Oregon Water Resources Department

Memo

Date: March 20, 2008

To: Caseworkers, Water Rights Section

From: Doug Woodcock
Manager, Ground Water Section

Subject: Long-Term Interference in Klamath Basin

The water supply issues in Klamath basin are numerous and complex, as exemplified by the federal interest in resolving Klamath ESA and T&E concerns through the Klamath Water Bank. A very large uncertainty in future water allocation centers on the outcome of the Klamath adjudication. In addition to the current water conflicts in the basin, there will be users whose surface water claims are denied in the adjudication process and, absent a supplemental supply, will be without a water source to continue their historical farming practice and livelihood.

A cooperative ground water investigation of the Upper Klamath Basin (Ground-Water Hydrology of the Upper Klamath Basin, Oregon and California, USGS, 2007) has determined that much of the inflow to Upper Klamath Lake can be attributed to ground water discharge to streams and major spring complexes for some miles around the lake. Ground water wells that develop water from the local and regional flow systems that contribute to the lake and spring complexes will interfere with these over-appropriated surface water supplies and further exacerbate water supply problems in the basin.

Caseworkers: Not all ground water files that are determined to be hydraulically connected to surface water are assumed to have potential for substantial interference (PSI). Those files that do have PSI are then assessed for water availability. *Within the Klamath Basin* the Commission has provided direction on how non-supplemental uses are to be evaluated when the well(s) are hydraulically connected with Klamath Lake or surface waters that contribute to Klamath Lake or the Klamath River. Hydraulic connection with over-appropriated surface water is a sufficient circumstance for denial for uses other than supplemental, even in the absence of PSI.

Inserted in file: G-17286 Date: 1\13\10 Intials: DW

PUBLIC INTEREST REVIEW FOR GROUND WATER APPLICATIONS

TO: Water Rights Section **Date** **8 January 2010**

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

SUBJECT: Application **G-17286** 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: **The Klamath Tribes** County: **Klamath**

A1. Applicant(s) seek(s) **0.31 (138 gpm)** cfs from **1** well(s) in the **Klamath** Basin, **Upper Klamath Lake** sub basin Quad Map: **Agency Lake**

A2. Proposed use: **Irrigation (20.4 acres, primary), Commercial (primary), and Residential (primary & supplemental)**
Seasonality: **Residential & Commercial = Year Round (365 days), Irrigation = 15 April to 15 October (184 days)**

A3. Well and aquifer data **(attach and number logs for existing wells; mark proposed wells as such under logid)**:

Well	Logid	Applicant's Well #	Proposed Aquifer*	Proposed Rate(cfs)	Location (T/R-S QQ-Q)	Location, metes and bounds, e.g. 2250' N, 1200' E fr NW cor S 36
1	**Not Drilled**	**2**	**Basin fill**	**0.31**	**35S/7E-sec 8 DBC**	**1890' N, 2060' W fr SE cor S 8**
2						
3						
4						

* 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	**4265**	**?**	**?**	**N.A.**	**Prop +/-600**	**Prop +/-340**	**Prop +/-500**	**?**	**?**	**?**	**?**	**?**

Use data from application for proposed wells.

A4. **Comments:**

The proposed water use is for a 55 acre subdivision:

Well 1 is under application G-15844 (permit G-15486), is not constructed, but 600 ft abandoned test hole was, 0.03 cfs (13.5 gpm) was approved for domestic use (25 homes)

This application G-17286 proposes adding Well 2 for:
Irrigation of 20.4 acres (primary) = 114.4 gpm (0.25 cfs), 61.2 ac-ft/yr total
Commercial (primary) for community center = 2.7 gpm (0.006 cfs), 1.42 mil gal / yr (4.4 ac-ft/yr)
Domestic (primary) for 10 homes = 7.2 gpm (0.016 cfs), 3.78 mil gal / yr (11.6 ac-ft/yr)
Domestic (supplemental to Well 1, 25 homes) = 13.46 gpm (0.030 cfs), 7.1 mil gal / yr (21.8 ac-ft/yr)

Proposed aquifer is basin fill based on application and water well reports submitted (KLAM 57258 & KLAM 1213)

The static water may be about 85 ft blsd on the proposed location and USGS report (Gannett and others, 2007). The report shows the proposed well location on a ground water divide between Agency Lake and the Williamson River.

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, 7F, 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, 7F and 7N.**

The understanding of the Upper Klamath Basin hydrogeology has improved since the review of previous application G-15844 (permit G-15486)

Data from the eastern Lost River sub-basin ground water investigation (Grondin, 2004) and the current 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 water level declines in the basin south of Upper Klamath Lake since 2001. The declines are greater than typically observed during drought periods. They appear related to the USBOR Klamath Project Water Bank.

Further, the current USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) has also found an exception to the basin-wide ground water level trends at wells in the vicinity of Upper Klamath Lake. Ground water levels at these wells are highly influenced by lake levels.

The closest state observation well to the applicant's area is state observation well 274 (KLAM 1362) located about 4.5 miles southeast of the proposed well site. It is 500 feet deep, completed in basin fill. The hydrograph is from 1965 to 2009. It shows the ground water level is influenced by lake levels. The hydrograph for the applicant's well is expected to be similar given its proximity to surface water (Agency Lake).

Another state observation well 273 (KLAM 11796) is located at Collier State Park, close to the Williamson River, about 6.5 miles northeast of the proposed well site. It is 221 feet deep, completed in rock (most likely basalt). The hydrograph is from the 1950s to 2009. It shows seasonal variations generally less than 1 foot, and the long term trend appears to be climate influenced. No net long term decline is apparent.

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**	☐	☒
		☐	☐
		☐	☐

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 submitted with the application and for other wells in the same section (section) as the proposed well indicate the basin fill thickness exceeds 600 feet. None of the wells penetrated the basin fill to reach basalt.

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**	**Williamson River**	**4180**	**4145**	**6600**	☒	☐	☐	☐	☒
1	**2**	**Agency Lake**	**4180**	**4141**	**7000**	☒	☐	☐	☐	☐
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation: Ground water elevation based on Gannett and others (2007)

A hydraulic connection to Agency Lake and the Williamson River is very likely given Gannett and others (2007) show the proposed well location on a ground water divide with ground water flow to both the lake and river and given the discussion below.

The eastern Lost River sub-basin ground water investigation data (Grondin, 2004) and the current USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) indicate low yield (low hydraulic conductivity) sediments overlie higher yield (high conductivity) basalt. Many domestic wells produce from the sediments and most irrigation wells produce from the basalt. Ground water in the sediments and the basalt appear hydraulically connected. The data include similar or small differences between basalt and sedimentary ground water levels and data showing ground water levels at wells completed in the sediments responding to pumping ground water from basalt.

In addition to the hydraulic connection between basalt and the overlying sediments, the USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) found ground water level trends at wells in the vicinity of Upper Klamath Lake are highly influenced by lake levels. Lake influenced ground water should include the applicant's area also as evidenced by state observation well 274 (KLAM 1362) located about 4.5 miles southeast of the proposed well site. The hydrograph shows the ground water level is highly influenced by lake levels. The hydrograph for the applicant's well is expected to be similar.

Water Availability Basin the well(s) are located within: LINK R> KLAMATH R- AB UNN STR
WILLIAMSON R > UPPER KLAMATH L – AT MOUTH

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

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

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

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

Comments:

The proposed well is more than one-mile from the Williamson River and Agency Lake.

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.

Williamson River (same well: 184 days irrigation calculated separate from 365 days domestic and commercial)

Non-Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**1**	**4.3%**	**3.9%**	**3.7%**	**2.2%**	**3.7%**	**4.9%**	**5.9%**	**6.8%**	**7.5%**	**6.3%**	**5.3%**	**4.7%**
Well Q as CFS		**0.00**	**0.00**	**0.00**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.00**	**0.00**
Interference CFS		**0.007**	**0.007**	**0.006**	**0.004**	**0.006**	**0.008**	**0.010**	**0.012**	**0.013**	**0.011**	**0.009**	**0.008**
1	**1**	**2.2%**	**3.7%**	**4.9%**	**5.9%**	**6.8%**	**7.5%**	**8.2%**	**8.9%**	**9.5%**	**10.1%**	**10.6%**	**11.1%**
Well Q as CFS		**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**
Interference CFS		**0.001**	**0.002**	**0.003**	**0.003**	**0.004**	**0.004**	**0.004**	**0.005**	**0.005**	**0.005**	**0.006**	**0.006**
(A) = Total Interf.		**0.008**	**0.009**	**0.009**	**0.007**	**0.010**	**0.012**	**0.014**	**0.017**	**0.018**	**0.016**	**0.015**	**0.014**
(B) = 80 % Nat. Q		**816**	**924**	**1210**	**1320**	**1280**	**915**	**639**	**553**	**589**	**651**	**677**	**818**
(C) = 1 % Nat. Q		**8.16**	**9.24**	**12.10**	**13.20**	**12.80**	**9.15**	**6.39**	**5.53**	**5.89**	**6.51**	**6.77**	**8.18**
(D) = (A) > (C)		**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
(E) = (A / B) x 100		**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.002**	**0.003**	**0.003**	**0.002**	**0.002**	**0.002**

(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.

Agency Lake (same well: 184 days irrigation calculated separate from 365 days domestic and commercial)

Non-Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
Distributed Wells													
Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**2**	**12.3%**	**9.9%**	**8.2%**	**40.4%**	**54.1%**	**61.2%**	**65.8%**	**69.1%**	**71.5%**	**36.1%**	**22.3%**	**16.0%**
Well Q as CFS		**0.00**	**0.00**	**0.00**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.00**	**0.00**
Interference CFS		**0.021**	**0.017**	**0.014**	**0.069**	**0.092**	**0.104**	**0.112**	**0.117**	**0.122**	**0.061**	**0.038**	**0.027**
1	**2**	**40.4%**	**54.1%**	**61.2%**	**65.8%**	**69.1%**	**71.5%**	**73.5%**	**75.1%**	**76.5%**	**77.6%**	**78.6%**	**79.4%**
Well Q as CFS		**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**	**0.052**
Interference CFS		**0.021**	**0.028**	**0.032**	**0.034**	**0.036**	**0.037**	**0.038**	**0.039**	**0.040**	**0.040**	**0.041**	**0.041**
(A) = Total Interf.		**0.042**	**0.045**	**0.046**	**0.103**	**0.128**	**0.141**	**0.150**	**0.156**	**0.162**	**0.101**	**0.079**	**0.068**
(B) = 80 % Nat. Q		**1470**	**1520**	**1690**	**2220**	**2100**	**1670**	**1180**	**914**	**830**	**808**	**952**	**1240**
(C) = 1 % Nat. Q		**14.70**	**15.20**	**16.90**	**22.20**	**21.00**	**16.70**	**11.80**	**9.14**	**8.30**	**8.08**	**9.52**	**12.40**
(D) = (A) > (C)		**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
(E) = (A / B) x 100		**0.003**	**0.003**	**0.003**	**0.005**	**0.006**	**0.008**	**0.013**	**0.017**	**0.020**	**0.013**	**0.008**	**0.005**

(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:

Hunt (1999) was used to calculate the interference at Williamson. The 1999 version was used given the well does not penetrate the sediments to the basalt below. The values used for the calculations are conservative and appropriate until better values become available. The transmissivity and hydraulic conductivity value used for the sediments is the derived from specific capacity data from 13 wells in T35S/R7E-sec 7 and 12 wells in T35S/R7E-sec 8. The hydraulic conductivity assigned to the river bed is 1/100 of the sediment hydraulic conductivity. The assigned aquifer thickness for the basin fill is a conservative 500 feet. The river bed thickness is a conservative 500 feet; it may be less than 100 feet. The 175 foot river width used is an average. A pro-rated pumping rate was used (total volume / total time).

Hunt (1999) was also used to calculate the interference at Agency Lake. The 1999 version was used given the well does not penetrate the sediments to the basalt below. The values used for the calculations are conservative and appropriate until better values become available. The transmissivity and hydraulic conductivity value used for the sediments is the derived from specific capacity data from 13 wells in T35S/R7E-sec 7 and 12 wells in T35S/R7E-sec 8. The hydraulic conductivity assigned to the Agency Lake bed is 1/100 of the sediment hydraulic conductivity. The assigned aquifer thickness for the basin fill is a conservative 500 feet; the thickness may reach or exceed 1,000 feet. The assigned lake bed thickness is a conservative 500 feet; it may be less than 100 feet. The 7,500 foot lake width is conservative; the shortest width is more than 10,000 feet. A pro-rated pumping rate was used (total volume / total time).

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**

If a permit is issued, include conditions 7B, 7F, 7N, 7J

A hydraulic connection to Agency Lake and the Williamson River exists.

A hydraulic connection to Agency Lake and the Williamson River is very likely given Gannett and others (2007) show the proposed well location on a ground water divide with ground water flow to both the lake and river and given the discussion below.

The eastern Lost River sub-basin ground water investigation data (Grondin, 2004) and the current USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) indicate low yield (low hydraulic conductivity) sediments overlie higher yield (high conductivity) basalt. Many domestic wells produce from the sediments and most irrigation wells produce from the basalt. Ground water in the sediments and the basalt appear hydraulically connected. The data include similar or small differences between basalt and sedimentary ground water levels and data showing ground water levels at wells completed in the sediments responding to pumping ground water from basalt.

In addition to the hydraulic connection between basalt and the overlying sediments, the USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) found ground water level trends at wells in the vicinity of Upper Klamath Lake are highly influenced by lake levels. Lake influenced ground water should include the applicant's area also as evidenced by state observation well 274 (KLAM 1362) located about 4.5 miles southeast of the proposed well site. The hydrograph shows the ground water level is highly influenced by lake levels. The hydrograph for the applicant's well is expected to be similar.

References Used:

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.

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.

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.

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

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.

State Observation Well 274 (KLAM 1362)

Specific capacity data from 15 water well reports for wells in T35S/R7E-sec 7 and sec 8

USGS Agency Lake, Oregon quadrangle map (1:24,000 scale)

D. WELL CONSTRUCTION, OAR 690-200

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

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.

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

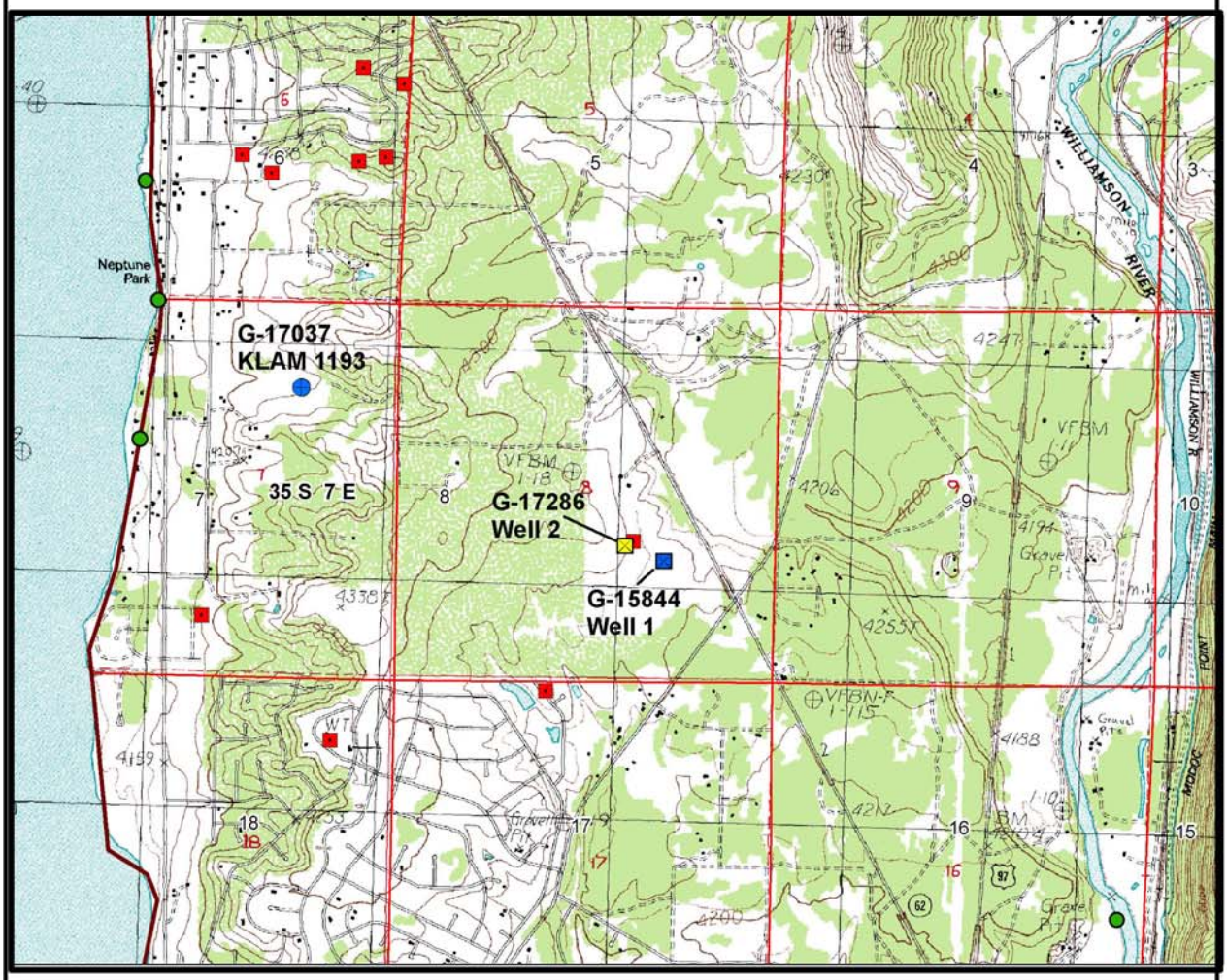
THIS SECTION TO BE COMPLETED BY ENFORCEMENT PERSONNEL

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

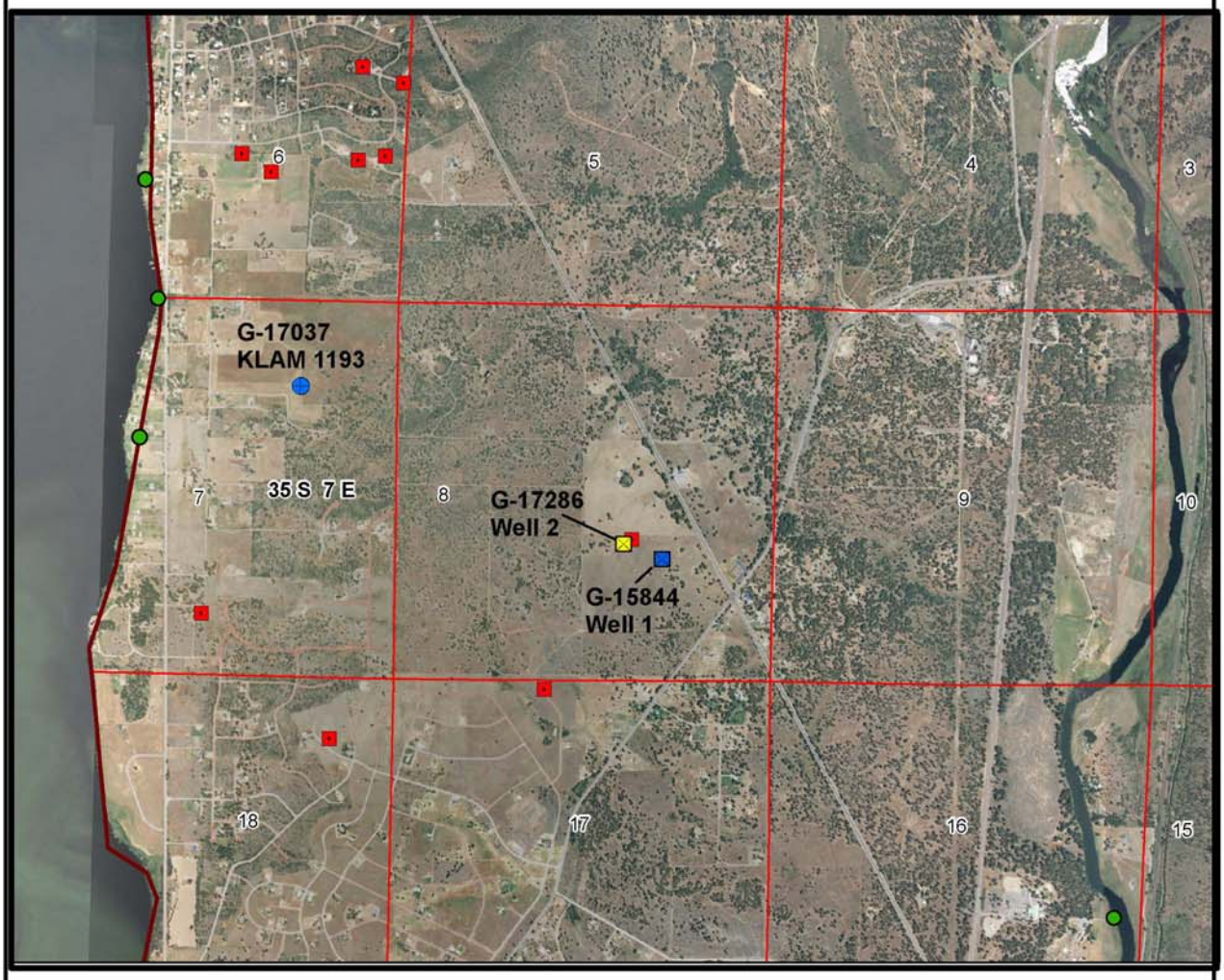
_____ _____, 200____.
(Enforcement Section Signature)

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

Ground Water Right Application G-17286
Klamath Tribes



Ground Water Right Application G-17286
Klamath Tribes



0 0.25 0.5 1 1.5 2
Miles

N

Yellow = Proposed Well
Red or Blue = Other Wells

Green = Surface Water Rights

10/03/2003 09:19 541-884-8799 PAGE 01

KLAM 57258

Test Hole Fill of Bentonite

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537765)

WELL ID # L46058
(START CARD)# 1560[illegible]2

(1) OWNER 0323
KLAMATH TRIBES
P.O. BOX 436
CHILOQUIN OR 97624

(2) TYPE OF WORK : NEW WELL

(3) DRILL METHOD : ROTARY MUD

(4) PROPOSED USE: Community- TEST HOLE

(5) BORE HOLE CONSTRUCTION:

Special Construction Approval NO Depth of Completed Well 608 ft.
Explosives used NO Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	AMOUNT Sacks
12"	0	19	BENTONITE	0	19	9
8"	19	608				

How was seal Placed POURED DRY
Backfil placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of Gravel

(6) CASING / LINER:

	Dia.	From	To	Gage	Material
CASING	8"	+1	19	250	STEEL

Final location of shoe (s)

(7) PERFORATIONS / SCREENS:

METHOD	TYPE	MATERIAL

From	To	Slot size	Number	Dia.	Tele / pipe size

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

Yield GPM	Drawdown	Drill stem at	Time
			1 HOUR

Temperature of Water F Depth Artesian Flow Found
Was a water analysis done? NO By whom
Did any strata contain water not suitable for intended use? No

(9) LOCATION OF WELL by legal description
County KLAMATH Latitude Longitude
Township 35 S. Range 7 E.
Section 8 SE 1/4 SE 1/4
Tax Lot 1700 Lot Block Subdivision
Street Address of Well (or nearest address)
SW CORNER OF HWY 62 & S. CHILOQUIN RD AP

(10) STATIC WATER LEVEL:
ft. below land surface Date
Artesian pressure Date

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

From	To	Estimated Flow	Date	SWL

(12) WELL LOG: Ground Elevation

	FROM	TO	SWL
YELLOW CLAYSTONE	0	4	
BROWN SAND AND CLAY	4	9	
BROWN CLAY	9	26	
COURSE SAND	26	54	
COURSE SAND W/SEAMS OF BROWN CLAY	54	304	
GREY CLAY	304	338	
BLUE CLAYSTONE	338	342	
GREY CLAY W/BLUE CLAY	342	498	
SANDSTONE	498	514	
GREY CLAY W/STREAKS OF SAND	514	552	
SANDSTONE	552	578	
BLUE CLAYSTONE	578	608	

RECEIVED
NOV 10 2009
WATER RESOURCES DEPT
SALEM, OREGON

Date started September 17, 2003 Completed October 2, 2003

(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 well construction standards. Materials used and information reported above are true to my best knowledge and belief.

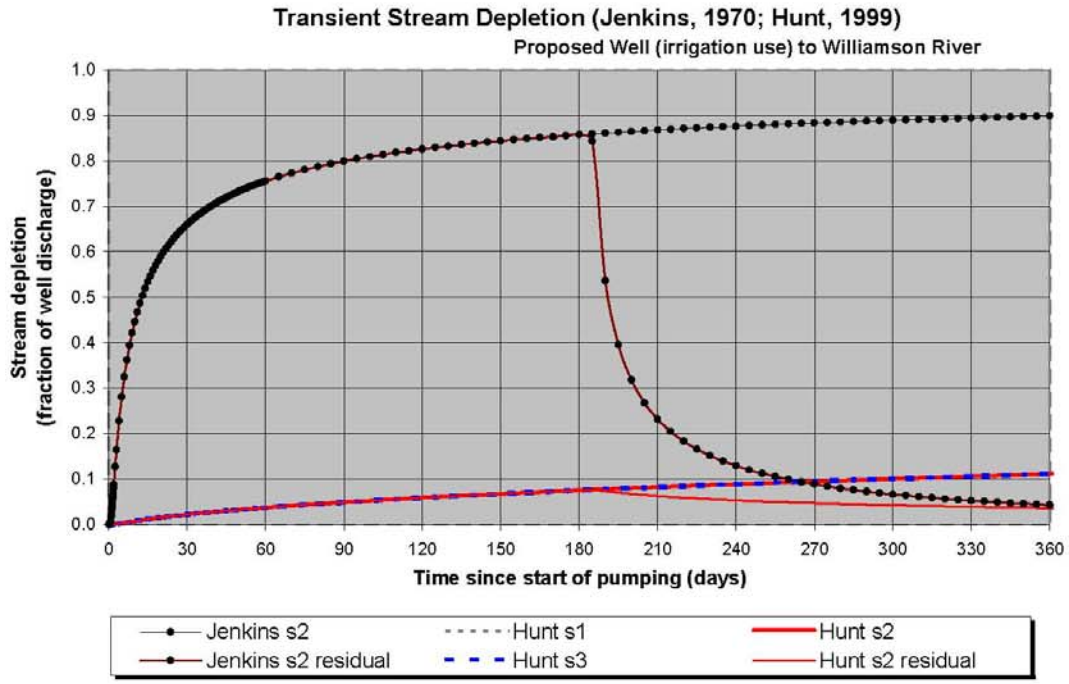
WWC # 1758

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 well construction standards. This report is true to the best of my knowledge and belief.

DATE 10-3-03 WWC # 693

EXHIBIT C

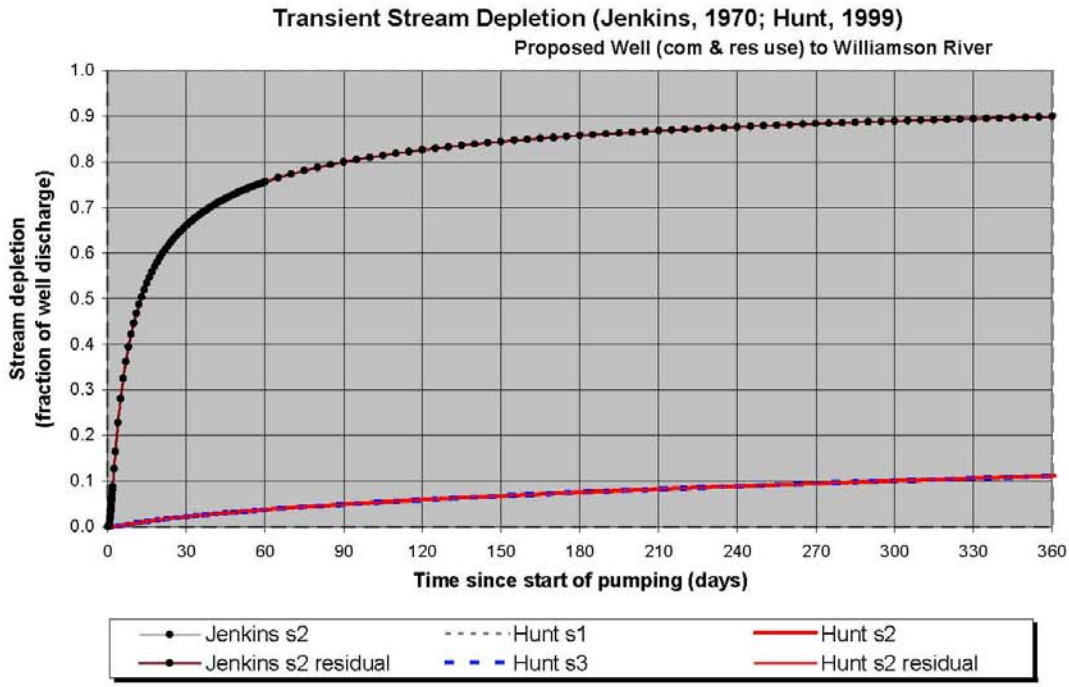


Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 184 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Hunt SD s2	0.0221	0.0374	0.0492	0.0591	0.0677	0.0754	0.0627	0.0532	0.0471	0.0427	0.0393	0.0365
Qw, cfs	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
H SD s2, cfs	0.004	0.006	0.008	0.010	0.012	0.013	0.011	0.009	0.008	0.007	0.007	0.006

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.17	0.17	0.17	cfs
Distance to stream	a	6600	6600	6600	ft
Aquifer hydraulic conductivity	K	7.5	7.5	7.5	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	3750	3750	3750	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	175	175	175	ft
Streambed hydraulic conductivity	Ks	0.075	0.075	0.075	ft/day
Streambed thickness	bs	500	500	500	ft
Streambed conductance	sbc	0.02625	0.02625	0.02625	ft/day
Stream depletion factor (Jenkins)	sdf	11.616	11.616	11.616	days
Streambed factor (Hunt)	sbf	0.0462	0.0462	0.0462	

G_17286_Klamath_Tribes_Agency_Lake_Hunt_1999_depletion_Williamson_River.xls

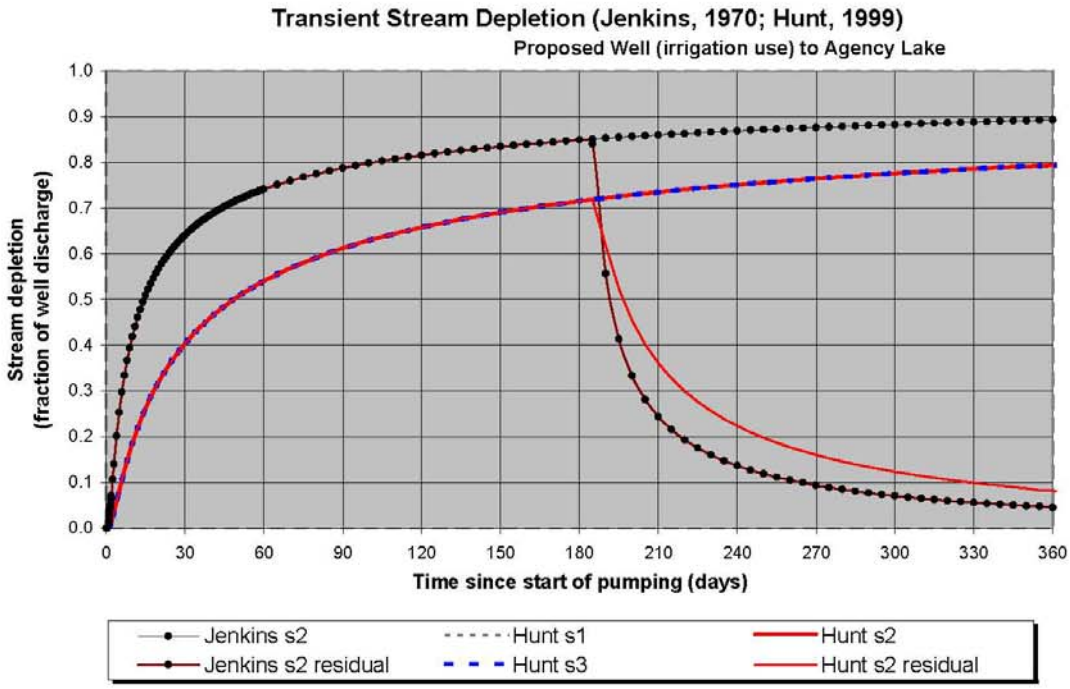


Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 365 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Hunt SD s2	0.0221	0.0374	0.0492	0.0591	0.0677	0.0754	0.0824	0.0889	0.0949	0.1005	0.1059	0.1109
Qw, cfs	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
H SD s2, cfs	0.001	0.002	0.003	0.003	0.004	0.004	0.004	0.005	0.005	0.005	0.006	0.006

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.0521	0.0521	0.0521	cfs
Distance to stream	a	6600	6600	6600	ft
Aquifer hydraulic conductivity	K	7.5	7.5	7.5	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	3750	3750	3750	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	175	175	175	ft
Streambed hydraulic conductivity	Ks	0.075	0.075	0.075	ft/day
Streambed thickness	bs	500	500	500	ft
Streambed conductance	sbc	0.02625	0.02625	0.02625	ft/day
Stream depletion factor (Jenkins)	sdf	11.616	11.616	11.616	days
Streambed factor (Hunt)	sbf	0.0462	0.0462	0.0462	

G_17286_Klamath_Tribes_Agency_Lake_Hunt_1999_depletion_Williamson_River.xls

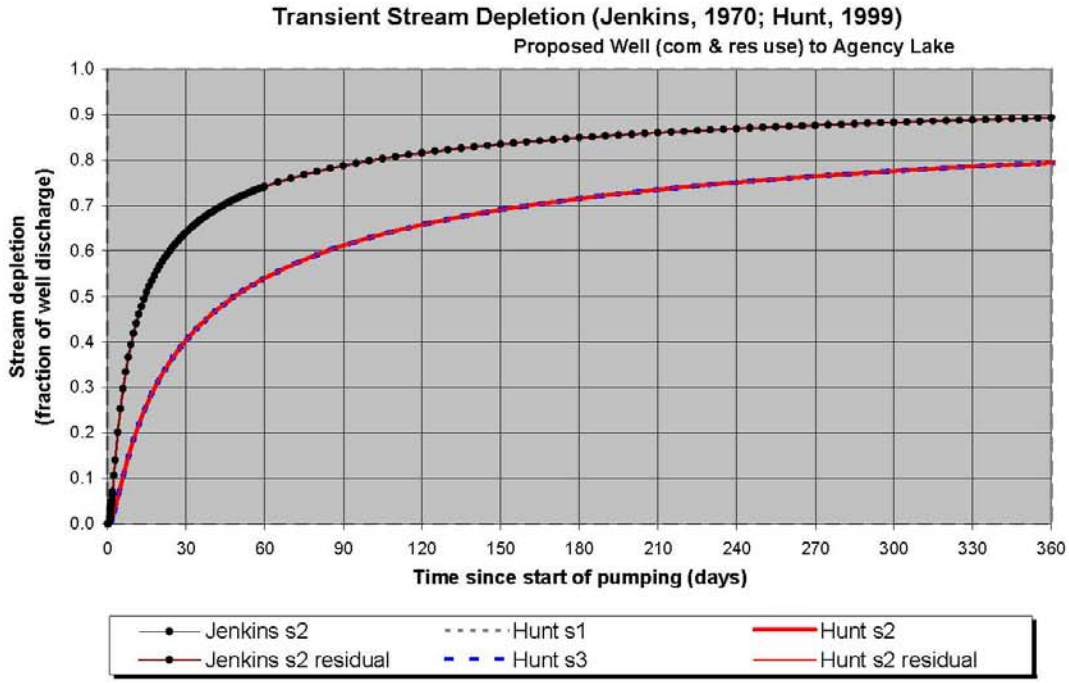


Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 184 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Hunt SD s2	0.4039	0.5406	0.6121	0.6580	0.6906	0.7154	0.3606	0.2233	0.1600	0.1232	0.0993	0.0818
Qw, cfs	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
H SD s2, cfs	0.069	0.092	0.104	0.112	0.117	0.122	0.061	0.038	0.027	0.021	0.017	0.014

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.17	0.17	0.17	cfs
Distance to stream	a	7000	7000	7000	ft
Aquifer hydraulic conductivity	K	7.5	7.5	7.5	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	3750	3750	3750	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	7500	7500	7500	ft
Streambed hydraulic conductivity	Ks	0.075	0.075	0.075	ft/day
Streambed thickness	bs	500	500	500	ft
Streambed conductance	sbc	1.125	1.125	1.125	ft/day
Stream depletion factor (Jenkins)	sdf	13.06666667	13.06666667	13.06666667	days
Streambed factor (Hunt)	sbf	2.1	2.1	2.1	

G_17286_Klamath_Tribes_Agency_Lake_Hunt_1999_depletion_Agency_Lake.xls



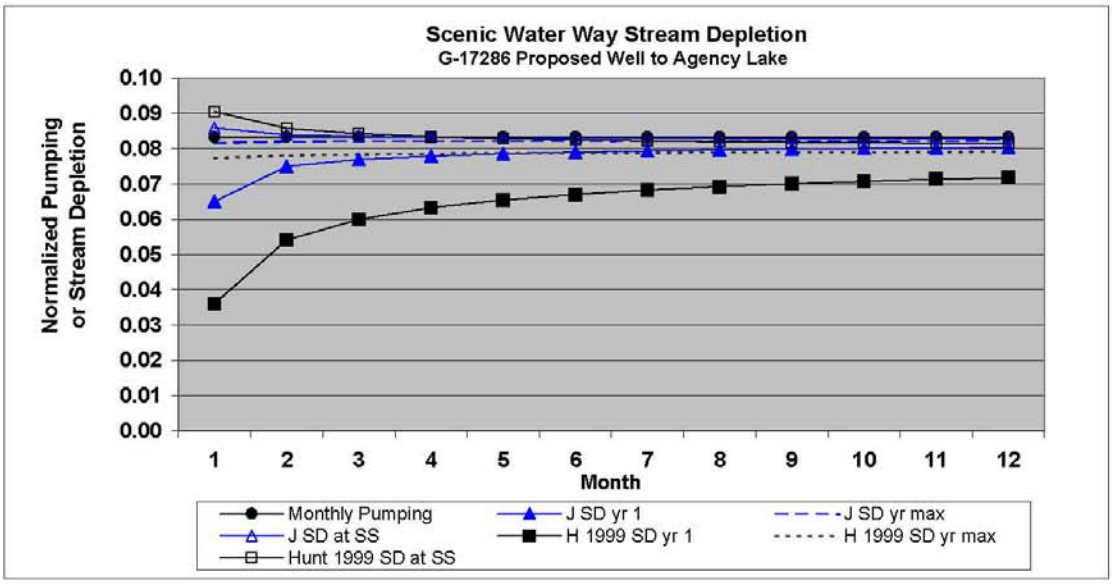
Output for Hunt Stream Depletion, Scenerio 2 (s2): Time pump on = 365 days

Days	30	60	90	120	150	180	210	240	270	300	330	360
Hunt SD s2	0.4039	0.5406	0.6121	0.6580	0.6906	0.7154	0.7350	0.7510	0.7645	0.7760	0.7861	0.7942
Qw, cfs	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
H SD s2, cfs	0.021	0.028	0.032	0.034	0.036	0.037	0.038	0.039	0.040	0.040	0.041	0.041

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.0521	0.0521	0.0521	cfs
Distance to stream	a	7000	7000	7000	ft
Aquifer hydraulic conductivity	K	7.5	7.5	7.5	ft/day
Aquifer thickness	b	500	500	500	ft
Aquifer transmissivity	T	3750	3750	3750	ft*ft/day
Aquifer storage coefficient	S	0.001	0.001	0.001	
Stream width	ws	7500	7500	7500	ft
Streambed hydraulic conductivity	Ks	0.075	0.075	0.075	ft/day
Streambed thickness	bs	500	500	500	ft
Streambed conductance	sbc	1.125	1.125	1.125	ft/day
Stream depletion factor (Jenkins)	sdf	13.06666667	13.06666667	13.06666667	days
Streambed factor (Hunt)	sbf	2.1	2.1	2.1	

G_17286_Klamath_Tribes_Agency_Lake_Hunt_1999_depletion_Agency_Lake.xls

Oregon Water Resources Department



Region	30	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	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.00
Jenkins SD													
yr1	0.065	0.075	0.077	0.078	0.079	0.079	0.079	0.080	0.080	0.080	0.080	0.080	0.068
yrmax-1	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.014
yrmax	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.014
yrmax-yr1	0.017	0.007	0.005	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.054
J SD SS	**0.086**	**0.084**	**0.083**	**0.083**	**0.083**	**0.083**	**0.083**	**0.083**	**0.083**	**0.083**	**0.083**	**0.083**	**0.000**
Hunt SD 1999													
yr 1	0.036	0.054	0.060	0.063	0.065	0.067	0.068	0.069	0.070	0.071	0.071	0.072	0.233
yr max-1	0.077	0.078	0.078	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.056
yr max	0.077	0.078	0.078	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.056
yrmax-yr1	0.041	0.024	0.018	0.015	0.013	0.012	0.011	0.010	0.009	0.008	0.008	0.007	0.177
H99 SD SS	**0.090**	**0.086**	**0.084**	**0.083**	**0.083**	**0.083**	**0.082**	**0.082**	**0.082**	**0.082**	**0.082**	**0.081**	**0.000**

Parameters:		Values	Units	
Maximum number of years pumped	yrmax	25	years	
Days pumped each month	tpoff	30.4375	days/month	
Perpendicular from well to stream	a	2300	ft	
Well depth	d	125	ft	
Aquifer hydraulic conductivity	K	7.5	ft/day	
Aquifer saturated thickness	b	500	ft	
Aquifer transmissivity	T_ft	3,750	ft*ft/day	= K*b
Aquifer transmissivity	T_gal	28,050	gpd/ft	= K*b
Aquifer storativity or specific yield	S	0.001		
Streambed conductivity (Hunt 1999)	Ks	0.075	ft/day	
Streambed thickness, Hunt 1999	bs	500	ft	
Stream width (Hunt 1999)	ws	7500	ft	
Streambed conductance (lambda)	sbc	1.1250	ft/day	= Ks*ws/bs
Stream depletion factor	sdf	1.4107	days	= (a^2*S)/(T)
Streambed factor	sbf	0.6900		= sbc*a/T

S:\groups\gwater\grondin\areas\klamath\water_rights\G_17286_Klamath_Tribes_Agency_Lake_scenic_stream_depletion_sd_1033_3_30.xls

T35S/R7E-sec 7							
Well_Co	**Well_Num**	**T (ft2/day)**	**Well_depth**	**1st_water**	**K (ft/day)**	**Comment**	
KLAM	1180	1,311,141.29	64.00	20.00	29,798.67	excluded	
KLAM	1181	120.95	50.00	40.00	12.10		
KLAM	1182	44.05	76.00	72.00	11.01		
KLAM	1183	110.44	82.00	17.00	1.70		
KLAM	1186	77.69	70.00	63.00	11.10		
KLAM	1187	76.47	57.00	50.00	10.92		
KLAM	1188	278.47	65.00	8.00	4.89		
KLAM	1189	408.18	46.00	17.00	14.08		
KLAM	1191	935.96	263.00	29.00	4.00		
KLAM	1192	234.74	110.00	17.00	2.52		
KLAM	1200	702.60	250.00	26.00	3.14		
KLAM	53237	247.81	98.00	66.00	7.74		
KLAM	54508	1,096.12	105.00	13.00	11.91		
KLAM	55065	57.73	143.00	65.00	0.74		
	Minimum	44.05		**Minimum**	0.74		
	Maximum	1,096.12		**Maximum**	14.08		
	Average	337.79		**Average**	7.37		
	Median	234.74		**Median**	7.74		
T35S/R7E-sec 8							
Well_Co	**Well_Num**	**T (ft2/day)**	**Well_depth**	**1st_water**	**Open Interval**	**K (ft/day)**	**Comment**
KLAM	1201	110.44	65.00	40.00	13.00	8.50	
KLAM	1202	275.06	99.00	64.00	29.00	9.48	
KLAM	1203	1,059.02	325.00		136.00	7.79	
KLAM	1204	3,728.96	97.00		20.00	186.45	
KLAM	1205	1,333.35	90.00	89.00	9.00	148.15	
KLAM	1209	1,333.35	95.00	94.00	1.00	1,333.35	
KLAM	1210	96.29	100.00	91.00	9.00	10.70	
KLAM	1211	862.19	95.00	70.00	10.00	86.22	
KLAM	1214	1,694.21	90.00	86.00	1.00	1,694.21	
KLAM	1215	131.58	108.00	75.00	8.00	16.45	
KLAM	1216	204.09	95.00	90.00	5.00	40.82	
KLAM	11699	2,325.50	105.00	85.00	15.00	155.03	
	Minimum	96.29		**Minimum**		7.79	
	Maximum	3,728.96		**Maximum**		1,694.21	
	Average	1,096.17		**Average**		308.10	
	Median	960.61		**Median**		63.52	