin) applies.

OAR 690-513-0030 (2)(d) says "Groundwater from any well within 1,000 feet of Thomas Creek, or a tributary, and taking water from an unconfined aquifer is classified for domestic and stockwater uses only. This paragraph only applies to wells within the following areas:...(D) Sections 1-3 and 10-15; Township 39S; Range 19E;"

The well location is within the area noted. It is in T39S/R19E-sec 14.

Groundwater in the Goose Lake area is identified as unconfined.

The proposed POA well is less than 100 feet from an intermittent stream drainage that discharges to a ditch that may discharge to Thomas Creek. Other surface water is more than 1,000 feet from the proposed POA well. The Department needs to determine whether the intermittent stream drainage is identified as a tributary to Thomas Creek or not. It is uncertain to this reviewer.

If the intermittent stream is not identified as a tributary to Thomas Creek, agricultural use is allowed for the proposed well location.

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

Currently, 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, 7N, 7P, 7T, and special conditions** ;
   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:**

If a permit is issued, recommend conditions 7B, 7N, 7P, 7T, and the following

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).

Reports for the Goose and Summer Lakes Basin indicate ground water occurs in alluvium, basin fill sediments, and different basalt units. Geologic maps (Morgan 1988, Walker 1963, and others) indicate basin-fill sedimentary deposits at the proposed POA well. The well is located between Cottonwood Creek and Thomas Creek. Morgan (1988) shows the well location adjacent to a divide in the surficial geology with fluvial terrace and lacustrine deposits (Qlo) to the west and alluvial deposits (Qal) to the east. Walker (1963) mapped the surface geology at the well site as sedimentary deposits (QTs) that includes lacustrine, fluviatile, and Aeolian sedimentary rocks, interstratified tuff, ashy diatomite, and unconsolidated clay, sand, silt, and gravel, mostly in pluvial basins that correlates to water laid volcanic deposits of Wells and Peck (1961). Walker (1963) mapped nearby surface geology as alluvium (Qal) described as unconsolidated fluviatile gravel, sand, and silt. In places, it can include talus, fanglomerate, lakebed deposits, and wind-blown sand. Both Morgan (1988) and Walker (1963) show ash-flow tuffs, tuffaceous sedimentary rocks, tuff breccias, andesite and basalt flows (Tv) in the uplands that surround the Goose lake Valley. These underlie the basin-fill sedimentary deposits in the valley.

Data indicate groundwater at the well is below the elevation of Cottonwood Creek at the closest reach to the west and above Cottonwood Creek at a lower reach to the south. The data also indicates groundwater at the well is above the elevation of Thomas Creek.

Morgan (1988) notes ground water flow is generally from upland recharge areas to lowland discharge areas, primarily Goose Lake. However, local subsystems discharge to lakes, reservoirs, meadows, and streams. Large quantities of ground water move through complexly interbedded, discontinuous, unconsolidated sand, gravel, silt, and clay deposits. Morgan characterizes the upper portion of ground water as unconfined with confined-like conditions increasing with depth. This appears related to anisotropic hydraulic conductivities with horizontal hydraulic conductivity much greater than vertical hydraulic conductivity. For one site noted, the estimated ratios ranged from 2:1 to 179:1. There is no indication of shallower ground water being separated from deeper ground water by a confining layer.

The nearest state observation well found was state observation 380 (well LAKE 2320). The well is 110 feet deep, and it is completed in basin-fill. It is located about 3.4 miles south of the proposed well. The ground water level data is from 1962 to 2014. The annual trend appears climate controlled with no apparent decline for that period. Seasonal fluctuations vary from year to year, from less than 5 feet to about 10 feet.

The next nearest state observation well found was state observation well 379 (well LAKE 1979). The well is 530 feet deep, and it is completed in the basin-fill. It is located about 4.6 miles north of the proposed well site. The groundwater level data is from 1976 to 2014. The annual trend appears climate controlled with no apparent decline for that period. Seasonal fluctuations vary from year to year, from less than 5 feet to more than 10 feet.

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	**Basin-Fill Sediments**	☐	☒
		☐	☐
		☐	☐
		☐	☐

Basis for aquifer confinement evaluation:

The system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement.

The water well report (well-log) for well LAKE 52538 indicates the productive water bearing zone(s) tapped by the well is solely within the predominantly basin-fill sedimentary unit that overlies the predominantly volcanic-basalt rock and sediments unit. The well's liner is perforated from 247 to 387 feet depth adjacent to layers of sands and gravels and some layers of clay and fractured claystone.

Reports for the Goose and Summer Lakes Basin indicate ground water occurs in alluvium, basin fill sediments, and different basalt units. Geologic maps (Morgan 1988, Walker 1963, and others) indicate basin-fill sedimentary deposits at the proposed POA well. The well is located between Cottonwood Creek and Thomas Creek. Morgan (1988) shows the well location adjacent to a divide in the surficial geology with fluvial terrace and lacustrine deposits (Qlo) to the west and alluvial deposits (Qal) to the east. Walker (1963) mapped the surface geology at the well site as sedimentary deposits (QTs) that includes lacustrine, fluviatile, and Aeolian sedimentary rocks, interstratified tuff, ashy diatomite, and unconsolidated clay, sand, silt, and gravel, mostly in pluvial basins that correlates to water laid volcanic deposits of Wells and Peck (1961). Walker (1963) mapped nearby surface geology as alluvium (Qal) described as unconsolidated fluviatile gravel, sand, and silt. In places, it can include talus, fanglomerate, lakebed deposits, and wind-blown sand. Both Morgan (1988) and Walker (1963) show ash-flow tuffs, tuffaceous sedimentary rocks, tuff breccias, andesite and basalt flows (Tv) in the uplands that surround the Goose lake Valley. These underlie the basin-fill sedimentary deposits in the valley.

Morgan (1988) notes ground water flow is generally from upland recharge areas to lowland discharge areas, primarily Goose Lake. However, local subsystems discharge to lakes, reservoirs, meadows, and streams. Large quantities of ground water move through complexly interbedded, discontinuous, unconsolidated sand, gravel, silt, and clay deposits. Morgan characterizes the upper portion of ground water as unconfined with confined-like conditions increasing with depth. This appears related to anisotropic hydraulic conductivities with horizontal hydraulic conductivity much greater than vertical hydraulic conductivity. For one site noted, the estimated ratios ranged from 2:1 to 179:1. There is no indication of shallower ground water being separated from deeper ground water by a confining layer.

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	Spring (certificate 66628)	4769	4790	1,565	☒	☐	☐	☐	☒
1	2	Spring (certificate 53537)	4769	4750	10,700	☒	☐	☐	☐	☒
1	3	Thomas Creek	4769	4735	12,800	☒	☐	☐	☐	☒
1	4	Cottonwood Creek	4769	4840	9,860	☒	☐	☐	☐	☒
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation:

There are two springs identified. The first spring is located about 1565 feet (0.30 mile) west of the proposed POD well site. The associated water right is certificate 66628 (file S-56450, priority date = 18 August 1977, rate = 0.57 cfs, POU = 22.7 primary acres). The source is identified as "spring/seepage." Subsequent to that right, a groundwater right was issued (see certificate 66627, file G-9848) to the spring owner allowing a well to irrigate 3 primary acres and 22.7 supplemental acres. The well is less than 300 feet from the spring. The proposed POD well for this application (G-17931) is likely down the hydrogeologic gradient from the spring.

The second spring is located about 10,700 feet (2.03 mile) south at the SE corner of section 23. The spring is identified on the USGS map. OWRD water right data shows an adjoining water right in that area, certificate 53537 (file S-58711, priority date 24 May 1979, rate 0.37 cfs, POU = 14.8 primary acres). The source is identified as "un-named drain." It is uncertain if the drain is associated with the spring. The proposed POD well for this application (G-17931) is likely up the hydrogeologic gradient from the spring.

The proposed POD well for this application (G-17931) is up the hydrogeologic gradient from Thomas Creek.

The proposed POD well for this application (G-17931) is down the hydrogeologic gradient from the nearest reach of Cottonwood Creek to the west and up the hydrogeologic gradient from the lower reach of Cottonwood Creek to the south. Cottonwood Creek is tributary to Thomas Creek.

Water Availability Basin the well(s) are located within: THOMAS CR > GOOSE 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.**	☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐

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 POA well is less than one-mile from spring (certificate 66628) and more than one-mile from the other surface water identified in section C2.

No instream water right or natural flow values were found associated with spring (certificate 66628).

Groundwater interference with spring (certificate 66628) discharge was not calculated. Instead, the groundwater level drawdown at the spring due to pumping the proposed POA well was calculated using the Theis equation.

The groundwater level drawdown at the spring due to pumping the proposed POA well was 17 feet at the end of 30 days and 27 feet at the end of 245 days of pumping. The interference with the spring would likely seasonally dry-up the spring. Flow from the spring may be problematic already given the spring owner obtained a groundwater right (see certificate 66627, file G-9848) allowing a well to irrigate 3 primary acres and 22.7 supplemental acres. That well is less than 300 feet from the spring.

The calculation groundwater level drawdown used a pro-rated rate (total annual volume requested divided by the total pumping period) of 0.91 cfs (407 gpm), a transmissivity of 1,300 ft2/day derived from specific capacity data for well LAKE 4012 located in the same section as the proposed POA well, and an intermediate storage coefficient of 0.001. The transmissivity used is consistent with the range Morgan (1988) noted for the basin-fill within the Goose Lake valley.

C4a. **690-09-040 (5):** Estimated impacts on **hydraulically connected surface water sources greater than one mile** as a percentage of the proposed pumping rate. Limit evaluation to the effects that will occur up to one year after pumping begins. This table encompasses the considerations required by 09-040 (5)(a), (b), (c) and (d), which are not included on this form. Use additional sheets if calculated flows from more than one WAB are required.

Non-Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	%	%	%	%	%	%	%	%	%	%	%	%
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													
(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:

The proposed POA well is more than one-mile from spring (certificate 53537).

No instream water right or natural flow values were found associated with spring (certificate 53537). The spring is identified on the USGS map. OWRD water right data shows an adjoining water right in that area, certificate 53537 (file S-58711, priority date 24 May 1979, rate 0.37 cfs, POU = 14.8 primary acres). The source is identified as "un-named drain." It is uncertain if the drain is associated with the spring.

Groundwater interference with spring (certificate 53537) discharge was not calculated. Instead, the groundwater level drawdown at the spring due to pumping the proposed POA well was calculated using the Theis equation.

The groundwater level drawdown at the spring due to pumping the proposed POA well was 1.7 feet at the end of 30 days and 9.2 feet at the end of 245 days of pumping. The interference with the spring would likely seasonally dry-up the spring by the end of the 245 day irrigation season.

The calculation groundwater level drawdown used a pro-rated rate (total annual volume requested divided by the total pumping period) of 0.91 cfs (407 gpm), a transmissivity of 1,300 ft2/day derived from specific capacity data for well LAKE 4012 located in the same section as the proposed POA well, and an intermediate storage coefficient of 0.001. The transmissivity used is consistent with the range Morgan (1988) noted for the basin-fill within the Goose Lake valley.

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	**3**	**15.8%**	**14.4 %**	**1.3 %**	**4.3 %**	**7.3 %**	**9.9 %**	**12.3 %**	**14.4 %**	**16.3 %**	**18.1 %**	**18.8 %**	**17.4 %**
Well Q as CFS		**0.00**	**0.00**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.00**	**0.00**
Interference CFS		**0.143**	**0.131**	**0.012**	**0.039**	**0.066**	**0.090**	**0.111**	**0.130**	**0.148**	**0.164**	**0.171**	**0.157**
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													
(A) = Total Interf.		**0.143**	**0.131**	**0.012**	**0.039**	**0.066**	**0.090**	**0.111**	**0.130**	**0.148**	**0.164**	**0.171**	**0.157**
(B) = 80 % Nat. Q		**16.70**	**38.70**	**76.60**	**151.00**	**111.00**	**41.70**	**13.10**	**8.24**	**8.98**	**10.40**	**14.50**	**19.10**
(C) = 1 % Nat. Q		**0.1670**	**0.3870**	**0.7660**	**1.5100**	**1.1100**	**0.4170**	**0.1310**	**0.0824**	**0.0898**	**0.1040**	**0.1450**	**0.1910**
(D) = (A) > (C)		**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**No**
(E) = (A / B) x 100		**0.856**	**0.339**	**0.016**	**0.026**	**0.059**	**0.216**	**0.847**	**1.578**	**1.648**	**1.577**	**1.179**	**0.822**

(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:

The proposed POA well is more than one-mile from Thomas Creek.

Hunt (1999) was used to calculate the interference with Thomas Creek due to pumping the proposed POA well. The calculations indicate the interference with the creek will exceed one-percent of the natural flow (80% exceedance) during four months when the creek flow is lowest.

The calculation groundwater level drawdown used a pro-rated rate (total annual volume requested divided by the total pumping period) of 0.91 cfs (407 gpm), a transmissivity of 1,300 ft2/day derived from specific capacity data for well LAKE 4012 located in the same section as the proposed POA well, an intermediate storage coefficient of 0.001, a stream width of 25 feet, and a streambed thickness of 10 feet with a vertical hydraulic conductivity of 0.026 ft/day (the horizontal hydraulic conductivity of the basin-fill divided by 100). The transmissivity used is consistent with the range Morgan (1988) noted for the basin-fill within the Goose Lake valley.

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	**4**	**14.3%**	**12.9 %**	**2.2 %**	**5.5 %**	**8.3 %**	**10.7 %**	**12.9 %**	**14.8 %**	**16.5 %**	**18.1 %**	**17.9 %**	**15.9 %**
Well Q as CFS		**0.00**	**0.00**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.00**	**0.00**
Interference CFS		**0.130**	**0.117**	**0.020**	**0.049**	**0.075**	**0.097**	**0.117**	**0.134**	**0.150**	**0.164**	**0.163**	**0.145**
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													
(A) = Total Interf.		**0.130**	**0.117**	**0.020**	**0.049**	**0.075**	**0.097**	**0.117**	**0.134**	**0.150**	**0.164**	**0.163**	**0.145**
(B) = 80 % Nat. Q		**6.63**	**9.62**	**17.10**	**38.80**	**40.30**	**15.10**	**4.78**	**2.99**	**2.83**	**3.22**	**4.31**	**5.60**
(C) = 1 % Nat. Q		**0.0662**	**0.0962**	**0.1710**	**0.3880**	**0.4030**	**0.1510**	**0.0478**	**0.0299**	**0.0283**	**0.0322**	**0.0431**	**0.0560**
(D) = (A) > (C)		**Yes**	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
(E) = (A / B) x 100		**1.961**	**1.216**	**0.117**	**0.126**	**0.186**	**0.642**	**2.448**	**4.482**	**5.300**	**5.093**	**3.782**	**2.589**

(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:

The proposed POA well is more than one-mile from Cottonwood Creek.

Hunt (1999) was used to calculate the interference with Cottonwood Creek due to pumping the proposed POA well. The calculations indicate the interference with the creek will exceed one-percent of the natural flow (80% exceedance) during eight months when the creek flow is lowest.

The calculation groundwater level drawdown used a pro-rated rate (total annual volume requested divided by the total pumping period) of 0.91 cfs (407 gpm), a transmissivity of 1,300 ft2/day derived from specific capacity data for well LAKE 4012 located in the same section as the proposed POA well, an intermediate storage coefficient of 0.001, a stream width of 20 feet, and a streambed thickness of 10 feet with a vertical hydraulic conductivity of 0.026 ft/day (the horizontal hydraulic conductivity of the basin-fill divided by 100). The transmissivity used is consistent with the range Morgan (1988) noted for the basin-fill within the Goose Lake valley.

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

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

OAR 690-513-0030 (Goose Lake Subbasin) applies.

OAR 690-513-0030 (2)(d) says "Groundwater from any well within 1,000 feet of Thomas Creek, or a tributary, and taking water from an unconfined aquifer is classified for domestic and stockwater uses only. This paragraph only applies to wells within the following areas:...(D) Sections 1-3 and 10-15; Township 39S; Range 19E;"

The well location is within the area noted. It is in T39S/R19E-sec 14.

Groundwater in the Goose Lake area is identified as unconfined.

The proposed POA well is less than 100 feet from an intermittent stream drainage that discharges to a ditch that may discharge to Thomas Creek. Other surface water is more than 1,000 feet from the proposed POA well. The Department needs to determine whether the intermittent stream drainage is identified as a tributary to Thomas Creek or not. It is uncertain to this reviewer.

If the intermittent stream is not identified as a tributary to Thomas Creek, agricultural use is allowed for the proposed well location.

Calculations indicate the interference with Thomas Creek will exceed one-percent of the natural flow (80% exceedance) during four months when the creek flow is lowest.

Calculations indicate the interference with Cottonwood Creek will exceed one-percent of the natural flow (80% exceedance) during eight months when the creek flow is lowest.

If a permit is issued, recommend conditions 7B, 7N, 7P, 7T, and the following

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).

The groundwater system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement.

The water well report (well-log) for well LAKE 52538 indicates the productive water bearing zone(s) tapped by the well is solely within the predominantly basin-fill sedimentary unit that overlies the predominantly volcanic-basalt rock and sediments unit. The well's liner is perforated from 247 to 387 feet depth adjacent to layers of sands and gravels and some layers of clay and fractured claystone.

Reports for the Goose and Summer Lakes Basin indicate ground water occurs in alluvium, basin fill sediments, and different basalt units. Geologic maps (Morgan 1988, Walker 1963, and others) indicate basin-fill sedimentary deposits at the proposed POA well. The well is located between Cottonwood Creek and Thomas Creek. Morgan (1988) shows the well location adjacent to a divide in the surficial geology with fluvial terrace and lacustrine deposits (Qlo) to the west and alluvial deposits (Qal) to the east. Walker (1963) mapped the surface geology at the well site as sedimentary deposits (QTs) that includes lacustrine, fluviatile, and Aeolian sedimentary rocks, interstratified tuff, ashy diatomite, and unconsolidated clay, sand, silt, and gravel, mostly in pluvial basins that correlates to water laid volcanic deposits of Wells and Peck (1961). Walker (1963) mapped nearby surface geology as alluvium (Qal) described as unconsolidated fluviatile gravel, sand, and silt. In places, it can include talus, fanglomerate, lakebed deposits, and wind-blown sand. Both Morgan (1988) and Walker (1963) show ash-flow tuffs, tuffaceous sedimentary rocks, tuff breccias, andesite and basalt flows (Tv) in the uplands that surround the Goose lake Valley. These underlie the basin-fill sedimentary deposits in the valley.

Data indicate groundwater at the well is below the elevation of Cottonwood Creek at the closest reach to the west and above Cottonwood Creek at a lower reach to the south. The data also indicates groundwater at the well is above the elevation of Thomas Creek.

Morgan (1988) notes ground water flow is generally from upland recharge areas to lowland discharge areas, primarily Goose Lake. However, local subsystems discharge to lakes, reservoirs, meadows, and streams. Large quantities of ground water move through complexly interbedded, discontinuous, unconsolidated sand, gravel, silt, and clay deposits. Morgan characterizes the upper portion of ground water as unconfined with confined-like conditions increasing with depth. This appears related to anisotropic hydraulic conductivities with horizontal hydraulic conductivity much greater than vertical hydraulic conductivity. For one site noted, the estimated ratios ranged from 2:1 to 179:1. There is no indication of shallower ground water being separated from deeper ground water by a confining layer.

References Used:

Gonthier, J.B. 1985, A description of aquifer units in eastern Oregon: USGS Water Resources Investigations Report 84-4095, 39 p., 4 plates.

Hunt, B., 1999, Unsteady stream depletion from ground water pumping: Ground Water, v. 37, no. 1, p. 98-102.

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

Miller, D.W., 1986, Appraisal of ground-water conditions in the Fort Rock Basin, Lake County, Oregon: Oregon Water Resources Department, Ground Water Report No. 31, 196 p and plates.

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.

Peterson, N.V., and Brown, D.E., 1980, Preliminary geology and geothermal resource potential of the Lakeview area, Oregon: DOGAMI Open-File Report O-80-09, 57 p., 1:62,500 maps.

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.

Theis, C.V. 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground water 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 Reppening, C.A., 1965, Reconnaissance geologic map of the Adel quadrangle, Lake, Harney, and Malheur Counties, Oregon: USGS Miscellaneous Geologic Investigations Map I-446.

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

Wells, F.G., and Peck, D.L., 1961, Geologic map of Oregon west of the 121st meridian: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-325.

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

State observation well 380 (well LAKE 2320) and state observation well 379 (well LAKE 1979).

Water well reports for area wells, particularly well LAKE 4012 and the proposwed POA well LAKE 52538.

Lakeview NW USGS quadrangle map (1:24,000 scale)

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** 1 **Logid:** LAKE 52538

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

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

D3. **THE WELL construction deficiency or other comment is described as follows:** _____

D4. ☐ **Route to the Well Construction and Compliance Section for a review of existing well construction.**

Well enforcement staff was consulted. The staff indicated the well meets well construction standards based on what is found on the water well report submitted for well LAKE 52538.

Water Availability Tables

See attachments

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

LAKE 52538
8/11/2014

WELL I.D. LABEL# L 114391
START CARD # 1023697
ORIGINAL LOG #

(1) LAND OWNER

Owner Well I.D.
First Name JAMES Last Name VOTTO
Company
Address 93905 PIKE LN.
City LAKEVIEW State OR Zip 97630

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Conversion [ ] Alteration (complete 2a & 10) [ ] Abandonment(complete 5a)

(2a) PRE-ALTERATION

	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
Casing:									

	Material	From	To	Amt	sacks/lbs
Seal:					

(3) DRILL METHOD

[ ] Rotary Air [X] Rotary Mud [ ] Cable [ ] Auger [ ] Cable Mud
[ ] Reverse Rotary [ ] Other

(4) PROPOSED USE

[ ] Domestic [X] Irrigation [ ] Community
[ ] Industrial/ Commericial [ ] Livestock [ ] Dewatering
[ ] Thermal [ ] Injection [ ] Other

(5) BORE HOLE CONSTRUCTION

Special Standard [ ] (Attach copy)
Depth of Completed Well 387.00 ft.

BORE HOLE

Dia	From	To
24	0	56
20	56	387

SEAL

Material	From	To	Amt	sacks/lbs
Cement	0	56	46	S

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from ft. to ft. Material
Filter pack from 0 ft. to 387 ft. Material PEA GRAVEL Size pea gravel
Explosives used: [ ] Yes Type Amount

(5a) ABANDONMENT USING UNHYDRATED BENTONITE

Proposed Amount Actual Amount

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
(•)	( )	20	[X]	2	56	250	(•)	( )	[X]	[ ]
( )	(•)	12	[X]	2.5	387	250	(•)	( )	[X]	[ ]
( )	( )		[ ]				( )	( )	[ ]	[ ]
( )	( )		[ ]				( )	( )	[ ]	[ ]
( )	( )		[ ]				( )	( )	[ ]	[ ]

Shoe [ ] Inside [ ] Outside [ ] Other Location of shoe(s)
Temp casing [ ] Yes Dia From To

(7) PERFORATIONS/SCREENS

Perforations Method Saw cut
Screens Type Material

Perf/ Screen	Casing/ Screen Liner	Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Perf	Liner	12	247	387	.125	3	5200	

(8) WELL TESTS: Minimum testing time is 1 hour

( ) Pump ( ) Bailer (•) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
1000		160	2
1500		200	1

Temperature 56 °F Lab analysis [ ] Yes By
Water quality concerns? [ ] Yes (describe below) TDS amount

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County LAKE Twp 39.00 S N/S Range 19.00 E E/W WM
Sec 14 NW 1/4 of the NE 1/4 Tax Lot 100
Tax Map Number Lot
Lat ° ' " or DMS or DD
Long ° ' " or DMS or DD
(•) Street address of well ( ) Nearest address
93905 PIKE LN. LAKEVIEW

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Pre-Alteration			[ ]	
Completed Well	7/22/2014		[ ]	5.9

Flowing Artesian? [ ] Dry Hole? [ ]

WATER BEARING ZONES Depth water was first found 14.00

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
7/23/2014	58	372	1500		[ ]	5.85
					[ ]	
					[ ]	
					[ ]	
					[ ]	

(11) WELL LOG

Ground Elevation

Material	From	To
Fine brown sand	0	14
Pea gravel	14	16
Fine brown sand	16	21
Pea gravel	21	24
fine brown sand with gravel	24	50
Grey clay	50	58
Fractured clay stone/sand/gravel/shells	58	74
Gravel with sand	74	82
fractured sandstone	82	91
gravel and coarse sand	91	130
grey clay w/ fractured sandstone layers	130	144
fractured sandstone with gravel	144	148
sandy grey clay	148	156
Fractured grey clay stone w/ gravel	156	169
sandy grey clay	169	189
coarse sand and gravel	189	202
sandy grey clay	202	213
fractured sandstone with gravel	213	218
Fractured grey clay stone	218	234

Date Started 7/22/2014 Complete 8/6/2014

(unbonded) Water Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1940 Date 8/11/2014

Signed BENJAMIN FRY (E-filed)

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1355 Date 8/11/2014

Signed ARTHUR L FRY (E-filed)

Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK Form Version:

WATER SUPPLY WELL REPORT - continuation page

LAKE 52538

8/11/2014

WELL I.D. LABEL# L 114391
START CARD # 1023697
ORIGINAL LOG #

(2a) PRE-ALTERATION

Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

Material	From	To	Amt	sacks/lbs

(5) BORE HOLE CONSTRUCTION

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs

FILTER PACK

From	To	Material	Size

(6) CASING/LINER

Casing Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(7) PERFORATIONS/SCREENS

Perf/ Screen	Casing/ Screen Liner	Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(10) STATIC WATER LEVEL

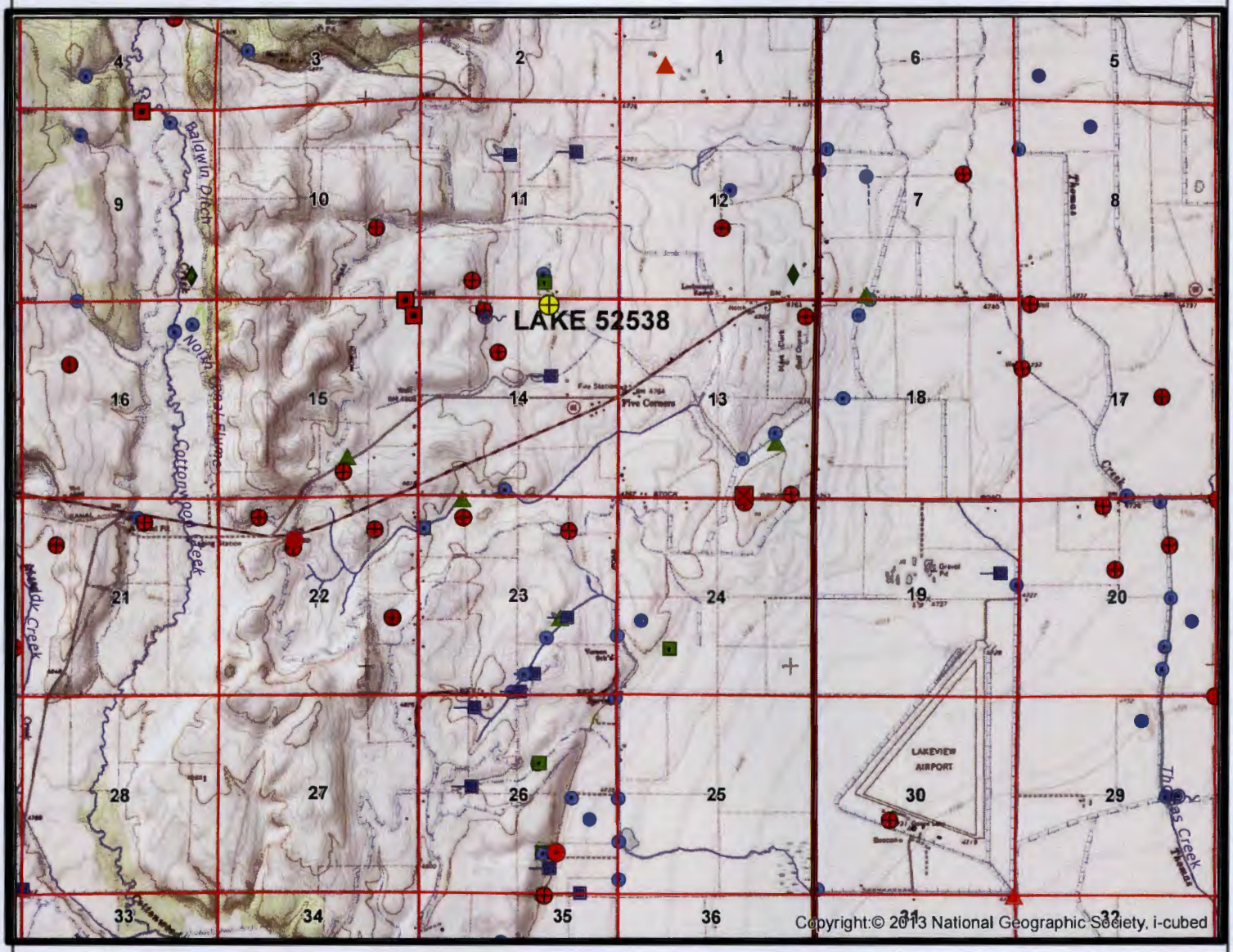
SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) WELL LOG

Material	From	To
Gravel with sand	234	242
wood	242	243
sand grey clay with wood	243	248
sandy grey clay with gravel and wood	248	262
gravel, sand, and clay layers	262	364
fractured clay stone	364	368
gravel with sand	368	372
grey clay	372	387

Comments/Remarks

Groundwater Permit Application G-17931
James W. Votto



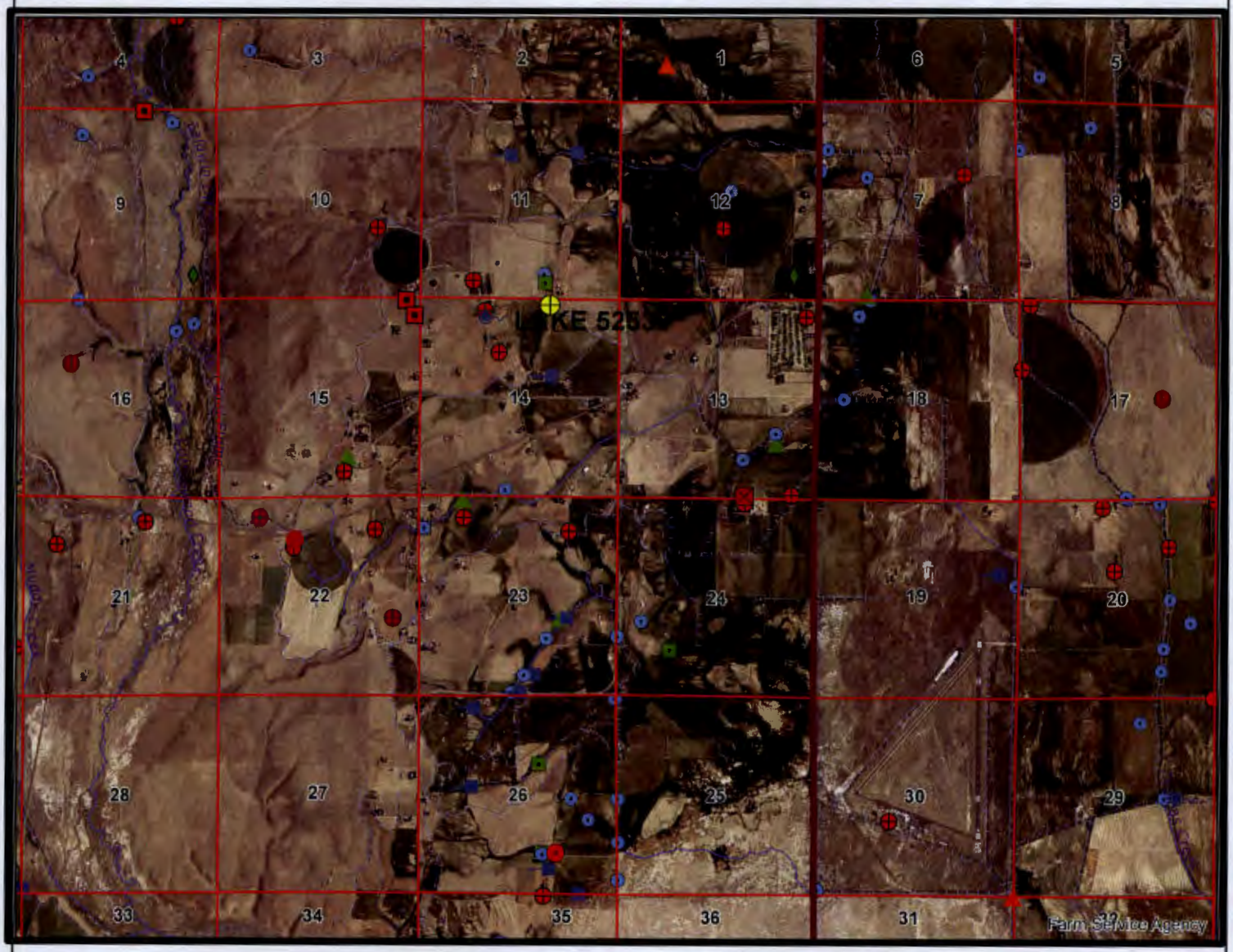
0 0.5 1 2
Miles

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

Blue and Other = surface water rights

N

Groundwater Permit Application G-17931
James W. Votto



0 0.5 1 2
Miles

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

Blue and Other = surface water rights

N

Drawdown Calculations Using Theis Equation

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

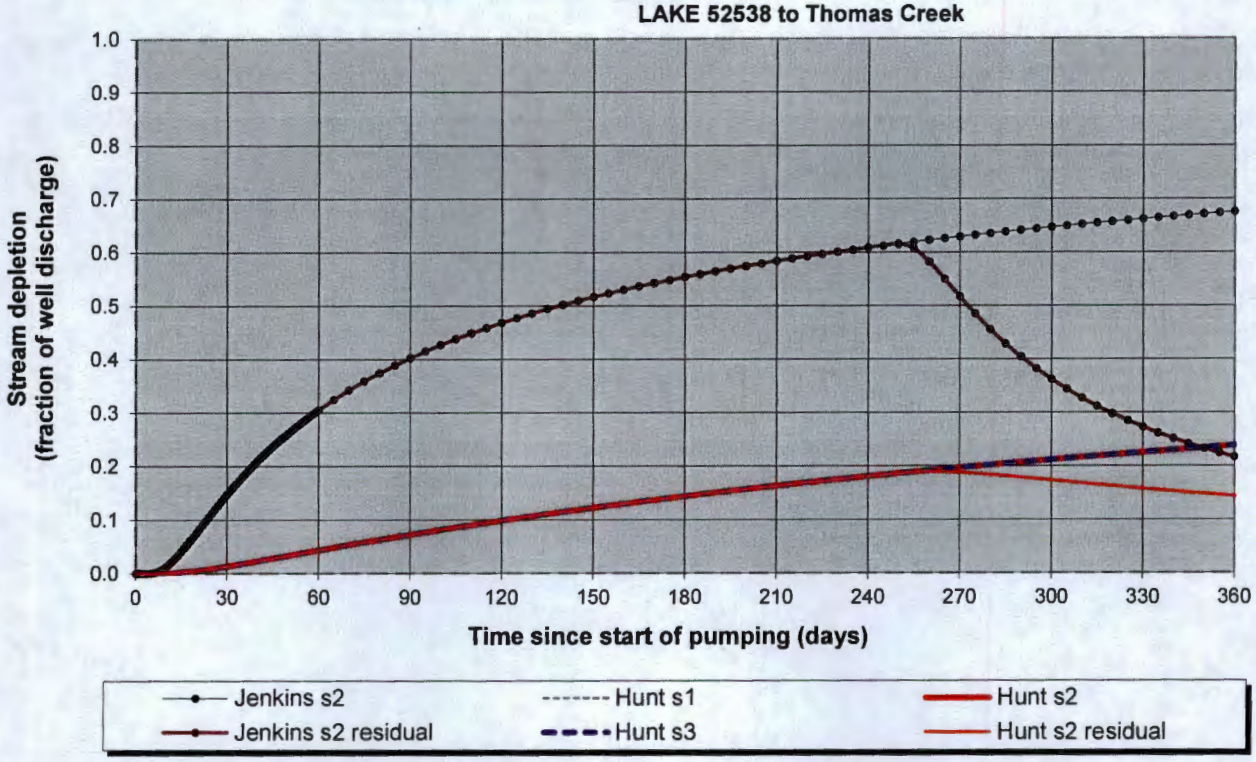
$u = (r*r*S)/(4*T*t)$

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

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 Well (LAKE 52538) to Spring (certificate 66628): Transmissivity from well LAKE 4012 specific capacity dat											
9,724.68	1,300.00	0.00100	825.00	1.84	30.00	1,565.00	3.14	0.0157	3.5925	34.9244	Continuous Pumping at Full Rate
9,724.68	1,300.00	0.00100	825.00	1.84	245.00	1,565.00	3.14	0.0019	5.6789	55.2067	Continuous Pumping at Full Rate
9,724.68	1,300.00	0.00100	407.31	0.91	30.00	1,565.00	3.14	0.0157	3.5925	17.2425	Pro-Rated Pumping Rate
9,724.68	1,300.00	0.00100	407.31	0.91	245.00	1,565.00	3.14	0.0019	5.6789	27.2560	Pro-Rated Pumping Rate
Proposed Well (LAKE 52538) to Spring (certificate 53537): Transmissivity from well LAKE 4012 specific capacity dat											
9,724.68	1,300.00	0.00100	825.00	1.84	30.00	10,700.00	3.14	0.7339	0.3507	3.4090	Continuous Pumping at Full Rate
9,724.68	1,300.00	0.00100	825.00	1.84	245.00	10,700.00	3.14	0.0899	1.9201	18.6662	Continuous Pumping at Full Rate
9,724.68	1,300.00	0.00100	407.31	0.91	30.00	10,700.00	3.14	0.7339	0.3507	1.6831	Pro-Rated Pumping Rate
9,724.68	1,300.00	0.00100	407.31	0.91	245.00	10,700.00	3.14	0.0899	1.9201	9.2157	Pro-Rated Pumping Rate

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

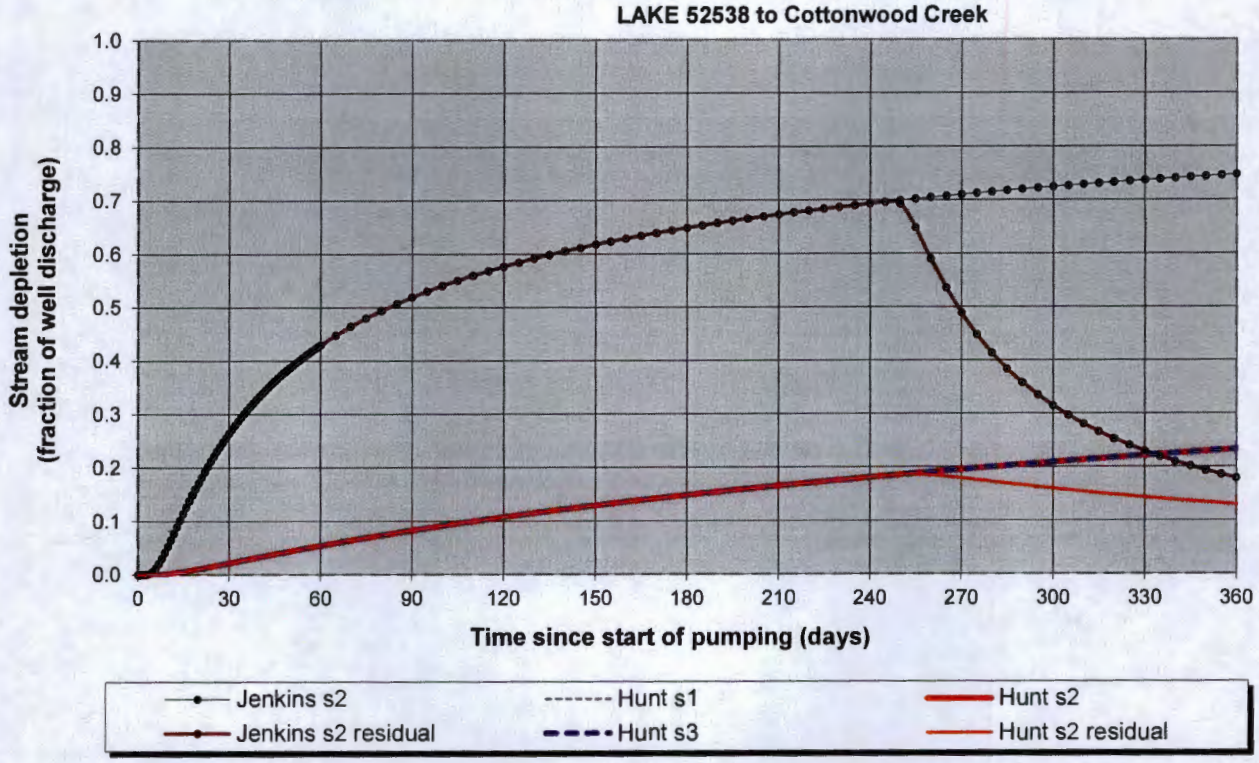


Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 245 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Qw, cfs	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908
Jenk SD %	0.147	0.305	0.403	0.469	0.517	0.554	0.584	0.608	0.517	0.362	0.273	0.217
Jen SD cfs	0.134	0.277	0.365	0.425	0.469	0.503	0.530	0.552	0.469	0.329	0.248	0.196
Hunt SD %	0.013	0.043	0.073	0.099	0.123	0.144	0.163	0.181	0.188	0.174	0.158	0.144
Hunt SD cfs	0.012	0.039	0.066	0.090	0.111	0.130	0.148	0.164	0.171	0.157	0.143	0.131

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.9075	0.9075	0.9075	cfs
Distance to stream	a	12800	12800	12800	ft
Aquifer hydraulic conductivity	K	2.6	2.6	2.6	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	1300	1300	1300	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	25	25	25	ft
Streambed hydraulic conductivity	Ks	0.026	0.026	0.026	ft/day
Streambed thickness	bs	10	10	10	ft
Streambed conductance	sbc	0.065	0.065	0.065	ft/day
Stream depletion factor (Jenkins)	sdf	126.0307692	126.0307692	126.0307692	days
Streambed factor (Hunt)	sbf	0.64	0.64	0.64	

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



Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 245 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Qw, cfs	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908
Jenk SD %	0.264	0.430	0.519	0.577	0.618	0.649	0.673	0.693	0.488	0.314	0.229	0.179
Jen SD cfs	0.240	0.390	0.471	0.523	0.560	0.589	0.611	0.629	0.443	0.285	0.208	0.162
Hunt SD %	0.022	0.055	0.083	0.107	0.129	0.148	0.165	0.181	0.179	0.159	0.143	0.129
Hunt SD cfs	0.020	0.049	0.075	0.097	0.117	0.134	0.150	0.164	0.163	0.145	0.130	0.117

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.9075	0.9075	0.9075	cfs
Distance to stream	a	9860	9860	9860	ft
Aquifer hydraulic conductivity	K	2.6	2.6	2.6	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	1300	1300	1300	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	20	20	20	ft
Streambed hydraulic conductivity	Ks	0.026	0.026	0.026	ft/day
Streambed thickness	bs	10	10	10	ft
Streambed conductance	sbc	0.052	0.052	0.052	ft/day
Stream depletion factor (Jenkins)	sdf	74.78430769	74.78430769	74.78430769	days
Streambed factor (Hunt)	sbf	0.3944	0.3944	0.3944	

Water Availability Analysis

COTTONWOOD CR > THOMAS CR - AT MOUTH
GOOSE & SUMMER LAKE BASIN
Water Availability as of 11/26/2014

Watershed ID #: 31300103 (Map)
Date: 11/26/2014

Exceedance Level: 80%
Time: 2:07 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	31300102	THOMAS CR> GOOSE L- AT MOUTH	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes
2	**31300103**	**COTTONWOOD CR> THOMAS CR- AT MOUTH**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**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	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	No	-7.41
FEB	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	No	-12.80
MAR	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	No	-14.20
APR	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	No	-24.60
MAY	31300102	THOMAS CR > GOOSE L - AT MOUTH	No	-81.20
JUN	31300102	THOMAS CR > GOOSE L - AT MOUTH	No	-102.00
JUL	31300102	THOMAS CR > GOOSE L - AT MOUTH	No	-31.50
AUG	31300102	THOMAS CR > GOOSE L - AT MOUTH	No	-16.50
SEP	31300102	THOMAS CR > GOOSE L - AT MOUTH	No	-12.80
OCT	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	No	-3.37
NOV	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	Yes	0.19
DEC	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	No	-5.96
ANN	31300103	COTTONWOOD CR > THOMAS CR - AT MOUTH	Yes	1,140.00

Detailed Reports for Watershed ID #31300102

THOMAS CR > GOOSE L - AT MOUTH
GOOSE & SUMMER LAKE BASIN
Water Availability as of 11/26/2014

Watershed ID #: 31300102 (Map)
Date: 11/26/2014

Exceedance Level: 80%
Time: 2:07 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	16.70	16.70	0.00	0.00	0.00	0.00
FEB	38.70	26.90	11.80	0.00	0.00	11.80

MAR	76.60	47.50	29.10	0.00	0.00	29.10
APR	151.00	108.00	42.80	0.00	0.00	42.80
MAY	111.00	192.00	-81.20	0.00	0.00	-81.20
JUN	41.70	143.00	-102.00	0.00	0.00	-102.00
JUL	13.10	44.60	-31.50	0.00	0.00	-31.50
AUG	8.24	24.70	-16.50	0.00	0.00	-16.50
SEP	8.98	21.80	-12.80	0.00	0.00	-12.80
OCT	10.40	13.60	-3.22	0.00	0.00	-3.22
NOV	14.50	5.88	8.62	0.00	0.00	8.62
DEC	19.10	13.90	5.24	0.00	0.00	5.24
ANN	62,400.00	39,800.00	28,800.00	0.00	0.00	28,800.00

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	16.30	0.00	0.21	0.03	0.00	0.02	0.10	0.00	16.70
FEB	26.50	0.00	0.21	0.03	0.00	0.02	0.10	0.03	26.90
MAR	34.40	12.70	0.21	0.03	0.00	0.02	0.10	0.03	47.50
APR	47.00	60.80	0.21	0.03	0.00	0.02	0.10	0.00	108.00
MAY	26.50	165.00	0.21	0.03	0.00	0.02	0.10	0.00	192.00
JUN	5.99	137.00	0.43	0.03	0.00	0.02	0.10	0.00	143.00
JUL	1.70	42.30	0.43	0.03	0.00	0.02	0.10	0.00	44.60
AUG	1.03	23.10	0.43	0.03	0.00	0.02	0.10	0.00	24.70
SEP	1.15	20.10	0.43	0.03	0.00	0.02	0.10	0.00	21.80
OCT	1.47	11.80	0.21	0.03	0.00	0.02	0.10	0.00	13.60
NOV	5.52	0.00	0.21	0.03	0.00	0.02	0.10	0.00	5.88
DEC	13.50	0.00	0.21	0.03	0.00	0.02	0.10	0.00	13.90

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.

Detailed Reports for Watershed ID #31300103

COTTONWOOD CR > THOMAS CR - AT MOUTH
GOOSE & SUMMER LAKE BASIN
Water Availability as of 11/26/2014

Watershed ID #: 31300103 (Map)
Date: 11/26/2014

Exceedance Level: 80%
Time: 2:07 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	6.63	14.00	-7.41	0.00	0.00	-7.41
FEB	9.62	22.50	-12.80	0.00	0.00	-12.80
MAR	17.10	31.30	-14.20	0.00	0.00	-14.20
APR	38.80	63.40	-24.60	0.00	0.00	-24.60

MAY	40.30	103.00	-62.70	0.00	0.00	-62.70
JUN	15.10	75.00	-59.90	0.00	0.00	-59.90
JUL	4.78	21.60	-16.90	0.00	0.00	-16.90
AUG	2.99	11.30	-8.32	0.00	0.00	-8.32
SEP	2.83	10.20	-7.35	0.00	0.00	-7.35
OCT	3.22	6.59	-3.37	0.00	0.00	-3.37
NOV	4.31	4.12	0.19	0.00	0.00	0.19
DEC	5.60	11.60	-5.96	0.00	0.00	-5.96
ANN	17,500.00	22,600.00	1,140.00	0.00	0.00	1,140.00

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	14.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	14.00
FEB	22.40	0.00	0.00	0.00	0.00	0.01	0.00	0.03	22.50
MAR	24.40	6.82	0.00	0.00	0.00	0.01	0.00	0.03	31.30
APR	31.40	32.00	0.00	0.00	0.00	0.01	0.00	0.00	63.40
MAY	15.10	87.90	0.00	0.00	0.00	0.01	0.00	0.00	103.00
JUN	3.32	71.70	0.00	0.00	0.00	0.01	0.00	0.00	75.00
JUL	0.99	20.60	0.00	0.00	0.00	0.01	0.00	0.00	21.60
AUG	0.50	10.80	0.00	0.00	0.00	0.01	0.00	0.00	11.30
SEP	0.49	9.68	0.00	0.00	0.00	0.01	0.00	0.00	10.20
OCT	0.58	6.00	0.00	0.00	0.00	0.01	0.00	0.00	6.59
NOV	4.11	0.00	0.00	0.00	0.00	0.01	0.00	0.00	4.12
DEC	11.60	0.00	0.00	0.00	0.00	0.01	0.00	0.00	11.60

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.