WATER RESOURCES DEPARTMENT

MEMO **28 August 2014**

TO: **Application G- 17892**

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.

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

DISTRIBUTION OF INTERFERENCE

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

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

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

PUBLIC INTEREST REVIEW FOR GROUND WATER APPLICATIONS

TO: Water Rights Section Date **28 August 2014**

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

SUBJECT: Application G- **17892** 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: **Martin M. Landa** County: **Lake**

A1. Applicant(s) seek(s) **1.59 cfs (714 gpm)** cfs from **1** well(s) in the **Goose & Summer Lakes** Basin, **Warner Lakes** subbasin Quad Map: **May Lake**

A2. Proposed use: **Supplemental Irrigation (127.25 acres)** Seasonality: **1 March to 1 October (215 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**	**Well 1**	**Basalt/Basin-Fill**	**1.59**	**T40S/R23E-sec 12 dad**	**1760' N, 156' W fr SE cor S 12**
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	**4489**	**?**	**?**	**?**	**?**	**+/- 150**	**+/- 150**	**?**	**?**	**?**	**?**	**?**
2												
3												
4												

Use data from application for proposed wells.

A4. **Comments:**

The application requests a total maximum pumping rate of 1.59 cfs (714 gpm) and a total maximum annual volume of 382.0 acre-feet from a single well to supplemental irrigate 127.25 acres (3 ac-ft per acre). The maximum pumping rate and maximum annual volume are what is typically allowed for 127.25 acres.

The static water level is uncertain. Data for well LAKE (2878) located south of the proposed well site and well LAKE 2671 (state observation well 382) located in the Adel vicinity north of the proposed well site suggest the static water level could be less than 25 feet below land surface.

The application was uncertain if the production would come from the predominantly basin fill unit or the predominantly basalt-volcanic unit below. This review recommends a condition to require production from the predominantly basalt-volcanic unit only.

Application G- 17892 continued Date 28 August 2014

A5. ☐ **Provisions of the** in general OAR 690-513; particularly OAR 690-513-0040 (Warner Lakes sub-basin); specifically 690-513-0040 (2)(k) related to Twentymile Creek and other named creeks 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:

The proposed well location appears to be more than 1,000 feet from the perennial portion of Twentymile Creek and its tributaries. Wells located within 1,000 feet of Twentymile Creek and obtaining unconfined groundwater are classified for domestic and stock-water uses only.

It should be noted that the proposed well location is less than 1,000 feet from a Twentymile Creek alluvial fan distributary drainage that is intermittent.

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

Currently, there is no administrative area.

B. 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, 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):

Application G- 17892 continued Date 28 August 2014

B3. Ground water availability remarks:

The state observation well with long term data (early 1960s to 2014) closest to the proposed POA well is state observation well 382 (well LAKE 2671) located in T39S/R24E-sec 21 bdb in Adel about about 5.1 miles northeast of the proposed POA well. The water level data for the well shows long term climate influences as well as annual seasonal influences. The dominant annual seasonal influence at this well may be surface water management related. Generally, the groundwater levels appear to be highest during the irrigation season and lowest during the off season. Before 2000, annual groundwater levels were generally steady between 15 and 20 feet below land surface at the well. After 2000, the annual groundwater level may have declined a few feet. Climate may be partly to entirely responsible for the lower levels after 2001. Ongoing groundwater level measurements will help that determination.

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

The "large" water use condition: (require a totalizing flow meter at each well. Each flow meter shall be located within 50 feet of the wellhead and adjacent to each flow meter shall be a clearly visible monument with a sign noting the flow meter. Lastly, require for every flow meter the reading, recording (monthly at minimum), and annual reporting of the flow meter data, all flow meters).

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

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 (as required by permit condition)**	☐	☒
		☐	☐
		☐	☐
		☐	☐

Basis for aquifer confinement evaluation:

Walker and Repenning (1965) map the surface geology at the proposed POA well as Qal (unconsolidated fluviatile gravel, sand, and silt). Nearby, they map QTs (lacustrine, fluviatile, and Aeolian sedimentary rocks, interstratified tuff, ashy diatomite and unconsolidated clay, sand, and gravel), Tts (mostly fine grained tuffaceous sedimentary rocks and tuffs representing flood plain or shallow lake deposits, Tbf (massive basalt flows and minor interbeds of tuff and scoria), and Tb (basalt) is exposed in the uplands to the west of the wells. The Tts, Tbf, and/or Tb volcanic units (part of the predominantly basalt-volcanic unit) exposed in the uplands generally occur beneath the Qal and QTs units (part of the predominantly basin-fill sediment unit) in the valley.

The groundwater system is identified as generally unconfined with discontinuous low permeability layers causing local (discontinuous, limited) confinement. Generally, lower transmissivity (lower permeability) sediment (predominantly basin-fill sediment unit) of varying thickness overlies higher transmissivity (higher permeability) basalt-volcanic (predominantly basalt-volcanic unit). Groundwater occurs in both the predominantly basin-fill sediment unit and the predominantly basalt-volcanic unit. Groundwater is vertically connected within each unit and between each unit. This is based upon investigations by Sammel and Craig (1981) for Warner Valley, Morgan (1988) for Goose Lake Valley and Miller (1984 and 1986) for the Fort Rock and Christmas Valley area. Sammel and Craig (1981) particularly note the similarity of the hydrogeology in the Warner Lakes Valley to the Klamath Basin.

The predominant basin-fill sediment unit thickness can vary significantly (hundreds of feet) by location. Wells identified near the proposed well site do not penetrate the predominantly basin-fill sediment unit. Further north in Warner Valley (T35 & 36S, R24 & 25E), the depth to the top of the predominantly basalt-volcanic unit ranges from about 75 feet at well LAKE 1839, 104 feet at well LAKE 1825, 150 feet at well LAKE 1886, and exceeds 640 feet (below well bottom) at well LAKE 4281.

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	Twentymile Creek	4480	4495	7,290	☒	☐	☐	☐	☒
1	2	4 un-named springs (cert 69825)	4480	4515	13,820	☒	☐	☐	☐	☒
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation:

Available reports indicate groundwater and surface water are connected in the Warner Lakes Valley, and groundwater flows from south to north in the valley.

Twentymile Creek is a perennial creek. Other surface water in the vicinity is intermittent. The distance to Twentymile Creek is to the nearest reach. The proposed well site appears to be down the groundwater level hydraulic gradient from Twentymile Creek.

The 4 un-named springs appear to have live flow based on aerial photo. The springs have a water right (certificate 69825) with a 1 January 1993 priority date. The springs are used to fill a low reservoir for livestock watering. The springs are at the base of the adjoining upland and may be fault controlled. The proposed well site appears to be down the groundwater level hydraulic gradient from springs.

Water Availability Basin the well(s) are located within: TWENTMILE CR > CRUMP 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:

No analysis. The proposed well site is more than 1.0 mile from perennial surface water.

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	0.5%	0.5%	0.0%	0.0%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%
Well Q as CFS		0.00	0.00	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.00	0.00	0.00
Interference CFS		0.004	0.005	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004
(A) = Total Interf.		0.004	0.005	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004
(B) = 80 % Nat. Q		10.40	13.70	33.30	38.50	46.80	15.10	4.21	3.12	3.94	4.78	6.88	8.95
(C) = 1 % Nat. Q		0.1040	0.1370	0.3330	0.3850	0.4680	0.1510	0.0421	0.0312	0.0394	0.0478	0.0688	0.0895
(D) = (A) > (C)		No	No	No	No	No	No	No	No	No	No	No	No
(E) = (A / B) x 100		0.038	0.036	0.000	0.000	0.002	0.007	0.024	0.064	0.051	0.063	0.044	0.045

(A) = total interference as CFS; (B) = WAB calculated natural flow at 80% exceed. as CFS; (C) = 1% of calculated natural flow at 80% exceed. as CFS; (D) = highlight the checkmark for each month where (A) is greater than (C); (E) = total interference divided by 80% flow as percentage.

Basis for impact evaluation:

Analysis is done in this section given the proposed POA well is more than 1.0 mile from Twentymile Creek and 4 un-named springs (certificate 69825).

The Table above was used for interference with Twentymile Creek only given it is the only local water body with water availability data.

A pro-rated pumping rate of 0.90 cfs (402 gpm) was used for the pumping rate. The pro-rated rate is the maximum annual volume of water allowed (382.0 ac-ft) divided the total time (215 days). This distributes the pumping over the entire proposed irrigation season.

Hunt (2003) was used to calculate the interference:

Used pro-rated pumping rate = 0.90 cfs (402 gpm),
Used aquifer transmissivity = 8,300 ft2/day based on specific capacity of LAKE 1779, LAKE1825, LAKE 1839, & LAKE 4070. The value is within the range noted by Sammel and Craig (1981)
Used an intermediate storage coefficient = 0.001
Used sediment hydraulic conductivity Kv = 1.00 ft/day (based well LAKE 4281)
Used estimated sediment thickness below creek = 150 feet (based on LAKE 1886 near Honey Creek)
Used stream width = 30 feet.

The Theis equation (Theis, 1935) was used to calculate the groundwater level drawdown at the 4 un-named springs (certificate 69825) using the same values above. The calculated drawdowns are shown below. The springs and the related water right could potentially be adversely impacted.

Pumping Scenario	Elapsed Time (days)	Calculated Drawdown (feet)		
			4 un-named springs	
Continuous Full Rate (1.59 cfs)	30		1.66	
	215		4.04	
Continuous Pro-Rated (0.90 cfs)	30		0.93	
	215		2.28	

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) **7B, 7F, 7N, 7P, 7T, and other (see below)**;

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

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

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

The "large" water use condition: (require a totalizing flow meter at each well. Each flow meter shall be located within 50 feet of the wellhead and adjacent to each flow meter shall be a clearly visible monument with a sign noting the flow meter. Lastly, require for every flow meter the reading, recording (monthly at minimum), and annual reporting of the flow meter data, all flow meters).

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

Walker and Repenning (1965) map the surface geology at the proposed POA well as Qal (unconsolidated fluviatile gravel, sand, and silt). Nearby, they map QTs (lacustrine, fluviatile, and Aeolian sedimentary rocks, interstratified tuff, ashy diatomite and unconsolidated clay, sand, and gravel), Tts (mostly fine grained tuffaceous sedimentary rocks and tuffs representing flood plain or shallow lake deposits, Tbf (massive basalt flows and minor interbeds of tuff and scoria), and Tb (basalt) is exposed in the uplands to the west of the wells. The Tts, Tbf, and/or Tb volcanic units (part of the predominantly basalt-volcanic unit) exposed in the uplands generally occur beneath the Qal and QTs units (part of the predominantly basin-fill sediment unit) in the valley.

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References Used:

References consulted were:

Hampton, E.R., 1964, Geologic factors that control the occurrence and availability of ground water in the Fort Rock Basin, Lake County, Oregon: USGS Professional Paper 383-B, 29 p.

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

McFarland, W.D. and Ryals, G.N., 1991, Adequacy of available hydrogeologic data for evaluation of declining ground-water levels in the Fort Rock Basin, south-central Oregon: USGS Water Resources Investigations Report 89-4057, 47 p.

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

Miller, D.W., 1986, Ground-water conditions in the Fort Rock Basin, northern Lake County, Oregon: OWRD Ground Water Report No. 31, 196 p.

Morgan, D.S., 1988, Geohydrology and numerical model analysis of ground-water flow in the Goose Lake Basin, Oregon and California: USGS Water Resources Investigations Report 87-4058, 92 p.

Oregon Water Resources Department, 1989, Goose and Summer Lakes Basin report: OWRD Basin Report, 112 p.

Peterson, N.V. and McIntyre, J.R., 1970, The reconnaissance geology and mineral resources of eastern Klamath County and western Lake County, Oregon: DOGAMI Bulletin 66, 70 p.

Phillips, K.N. and VanDenburgh, A.S., 1971, Hydrology and geochemistry of Abert, Summer, and Goose Lakes, and other closed-basin lakes in south-central Oregon: USGS Professional Paper 502-B, 86p.

Sammel, E.A. and Craig, R.W., 1981, The geothermal hydrology of Warner Valley, Oregon: a reconnaissance study: USGS Professional Paper 1044-I, 147 p.

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

Walker, G.W., 1963, Reconnaissance geologic map of the eastern half of the Klamath Falls (AMS) quadrangle, Lake and Klamath Counties, Oregon: USGS Mineral Investigations Field Studies Map MF-260.

Walker, G.W. and Repenning, C.A., 1965, Reconnaissance geologic map of the Adel quadrangle, Lake, Klamath, and Malheur Counties, Oregon: USGS Miscellaneous Geologic Investigations Map I-446.

Walker, G.W., 1973, Preliminary geologic and tectonic maps of Oregon east of the 121st meridian: USGS Miscellaneous Field Studies Map MF-495

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

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

State Obesrvation Wells SOW 382 (LAKE 2671).

Water well reports for wells in Township 35, 36, 39, & 40 South/Range 23, 24 & 25 East

USGS May Lake quad map (1:24,000 scale)

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** 1 **Logid:** Proposed, not yet constructed
Well #: _____ **Logid:** _____

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.

Comments: _____

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

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.

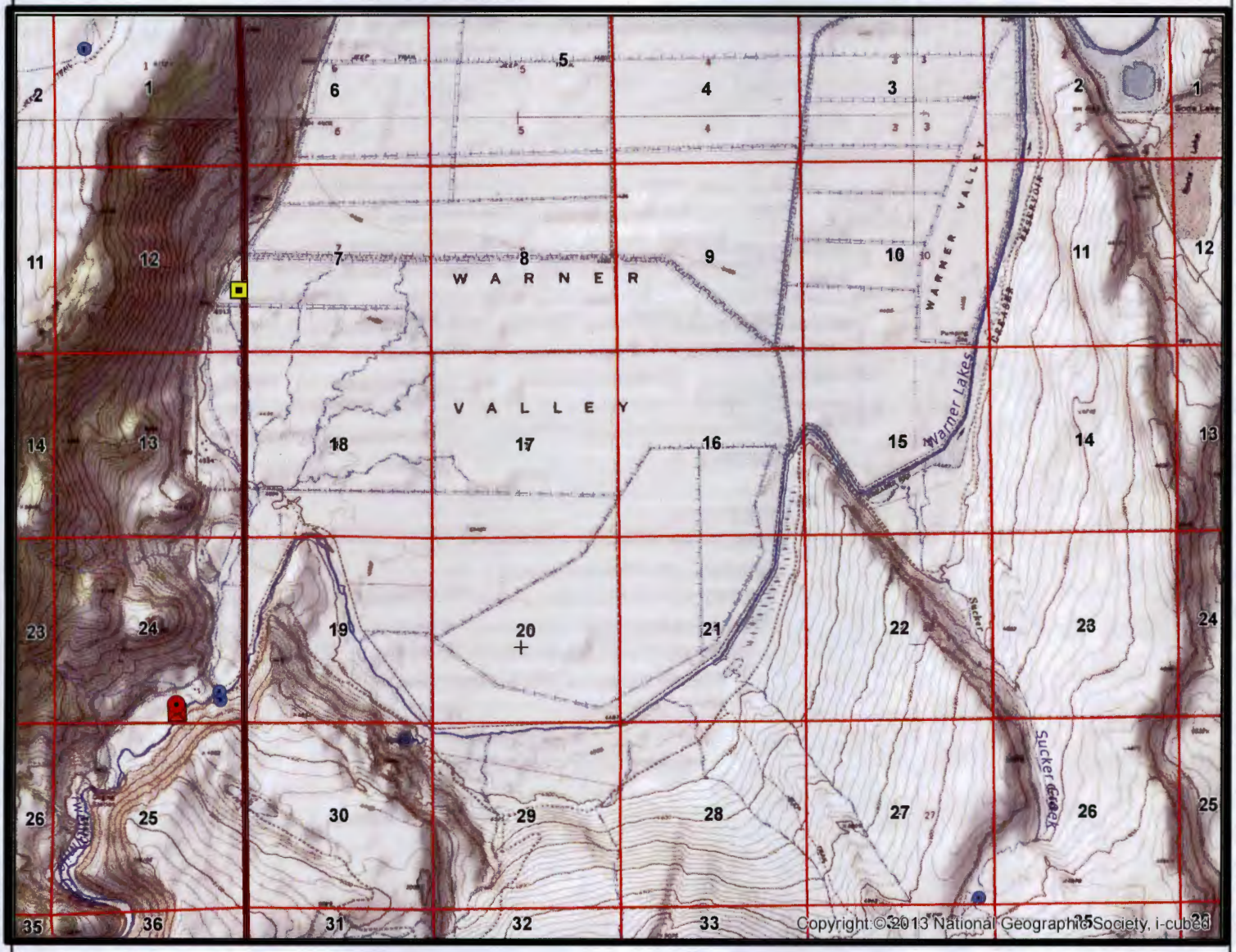
THIS SECTION TO BE COMPLETED BY ENFORCEMENT PERSONNEL

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).**

Groundwater Permit Application G-17892
Martin M. Landa



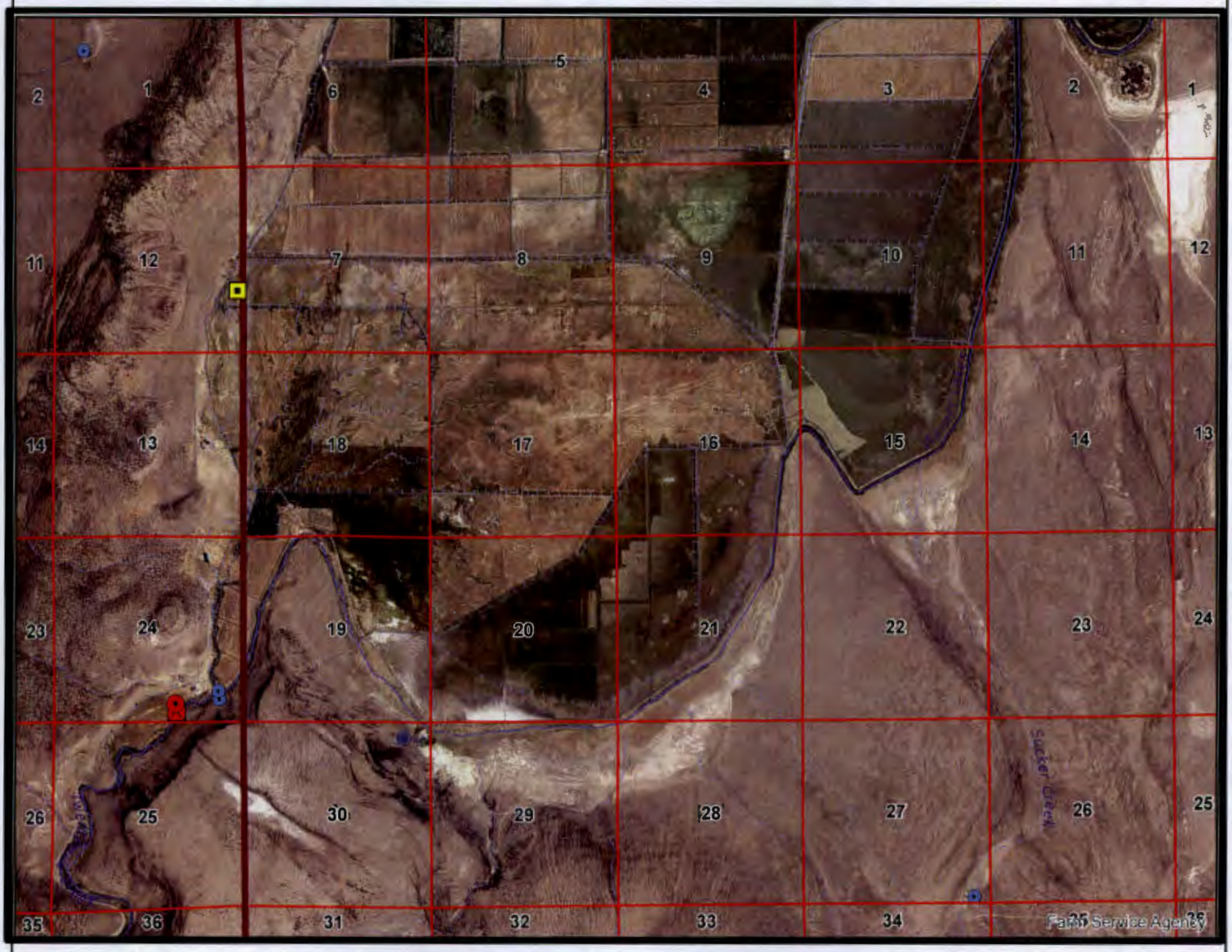
0 0.5 1 2
Miles

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

Blue and Other = surface water rights

N

Groundwater Permit Application G-17892
Martin M. Landa



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Miles

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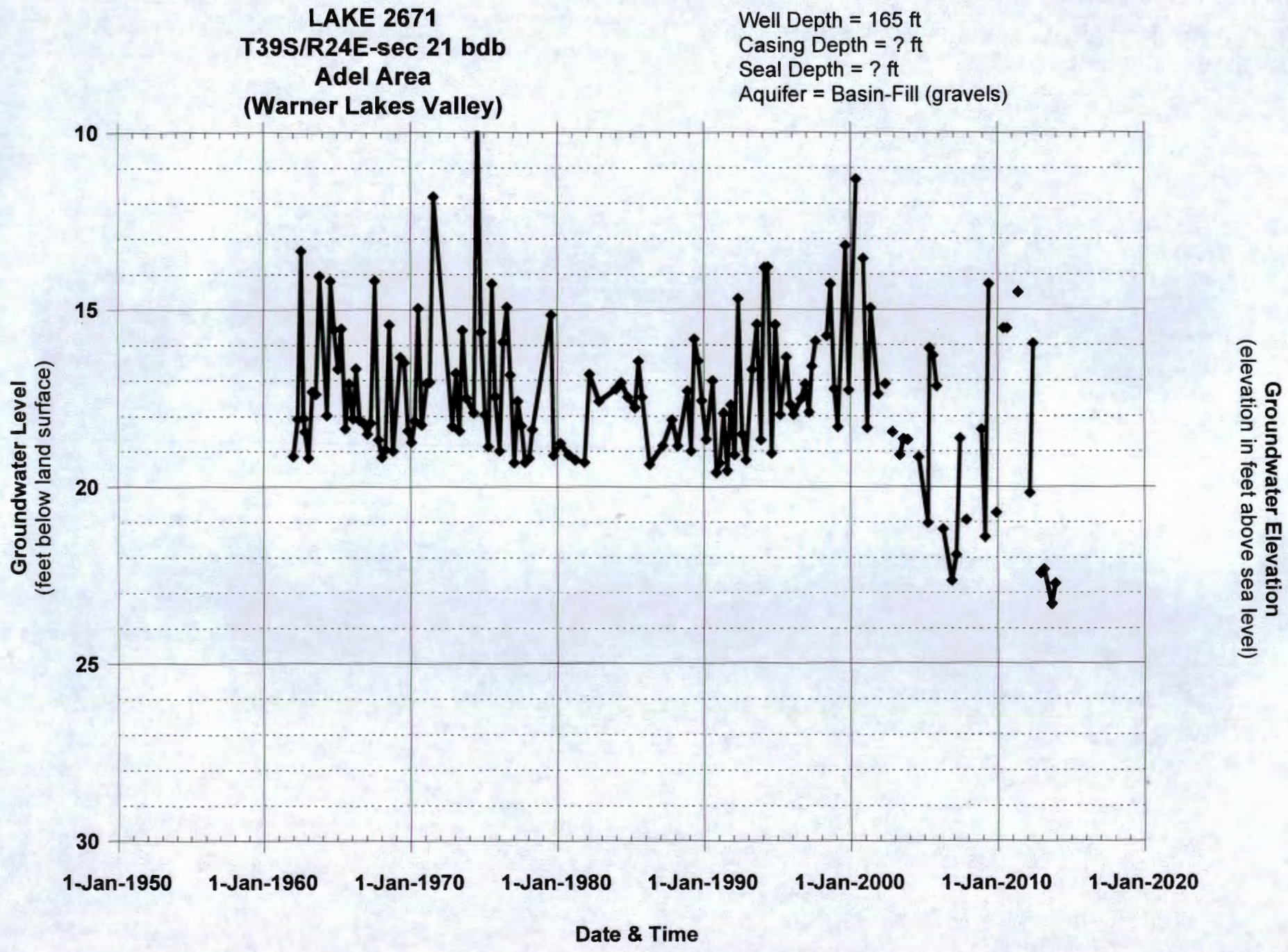
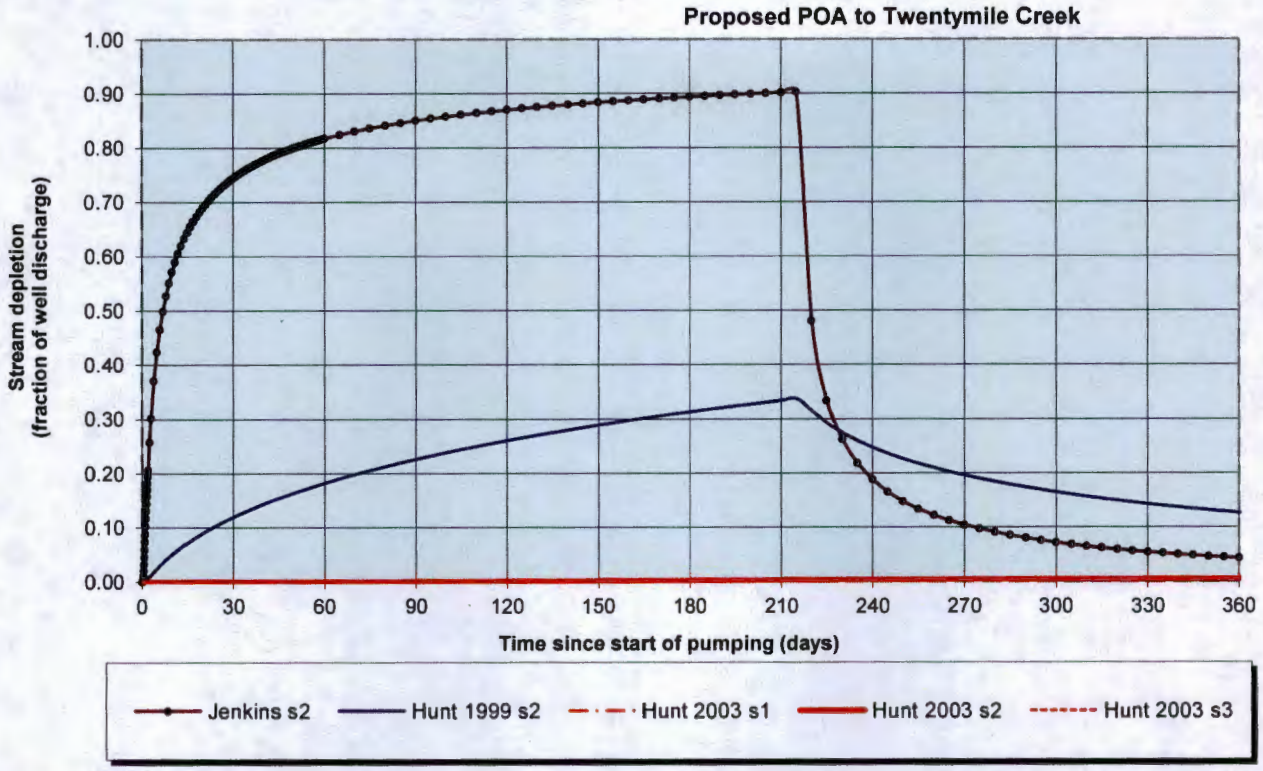

LAKE 2671
T39S/R24E-sec 21 bdb
Adel Area
(Warner Lakes Valley)
Well Depth = 165 ft
Casing Depth = ? ft
Seal Depth = ? ft
Aquifer = Basin-Fill (gravels)
Groundwater Level
(feet below land surface)
10
15
20
25
30
1-Jan-1950
1-Jan-1960
1-Jan-1970
1-Jan-1980
1-Jan-1990
1-Jan-2000
1-Jan-2010
1-Jan-2020
Date & Time
Groundwater Elevation
(elevation in feet above sea level)

Transient Stream Depletion (Jenkins, 1970; Hunt, 1999, 2003)



Output for Stream Depletion, Scenerio 2 (s2):						Time pump on (pumping duration) = 215 days						
Days	30	60	90	120	150	180	210	240	270	300	330	360
J SD	74.4%	81.7%	85.0%	87.0%	88.4%	89.4%	90.2%	18.8%	10.4%	7.2%	5.4%	4.3%
H SD 1999	12.0%	18.2%	22.6%	26.1%	28.9%	31.3%	33.4%	24.7%	19.6%	16.5%	14.3%	12.7%
H SD 2003	0.0%	0.0%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%
Qw, cfs	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
H SD 99, cfs	0.108	0.164	0.204	0.234	0.260	0.282	0.301	0.222	0.176	0.148	0.129	0.114
H SD 03, cfs	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.005

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate of well	Qw	0.90	0.90	0.90	cfs
Time pump on (pumping duration)	tpon	215	215	215	days
Perpendicular from well to stream	a	7290	7290	7290	ft
Well depth	d	500	500	500	ft
Aquifer hydraulic conductivity	K	83	83	83	ft/day
Aquifer saturated thickness	b	100	100	100	ft
Aquifer transmissivity	T	8300	8300	8300	ft*ft/day
Aquifer storativity or specific yield	S	0.001	0.001	0.001	
Aquitard vertical hydraulic conductivity	Kva	1	1	1	ft/day
Aquitard saturated thickness	ba	150	150	150	ft
Aquitard thickness below stream	babs	150	150	150	ft
Aquitard porosity	n	0.2	0.2	0.2	
Stream width	ws	30	30	30	ft
Streambed conductance (lambda)	sbc	0.200000	0.200000	0.200000	ft/day
Stream depletion factor	sdf	6.402904	6.402904	6.402904	days
Streambed factor	sbf	0.175663	0.175663	0.175663	
input #1 for Hunt's Q_4 function	t'	0.156179	0.156179	0.156179	
input #2 for Hunt's Q_4 function	K'	42.686024	42.686024	42.686024	
input #3 for Hunt's Q_4 function	epsilon'	0.005000	0.005000	0.005000	
input #4 for Hunt's Q_4 function	lamda'	0.175663	0.175663	0.175663	

G_17892_Landa_Warner_Lakes_Twentymile_Cr_Hunt_2003_depletion_sd_hunt_2003_1.01

Drawdown Calculations Using Theis Equation

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

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

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

s = drawdown (L)
T = transmissivity (L*L/T)
S = storage coefficient (dimensionless)
pi = 3.141592654
r = radial distance (L)
t = time (T)
u = dimensionless
W(u) = well function

Transmissivity T (gpd/ft)	Transmissivity T (ft2/day)	Storage Coefficient S	Pumping Rate Q (gal/min)	Pumping Rate Q (ft3/sec)	Time t (days)	Distance r (feet)	pi	u	W(u)	Drawdown s (feet)	Comments
								Note : W(u) calculation valid when u < 7.1			
Note:	yellow grid areas are where values are calculated							7.0000	1.1545E-04		W(u) calculation test
Proposed POA Well to un-named springs (Transmissivity from specific capacity data											
62,088.32	8,300.00	0.00100	713.64	1.59	30.00	13,820.00	3.14	0.1918	1.2572	1.6559	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	713.64	1.59	215.00	13,820.00	3.14	0.0268	3.0703	4.0439	Continuous Pumping at Full Rate
62,088.32	8,300.00	0.00100	401.79	0.90	30.00	13,820.00	3.14	0.1918	1.2572	0.9323	Pro-Rated Pumping Rate
62,088.32	8,300.00	0.00100	401.79	0.90	215.00	13,820.00	3.14	0.0268	3.0703	2.2768	Pro-Rated Pumping Rate

Theis_Equation_specific_capacity_to_transmissivity							
Basalt							
Well County	**Well Num**	**Transmissivity**	**Transmissivity**	**Open Interval**	**Conductivity**		
		ft2/day	**gpd/ft**	**feet**	**ft/day**		
LAKE	1779	4,299.52	32,162.65				
LAKE	1825	15,338.56	114,740.40				
LAKE	1839	12,012.45	89,859.37		#DIV/0!		
LAKE	4070	1,551.71	11,607.60		#DIV/0!		
		8,300.56	**62,092.51**	**Average**		**#DIV/0!**	**ft/day**
Basin-Fill							
Well County	**Well Num**	**Transmissivity**	**Transmissivity**	**Open Interval**	**Conductivity**		
		ft2/day	**gpd/ft**	**feet**	**ft/day**		
LAKE	4281	631.62	4,724.85	640.00	0.99		
		631.62	**4,724.85**	**Average**		**#DIV/0!**	**ft/day**