The Jacks Creek Total Maximum Daily Load (TMDL) Modification Of the Bruneau River Watershed Management Plan (Bruneau River TMDL)



By

Dr. Balthasar B. Buhidar, Ph.D.
Regional Manager – Water Quality Protection
Idaho Department of Environmental Quality
Twin Falls Regional Office

Revised Final Submittal October 24, 2007

The Jacks Creek Total Maximum Daily Load (TMDL) Modification Of the Bruneau River Watershed Management Plan (Bruneau River TMDL)

By

Dr. Balthasar B. Buhidar, Ph.D.
Regional Manager – Water Quality Protection
Idaho Department of Environmental Quality
Twin Falls Regional Office

Revised Final Submittal October 24, 2007

INFORMATION AT A GLANCE	
303(d) Waterbody	Jacks Creek
Assessment Unit	ID17050102SW002
Subbasin & HUC No.	Bruneau River Subbasin – HUC 17050102
Pollutants of Concern	Sediment, nutrients, bacteria
NPDES Permitted Facilities	Ace Development USA, Inc.: NPDES No. 130123 Arraina Inc.: NPDES No. 130122
Type of Facilities in the Drainage	Aquaculture: NPDES point sources Agriculture: Cattle ranching, agricultural cropland
Approved TMDL – Year Approved	Bruneau River TMDL - 2000

INTENT AND PURPOSE

The intent and purpose of the *Jacks Creek TMDL Modification* is to establish water quality load allocations for sediment, nutrients, and bacteria on Jacks Creek in the Bruneau River Subbasin. Jacks Creek is a §303(d) listed waterbody and is generally described in the Bruneau River Total Maximum Daily Load (i.e. Bruneau River TMDL) as having its beneficial uses impaired (Lay 2000, p 42, §2.1.4.2.2). The receiving waterbody to Jacks Creek is the C. J. Strike Reservoir reach of the Snake River, which is also §303(d) listed. Consequently, the Jacks Creek TMDL Modification is necessary to protect the beneficial uses of the Snake River as part of the Bruneau River TMDL.

In the Bruneau River TMDL, the aquaculture fish hatcheries were originally assigned a wasteload allocation based on a concentration limit that was not possible to meet as warm water facilities based on EPA's General Aquaculture Permit (IDG-130000, Aquaculture Facilities in Idaho, subject to Wasteload Allocations under Selected Total Maximum Daily Loads). A final Section 401 water quality certification was issued by DEQ on October 5, 2007 based on EPA's proposed final versions (received September 7, 2007) of the permit.

The Jacks Creek TMDL Modification corrects the inconsistency of the phosphorus concentration target used in the Bruneau River TMDL for the aquaculture facilities versus that used in the General Aquaculture Permit for establishing a technology based effluent limitation; and, at the same time, implements the applicable state water quality standards that are based on the relationship between pollutant sources and instream water quality conditions to meet beneficial uses. This TMDL revision provides consistency between the Bruneau River TMDL and the C. J. Strike TMDL. The Jacks Creek TMDL Modification establishes the allowable

loadings and quantifiable parameters for Jacks Creek and provides the basis for the State to establish water quality-based controls.

These controls should provide the pollutant reductions necessary for Jacks Creek to meet water quality standards. If water quality standards and beneficial uses are not achieved, the TMDL may require more stringent reductions through implementation of other best management practices or limitations.

IDENTIFICATION OF WATERBODY, POLLUTANTS OF CONCERN, POLLUTANT SOURCES, AND PRIORITY RANKING

Jacks Creek is specifically identified in the Bruneau River TMDL (Lay 2000, p 3, Table 1) as a §303(d) listed waterbody. The Bruneau River system is a tributary to the Snake River, known as the "Bruneau Arm of the Snake River." This system discharges into the Snake River at River Mile 494.9 of the Snake River. Within the Bruneau River system, Jacks Creek discharges at River Mile 12.5 (EPA 2006). As described in the Bruneau River TMDL, Jacks Creek begins at the confluence of Big Jacks Creek and Little Jacks Creek (Lay 2000, p 30, §2.1.2.2).

Pollutants of concern are based on the water quality impairments to Jacks Creek itself as well as to the C. J. Strike Reservoir, as described in the Bruneau River TMDL. The primary pollutants-of-concern are sediment (as total suspended solids or TSS), nutrients (as total phosphorus or TP), and bacteria (as *Escherichia coli* or *E. coli*) (Lay 2000, pp 56-58, 63-65, 95-97). Linked to these pollutants-of-concern is dissolved oxygen (or DO). Water cleanup efforts associated with sediment, nutrients, and bacteria in the Bruneau River TMDL (Lay 2000, pp 91-92, 96) are expected to improve DO levels and the overall water quality of Jacks Creek.

Jacks Creek is a high priority stream and is presently under implementation planning as a post-TMDL component in the Bruneau River TMDL process. As part of Idaho's TMDL schedule, Jacks Creek underwent a subbasin assessment process to assess the beneficial use support status, which is defined in the Bruneau River TMDL (Lay 2000, pp 55, Table 11).

After determination that Jacks Creek was a water quality limited stream and required a TMDL, it was determined (with consultation from the stakeholders of the Bruneau River Group) that the application of pollution controls to point sources and nonpoint sources would help to restore the beneficial uses of Jacks Creek. DEQ developed the TMDL, taking the following into consideration:

- Identification of significant sources of pollution from past and present activities.
- Application of cost-effective interim pollution control strategies to the point sources and nonpoint sources to achieve full support status within a reasonable period of time
- Consultation with the appropriate stakeholders in the Bruneau River Subbasin, designated agencies, and private landowners to determine the feasibility of cost-effective interim pollution control strategies that can be effectively applied to the sources of pollution to achieve full support status within a reasonable period of time.
- Monitoring by the DEQ Twin Falls Regional Office (DEQ-TFRO), after the application of pollution control strategies in Jacks Creek, to determine whether application of pollution controls were successful in restoring Jacks Creek to full support status.

Because Jacks Creek is a high priority §303(d) stream under implementation planning with an approved TMDL, any new or increased discharge of causative pollutants will be allowed only if consistent with the approved TMDL. The dominant pollution impacts on the water quality of Jacks Creek has been determined to come from agricultural sources (inclusive of the aquaculture fish farms as a component). As such, agricultural operations are strongly encouraged to adopt best management practices on a voluntary basis as prescribed in Idaho Code.

DESCRIPTION OF THE APPLICABLE WATER QUALITY STANDARDS AND NUMERIC WATER QUALITY TARGET

The *Bruneau River TMDL* describes the water quality standards for Jacks Creek (Lay 2000, p 55, §2.3.2); Jacks Creek does not have designated beneficial uses under the rules and regulations for the state of Idaho. Due to the influence of artesian geothermal sources that provide the overall water flow into Jacks Creek annually (Buhidar 2006), the existing beneficial use is warm water aquatic life under the Bruneau River TMDL (Lay 2000, p 55, Table 11) .

These warm water sources do not preclude cold water from running through Jacks Creek during high flow events from Little Jacks Creek or Big Jacks Creek. Jacks Creek is best described as a modified system, but a final determination based on the chemical, physical, and biological levels necessary to attain the existing aquatic life community for a modified aquatic life level has not been completed.

Because primary recreational activities are not known to exist, secondary contact recreation standards were applied to Jacks Creek. Jacks Creek functions as an agricultural drain from the Jacks Creek drainage to the C. J. Strike Reservoir (Buhidar 2006, §2.4 and §2.4.1).

Jacks Creek is §303(d) listed in the *2002 Integrated Report* and is § 303(d) listed for bacteria, organic enrichment (as low DO), phosphorus, and siltation (DEQ 2005, pp 208-209). Table 1 shows the National Assessment Database (EPA 2002) listing for the Bruneau River Watershed, indicating the assessment units (AUs) catalog numbers and water quality status of Jacks Creek in the Bruneau River Subbasin.

Table 1. Jacks Creek assessment units and water quality status.

Jacks Creek Designation	Assessment Unit (AU)	Water Quality Status	Idaho Identification
Confluence of Little and Big Jacks Creeks to C. J. Strike Reservoir	ID-17050102SW002_02[a]	Not Assessed	SW-2[f]
	ID-17050102SW002_03[b]		
	ID-17050102SW002_04[c]		
	ID-17050102SW002_05[d,e]	Impaired	

AU = Assessment Unit. ID = Idaho. I = Impaired. NA = Not Assessed.
[a]AU ID-17050102SW002_02 = 1st and 2nd Rosgen Order.
[b]AU ID-17050102SW002_30 = 3rd Rosgen Order.
[c]AU ID-17050102SW002_04 = 4th Rosgen Order.
[d]AU ID-17050102SW002_05 = 5th Rosgen Order.
[e]The 1998 303(d) Crosswalk developed by the DEQ State Office for linking the 1998 303(d) water quality limited streams (like Jacks Creek) to its appropriate assessment unit has ID-17050102SW002_05 as water quality limited stream segment ID2551 (approximately 12.28 miles) for the designation from Little Jacks Creek to C. J. Strike Reservoir. This is the impaired segment of Jacks Creek (the 5th Rosgen Order) that is 303(d) listed in the overall assessment unit. The other segments of Jacks Creek (the 1st, 2nd, 3rd, and 4th Rosgen Order) were not assessed.
[f]Based on IDAPA §58.01.02.140.02 – Bruneau Subbasin as part of the Southwest Idaho Basin.

The numeric water quality standards and narrative targets imposed by the *Jacks Creek TMDL Modification* are based on the assumptions in the *Bruneau River TMDL* (Lay 2000) and described in the *Jacks Creek TMDL Technical Support Document* (or *Jacks Creek TSD*;

Buhidar 2006) for the establishment of wasteload allocations for the fish hatcheries on Jacks Creek. However, the instream targets were revised based on EPA's comments and concerns in order to be consistent with the C. J. Strike TMDL and the Bruneau River TMDL. These in-stream standards are described as follows:

- **Sediment**. According to IDAPA §58.01.02.200.08, sediment shall not exceed quantities which impair designated beneficial uses. The Bruneau River TMDL showed that the water quality of Jacks Creek is impaired due to the excess sediment concentrations, sediment being listed specifically as a pollutant and/or stressor (Lay 2000, p 48, §2.2.1, Table 8).

  Water quality in Jacks Creek was reported to have total suspended sediment (TSS) at 40.0 mg/L (mean) but has also been shown to have maximum concentrations of 96.0 mg/L TSS (Lay 2000, p 64, Table 14). The *Jacks Creek TSD* showed a seasonal average of 41.5 mg/L TSS and a maximum value of 81.4 mg/L TSS (Buhidar 2006, §5.2, Table 5, and §5.2.2). The recommended instream water quality target for TSS is 50 mg/L (average monthly) in Jacks Creek as a tributary to the Bruneau River (Lay 2000, p 57), so, during certain times of the irrigation season and/or the spring flush, the instream water quality target of 50.0 mg/L monthly average was exceeded.

- **Nutrients**. According to IDAPA §58.01.02.200.06, surface waters of the state (like Jacks Creek) shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. The *Bruneau River TMDL* showed that the water quality of Jacks Creek is impaired due to the excess nutrient concentrations (as TP), which TP as a nutrient is being listed specifically as a pollutant and/or stressor (Lay 2000, p 48, §2.2.1, Table 8).

  Water quality in Jacks Creek was reported to have total phosphorus (TP) at 0.187 mg/L (mean), but it has also been shown to have a maximum concentration of 0.296 mg/L TP (Lay 2000, p 64, Table 14). The *Jacks Creek TSD* showed a seasonal average of 0.233 mg/L TP and a maximum value of 0.300 mg/L TP (Buhidar 2006, §5.2, Table 5, and §5.2.3).

  The recommended in-stream water quality target for TP, as assessed in the Bruneau River TMDL, was 0.050 mg/L TP monthly average (Lay 2000, p 56). DEQ will retain the water quality target for TP of 0.05 mg/L because evidence exists that cropland irrigation water reuse and attenuation of total phosphorus of the aquaculture effluent from the two fish farms on the agricultural land allows for very little TP to ever reach the Bruneau Arm of the Snake River. In fact, the most probable estimate of this agricultural activity is that 15% of the aquaculture effluent reaches Jacks Creek and then the C. J. Strike Reservoir. Thus, 85% of the effluent is reused as agricultural cropland irrigation.

  Bacteria. Jacks Creek water quality standards are based on secondary contact recreation (Lay 2000, p 64, §2.4.2; pp 92-93, §3.1.3) that are appropriate for fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur (IDAPA §58.01.02.100.02.b). Discussions with local residents and local land management agencies indicate that primary contact recreation is an inappropriate designation for Jacks Creek. Thus, the secondary contact recreation standard is applied. Based on IDAPA §58.01.02.251.01.a, the *E. coli* bacteria standard is a geometric mean criterion (for both primary and secondary contact recreation) of 126 *E. coli* organisms/100 mL, based on a minimum of five (5) samples taken every three (3) to five (5) days over a thirty (30) day period. The "trigger" for this target is a single sample value of 576 *E. coli* organisms/100 mL based on the secondary contact recreational standard (IDAPA §58.01.02.251.01.b.i).

The measured *E. coli* in Jacks Creek averages 806 CFU/100 mL (annually), but has been shown to have maximum concentrations of 2,400 CFU/100 mL (Lay 2000, p 64, Table 14), a level described in the TMDL as being "above the threshold values indicating the recreation beneficial uses may not be supported" (Lay 2000, p 64). Further sampling conducted during the development of the Bruneau River TMDL was done to collect enough samples to apply the geometric mean water quality standard (126 CFU/100 mL) and the results indicated that the secondary contact recreation is not supported as well.

During development of the J*acks Creek TSD*, it was determined that the average *E. coli* value was 2,395 CFU/100 mL with a maximum value of 10,725 CFU/100 mL. Due to resource constraints, it was not possible to determine the geometric mean, but sufficient information exists to infer from the instantaneous values collected throughout Jacks Creek that the geometric mean would also be exceeded for the secondary contact recreation standard (Buhidar 2006, §5.2, Table 5).

Because of the higher values of TSS and TP (as previously noted), and because *E. coli* is not scientifically known to be developed in the intestines of cold-blooded fish, it was concluded that the *E. coli* comes from the predominant agricultural sources in the Jacks Creek drainage and not necessarily from the aquaculture fish farms.

LOADING CAPACITY – LINKING WATER QUALITY AND POLLUTANT SOURCES

The loading capacity (LC) is the greatest amount of loading that a water body can receive without violating water quality standards. In the case of Jacks Creek, the LC is dictated by flow due to the agricultural industry activities within the Jacks Creek drainage, Jacks Creek being the receiving 303(d) listed waterbody. For Jacks Creek to meet water quality standards, it is imperative that the sources contributing pollutants to Jacks Creek meet water quality standards as well. Otherwise, attainment of water quality standards (and beneficial uses) cannot be achieved in Jacks Creek.

To determine the LC for Jacks Creek, it is necessary to have an estimate of the flow from the creek prior to discharge into the Bruneau Arm of the Snake River (or the C. J. Strike Reservoir). Based on the *Jacks Creek TSD*, the average flow in Jacks Creek is 17.49 cfs (Buhidar 2006, §6.4.2, Table 24). However, the 17.49 cfs is based on the 70th percentile flow of the flow volumes collected and does not necessarily reflect the low flow scenario. Appendix C provides DEQ's approach to this issue and addresses the low flow scenario in Jacks Creek from two perspectives. First, the intermittent surface hydrology of Jacks Creek indicates a conservative flow estimate of 4.944 cfs as defined in the Bruneau River TMDL. Second, the use of geothermal water sources shows the 10th percentile flow estimate of 2.320 cfs. By combining both flow estimates (4.944 cfs + 2.320 cfs) provides an estimate of 7.264 cfs for Jacks Creek year 'round. This combined flow estimate was used to estimate the overall design flow of Jacks Creek.

Therefore, based on the Bruneau River TMDL provisions for instream water quality standards (or targets) for TSS (Lay 2000) and the geothermal flow 10th percentile flow estimate; and, based on the instream water quality standards (or targets) for TSS (50 mg/L), TP (0.05 mg/L) and *E. coli* (126 CFU/100 mL); the Jacks Creek LC is defined as follows (as described in Section III):

- **Sediment (as TSS):** 50 mg/L (average monthly) in the tributaries. Therefore,

  TSS LC = 50 mg/L TSS x 7.264 cfs x 5.4 = 1,961.28 lb/day TSS LC

- **Nutrients (as TP):** The recommended instream water quality target for TP is 0.050 mg/L TP, as described in Section III. Therefore,

  TP LC = 0.050 mg/L TP x 7.264 cfs x 5.4 = 1.96 lb/day TP LC

- **Bacteria (as *E. coli*)**: The secondary recreational standard is a geometric mean of 126 *E. coli* organisms/100 mL based on five (5) samples taken over a 30-day period at equal intervals between samples. Therefore,

  126 CFU/100 mL *E. coli* x 7.264 cfs x 0.02445 = 22.4 CFU/day *E. coli* LC

The current load for Jacks Creek, as determined based on the *Jacks Creek TSD* and Appendix C, is shown and compared to the LC in Table 2 (Buhidar 2006, §6.4.2, Table 24) as follows. On average, the three pollutant parameters (i.e. TSS, TP and *E. coli*) will require reductions to meet the LC of Jacks Creek.

Table 2. LC and average existing load for Jacks Creek on TSS, TP, and *E. coli.*

Jacks Creek	TSS, lb/day	TP, lb/day	E. coli, CFU/day
Loading Capacity	1,961.28	1.96	22.4
Existing Load	3,919.5	22.01	1,024.2
% Reduction to Meet LC	50.0%	91.1%	97.8%
TSS = Total Suspended Solids. TP = Total Phosphorus. E. coli = Escherichia coli bacteria. LC = Loading Capacity.			

Based on the required reductions shown in Table 2, TSS may only be required during certain parts of the irrigation season, but the application of best management practices may be needed to maintain a water quality strategy year-round. As described in the Bruneau River TMDL and in Appendix C, the same best management practices that would be applied for TSS would also have a reduction effect on E. coli *and TP, since the pollutant sources are essentially the same for all three parameters. However, the fish farm effluent will have its own set of effluent limitation requirements for these pollutants based on their NPDES permit.*

Effect of TMDL Modification on King Hill – C. J. Strike Reservoir TMDL

Since the change in LC under this TMDL modification for Jacks Creek involves increasing the TP LC, it is necessary to describe the effect the LC increase will have on the C. J. Strike Reservoir, which has its own TMDL under the King Hill - C. J. Strike Reservoir Subbasin Assessment (SBA) and TMDL (DEQ 2006). As described in the King Hill – C. J. Strike Reservoir SBA and TMDL, the LC is based on two influent sources: (1) the Snake River LC on the Snake River Arm (4,612.1 lb/day TP) and (2) the Bruneau River LC on the Bruneau River Arm (132.3 lb/day TP), for a total of 4,744.3 lb/day TP LC (DEQ 2006, p 177, Table 47, kg/day converted to lb/day).

The influence of TP into the C. J. Strike Reservoir from Jacks Creek is predicated on the LC for TP based on the intermittent hydrology upstream of Jacks Creek and the input from geothermal groundwater well sources. Appendix C, Responses 1E and 1F provides a description of the effect from Jacks Creek. Basically, the localized impact from Jacks Creek into the Bruneau Arm (or the C. J. Strike Reservoir) is estimated to be 1.48% of the LC for C. J. Strike Reservoir. However, the cumulative impact from Jacks Creek into both the Bruneau Arm and the Snake River Arm at the discharge point at the C. J. Strike Dam is 0.04% of the LC for the C. J. Strike Reservoir. DEQ considers the 1.48% (localized impact) and the 0.04% (cumulative impact) to be a minimal portion of the LC for the C. J. Strike Reservoir; but especially for the aquaculture fish farms since they contribute only 15% of their effluent discharge into Jacks Creek.

WASTELOAD ALLOCATIONS (WLAS)

The wasteload allocation (WLA) is that portion of the receiving water's LC that is allocated to one of its existing or future point sources of pollution. Because Jacks Creek is on the 303(d) list, application of the instream standards is based on achieving the beneficial uses of Jacks Creek by having a LC for each pollutant.

Only two (2) point sources are known to exist on Jacks Creek: the Ace Development USA, Inc. (NPDES No. ID-130123); and the Arraina Inc. (NPDES No. ID-130122). Both are fish hatcheries. The WLAs for these facilities are based on the discharge monitoring records for the period of record from March 2000 to March 2004 (or N = 23 and N = 22, respectively).

Table 3 summarizes existing water quality conditions of each fish hatchery in terms of influent, effluent, and net discharge into Jacks Creek. Only the water quality parameters for TSS, TP, and *E. coli* are being considered for the Jacks Creek TMDL Modification. The temperature component is being considered in the Bruneau River Temperature TMDL, which is a separate TMDL altogether.

Table 3. Existing characteristics of the fish hatcheries on Jacks Creek

facility characteristic	Flow, cfs	TSS, mg/L	TP, mg/L	E. coli, CFU/100 mL
Arraina Inc. Fish Hatchery				
Influent	5.5	1.1	0.012	0
Effluent	4.4	17.7	0.235	0 + Unknown[a]
Net	-	16.6	0.223	0 + Unknown[a]
Ace Development USA, Inc. Fish Hatchery				
Influent	3.7	1.0	0.020	0
Effluent	2.7	26.6	0.351	0 + Unknown[a]
Net	-	25.6	0.331	0 + Unknown[a]
Combining Both Facilities				
Influent	9.2	1.05	0.016	0
Effluent	7.1	22.15	0.293	0 + Unknown[a]
Net	-	21.1	0.277	0 + Unknown[a]

The information above comes from the Jacks Creek TMDL Technical Support Document (Buhidar 2006, §5.6 and §5.2 – Table 5). Net = Effluent – Influent. TSS = Total Suspended Solids. TP = Total Phosphorus. *E. coli* = *Escherichia coli*.

[a]E. coli values based on the influent artesian well water, which has zero E. coli. The effluent discharged from the facilities contains zero E. coli. However, that same effluent, prior to discharge to Jacks Creek, has exposure to agricultural nonpoint source activities and consequently may contain E. coli unrelated to the fish hatchery.

Table 4 summarizes wasteload allocations for the fish hatcheries on Jacks Creek based on the water quality characteristics shown in Table 3 for TSS (based on a 15.0 mg/L concentration for warm water fishery), TP (based on a 0.200 mg/L concentration for warm water fishery) and *E. coli* (based on a zero concentration for all fishery).

Table 4.Wasteload allocations for fish hatcheries on Jacks Creek.

facility characteristic	Flow, cfs	TSS, lb/day Based on 15.0 mg/L target	TP, lb/day Based on 0.200 mg/L target	*E. coli*, CFU/day Based on 0.0 CFU/100 mL target
Arraina Inc. Fish Hatchery				
Influent	5.5[c]	26.1[a]	0.29[b]	0 + Unknown[f]
Effluent	4.4[c]	420.6[a]	5.58[b]	0.0[f]
Existing Net Load	-	394.4[a]	5.3[b]	0.0 + Unknownf
Net Load Target	-	356.4[d]	4.8[b]	0.0
% Reduction	-	9.6%[d]	9.4%[b]	0.0%
Ace Development USA, Inc. Fish Hatchery				
Influent	3.7[c]	14.6[a]	0.29[b]	0 + Unknown[f]
Effluent	2.7[c]	387.8[a]	5.12[b]	0.0
Existing Load	-	373.2[a]	4.8[b]	0.0 + Unknown[f]
Net Load Target	-	218.7[d]	2.9[b]	0.0
% Reduction	-	41.4%[d]	39.6%[b]	0.0%
Combining Both Facilities				
Influent	9.2[c]	40.7[e]	0.58	0 + Unknown[f]
Effluent	7.1[c]	808.4[e]	10.70	0.0[f]
Existing Load	-	767.2[d]	10.10[b]	0.0 + Unknown[f]
Net Load Target	-	575.1[d]	7.70[b]	0.0
% Reduction	-	25.0%[d]	23.8% (Mean)	0.0%

Net = Effluent – Influent. TSS = Total Suspended Solids. TP = Total Phosphorus. *E. coli* = *Escherichia coli*.
[a]TSS load analysis based on Jacks Creek TMDL Technical Support Document, §5.6, Tables 13 and 14.
[b]TP existing load from Jacks Creek TMDL Technical Support Document, §5.6, Table 11 and 12.
[c]Flow information from Jacks Creek TMDL Technical Support Document, §5.6, Table 8.
[d]Net TSS Load Target based on Jacks Creek TMDL Technical Support Document, §5.6, Tables 14 and 15 based on a Net TSS Target of 15 mg/L.
[e]Influent and Effluent combined loads are based on the additional of the loads from both facilities.
[f]Based on Table 3. Effluent is assumed to be zero (0.0) since no *E. coli* are generated from the fish production. Consequently, E. coli generated is assumed to come from non fish sources.

The wasteload allocations are as follows:

- **TSS WLA**: The TSS limitation for raceway effluent discharges for warm water fish hatcheries is 15.0 mg/L Net TSS. This limit has foundation and precedence in the 1999 Idaho General Aquaculture Permit (NPDES No. ID-G13-0000; EPA 1999, Section C. 2. *Warm Water Raceway and Associated Full-flow Settling Basin Discharges*). Therefore, use of the 15.0 mg/L Net TSS for warm water facilities in the Jacks Creek TMDL Modification is consistent and provides a rational basis for use of this provision. This value is not based on the TMDL process developed under the Mid-Snake TMDL (Buhidar 1997) or the Upper Snake Rock TMDL (Buhidar 1999, Buhidar 2000) or the modifications incorporated in the Upper Snake Rock TMDL Modification (Buhidar 2005), because these were based on the aquaculture industry of the Upper Snake Rock Subbasin meeting a certain target load (i.e. based on 5.0 mg/L TSS) as a consequence of the receiving §303(d) waterbody (i.e. the Snake River) (Buhidar 2005).

  In addition, use of the 15 mg/L TSS limitation comes also from the NPDES General Aquaculture Permit as an average monthly (with 25 mg/L TSS as a maximum daily limit). This distinction is specific for warm water aquaculture facilities and, therefore, is not a cold water provision, which carries a 5 mg/L TSS limitation.

Therefore, based on the discharge monitoring reports for the period of record for the Arraina facility (May 2000 through February 2004) and the Ace facility (May 2000 through February 2004), the following are the Net TSS WLAs (as shown in Table 4):

Arraina Facility:

TSS WLA = Limitation Target x Facility Flow x 5.4

TSS WLA = 15.0 mg/L TSS x 4.4 cfs x 5.4

TSS WLA = 356.4 lb/day TSS

Ace Facility:

TSS WLA = Limitation Target x Facility Flow x 5.4

TSS WLA = 15.0 mg/L TSS x 2.7 cfs x 5.4

TSS WLA = 218.7 lb/day TSS

Based on the discharge monitoring reports for the Arraina facility period of record (May 2000 through February 2004), the raceway average TSS net target load was exceeded 12 times in 24 sampling months (50.0% of the time). The Ace Development facility for the same period of record exceeded the TSS net target load 16 times out of 22 sampling months (or 72.7% of the time).

- **TP WLA:** The TP limitation for raceway effluent discharges for warm water fish hatcheries is 0.200 mg/L Net TP. This limit has foundation and precedence in the 1999 Idaho General Aquaculture Permit (NPDES No. ID-G13-0000; EPA 1999, Section C. 2. Warm Water Raceway and Associated Full-flow Settling Basin Discharges) as well as in the TMDL process developed under the Mid-Snake TMDL (Buhidar 1997) or the Upper Snake Rock TMDL (Buhidar 1999, Buhidar 2000) or the modifications incorporated in the Upper Snake Rock TMDL Modification (Buhidar 2005). Therefore, use of the 0.200 mg/L Net TP for warm water facilities in the Jacks Creek TMDL Modification is consistent and provides a rational basis for use of this provision.

  Therefore, based on the discharge monitoring reports for the period of record for the Arraina facility (May 2000 through February 2004) and the Ace facility (May 2000 through February 2004), the following are the Net TP WLAs (as shown in Table 4):

  Arraina Facility:

  TP WLA = Limitation Target x Facility Flow x 5.4

  TP WLA = 0.200 mg/L TP x 4.4 cfs x 5.4

  TP WLA = 4.752 = 4.8 lb/day TP

  Ace Facility:

  TP WLA = Limitation Target x Facility Flow 5.4

  TP WLA = 0.200 mg/L TP x 2.7 cfs x 5.4

  TP WLA = 2.916 = 2.9 lb/day TP

  Based on the discharge monitoring reports for the Arraina facility period of record (May 2000 through February 2004), the raceway average TP net target load was exceeded 11 times in 24 sampling months (45.8% of the time). The Ace Development facility for the

same period of record exceeded the TP net target load 16 times out of 22 sampling months (72.7% of the time).

- ***E. coli* WLA**: As stipulated in Buhidar and Sharpnack (2003), "Relative to the aquaculture industry in the Upper Snake Rock subbasin, the fecal coliform or *E. coli* criteria are not indigenous to cold water fish hatcheries or warm water fish hatcheries. Total coliform bacteria are a collection of relatively harmless microorganisms that live in man and warm- and cold-blooded animals. They aid in the digestion of food. A specific subgroup of this collection is the fecal coliform bacteria, the most common member being *E. coli*. Fecal coliform bacteria and *E. coli* are generated in the intestines of man or warm-blooded animals. Fish, whether raised in cold water or warm water, are cold-blooded animals and do not generate fecal coliform bacteria or *E. coli* in their intestines."

  Consequently, no limitations are imposed for *E. coli* on the fish hatcheries of Jacks Creek. Their WLA for *E. coli* is zero.

  No information was available form the discharge monitoring reports for the *E. coli* load for the period of record since monitoring for *E. coli* is not required under their NPDES permit. But DEQ hypothesizes under the scenario described in the previous paragraph that the fish farm facilities do not generate or discharge *E. coli* as a component of their effluent. Therefore, a WLA of zero is applied to both facilities.

LOAD ALLOCATIONS (LAS)

The load allocation (LA) is that portion of the receiving water's LC attributed either to one of its existing or future nonpoint sources of pollution. It can also be attributed to natural background (NBK) sources. Therefore, we may generally describe the LA in the following equation:

$$LA = NPS + NBK$$

The LC is the starting point to mathematically define the LA for Jacks Creek. The LC, as described in Section IV, is the greatest loading that water can receive without violating water quality standards. By definition, the components that make up the LC cannot be greater than the LC itself. Consequently, the LA for nonpoint sources combined with the WLA for point sources must be less than the LC.

To these components must be added the "available load" (AL), which represents the load actually available for allocation between point sources and nonpoint sources after the uncertainty component is considered. That uncertainty component is best defined as the margin of safety (MOS), which is further described in Section VII.

Essentially, the available load is the LC minus the MOS (which in this situation is 10% of the LC). Recall from Section IV, Loading Capacity – Linking Water Quality and Pollutant Sources that the TSS LC is 1,961.28 lb/day, the TP LC is 1.96 lb/day, and the *E. coli* LC is 22.4 cfu/day. Therefore,

$$LC = (NPS + NBK) + WLA + MOS = LA + WLA + MOS$$

$$AL = LA + WLA = LC – MOS$$

$$LA = LC – MOS – WLA = LC – (MOS + WLA)$$

Based on this algorithm, we can establish the LA for Jacks Creek using the TMDL LA formula for TSS, TP and *E. coli*: But, we must also acknowledge that only 15% of the fish effluent discharges to Jacks Creek, since 85% is reused as cropland irrigation. See Appendix C for further reference on the 15% discharge-85% reuse discussion. Therefore,

Calculating the TSS LA:

TSS LA = LC – (MOS + [WLA x 15% Discharge])

TSS LA = 1,961.28 lb/day TSS – (196.13 lb/day + [575.1 lb/day x 15%])

TSS LA = 1,961.28 lb/day TSS – (196.13 lb/day + 86.27 lb/day)

TSS LA = 1,678.88 lb/day TSS

Calculating the TP LA:

TP LA = LC – (MOS + [WLA x 15% Discharge])

TP LA = 1.96 lb/day TP – (0.20 lb/day + [7.70 lb/day x 15%])

TP LA = 1.96 lb/da TP – (0.20 lb/day + 1.16 lb/day)

TP LA = 0.60 lb/day TP

Calculating the *E. coli* LA:

E. coli LA = LC – (MOS + [WLA x 15% Discharge])

E. coli LA = 22.4 CFU/day *E. coli* – (2.2 CFU/day + [0.0 CFU/day x 15%])

E. coli LA = 22.4 CFU/day E. coli – (2.2 CFU/Day + 0.0 CFU/day)

E. coli LA = 20.2 CFU/day *E.coli*

Within the structure of the Jacks Creek TMDL Modification, the LA was further divided into the three (3) general categories: (1) permitted nonpoint source facilities; (2) agricultural, grazing, private, corridor; and (3) stormwater construction-type facilities:

- The first category deals with permitted nonpoint source facilities associated with the Federal Energy Regulatory Commission (FERC) permitted hydropower facilities; all land application facilities (LAFs) that may or may not require a permit from the State; and all confined feeding operations (CFOs) that may or may not require an NPDES permit from EPA for a 24-hour, 25 year storm event.
- The second category deals with all agricultural lands (inclusive of irrigated and non irrigated lands farmlands); grazing on public lands and state lands; private land ownership that includes all nonpoint source activities; and those activities more closely related to the Jacks Creek stream corridor that are not necessarily associated with the other sub components of this second general category.
- The third category deals with all construction activities that may require a general permit (from EPA) and that may have a direct impact to Jacks Creek and which require erosion and sediment controls. This third category utilizes a 2% reserve from the overall nonpoint source category and reverts back to this category once the construction activity is finalized. Precedence and justification for this 2% approach may be shown in Buhidar (2005). Calculations for this category are summarized as follows:

  Construction Activities = Pollutant LA x 2%

  Calculating TSS Construction Activities:

  TSS Construction Activities = TSS LA x 2%

  TSS Construction Activities = 1,678.88 lb/day x 2%

  TSS Construction Activities = 33.58 lb/day TSS

  Calculating TP Construction Activities:

  TP Construction Activities = TP LA x 2%

TP Construction Activities = 0.60 lb/day x 2%

TP Construction Activities = 0.01 lb/day TP

Calculating *E. coli* Construction Activities:

E. coli Construction Activities = *E. coli* LA x 2%

E. coli Construction Activities = 20.2 CFU/day x 2%

E. coli Construction Activities = 0.4 CFU/day *E. coli*

The definition of construction activities, as defined under the TMDL process, has to do with any land-disturbing activity that has the potential to create erosion and sedimentation. It is not limited to just septic systems associated with rural subdivisions or other similar ventures, which normally are not associated with larger land disturbances. This identification of construction activities is a component of nonpoint sources and is a requirement under the TMDL process. In addition, the application of the 2% for stormwater construction activities is primarily for activities that may occur within the stream corridor of Jacks Creek (as a 2-mile corridor measured as 1-mile buffers on both sides of the stream). For such projects greater than 1 acre of disturbed land an NPDES Construction General Permit is required.

Natural Background (NBK) is not segregated out as a separate component to the LA. Jacks Creek is a predominant geothermal system that emanates from the local Bruneau – Grand View area aquifer. Although it does have stormwater influences during the winter-spring seasons of the year, NBK effects to water quality are considered implicit to the LA and are therefore incorporated through conservative assumptions in the analysis as a minimal part of the LA.

In terms of future growth for nonpoint sources, no specific allocation was set aside for this; therefore the allocation is zero. However, as a general consideration, it is noted that future growth of the Jacks Creek drainage may incorporate a land use changes, such as from agricultural or grazing lands to subdivisions. Such changes, or any similar to it, will still be considered a part of the overall nonpoint source category that is associated with the LA; and, therefore, must demonstrate compliance with the overall water quality goals of the Jacks Creek TMDL Modification to be in compliance with the TMDL process. Best management practices must be designed, managed and implemented by the nonpoint source community to fully protect and maintain the beneficial uses of Jacks Creek.

The conversion of nonpoint source lands to point sources would require the NPDES permitting process and is a separate issue from what has been discussed as future growth for nonpoint sources; but likewise must meet the limitations imposed by their NPDES permit to protect and maintain the beneficial uses of Jacks Creek.

MARGIN OF SAFETY (MOS)

A 10% margin of safety (MOS) was applied on all pollutants-of-concern as defined in the Bruneau River TMDL (Lay 2000, p 101) and in the Jacks Creek TMDL Technical Support Document (Buhidar 2006). Woven into this explicit MOS is an implicit component having the assumption “that conservative approaches taken throughout the [*Bruneau River TMDL*] will have been sufficiently identified in appropriate sections” (Lay 2000. p 101).

As defined under U.S. Code. Title 33, Chapter 26, Sub Chapter III, §1313 (d) (1) C, “Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.”

Therefore, the 10% MOS is to account for any lack of knowledge concerning the relationship between effluent limitations and water quality. As such:

Calculating the TSS MOS:

TSS MOS = TSS LC x 10%

TSS MOS = 1,961.28 lb/day TSS LC x 10%

TSS MOS = 196.13 lb/day TSS MOS

Calculating the TP MOS:

TP MOS = TP LC x 10%

TP MOS = 1.96 lb/day TP LC x 10%

TP MOS = 2.0 lb/day TP MOS

Calculating the *E. coli* MOS:

E. coli MOS = *E. coli* LC x 10%

E. coli MOS = 22.4 CFU/day *E. coli* LC x 10%

E. coli MOS = 2.2 CFU/day *E. coli* MOS

SEASONAL VARIATION

Application of a seasonal component into the TMDL for Jacks Creek was not considered because little information existed to allow for this. Therefore, the seasonal variation is zero. Please see Appendix C, Question 5, for a more in depth discussion about seasonality. However, it is reasonable to assume that future iterations of the Jacks Creek TMDL Modification may require seasonal considerations, so these considerations are deferred until such time as more information is provided to justify them.

OVERALL TMDL TABLE BASED ON THE LC FOR JACKS CREEK

Table 5 summarizes the overall recommendations of Sections IV, V, VI, VII and VII, based on the water quality targets set for Jacks Creek on instream water quality targets for TSS (50.0 mg/L), TP (0.05 mg/L) and *E. coli* (125 CFU/100 mL as a geometric mean). Flow provisions are based on average flows of 7.264 cfs for Jacks Creek as discussed in Section IV. The 85% effluent reuse for the fish farm wasteload allocations is based on the premise that 85% of the effluent discharge is reused as cropland irrigation; and therefore never reaches Jacks Creek. It is estimated that only 15% or less of the fish farm effluent discharges to Jacks Creek on an annual basis.

Table 5. Jacks Creek overall TMDL recommendations.

TMDL COMPONENTS	TSS, lb/day	TP, lb/day	E. coli, CFU/day
NONPOINT SOURCES			
FERC, LAFs, CFOs	0.0	0.0	0.0
Ag, Graze, Private, Corridor	1,645.30	0.59	19.8
Stormwater – Construction – 2%	33.58	0.01	0.4
Nonpoint Source SubTotal	1,678.88	0.60	20.2
NPDES PERMITTED POINT SOURCES			
Ace Development FH	[218.70]	[2.90]	[0.0]
85% Effluent Reuse	32.81	0.44	0.0
Arraina Inc. FH	[356.40]	[4.80]	[0.0]
85% Effluent Reuse	53.46	0.72	0.0
Point Source SubTotal	86.27	1.16	0.0
MARGIN OF SAFETY & LOADING CAPACITY			
Margin of Safety – 10%	196.13	0.20	2.2
Loading Capacity	1,961.28	1.96	22.4

E. coli = *Escherichia coli*. TSS = Total Suspended Solids. TP = Total Phosphorus. WLA = Wasteload Allocation for an NPDES permitted point source facility.
Seasonal variation is not a component in the Jacks Creek TMDL Modification at this time.
FERC = Federal Energy Regulatory Commission permitted hydropower facilities. LAFs = Land Application Facilities. CFOs = Confined Feeding Operations like dairies and feedlots of all sizes. Ag = All agricultural cropland and farmland combined. Graze = All grazing lands. Private = All privately owned lands. Corridor = All stream corridor components associated with Jacks Creek. FH = Fish Hatchery.

Relative to TSS, the overall nonpoint source category (1,678.88 lb/day TSS) represents 85.6% of the TSS LC. The point source category (86.27 lb/day TSS) represents 4.4% of the TSS LC. The remaining 10% is attributable to the TSS MOS. This accounts for 100% of the TSS LC (i.e. 85.6% Nonpoint Source + 4.4% Point Source + 10.0% MOS = 100.0%).

Relative to TP, the overall nonpoint source category (0.60 lb/day TP) represents 30.6% of the TP LC. The point source category (1.16 lb/day TP, which represents the value that actually discharges into Jacks Creek) represents 59.2% of the TP LC. The remaining 10% is attributable to the TP MOS. This accounts for 100% of the TP LC (i.e. 30.6% Nonpoint Source + 59.2% Point source + 10.0% MOS = 99.8%; the 0.2% deficiency is due to a rounding error in calculating the percentages to a 10^{th} decimal point and not to a 100^{th} decimal place).

Relative to *E. coli*, the overall nonpoint source category (20.2 CFU/day *E. coli*) represents 90.2% of the *E. coli* LC. The point source category (0.0 CFU/day *E. coli*) represents 0.0% of the *E. coli* LC. The remaining 10.0% is attributable to the *E. coli* MOS. This accounts for 100% of the *E. coli* LC (i.e. 90.2% + 0.0% + 10.0% = 100.2%; the 0.2% deficiency is due to a rounding error in calculating the percentages to a 10^{th} decimal point and not to a 100^{th} decimal place).

DEQ recognizes that general construction type activities do not of themselves generate *E. coli*, as previously discussed in Section VI, item 3 (Stormwater Construction Activities). However, the ground disturbing aspects of those activities tend to promote sedimentation, which provides a source of *E. coli* as a direct impairment to the receiving waterbody because *E. coli* may already be entrained in the sediment. That entrainment is associated with feces from warm blooded animals, which is the source of the *E. coli*. The recognition of these latent or unseen sources of *E. coli* is recognized all over south-central Idaho and in the Bruneau River Subbasin as a consequence of grazing management. Therefore, and as a consequence of the TMDL process, DEQ encourages the nonpoint source community as a whole to apply best management practices on all ground-disturbing activities that may have water quality impairment influences on the receiving waterbody from TMDL pollutants such as *E. coli*.

REASONABLE ASSURANCES

Providing reasonable assurance that point sources and nonpoint sources will meet the beneficial uses of Jacks Creek is a necessary requirement of the Jacks Creek TMDL Modification. Determining the LC for Jacks Creek (for TSS, TP and *E. coli*) and allocating allowable limits within the confines of the LC provides reasonable assurance that the LC can be met by both the point sources and the nonpoint sources, assuming both meet their imposed targets. Therefore, reasonable assurance will provided through the following:

- **Point Sources.** Point sources (fish hatcheries) will receive WLAs that are below and within the LC of the Jacks Creek waterbody and are specifically set up to meet the beneficial uses of Jacks Creek and, thus, the beneficial uses of the C. J. Strike Reservoir of the Snake River. This goal will be accomplished through the NPDES permitting process.
- **Nonpoint Sources**. Nonpoint sources will receive LAs that are below and within the LC of the Jacks Creek waterbody and are specifically set up to meet the beneficial uses of Jacks Creek and, thus, the beneficial uses of the Snake River. DEQ-TFRO, in conjunction with the land management agencies, will coordinate with public and private land ownerships to incorporate water quality cleanup projects specifically targeted to reducing erosion and sediment sources.

In the case of Jacks Creek, both point source and nonpoint source industries will provide management strategies that support reasonable assurances in meeting the water quality standards and beneficial uses of Jacks Creek and the C. J. Strike Reservoir jointly.

MONITORING PLAN TO TRACK TMDL EFFECTIVENESS

The overall purpose and intent of water quality monitoring is to assess beneficial use and water quality standards attainment on Jacks Creek. The monitoring plan that will be used on Jacks Creek will involve four approaches:

- First, the NPDES permitted facilities will conduct monitoring pertaining to their NPDES permit as defined by EPA.
- Second, DEQ intends to monitor (depending on available resources) Jacks Creek as it pertains to any water quality cleanup projects, as referenced in Section XII. Monitoring will include the monitoring sites previously studied in the *Jacks Creek TSD*.
- Third, the Beneficial Use Reconnaissance Program (BURP) will be utilized to ascertain the status of beneficial uses on Jacks Creek as defined by the BURP protocols.
- Fourth, other monitoring that involves private landowners, public land management agencies, and the Idaho Soil Conservation Commission (ISCC) will be used. Erosion assessments will be used as monitoring is further developed over the next 5 to 10 years; and will be reviewed on a 5 year basis to ascertain if the goals of the TMDL are being met.

IMPLEMENTATION PLANNING

Jacks Creek TMDL Modification is a part of the Bruneau River Implementation Plan. DEQ is presently in the process of assessing potential water quality cleanup projects on Jacks Creek with the assistance of private landowners and the ISCC.

PUBLIC PARTICIPATION

Prior to finalization of the draft Jacks Creek TMDL Modification, DEQ-TFRO visited the Jacks Creek watershed, the NPDES-permitted facilities, and various landowners to gather the necessary information for establishing the TMDL. DEQ-TFRO solicited public comments for the 30 days from August 17, 2006 through September 18, 2006. Comments received are shown in Appendix B and are incorporated into the body of this document. Additional comments from EPA are shown in Appendix C and these two have been incorporated into the body of this document.

REFERENCES

Buhidar B. B. 1997. The Middle Snake River Watershed Management Plan. Phase 1 TMDL Total Phosphorus. March 25, 1997. Twin Falls (ID): DEQ-TFRO.

Buhidar B. B. 1999. The Upper Snake Rock Watershed Management Plan. December 20, 1999. Twin Falls (ID): DEQ-TFRO.

Buhidar B. B. 2000. TMDL Executive Summary – Upper Snake/Rock Subbasin TMDL. July 2000. Twin Falls (ID): DEQ-TFRO.

Buhidar B. B. 2005. The Upper Snake Rock TMDL Modification. July 22, 2005. Twin Falls (ID): DEQ-TFRO.

Buhidar B. B. 2006. The Jacks Creek TMDL – 2005 – Technical Support Document. June 26, 2006. Twin Falls (ID): DEQ-TFRO.

Buhidar B. B. and Sharpnack R. 2003. Staff Analysis: a determination of reasonable assurance using localized impacts and accumulative impacts assessments on the proposed aquaculture industry wasteload allocations for the Middle Snake River and its tributaries. January 20, 2003. Twin Falls (ID): DEQ-TFRO.

Environmental Protection Agency (EPA). 1999. Authorization to discharge under the aquaculture facilities in Idaho and associated, on-site fish processors. Effective August 19, 1999. Seattle (WA): Region 10, EPA.

EPA. 2002. National Assessment Database – Assessment Data for Idaho, Bruneau Watershed, Year 2002. Internet Website: http://iaspub.epa.gov/tmdl/w305b_report_v2.huc?p_huc=17050102&p_state=ID . Washington (D. C.): EPA.

EPA. 2006. EnviroMapper for Water. The C. J. Strike Reservoir. Internet Website: http://map8.epa.gov . Washington (D. C.) U. S. EPA.

Idaho Code § 39.3611. Development and implementation of total maximum daily load or equivalent processes. Internet site: http://www3.state.id.us/idstat/TOC/39036KTOC.html .

IDAPA §58.01.02. Idaho water quality standards and wastewater treatment requirements. Internet site: http://adm.idaho.gov/adminrules/rules/idapa58/0102.pdf .

Idaho Department of Environmental Quality (DEQ). 1998. The 1998 303(d) List with HUCs. Boise (ID): DEQ-State Office.

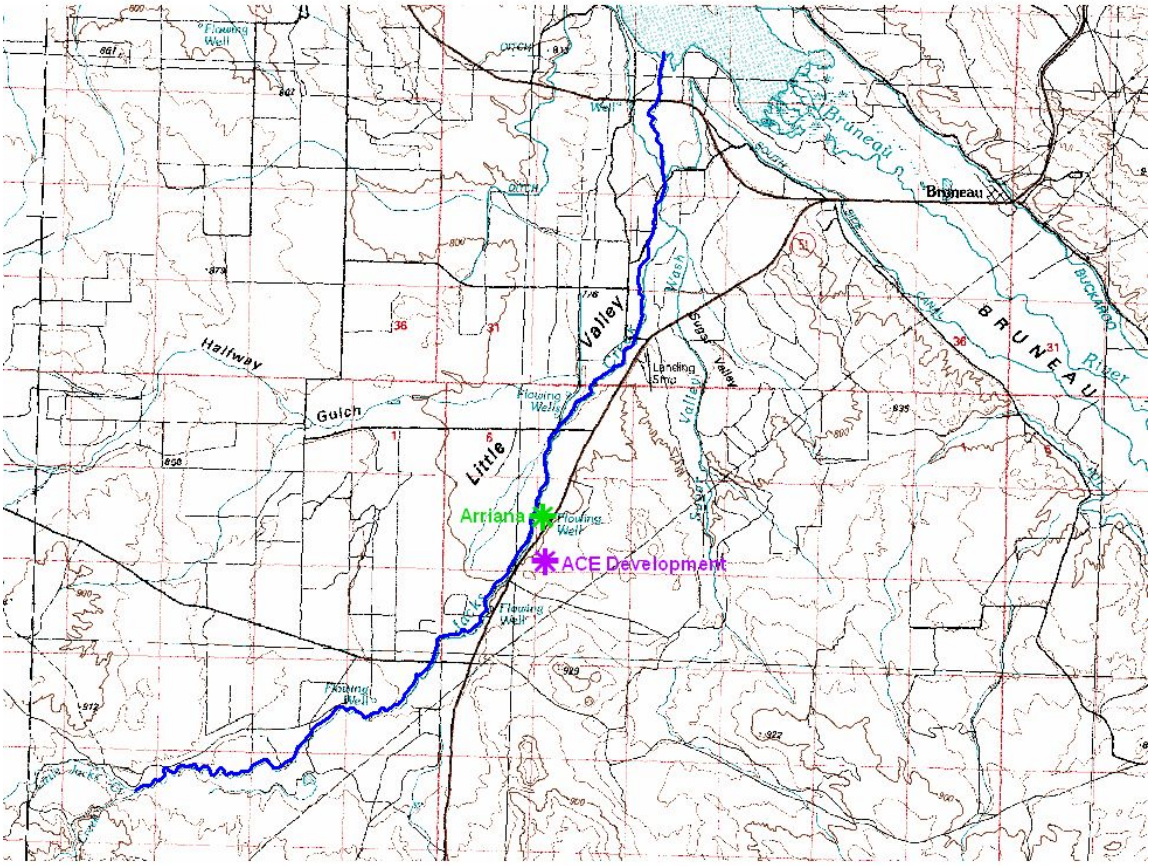
DEQ. 2005. Principles and Policies for the 2002 INTEGRATED (303(d)/305(b)) REPORT. September 30, 2005. Boise (ID): DEQ-State Office.

DEQ. 2006. King Hill – C. J. Strike Reservoir Subbasin Assessment and Total Maximum Daily Load. March 2006. Boise (ID): DEQ-Boise Regional Office.

Lay C. 2000. Bruneau Subbasin Assessment and Total Maximum Daily Loads of the §303(d) Water Bodies. December 22, 2000. Twin Falls (ID): DEQ-TFRO.

APPENDIX A: MAP OF THE JACKS CREEK DRAINAGE AREA AND FISH HATCHERIES

Jack's Creek



0 3 6 Miles

Jack's Creek
1:100,000 Topographic Map
Ace Development
Arriana

N
W E
S

This page intentionally left blank for correct double-sided printing.

APPENDIX B: RESPONSE TO PUBLIC COMMENTS

Start of Public Comment Period: August 17, 2006
End of Public Comment Period: September 18, 2006

The only comments that were received by DEQ were from the U. S. Environmental Protection Agency on September 28, 2006. These comments are summarized in Table 6, along with DEQ's responses.

Table 6. Summary of public comments and responses.

Source of Comment	Comments and Responses
Comments 1 and 2 are found in Comment 2 of the EPA public comment letter due to a clerical mistake. Both comments are set as Response 1 and 2 below as appropriate.	
William C. Stewart U. S. EPA – Boise, Idaho	Comment 1. The instream target for Jacks Creek was set at 0.050 mg/L of total phosphorus in the original Bruneau River TMDL. This TMDL modification proposes raising the instream target to 0.100 mg/L of TP. What is the effect of raising the target to 0.100 mg/L of TP on the downstream receiving water (C. J. Strike Reservoir)?
	Response 1. Based on the loading capacity as defined in the C. J. Strike Reservoir TMDL for phosphorus, the effect of raising the target to 0.100 mg/L TP is less than 0.5%. In effect, the Jacks Creek TMDL Modification allocates a loading capacity to Jacks Creek that represents 0.199% of the C. J. Strike Reservoir loading capacity. DEQ believes that this represents a very small load to the remaining 99.801% of the reservoir's loading capacity; and therefore is not a significant increase-of-concern to the C. J. Strike TMDL. Mathematically speaking, the load increase could well be attributable to simple monitoring error (as an example) and therefore would be an insignificant concern to the C. J. Strike TMDL.
William C. Stewart U. S. EPA – Boise, Idaho	Comment 2. Will this [the modification of 0.050 mg/L TP to 0.100 mg/L TP] have an impact on the targets set in the C. J. Strike TMDL?
	Response 2. DEQ believes that there are two perspectives to consider in the water quality targets for the C. J. Strike TMDL. First, based on the loading capacity in Jacks Creek in comparison to the loading capacity in the C. J. Strike Reservoir, DEQ does not believe that there would be a significant impact on the targets set in the C. J. Strike TMDL. As discussed in Response 1 (above), the overall increase in the loading capacity to Jacks Creek is insignificant to the C. J. Strike TMDL. The targets set in the C. J. Strike TMDL will not be changed due to the Jacks Creek TMDL Modification.
William C. Stewart U. S. EPA – Boise, Idaho	Comment 3. The rationale for determining the wasteload allocations for total phosphorus and the wasteload allocations for total suspended solids appear to be inconsistent. The 2005 Upper Snake Rock TMDL Modification was cited for TP but was not used for TSS.
	Response 3. The Jacks Creek TSD provides the basis for the TSS wasteload allocation. Table 15, page 32, stipulates that the Net TSS Target is 15 mg/L TSS for both fish facilities but specifically for a warm water facility (which they both are). This approach is also demonstrated in the Jacks Creek TMDL Modification public comment draft, Section 5, page 7. As discussed in the TMDL, the TSS limitation for raceway effluent discharges for warm water fish hatcheries is 15.0 mg/L Net TSS. This limit has foundation and precedence in the 1999 Idaho General Aquaculture Permit (NPDES No. IDG13-0000; EPA 1999 [Section C. 2. Warm Water Raceway and Associated Full-flow Settling Basin Discharges]). Therefore, the use of the 15.0 mg/L Net TSS for warm water facilities in the Jacks Creek TMDL Modification is consistent and provides a rational basis for use of this provision because Jacks Creek has a dominant warm water (or modified) characteristic rather than cold water. This approach is not based on the TMDL process developed under the Mid-Snake TMDL or the Upper Snake Rock TMDL or the modifications incorporated in the Upper Snake Rock TMDL Modification because these were handled to meet a certain target load (i.e. based on 5.0 mg/L TSS) as a consequence of the receiving 303(d) waterbody (i.e. the Snake River) which is a cold water stream. Jacks Creek, on the other hand, and as discussed in the Jacks Creek TSD and TMDL is a modified

Source of Comment	Comments and Responses
	stream which has a warm water characteristic. Further, the use of the 15 mg/L TSS limitation is demonstrated in the Draft General Aquaculture Permit Fact Sheet, page 40, Table 13, which shows the Effluent Limitations for Bruneau River Facilities as a Net TSS of 15 mg/L as an average monthly limit and a 25 mg/L TSS maximum daily limit. More specifically, in the same Draft General Aquaculture Permit Fact Sheet, Appendix B, page 10, Table B-3, shows the separation between cold water facilities as 5 mg/L TSS and warm water facilities as 15 mg/L TSS, respectively. Consequently, DEQ believes that the use of the 15 mg/L TSS limitation for the Jacks Creek facilities in the Bruneau River Subbasin is consistent with EPA's approach for warm water raceways and associated full-flow settling basins discharges. But in addition, it is also consistent with the Mid-Snake TMDL, the Upper Snake Rock TMDL and the Upper Snake Rock TMDL Modification from the standpoint that the Snake River is not a cold water stream (as defined in these TMDLs). Rather, it is specific to a dominant warm water type stream like Jacks Creek.
William C. Stewart U. S. EPA – Boise, Idaho	Comment 4. The total phosphorus load allocation for nonpoint source was set at 0.80 pounds per day. Information in the EPA Idaho Operations Office indicates that there is a significant cattle operation located on Jacks Creek near the aquaculture facilities that may be impacting the creek. Was this considered in the establishment of the load allocation for TP?
	Response 4. DEQ's pollutant source inventory indicates that there is more than one significant cattle operation as well as farming operations associated with the Jacks Creek drainage. The strategy and approach used in the Jacks Creek TMDL was based on similar approaches used in the Upper Snake Rock TMDL that has receiving water bodies inclusive of cattle grazing operations, agricultural farming operations and aquaculture facilities. In fact, three primary environmental pollutant source concerns of significance are defined in the Jacks Creek drainage. As described in the Jacks Creek TMDL Technical Support Document (p. 7, Section 2.4 and p. 8, Section 2.4.1): (1) The first environmental pollutant source concern has to do with aquaculture fish facilities as point sources. The Ace and Arraina facilities use geothermal resources and discharge to Jacks Creek, but these facilities utilize approximately 85% of their effluent for cropland irrigation prior to discharge. (2)The second environmental pollutant source concern has to do with livestock activity as a nonpoint source near or within the Jacks Creek stream corridor. Present research indicates that livestock activity is a predominant land use that is characteristic in non-wilderness areas, especially in the vicinity of springs and small reservoirs. Since springs and small reservoirs are not significant in the Jacks Creek drainage, cattle activity is confined to within the creek or along the stream banks. (3) The third environmental pollutant source concern has to do with irrigation return drains as nonpoint sources to Jacks Creek. These return drains are predominantly irrigation tail water from various agricultural fields in the Jacks Creek drainage. Most of the irrigation water is from irrigated cropland. Other environmental concerns are also described (i.e. septic tank drain fields, waterfowl resting and feeding, stormwater runoff, and accidental spills or releases from vehicle use of State Highway 51) but these are considered secondary or tertiary source concerns (See p. 8, Sections 2.4.2 and 2.4.3). These three primary environmental concerns, as well as those considered secondary and tertiary, were considered in the establishment of the load allocation for TP and TSS. The nonpoint source reductions required are based in part on what has been established in other nonpoint source TMDLs; but also in consideration of present nonpoint source activities on Jacks Creek in order to meet the beneficial uses of Jacks Creek.
William C. Stewart U. S. EPA – Boise, Idaho	Comment 5. The load allocation for E. coli listed for construction activities was confusing. The explanation for excluding it could be the same one that was used for aquaculture facilities. Construction activities don't produce E. coli by themselves. If

Source of Comment	Comments and Responses
	you are referring to septic tanks from the new construction, 1.0 CFU/day doesn't seem to be a workable concentration.
	DEQ Multiple Response to Comment 3
	Response 5a. The definition of construction activities as defined under the TMDL process has to do with any land disturbing with the potential to create erosion and sedimentation. It is not limited to just septic systems associated with rural subdivisions or other similar ventures; and, it is not just associated with EPA's Construction General Permit. As such, the application of best management practices to limit water pollution from such construction sites is paramount and falls within the guidelines and policies of the state's land management agencies and the federal land management agencies. This identification of construction activities is a component of the nonpoint source community of industries and is desirable under the TMDL process.
	Response 5b. The confusion that may be apparent as described in category 3 in Section VI on page 10 has to do with using 2% of the overall nonpoint source load for any construction activity that occurs within the stream corridor of Jacks Creek. It does not apply outside of that stream corridor. DEQ refers to this 2% as a "reserve" because it is reserved for such construction activities and only those construction activities. Once the activity is finalized, then the 2% reverts back to the nonpoint source load for use in other areas of Rueger Springs Creek of similar nature.
	Response 5c. The use of 1.3 CFU/day is appropriate for such land disturbing activities based on support from the Bruneau River Public Group. Table 26 (p 107) of the Lake Walcott TMDL refers to these activities as Suburban Nonpoint Source and includes construction. It also is in line with DEQ's No Net Increase Policy as described in the Lake Walcott TMDL (pp 120-121). This value is not reflected in the Lake Walcott TMDL because at that time EPA did not warrant its inclusion as part of the TMDL approval process. Since then it has been incorporated into all TMDLs as a component of the nonpoint source with WAG support.
	Response 5d. DEQ concurs that general construction type activities do not of themselves generate E. coli. However, the ground disturbing aspects of those activities tend to promote sedimentation, which provides a source of E. coli as direct impairments to streams because the E. coli may already be entrained in the sediment from past activities associated with feces from warm blooded animals. The recognition of these latent sources is known and recognized scientifically all over south-central Idaho and therefore (and as a consequence of the TMDL process) encourages the nonpoint source community to apply best management practices on all ground disturbing activities that may have an water quality impairment influence on the receiving waterbody.

This page intentionally left blank for correct double-sided printing.

APPENDIX C: DEQ'S RESPONSE TO EPA COMMENTS ON THE JACKS CREEK TMDL MODIFICATION, JANUARY 29, 2007 – FINAL EPA SUBMITTAL

October 25, 2007

CONTENTS

Purpose of this Modification 27
EPA Comment 1..... 27
EPA Comment 2..... 30
EPA Comment 3..... 35
EPA Comment 4..... 44
EPA Comment 5..... 46

Photographs

Photo 1. C. J. Strike Wildlife Management Area where Jacks Creek receives backflow from the C. J. Strike Reservoir. 53
Photo 2. Jacks Creek in the C. J. Strike Wildlife Management Area, just above the discharge area into the C. J. Strike Reservoir..... 53
Photo 3. Jacks Creek channel at Highway 78 prior to entering the C. J. Strike Wildlife Management Area. 54
Photo 4. Jacks Creek at Cattle Drive Road..... 54
Photo 5. Temperature mitigation ponds at Arraina Fish Hatchery that hold water for cropland irrigation reuse. 15% of this water may discharge into Jacks Creek..... 55
Photo 6. Ace Development Fish Hatchery groundwater well source. 15% of this water may discharge to Jacks Creek. 85% of this water may be reused for cropland irrigation. 55
Photo 7. USGS Weir where Big Jacks Creek and Little Jacks Creek merge to form Jacks Creek. The stream is dry during most times of the year..... 56

This page intentionally left blank for correct double-sided printing.

PURPOSE OF THIS MODIFICATION

The Idaho Department of Environmental Quality (DEQ) is making changes to its final Jacks Creek TMDL Modification (Version: January 29, 2007 Final Submittal) to address EPA's concerns regarding consistency between the Bruneau River TMDL, the C. J. Strike TMDL, and the proposed Jacks Creek TMDL Modification. The only comments received originally during the public comment period for the Jacks Creek TMDL Modification came from EPA.

EPA provided five (5) comments regarding DEQ's March 2, 2007 final TMDL submittal. These questions concerned (1) TMDL consistency; (2) eutrophication, algal blooms, and nuisance vegetation growth; (3) the low flow scenario; (4) the nonpoint source load allocations; and (5) consideration for seasonality. DEQ has completed additional research and revisions of the TMDL to provide verifiable responses to these questions as well as to establish consistency within the Jacks Creek TMDL Modification and other comparable TMDLs.EPA also requested that digital pictures of the area be included for better clarification.

DEQ visited with the owner of the Ace Development and Arraina fish farms on several occasions to provide input to the questions that EPA asked and then prepared responses to each of the five EPA comments DEQ also added several pictures of the Jacks Creek drainage.

EPA COMMENT 1

> Page 6 of the Modification states that the new allocations for Jacks Creek increases the total phosphorus load from Jacks Creek to C.J. Strike Reservoir from 1.35 lbs/day to 9.44 lbs/day, resulting in an increase to the load capacity for C.J. Strike. It further explains that the load from Jacks Creek of 1.35 lbs/day found in the original Bruneau River TMDL represents 0.028% of the C.J. Strike load capacity and that the increased TP load allocation in the Modification of 9.44 lbs/day represents 0.199% of the TP load capacity for C.J. Strike. We believe that the Bruneau River Arm of C.J. Strike is a more appropriate basis for comparison of the impact of the proposed load increase since the load of TP from the Snake River Arm does not affect the Bruneau River arm of the reservoir to a great extent. Under this comparison basis, the TP impact of Jacks Creek to the Bruneau River arm of C.J. Strike (LC = 60 kg/day or 132.3 lb/day) would be ([1.35 lb/day/132.3 lb/day] X 100%) = 1.02% vs. ([9.44 lb/day/132.3 lb/day] X 100%) = 7.14%. The resulting increase to the load capacity for C.J. Strike is not part of the modification available for review.

DEQ Response

The approach that EPA suggests appears to be more in line with a Localized Impacts Assessment (LIA) of Jacks Creek discharge solely into the Bruneau Arm of the Snake River without consideration for the entire reservoir, thus excluding the Snake River Arm. We believe DEQ's approach is more consistent with the C. J. Strike TMDL as a Cumulative Impacts Assessment (CIA), which includes both the Bruneau Arm of the Bruneau River and the Snake River Arm of the Snake River at the discharge point at the C. J. Strike Dam. This CIA approach is supported in the C. J. Strike TMDL by the following statements:

- Page 163, Section 5.2: "The current nutrient load in C .J. Strike Reservoir is based on the sum of the boundary conditions to the reservoir, which includes the Snake River and Bruneau River arms."
- Page 171: "The load capacity and the ensuing TMDL for C .J. Strike Reservoir are based on inflowing loads from the Snake River and the Bruneau River."

DEQ will address EPA's concerns relying in part on a two-pronged approach that includes: attributes of the LIA to the Bruneau Arm of the Bruneau River, and, second, attributes of a CIA

to the Snake River Arm. DEQ notes that since Jacks Creek discharges into the C. J. Strike Reservoir (which is the Bruneau Arm of the Bruneau River), the in-stream water quality target for TP of 0.050 mg/L should be retained to be consistent with the EPA approved Bruneau River TMDL

Jacks Creek Flow Design Flow Determination

The Bruneau River TMDL points out that the design flow for Jacks Creek is 4.944 cfs (or 0.14 cubic meters per second) on page 96 [Section 3.2.2.1] and page 97 [Section 3.2.2.4]). This design flow was considered by DEQ l to be conservative, as it incorporated the low average summer flow. However, because this design flow is based on the descending limb of the annual hydrograph collected at the USGS gage in the Big Jacks Creek channel, which resides upstream of Jacks Creek, it does not consider the geothermal wells that are used year-round in the drainage. Without considering the geothermal water inputs into Jacks Creek, this design flow does not provide a complete picture of the water sources into Jacks Creek.

Investigation of Geothermal Flow Sources that Contribute to Jacks Creek

DEQ investigated, with assistance from the Idaho Department of Water Resources (IDWR), the geothermal sources that discharge into Jacks Creek. We concentrated primarily on those geothermal sources immediately adjacent to the nearby farms associated with Jacks Creek (based on a section, township, and range grid of the drainage). We also considered those geothermal sources that have water rights specific to irrigation water use, since this is the primary intended beneficial use for those waters (followed by fish propagation, stock water, and domestic water supply, as defined by IDWR regulations).

During this investigation, DEQ relied on irrigation efficiency information from the Twin Falls Canal Company and the North Side Canal Company, both of whom have expertise in gravity-fed and sprinkler-fed irrigation systems.

As confirmed by the NRCS Office in Mountain Home and the Idaho Soil Conservation Commission (ISCC) Office in Bruneau, only about 10% of the water applied through gravity fed systems eventually reaches Jacks Creek. Of the 149.32 cfs that is used for irrigation via geothermal water, only 14.932 cfs eventually reaches Jacks Creek. The 10^{th} percentile of this flow is 2.320 cfs, which represents a conservative average estimate of the geothermal waters that discharge into Jacks Creek.

Generally speaking, the low flow scenario is characterized by the 10^{th} Percentile of the known flows based on the period of record. However, very little information is known about the actual flows at the USGS gage at Big Jacks Creek during the spring-summer months based, because the flow information here is primarily what is coming from the upper drainage. This flow essentially subsides in the spring-summer months, as Jacks Creek dries out.

The geothermal water is the predominant source of the Jacks Creek flow, making Jacks Creek a modified flow regime dependent on two water supply sources:

- Big Jacks Creek flow (inclusive of Little Jacks Creek) as represented by the USGS flow estimate of 4.944 cfs
- Geothermal flow sources in Jacks Creek from the agricultural production sources as represented by the 10^{th} percentile flow estimate of their water rights, or 2.320 cfs.

Combining Jacks Creek Flow and Geothermal Flow

By combining both conservative flow estimates of Jacks Creek Flow (i.e. 4.944 cfs) and the Geothermal Flow Sources (i.e. 2.320 cfs), a derived flow estimate of 7.264 cfs provides for a

more realistic flow in the Jacks Creek drainage. This also allowed for conservative flow estimates throughout the year, as well as for such times as the flow was strictly from the geothermal flow sources alone.

Therefore, the Jacks Creek loading capacity (LC) for TP will be modified from the January 29, 2007 version of the Jacks Creek TMDL Modification as follows:

Estimating the Loading Capacity (LC) of Jacks Creek.

Utilizing the combined conservative flow of 7.264 cfs, the following LC calculation represents the assimilative capacity for TSS, TP and *Escherichia coli* (*E. coli*) on Jacks Creek.

- Standard LC Algorithm = Flow, cfs x Pollutant, mg/L x 5.4 = lb/day LC for TSS & TP:

- TSS LC = 7.264 cfs x 50 mg/L TSS x 5.4 = 1,961.28 lb/day TSS LC
- TP LC = 7.264 cfs x 0.050 mg/L TP x 5.4 = 1.96 lb/day TP LC
- Standard LC Algorithm = Flow, cfs x Pollutant, cfu/100 mL x 0.02445 = cfu/day *E. coli*:
- E. coli LC = 126 cfu/100 mL x 7.264 cfs x 0.02445 = 22.4 cfu/day *E. coli* LC

Localized Impacts Assessment (LIA)

As discussed, a LIA is conducive to the Bruneau Arm of the Bruneau River (or the C. J. Strike Reservoir). As described in the King Hill – C. J. Strike Reservoir Assessment and TMDL (page 171); the average annual discharge from the Bruneau River is 325 cfs based on the 1997-2002 flow data. Table 47 (page 177) in the C. J. Strike TMDL indicates a load capacity of 60 kg/day TP (or 132.3 lb/day TP). The estimated LC for Jacks at 1.96 lb/day TP is approximately 1.48% of the LC for C. J. Strike in the Bruneau Arm of the Bruneau River [i.e. 1.48% = 100% x 1.96 lb/day / 132.3 lb/day].

Cumulative Impacts Assessment (CIA)

Similarly, a CIA is conducive to both the Bruneau Arm of the Bruneau River and the Snake River Arm of the Snake River at the discharge point at the C. J. Strike Dam. As described in the King Hill – C. J. Strike Reservoir Assessment and TMDL (page 171); the average annual discharge from the Snake River Arm is 11,375 cfs. Table 47 (page 177) in the C. J. Strike TMDL indicates a LC of 2,092 kg/day TP (or 4,612.1 lb/day TP). The estimated LC for Jacks Creek at 1.96 lb/day TP is approximately 0.04% of the LC for C. J. Strike in the Bruneau Arm of the Bruneau River [i.e. 0.04% = 100% x 1.92 lb/day / 4,612.1 lb/day]. DEQ considers this a minimal portion relative to the LIA on the C. J. Strike Reservoir in the Bruneau Arm.

Conclusions

The LIA of 1.48% and CIA of 0.04% assume that the entire TP from Jacks Creek discharges directly into the C. J. Strike Reservoir. However, as will be shown in DEQ's response to EPA's Question 5 (page 46), this is not the case with the fish farms involved. DEQ will demonstrate that about 85% of the fish farm effluent is reused as cropland irrigation; and seldom reaches Jacks Creek.

Therefore, DEQ concludes that the TP LC (1.96 lb/day TP) represents a minimal portion of the LIA 1.48%) of the C. J. Strike Reservoir LC in the Bruneau Arm and a minimal portion of the CIA (0.04%) of the entire C. J. Strike Reservoir LC. This conclusion is based on an instream water quality target of 0.075 mg/L TP in the C. J. Strike Reservoir; while the instream target for Jacks Creek is 0.05 mg/L TP, which is less than the run-of-river characteristics of the reservoir

(since the water moves through the reservoir in less than 24 hours based on the C. J. Strike TMDL).

However, DEQ notes that the C. J. Strike TMDL specifically addresses the TP nutrient TMDL LC as an instream target of 0.075 mg/L for the entire C. J. Strike Reservoir:

> The load capacity for the Snake River nutrient TMDL is determined by using the target of 0.075 mg/L TP and average flow values for the Snake River and the Bruneau River—11,375 cfs and 325 cfs, respectively—both of which are calculated from 1997-2002 flow data.").
>
> Page 171, C.J. Strike TMDL

Therefore, DEQ also concludes that the 0.05 mg/L TP instream target in Jacks Creek (as part of the Bruneau River TMDL) is more stringent than the 0.075 mg/L TP instream target used in the development of the C. J. Strike TMDL for the reservoir.

EPA COMMENT 2

> There are documented low dissolved oxygen concentrations in the Bruneau River Arm of C.J. Strike Reservoir. Also, the Bruneau Arm appears to show signs of eutrophication, algal blooms, and nuisance vegetation growth. All of these factors indicate a potential issue with excessive phosphorus loading and therefore a concern with an action that increases phosphorus load allocations. There is no discussion of these factors in the Jacks Creek Modification document.

DEQ Response

DEQ's response to this comment is based on the ecological approaches used in the Bruneau River TMDL and C. J. Strike TMDL to achieve water quality standards and attain beneficial uses. These approaches looked for the answers to the following questions:

- Is the TP loading from Jacks Creek the only source in the Bruneau Arm?
- Is there discussion in the C. J. Strike TMDL that addresses eutrophication, algal blooms, and nuisance vegetation growth coming directly from Jacks Creek?
- Does Jacks Creek deliver low dissolved oxygen (DO) contributions to the C. J. Strike Reservoir?
- Does Jacks Creek deliver excessive phosphorus contributions the to C. J. Strike Reservoir?
- Jacks Creek has many geothermal sources that eventually discharge into it. Does the Bruneau Arm also have these or other geothermal type sources that discharge into it?

The answers to these questions are explored in the following.

Is the TP loading from Jacks Creek the only source in the Bruneau Arm?

Page 176 of the C. J. Strike TMDL it states:

> The available data show that total phosphorus loading to the C.J. Strike Reservoir originates almost entirely from the Snake River and the Bruneau River, with the Snake River by far accounting for the largest portion.

Jacks Creek is considered a minimal source of TP loading into the Bruneau Arm of the C. J. Strike Reservoir. Although not specifically addressed in the C. J. Strike TMDL, an estimate of the TP loading into the reservoir from both the Snake River Arm and the Bruneau Arm (based on Table 47, page 177, in the C. J. Strike TMDL) is calculated as 97.2% and 2.8%, respectively. Jacks Creek is represented as a component of the Bruneau Arm (something less than 2.8%).

However, from a conservative perspective there probably exist other sources in the Bruneau Arm that were not specifically identified in the C. J. Strike TMDL or in the Bruneau River TMDL, and which DEQ does not dispute may exist. However, such TP load sources are certainly minimal to the C. J. Strike Reservoir and do not necessarily provide additional significant TP loadings into the reservoir.

Is there discussion in the C. J. Strike TMDL that addresses eutrophication, algal blooms, and nuisance vegetation growth coming directly from Jacks Creek?

The C. J. Strike TMDL does not address Jacks Creek as a source of eutrophication, algal blooms, or nuisance vegetation growth. There are only two places in the C. J. Strike TMDL that address Jacks Creek specifically:

- The first is in Figure 9 (page 21), which illustrates Big Jacks Creek (as an average flow of 4 cfs; which should be 4.944 cfs based on the Bruneau River TMDL Sections 3.2.2.1 and 3.2.2.4). However, noted in DEQ's response to EPA comment 1, this flow is not representative of the overall flow from Jacks Creek. The 4 cfs (or 4.944 cfs) flow is the USGS weir flow and does not encompass the geothermal inputs from Jacks Creek. Considering the geothermal sources, which are not accounted in the USGS flow dataset, the flow is greater than 4.944 cfs.
- The second reference to Jacks Creek in the C. J. Strike TMDL is on page 328 (as part of the public comments) which answers the question as to why Jacks Creek was not addressed specifically in the C. J. Strike TMDL. The response was, "The 2001 Bruneau River TMDL, which included Jacks Creek, established an in-stream total phosphorus target of 0.05 mg/L. Since this target is more stringent than the reservoir boundary condition target of 0.075 mg/L, no additional reductions are required from Jacks Creek."

Additionally, on page 176 of the C. J. Strike TMDL, it specifically states:

> The available data show that total phosphorus loading to the C.J. Strike Reservoir originates almost entirely from the Snake River and the Bruneau River, with the Snake River by far accounting for the largest portion.

A rough estimate of the TP loading from the Bruneau Arm was calculated as 2.8% above. Based on this value, it can only be concluded that Jacks Creek is not a major source of eutrophication, algal blooms, and nuisance vegetation growth to the C. J. Strike Reservoir.

However, on page 95 of the Bruneau River TMDL (Section 3.2.2.1), it is mentioned that the nutrients (i.e. TP) that discharge from Jacks Creek are elevated at all times. Additionally, no seasonal component could be established with DEQ's data (see page 96, Section 3.2.2.1), either in the Bruneau River TMDL or the Jacks Creek TMDL Modification; therefore, establishing seasonality was not attempted at the present time.

Based on these considerations, DEQ's response is =the same: if the instream target of the Bruneau TMDL is maintained at 0.05 mg/L, below the the instream target for C. J. Strike of 0.075 mg/L TP, there should be sufficient assurance to alleviate concerns for eutrophication, algal blooms, or nuisance vegetation growth that may come from Jacks Creek into the C. J. Strike Reservoir. DEQ' notes that in its response in Question 1, Conclusions specific to the fish farm TP discharges; about 85% of the fish farm effluent is reused as cropland irrigation, seldom reaching Jacks Creek. This should provide reasonable assurance that the fish farm effluent affect on Jacks Creek and the C. J. Strike Reservoir is reduced because of the effluent discharge reuse for cropland irrigation.

Does Jacks Creek deliver low dissolved oxygen (DO) contributions to the C. J. Strike Reservoir?

Section 3.2.2.2 (page 96) and Section 3.2.2.4 (page 97) of the Bruneau River TMDL suggest that the critical period for low DO in Jacks Creek is primarily based on the life history and biology of the aquatic plant community on a warm water aquatic life. Little data exists to define the diurnal fluctuations within the Jacks Creek system. The most likely time of year (based on best professional judgment) when DO levels would drop due to the dark respiration phase of a plant's metabolic cycle is during the early to mid-summer months. It is assumed that by the early part of the summer nighttime, DO sags below water quality standards (< 6.0 mg/L DO) might occur. The C. J. Strike TMDL (page 136) indicates:

> The Bruneau River arm of C.J. Strike Reservoir also experiences dissolved oxygen depletion, ***although not to the extent of the Snake River arm***.

Why? As explained in the C. J. Strike TMDL:

> ". . . the Bruneau River arm is shallower than the Snake River arm and is more susceptible to wind related mixing in the upper layers of the reservoir. As a result, the number of dissolved oxygen values below 6.0 mg/L (above the hypolimnion) is minimal (less than 10%) and not numerous enough to constitute a violation of the water quality standards"
>
> (page 136, C. J. Strike TMDL)

DEQ's most recent 2004 water quality data for instantaneous DO sampling is summarized in Table 7, which indicates the following:

- Instantaneous DO values between 1-Vaught Road and 6-Highway 78 (or upstream of the C. J. Strike Wildlife Management Area) are above the water quality numeric standard (i.e. > 6.00 mg/L; or an average of 9.56 mg/L with a range of 7.17-13.00 mg/L); and,
- Instantaneous DO values between 7-Main and 7-Wetland (or in the C. J. Strike Wildlife Management Area) are also above the water quality numeric standard (i.e. or an average of 7.75 mg/L with a range of 0.62-1.03 mg/L).
- Aquaculture facilities that discharge below 3-Selman Farm and above 4-Cattle Drive Road monitoring sites do not necessarily reduce the DO concentration in Jacks Creek as shown more visibly in the 1-Vaught Road and 2-Shoo Fly road monitoring sites, which are influenced more by cropland agriculture and cattle grazing.

Table 7. Jacks Creek dissolved oxygen (DO) data for the 2004 monitoring season

Monitoring Site	Mean DO, mg/L	MIN DO, mg/L	Max do, mg/L
7-Wetland	5.50	0.62	9.36
7-Main	9.99	0.61	14.70
Site 7 Mean	7.75	0.62	12.03
6-Highway 78	11.62	10.04	14.17
5-Davis Road	10.20	6.39	12.98
4-Cattle Drive Road	9.70	6.81	12.46
Aquaculture Facilities Discharge Between 3-Selman & 4-Cattle Drive Road			
3-Selman Farm	10.23	8.27	16.66
2-Shoo Fly Road	8.65	5.52	13.80
1-Vaught Road	6.93	6.01	7.95
0-USGS Weir (Gage)	0.00	0.00	0.00
Sites 1-6 Mean	9.56	7.17	13.00
MIN = Minimum. MAX = Maximum. DO = Dissolved Oxygen. Site 7 Mean = Mean of 7-Wetland and 7-Main. Sites 1-6 Mean = Mean of all sites excluding 7-Wetland, 7-Main, and 0-USGS Weir. A value of 0.00 at 0-USGS Weir indicates that no flow was recorded past the USGS weir station.			

About 85% of the fish farm effluent is reused as cropland irrigation and seldom reaches Jacks Creek, so the DO levels that are reduced downstream of 4-Cattle Drive Road in the 7-Wetland and 7-Main monitoring sites are reduced for reasons not necessarily attributable to fish farm effluent. DEQ investigated, through field ground truthing, that the drop in some DO values between 7-Main (for several readings) and the 7-Wetland are attributable to the influence from the wetland area of the C. J. Strike Wildlife Management Area, as well as the reduced water velocity due to the backwaters' influence from the C. J. Strike Reservoir (as a consequence of an elevation difference; higher elevation in the reservoir versus lower elevation in Jacks Creek at the confluence during certain times of the year). However, the influence from warm water sources also contributes to the low DO concentrations because of agricultural water supply to which aquaculture is ancillary and not predominant. Aquaculture may be argued scientifically is a contributor but not the main source of these low DO potentials.

Since geothermal agricultural sources are a dominant hydrologic feature of the Jacks Creek drainage, it is reasonable to expect low DO concentrations in Jacks Creek based on the warm water condition alone. Chemically, cold water can hold more DO than warm water. Cold water species often have higher DO requirements than warm water species. Jacks Creek, as discussed in DEQ's Response 1A, 1B and 1C, demonstrates that it is a modified (both cold and warm) water regime or system. Since the ecological quality of the water depends largely upon the amount of DO the water can hold, it is not surprising that trout species do not inhabit the Jacks Creek habitat. This has been the historical situation of the Jacks Creek drainage since the 1930s. Consequently, the species of carp which exists in Jacks Creek is far more tolerant of minimum DO values (i.e. 2.0 mg/L) than trout (i.e. 6.5 mg/L). Consequently, trout are not known to exist in Jacks Creek (although they do exist in Big Jacks Creek upstream of Jacks Creek above the USGS weir) because of this modified water regime.

Therefore, DEQ concludes, as stated in the Bruneau River TMDL and the Jacks Creek Technical Support Document (TSD), that there are minimal low DO contributions into the C. J. Strike Reservoir. Uncertainty exists as to what the DO level may be. The most probable time when low DO concentrations may exist is during the early to mid-summer months. This contribution is considered small when compared to the volume of water discharging from Jacks Creek into the C. J. Strike Reservoir. DEQ concludes based on field observations in 2004 that there exists a backwater influence into the Jacks Creek channel from the C. J. Strike Reservoir and from the wetland area during the mid-summer months. However, more field DO data is desirable to better qualify these assumptions.

Does Jacks Creek deliver excessive phosphorus contributions to C. J. Strike Reservoir?

As discussed in the Jacks Creek TSD, there is little historical water quality information for phosphorus (as total phosphorus or TP) for Jacks Creek, Big Jacks Creek and Little Jacks Creek. Like DO, the more extensive water quality information available is that collected by DEQ and IDA, but this was limited because of funding and resource constraints.

DEQ's most recent 2004 water quality data for TP (Table 8) indicates the following:

- TP values between 1-Vaught Road and 6-Highway 78 are well above the water quality numeric instream target (i.e. greater than 0.050 mg/L; or an average of 0.271 mg/L with a range of 0.139-0.512 mg/L); and,
- TP values between 7-Main and 7-Wetland are also well above the water quality numeric target (i.e. or an average of 0.205 mg/L with a range of 0.087-0.381 mg/L).
- Aquaculture facilities that discharge below 3-Selman Farm and above 4-Cattle Drive Road are not the primary source of increased TP concentration in Jacks Creek as shown more visible in the 1-Vaught Road and 2-Shoo Fly Road, as well as 6-Highway 78 and 5-Davis

Road, monitoring sites which are influenced more by cropland agriculture and cattle grazing.

Table 8. Jacks Creek total phosphorus (TP) data for the 2004 monitoring season

Monitoring Site	Mean TP, mg/L	MIN TP, mg/L	Max TP, mg/L
7-Wetland	0.300	0.099	0.686
7-Main	0.241	0.179	0.338
Site 7 Mean	0.271	0.139	0.512
6-Highway 78	0.218	0.122	0.335
5-Davis Road	0.184	0.115	0.307
4-Cattle Drive Road	0.180	0.106	0.288
Aquaculture Facilities Discharge Between 3-Selman & 4-Cattle Drive Road			
3-Selman Farm	0.164	0.012	0.393
2-Shoo Fly Road	0.211	0.046	0.434
1-Vaught Road	0.274	0.121	0.526
0-USGS Weir (Gage)	0.000	0.000	0.000
Sites 1-6 Mean	0.205	0.087	0.381
MIN = Minimum. MAX = Maximum. TP = Total Phosphorus. Site 7 Mean = Mean of 7-Wetland and 7-Main. Sites 1-6 Mean = Mean of all sites excluding 7-Wetland, 7-Main, and 0-USGS Weir. A value of 0.00 at 0-USGS Weir indicates that no flow was recorded past the USGS weir station.			

Approximately 85% of the fish farm effluent is reused as cropland irrigation and therefore seldom reaches Jacks Creek, so the TP levels reduced downstream of 4-Cattle Drive Road in the 7-Wetland and 7-Main monitoring sites are due to other reasons not necessarily attributable to fish farm effluent. However, on page 95 of the Bruneau River TMDL (Section 3.2.2.1), the nutrients (i.e. TP) that discharge from Jacks Creek are indeed elevated at all times (based on DEQ's and IDA's more recent water quality monitoring). Additionally, no seasonal component was established with DEQ's data (see page 96, Section 3.2.2.1), both in the Bruneau River TMDL as well as in the Jacks Creek TMDL Modification; and therefore, seasonality was not attempted, nor is it encouraged until more definitive data is collected to confirm it.

The Jacks Creek TSD, however, does confirm that the primary source of TP is indeed coming from agricultural and includes cropland farming, cattle grazing and, aquaculture on a smaller scale. In the case of cropland farming, the geothermal water tailwater principally discharges the water from the cropland soils into Jacks Creek. Cattle grazing reflect an issue of cattle encroachment into the streambanks and channel of Jacks Creek, as evidenced by cattle tromping in the riparian area and disturbed riparian vegetation.

And aquaculture provides its own TP load to the system as a consequence of fish effluent. But as demonstrated with Tables 1 (for DO concentrations) and 2 (for TP concentrations), the influence of aquaculture effluent is essentially masked in the nonpoint source loadings from cropland farming and cattle grazing; especially since 85% of the effluent seldom reaches Jacks Creek.

An additional component to the nutrient or TP issue is that of sediment (i.e. total suspended solids or TSS). As explained in the Bruneau River TMDL (Section 3.2.2.4, page 97), suspended sediment is elevated in Jacks Creek in the early spring during higher flow events. The Jacks Creek TSD confirms this but also notes that excess sediment delivery and transport occurs mostly during the spring and summer months with some leveling off during the late fall and winter season. However, as explained in the Bruneau River TMDL (Section 3.1.4, page 94) and as confirmed by the Jacks Creek TSD, a strong relationship exists between TSS and TP in Jacks Creek. Therefore, there is a high probability that any reduction in TP is most likely to come from the same best management practices that would reduce TSS. In addition, TP reductions to approximately 0.200 mg/L TP instream concentration should result in TSS levels meeting the TSS instream water quality target (i.e. < 50 mg/L as a monthly average) for support of salmonid

populations (based on cold water aquatic life and salmonid spawning (as explained in the Bruneau River TMDL, page 94). However and as previously discussed, Jacks Creek is a modified hydrologic system of both cold water and warm water as explained in the Jacks Creek TMDL Modification:

> The existing beneficial use is warm water aquatic life under the Bruneau River TMDL (Lay 2000 [p 55, Table 11]) due to the influence of artesian geothermal sources that provide the overall water flow into Jacks Creek annually. These warm water sources do not necessarily preclude cold water from running through Jacks Creek during high flow events from Little Jacks Creek or Big Jacks Creek. Consequently, Jacks Creek is more descriptive of a modified system, which is yet to be determined based on the chemical, physical, and biological levels necessary to attain the existing aquatic life community for a modified aquatic life level
>
> Jacks Creek TMDL, Section III, page 3

Jacks Creek has many geothermal sources that eventually discharge into it. Does the Bruneau Arm also have these or other geothermal type sources that discharge into it?

No other types of geothermal sources unique like Jacks Creek are identified in the C. J. Strike TMDL that discharges into the Bruneau Arm of the C. J. Strike Reservoir. Certainly, there are other geothermal sources, but not at the levels similar to Jacks Creek. DEQ investigated, with the assistance of IDWR, if other such sources existed in the Bruneau River Subbasin similarly as unique as Jacks Creek. The conclusion was that Jacks Creek was very unique as a geothermal system composed of various farms, cattle operations and aquaculture. No other such drainage system exists in the Bruneau River Subbasin. Therefore, DEQ concludes that Jacks Creek is unique in its method of agricultural use of geothermal water as it relates to the C. J. Strike Reservoir.

Conclusions

DEQ concludes that water quality cleanup efforts associated with sediment, nutrients, and bacteria (See Lay 2000, pp 91-92, 96), are expected to improve dissolved oxygen levels and the overall water quality of Jacks Creek; thus not affecting the water quality of the C. J. Strike Reservoir. The Jacks Creek TMDL Modification initially presented no additional discussion on what effects, if any, the proposed modification (at a 0.100 mg/L TP concentration) would have on C. J. Strike Reservoir because the proposed modifications were expected to be minimal.

The present response to EPA's comments also proposes the same minimal effects. However, this is based on a discharge of instream water quality of 0.05 mg/L TP. As previously discussed, since the 0.05 mg/L TP instream target is more stringent than the reservoir boundary condition target of 0.075 mg/L (as discussed in the C. J. Strike TMDL), no additional reductions are required from Jacks Creek at the 0.05 mg/L TP instream concentration target.

EPA COMMENT 3.

> In the Jacks Creek Modification, load capacities were calculated using 17.49 cfs flows. The Jacks Creek Technical Support Document states that 17.49 cfs represents a "70th percentile flow" of the flows that eventually pass the monitoring sites 7-main and 7-wetland. It is explained that this means that 70 percent of the flows in the stream are below 17.49 cfs. This is not protective of low flow conditions. Also, under low flow conditions, we don't think the 0.1 mg/l target concentration will be met.

DEQ Response

DEQ will revise the proposed instream concentration TP target of 0.100 mg/L back to the original 0.05 mg/L to maintain consistency with the C. J. Strike TMDL and the Bruneau River TMDL. As explained earlier, the more accurate flow in the Jacks Creek drainage is a combination of the USGS gage (i.e. 4.944 cfs, which is defined as the design flow) and the geothermal sources (i.e. 2.320 cfs, which was never considered in the any of the Bruneau River TMDL calculations) for a total of 7.264 cfs as a conservative low flow scenario for the Jacks Creek drainage.

This approach supports the 10^{th} Percentile flow approach for a conservative low flow scenario. This approach is consistent with previous TMDLs developed by DEQ. Thus, the USGS gage flow alone is NOT representative of the flow at the 7-Main (or Highway 78) monitoring site. This is explained fully in the Jacks Creek TSD but restated here.

DEQ reiterates from the Jacks Creek TSD that the Jacks Creek drainage is a modified hydrology regime, conducive to both cold water during the late fall to winter through early spring months followed by warm water geothermal sources during all times of the year, but predominantly during the mid to late spring though the summer and early fall months. Because of this modified regime, the habitat conducive to cold water aquatic life is not present in Jacks Creek. Rather, the habitat is a warm water aquatic life based on visual observations of the drainage during the 2004 monitoring months; as well as with discussions with local land owners.

DEQ provides the following information on the intermittent hydrology of Jacks Creek, its geothermal sources and storm water events that influence the system.

Intermittent Hydrology

Jacks Creek is an intermittent waterbody. It is not perennial. Essentially, there are two flow sources that operate independent of each other; and consequently affect the flow hydrology and aquatic life of Jacks Creek:

The first flow source is the stream flow that comes directly from Big Jacks Creek and Little Jacks Creek in the spring months as a consequence of snowmelt and storm events. This flow (again as discussed in the Jacks Creek TSD, i.e. Table 4, page 11) causes Jacks Creek to become dry in the summer and fall months (although historically Jacks Creek has gone dry in all months) when little moisture discharges from upstream through the stream channel into Jacks Creek. DEQ investigated the two sources for surface water inputs into Jacks Creek: (1) the surface stream flow from Big Jacks Creek and (2) the surface stream flow from Little Jacks Creek.

Surface Stream Flow from Big Jacks Creek

The USGS Gage at Big Jacks Creek (USGS Gage 13169500) provides flow data from December 1, 1938 to September 30, 2004. This provides a possible number of values of 24,045 days (or N1 = 24,045 possible data points based on 65 years, 9 months, 29 days). However, there is a gap in flows from October 29, 1949 to July 6, 1965 because no data was collected during that period by USGS. This gap represents 5,729 days (or N2 = 5,729 possible data points based on 15 years, 8 months, 7 days). Therefore, of the possible N1 = 24,045 values with a data gap of N2 = 5,729 values, there exist N3 = 18,316 days of recorded data. Of these N3 = 18,316 days, 61.5% have zero flows past the USGS gage station; meaning the streamflow is dry in the Jacks Creek stream channel.

Figure 1 summarizes the flow information for the Big Jacks Creek USGS 13169500 gage. The summary is for 50 calendar years (or 50 years, 1 month, 7 days) of flow data (i.e. 1938-1949

and 1965-2004), which is equivalent to 49 USGS hydrologic years due to an overlap in both calendar systems. Of these 50 years (or 49 hydrologic years), only 48 years had actual flow in the Jacks Creek stream channel (past the USGS weir).

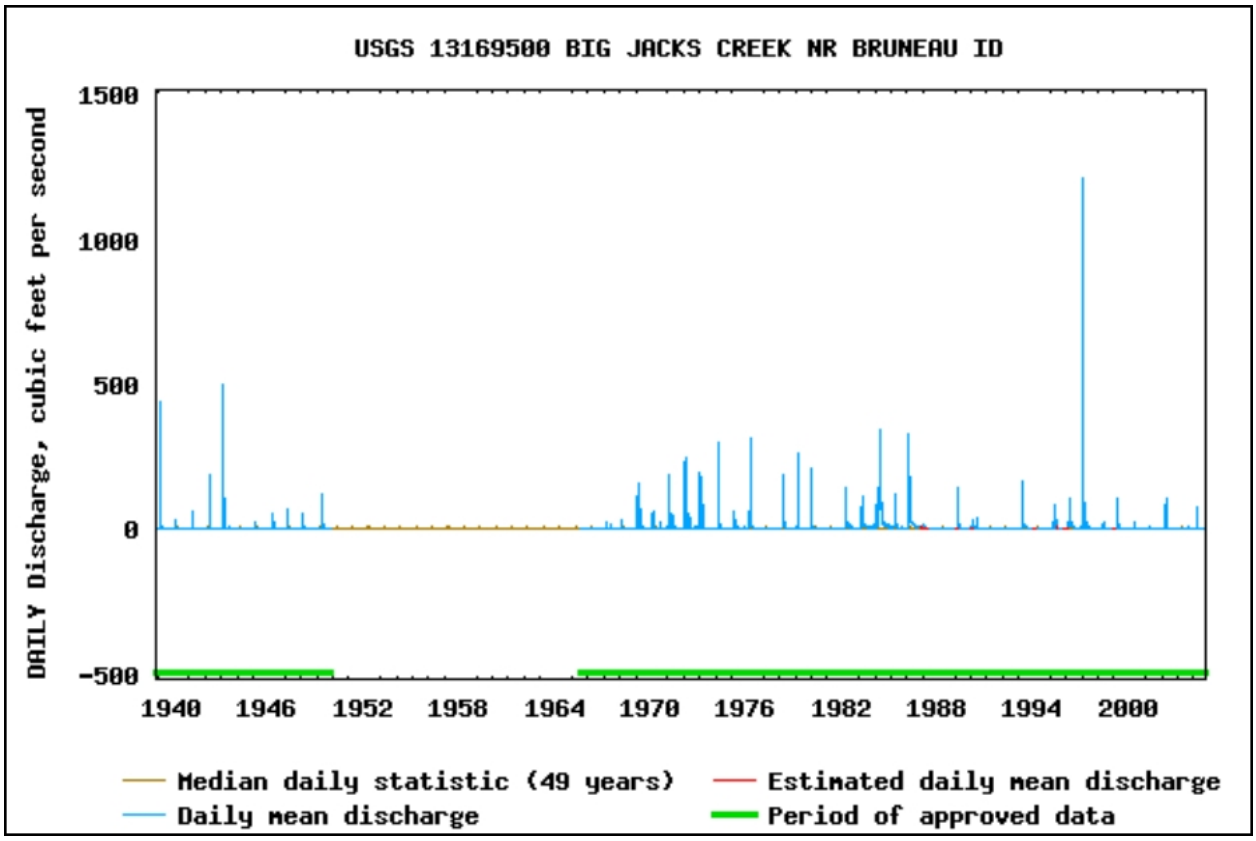


Figure 1. USGS 13169500 Big Jacks Creek near Bruneau, Idaho

A more extensive review of the USGS data for Big Jacks Creek indicates the following regarding the Big Jacks Creek USGS Gage data:

- Actual number of years with flow in stream channel: 48 years
- Average number of days/year with flow in stream channel: 156
- Minimum number of days/year with flow in stream channel: 2
- Maximum number of days/year with flow in stream channel: 365
- Average stream flow per 156 days in 48 years: 10.2 cfs
- Minimum stream flow per 156 days in 48 years: 0.0 cfs
- Maximum stream flow per 156 days in 48 years: 1210.0 cfs

Figure 2 illustrates the number of times flow was measured in Big Jacks Creek Gage in 48 years. In general, the months February through June had 54.0% (or 25-37 recorded times in 150 days) of the most flow on average in any single year; and the months July through January had 46.0% (or 16 to 25 recorded times in 215 days) of the least flow. However, ground truthing of the channel indicates that from the USGS gage

downstream for approximately 0.3 miles the water will potentially sub out (due to the geology of the stream channel) whenever the flow is less the 0.1 cfs. This means (and as previously noted) that although the USGS gage indicates that 38.5% of the time there is flow in the stream channel of Jacks Creek, 61.5% of the time the flows are essentially zero.

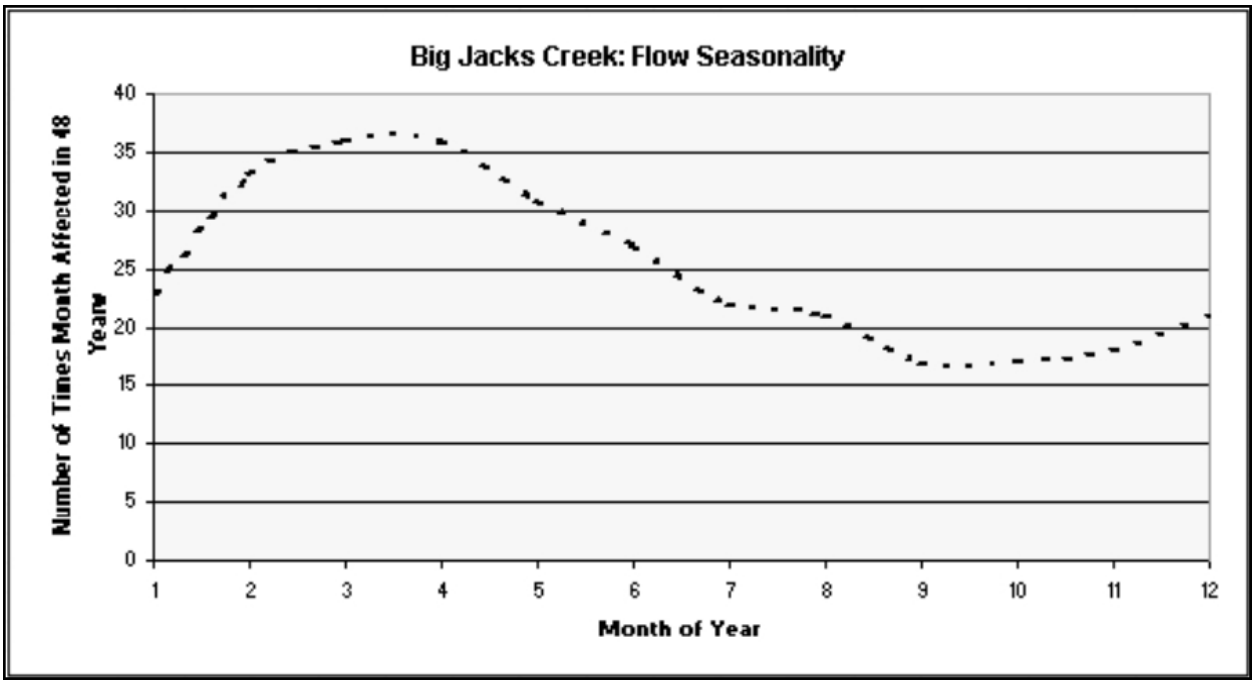


Figure 2. Monthly Number of Times Flow Exists Below Big Jacks Creek Gage Site

Surface Stream Flow from Little Jacks Creek

Little Jacks Creek also feeds into Jacks Creek just above the USGS weir. A USGS gage was established but is presently non-functional. Figure 3 summarizes the flow information for the Little Jacks Creek USGS 13170000 gage. The summary is for 10 years of information (i.e. 1938-2004). The gage indicates that 87.5% of the time the stream channel was essentially dry

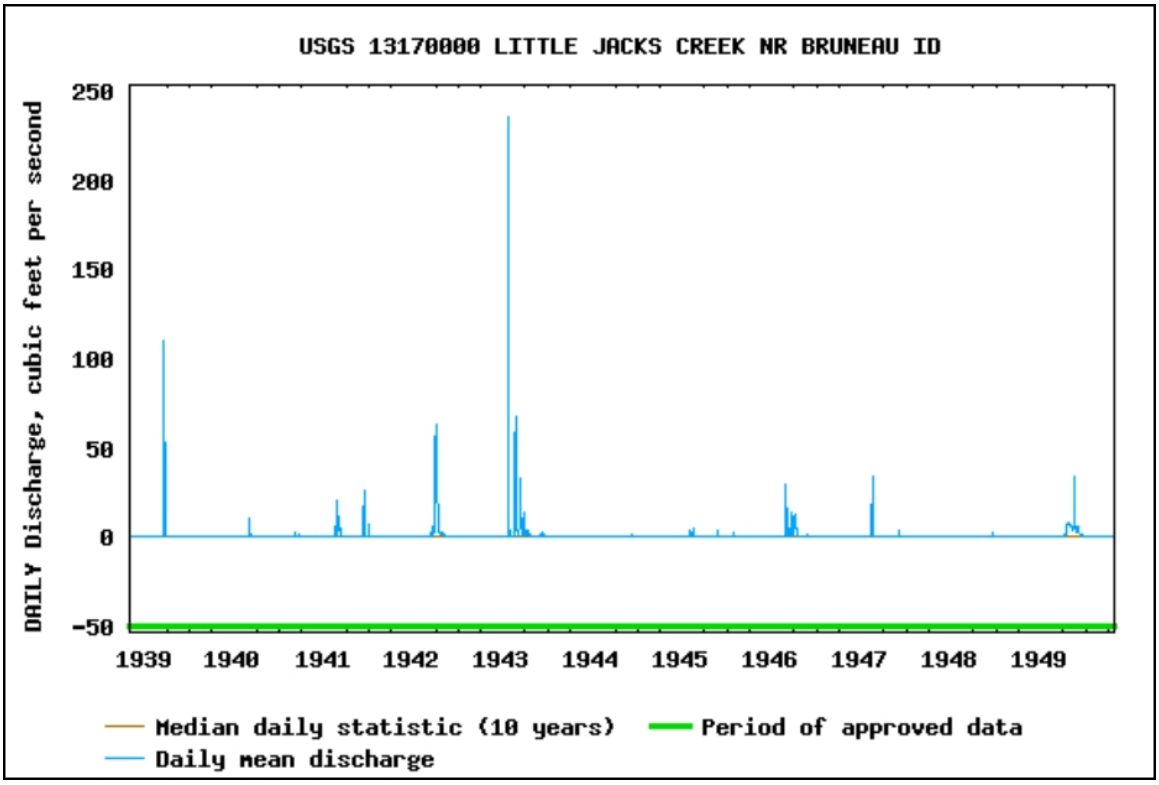


Figure 3. USGS 13170000 Little Jacks Creek near Bruneau, Idaho.

A more extensive review of the USGS data for Little Jacks Creek indicates the following about Little Jacks Creek USGS Gage Data:

- Actual number of years with flow in stream channel: 11 years
- Average number of days/year with flow in stream channel: 50
- Minimum number of days/year with flow in stream channel: 2
- Maximum number of days/year with flow in stream channel: 120
- Average stream flow per 50 days in 11 years: 5.5 cfs
- Minimum stream flow per 50 days in 11 years: 0.0 cfs
- Maximum stream flow per 50 days in 11 years: 235.0 cfs

Figure 4 illustrates the number of times flow existed in Little Jacks Creek Gage based on the number of times in 11 years the stream gage indicated a flow measure at the gage site. In general, the months February through June had 79.5% of the most flow on average in any single year; and the months April through January had 20.5% of the least flow. However, ground truthing of the channel indicates that from the USGS gage downstream for approximately 0.3 miles the water will potentially sub out (due to the geology of the stream channel) whenever the flow is less the 0.1 cfs or more. This means (as previously noted) that although the USGS gage indicates that 29.5% of the time there is flow in the stream channel of Jacks Creek, 70.5% of the time the flows are zero.

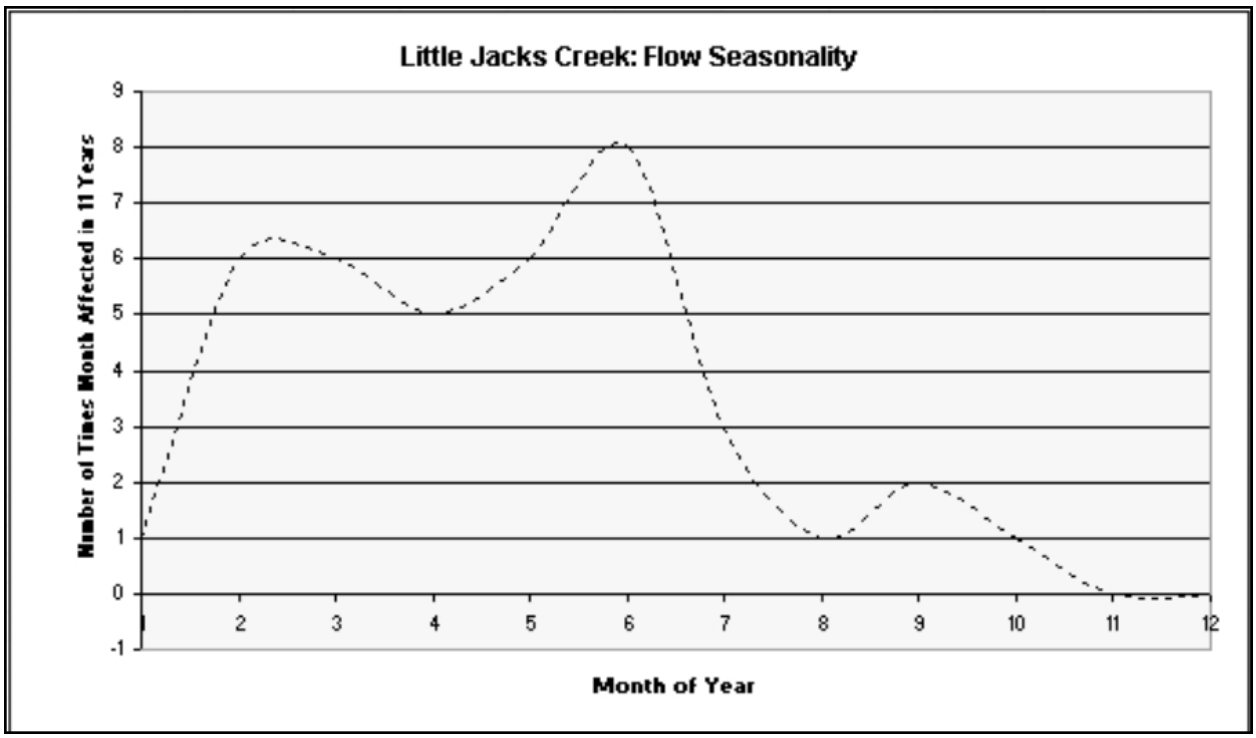


Figure 4. Monthly Number of Times Flow Exists Below Little Jacks Creek Gage Site.

Combining Both Big Jacks Creek and Little Jacks Creek

Based on the USGS gage flows for Big Jacks Creek (50 years of flow data) and Little Jacks Creek (10 years of flow data), it may be concluded that the recipient of these flows, Jacks Creek, is dry during a significant portion of its water year. Figures 1 and 2 illustrate this dilemma. Combining Figure 3 (Big Jacks Creek) and Figure 4 (Little Jacks Creek) to get Figure 5, it can be seen that the seasonality influence from Little Jacks Creek is very low.

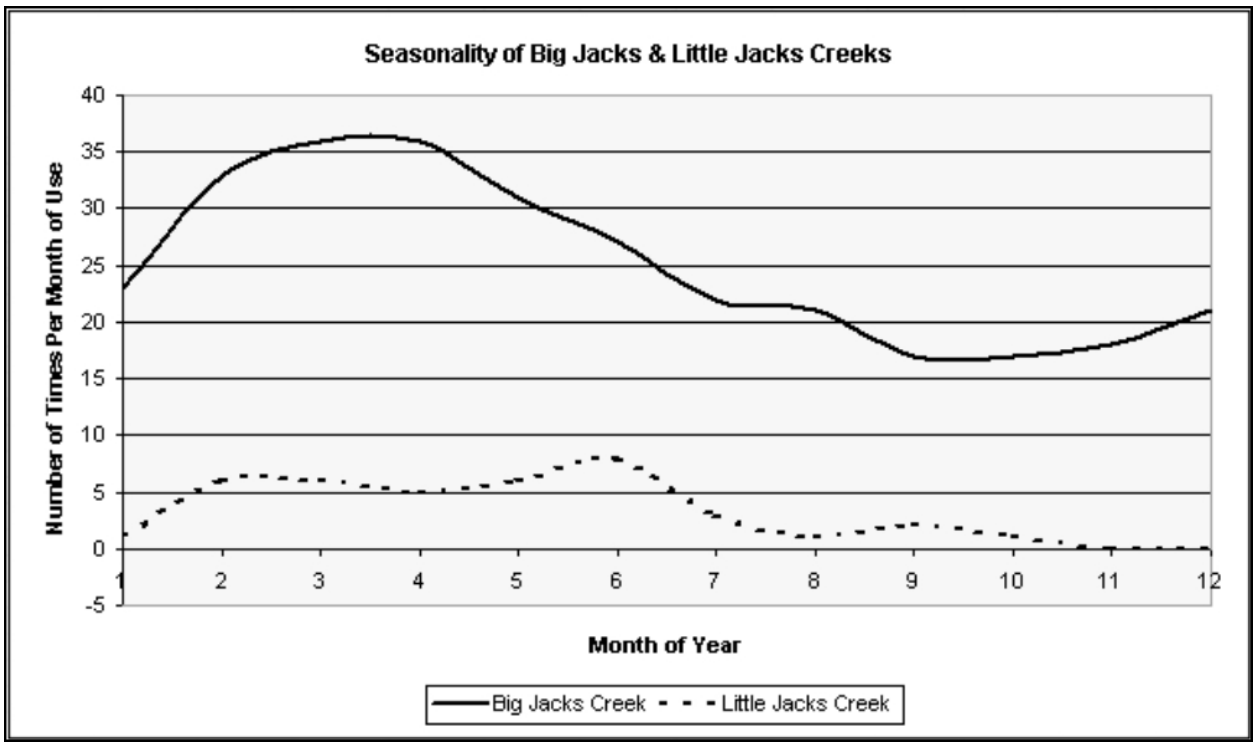


Figure 5. Monthly Number of Times Flow Exists Below Big Jacks and Little Jacks Creeks.

Depending on the month and the amount of water available, the percentage of water passing the USGS gage station that is primarily from Little Jacks Creek amounts to 0.0% - 2.3% of the total. Annually, Little Jacks Creek accounts for 11.4% of the total water and Big Jacks Creek 88.6% of the total water that may discharge into Jacks Creek when flow is available past the USGS gage. When both creeks are discharging into Jacks Creek, the high flow season generally runs from February through June (peak months being March and April); and the low flow season runs from July through January (low valley months being September through November). *However, this assumes that water is prevalent at those times of the year; and realistically that just isn't the case in most years. In fact, in most years the historical gage information records zero for the entire year*. Because of this intermittent hydrology, the hydrograph for Jacks Creek is very different than what is normally considered for perennial streams where a single source of water perennially exists.

Based on this discussion, to supplement the flow in Jacks Creek for agricultural purposes, it would be necessary for the water supply to be increased from some source outside of Big Jacks Creek and Little Jacks Creek; because these tributary sources are unreliable water sources for the Jacks Creek agricultural community. That outside source is the geothermal artesian water supply from private wells, which is the second flow source for Jacks Creek.

Geothermal Sources

The second flow source for Jacks Creek is the geothermal ground water wells that are used for agricultural irrigation during the late spring and summer through fall months, explained in the Jacks Creek TSD.

Geothermal Flow Scenario

The geothermal wells used in the spring and summer months are principally used because Jacks Creek would essentially run dry if it wasn't for the flow from the geothermal wells that provide the agricultural water supply for the cropland and stockwater. However, this geothermal water flowing into the channel of Jacks Creek is not the classical low flow scenario typically considered in a TMDL. Rather, this geothermal flow scenario is independent of upstream flows below the USGS weir.

In DEQ's professional opinion, the provision more appropriate to Jacks Creek would include the flow from Big Jacks and Little Jacks Creeks ***plus*** the geothermal wells along Jacks Creek. This means that the classical low flow scenario from one flow source cannot be applied in the Jacks Creek hydrology because of these two independent flow scenarios. Essentially, the stream flow above the USGS gage and the geothermal well water used during the irrigation season must be combined to better describe the flow hydrology of Jacks Creek.

IDWR Water Rights Survey of Geothermal Wells

To more fully describe the geothermal well sources, DEQ conducted a survey (with the assistance of IDWR) from the IDWR web site (http://www.idwr.state.id.us/) of the IDWR water rights for groundwater geothermal wells that discharge to Jacks Creek. This survey of geothermal sources was conducted on the provisions described in the individual water rights; specifically, irrigation as a beneficial uses along the Jacks Creek stream corridor. DEQ had previously in 2004 visited many of these geothermal well sources with the ISCC Bruneau Field Office, and therefore knew approximately how far from the stream corridor these well sources existed that discharged as cropland irrigation into the Jacks Creek drainage.

Based on this survey of geothermal wells using the IDWR water rights information, it was determined that the overall appropriation of total geothermal water from groundwater wells was estimated at 286.79 cfs along the Jacks Creek corridor. However, some of the water rights are duplicated in terms of their point of use along the Jacks Creek corridor; such that the actual accumulative flow is less than the overall appropriation of 286.79 cfs. In fact, DEQ and IDWR estimated the flow to be approximately 149.32 cfs net total (excluding the duplications).

Assuming a conservative irrigation efficiency of 90% (as gravity-fed irrigation), the amount of water that might reach Jacks Creek as tailwater discharge from the various farms is approximately 14.932 cfs (i.e. 100% - 90% = 10%; 149.32 cfs x 0.10 = 14.932 cfs). This assumes that 90% of the water (or 134.388 cfs) as groundwater is consumptively used for agricultural irrigation (inclusive of evaporation). DEQ knows this to be correct because it ground truthed this agricultural irrigation practice with the tailwater discharge from various farms during the 2004 irrigation season. It also ground truthed this same practices in subsequent visits in 2005, 2006 and 2007 during the irrigation season.

Fish Farm Effluent Flow Discharges into Jacks Creek

The Jacks Creek TSD (i.e. Table 5), which is shown in Table 9, indicates that the average range of flows was 0.00 cfs (at the 0-USGS Weir) to 13.00 cfs (at the 7-Main Monitoring Site) during the 2004 monitoring season (which was primarily during the "tailwater discharge" period), with a maximum flow of 25.52 cfs at the 7-Wetland monitoring site. Other sources indicate similar or higher flows, depending on the water year and various storm events. Therefore, the 14.932 cfs "tailwater discharge" previously discussed, falls within the range of 0.00 cfs and 25.52 cfs.

However, as discussed on page 45 of the Jacks Creek TSD, "DEQ was unable to find historical [USGS] flow data specific for Jacks Creek other than IDWR water right information"; because the flow information is only valid for the USGS weir gage at the confluence of Big Jacks Creek

and Little Jacks Creek. Therefore, DEQ identified this as a data gap (page 45) and suggested that further field research was required "to obtain more flow information at the 7-Main site and utilize this flow information to more accurately describe the flow condition of Jacks Creek prior to discharge into the C. J. Strike Reservoir".

Table 9. Jacks Creek stream flow (Q) for the 2004 monitoring season – geothermal sources

Monitoring Site	Mean Q, cfs	MIN Q, cfs	Max Q, cfs
7-Wetland	12.58	3.42	25.52
7-Main	13.00	3.50	24.50
6-Highway 78	9.81	2.36	19.55
5-Davis Road	6.11	2.93	13.32
4-Cattle Drive Road	5.41	4.07	6.89
Aquaculture Facilities Discharge Between 3-Selman & 4-Cattle Drive Road			
3-Selman Farm	0.79	0.25	1.91
2-Shoo Fly Road	0.30	0.01	1.26
1-Vaught Road	0.41	0.00	2.11
0-USGS Weir (Gage)	0.00	0.00	0.00
Q = Jacks Creek stream flow (Q).			

As previously noted, approximately 85% of the fish farm effluent is reused as cropland irrigation; and seldom reaches Jacks Creek, so the flow downstream of 4-Cattle Drive Road in through 7-Wetland and 7-Main monitoring sites is cumulative, increasing due to the agricultural cropland tailwater discharge.

From the Jacks Creek TSD (i.e. Table 38) it is noted that the average flow values for the Arraina fish hatchery is 4.4 cfs effluent; and for the Ace Development fish hatchery is 2.7 cfs effluent. The summation of both these effluent flows is 7.1 cfs (i.e. 4.4 cfs + 2.7 cfs = 7.1 cfs). If 85% of this flow does not reach Jacks Creek (or 15% reaches Jacks Creek), then approximately 1.065 cfs (i.e. 7.1cfs x 0.15 = 1.065 cfs) potentially discharges to Jacks Creek.

However, if we consider the application of the conservative irrigation efficiency of 90% (as gravity-fed) at the point just downstream where both these geothermal water sources may discharge into Jacks Creek, the estimated "tailwater discharge" is 0.1065 cfs (i.e. 1.065 cfs x 0.10 = 0.1065 cfs) into Jacks Creek. Taking the average flow at the 3-Selman Farm monitoring site (i.e. 0.79 cfs from Table 9); and adding the approximate 15% flow (i.e. 0.1065 cfs) that may end up as tailwater discharge in Jacks Creek; gives an approximate estimate of 0.8965 cfs that may be recorded at 4-Cattle Drive Road (as shown in Table 9 above).

However, the estimated 0.8965 cfs is less than the actual average flow of 5.41 cfs shown in Table 3 above; which means that other agricultural geothermal sources are discharging above 4-Cattle Drive Road beyond that of the fish farm effluent. Consequently, the flow discharge from the fish farms is much less than that from other tailwater sources that discharge into Jacks Creek.

High Flow and Storm water events

Jacks Creek experiences spring runoff during March-April, causing high flows and occasional flooding. Generally, the thaw is short-lived (less than a week although it could be longer), but during those events the riparian areas demonstrate erosion from the streambanks and the channel itself. In addition, flash flood events during summer months provide additional erosion to the streambanks of Jacks Creek. The flow events associated with storm water (both rainfall and snow fall) indicate a spike in the hydrograph for Jacks Creek that is typical of arid streams in the Pacific Northwest that are (1) high volume, (2) short-lived, and (3) of long-term duration between events.

DEQ investigated the historical USGS gage record and determined that Big Jacks Creek had a total of 48 confirmed storm events where the flow in the stream channel exceeded the 90th percentile peak flow (> 11.0 cfs). The flows during these storm driven events ranged from 19.0 cfs to 1210.0 cfs, with an average of 162.3 cfs. The number of days between each of these events ranged from 14 days to 1031 days (or 0.04 years to 2.82 years or an average of 1.02 years). In addition, the historical USGS gage information indicates that most of these storm events occur in the January to April period with the month of March being the most common. The historical record also shows that the months of July through December had little-to-none storm events.

Conclusions

DEQ will make the following revisions to meet the load capacities of the C. J. Strike TMDL and the Bruneau River TMDL:

- The 0.1 mg/L TP target on Jacks Creek will revert back to 0.05 mg/L TP as initially described in the Bruneau River TMDL. This water quality target supports and meets the C. J. Strike Reservoir TP target of 0.075 mg/L in the C. J. Strike TMDL provisions. It also meets the provisions described in the Bruneau River TMDL for the Jacks Creek drainage.
- The 90th Percentile flow (i.e. 2.320 cfs; from DEQ's Response 1B) will be used for the geothermal well sources that discharge into Jacks Creek. The 90th Percentile flow is more descriptive of the low flow scenario and consistent with the C. J. Strike TMDL and the Bruneau River TMDL.
- The conservative low flow scenario (i.e. 4.944 cfs; from DEQ's Response 1A) initially used in the Bruneau River TMDL for Jacks Creek will be retained as intended, thus maintaining consistency with the Bruneau River TMDL and the C. J. Strike TMDL.
- The 90th Percentile flow (i.e. 2.320 cfs) for the geothermal well sources plus the conservative low flow (i.e. 4.944 cfs) for Jacks Creek will be combined to more fully address the flow characteristics of Jacks Creek. Therefore, 2.320 cfs plus 4.944 cfs will give a flow estimate of 7.264 cfs (as previously noted in DEQ's Response 1C) for the Jacks Creek drainage as the low flow scenario.

EPA COMMENT 4.

> In Table 5, the TP load allocation for nonpoint sources was set at 0.88 lbs/day for FERC hydropower facilities, land application facilities, and CAFOs, while the load allocations for agriculture, grazing, private lands and the stream corridor were set at 0.00 lbs/day. This does not seem like a realistic NPS load allocation for Jacks Creek.

DEQ Response

DEQ has reviewed Table 5 in the Jacks Creek TMDL Modification (p 12) and has concluded that it incorrectly assigned the load allocation in the TMDL Components to FERC, LAFs, CFOs as 3,601.5 lb/day TSS, 0.88 lb/day TP and 478.5 cfu/day *E. coli* and zero to Ag, Graze, Private, Corridor. The load allocations should have been reversed. Table 10 below shows the previous recommendations. The new Table 5 shows the revised loads to be incorporated in the Jacks Creek TMDL Modification – Public Comment Draft.

Table 10. "Previous Jacks Creek overall TMDL LA and WLA recommendations"

TMDL COMPONENTS	TSS, lb/day	TP, lb/day	E. coli, CFU/day
NONPOINT SOURCES			
FERC, LAFs, CFOs	0.0	0.00	0.0
Ag, Graze, Private, Corridor	3,601.5	0.88	47.5
Stormwater – Construction – 2%	73.5	0.02	1.0
NPDES PERMITTED POINT SOURCES			
Ace Development FH	218.7	2.90	0.0
Arraina Inc. FH	356.4	4.70	0.0
MARGIN OF SAFETY & LOADING CAPACITY			
Margin of Safety – 10%	472.2	0.94	5.4
Loading Capacity	4,722.3	9.44	53.9

E. coli = Escherichia coli. TSS = Total Suspended Solids. TP = Total Phosphorus. WLA = Wasteload Allocation for an NPDES permitted point source facility. Seasonal variation is not a component in the Jacks Creek TMDL Modification at this time.
FERC = Federal Energy Regulatory Commission permitted hydropower facilities. LAFs = Land Application Facilities. CFOs = Confined Feeding Operations like dairies and feedlots of all sizes. Ag = All agricultural cropland and farmland combined. Graze = All grazing lands. Private = All privately owned lands. Corridor = All stream corridor components associated with Jacks Creek. FH = Fish Hatchery.

Therefore, Table 5 in the Jacks Creek TMDL Modification (Public Comment Draft) will be corrected accordingly. However, based on DEQ's Responses 1, 2, 3 and 4, and subsequent Response 5, Table 5 in the Jacks Creek TMDL Modification (Public Comment Draft) must be changed to reflect the necessary changes in the loading capacities for TSS, TP and *E. coli*.

Table 11 below provides the necessary changes and which will be included in the revision of the Jacks Creek TMDL Modification as previously calculated in DEQ's Response 1D. The wasteload allocations for the fish farms are based on the Jacks Creek TMDL Modification – Public Comment Draft, Section V, pages 8-9 for TSS, TP and *E. coli*.

Table 11. "Revised Jacks Creek overall TMDL LA and WLA recommendations".

TMDL COMPONENTS	TSS, lb/day	TP, lb/day	E. coli, CFU/day
NONPOINT SOURCES			
FERC, LAFs, CFOs	0.0	0.00	0.0
Ag, Graze, Private, Corridor	1,645.30	0.59	19.8
Stormwater – Construction – 2%	33.58	0.01	0.4
Nonpoint Source SubTotal	1,678.89	0.60	20.2
NPDES PERMITTED POINT SOURCES			
Ace Development FH	[218.70]	[2.90]	[0.0]
85% Effluent Reuse from Ace	32.81	0.44	0.0
Arraina Inc. FH	[356.40]	[4.80]	[0.0]
85% Effluent Reuse from Arraina	53.46	0.72	0.0
NPDES Point Source Subtotal	86.27	1.16	0.0
MARGIN OF SAFETY & LOADING CAPACITY			
Margin of Safety – 10%	196.13	0.20	2.2
Loading Capacity	1,961.28	1.96	22.4

E. coli = Escherichia coli. TSS = Total Suspended Solids. TP = Total Phosphorus. WLA = Wasteload Allocation for an NPDES permitted point source facility. Seasonal variation is not a component in the Jacks Creek TMDL Modification at this time.
FERC = Federal Energy Regulatory Commission permitted hydropower facilities. LAFs = Land Application Facilities. CFOs = Confined Feeding Operations like dairies and feedlots of all sizes. Ag = All agricultural cropland and farmland combined. Graze = All grazing lands. Private = All privately owned lands. Corridor = All stream corridor components associated with Jacks Creek. FH = Fish Hatchery.
85% Effluent Reuse for Ace and Arraina = 85% of the effluent is reused as cropland irrigation and never reaches Jacks Creek. It is estimated that only 15% of the effluent discharges to Jacks Creek.

Zero Allocations for FERC, LAFs, and CFOs

The reason for the load allocation of zero to FERC, LAFs, CFOs is based on the following rational, which has been used extensively in all of the approved TMDLs in Southcentral Idaho:

- FERC licensed facilities do not generate TSS, TP of E. coli.Consequently, they are assigned a load allocation of zero. Facility operators from FERC licensed facilities have never questioned the zero allocation and consequently support the approach.
- LAFs, or Land Application Facilities, are generally categorized into four groups: (1) Complete Containment Lagoons (or Evaporative Lagoons) which have zero discharge; (2) historical Rapid Infiltration Basins (RIBs) which discharge to groundwater (and not surface water) but are generally not endorsed by DEQ without adequate justification; (3) Discharging Lagoons through an outfall to a surface water which require a NPDES permit; and (4) Land Application Permitted Facilities that discharge to agricultural soils with a growing non edible crop with specific permit terms and conditions. The types of land application facilities that are defined as zero dischargers are those that do not discharge to surface waters. These are assigned a load allocation of zero. If there is a discharge from any land application facility to surface water, then it would require an NPDES permit; thus formalizing it as a point source discharger.
- CFOs, or Confined Feeding Operations, inclusive of all-sizes of dairies, feedlots and confined animal operations, are not allowed to discharge to waters of the State of Idaho. They are, however, permitted under an NPDES permit for a 24-hour, 25-year discharge on a one-time basis. Consequently, they are assigned a load allocation of zero.

EPA COMMENT 5.

> On page 12, Section VIII, it is stated "Application of a seasonal component into the TMDL for Jacks Creek was not considered because little information existed to allow for this." A discussion of seasonal variation is a required component of a TMDL.

DEQ Response

DEQ recognizes that a discussion of seasonal variation is a required component of all TMDLs. Section VIII in the Jacks Creek TMDL Modification provides the basis for what is known now. Essentially, little information exists to allow seasonality to be considered.

> Since little information exists, DEQ is suggesting that seasonal variation not be considered until such information is collected to confirm it. Current data suggest there is no seasonal variation, thus the seasonal variation is zero. DEQ will review the seasonality issue in future iterations of the Jacks Creek TMDL

Future modifications may require seasonal considerations but will be deferred until more information is provided to justify them. However, the following discussion provides justification for future seasonality considerations and also provides justification regarding the 85% fish farm effluent reuse as previously discussed and points to the fact that seasonality in the Jacks Creek drainage is very complex.

Bruneau River TMDL Considerations

The Bruneau River TMDL states the following on seasonality based on the pollutant-of-concern:

- Section 3.2.2.1, page 96, "With the apparent year-round elevated loadings of TP from a variety of sources, no seasonal component can be clearly seen." Therefore, no indications of seasonality are suggested.

- Section 3.2.2.3, page 96, “Bacterial contamination occurs almost year-round.” Therefore, no indications of seasonality are suggested.
- Section 3.1.4, page 94, “Jacks Creek is the lone exception in the subbasin in that it is seasonally affected by excess suspended sediment.” And in Section 3.2.2.4, page 97, “suspended sediment is elevated in Jacks Creek in the early spring during higher flows. The potential beneficial use impairment from this seasonal spike is warm water biota and recreational use.” Therefore, some seasonality is expressed by suspended sediment, but only because of the seasonal spike in the early spring during higher flows, which is illustrated in Figure 1 (Big Jacks Creek) and Figure 2 (Little Jacks Creek) in Response 3.

Irrigation Season Considerations

Because this information on seasonality is very limited, DEQ provides the following additional information after a discussion with the owner of both fish facilities. Figure 6 below summarizes the various water sources that may be involved with irrigation and fish propagation for the Bruneau Cattle Company and Harley Ranches (the legal water right holders for fish propagation). In addition, the surface water source from Big Jacks Creek and Little Jacks Creek is not utilized for fish propagation since only the groundwater sources nearest Jacks Creek are used for fish propagation. Figure 6 also notes that two designation periods for irrigation water rights are established: (1) those from March 15 to November 15 and (2) those from April 1 to October 31. Fish propagation is designated from January 1 to December 31. This means the period from November 15 to March 15 has no irrigation designation.

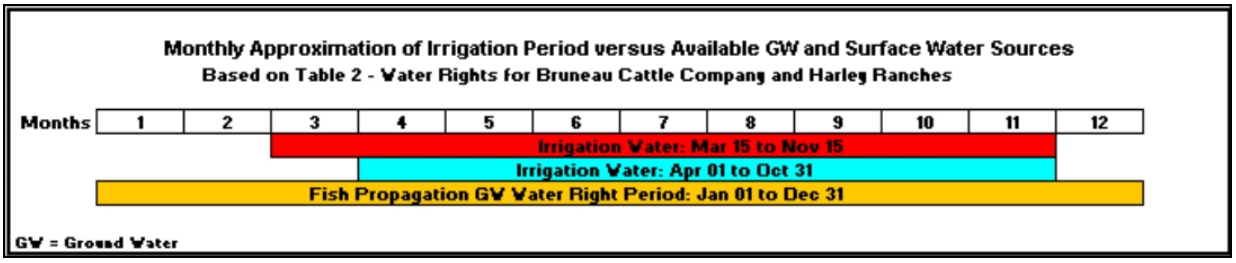


Figure 6. Monthly approximation of Irrigation Period based on Water Rights,

Based on information provided in the Jacks Creek TSD and additional information from the facilities’ owner, agricultural seasonality as best understood presently may best be described as follows:

Jacks Creek Natural Mainstem Seasonality

As shown in Table 4 (p 30) of the Jacks Creek TSD, the water pattern characteristic of Jacks Creek is generally of the following categories: (1) March to May is generally wet and (2) June to February is generally dry. That period may be expanded, based on the USGS Big Jacks Gage (USGS 13169500), from February to June, as depicted in Figure 6 above. This means that the Jacks Creek stream channel is generally dry 75% of the time because the annual higher flow event historically occurs in the March to May period (although it has been noted on occasion in February and June). This was reconfirmed by DEQ with the owner of the fish facilities, IDWR, the ISCC-Bruneau Field Office and other local Jacks Creek landowners.

Agricultural Discharge Seasonality

Figure 6 above points to a level of seasonality based on the water supply use in the Jacks Creek drainage from groundwater wells and whatever water may get past the USGS Weir. As previously explained, if the agricultural community relied solely on water coming from Big

Jacks Creek and Little Jacks Creek during the March to May higher flow period, then during the June to October period, when agriculture is in peak demand, the Jacks Creek mainstem would be little used as a water source because it would be dry.

Consequently, the agricultural community relies heavily on the geothermal wells as their primary water supply during the irrigation season. That practice has been historically in place since the 1940s and continues at the present time. This is discussed in the Jacks Creek TSD (pages 18 and 29). On page 30 of the Jacks Creek TSD DEQ concludes, "The major source of water to Jacks Creek in the agricultural zone is irrigation water that comes from geothermal artesian wells. Most water along Jacks Creek during the spring and summer comes from irrigation tailwater sources, which originally comes from the artesian geothermal wells."

The seasonality of Jacks Creek as an agricultural discharge from various cropland tailwater provides evidence, both historic and current, that the stream channel is used as a canalway since the 1930s. Essentially, the Jacks Creek channel has historically evolved into a canalway as a conveyance for irrigation water from the tailwater discharge from the various farms that discharge to it. The Jacks Creek TSD (page 31) stipulates that "all farms along Jacks Creek discharge directly to Jacks Creek through their irrigation tailwater. It is estimated that 100% of the farm water that discharges to Jacks Creek is from artesian wells that are near the stream or that originate from as far as 4 miles away." Associated with this aspect and associated components that result from a channelized canalway, and based on an extensive discussion in the Jacks Creek TSD, DEQ affirms that the Jacks Creek channel is indeed a canalway based on its historic and present agricultural use. It is only during the non-irrigation season, but especially during the high flow early spring months that water in the channel is principally from Big Jacks Creek and Little Jacks Creek. As such, five (5) areas of agricultural operations or practices point to Jacks Creek functioning as a canalway based on the Jacks Creek TSD: (1) row-crop cultivation (page 38); (2) livestock grazing (page 38); (3) storm water erosional events (page 38); (4) stream channelization (page 38); and (5) artesian geothermal warm water erosion (pages 38-39).

Aquaculture Discharge Seasonality.

Both the Ace and Arraina fish facilities operate 12 months of the year and grow all life stages of tilapia on both farms (as well as other warm water species). However, the operation of both facilities does not involve discharges into Jacks Creek 12 months of the year. This creates a complexity of sorts in understanding exactly when the fish farms discharge directly into Jacks Creek. This is also discussed in the Jacks Creek TSD (page 24).

The conclusion drawn is that approximately 85% of the fish farm effluent from both facilities is re-used for "cropland irrigation prior to discharge." This may be confirmed with the beneficial use definitions for both irrigation and fish propagation in the IDWR water right for both fish farms. The 85% reuse of the effluent for cropland irrigation is restated in the Jacks Creek TSD (page 31): "at least 85% of their effluent is used for cropland irrigation".

This is reiterated again on page 82 of the Jacks Creek TSD: "The only point sources on Jacks Creek are the Ace Development and Arraina Inc. facilities; both facilities discharge to Jacks Creek, but a major portion of their effluent (about 85%) is utilized for cropland irrigation." This means approximately 85% of the effluent never reaches Jacks Creek during the period (in the summer) when the effluent is reused for agricultural discharge to the cropland.

Water Rights and Water Supply Use

DEQ visited with the owner of the fish farms; who in turn verified the reuse aspects of the geothermal water with the water rights owner(s); and both provided some additional

information that aids in the discussion on seasonality as well as the 85% reuse of the cropland irrigation. The Bruneau Cattle Company and Harley Ranches legally own the geothermal water sources that feed the two fish farms. The Ace facility utilizes a 3000 GPM water right; and the Arraina facility utilizes a 5 cfs water right (Jacks Creek TSD, Table 2, p 20). Both fish propagation water rights are secondary non consumptive uses since cropland irrigation is the primary consumptive use.

The agricultural period generally runs from April 1st through November 15th as the widest irrigation window (as previously shown in Figure 6). This means that the fish farms have an agreement with the Bruneau Cattle Company and Harley Ranches to use the consumptive irrigation water for non consumptive aquaculture fish rearing. In turn, the Bruneau Cattle Company and Harley Ranches utilize the same non consumptive fish farm effluent water as reuse irrigation water on their alfalfa and cropland fields. DEQ investigated and ground truthed this relationship with IDWR as well as on the fish farm sites and noted that:

- Ace Development Fish Farm. The geothermal wells are plumbed through a system that places the warm water in temperature mitigation pond. From here, the water is moved to a series of fish tanks, from which it is then moved to some large ponds. The water is re-circulated to the fish tanks from the large ponds or else move to the raceways where it is moved to a full flow settling pond. During the winter, some of the water is pump for stockwater; but during the irrigation season the water is pumped for irrigation. According to both the owner of the fish farm and the water rights owner, approximately 85% of the water from the full flow settling pond is reused for cropland irrigation. Approximately 15% is returned to Jacks Creek.

- Arraina Fish Farm. The geothermal wells are plumbed through a system that places the warm water in some temperature mitigation ponds. From here the water is moved through a series of raceways which is then re-circulated to some temperature mitigation ponds. Then, the water is moved to a large conditioning pond, from which the water is pumped for cropland irrigation or else discharged into Jacks Creek. According to both the owner of the fish farm and the water rights owner, approximately 100% of the water from the large conditioning pond never reaches Jacks Creek because it is immediately used for cropland irrigation during the irrigation growing season.

- Bruneau Cattle Company and Harley Ranches. The Bruneau Cattle Company and Harley Ranches are high alfalfa-high production facilities that operate from approximately April 1st through October 31st (or longer depending on the growing season). The amount of alfalfa-hay that is grown is based on four (4) cuttings per season. Normally, there is about a one (1) week shut down period during each cutting. In the Pacific Northwest, alfalfa-hay has the most water applied use than most other crops; averaging 2.5 feet per acre of water or more.

  Because of the nature of the arid soils in the Jacks Creek drainage, consistent maintenance of water at 75% field capacity is critical for alfalfa-hay production to produce an average yield of 4-5 tons per acre under 4 cuttings. Thus, much of the water collected at the full flow settling pond for Ace Development and the conditioning pond for Arraina does indeed get used up for alfalfa-hay irrigation during the irrigation growing season.

  DEQ confirmed this use of the water on numerous occasions during the 2004 season as solid set sprinkler pipes and wheel lines were used to deliver the water accordingly. DEQ noted that little discharge occurred during the irrigation crop season from both fish farm facilities; and therefore assumes that the actual delivery of fish farm effluent water is conservatively speaking about 85% for both facilities. Consequently, Table 5 above (in DEQ's Response 4) provides the estimate of this 85% cropland delivery as a 15% discharge

to Jacks Creek for both facilities (even though it is highly probable that the actual effluent discharge to Jacks Creek may be less than 15%).

As described in the Jacks Creek TMDL Modification, Arraina Fish Farm has a flow of 4.4 cfs and the Ace Fish Farm has a flow of 2.7 cfs. Therefore, the total flow for both facilities is 7.1 cfs. DEQ assumes that the discharge from the fish farms alone contribute a combined total of 7.1 cfs of the streamflow as geothermal groundwater (assuming the 7.1 cfs completely discharges into Jacks Creek). The 7.1 cfs does not represent a minimum, mean or maximum streamflow for Jacks Creek; but rather the average effluent discharge from both facilities (as confirmed by the fish farm owner) that could potentially enter Jacks Creek. But only 15% of the 7.1 cfs discharges into Jacks Creek, since 85% is utilized as reuse for crop irrigation prior to any discharge into Jacks Creek. Additionally, other geothermal agricultural dischargers exist upstream and downstream of the fish facilities and these also contribute to Jacks Creek stream flow.

DEQ the various water rights associated with the Bruneau Cattle Company and Harley Ranches, who are the legal water right owners of the water utilized for fish propagation for Ace and Arraina fish farms, prior to cropland irrigation. Table 6 summarizes the various source waters, the various water right beneficial uses, and the time period of diversion use for each source water that is associated with Jacks Creek for the Bruneau Cattle Company (for Ace Development) and Harley Ranches (for Arraina).

Table 12. Water Rights Summaries for Bruneau Cattle Company and Harley Ranches.

source water	beneficial use	time period of diversion
Bruneau Cattle Company		
Ground Water	Irrigation	April 1 to October 31
		March 15 to November 15
	Stockwater	January 1 to December 31
	Domestic	January 1 to December 31
	Fish Propagation	January 1 to December 31
Jacks Creek	Irrigation	March 15 to November 15
Waste Water	Irrigation	March 1 to November 15
Harley Ranches		
Ground Water	Irrigation	April 1 to October 31
		March 15 to November 15
	Stockwater	January 1 to December 31
	Domestic	January 1 to December 31
	Fish Propagation	January 1 to December 31
Jacks Creek	Irrigation	March 15 to November 15
Waste Water	None	None

Source Water = the source of the water used for the intended beneficial use.
Beneficial Use = the use of the water as defined by IDWR regulations for the water right.
Time Period of Diversion = the time period in which the water is being diverted for the intended use.
Irrigation = a water right beneficial use that deals with agricultural irrigation for croplands and grazing lands.
Stockwater = a water right beneficial use that deals with watering for cattle.
Domestic = a water right beneficial use that deals with watering for human use.

Table 7 below accounts for the total amount of water used for irrigation and that used for fish propagation. However, cropland irrigation is the principal use followed by fish propagation as a secondary use to irrigation.

Table 13Water Rights for irrigation and fish propagation for Bruneau Cattle Company (Ace Development Fish Hatchery) and Harley Ranches (Arraina Fish Hatchery)

Water rights number & Owner	DIVERSION RATE, cfs		SOURCE	USE: TIME OF USE
	TOTAL1	FP TOTAL2		
ARRAINA FISH HATCHERY3				
51-07102A Harley Ranches		1.90	Groundwater	FP: Jan 01 to Dec 31
51-07064A Harley Ranches	1.00	1.00	Groundwater	Irr: Apr 01 to Oct 31 FP: Jan 01 to Dec 31
51-07064B Craig L. Christensen	0.66		Groundwater	Irr: Apr 01 to Oct 31
51-07102B Craig L. Christensen	1.90	1.90	Groundwater	Irr: Apr 01 to Oct 31 FP: Jan 01 to Dec 31
Sub Total	3.56	4.80	-	-
ACE DEVELOPMENT FISH HATCHERY4				
51-07118 Bruneau Cattle Co.		3.20	Groundwater	FP: Jan 01 to Dec 31
51-02164 Bruneau Cattle Co.	2.00		Groundwater	Irr: Mar 15 to Nov 15
51-02117 Bruneau Cattle Co.	4.48		Groundwater	Irr: Mar 15 to Nov 15
51-02113 Bruneau Cattle Co.	7.89		Groundwater	Irr: Apr 01 to Oct 31
51-7013 Donald L. Davis	1.27		Groundwater	Irr: Apr 01 to Oct 31
Sub Total	15.64	3.20	-	-
COMBINING BOTH FISH HATCHERY WATER RIGHTS				
Total	19.20	8.00	Groundwater	FP: Jan 01 to Dec 31 Irr: Mar 15 to Nov 15 Irr: April 01 to Oct 31

Jan = January. Apr = April. Oct = October. Dec = December. Irr = Irrigation. FP = Fish Propagation.
1Total = Irrigation + Fish Propagation total volume.
2FP Total = Fish Propagation volume.
3Arraina Fish Hatchery: The principal water right for fish propagation is 51-07102A. Additional water rights
4Ace Development Fish Hatchery: The principal water right for fish propagation is 51-07118 because its water use is specific for fish propagation. The remaining water rights (i.e. 51-02164, 51-02117, 51-02113 and 51-7013) are diverted through the same point of diversion as water right 51-07118.

Based on the flow volumes used in the Jacks Creek TMDL Modification – Public Comment Draft document (i.e. 4.4 cfs for Arraina and 2.7 cfs for Ace Development, or a total of 7.1 cfs for both), we may conclude that the total water rights allocation for both facilities (i.e. 8.00 cfs) is greater than that used in the development of the wasteload allocation calculations. The difference of 0.90 cfs (i.e. 8.00 cfs – 7.1 cfs = 0.90 cfs) is attributed to leakage and evaporation; which represents an 11.3% water loss for both water sources. This may be confirmed in IDWR's Fact Sheet for various water rights in the Jacks Creek drainage that stipulate the land to be a very sandy loam requiring large amounts of water resulting in ditch losses. For the Bruneau Cattle Company and Harley Ranches, the approved IDWR Application for Permit states that during the irrigation season, "usually from March 15 to November 15th, the flow into the settling pond is pumped for irrigation purposes".

Therefore, DEQ hypothesizes that the non consumptive water use volume may be best described as follows:

Non consumptive Water Volume = Input – (Leakage + Evaporation) = Output

Where, Input = 8.00 cfs Water Right Allocation

Output = Potential discharge to Jacks Creek

Or, 7.2 cfs = 8.00 cfs – (Leakage + Evaporation)

Leakage + Evaporation = 0.90 cfs

Since, 85% of this water (i.e. 7.2 cfs) is reused for cropland irrigation; and since 15% represents an estimate of what is delivered to Jacks Creek during the irrigation season, the overall Output to Jacks Creek may best be described as follows:

Non consumptive Water Volume = Input – (Leakage + Evaporation) – 85% Reuse

PHOTOGRAPHS OF THE JACKS CREEK DRAINAGE



Photo 1. C. J. Strike Wildlife Management Area where Jacks Creek receives backflow from the C. J. Strike Reservoir.



Photo 2. Jacks Creek in the C. J. Strike Wildlife Management Area, just above the discharge area into the C. J. Strike Reservoir.



Photo 3. Jacks Creek channel at Highway 78 prior to entering the C. J. Strike Wildlife Management Area.



Photo 4. Jacks Creek at Cattle Drive Road.



Photo 5. Temperature mitigation ponds at Arraina Fish Hatchery that hold water for cropland irrigation reuse. 15% of this water may discharge into Jacks Creek.



Photo 6. Ace Development Fish Hatchery groundwater well source. 15% of this water may discharge to Jacks Creek. 85% of this water may be reused for cropland irrigation.



Photo 7. USGS Weir where Big Jacks Creek and Little Jacks Creek merge to form Jacks Creek. The stream is dry during most times of the year.