WATER RESOURCES DEPARTMENT

MEMO December 21, 2015

TO: **Application G-** 18121

FROM: **GW:** Aurora Bouchier
(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 GROUNDWATER APPLICATIONS

TO: Water Rights Section Date **December 21, 2015**

FROM: Groundwater Section **Aurora C Bouchier / Ken Lite**
Reviewer's Name

SUBJECT: Application G- **18121** 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 groundwater 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: **Randall Arnett** County: **Crook**

A1. Applicant(s) seek(s) **0.003** cfs from **2** well(s) in the **Deschutes** Basin, **Lower Crooked** subbasin

A2. Proposed use **Pond maintenance** Seasonality: **January 1 – December 31**

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	CROO 365	1	Alluvium	0.003	T13S/R17E-S25 SE-NE	1780' S, 80'W of NE cor S 25
2	CROO 54251	2	Bedrock	0.003	T13S/R17E-S25 SE-NE	1612' S, 2'W of NE cor S 25
3						
4						
5						

* 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	3530	40	10	2/27/1992	60	0-22	+1-50		30-50	10	40	Pump
2	3540	13	28	6/24/2015	196	0-59	+2-59		156-196**	30		Air

Use data from application for proposed wells.

A4. **Comments:** Mill Creek is a perennial stream cutting into low permeability units of the Clarno and John Day formations. Mill Creek is a regional sink for groundwater discharge with numerous springs along its valley and at the source of many of the tributaries to Mill Creek. Any withdrawals from Mill Creek will likely affect downstream water rights. According to Water Master Jeremy Giffin (personal communication 7/21/2015), this is the most heavily regulated creek in the basin.

Both wells are located on an elevated alluvial terrace above Mill Creek. Well 1 (CROO 365) is constructed into the alluvium. Well 2 (CROO 54251) is constructed into a water-bearing zone within a basalt flow of the Clarno Formation. Hydraulic head is coincident with overlying terrace gravel and the creek.

A5. ☒ **Provisions of the** Deschutes Basin rules relative to the development, classification and/or management of groundwater hydraulically connected to surface water ☐ **are**, *or* ☒ **are not**, activated by this application. (Not all basin rules contain such provisions.)
Comments: The location is located outside the USGS Deschutes Groundwater Study Area.

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

B. GROUNDWATER AVAILABILITY CONSIDERATIONS, OAR 690-310-130, 400-010, 410-0070

B1. **Based upon available data**, I have determined that groundwater* 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 groundwater 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 groundwater 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 groundwater resource; or

d. ☒ **will, if properly conditioned**, avoid injury to existing groundwater rights or to the groundwater resource:
   i. ☒ The permit should contain condition #(s) **7N, 7J**;
   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 groundwater production from no deeper than _____ ft. below land surface;

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

c. ☐ **Condition** to allow groundwater production only from the _____ groundwater 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 Groundwater 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. **Groundwater availability remarks:** _____

Condition with 7N and 7J.

Both wells are located on an elevated alluvial terrace above Mill Creek. Well 1 (CROO 365) is constructed into the alluvium. Well 2 (CROO 54251) is constructed into water-bearing zones within a basalt layer of the Clarno Formation. The Clarno Formation is Eocene in age and consists of lava flows, mudflows, and tuffs which are mainly of basaltic and andesitic composition (Waters, 1968). Due to its age, the Clarno Formation generally has very low permeability as much of the tuffaceous material has devitrified and the lava flows have weathered and contain abundant secondary minerals. Productive permeability in the Clarno Formation tends to be secondary, such as along fractures zones. In Well 2 the hydraulic head is coincident with overlying terrace gravel within a ¼ mile of the well. The groundwater in the basalt may be hydraulically connected to the overlying sediment via a fracture network, and therefore, when saturated, the underlying basalt may be hydraulically connected to surface water. The orientation of any local fracture network is unknown. Other wells in the area appear to be producing water from both the alluvium and water-bearing zones in the Clarno Formation (CROO 680, CROO 683, and CROO 51917).

There are no nearby wells for which water level trends are available.

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

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

Well	Aquifer or Proposed Aquifer	Confined	Unconfined
1	**Alluvium**	☐	☒
2	**Bedrock (Basalt)**	☐	☒
		☐	☐
		☐	☐
		☐	☐

Basis for aquifer confinement evaluation: Well 1 (CROO 365) is producing water from the Quaternary alluvium. Although the well log shows a clay layer from 16-30 feet and lists a static water level above the water bearing zone at which it was encountered, it is likely that the well has an efficient connection with the creek due to the elevation of the static water level in the well being coincident with that of the adjacent section of the creek.

The well log for Well 2 (CROO 54251) lists 110 feet of basalt overlying the water bearing zone. Given the age of the formation, the groundwater in the basalt is likely hydraulically connected to the overlying sediment and subsequently to surface water through secondary porosity in the form of a fracture network. An indication that the bedrock is likely fractured is the static water level in Well 2 being coincident with the elevation of the stream within a ¼ mile of the well, although the orientation of any fractures is unknown.

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	**Mill Creek**	**3520**	**3520**	**120**	☒	☐	☐	☒	☐
2	1	**Mill Creek**	**3512**	**3520**	**300**	☒	☐	☐	☒	☐
						☐	☐	☐	☐	☐

Basis for aquifer hydraulic connection evaluation: The elevation of the static water level listed on the well log for CROO 365 is coincident with the elevation of the adjacent segment of Mill Creek. The elevation of the static water level listed on the well log for CROO 54251 is lower than the elevation of the adjacent segment of Mill Creek. However, the elevation of the static water level for CROO 54251 is coincident with the elevation of a segment of Mill Creek located less than ¼ mile (~900 ft) downstream from the well.

Water Availability Basin the well(s) are located within: 70611: OCHOCO CR > CROOKED 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	☒	☐	-	-	☐	**3.35**	☐	**30-40%**	☒
2	1	☒	☐	-	-	☐	**3.35**	☐	**See comments**	☒
		☐	☐			☐		☐		☐
		☐	☐			☐		☐		☐

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: For Well 1 (CROO 365), interference with Mill Creek at 30 days was estimated using the Hunt 1999 model and assuming a 3 foot streambed thickness. The aquifer storativity values were ranged between .15 and .3 based on published values for unconsolidated gravel (Driscoll, 1986).

Well 2 (CROO 54251) is likely impacting surface water along Mill Creek. However, the nature of the aquifer unit precludes the use of available analytical models to evaluate the timing of interference.

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
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													

Distributed Wells

Well	SW#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													
		%	%	%	%	%	%	%	%	%	%	%	%
Well Q as CFS													
Interference CFS													

(A) = Total Interf.												
(B) = 80 % Nat. Q												
(C) = 1 % Nat. Q												

(D) = (A) > (C)												
(E) = (A / B) x 100	%	%	%	%	%	%	%	%	%	%	%	%

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

Basis for impact evaluation:

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 groundwater 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:**

References Used:

Application file: G-18121.

Driscoll, F.G. (editor), 1986. Groundwater and Wells, Second Edition.

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

OWRD files for Emergency Drought Application G-1811.

Water, A.C., and Vaughan, R.H., 1968. Reconnaissance Geologic Map of the Ochoco Reservoir Quadrangle, Crook County, Oregon: United States Geological Survey, Miscellaneous Geologic Investigations Map I-541.

Well logs for CROO 365 and CROO 54251, as well as nearby CROO 680, CROO 683, and CROO51917.

D. WELL CONSTRUCTION, OAR 690-200

D1. **Well #:** _____ **Logid:** _____

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

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

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

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

Water Availability Tables

DETAILED REPORT ON THE WATER AVAILABILITY CALCULATION

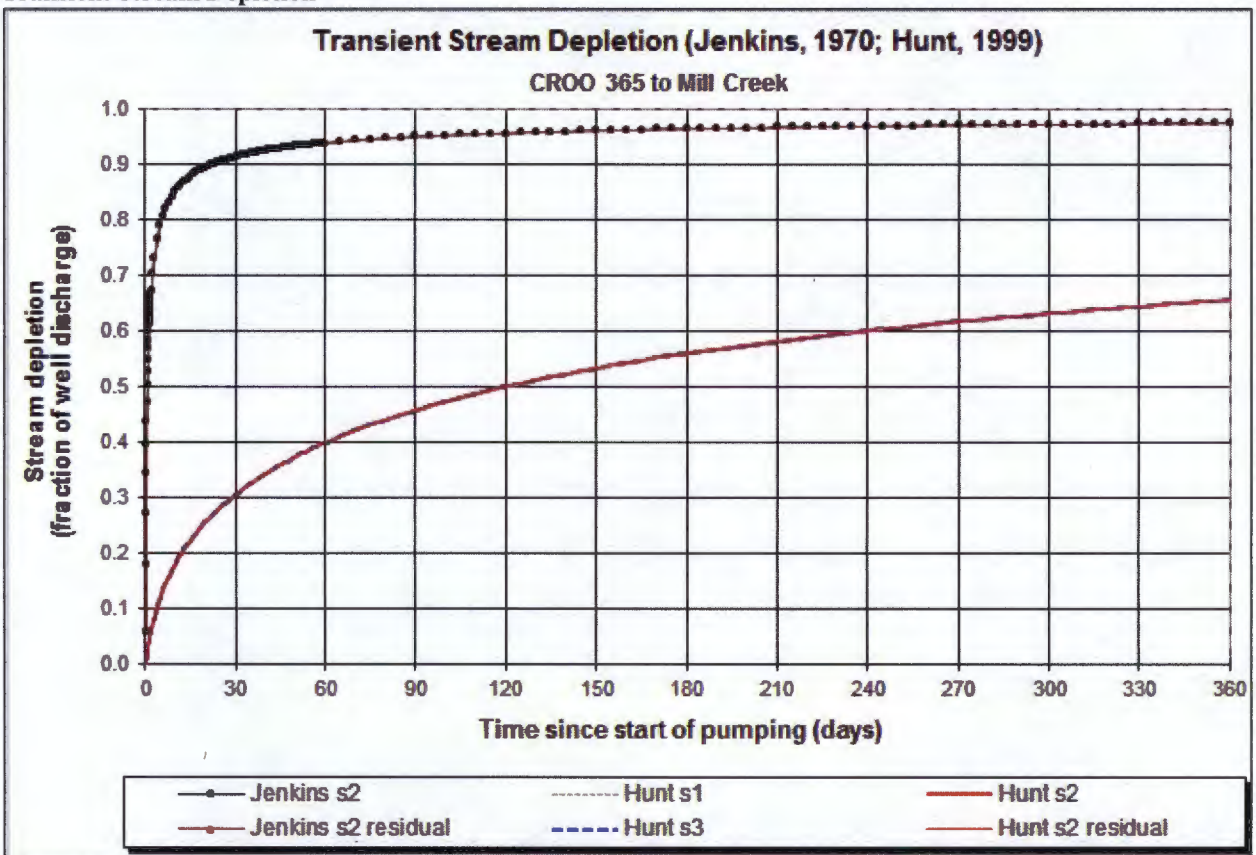
Watershed ID #: 70611 — OCHOCO CR > CROOKED R - AT MOUTH — Exceedance Level: 80
Time: 11:29 AM — Basin: DESCHUTES — Date: 12/16/2015

Month	Natural Stream Flow	Consumptive Use and Storage	Expected Stream Flow	Reserved Stream Flow	Instream Requirements	Net Water Available
	Monthly values are in cfs. Storage is the annual amount at 50% exceedance in ac-ft.					
JAN	15.20	58.00	-42.80	0.00	23.00	-65.80
FEB	35.40	97.80	-62.40	0.00	35.00	-97.40
MAR	71.10	84.00	-12.90	0.00	45.00	-57.90
APR	96.50	109.00	-12.30	0.00	45.00	-57.30
MAY	62.30	105.00	-42.60	0.00	45.00	-87.60
JUN	43.10	103.00	-60.10	0.00	35.00	-95.10
JUL	12.80	130.00	-117.00	0.00	14.70	-132.00
AUG	5.78	94.90	-89.10	0.00	6.27	-95.40
SEP	5.95	41.50	-35.50	0.00	6.50	-42.00
OCT	3.35	5.31	-1.96	0.00	6.89	-8.85
NOV	4.94	8.63	-3.69	0.00	8.62	-12.30
DEC	11.00	42.10	-31.10	0.00	23.00	-54.10
ANN	44,600	53,000	11,300	0	17,700	5,240

Well Location Map

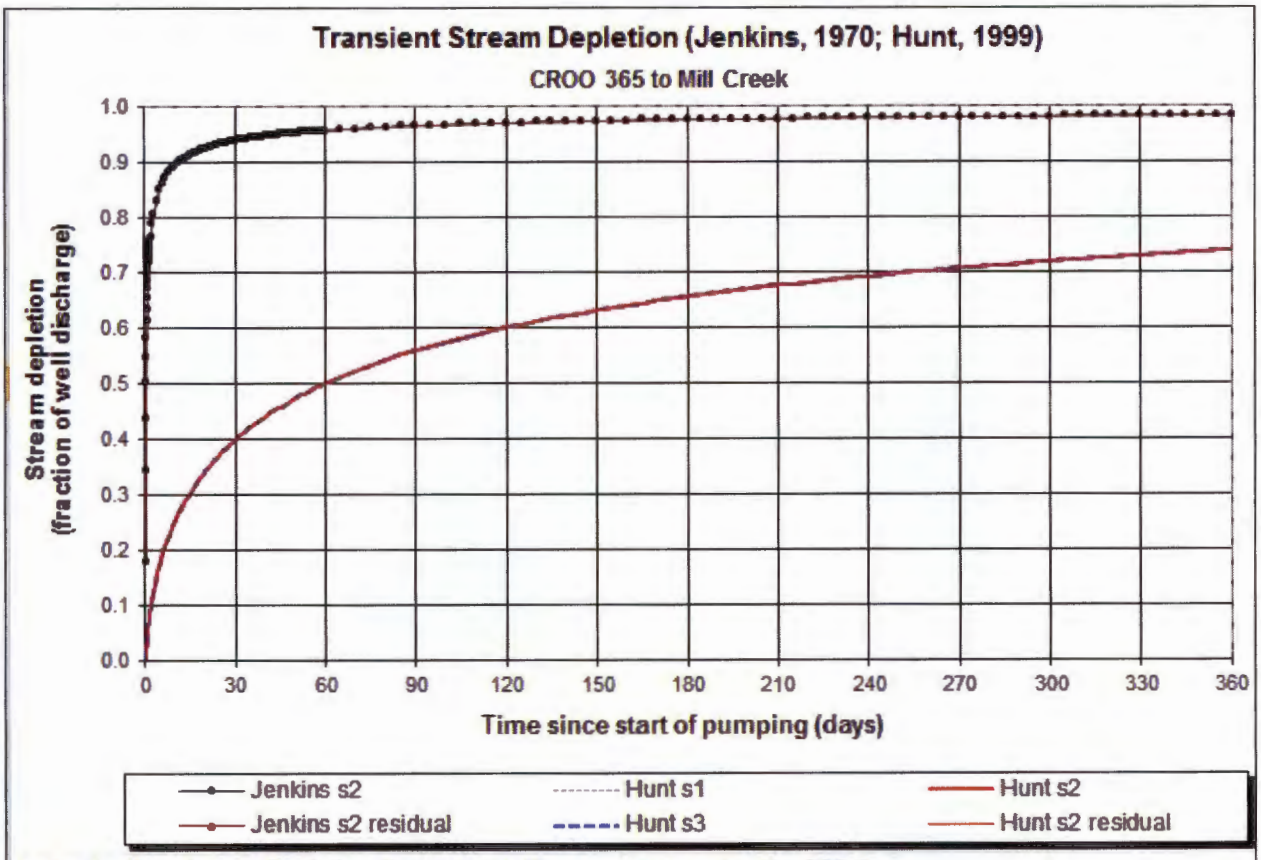
Water-Level Trends in Nearby Wells
Non available.

Transient Stream Depletion



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
Qw, cfs	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Jenk SD s2 %	91.28	93.83	94.96	95.63	96.09	96.43	96.70	96.91	97.09	97.24	97.37	97.48
Jen SD s2 cfs	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Hunt SD s2 %	30.47	39.92	45.80	50.03	53.30	55.95	58.16	60.04	61.68	63.12	64.40	65.55
Hunt SD s2 cfs	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.003	0.003	0.003	cfs
Distance to stream	a	120	120	120	ft
Aquifer hydraulic conductivity	K	300	300	300	ft/day
Aquifer thickness	b	20	20	20	ft
Aquifer transmissivity	T	6000	6000	6000	ft*ft/day
Aquifer storage coefficient	S	0.3	0.3	0.3	
Stream width	ws	20	20	20	ft
Streambed hydraulic conductivity	Ks	1	1	1	ft/day
Streambed thickness	bs	3	3	3	ft
Streambed conductance	sbc	6.666666667	6.666666667	6.666666667	ft/day
Stream depletion factor (Jenkins)	sdf	0.72	0.72	0.72	days
Streambed factor (Hunt)	sbf	0.133333333	0.133333333	0.133333333	



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
Qw, cfs	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Jenk SD s2 %	93.83	95.63	96.43	96.91	97.24	97.48	97.66	97.82	97.94	98.05	98.14	98.22
Jen SD s2 cfs	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Hunt SD s2 %	39.92	50.03	55.95	60.04	63.12	65.55	67.54	69.21	70.64	71.88	72.97	73.95
Hunt SD s2 cfs	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002

Parameters:		Scenario 1	Scenario 2	Scenario 3	Units
Net steady pumping rate	Qw	0.003	0.003	0.003	cfs
Distance to stream	a	120	120	120	ft
Aquifer hydraulic conductivity	K	300	300	300	ft/day
Aquifer thickness	b	20	20	20	ft
Aquifer transmissivity	T	6000	6000	6000	ft*ft/day
Aquifer storage coefficient	S	0.15	0.15	0.15	
Stream width	ws	20	20	20	ft
Streambed hydraulic conductivity	Ks	1	1	1	ft/day
Streambed thickness	bs	3	3	3	ft
Streambed conductance	sbc	6.666666667	6.666666667	6.666666667	ft/day
Stream depletion factor (Jenkins)	sdf	0.36	0.36	0.36	days
Streambed factor (Hunt)	sbf	0.133333333	0.133333333	0.133333333	