WATER RESOURCES DEPARTMENT

MEMO **Date: 12 December, 2014**

TO: **Application G- 17942**

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

SUBJECT: Scenic Waterway Interference Evaluation

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

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

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

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

DISTRIBUTION OF INTERFERENCE

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

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

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

SEE ATTACHED MEMO

WATER RESOURCES DEPARTMENT

MEMO **Date: 12 December, 2014**

TO: **Application G- 17942**

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

SUBJECT: Scenic Waterway Interference Evaluation

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

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

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

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

DISTRIBUTION OF INTERFERENCE

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

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

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

SEE ATTACHED MEMO

State of Oregon
Water Resources Department

Memorandum

To: Barry Norris – Administrator, Technical Services Division
Dwight French – Administrator, Waterights Division
Tom Paul – Deputy Director
Doug Woodcock – Administrator, Field Services Division

From: Ivan Gall – Manager, Groundwater Section

Date: February 19, 2013

Subject: Analysis of Groundwater Pumping Impacts on Klamath Scenic Waterway Flows

In 1971 the Oregon Legislature created the Scenic Waterway Act, codified by Oregon Revised Statutes 390.805 to 390.925, to preserve for the benefit of the public Waldo Lake and selected parts of the state's free-flowing rivers. The Klamath Scenic Waterway was part of the Act and includes the Klamath River from the John Boyle Dam powerhouse downstream to the Oregon-California border. Under the Act, the Water Resources Commission is allowed to allocate small amounts of surface water for human consumption and livestock watering, as long as issuing the water right does not significantly impair the free-flowing character of these waters in quantities necessary for recreation, fish and wildlife, and the amount allocated may not exceed a cumulative total of one percent of the average daily flow or one cubic foot per second (cfs), whichever is less.

In 1995 the Scenic Waterway Act was modified to address the impact of groundwater uses that, based upon a preponderance of evidence, would measurably reduce the surface water flows within a scenic waterway. "Measurably reduce" means that the use authorized will individually or cumulatively reduce surface water flows within the scenic waterway in excess of a combined cumulative total of one percent of the average daily flow or one cfs, whichever is less.

In 2012 the United States Geological Survey (USGS), in cooperation with OWRD and the US Bureau of Reclamation, completed groundwater flow and management models for the Upper Klamath Basin. The 2012 groundwater flow model uses generally accepted hydrogeologic methods and the relevant field data to model the cumulative effects of groundwater pumping within the Klamath Scenic Waterway, and provides a comprehensive methodology for analyzing the relevant field data necessary to determine whether the cumulative use of groundwater in the Klamath Basin will measurably reduce the surface water flow necessary to maintain the free-flowing character of the Klamath Scenic Waterway.

In September 2012 the OWRD Groundwater Section conducted two model simulations. The two simulations used the 2012 USGS flow model, incorporating groundwater permits issued (61.96 cfs) since adoption of the 1995 Scenic Waterway Act amendment up through 2004. Each simulation was run to steady-state, where inflows and outflows for that model run balanced. An evaluation of the water budgets showed that groundwater discharge to the Klamath Scenic Waterway decreased by 5.88 cfs as a result of the 61.96 cfs of groundwater uses issued between 1995 and 2004. These results indicate to the OWRD that a preponderance of evidence exists to establish that groundwater development occurring in the Upper Klamath Basin in Oregon since 1995 has "measurably reduced" surface water flows within the Klamath Scenic Waterway.

In January 2013 the OWRD Groundwater Section conducted flow model simulations to evaluate impacts to streams from pumping groundwater within the Lost River subbasin. Groundwater pumping was simulated by placing wells in the model that correspond to the center of 39 townships in the southeast part of the Klamath Basin in Oregon. Each of the simulations was run to steady-state, where inflows and outflows for that model run balanced. These results indicate that the scenic waterway is impacted by pumping groundwater in all of the townships evaluated in Oregon in the Lost River subbasin. In summary, a preponderance of evidence exists to establish that groundwater development occurring in Oregon since 1995 in the Upper Klamath Basin and Lost River subbasin has "measurably reduced" surface water flows within the Klamath Scenic Waterway.

References:

Gannett, M.W., Lite, K.E., Jr., La Marche, J.L., Fisher, B.J., and Polette, D.J., 2007. Ground-water hydrology of the upper Klamath Basin, Oregon and California: U.S. Geological Survey Scientific Investigations Report 2007-5050, 84p.

Gannett, M.W., Wagner, B.J., and Lite, K.E., Jr., 2012. Groundwater simulation and management models for the upper Klamath Basin, Oregon and California: U.S. Geological Survey Scientific Investigations Report 2012-5062, 92p.

PUBLIC INTEREST REVIEW FOR GROUND WATER APPLICATIONS

TO: Water Rights Section **Date** 12 December 2014

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

SUBJECT: Application **G-** 17942 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: Productive Timberland LLC and NBCC, LCC (Roger Nicholson) County: Klamath

A1. Applicant(s) seek(s) (449 gpm) 1.0 cfs from 1 well(s) in the Klamath River Basin,

Wood River watershed in the Upper Klamath Lake subbasin Quad Map: Mares Egg Spring

A2. Proposed use: Irrigation (supplemental 570 acres) Seasonality: 1 March to 31 October (245 days)

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

Well	Logid	Applicant's Well #	Proposed Aquifer*	Proposed Rate(cfs)	Location (T/R-S QQ-Q)	Location, metes and bounds, e.g. 2250' N, 1200' E fr NW cor S 36
1	**KLAM 57662**	**1**	**Basalt**	**1.00**	**33S/7.5E-sec 19 ABB**	**20' S, 200' E fr N qtr cor S 19**
2						
3						

* Alluvium, CRB, Bedrock

Well	Well Elev ft msl	First Water ft bls	SWL ft bls	SWL Date	Well Depth (ft)	Seal Interval (ft)	Casing Intervals (ft)	Liner Intervals (ft)	Perforations Or Screens (ft)	Well Yield (gpm)	Draw Down (ft)	Test Type
1	**4194**	**3**	**+3.5**	**11/17/10**	**534**	**0-518**	**+1.5-518**	**None**	**None**	**860**	**?**	**Flow**

Use data from application for proposed wells.

A4. **Comments:**

The application says the proposed period of use is "irrigation season." Often, that is 1 March to 31 October. The groundwater rule currently being negotiated for the Klamath Basin "Off Project Area" defines irrigation season as 1 March to 31 October. That understanding will be used for this review.

The proposed rate is less than the maximum typically allowed for 570 acres (7.13 cfs = 3,198 gpm).

The proposed maximum duty is 240 acre-feet which is less than the maximum allowed for 570 acres. Note: it takes 121 days to pump 240 acre-feet at a pumping rate of 1.00 cfs. Distributing the 240 acre-feet duty over 245 days yields an average pro-rated pumping rate of 0.494 cfs (222 gpm) for the irrigation season.

The well obtains groundwater solely from the predominantly basalt/volcanic unit beneath the predominantly basin-fill unit given the well has continuous casing and continuous seal from land surface, through the predominantly basin-fill unit, and into the predominantly basalt/volcanic unit.

The application includes a settlement agreement to mitigate the proposed groundwater as noted in the application cover letter, which says: "Please note that the application is submitted pursuant to a recently finalized settlement agreement involving our clients, JaCox Ranches, Oreg., Ltd. (JaCox), the Klamath Basin Rangeland Trust (KBRT), and the Oregon Water Resources Department (OWRD), in connection with an instream transfer application filed by JaCox and KBRT (Application T-11375). A copy of the fully executed settlement agreement is enclosed for the application file. As part of the settlement agreement, the parties contemplated that Nicholson would submit this application for 1.0 cubic foot per second (cfs) of ground water, to be used for supplemental irrigation on Nicholson property in the Klamath Basin. Pursuant to the agreement, up to 1.0 cfs of the surface water approved for instream transfer under T-11375 would be available, as needed, for mitigation to offset potential surface water impacts from the proposed ground water use. As further described in the settlement agreement, we understand OWRD is prepared to issue an initial review indicating the ground water application can be approved with mitigation as proposed."

A copy of the settlement agreement is attached.

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) #** _____, _____, _____, _____, _____, 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, 7J, 7N, 7T**;
   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, 7J, 7N, 7T and the following special condition:

Special condition for groundwater production: "Groundwater production shall occur from the predominant basalt unit below the predominant basin fill unit by casing and sealing through the basin fill unit into the basalt unit."

Note: the well currently meets the special condition for groundwater production.

Special condition for irrigation duty: "The annual maximum duty allowed shall be 240 acre-feet total volume."

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, Gannett and others (2007), the USGS (2005), and OWRD 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 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.

Two wells with groundwater level data closest to the proposed POA well are well KLAM 11791 (a flowing well) located about 2.5 miles east of the applicant's proposed POA well and well KLAM 686 located about 3.5 miles north of the applicant's proposed POA well. Both wells are completed in sediment (the predominantly basin-fill unit). Data related to a nearby well completed the predominantly volcanic/basalt unit was not found. The data for both wells are from 2000 to present. Both hydrographs indicate a groundwater level decline in the early 2000s followed by a recovery with subsequently stable groundwater levels at a level 2 to 5 feet below earliest 2000s level. Data for both wells show higher groundwater levels during the irrigation season (summer) and lower groundwater levels during the off-season (winter). This indicates a local surface water influence on the groundwater.

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**	☐	☒
		☐	☐
		☐	☐

Basis for aquifer confinement evaluation:

The groundwater system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement. Generally, low transmissivity (low permeability) sediment (predominantly basin-fill unit) of varying thickness overlies high transmissivity (high permeability) basalt (predominantly volcanic/basalt unit). Ground water occurs in both the sediment and basalt, and the groundwater in the sediment and basalt is hydraulically connected.

The water well reports (well log) for the proposed POA well (KLAM 57662) indicate the basin fill thickness at the well site is 508 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	**Sevenmile Creek**	**4197.5**	**4180**	**7,700**	☒	☐	☐	☐	☒
1	2	**Wood River**	**4197.5**	**4200**	**18,500**	☒	☐	☐	☐	☒
1	3	**Fort Creek**	**4197.5**	**4180**	**20,200**	☒	☐	☐	☐	☒
1	4	**Crooked Creek**	**4197.5**	**4170**	**22,350**	☒	☐	☐	☐	☒
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation:

The distances and surface water elevation in the table above are for the identified gaining reaches of those surface water bodies.

A connection to Sevenmile Creek, Wood River, Fort Creek, Crooked Creek, and Upper Klamath Lake exists. See 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 (predominantly basin-fill unit) overlie higher yield (high conductivity) basalt (predominantly volcanic/basalt unit). 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.

Two wells with groundwater level data closest to the proposed POA well are well KLAM 11791 (a flowing well) located about 2.5 miles east of the applicant's proposed POA well and well KLAM 686 located about 3.5 miles north of the applicant's proposed POA well. Both wells are completed in sediment (the predominantly basin-fill unit). Data related to a nearby well completed the predominantly volcanic/basalt unit was not found. Data for both wells show higher groundwater levels during the irrigation season (summer) and lower groundwater levels during the off-season (winter). This indicates a local surface water influence on the groundwater.

In regards to Upper Klamath lake, 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.

Additionally, the USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) shows the proposed well site is in an area of groundwater flowing toward the Wood River Valley from the surrounding western, northern, and eastern uplands and then flowing primarily south through the valley to Upper Klamath Lake with discharge flow toward Sevenmile Creek, Wood River, Fort Creek, and Crooked Creek.

Lastly, the water well report for the proposed POA well (KLAM 57662) shows an upward groundwater flow gradient.

Water Availability Basin the well(s) are located within: WOOD R > UPPER KLAMATH L – AT MOUTH
FORT CR > WOOD r – AT MOUTH
CROOKED CR > WOOD R – 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	☐	☐			☐		☐		☐
1	2	☐	☐			☐		☐		☐
1	3	☐	☐			☐		☐		☐
1	4	☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐

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:

No analysis given each surface water body identified is more than 1.0 mile from the proposed POA well (KLAM 57662).

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	28.1 %	24.8 %	0.8 %	4.8 %	10.2 %	15.2 %	19.8 %	23.6 %	27.0 %	30.2 %	32.3 %	31.1 %
Well Q as CFS		0.000	0.000	0.494	0.494	0.494	0.494	0.494	0.494	0.494	0.494	0.000	0.000
Interference CFS		0.139	0.123	0.004	0.024	0.050	0.075	0.098	0.117	0.134	0.149	0.160	0.154
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.		0.139	0.123	0.004	0.024	0.050	0.075	0.098	0.117	0.134	0.149	0.160	0.154
(B) = 80 % Nat. Q		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
(C) = 1 % Nat. Q		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
(D) = (A) > (C)		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
(E) = (A / B) x 100		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

(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:

There is no water availability calculation for Sevenmile Creek.

The Hunt 2003 calculation method was used to calculate the groundwater-surface water interference. The calculation was consistent with the groundwater-surface water inference calculations recently conducted by OWRD for the Upper Klamath basin wells. The model input and results are attached.

Note: the calculation assumes all the groundwater-surface water interference occurs at the single stream being analyzed.

The calculation used the following:

A pro-rated pumping rate of 0.494 cfs (222 gpm), which equals the total proposed annual volume (240 ac-ft) divided by total the pumping period (245 days).

For the higher permeability geologic materials supplying water to the well: a transmissivity of 16,945 ft2/day based on Gannett and others (2012), an intermittent storage coefficient value of 0.001

For the lower permeability geologic material between the stream and the higher permeability geologic materials supplying water to the well: a thickness of 90 feet at the stream, a vertical hydraulic conductivity of 127.46 ft/day based on an analysis of groundwater discharge to the gaining reach identified for the stream (see attached), a porosity of 0.10, and a stream width of 15 feet.

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**	**31.2 %**	**25.5 %**	**5.1 %**	**16.9 %**	**26.3 %**	**33.3 %**	**38.7 %**	**43.0 %**	**46.5 %**	**49.5 %**	**48.8 %**	**39.1 %**
Well Q as CFS		**0.000**	**0.000**	**0.494**	**0.494**	**0.494**	**0.494**	**0.494**	**0.494**	**0.494**	**0.494**	**0.000**	**0.000**
Interference CFS		**0.154**	**0.126**	**0.025**	**0.084**	**0.130**	**0.164**	**0.191**	**0.212**	**0.230**	**0.244**	**0.241**	**0.193**
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.		**0.154**	**0.126**	**0.025**	**0.084**	**0.130**	**0.164**	**0.191**	**0.212**	**0.230**	**0.244**	**0.241**	**0.193**
(B) = 80 % Nat. Q		**314.0**	**309.0**	**315.0**	**334.0**	**379.0**	**375.0**	**371.0**	**347.0**	**334.0**	**335.0**	**328.0**	**312.0**
(C) = 1 % Nat. Q		**3.140**	**3.090**	**3.150**	**3.340**	**3.790**	**3.750**	**3.710**	**3.470**	**3.340**	**3.350**	**3.280**	**3.120**
(D) = (A) > (C)		**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
(E) = (A / B) x 100		**0.049**	**0.041**	**0.008**	**0.025**	**0.034**	**0.044**	**0.051**	**0.061**	**0.069**	**0.073**	**0.073**	**0.062**

(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:

There is a water availability calculation for Wood River.

The Hunt 2003 calculation method was used to calculate the groundwater-surface water interference. The calculation was consistent with the groundwater-surface water inference calculations recently conducted by OWRD for the Upper Klamath basin wells. The model input and results are attached.

Note: the calculation assumes all the groundwater-surface water interference occurs at the single stream being analyzed.

The calculation used the following:

A pro-rated pumping rate of 0.494 cfs (222 gpm), which equals the total proposed annual volume (240 ac-ft) divided by total the pumping period (245 days).

For the higher permeability geologic materials supplying water to the well: a transmissivity of 16,945 ft2/day based on Gannett and others (2012), an intermittent storage coefficient value of 0.001

For the lower permeability geologic material between the stream and the higher permeability geologic materials supplying water to the well: a thickness of 100 feet at the stream, a vertical hydraulic conductivity of 159.86 ft/day based on an analysis of groundwater discharge to the gaining reach identified for the stream (see attached), a porosity of 0.01, and a stream width of 100 feet.

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	31.8 %	26.5 %	2.7 %	12.2 %	20.8 %	27.7 %	33.1 %	37.5 %	41.2 %	44.3 %	45.5 %	38.7 %
Well Q as CFS		0.000	0.000	0.494	0.494	0.494	0.494	0.494	0.494	0.494	0.494	0.000	0.000
Interference CFS		0.157	0.131	0.013	0.060	0.103	0.137	0.163	0.185	0.204	0.219	0.225	0.191
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.		0.157	0.131	0.013	0.060	0.103	0.137	0.163	0.185	0.204	0.219	0.225	0.191
(B) = 80 % Nat. Q		79.40	79.40	80.30	81.10	81.90	82.40	82.00	82.30	81.90	81.40	80.40	80.00
(C) = 1 % Nat. Q		0.794	0.794	0.803	0.811	0.819	0.824	0.820	0.823	0.819	0.814	0.804	0.800
(D) = (A) > (C)		No	No	No	No	No	No	No	No	No	No	No	No
(E) = (A / B) x 100		0.198	0.165	0.016	0.074	0.126	0.166	0.199	0.225	0.249	0.269	0.280	0.239

(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:

There is a water availability calculation for Fort Creek.

The Hunt 2003 calculation method was used to calculate the groundwater-surface water interference. The calculation was consistent with the groundwater-surface water inference calculations recently conducted by OWRD for the Upper Klamath basin wells. The model input and results are attached.

Note: the calculation assumes all the groundwater-surface water interference occurs at the single stream being analyzed.

The calculation used the following:

A pro-rated pumping rate of 0.494 cfs (222 gpm), which equals the total proposed annual volume (240 ac-ft) divided by total the pumping period (245 days).

For the higher permeability geologic materials supplying water to the well: a transmissivity of 16,945 ft2/day based on Gannett and others (2012), an intermittent storage coefficient value of 0.001

For the lower permeability geologic material between the stream and the higher permeability geologic materials supplying water to the well: a thickness of 80 feet at the stream, a vertical hydraulic conductivity of 90.93 ft/day based on an analysis of groundwater discharge to the gaining reach identified for the stream (see attached), a porosity of 0.01, and a stream width of 40 feet.

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	31.4 %	26.9 %	1.1 %	7.5 %	14.7 %	20.9 %	26.2 %	30.6 %	34.3 %	37.5 %	39.8 %	36.5 %
Well Q as CFS		0.000	0.000	0.494	0.494	0.494	0.494	0.494	0.494	0.494	0.494	0.000	0.000
Interference CFS		0.155	0.133	0.005	0.037	0.073	0.103	0.129	0.151	0.169	0.185	0.197	0.180
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.		0.155	0.133	0.005	0.037	0.073	0.103	0.129	0.151	0.169	0.185	0.197	0.180
(B) = 80 % Nat. Q		75.30	82.40	87.40	85.60	75.60	77.80	69.70	70.70	66.50	80.50	81.90	84.80
(C) = 1 % Nat. Q		0.753	0.824	0.874	0.856	0.756	0.778	0.697	0.707	0.665	0.805	0.891	0.848
(D) = (A) > (C)		No	No	No	No	No	No	No	No	No	No	No	No
(E) = (A / B) x 100		0.206	0.161	0.006	0.043	0.097	0.132	0.185	0.214	0.254	0.230	0.241	0.212

(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:

There is a water availability calculation for Crooked Creek.

The Hunt 2003 calculation method was used to calculate the groundwater-surface water interference. The calculation was consistent with the groundwater-surface water inference calculations recently conducted by OWRD for the Upper Klamath basin wells. The model input and results are attached.

Note: the calculation assumes all the groundwater-surface water interference occurs at the single stream being analyzed.

The calculation used the following:

A pro-rated pumping rate of 0.494 cfs (222 gpm), which equals the total proposed annual volume (240 ac-ft) divided by total the pumping period (245 days).

For the higher permeability geologic materials supplying water to the well: a transmissivity of 16,945 ft2/day based on Gannett and others (2012), an intermittent storage coefficient value of 0.001

For the lower permeability geologic material between the stream and the higher permeability geologic materials supplying water to the well: a thickness of 500 feet at the stream, a vertical hydraulic conductivity of 891.92 ft/day based on an analysis of groundwater discharge to the gaining reach identified for the stream (see attached), a porosity of 0.10, and a stream width of 10 feet.

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: recommend conditions 7B, 7J, 7N, 7T and the following special condition:

Special condition for groundwater production: "Groundwater production shall occur from the predominant basalt unit below the predominant basin fill unit by casing and sealing through the basin fill unit into the basalt unit."

Note: the well currently meets the special condition for groundwater production.

Special condition for irrigation duty: "The annual maximum duty allowed shall be 240 acre-feet total volume."

A connection to Sevenmile Creek, Wood River, Fort Creek, Crooked Creek, and Upper Klamath Lake exists. See 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 (predominantly basin-fill unit) overlie higher yield (high conductivity) basalt (predominantly volcanic/basalt unit). 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.

Two wells with groundwater level data closest to the proposed POA well are well KLAM 11791 (a flowing well) located about 2.5 miles east of the applicant's proposed POA well and well KLAM 686 located about 3.5 miles north of the applicant's proposed POA well. Both wells are completed in sediment (the predominantly basin-fill unit). Data related to a nearby well completed the predominantly volcanic/basalt unit was not found. Data for both wells show higher groundwater levels during the irrigation season (summer) and lower groundwater levels during the off-season (winter). This indicates a local surface water influence on the groundwater.

In regards to Upper Klamath lake, 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.

Additionally, the USGS-OWRD cooperative Upper Klamath Basin ground water investigation (Gannett and others, 2007) shows the proposed well site is in an area of groundwater flowing toward the Wood River Valley from the surrounding western, northern, and eastern uplands and then flowing primarily south through the valley to Upper Klamath Lake with discharge flow toward Sevenmile Creek, Wood River, Fort Creek, and Crooked Creek.

Lastly, the water well report for the proposed POA well (KLAM 57662) shows an upward groundwater flow gradient.

References Used:

Gannett, M.W., Wagner, B.J., and Lite, K.E. 2012. Groundwater Simulation and Management Models for the Upper Klamath Basin, Oregon and California. USGS Scientific Investigations Report 2012-5062.

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.

Water level data for wells KLAM 11791 & KLAM 686

USGS Mares Egg Spring and Fort Klamath quadrangle maps (1:24,000 scale)

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** 1 **Logid:** KLAM 57662

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.

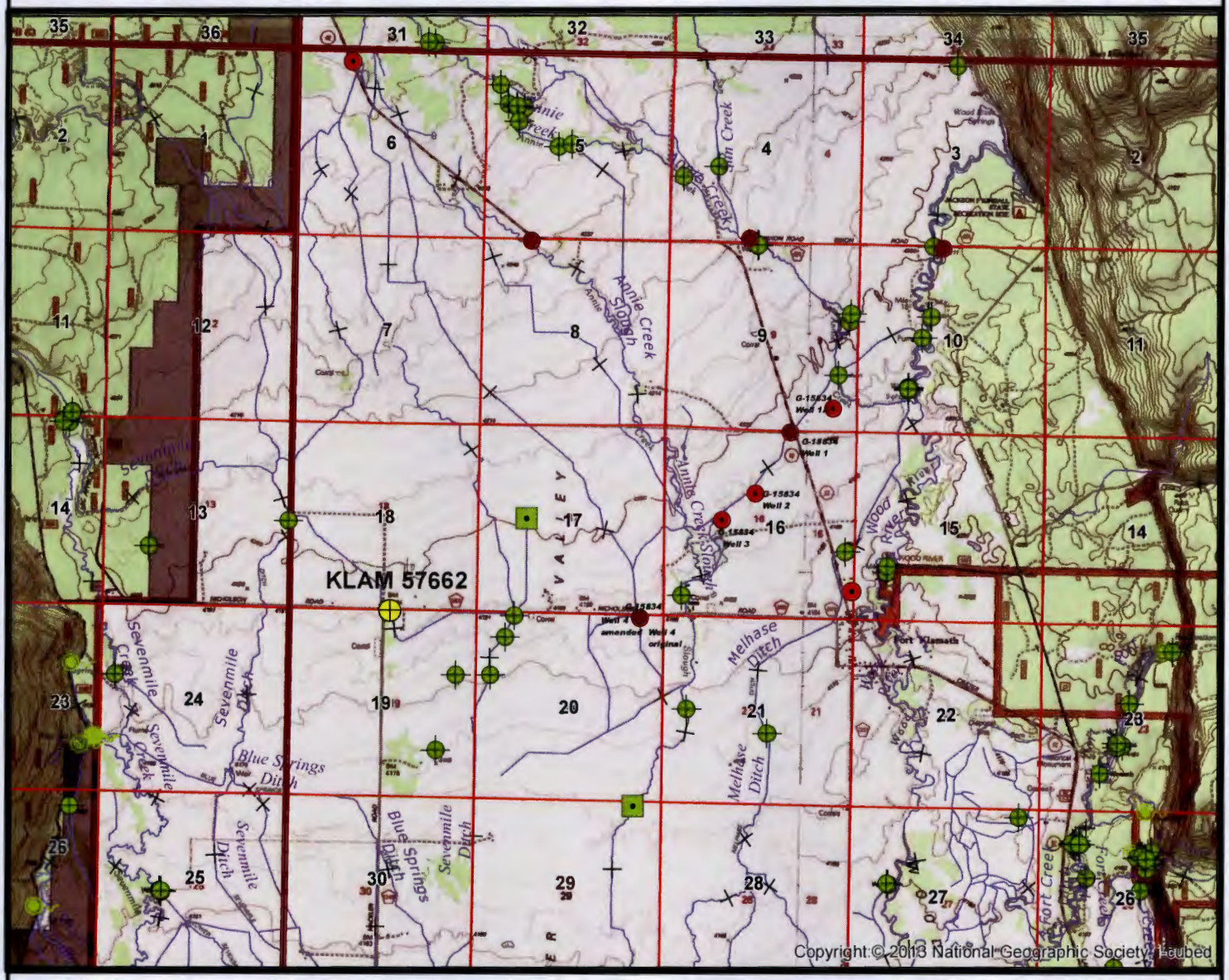
b. ☐ I don't know if it met standards at the time of construction.

D6. ☐ **Route to the Well Construction and Compliance Section for a review of existing well construction.**

Water Availability Tables

See Attachments

Groundwater Permit Application G-17942
Productive Timberland LLC and NBCC, LLC



0 0.25 0.5 1 1.5 2
Miles

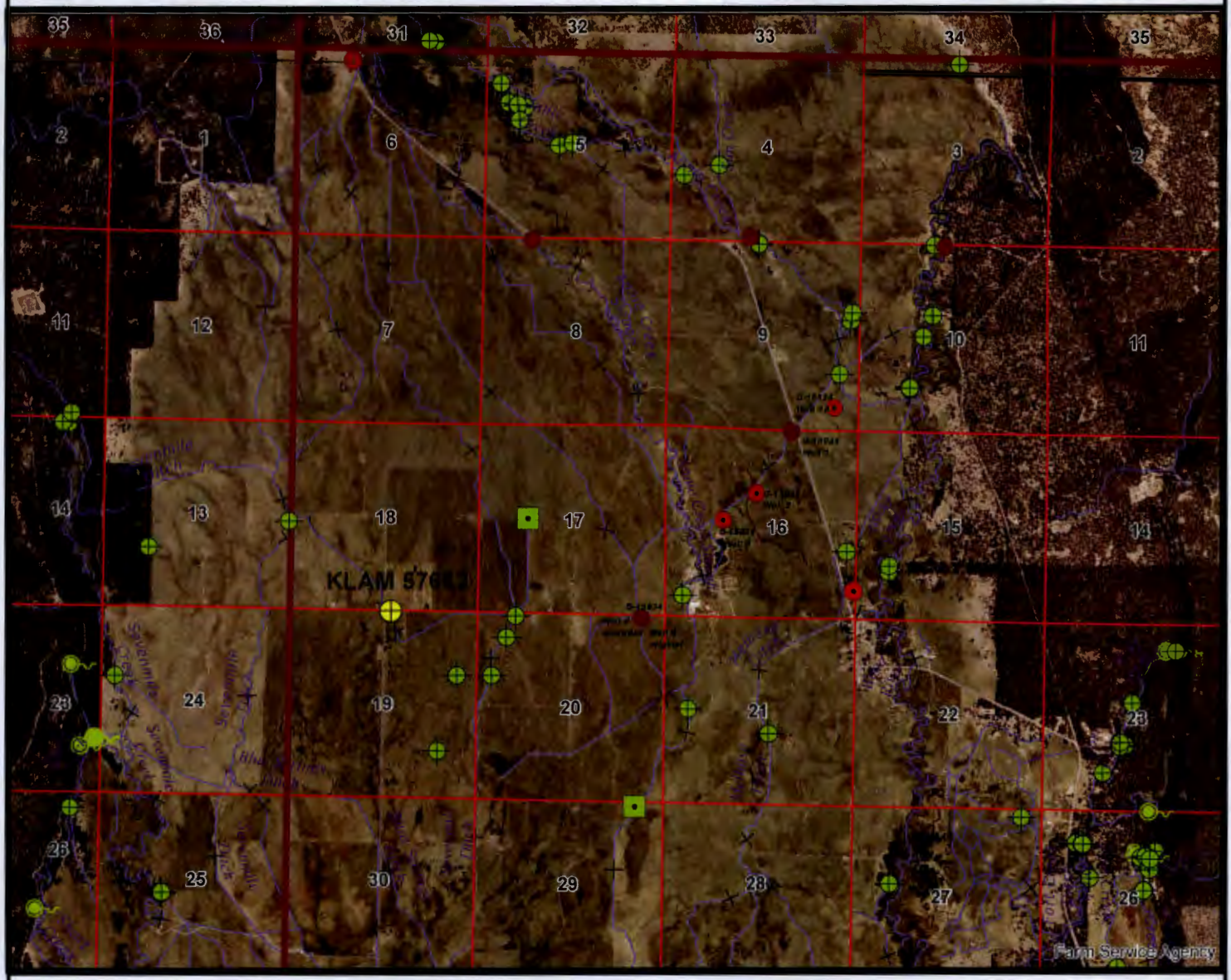
Yellow = Proposed POAs
Red & Blue = Other Wells

Green = Surface Water Rights

Legend
Townships
Sections

N

Groundwater Permit Application G-17942
Productive Timberland LLC and NBCC, LLC



0 0.25 0.5 1 1.5 2
Miles

Yellow = Proposed POAs
Red & Blue = Other Wells

Green = Surface Water Rights

Legend
Townships
Sections

N