PUBLIC INTEREST REVIEW FOR GROUND WATER APPLICATIONS

TO: Water Rights Section **Date** **11 March 2009**

FROM: Ground Water/Hydrology Section **Gerald H. Grondin**
Reviewer's Name

SUBJECT: Application **G-17178** Supersedes review of **N.A.**
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: **Balin Farm Trust** County: **Klamath**

A1. Applicant(s) seek(s) **1.11 (500 gpm)** cfs from **1** well(s) in the **Klamath** Basin, **Lost River** sub basin Quad Map: **Merrill**

A2. Proposed use: **Irrigation (supplemental 88.2 acres)** Seasonality: **1 April through 31 October (214 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	**KLAM 52797**	**?**	**Basalt**	**1.11**	**40S/9E-sec 13 CDC**	**200' N, 1900' E fr SW cor S 13**
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	**4115**	**48**	**39**	**6/19/01**	**187**	**0 – 25**	**+1 – 25**	**None**	**None**	**2500**	**?**	**A**
2												

Use data from application for proposed wells.

A4. **Comments:**

The application requests 1.11 cfs (500 gpm) for supplemental irrigation of 88.2 acres. Often, the allowed rate is 1/80 cfs per acre. For 88.2 acres, that would be 1.10 cfs (495 gpm).

The reported casing and seal in well KLAM 52797 penetrates from land surface through a relatively thin layer of basin fill (17 feet) and 8 feet into underlying the basalt. Water well reports (well logs) indicate the basin fill layer thickens to 100's of feet to the north and east. Ground water occurs in both the basin fill and the basalt. Other water well reports (well logs) for nearby wells report water bearing zones in the basin fill with first water less than 100 feet below land surface.

The well is also under files: LL-518, LL-555, G-15362 (drought permit G-13914), G-15480 (permit G-15224), G-15945 (drought permit G-15375), G-16221 (drought permit G-15603), G-16417 (drought permit G-15895),

This application is filed concurrently with application G-17177 (well KLAM 52824, also T40S/R09E-sec 13). Both ground water permit applications are for supplemental irrigation within the USBOR Klamath Project. A permit for supplemental irrigation (ground water when project surface water is not available) is one current qualification for participation in the USBOR water bank.

A5. ☐ **Provisions of the N.A.** 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: **No basin rule applies. Only the Klamath River Compact ORS 542.610 to 542.630 applies to the Klamath Basin. However, that compact applies to surface water only, not ground water**

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 and 7N**
   ii. ☐ The permit should be conditioned as indicated in item 2 below.
   iii. ☒ The permit should contain special condition(s) as indicated in item 3 below;

B2. a. ☐ **Condition** to allow ground water production from no deeper than _____ ft. below land surface;

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

c. ☐ **Condition** to allow ground water production only from the _____ ground water reservoir between approximately_____ ft. and_____ ft. below land surface;

d. ☐ **Well reconstruction** is necessary to accomplish one or more of the above conditions. The problems that are likely to occur with this use and without reconstructing are cited below. Without reconstruction, I recommend withholding issuance of the permit until evidence of well reconstruction is filed with the Department and approved by the Ground Water Section.

Describe injury –as related to water availability– that is likely to occur without well reconstruction (interference w/ senior water rights, not within the capacity of the resource, etc): _____

B3. **Ground water availability remarks:** _____

Recommend conditions 7B and 7N

Recommend condition saying: "The ground water reference level at well KLAM 52797 (well tag = L 29452) shall be 38.2 feet below land surface"

Data from the eastern Lost River sub-basin ground water investigation (Grondin, 2004) and the USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) indicate basin long-term ground water levels are generally controlled by climate and short-term (seasonal) ground water levels are controlled by ground water use.

Additionally, the USGS (2005) has documented annual ground water level declines in the basin south of Upper Klamath Lake since 2001, including wells in the vicinity of Spring Lake. The declines are greater than typically observed during drought periods. Gannett and others (2007) noted annual declines from 2001 to 2004 of 10 to 15 feet in the Spring Lake area. They appear related to the USBOR Klamath Project Water Bank.

At this time, future ground water use for the USBOR water bank is uncertain, and it is uncertain whether the post-1999 ground water level declines in the Spring Lake vicinity will continue, stabilize at a lower level, or recover.

Ground water level measurements at two Balin wells (KLAM 52824 and KLAM 52797) in T40S/R09E-section 13 are on file at OWRD. The data is primarily after the year 2000. The measurements show seasonal fluctuations and annual ground water level declines since 2001 consistent with the USGS (2005) and Gannett and others (2007) observations noted above. The measurements show a net decline of 5 to 10 feet since 2002. The annual decline moderated with decreased USBOR water bank activity.

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

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

Well	Aquifer or Proposed Aquifer	Confined	Unconfined
1	**Basalt**	☐	☒
2		☐	☐
3		☐	☐
4		☐	☐
5		☐	☐

Basis for aquifer confinement evaluation:

System is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement. Generally, low transmissivity (low permeability) sediment of varying thickness overlies high transmissivity (high permeability) basalt. Ground water occurs in both the sediment and basalt.

Water well reports (well logs) for wells in the Spring Lake vicinity indicate the sediment thickness varies from less than 25 feet to more than 1000 feet.

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**	**Lost River**	**4075**	**4070**	**9600**	☒	☐	☐	☐	☒
1	**2**	**Klamath River**	**4075**	**4080**	**37100**	☒	☐	☐	☐	☒
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation:

Ground water elevation is based upon OWRD measurement at KLAM 52797 on 25 March 2003 (SWL = 38.24 blsd).

The ground water elevation measurement used here occurred prior to a seasonal decline due to seasonal ground water use in the area, prior to annual ground water level declines in the area related to ground water use for the USBOR water bank, but after the onset of smaller annual ground water declines related to climate.

Gannett and others (2007) show ground water flow from the uplands north, west, and east of the Spring Lake vicinity toward the Lost River and Tule Lake. This includes flow across the proposed well site. Generally in the Upper Klamath Basin, ground water and surface water are hydraulically connected.

Given available data, it appears ground water at the proposed well (KLAM 52797) is hydraulically connected to the Lost River and the Klamath River. The connection with the Lost River appears to be primarily at the nearest reach and north. Further south towards Merrill, it appears the ground water elevation drops below the Lost River.

Water Availability Basin the well(s) are located within: LOST R > TULE L – AT STATE LINE
KLAMATH R > PACIFIC OCEAN - AB JOHN C BOYLE RES

C3a. **690-09-040 (4):** Evaluation of stream impacts for <u>each well</u> that has been determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. Limit evaluation to instream rights and minimum stream flows that are pertinent to that surface water source, and not lower SW sources to which the stream under evaluation is tributary. Compare the requested rate against the 1% of 80% *natural* flow for the pertinent Water Availability Basin (WAB). If Q is not distributed by well, use full rate for each well. Any checked ☒ box indicates the well is assumed to have the potential to cause PSI.

Well	SW #	Well < ¼ mile?	Qw > 5 cfs?	Instream Water Right ID	Instream Water Right Q (cfs)	Qw > 1% ISWR?	80% Natural Flow (cfs)	Qw > 1% of 80% Natural Flow?	Interference @ 30 days (%)	Potential for Subst. Interfer. Assumed?
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐

C3b. **690-09-040 (4):** Evaluation of stream impacts <u>by total appropriation</u> 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: **Well KLAM 52797 is more than 1.00 mile from the Lost River and the Klamath River.**

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

Non-Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.4%	0.4%	0.4%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%
Well Q as CFS		0.00	0.00	0.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.00	0.00
Interference CFS		0.004	0.004	0.004	0.001	0.002	0.002	0.003	0.003	0.004	0.005	0.004	0.004
Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
(A) = Total Interf.		0.004	0.004	0.004	0.001	0.002	0.002	0.003	0.003	0.004	0.005	0.004	0.004
(B) = 80 % Nat. Q		182.0	403.0	453.0	336.0	223.0	139.0	124.0	110.0	97.00	95.40	104.0	151.0
(C) = 1 % Nat. Q		1.820	4.030	4.530	3.360	2.230	1.390	1.240	1.100	0.970	0.954	1.040	1.510
(D) = (A) > (C)		No	No	No	No	No	No	No	No	No	No	No	No
(E) = (A / B) x 100		0.002	0.001	0.001	0.000	0.001	0.001	0.002	0.003	0.004	0.005	0.004	0.003

(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:

Well KLAM 52797 is more than 1.00 mile from the Lost River.

Given available data, it appears ground water at the proposed well (KLAM 52797) is hydraulically connected to the Lost River. The connection with the Lost River appears to be primarily at the nearest reach and north. Further south towards Merrill, it appears the ground water elevation drops below the Lost River.

Interference at the Lost River was calculated using Hunt (2003) given the well obtains ground water predominantly from basalt below basin fill. The basin fill in this vicinity near the Lost River likely exceeds 500 feet thickness, but thins to less than 100 feet near the upland areas. The values used in the model were basalt transmissivity of 26,300 ft2/day (based upon specific capacity data for nearby well KLAM 52824 and is within the range of values in Gannett and others (2007)), an intermediate storage coefficient of 0.001, basin fill thickness of 1,000 based on nearby well KLAM 52824 with a hydraulic conductivity of 2.09 ft/day based upon Upper Lost River sub-basin data.

The potential interference with distant springs to the northeast (west of Olene Gap) was not evaluated due conditions that exceed assumptions and capabilities of models currently available for analyses.

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**	**0.0**%	**0.0**%	**0.1**%	**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**	**0.00**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**0.00**	**0.00**
Interference CFS		**0.000**	**0.000**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
(A) = Total Interf.		**0.000**	**0.000**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
(B) = 80 % Nat. Q		**1470.**	**1530.**	**1710.**	**2240.**	**2110.**	**1670.**	**1180.**	**915.0**	**831.0**	**810.0**	**955.0**	**1240.**
(C) = 1 % Nat. Q		**14.70**	**15.30**	**17.10**	**22.40**	**21.10**	**16.70**	**11.80**	**9.150**	**8.310**	**8.100**	**9.550**	**12.40**
(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:

Well KLAM 52797 is more than 1.00 mile from the Klamath River.

Given available data, it appears ground water at the proposed well (KLAM 52797) is hydraulically connected to the Klamath River.

Interference at the Klamath River was calculated using Hunt (2003) given the well obtains ground water predominantly from basalt below basin fill. The basin fill near the Klamath River is about 100 feet thick, but thickening toward the valley and thinning toward upland areas. The values used in the model were basalt transmissivity of 26,300 ft2/day (based upon specific capacity data for nearby well KLAM 52824 and is within the range of values in Gannett and others (2007)), an intermediate storage coefficient of 0.001, basin fill thickness of 100 feet based on well log data for wells near the nearest reach of the Klamath River with a hydraulic conductivity of 2.09 ft/day based upon Upper Lost River sub-basin data.

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**_____

Recommend conditions 7B and 7N

Recommend condition saying: "The ground water reference level at well KLAM 52797 (well tag = L 29452) shall be 38.2 feet below land surface"

References Used:

Gannett, M.W., Lite, K.E., La Marche, J.L., Fisher, B.J., and Polette, D.J. 2007. Ground-Water Hydrology of the Upper Klamath Basin, Oregon and California. USGS Scientific Investigations Report 2007-5050.

USGS, 2005. Assessment of the Klamath Project pilot water bank: a review from a hydrologic perspective. Prepared by the U.S. Geological Survey Oregon Water Science Center, Portland, Oregon for the U.S. Bureau of Reclamation Klamath Basin Area Office, Klamath Falls, Oregon, May 3, 2005.

Grondin, G.H., 2004. Ground Water in the Eastern Lost River Sub-Basin, Langell, Yonna, Swan Lake, and Poe Valleys of Southeastern Klamath County, Oregon. Ground Water Report 41, Oregon Water Resources Department, Salem, Oregon.

Leonard, A.R. and Harris, A.B. 1974. Ground water in selected areas in the Klamath Basin, Oregon. OWRD Ground Water Report No. 21, 104 pgs.

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

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.

Hydrographs and ground water level data for wells KLAM 52824, KLAM 52797

Water well reports (well logs) for wells within T40S/R09E-sec 13, T40S/R10E-sec 6 & 7, T40S/R08E-sec 1, 2, 3, 11,12

USGS Lost River quadrangle map (1:24,000 scale)

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #**: **1** **Logid:** **KLAM 52797**

D2. **THE WELL does not meet current well construction standards based upon:**
- a. ☒ review of the well log;
- b. ☐ field inspection by _____;
- c. ☐ report of CWRE _____;
- d. ☐ other: (specify) _____

D3. **THE WELL construction deficiency**:
- a. ☐ constitutes a health threat under Division 200 rules;
- b. ☐ commingles water from more than one ground water reservoir;
- c. ☐ permits the loss of artesian head;
- d. ☐ permits the de-watering of one or more ground water reservoirs;
- e. ☐ other: (specify) _____

D4. **THE WELL construction deficiency is described as follows:** _____

D5. **THE WELL**
- a. ☒ **was**, *or* ☐ **was not** constructed according to the standards in effect at the time of original construction or most recent modification.
- b. ☐ I don't know if it met standards at the time of construction.

Comment:

Well KLAM 52797 appears to be cased and sealed through the basin fill (0 to 17 feet depth) and 8 feet into apparently consolidated basalt. This is consistent with with OAR 690-210-0150 (Sealing of Water Supply Wells in Consolidated Formations).

D6. ☐ **Route to the Enforcement Section.**

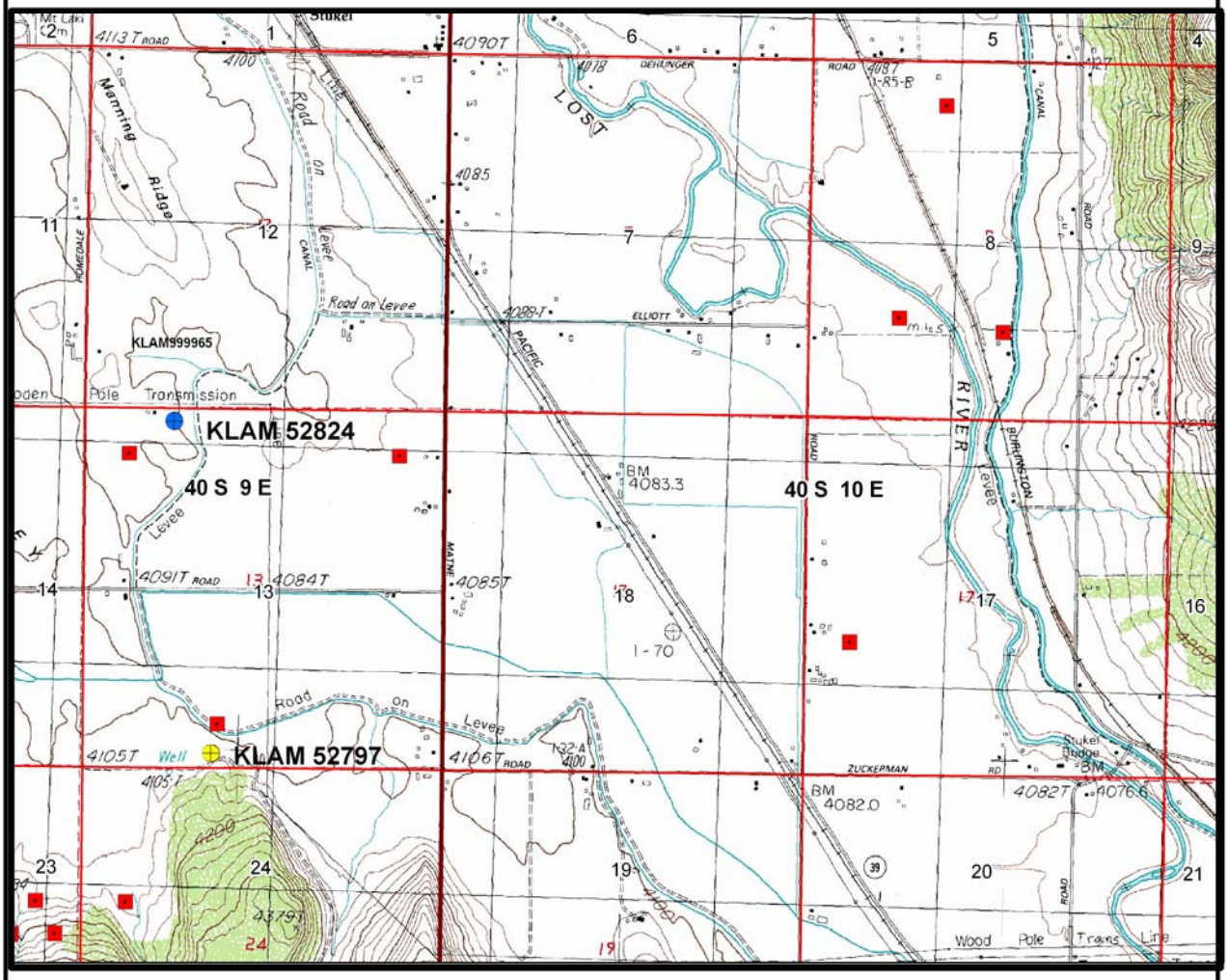
THIS SECTION TO BE COMPLETED BY ENFORCEMENT PERSONNEL

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

_____ _____, 200____.
(Enforcement Section Signature)

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

Ground Water Application G-17178
Scott & Cindy Balin



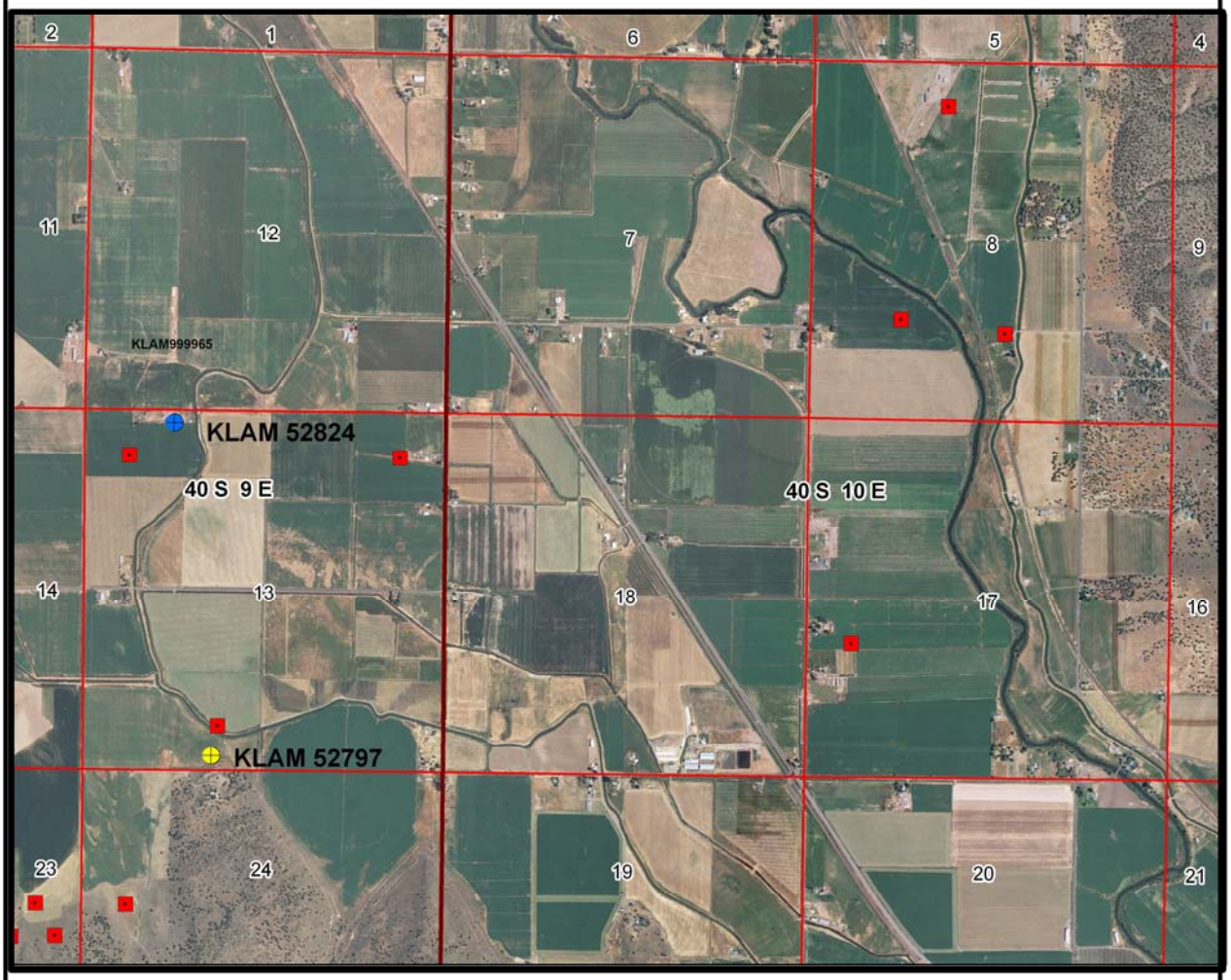
0 0.25 0.5 1 1.5 2
Miles

Yellow = Proposed Well (KLAM 52797)
Red & Blue = Other Wells (many = qtr qtr location)

Green = Surface Water Rights

N

Ground Water Application G-17178
Scott & Cindy Balin



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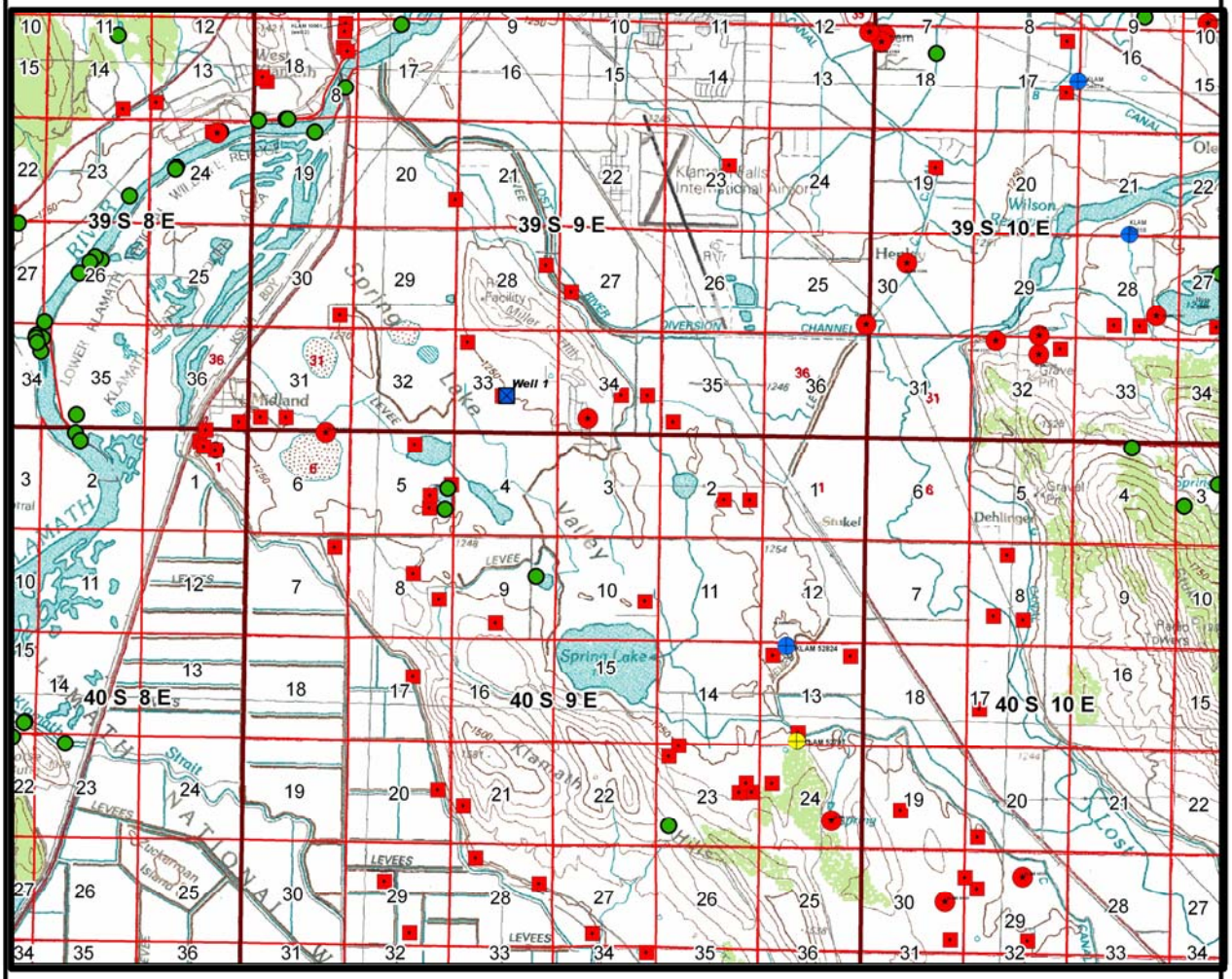

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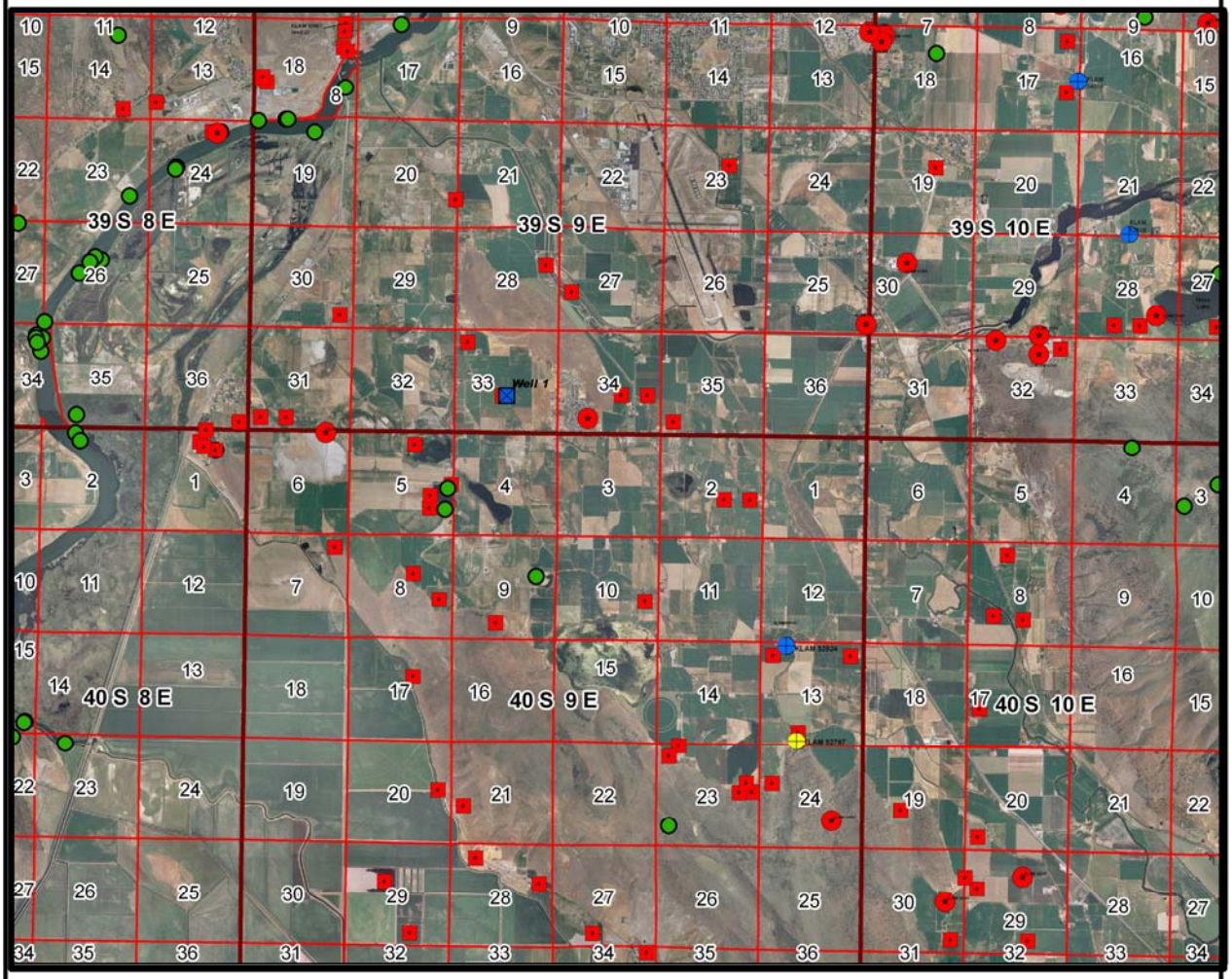
Ground Water Application G-17178
Scott & Cindy Balin



0 0.25 0.5 1 1.5 2
Miles

Yellow = Proposed Well (KLAM 52797)
Red & Blue = Other Wells (many = qtr qtr location)

Green = Surface Water Rights

N

KLAM 52797

RECEIVED
JUL 12 2001
WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L 29452
START CARD # 107317

(1) OWNER: Well Number #1
Name SCOTT BALIN
Address 6062 O'CONNOR RD
City KLAMATH FALLS State OR Zip 97603

(2) TYPE OF WORK
☑ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☑ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☑ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☑ No Depth of Completed Well 187 ft.
Explosives used ☐ Yes ☑ No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
22	0	25	CONCT	0	25	40 SKS
16	25	167				
12¼	167	187				

How was seal placed: Method ☐ A ☐ B ☑ C ☐ D ☐ E
☐ Other
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	16	+1	25	250	☑	☐	☑	☐
Liner:					☐	☐	☐	☐

Final location of shoe(s) 25 FEET

(7) PERFORATIONS/SCREENS:
☐ Perforations Method ____
☐ Screens Type ____ Material ____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.
2500			5 HRS

Temperature of water 71°F Depth Artesian Flow Found ____
Was a water analysis done? ☐ Yes By whom ____
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other ____
Depth of strata: ____

(9) LOCATION OF WELL by legal description:
County KLAMATH Latitude ____ Longitude ____
Township 40S N or S Range 9E E or W. WM.
Section 13 SE 1/4 SW 1/4
Tax Lot R4009 Lot 01300 Block 00000 Subdivision ____
Street Address of Well (or nearest address) 6062 O'CONNOR RD
KLAMATH FALLS, OR

(10) STATIC WATER LEVEL:
39 ft. below land surface. Date 6/19/01
Artesian pressure ____ lb. per square inch. Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 48 FT

From	To	Estimated Flow Rate	SWL
48	187	2000	39

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(12) WELL LOG: Ground Elevation ____

Material	From	To	SWL
TOPSOIL	0	1	
YELLOW CHALK	1	6	
DECOMPOSED LAVA	6	12	
HARD BLACK BASALT	12	15	
BROWN SHALE	15	17	
BROWN LAVA	17	30	
HARD GREY BASALT	30	43	
BROWN BASALT	43	56	
HARD GREY BASALT	56	61	
BROWN BASALT	61	70	
HARD GREY BASALT	70	76	
BLACK BASALT	76	84	
HARD GREY BASALT	84	90	
BLACK BASALT	90	119	
HARD GREY BASALT	119	129	
BLACK BASALT	129	150	
HARD GREY BASALT	150	153	
BLACK BASALT	153	160	
HARD GREY BASALT	160	166	
BLACK BASALT	166	187	

Date started JUNE 6, 01 Completed JUNE 19, 01

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, 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.
WWC Number ____
Signed ____ Date ____

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, 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.
WWC Number 601
Signed [signature] Date 7/7/01

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

Transmissivity from Specific Capacity using the Theis Equation

Adapted from Vorhis (1979)

Theis Equation: T = [Q/(4*s*pi)][W(u)]
u = (r*r*S)/(4*T*t)
W(u) = (-ln u)-(0.5772157)+(u)-(u*u/2*2!)+(u*u*u/3*3!)-(u*u*u*u/4*4!)+...

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

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

Note: Transmissivity is derived using an iterative process
The calculations use a known or assumed Storage Coefficient (S) provided by the user
Specific Capacity (Q/s) is used to first approximate the Transmissivity (T) used to calculate u in the first Theis equation iteration
The Transmissivity of the previous iteration is used to calculate u in a given Theis equation iteration
Total Theis Equation iterations = 25 iterations
Can accept answer if difference in calculated Transmissivity for the last 2 iterations is < 0.0001
Can accept answer if u in the last iteration is < 7.1

Note: Well efficiency is not included in the calculations

References:

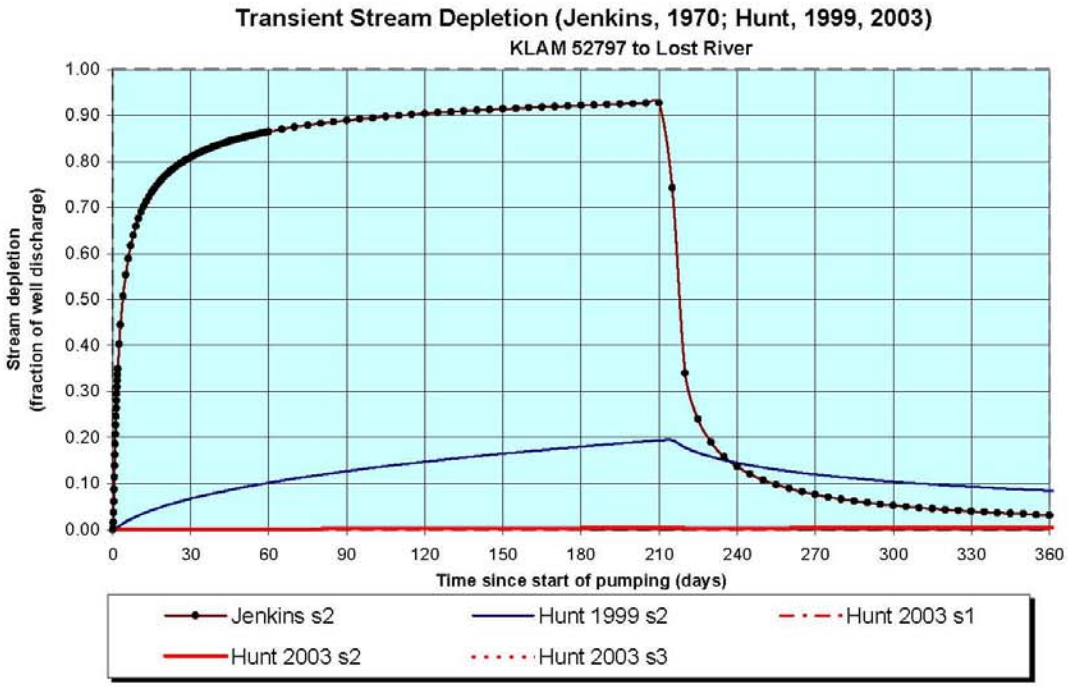
Theis, C.V. 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage. American Geophysical Union Transactions, 16 annual meeting, vol. 16, pg 519-524.

Vorhis, R.C. 1979. Transmissivity from pumped well data. Well Log, National Water Well Association newsletter, vol. 10, no. 11, Dec 1979, pg. 50-52.

Data Entry	Enter Data Below (yellow boxes only)	
Well Log ID or Comment for Records	KLAM 52824	
Pumping Rate (gpm) = Q =	3,000.00	(gpm)
Drawdown (feet) = s =	33.00	(feet)
Time (hours) = t =	8.0000	(hours)
Storage Coefficient = S =	0.000500	(dimensionless)
Well Diameter (inches) = d =	12.0000	(inches)
	Press F9 to Calculate	

Calculated Results	Calculated Results	
Transmissivity (ft2/day) = T =	26,284.60	(ft2/day)
Transmissivity (gpd/ft) = T =	196,622.46	(gpd/ft)
Transmissivity Difference = (last 2 iterations)	0.0000E+00 okay to use T if diff < 0.0001	(ft2/day)
u = (last iteration)	3.5667E-09 okay to use T if u <7.1	

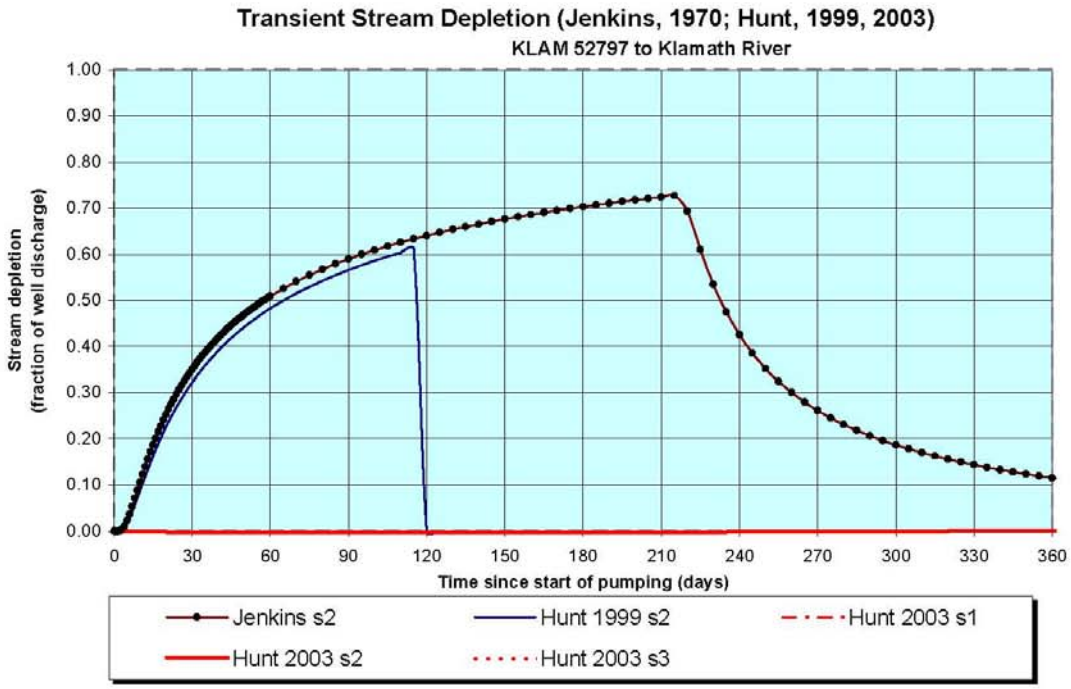
Drawdown s (feet)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft3/sec)	Time t (days)	Distance r = d/2 (feet)	u	W(u)	Transmissivity T (ft2/day)	Transmissivity difference from previous	Comments	Theis Equation Iteration
Note: yellow grid areas are where values are calculated						Note : W(u) calculation valid when u < 7.1					
						7.0000	1.1545E-04			W(u) calculation test	
33.00	0.00050	3,000.00	6.68	0.33	0.50			17,500.00		T = Q/s	
33.00	0.00050	3,000.00	6.68	0.33	0.50	5.3571E-09	18.4676	25,718.11	8.2181E+03	T = Theis Equation	1.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.6453E-09	18.8526	26,254.26	5.3615E+02	T = Theis Equation	2.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5708E-09	18.8732	26,282.99	2.8733E+01	T = Theis Equation	3.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5669E-09	18.8743	26,284.51	1.5233E+00	T = Theis Equation	4.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.59	8.0708E-02	T = Theis Equation	5.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	4.2761E-03	T = Theis Equation	6.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	2.2655E-04	T = Theis Equation	7.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	1.2002E-05	T = Theis Equation	8.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	6.3599E-07	T = Theis Equation	9.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	3.3691E-08	T = Theis Equation	10.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	1.7926E-09	T = Theis Equation	11.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	9.4587E-11	T = Theis Equation	12.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	13.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	14.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	15.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	16.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	17.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	18.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	19.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	20.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	21.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	22.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	23.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	24.00
33.00	0.00050	3,000.00	6.68	0.33	0.50	3.5667E-09	18.8744	26,284.60	0.0000E+00	T = Theis Equation	25.00



Output for Stream Depletion, Scenerio 2 (s2):						Time pump on (pumping duration) = 214 days						
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	80.9%	86.4%	88.9%	90.4%	91.4%	92.1%	92.7%	13.7%	7.6%	5.3%	4.0%	3.2%
H SD 1999	6.7%	10.2%	12.7%	14.8%	16.5%	18.0%	19.4%	14.5%	12.0%	10.4%	9.3%	8.5%
H SD 2003	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Qw, cfs	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
H SD 99, cfs	0.074	0.112	0.140	0.162	0.182	0.198	0.214	0.160	0.132	0.115	0.103	0.093
H SD 03, cfs	0.001	0.002	0.002	0.003	0.003	0.004	0.005	0.004	0.004	0.004	0.004	0.004

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	1.10	1.10	1.10	cfs
Time pump on (pumping duration)	tpon	214	214	214	days
Perpendicular from well to stream	a	9600	9600	9600	ft
Well depth	d	1414	1414	1414	ft
Aquifer hydraulic conductivity	K	52.6	52.6	52.6	ft/day
Aquifer saturated thickness	b	500	500	500	ft
Aquifer transmissivity	T	26300	26300	26300	ft*ft/day
Aquifer storativity or specific yield	S	0.001	0.001	0.001	
Aquitard vertical hydraulic conductivity	Kva	2.09	2.09	2.09	ft/day
Aquitard saturated thickness	ba	1000	1000	1000	ft
Aquitard thickness below stream	babs	950	950	950	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	75	75	75	ft
Streambed conductance (lambda)	sbc	0.165000	0.165000	0.165000	ft/day
Stream depletion factor	sdf	3.504183	3.504183	3.504183	days
Streambed factor	sbf	0.060228	0.060228	0.060228	
input #1 for Hunt's Q_4 function	t'	0.285373	0.285373	0.285373	
input #2 for Hunt's Q_4 function	K'	7.323741	7.323741	7.323741	
input #3 for Hunt's Q_4 function	epsilon'	0.005000	0.005000	0.005000	
input #4 for Hunt's Q_4 function	lamda'	0.060228	0.060228	0.060228	

G_17178_Balin_Spring_Lake_sd_hunt_2003_1.01.xls

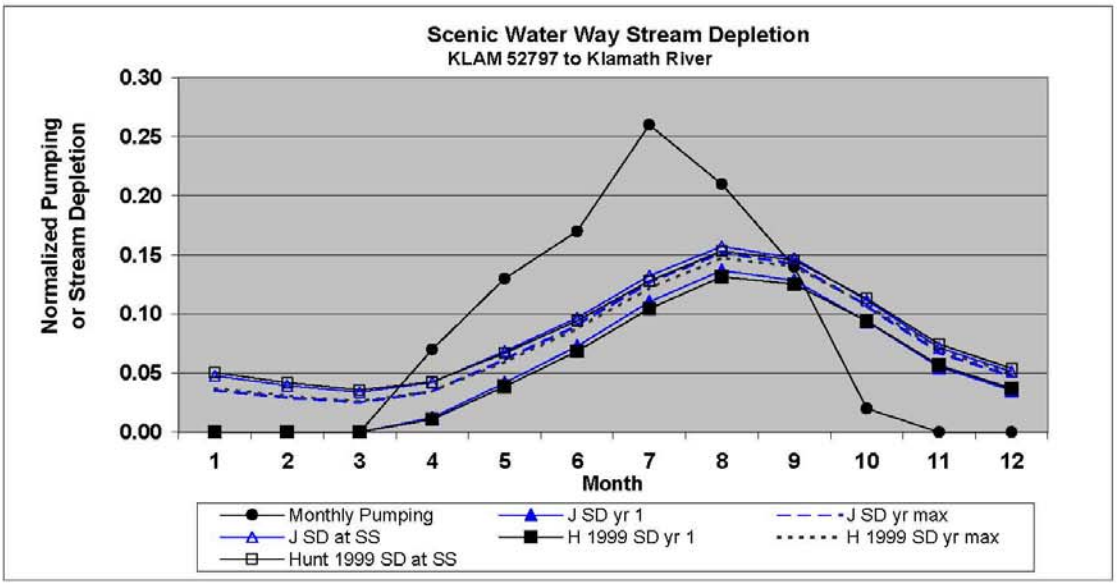


Output for Stream Depletion, Scenerio 2 (s2):						Time pump on (pumping duration) = 214 days						
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	35.0%	50.9%	59.0%	64.1%	67.6%	70.3%	72.4%	42.5%	26.1%	18.7%	14.3%	11.5%
H SD 1999	32.2%	48.3%	56.6%	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
H SD 2003	-0.2%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.1%	0.0%	0.0%	0.0%	0.0%
Qw, cfs	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100	1.100
H SD 99, cfs	0.355	0.531	0.623	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
H SD 03, cfs	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.001	0.000	0.000	0.000	0.001

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	1.10	1.10	1.10	cfs
Time pump on (pumping duration)	tpon	214	214	214	days
Perpendicular from well to stream	a	37100	37100	37100	ft
Well depth	d	1414	1414	1414	ft
Aquifer hydraulic conductivity	K	52.6	52.6	52.6	ft/day
Aquifer saturated thickness	b	500	500	500	ft
Aquifer transmissivity	T	26300	26300	26300	ft*ft/day
Aquifer storativity or specific yield	S	0.001	0.001	0.001	
Aquitard vertical hydraulic conductivity	Kva	2.09	2.09	2.09	ft/day
Aquitard saturated thickness	ba	100	100	100	ft
Aquitard thickness below stream	babs	75	75	75	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	900	900	900	ft
Streambed conductance (lambda)	sbc	25.080000	25.080000	25.080000	ft/day
Stream depletion factor	sdf	52.334981	52.334981	52.334981	days
Streambed factor	sbf	35.379011	35.379011	35.379011	
input #1 for Hunt's Q_4 function	t'	0.019108	0.019108	0.019108	
input #2 for Hunt's Q_4 function	K'	1093.801103	1093.801103	1093.801103	
input #3 for Hunt's Q_4 function	epsilon'	0.005000	0.005000	0.005000	
input #4 for Hunt's Q_4 function	lamda'	35.379011	35.379011	35.379011	

G_17178_Balin_Spring_Lake_sd_hunt_2003_1.01.xls

Oregon Water Resources Department



Region	18	Steady state stream depletion as a fraction of pumping normalized to crop water use consumption.											
Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Resid
Qw	0.00	0.00	0.00	0.07	0.13	0.17	0.26	0.21	0.14	0.02	0.00	0.00	0.00
Jenkins SD													
yr1	0.000	0.000	0.000	0.012	0.042	0.073	0.110	0.137	0.128	0.094	0.055	0.036	0.313
yrmax-1	0.035	0.029	0.025	0.034	0.061	0.091	0.127	0.152	0.142	0.107	0.067	0.047	0.081
yrmax	0.035	0.029	0.025	0.034	0.061	0.091	0.127	0.152	0.142	0.107	0.067	0.047	0.081
yrmax-yr1	0.035	0.029	0.025	0.022	0.020	0.018	0.016	0.015	0.014	0.013	0.012	0.012	0.233
J SD SS	**0.048**	**0.040**	**0.034**	**0.042**	**0.068**	**0.097**	**0.132**	**0.157**	**0.147**	**0.112**	**0.072**	**0.051**	**0.000**
Hunt SD 1999													
yr 1	0.000	0.000	0.000	0.011	0.039	0.068	0.104	0.132	0.125	0.094	0.057	0.037	0.333
yr max-1	0.037	0.031	0.027	0.034	0.060	0.087	0.122	0.148	0.140	0.108	0.070	0.049	0.087
yr max	0.037	0.031	0.027	0.034	0.060	0.087	0.122	0.148	0.140	0.108	0.070	0.049	0.087
yrmax-yr1	0.037	0.031	0.027	0.023	0.021	0.019	0.017	0.016	0.015	0.014	0.013	0.012	0.246
H99 SD SS	**0.050**	**0.042**	**0.036**	**0.043**	**0.067**	**0.094**	**0.128**	**0.153**	**0.146**	**0.113**	**0.074**	**0.054**	**0.000**

Parameters:		Values	Units	
Maximum number of years pumped	yrmax	25	years	
Days pumped each month	tpoff	30.4375	days/month	
Perpendicular from well to stream	a	37100	ft	
Well depth	d	1414	ft	
Aquifer hydraulic conductivity	K	52.6	ft/day	
Aquifer saturated thickness	b	500	ft	
Aquifer transmissivity	T_ft	26,300	ft*ft/day	= K*b
Aquifer transmissivity	T_gal	196,724	gpd/ft	= K*b
Aquifer storativity or specific yield	S	0.001		
Streambed conductivity (Hunt 1999)	Ks	2.09	ft/day	
Streambed thickness, Hunt 1999	bs	75	ft	
Stream width (Hunt 1999)	ws	900	ft	
Streambed conductance (lambda)	sbc	25.0800	ft/day	= Ks*ws/bs
Stream depletion factor	sdf	52.3350	days	= (a^2*S)/(T)
Streambed factor	sbf	35.3790		= sbc*a/T

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