U.S. Fish and Wildlife Service

2015 Taneum Creek Steelhead Migration Review

Technical Report

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On the Cover: *Taneum Canal Company dam showing PIT tag detection antenna in white PVC pipe near the upstream end of the fishway.*

2015 Taneum Creek Steelhead Migration Review

Study funded by

U.S. Bureau of Reclamation
Yakima River Basin Water Enhancement Project
Columbia-Cascades Area Office
1917 Marsh Road
Yakima, WA 98901
Interagency Agreement # R13-PG-13-416

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2015 TANEUM CREEK STEELHEAD MIGRATION REVIEW

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Abstract

In 1994, an agreement was developed among the US Bureau of Reclamation, Kittitas Reclamation District (KRD), Bonneville Power Administration, Yakama Nation, and Washington Department of Fish and Wildlife with the purpose of supplying water to Taneum Creek to enhance fishery resources. Historically, the creek was appropriated for irrigation and stock water, leaving it dewatered below the Taneum Canal Company (TCC) diversion dam for long time periods. According to the agreement, when the KRD canal system had adequate capacity Yakima Project water was delivered to Taneum Creek via the KRD South Branch Canal, boosting stream flows in dewatered reaches. In 2015, the state of Washington declared a drought emergency following a drastic decline in snowpack in the Cascade Mountains. Drought conditions led TCC to start diverting water on April 1, much earlier than usual. Consequently, stream flows in the creek during the adult steelhead trout (*Oncorhynchus mykiss*) migration period fell below 10 cfs. This report describes steelhead spawning migration behavior during 2015 based on PIT-tag detections at the mouth of the creek (TAN) and at the TCC diversion dam. Steelhead migration behavior was related to water management actions including flow enhancement by KRD. During the first two weeks of April, irrigation diversions likely limited the ability of fish to migrate in to the creek. The average travel time for fish from the TAN site to TCC (2.0 miles, 3.2 Km) during April was 11.25 days. In contrast, the average travel time between the two sites in May was 2.11 days, and similar data collected in 2013 showed steelhead travel times between the sites averaged 1.3 days. Delayed spawning may decrease reproductive fitness, particularly for female fish, as egg quality declines post-ovulation. Adult steelhead appeared to migrate upstream in response to flow supplementation from the KRD canal system. Flow measurements taken by WDFW along with PIT tag data indicated a minimum flow of 30 cfs may should be investigated as providing adequate fish passage. Flows low enough to impede adult passage can occur in non-drought years, thus future operations should consider coordination of irrigation activities during spring to reduce the potential for steelhead trout to experience migration delays.

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Introduction

In 1994, as part of the Yakima River Basin Water Enhancement Project (YRBWEP), the Kittitas Reclamation District (KRD) entered into an agreement with the Bureau of Reclamation, the Washington Department of Fish and Wildlife (WDFW), the Yakama Nation (YN), and the Bonneville Power Administration (BPA) to improve fish habitat in Taneum Creek, a tributary to the Yakima River in Kittitas County, Washington. This report reviews data and information related to the agreement, with the objectives of making recommendations for enhancing stream flows for fish migration and habitat.

Under the agreement, streamflows were enhanced by transporting up to 20 cubic feet per second (cfs) of Yakima Project water through the KRD canal system and delivering it to the creek via the Taneum Chute (Figure 1). The Taneum Chute conveys water from the KRD South Branch canal to Taneum Creek to supply Taneum Canal Company (TCC), which has both creek and KRD irrigation water rights. The agreement specified maintaining 6 cfs minimum flow in the creek below the TCC headworks as an "unofficial" Endangered Species Act flow goal (Appendix A). Historically, the section of Taneum Creek below the TCC diversion dam was dewatered during the summer months. Furthermore, fish passage and habitat improvements have substantially improved steelhead trout (*Oncorhynchus mykiss*) returns to the creek (Monk, 2015).

Flow enhancement under the 1994 agreement was typically implemented from June to October when streamflows were lowest. Flows supplied to the creek for fish enhancement were subordinated to KRD irrigation demands and were not always available. In recent years, flows in Taneum Creek fluctuated from 3 cfs to greater than 20 cfs during the summer months, based on data collected by WDFW (Table 1). In response to the 2015 drought, flow enhancement was initiated in late April, earlier than ever before.

Irrigation and stock water rights from Taneum Creek share a priority date of June 30, 1873. Currently, up to 82.6 percent of the creek flow is diverted when discharge is less than or equal to 98.0 cfs, with a maximum creek diversion quantity of 80.98 cfs (Mann Ditch is 3.4 percent, Taneum Canal is 79.0 percent, and Bruton Ditch irrigation diversion is 0.2 percent of creek flow). During the irrigation season, instream-flow trust water is 17.4 percent of available Taneum Creek water. Notably, the TCC irrigation water right can be exercised from February 20 to November 15 annually, which is a longer season than other Kittitas Valley water rights, most of which operate from mid-April through late October.

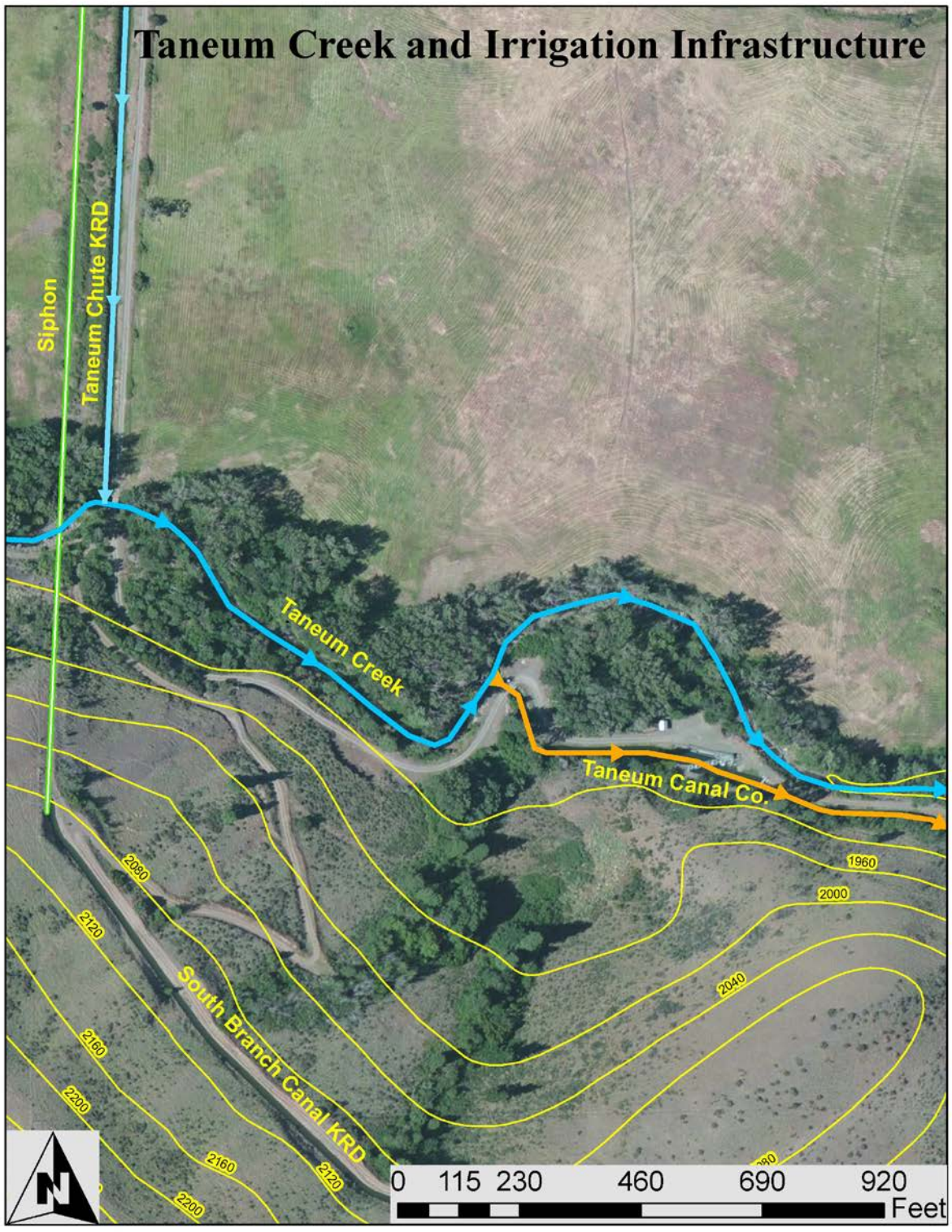

Figure 1. Water is delivered to Taneum Creek via the Taneum Chute on the KRD South Branch Canal, then diverted at the Taneum Canal Company headworks. The critical low flow reach of the creek is from TCC downstream 2.0 miles to the confluence with the Yakima River.

Materials and Methods

Water temperature and streamflow data were collected by Washington Department of Ecology (Brain Ranch Gage), KRD staff (Roger Satnik, pers. comm.), and WDFW (Jon Kohr, pers. comm.). U.S. Fish and Wildlife staff maintained PIT tag interrogation equipment. Fish were tagged by WDFW and YN Fisheries staff.

There were two PIT-tag interrogation sites on Taneum Creek in 2015. The main site was installed near the mouth of the creek about 45 m (150 feet) upstream of the confluence with the Yakima River. This site started operating on February 18, 2010, and has operated annually. The site has been non-functional periodically due to equipment failures, flood events, or for maintenance. This site was given the identification code "TAN" and listed as a small-scale interrogation site in the PTAGIS database, a regional repository for Columbia Basin PIT-tag data (www.ptagis.org). All PIT-tag codes collected at TAN were uploaded to PTAGIS weekly. Data for this report were obtained from PTAGIS and used to determine adult steelhead migration timing, direction of movement, and spawning location. Steelhead tag codes were entered in to the "complete tag history" function, and detailed observation records of adult steelhead detections at TAN were downloaded.

A second PIT tag interrogation site was established in the fishway of the Taneum Canal Company (TCC). Data from this site were uploaded to the PTAGIS database as "mark-recapture" data. Both sites at TAN and TCC were shut down during the winter of 2014–2015. The TAN site started operating on March 13, 2015, while TCC started collecting data on March 30.

Results

Figure 2 shows mean monthly flow in Taneum Creek measured at Washington State Department of Ecology's Brain Ranch Gage. Dominated by snowmelt, flows are usually highest during the spring. However, during the 2015 water year, much precipitation fell as rain instead of snow, even at high elevations. This is reflected in Figure 3, which shows Taneum Creek runoff higher than average during the winter but lower than average during spring 2015. Runoff in Taneum Creek declined from a mean monthly flow of 120 cfs in March to 32 cfs in May, opposite of the normal pattern.

Figure 4 shows flow in Taneum Creek measured at the KRD gage below the TCC fish screen return. On March 17, 2015, TCC began to divert a small amount of water. By April 6, flow in the creek below the irrigation diversion was approximately 10 cfs. From April 16 to18, flows increased to over 17 cfs, subsequently declined, and then increased from April 22 to 25, as the KRD canal began delivering water to the creek. Fish enhancement flows were not supplied steadily until May 4, when KRD and Reclamation maintained 20 cfs below the TCC for most of the spring (Figure 4).

Table 1. Flows measured in Taneum Creek by WDFW during the irrigation season at creek mile 1.4 near the Bruton Diversion 2011-2015 (Jonathan Kohr, WDFW). Monitoring was more frequent during the 2015 drought conditions.

Date	Flow Upstream of Bruton Diversion (cfs)
08/02/11	10.42
08/11/11	5.73
09/27/11	18.00
10/13/11	2.70
07/25/12	17.23
08/08/12	6.36
09/20/12	19.77
07/10/13	5.00
07/31/13	6.54
08/08/13	4.34
08/29/13	36.31
09/12/13	26.13
07/22/14	4.78
09/03/14	16.87
05/13/15	41.10
06/08/15	16.00
06/22/15	16.33
06/29/15	12.34
07/08/15	11.50
07/23/15	12.65
08/06/15	10.40
08/20/15	110.73*
09/02/15	109.54*
09/15/15	117.3*

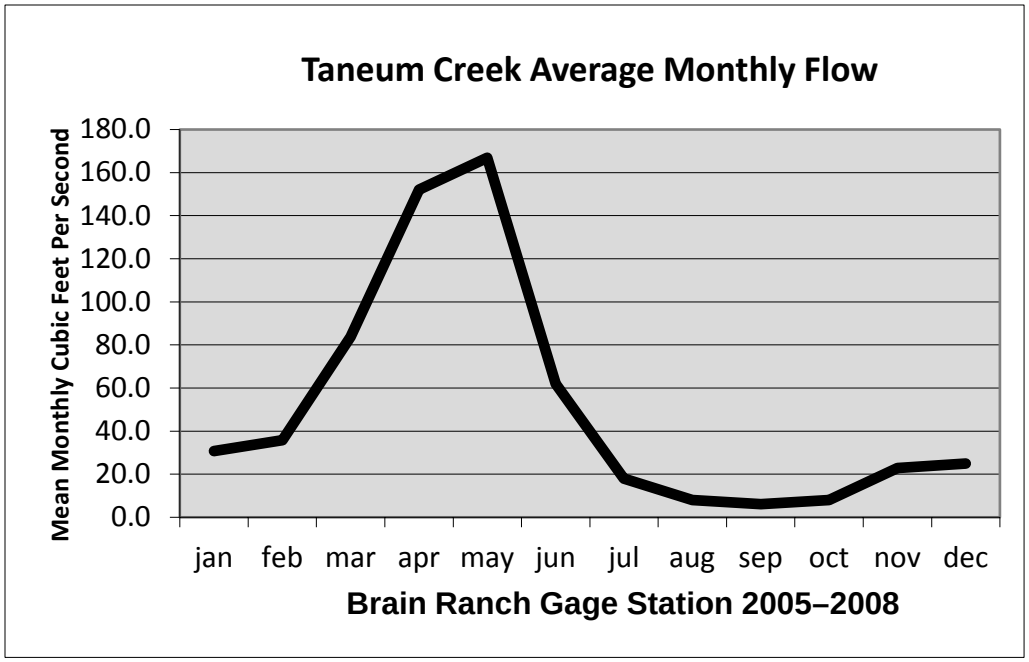

Figure 2. Mean monthly flow (cfs) in Taneum Creek for 2005–2008 data (Washington Department of Ecology Brian Ranch gage data). Flow enhancement under the 1994 agreement was typically implemented from June to October when streamflows were lowest.

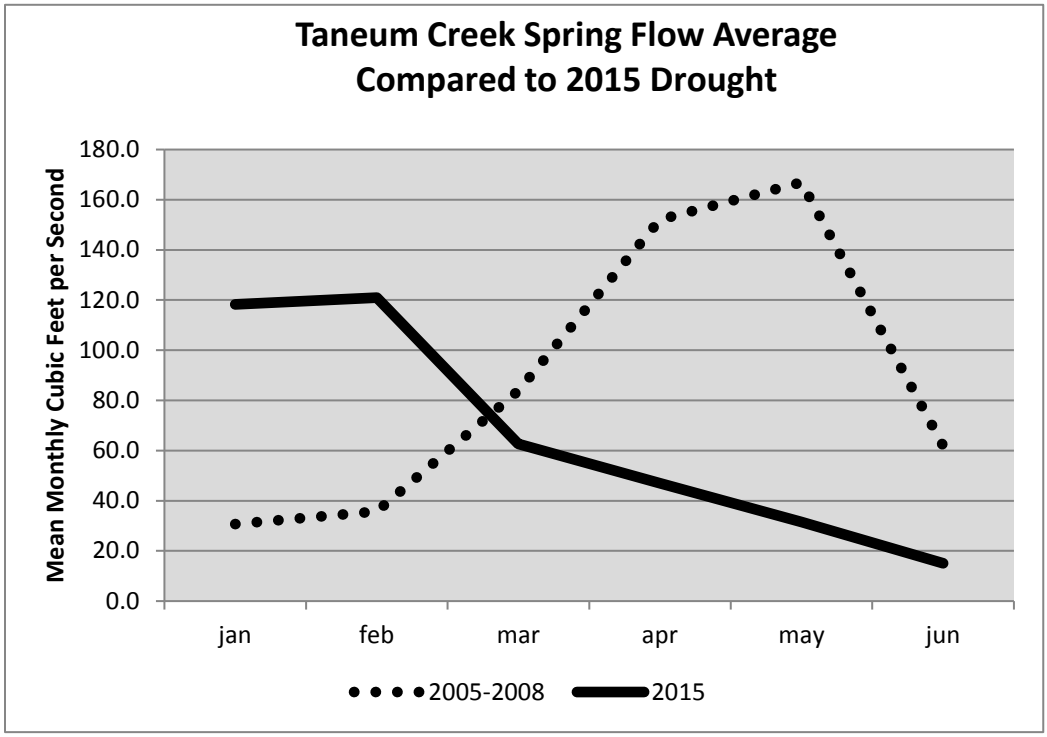

Figure 3. Mean monthly flow (cfs) in Taneum Creek for 2005–2008 data (Washington Dept. of Ecology Brain Ranch gage data). Flow enhancement under the 1994 agreement was typically implemented from June to October when stream flows were lowest.

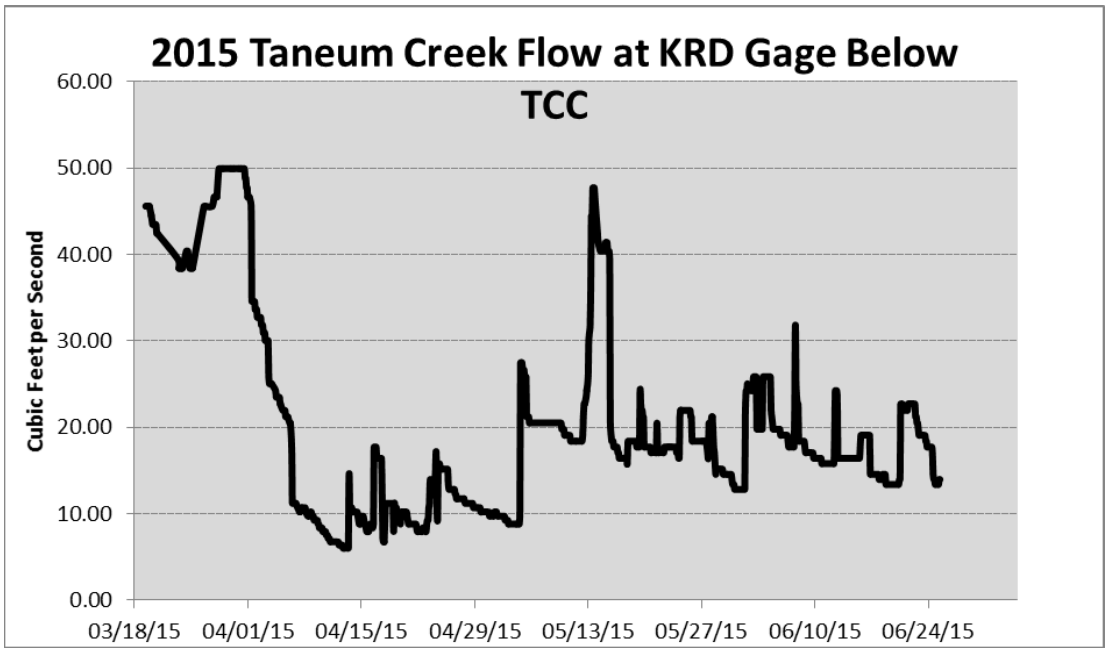

Figure 4. Taneum Creek instantaneous flows measured every 2 hours during spring 2015 below the TCC Diversion Dam and fish screen return (Roger Satnik, KRD, unpublished data).

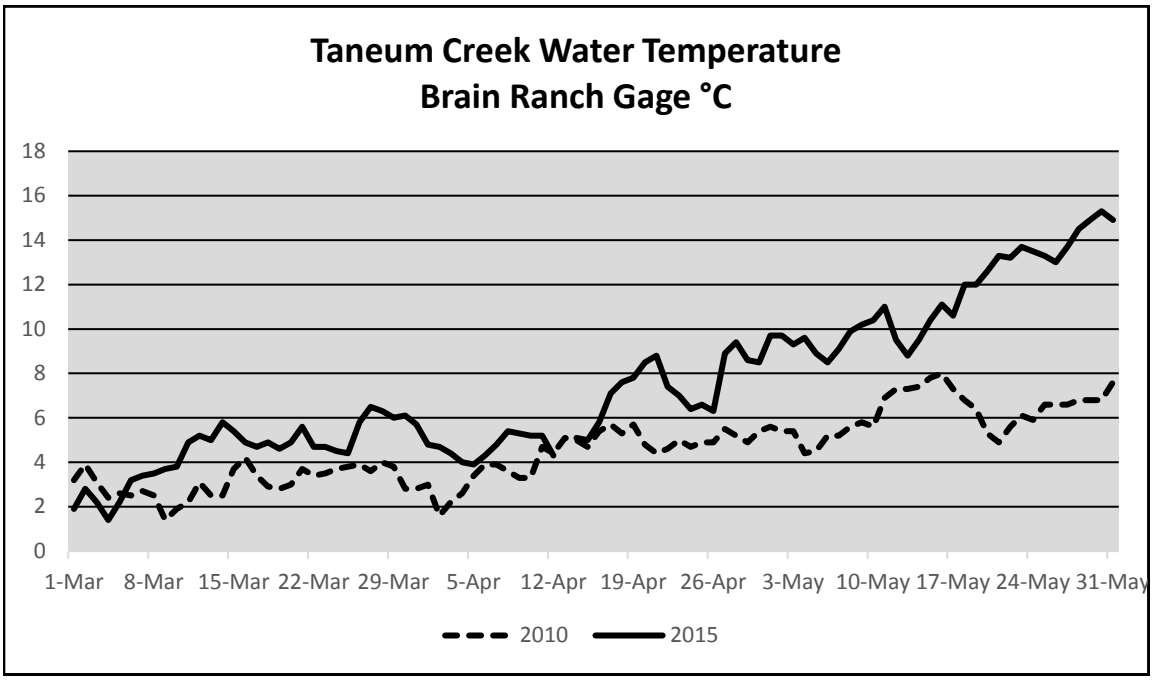

Figure 5. Taneum Creek water temperature in 2010 compared to 2015. Steelhead trout typically spawn in water temperatures ranging from 4 to 9 degrees centigrade (water temperature data for other years was not available).

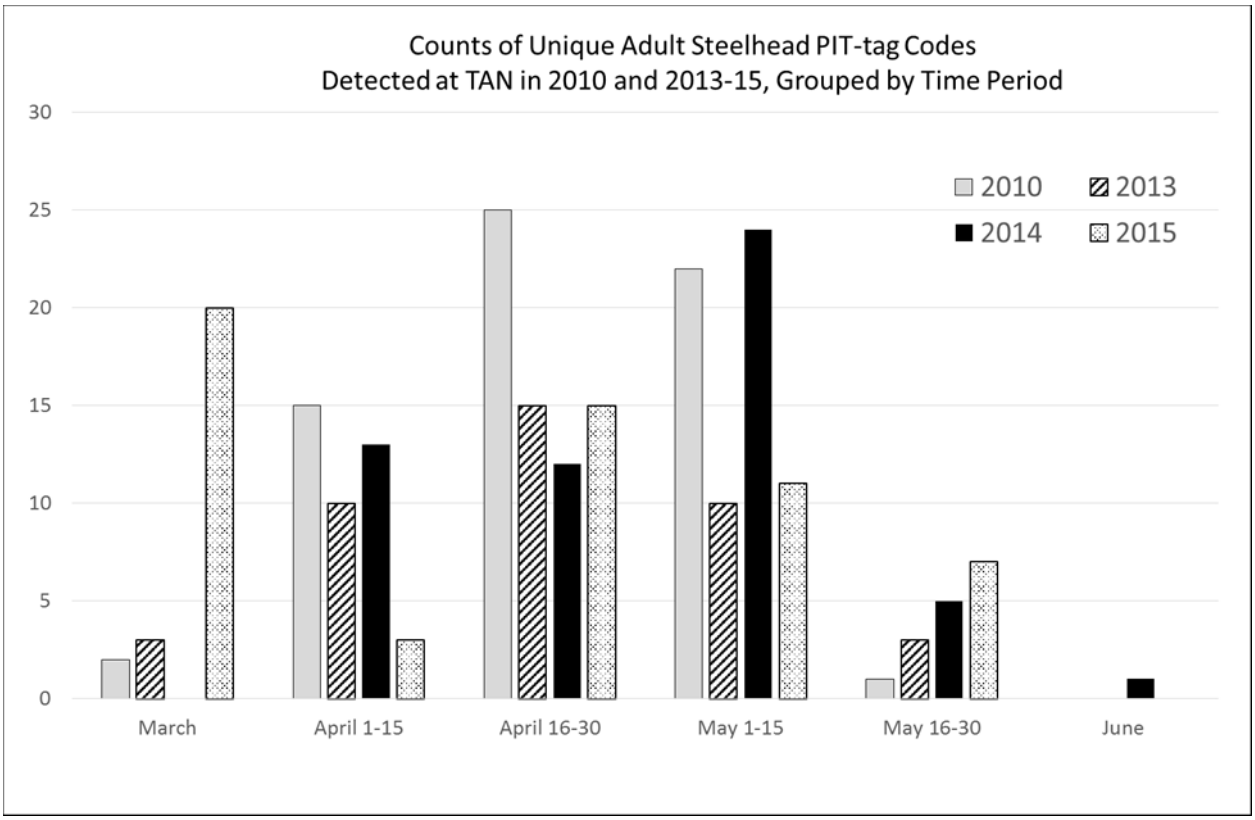

Figure 6. Adult steelhead PIT-tag counts grouped by time-period: 2010--2014 counts exhibit a normal distribution. In 2015, few fish were detected in early April during the time period of lowest stream flow in the creek.

Table 2. Count and percent of unique PIT-tag codes for adult steelhead detected at TAN by time period for 2010 compared to data collected in 2013 to 2015.

	2010		2013		2014		2015	
Time Period	Count	Percent	Count	Percent	Count	Percent	Count	Percent
March	2	3.1	3	7.3	0	0.0	20	35.7
April 1-15	15	23.1	10	24.4	13	23.6	3	5.4
April 16-30	25	38.5	15	36.6	12	21.8	15	26.8
May 1-15	22	33.8	10	24.4	24	43.6	11	19.6
May 16-30	1	1.5	3	7.3	5	9.1	7	12.5
June	0	0.0	0	0.0	1	1.8	0	0.0

Water temperatures during 2015 were also warmer than average. Steelhead typically spawn at temperatures ranging from 4 to 9 degrees centigrade, which were reached by mid-March, in contrast to 2010 when such temperatures were not reached until mid-April (Figure 5). Table 2 shows counts of adult steelhead detected at TAN (confluence) and TCC PIT tag interrogation sites during spring 2015. Adult steelhead were detected at Taneum Creek from March 18 through May 31, while fish were detected at TCC from March 31 through May 27.

Flow data was also evaluated for frequency of low flows during the spring migration period of March 15-June 6 (Figure 7) for the years 2006-2016, excluding 2011 through 2014 when such data were not available. Mean daily flows ranged from 16.0 to 549.0 cfs. Flows less than 100 cfs were observed in Taneum Creek approximately 50% of the spring steelhead migration period.

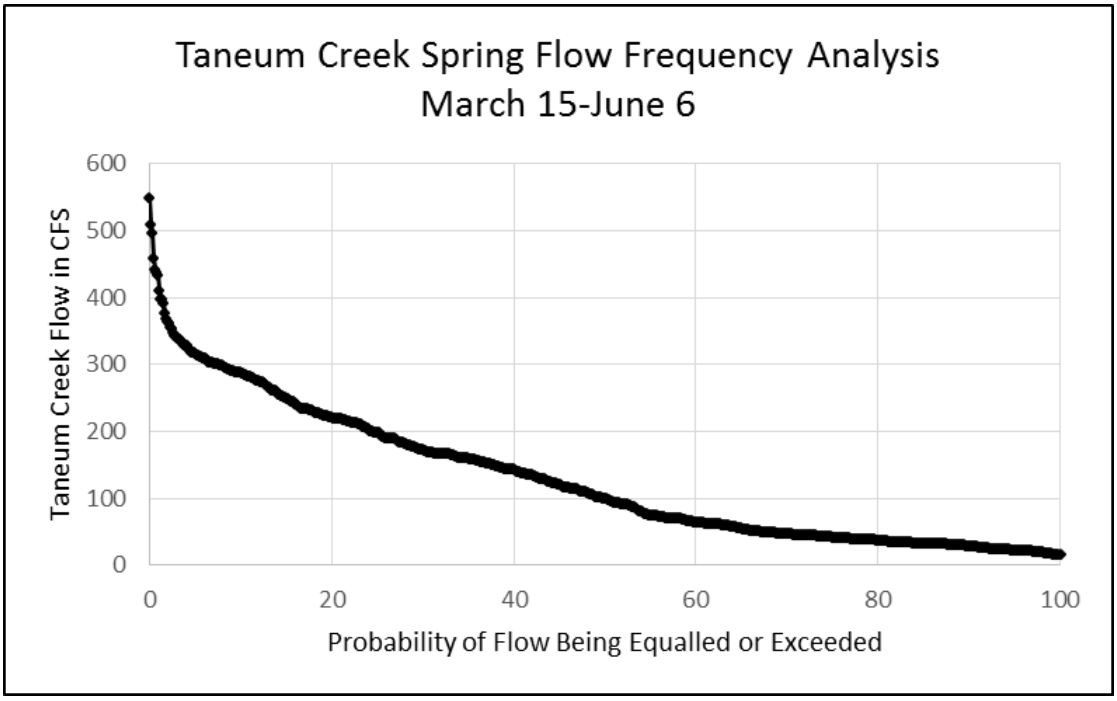

Figure 7. Taneum Creek mean daily flow frequency analysis for spring flows during steelhead migration season. Flows less than 100 cfs occur approximately 50% of the time. Data from Brain Ranch gage, 2006-2016, excluding missing years of 2011-2014.

Discussion

In 2015, a large proportion of steelhead entered Taneum Creek in March (Figure 5). Once stream flows below TCC fell to less than 10 cfs (Table 2) in early April, just three adults were detected at TAN during a two week time period. Compared to other years (Table 2) the lull in migration in early April 2015 appeared unusual. After April 15 water temperatures warmed considerably, motivating fish to spawn, and spikes in flow likely enabled fish to migrate upstream. Fish continued to enter the creek in May, when more substantial flow enhancement measures were in place.

The average travel time for fish from TAN to TCC, a distance of 2.0 miles (3.2 Km) during April was 11.25 days (see Table 3). In contrast, the average travel time between the two sites in May was 2.11 days. Similar data collected in 2013 showed steelhead travel time from TAN to TCC averaged 1.34 days (Monk 2015). Steelhead tend to travel faster as the spawning season progresses, so migration rates may have increased in response to factors other than improvements in flow. However, the lack of migrating fish in early April, low flows, and much longer travel times implied migration was impeded for most adult steelhead.

The consequences of delayed migration for adult spawners may be reduced fitness, particularly for females. One of the factors known to influence egg quality and the subsequent survival of offspring is the timing of fertilization relative to ovulation. Eggs undergo a series of changes following ovulation that generally render them less viable over time, a process termed overripening (Lahnsteiner 2000, Johnston et al. 2008). Egg viability for Rainbow Trout has been studied extensively due to their widespread use in aquaculture. Freshly ovulated eggs which had been retained in the coelomic cavity for 7, 14 and 21 days were investigated for aspects of morphology, physiology and biochemistry. Egg viability was significantly reduced from 85.9±16.4% in freshly ovulated eggs to 25.1±21.9% in over-ripened eggs. Decreases in viability can take the form of reduced rates of fertilization, hatching success, and increases in embryonic abnormalities. Significant delays in migration can reduce the reproductive fitness of female fish that have experienced ovulation.

Mean daily natural stream flows measured at the Brain Ranch gage from 2006-2016 were less than 100 cfs in Taneum Creek approximately 50% of the time, and were 60 cfs or less about 40% of the time. Thus, Taneum Canal Company operations may have the ability to affect steelhead migration more frequently than only in drought years, as cold weather and low or late runoff can also lead to low flow conditions.

Table 3. PIT-tagged adult steelhead trout migrating upstream past the TCC diversion dam in spring 2015; dates of first detection at TAN and TCC; and travel time between sites. *The sex of fish tagged as juvenile rainbow trout prior to ocean migration was not determined, but identified as adult steelhead by their migration history. Data were sorted by TCC first detection column.

Confirmed PIT-tag code	Sex*	TAN First Detection	TCC First Detection	Travel Time (days)
3DD.00774D7848	f	3/22/2015	3/31/2015	9
3D9.1C2DF46E97	f	3/21/2015	4/3/2015	13
3DD.00774D7587	f	3/28/2015	4/3/2015	6
3DD.00774C6716	f	3/27/2015	4/8/2015	12
3DD.00774DEFDA	f	4/8/2015	4/13/2015	5
3DD.00774DA84F	m	3/29/2015	4/18/2015	20
3D9.1C2DF44DD3	f	3/30/2015	4/18/2015	19
3DD.00774C510C	f	4/5/2015	4/18/2015	13
3DD.00774DE7E9	f	4/15/2015	4/18/2015	3
3D9.1C2D27849B	rbt	4/17/2015	4/19/2015	2
3DD.00774D61B3	f	4/17/2015	4/20/2015	3
3DD.00774D9A4F	f	4/19/2015	4/20/2015	1
3D9.1C2DAEBA50	rbt	3/21/2015	4/23/2015	33
3DD.00774C8E68	f	4/21/2015	4/24/2015	3
3DD.0077492A6C	f	4/21/2015	4/27/2015	6
3DD.00774DE14C	m	3/28/2015	4/28/2015	31
3DD.00774D620A	f	4/18/2015	4/28/2015	10
3DD.00774BAB7B	f	4/18/2015	5/2/2015	14
3DD.00774DC38C	f	4/19/2015	5/2/2015	13
3D9.1C2DF0EC2C	f	5/1/2015	5/2/2015	1
3DD.00774C90FB	f	5/1/2015	5/3/2015	2
3D9.1C2DF45B0E	f	5/5/2015	5/6/2015	1
3D9.1C2DF0A907	f	4/30/2015	5/9/2015	9
3D9.1C2DF46A86	f	5/5/2015	5/9/2015	4
3D9.1C2D7FB3DF	rbt	5/5/2015	5/10/2015	5
3D9.1C2E0D94C8	f	5/12/2015	5/15/2015	3
3DD.00774DBC48	f	5/16/2015	5/17/2015	1
3DD.00774D1DD0	f	5/19/2015	5/20/2015	1
3DD.00774DCE40	m	5/26/2015	5/27/2015	1

Recommendations

The WDFW Stream Team has taken "critical riffle" measurements to estimate flow requirements for fish passage on Taneum Creek (Jonathan Kohr, WDFW, unpublished data). This method estimated that for small, juvenile salmonids, a flow of 3.3 cfs was required for passage, 16.4 cfs was required for medium-sized salmonids (steelhead, Coho), and 32.4 cfs was required for large-bodied salmonids (adult Chinook) to migrate up Taneum Creek. These calculations are useful indicators of fish passage conditions but may not represent the actual instream flows necessary. For example, fish passage over beaver dams or waterfall may require different flow conditions than passage over shallow riffles.

For steelhead to migrate up Taneum Creek in a timely manner a minimum instream flow adequate for passage should be present throughout the immigration season. PIT-tag data suggested that some steelhead migrated upstream when flows were 15 to 20 cfs, but also indicated that discharges in this range delayed fish resulting in increased travel times. A flow of 30 cfs or greater should be investigated as more likely to allow for unimpeded migration than the 20 cfs specified in the 1994 agreement.

The difference in timing from when KRD and Reclamation started supplementing creek flows and when TCC started diverting water was important, as it encompassed about 3 weeks in early April during the peak of steelhead migration. In most water years creek flows are high enough to meet irrigation demands and fish migration needs; however, in drought years, or in years when very cold weather delays the runoff, TCC has the capability to divert enough flow from the creek to impede steelhead migration (Figure 7).

In future drought years, Reclamation and KRD could consider transporting flows to Taneum Creek earlier in the season; this action would depend upon KRD and Reclamation's annual prevailing conditions of river operations. Refining this strategy or including other actions (e.g., purchasing or leasing early season water from Taneum Canal Co.) could be considered priority actions for steelhead conservation during drought years or when spring runoff is low due to other factors.

The 1994 agreement specified that a minimum instream flow of 6 cfs must be present below the TCC diversion dam during the irrigation season. Flows have fallen below that when irrigation demands required all of the KRD South Branch Canal capacity, limiting the ability to provide enhancement flows.

Enhancing flows in Taneum Creek by delivering Yakima Project water through the KRD canal system is part of a broader effort via the YRBWEP and Integrated Plan to enhance tributary flows for fish while continuing to meet irrigation needs. This broader effort of streamflow enhancement includes delivering water to Manastash Creek and other priority streams for steelhead recovery in the Yakima Basin. However, KRD does have a limited capacity to deliver flows to achieve tributary enhancement objectives, especially during the irrigation season when irrigation demands are high. Determining flow requirement for fishery enhancement purposes

will help water managers make informed decisions regarding infrastructure improvements and prioritization of conservation measures. PIT-tag and other forms of data can be used to determine flow requirements.

References

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Lahnsteiner, F. 2000. Morphological, physiological and biochemical parameters characterizing the over-ripening of rainbow trout eggs. Fish Physiology and Biochemistry 23: 107.

Monk, P.A. 2015. Steelhead Return to Taneum Creek Following Habitat Restoration. Prepared for U.S. Bureau of Reclamation, Yakima River Basin Water Enhancement Project, prepared by U.S. Fish and Wildlife Service, Mid-Columbia Fishery Resource Office, Yakima Sub Office, 1917 Marsh Rd., Yakima, WA 98901.

Appendix A

KITTITAS RECLAMATION DISTRICT

CORNER OF FOURTH AVENUE AND WATER STREET
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ELLENSBURG, WASHINGTON 98926

TANEUM CREEK HABITAT ENHANCEMENT, FISH PASSAGE AND PROTECTIVE FACILITIES EVALUATION COOPERATIVE PROJECT 1994

COOPERATING AGENCIES

KITTITAS RECLAMATION DISTRICT (KRD)
BONNEVILLE POWER ADMINISTRATION (BPA)
YAKAMA INDIAN NATION (YIN)
WASHINGTON STATE DEPARTMENT OF FISH AND WILDLIFE (WDFW)
BUREAU OF RECLAMATION (BOR)

The fish passage and diversion screening facilities on Taneum Creek are part of the Yakima River Basin Fish Passage and Protective Facilities Program as identified in the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program and were substantially completed by 1993. Since 1990, Taneum Creek has been identified in the Yakima River Basin Water Enhancement Project proposed federal legislative attempts as an appropriate location to study the options for enhancing water supplies for the Yakima Basin tributaries. The cooperating agencies have recognized the potential fishery benefits of working together and working through existing programs to increase instream flows in Taneum Creek. This cooperative project is independent of KRD's Taneum Chute FERC license process and will proceed on a separate track to evaluate enhancement of water supplies for Taneum Creek habitat improvement, fish passage and screening facilities.

The cooperative project consists of KRD transporting Yakima River water from the Easton Diversion to Taneum Creek through its canal system at no cost to the cooperating agencies. The purpose of the cooperative project is to supply Taneum Creek with instream flows to enhance the fisheries resource. Water will only be transported when: 1). KRD's canal system capacity will allow for the extra water, 2). There are no costs associated with transportation of the extra water to KRD, 3). There are no negative impacts to other Yakima Project water users and 4). Flow in the Yakima River below Easton Diversion Dam is in excess of 105 CFS.

This cooperative agreement, starting in 1994, will be effective for a period of one year subject to in-season evaluation by cooperating entities. Yearly operations will be reviewed at the end of each year with all cooperating entities and interested parties. Up to five gaging station will be constructed and maintained to allow for the proper management and documentation of the Yakima River water being transported through the KRD canal, into Taneum Creek and back to the Yakima River. This project will be reviewed by System Operations Advisory Committee (SOAC) and all concerns will be taken into consideration.

KRD will install the gaging stations and manage the data from the stations. The data will be available to any one upon request.

BPA ~~will pay~~ has paid for the instrumentation for the gaging stations through the BOR's phase II screening program.

WDFD will supply a portion of the material and construct the gaging stations with BOR's assistance.

BOR will supply part of the material, assist WDFD and supply technical support to properly set up the stations and assist in the data management.

Yakama Indian Nation will participate in technical review process and biological assessment.

Costs for the Project are as follows:

BPA Instrumentation:	Stevens A/F Logger -	$1800.00
	12v Deep Cycle Battery -	100.00
	Tape/Weight/Float etc -	250.00
	KRD Frequency Telemetry, Receiver/Transmitter -	3200.00
	Sub-total	$5350.00
	Overhead 10%	535.00
	Per Station Total	$5885.00
	6 gaging stations =	$35,310.00
KRD Labor:	$1000.00 per station X 5 stations =	$5,000.00
WDFD Support:	Material and Fabrication of gages $1000.00 X 5	$5,000.00
BOR Support:	Labor and Technical - $800.00 X 5 =	$4,000.00
	Estimated Total initial cost for start up:	$46,810.00

KRD, WDFD, and BOR will be responsible for the maintenance and operation of the five gaging stations for a five year period, which will cost approximately $3000.00 a year or a total of an additional $15,000.00.

Total cost of the Cooperative Taneum Project: $61,810.00

TANEUM CREEK HABITAT ENHANCEMENT,
FISH PASSAGE AND PROTECTIVE FACILITIES EVALUATION
COOPERATIVE PROJECT
1994

COOPERATING AGENCIES

[signature] Secretary Manager
KITTITAS RECLAMATION DISTRICT

[signature] Yakima Project Office 9/20/94
BONNEVILLE POWER ADMINISTRATION

[signature] Fisheries Consultant
YAKAMA INDIAN NATION - Technical Review

[signature] Fish Biologist Screening Prgm Manager
WASHINGTON STATE DEPARTMENT OF FISH AND WILDLIFE

[signature] Manager, Yakima Field Office
BUREAU OF RECLAMATION

DRAFT

TANEUM CREEK WATER DISTRIBUTION WHEN AVAILABLE CREEK FLOW WATER IS LESS THAN 97.47 CFS AS METERED AT:

(Mann Ditch diversion quantity plus Taneum Creek flow above the Taneum Chute Inflow Point)

(Prepared by Jack Carpenter & Stan Isley. DRAFT: 7/30/02)

USER NAME	ACRES	DELIVERY DITCH	TOTAL CFS (97.47)	% OF TOTAL	CONTACT
RECLAMATION (RMEF / Knudson) 00284, (A)04191	142.33 & stockwater	Mann Ditch	10.62[1]	10.9%	David Murillo 575-5848 Ext 213 Ed Spigler 575-5848 Ext 275
KNUDSON 00284	17.67 & stockwater	Mann Ditch[2]	1.28	1.3%	Necia Knudson 964-2215 Teri Knudson 964-2194
SPRINGWOOD Investment Corp. 01943	7	Mann Ditch	0.67	0.7%	Greg Shelley 929-2387 Scott Gress 929-6067
STOVALL (Emrick) 00195	22	Mann Ditch	1.28	1.3%	Bill Stoval 964-2166
(SUBTOTAL)	***(189)***	***(Mann Ditch)***	***(13.84)***	***(14.2%)***	
ENOCHS (Nesmith) 01811	0.75	Bruton Ditch[3]	0.02	0.02%	Don & Karen Enochs 964-2077
STOVALL (Emrick) LITTLEFIELD (Emrick) GORDON (Emrick) 00195	47 & stockwater is 1/10 of a cfs (45 GPM)	Bruton Ditch	2.0	2.1%	Bill Stoval 964-2166 Dan Littlefield 964-9116 Tony & Cindy Gordon 964-2913
(SUBTOTAL)	***(47.75)***	***(Bruton Ditch)***	***(2.02)***	***(2.12%)***	
GEORGE (Lang) 01628	36 & stockwater	Taneum Ditch	1.5	1.6%	Craig George 964-2515
TANEUM CANAL COMPANY 00411	3700 & stockwater	Taneum Ditch	80	82.1%	TCC (Ben George) 964-2364
(SUBTOTAL)	***(3736)***	***(TaneumDitch)***	***(81.5)***	***(83.7%)***	
TOTAL	**3972.75**		**97.47**	**100.02%**	

[1]Bureau will leave their Taneum Creek right in-stream.. The maximum diversion at Mann Ditch at any time is 3.23 CFS

[2]The Mann Ditch headworks will be operated by Knudson

[3]The Bruton Ditch headworks will be operated by Reclamation

1.279

TANEUM CREEK OPERATIONS: 2002

TO CALCULATE MANN DITCH (MD), TANEUM CANAL COMPANY (TCC) AND BRUTON DITCH (BD) WATER RIGHTS:

FLOW IN CFS (CUBIC FEET PER SECOND) AT MANN DITCH WEIR (TC 0.00) ADDED WITH CFS AT TANEUM CREEK ABOVE KRD CHUTE (TC 0.50) EQUALS TOTAL CFS IN TANEUM CREEK

DRAFT 7/26/02

MULTIPLY TOTAL CFS IN TANEUM CREEK BY COURT DECREED PERCENTAGE OF CREEK:
MANN DITCH (MD): **3.3%**
RECLAMATION (BOR): **10.9%**
TANEUM CANAL CO. (TCC): **83.7%**
BRUTON DITCH (BD): **2.12%**

EXAMPLE: ASSUME 25 CFS TOTAL IN CREEK
MD: 25 X .033 = **0.825 CFS**
BOR: 25 X .109 = **2.725 CFS**
TCC: 25 X .837 = **20.925 CFS**
BD: 25 X .0212 = **0.53 CFS**

OPERATIONAL PROGRAM TO ADDRESS "UNOFFICIAL" ENDANGERED SPECIES FLOWS IN TANEUM CREEK AT TC 0.60:

BOR WILL LEAVE THEIR CREEK WATER RIGHT INSTREAM.

KRD WILL DELIVER UP TO 20 CFS "ENHANCED" WATER TO TANEUM CREEK WHEN CAPACITY ALLOWS. THIS 20 CFS IS TO BE LEFT INSTREAM TO THE YAKIMA RIVER. IT IS NOT USED TO CALCULATE PRIVATE WATER RIGHTS NOR ENHANCE PRIVATE WATER RIGHTS.

KRD WILL ONLY DELIVER "ENHANCED" WATER WHEN CAPACITY ALLOWS.

WHEN KRD CAN NOT DELIVER "ENHANCED" WATER: TCC WILL LEAVE ENOUGH TCC WATER RIGHT INSTREAM TO TOTAL NO LESS THAN 5 CFS AT GAGE STATION TC 0.60 WHEN COMBINED WITH THE BOR WATER RIGHT.

BOR WILL ORDER AND LEAVE IN STREAM 1 CFS OF THEIR KRD WATER WHEN KRD CAN NOT TRANSPORT "ENHANCED" FISH FLOWS. THIS WATER IS ADDITIVE TO THE BOR / TCC WATER AT TC 0.60.

THE OPERATIONAL CFS TARGET AT STATION TC 0.60 IS 7 CFS SO AS NOT TO GO BELOW THE 6 CFS "UNOFFICIAL" ESA FLOWS.

THE BRUTON DITCH IS NOT AUTHORIZED TO DIVERT ANY OF THE ESA FLOWS.

KRD WILL MAINTAIN TANEUM CREEK GAGE STATIONS: TC 0.00, TC 0.50, TC 0.60, BD 0.00, TC 3.50. ALL ASSOCIATED COSTS FOR INSTALLATION, MAINTENANCE, PARTS, RATING, DATA BASE, UPGRADES OR OTHER AUTHORIZED ACTIVITIES ARE REIMBURSABLE BY THE BUREAU.

Why not have natural flow user's pay?

KRD WILL MAINTAIN A TANEUM CREEK GAGE READINGS DATA BASE WHICH CAN BE ACCESSED BY COMPUTER AT:

KRD WILL MAINTAIN THE DATA BASE ONLY AS STAFF TIME ALLOWS. THIS IS A CONTRACTED SERVICE AND IS A SECONDARY TASK TO KRD OPERATIONS.

KRD WILL NOT OPERATE THE HEADWORKS / FISH FACILITIES, NOR MANAGE ANY WATER IN THE MANN OR BRUTON DITCHES.

WHO TO CALL:
MECHANICAL OR ELECTRICAL PROBLEMS AT FISH FACILITIES:
TOM LEONARD, BUREAU: **509-575-5845 EXT. 256**
BUREAU AFTER HOURS EMERGENCY: ——
WATER RIGHTS: WA. DEPT. OF ECOLOGY: ELAINE PETERSON: **509-575-2490**
ANY WORK REQUIRED IN STREAM: WA. STATE DEPT. OF FISH & WILDLIFE: **925-1013**
GAGE READINGS DATA BASE: ROGER SATNIK: **925-6158, MONDAY – FRIDAY, 8 AM – 4 PM** <u>ONLY</u>
FOR TECHNICAL QUESTIONS, NOT TO BE USED FOR OBTAINING GAGE READINGS.
ESA ISSUES: NATIONAL MARINE FISHERIES SERVICE: **962-8911**
YAKIMA RIVER BASIN WATER ENHANCEMENT PROGRAM: JIM ESGET: **509-575-5848 EXT. 267**
BUREAU OF RECLAMATION, YAKIMA FIELD OFFICE: DAVID MURILLO: **509-575-5848 EXT. 213**
KRD MANAGER: JACK CARPENTER: **925-6158**

CHKD BY	DATE	FEATURE
		TANEUM CREEK GAGE STATION LOCATIONS

DETAILS