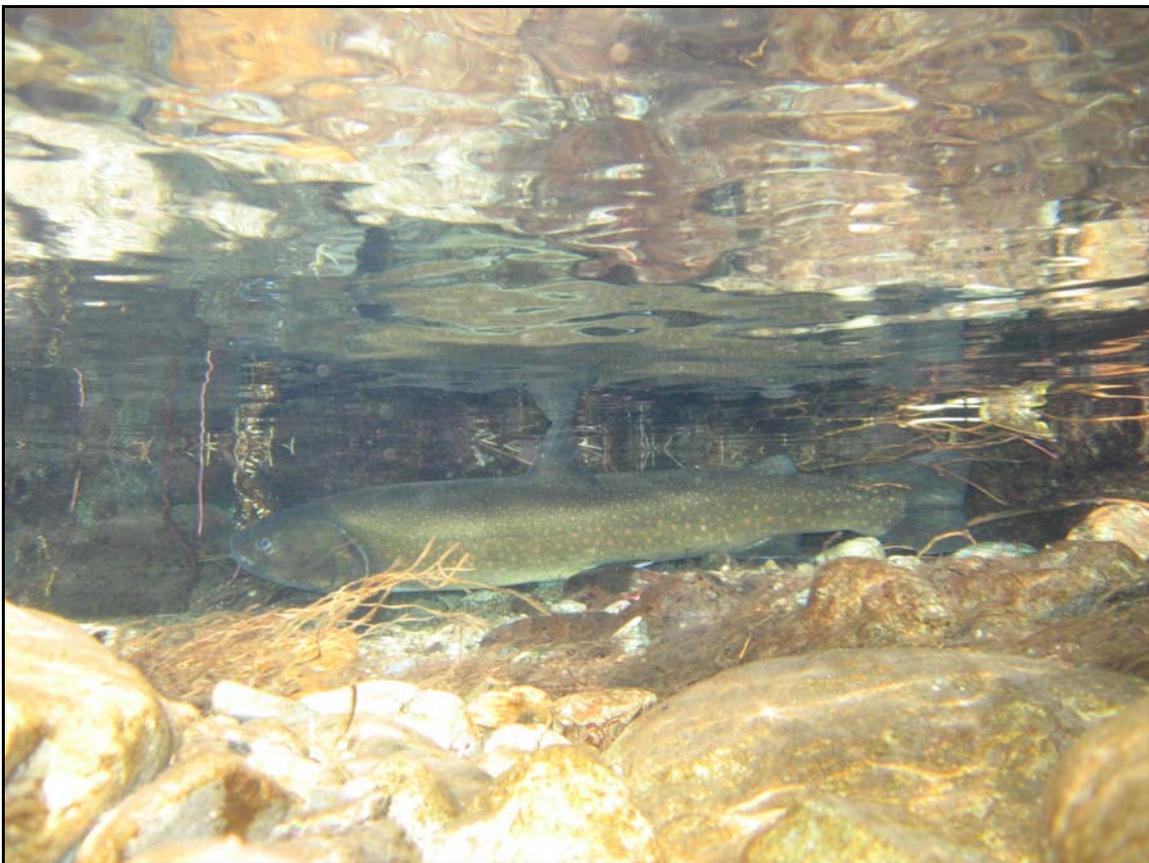


**U.S. Fish and Wildlife Service**

# **Upper Columbia Recovery Unit Bull Trout Telemetry Project: 2006 Progress Report for the Methow River Core Area**

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**U.S. Fish and Wildlife Service  
Mid-Columbia River Fishery Resource Office  
7501 Icicle Road  
Leavenworth, WA 98826**

*On the cover- an adult fluvial bull trout in the pool at the confluence of South Creek, isolated above the seasonal dry reach in the Twisp River during 2006. USFWS photograph by M.C. Nelson.*

# Upper Columbia Recovery Unit Bull Trout Telemetry Project: 2006 Progress Report for the Methow River Core Area

Upper Columbia Recovery Unit  
Bull Trout Telemetry Project  
FONS # 2001-002

Prepared by:  
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April 6, 2007

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UPPER COLUMBIA RECOVERY UNIT BULL  
TROUT TELEMETRY PROJECT:

2006 PROGRESS REPORT  
FOR THE METHOW RIVER CORE AREA

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*Abstract.-* The USFWS Mid-Columbia River Fishery Resource Office radio-tagged a total of 13 bull trout in the Methow Core Area during the spring and summer of 2006. In April, we tagged 3 bull trout in the lower Lost River and 2 bull trout in the mainstem Methow River, and during July and August we tagged 4 bull trout in Wolf Creek, 3 bull trout in West Fork Methow River, and 1 bull trout in Robinson Creek. We also tracked 17 bull trout tagged by the Douglas and Chelan Counties Public Utility Districts in the Columbia River; of these, 7 were tagged in 2006 and 1 in 2005 at Wells Dam, 6 were tagged in 2006 and 2 in 2005 at Rocky Reach Dam, and 1 was tagged in 2005 at Rock Island Dam. A total of 373 locations of 30 bull trout were recorded during mobile surveys, and 102 migration movements of 26 bull trout were recorded at fixed telemetry stations. Bull trout tagged in the Columbia River migrated into the Methow River from May 23 – July 2, 2006, as stream discharge declined from 12,900 - 2,960 ft<sup>3</sup>/sec, and 9 bull trout entered the Twisp River from June 24 – July 4, 2006, as flows declined from 912 – 537 ft<sup>3</sup>/sec. Columbia River bull trout also migrated to Wolf Creek (1 bull trout), Goat Creek (1 bull trout), Early Winters Creek (1 bull trout), and West Fork Methow River (2 bull trout). In Wolf Creek, none of the tagged bull trout moved past a log debris dam at rkm 6.6. Twenty-two bull trout were radio-tracked to known spawning grounds, and Columbia River bull trout were documented for the first time in Early Winters Creek and Goat Creek. Sixteen radio-tagged bull trout were isolated above the dry reaches that developed in the Twisp River, upper Methow River, and lower Goat Creek, but heavy rains in November re-watered the reaches. Ten radio transmitters were recovered or were motionless. Bull trout tagged in the Methow Core Area exhibited different movement patterns than bull trout tagged in the Columbia River. All 6 of the active Methow River tagged bull trout over-wintered in the Methow Core Area, while 11 of the 12 active Columbia River tagged bull trout returned to the Columbia River.

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## Introduction

The U. S. Fish and Wildlife Service (USFWS) listed bull trout *Salvelinus confluentus* within the Columbia River basin District Population Segment as threatened under the Endangered Species Act (ESA) on June 10, 1998 (USDOJ 1998). On November 1, 1999 bull trout were listed throughout the coterminous United States as threatened under the ESA (USDOJ 1999). Declining bull trout populations are thought to be the result of habitat degradation and fragmentation, blockage of migratory routes, reduced water quality, and introduction of nonnative species.

The USFWS draft bull trout recovery plan (USFWS 2002) delineated 8 local populations of bull trout in the Methow River Core Area: Gold Creek, Twisp River, Chewuch River, Wolf Creek, Early Winters Creek, Upper Methow River, Lost River, and Goat Creek; a ninth population in Beaver Creek was later added by the Upper Columbia Bull Trout Recovery Team (USFWS 2004). Lost River bull trout are classified as “Healthy” by the Washington Department of Fish and Wildlife, and the status of the other populations are considered “Unknown” (WDFW 2004). Additional information on the abundance and distribution of bull trout within these populations is needed (USFWS 2002). Rieman and McIntyre (1993), using metapopulation theory, suggested that bull trout in core population areas with between 5 and 10 local populations, such as the Methow River Core Area, may be at intermediate risk of local extinction. This is thought to be the result of the inability of the Methow River watershed bull trout to spread risk among a large collection of local populations when dealing with deterministic and stochastic events.

Bull trout redd surveys in the Methow River watershed have been conducted by the U. S. Forest Service (USFS) since 1992, but many surveys were incomplete and intermittent, particularly in the early survey effort (USFS 2006). Complete redd surveys of all spawning areas, as well as inventories of bull trout presence, have not been conducted (NPCC 2004). The tributaries containing the highest redd counts are the upper Twisp River including North Creek (101 redds in 1999), West Fork Methow River (54 in 2002), and Wolf Creek (29 in 1999) (NPCC 2004). The relationship of these redd counts to the true number of spawning bull trout has not been investigated.

Bull trout movement patterns within the Columbia River have been investigated by Mid-Columbia (Chelan, Douglas, and Grant Counties) Public Utility Districts in an effort to address issues related to bull trout, dam operation, and project re-licensing of the mid-Columbia River dams (BioAnalysts 2004). The Mid-Columbia PUDs radio tagged bull trout during 2001 and 2002 at Rock Island, Rocky Reach, and Wells dams. Tagged bull trout were documented moving into tributaries of the Columbia River but were recorded at only one known spawning area in the Methow River system. Although aerial surveys to locate bull trout in tributaries were flown, on the ground monitoring of the fish in the Methow system was limited to the Twisp River (Nelson 2004). In 2005, Douglas and Chelan County PUDs each implemented bull trout radio tagging projects to monitor the passage and incidental take of radio tagged adult bull trout at their Columbia River hydroelectric projects. The USFWS Mid-Columbia River Fishery Resource Office

(MCRFRO) tracked 6 of these bull trout after they entered the Methow River, and documented their migration into 3 tributaries previously not known to be used by Columbia River fluvial bull trout (Nelson and Nelle 2007).

In 2006, Chelan and Douglas County PUDs continued to radio-tag and monitor movements of tagged bull trout at mid-Columbia River dams, and MCRFRO radio-tagged bull trout in the Methow watershed. Through a cooperative approach of monitoring tagged bull trout between the mid-Columbia PUDs and MCRFRO, extensive information on movement patterns of bull trout within the Upper Columbia River Recovery Unit are now collected in a cost effective manner. It is essential to continue this process of cooperation during this period when bull trout are extensively monitored by radio telemetry at the mid-Columbia River dams and tributary entrances.

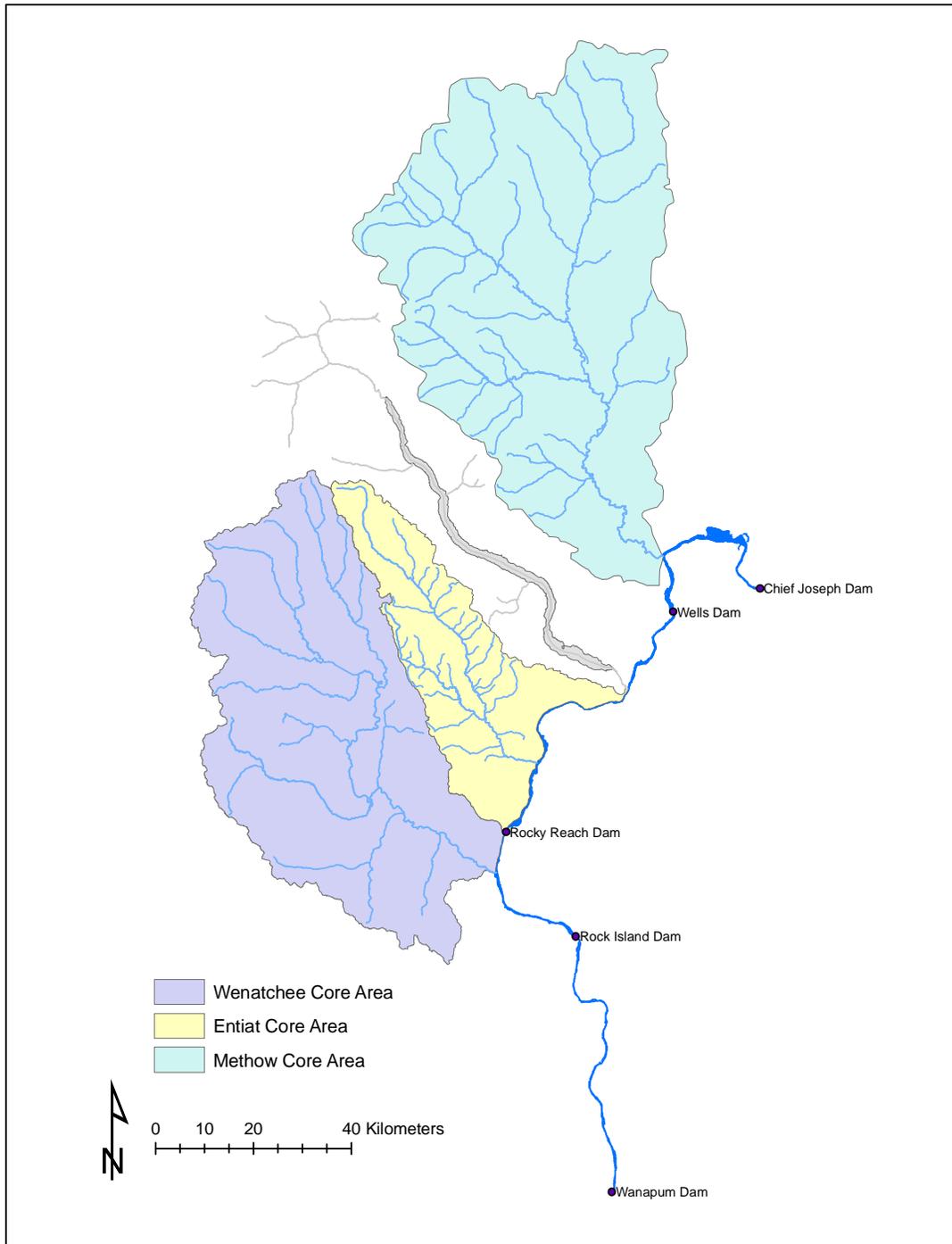
The USFWS draft bull trout recovery plan identified a need for research associated with bull trout migratory patterns and habitat use in the Methow River watershed. A better understanding of the life history of bull trout in the Methow River watershed will provide managers with information related to critical habitat, migratory corridors and barriers, and migratory timing. This information will be crucial in developing future species habitat plans and the eventual recovery of bull trout.

The objectives of this study are to define seasonal movements, migration timing and obstacles or barriers, and spawning locations of adult migratory bull trout in the Methow River watershed. This progress report summarizes results from the 2006 field season. The data presented here are provisional and may be interpreted differently in other agency reports as well as our final report to be issued at the conclusion of the study.

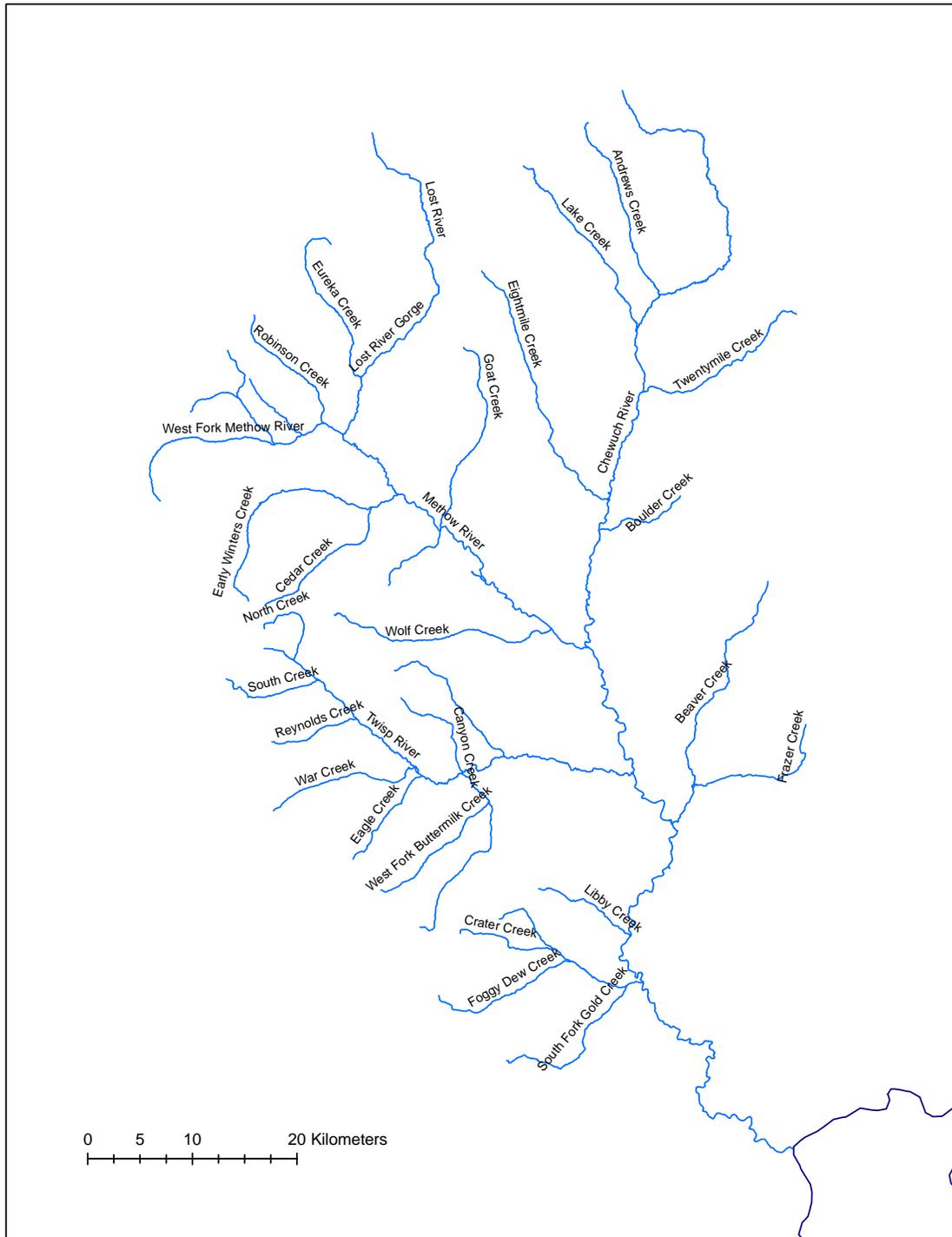
### **Study Area**

The Methow River, tributary to the Columbia River at river kilometer (rkm) 843.3, drains an area of approximately 4,895 km<sup>2</sup> (Figure 1). The Methow River sub-basin has seven primary sub-watersheds: the Upper Methow River, Lost River, Early Winters Creek, Chewuch River, Middle Methow River, Twisp River, and Lower Methow River (Figure 2). The tributaries shown in Figure 2 are areas of assumed historic or current distribution of bull trout in the Methow sub-basin (NPCC 2004).

Mean stream discharge is 1592 ft<sup>3</sup>/s; base flow is 264 ft<sup>3</sup>/s and flood stage can be as high as 46,700 ft<sup>3</sup>/s (Mullan et al. 1992). Snowmelt from the upper elevations of the Methow basin in spring and early summer generates most of the runoff in the basin, with 44-71% of the annual runoff volume occurring during May and June (NPCC 2004). The lowest stream flows occur in mid-winter (December to February) and early autumn (September) when stream flow is primarily the result of groundwater discharge. Several reaches dewater and flow subsurface at base flows, including the mainstem Methow near the town of Mazama, Goat Creek at the mouth, and Twisp River at Poplar Flats Campground. A map of the 2006 dry reaches and hydrographs of the 2006 stream discharges of the Methow River and some tributaries are shown in Appendix 1 (OCD 2007, USGS 2007).



**Figure 1. Map of the Upper Columbia Bull Trout Recovery Unit**



**Figure 2. Map of the Methow River watershed.**

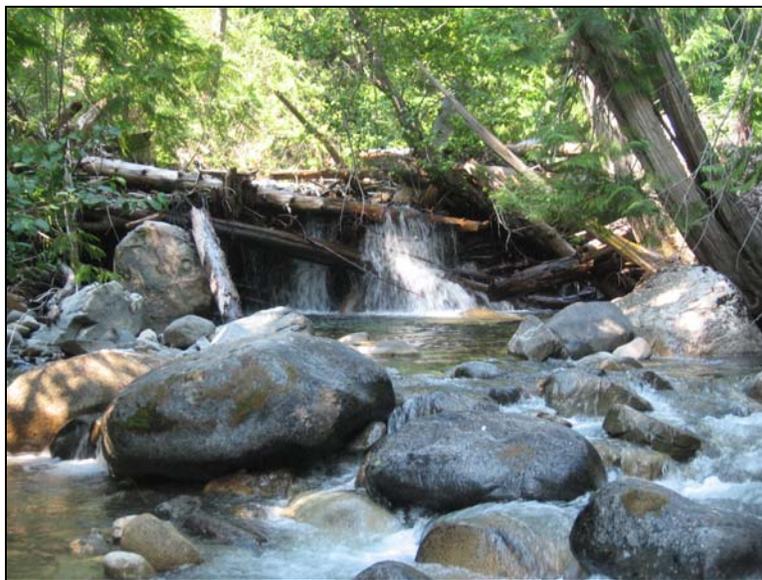
## Methods

### *Capture*

Adult bull trout were captured using hook and line methods. Spinning rods and reels, rigged with 8 lb test monofilament line and a lead jig with a rubber minnow body and a single barb-less hook, were used to angle for bull trout. River pools and runs, including holes downstream of migration obstacles and barriers were fished (Figures 3 and 4). All hooked bull trout were quickly played, landed with a knotless hand net, and placed in perforated PVC tubes. The holding tubes were tethered in the river in a quiet shady area of the pool until the bull trout was ready for surgery. Each capture site was geo-referenced using a hand held Garmin Map76™ global positioning (GPS) unit.



**Figure 3. Pool in the lower West Fork Methow River where bull trout code 80 was tagged.**



**Figure 4. Log jam and pool in Wolf Creek where 4 bull trout were caught and tagged.**

### ***Radio transmitters and PIT tags***

The radio tags we implanted in the bull trout were Lotek Engineering model SR-M16-25 digitally-encoded radio transmitters using frequency 148.320 MHz (channel 01) and tag codes 70 - 82. The radio tags are DSP compatible and contain a motion option, set at sensitivity level 4 or 5, with time to initiate motion signal of 24 or 48 hours and include motion reactivation. When the tag becomes motionless, the option is activated, and a base of 100 is added to the code (i.e. code 70 will transmit as code 170). This model radio tag is 16 mm in diameter and 51 mm in length, weighs 17 g in air and has an expected battery life of 3 years at a 5 second burst rate. Each fish was also tagged with a Passive Integrated Transponder (PIT) tag model TX1415 (3.4 x 23 mm) operating at 134.2 kHz.

In 2006, the radio tags deployed at Wells Dam by Douglas County PUD (DPUD) and LGL, Ltd were also Lotek Engineering model SR-M16-25 digitally-encoded radio transmitters on frequency 148.320 MHz (channel 01), with even numbered tag codes 50 – 68 transmitting at a 2.5 second burst rate. PIT tags were also implanted by DPUD. Radio tags used in 2006 at Rocky Reach and Rock Island Dams by Chelan County PUD (CPUD) and BioAnalysts, Inc. were Lotek model MCFT-3A transmitters and transmitted on frequency 148.580 MHz (channel 14) and codes 161 – 190 with a 5 second burst rate. There is no motion option on the MCFT-3A tag. PIT tags were not implanted by CPUD.

### ***Tag implantation procedure***

Prior to tagging bull trout, USFWS surgeons and assistants practiced surgical procedures on at least 10 rainbow trout obtained from the Entiat National Fish Hatchery. Most of the practice fish were held in tanks at the hatchery and observed for several weeks. All practice fish were sacrificed and autopsied for evaluation of the implantation.

Aseptic procedures were followed in all surgical procedures. This included triple wash and rinse of the surgeon's hands and arms with Purell® hand sanitizer (62% ethyl alcohol), use of sterile and doubled latex gloves, and an aseptic surgical field. Surgical instruments were sterilized using a pressure canner, and transmitters and PIT tags were sterilized by ethylene oxide (Mulcahy 2003). Seven sets of sterile surgical packs, each containing the necessary instruments and equipment for one implantation, were assembled and sterility was maintained by enclosing each pack in a series of waterproof zip lock type plastic bags (Figure 5). All surgeries were performed streamside using a portable surgery kit we developed for use in remote locations (Figure 6).

We surgically implanted radio transmitters in bull trout following the methods described by Summerfelt and Smith (1990). Each fish was anesthetized for 8 – 10 minutes in a bath using a solution of 80 mg of tricaine methanesulfonate (MS-222) per L of H<sub>2</sub>O and buffered with sodium bicarbonate to match the pH of the river water (Wedemeyer 1970). A battery operated bubbler was used to ensure the bull trout received adequate oxygen while in the anesthetic bath. Total and fork lengths (mm), weight (g), and a genetic tissue sample were collected from each bull trout. While still in the bath, anesthetized bull trout were floated onto a foam cradle designed to support the weight of the fish and prevent injury to the ribs and backbone during weighing and transport to and from the surgery table (Figure 7). The bull trout was oriented dorsal side down in the cradle while the gills

were irrigated with a buffered solution of 40 mg of MS-222/L during surgery. The ventral body surface of the bull trout was rinsed of MS-222 with river water and a 40 mm incision was made immediately anterior to the pelvic girdle and approximately 10 mm lateral of the mid-ventral line. Gender was determined if eggs or testes were visible.

We used a sterilized syringe to insert the PIT tag into the body cavity without contamination. A 1 cc plastic tuberculin syringe was modified by removing and discarding the detachable needle and cutting the tip off. Since the PIT tag diameter matched the inside diameter of the syringe, it was placed inside the syringe and the plunger was used to insert the tag through the incision into the body cavity.

To insert the radio-tag and thread the antenna through the body wall of the bull trout, we modified the shielded-needle method (Ross and Kleiner 1982). We constructed the hollow needle from a 14 gauge x 140 mm Radiopaque FEP I.V. catheter with the plastic tubing connector cut off. The shield was constructed from a plastic coffee straw with the ends rounded by a heat gun. Using the shielded hollow needle, the lateral body wall was punctured posterior to the incision. The shield was removed through the incision, the wire antenna end was threaded into the hollow needle and extended through the body wall, the needle was removed and the transmitter was inserted into the abdominal cavity. A sterile surgical drape was placed over the fish to reduce contamination of the suture material while the incision was closed in an interrupted pattern of 3 – 4 absorbable sutures tied with square knots (Figure 8). A FS-1 (24 mm) cutting needle and either Ethicon™ absorbable ViaCryl 3-0 PDS II violet monofilament (Polydioxanone) or coated ViaCryl 3-0 violet braided (Polyglactin 910) suture material was used.

The bull trout were allowed to recover from anesthetic in a holding tube for at least 30 minutes and were released in an area of reduced water velocity and cover near the capture site, and if possible, monitored after release.

### ***Monitoring of radio-tagged bull trout***

Bull trout locations were recorded using five monitoring methods: fixed receiver telemetry stations, truck surveys, boat surveys, foot ground surveys, and aerial surveys. Location coordinates were recorded with a Garmin GPSmap76 unit or placed by hand on 1:24000 U.S. Geological Survey (USGS) topographic maps. Information including the river, date and time, river mile, location description and other notes was recorded on a daily tracking form and in a Rite-in-the-Rain field notebook. Photo copies were made of the field notebook daily entries. GPS waypoints were downloaded into MapTech Terrain navigator and the marker files were exported into Desktop GIS ArcView v9.0 for creation of maps. For mainstem Methow and Columbia Rivers the river mile (rm) of a location was interpolated from river mile markers on USGS 1:24000 topographic maps; in tributaries the river mile was estimated by linear distance and map scale or from the stream catalog in Mullan et al. (1992). (Note that on USGS maps, river mile 0 of the Methow River is in middle of the Columbia River). River miles were then converted to river kilometers (rkm). Telemetry data was entered into an Access database and copies of receiver downloads, maps, daily tracking forms, and field notes were organized in 3-ring binders and archived at MCRFRO.

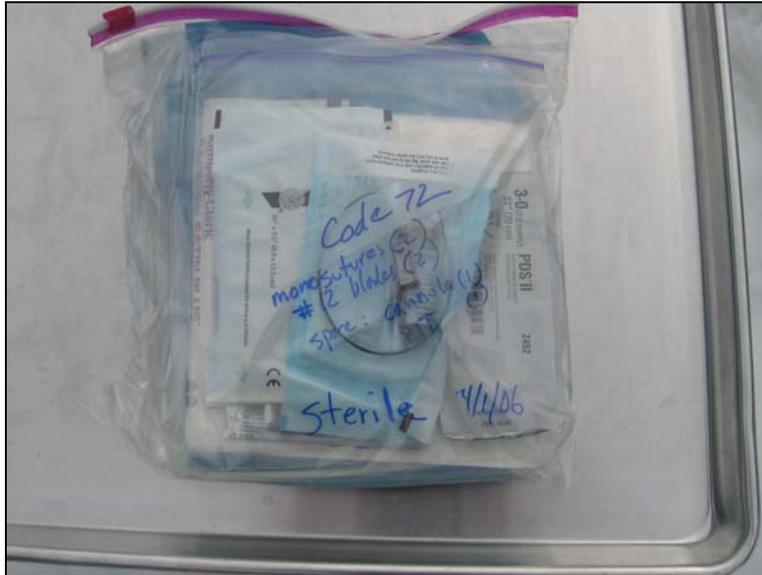


Figure 5. Sterile surgical pack with all the equipment and tools needed to implant one radio tag.



Figure 6. Stream side surgery at the Lost River on April 4, 2006.



**Figure 7. Weighing a bull trout in the surgical cradle provided support for the backbone and ribs.**



**Figure 8. A sterile surgical drape over the bull trout reduced contamination of the suture material.**

*Equipment-* We used Lotek Wireless model SRX400 (W7 or W31) or Grant Engineering Orion telemetry receivers at fixed stations. Lotek ASP 8 or Grant Hydra antenna switching units and three different models of yagi-type antennas (Grant Engineering 4 element model 4LYVT, Lindsay 4 element model 4LYV, or MaxRad 3 wire element model MYA1403) were used. For truck surveys, we used 2 Lotek SRX400 W31 receivers and 2 amplified Grant Engineering model 4LYVT yagi type antennas attached to a mast mounted to the receiver hitch on the truck. An AF Antrionics collapsible yagi 3-element antenna (F150-3FB) was used during foot surveys. Solar panels (60 watt BP and 75 watt Kyocera) equipped with ASC Specialty charge controllers were used to charge 12 V batteries at fixed stations. Small computer backup-type batteries were used at remote fixed stations and marine, wheelchair, or golf cart type batteries were used at easily accessible fixed stations. AC power was utilized at two stations.

*Fixed stations-* We set up fixed receiver telemetry stations at 7 locations in the Methow watershed (Figure 9). Two stations were setup in USGS gage houses, one in the pump house of the Methow Salmon Recovery Foundation (MSRF), and the others were housed streamside in metal boxes. Each station was designated by a two letter site code referencing its location or other information (Table 1). Hence, **LG** refers to the telemetry station at rkm 1.1 of the Methow River maintained by LGL, Limited for DPUD; **GS** refers to the USGS gage house #12449950 at rkm 10.6; **TG** refers to the USGS gage house #12449500 at rkm 64.4; **TR** refers to the station in MSRF pump house at rkm 2.1 of the Twisp River; **MC** is at the confluence of the Methow and Chewuch Rivers; **LC** is at the confluence of Lake Creek and Chewuch River; **WC** is at rkm 1.4 of Wolf Creek; and **LW** is at the confluence of Lost River and West Fork Methow River. Fixed telemetry stations were set up and maintained by Chelan and Douglas PUDs at mid-Columbia hydropower dams and tributary entrances (Figure 10). For details of the extensive telemetry systems monitoring their respective hydro-projects see BioAnalysts (2004 and 2006) and LGL and DPUD (2006). MCRFRO also maintained fixed telemetry stations in the Entiat River and Icicle Creek (Figure 10).

*Mobile surveys-* Surveys were conducted on foot using a hand held antenna and team tracking techniques (Nelson 2004), and by truck with hitch mounted and amplified dual yagi 4-element antennas (Nelson 2006). Two Lotek SRX400 receivers were used in the truck, with each receiver monitoring one frequency in signal/interval mode. When a tag was located, the code was recorded on a daily tracking map, as well as on the daily tracking form and in the field note book. The large size of the watershed usually precluded a single survey of the entire area. BioAnalysts, Inc. and LGL, Limited conducted boat surveys for the PUDs on the Columbia River and provided data on tag locations (BioAnalysts 2006, LGL and DPUD 2006).

*Aerial surveys-* A fixed wing aircraft, equipped with dual yagi antennas and Lotek receivers interfaced with GPS units, was used to record tagged bull trout locations in tributaries and the Columbia River. Aerial surveys were flown by BioAnalysts, Inc. for CPUD, and information on tag locations was shared with all cooperating agencies.

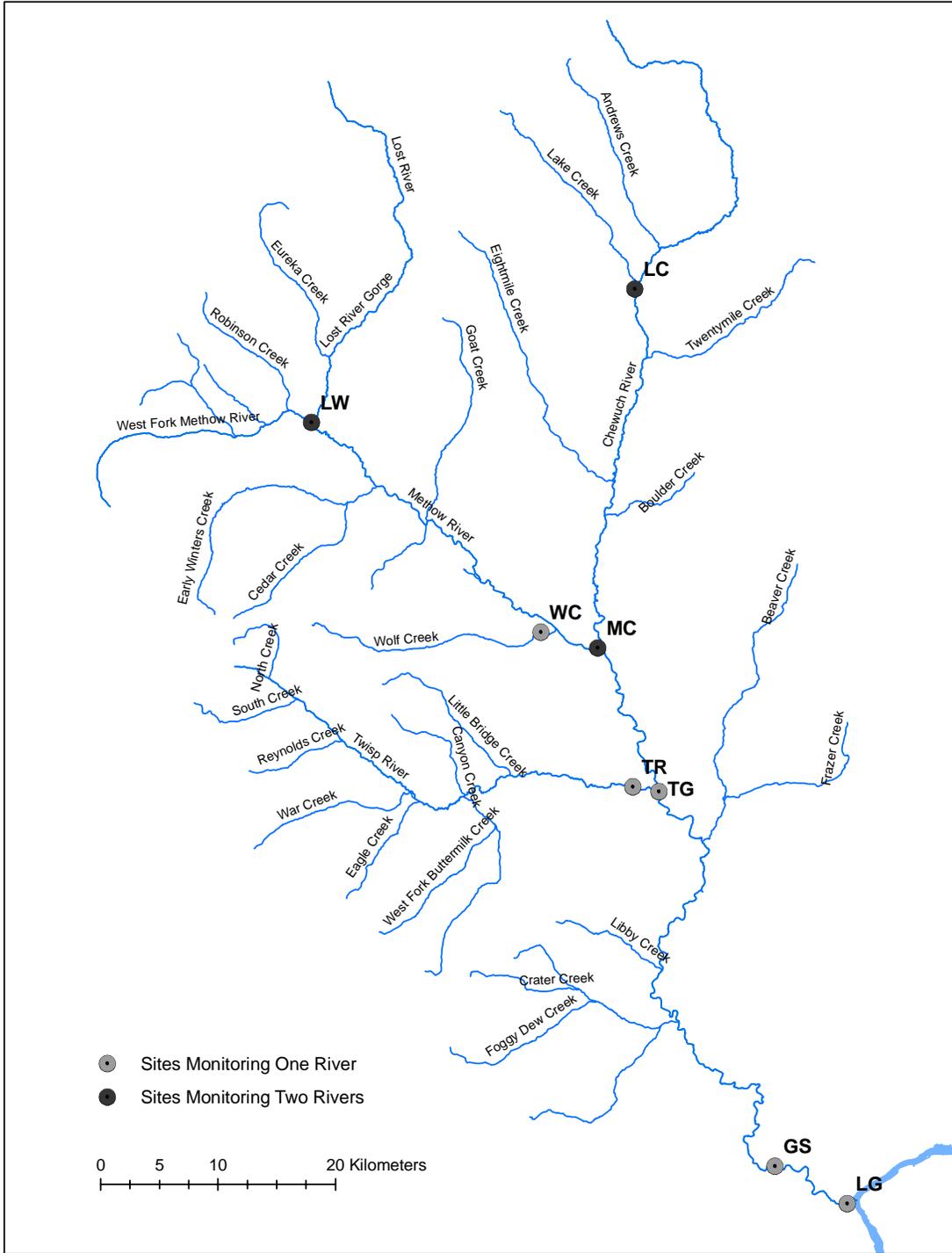
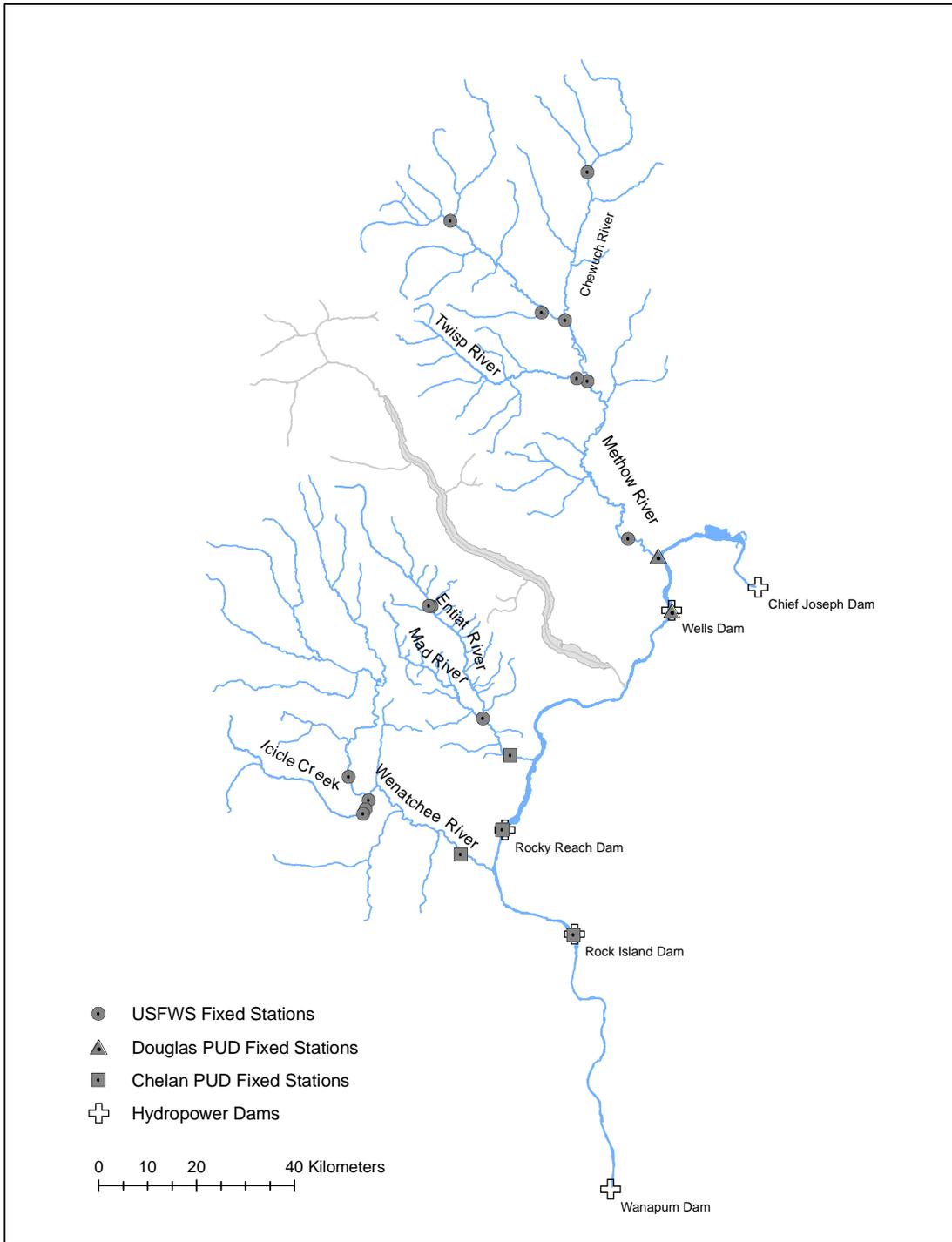


Figure 9. Map of fixed receiver telemetry stations in the Methow River watershed in 2006.



**Figure 10. Map of fixed receiver telemetry stations in the Upper Columbia Recovery Unit in 2006.**

**Table 1. Fixed receiver telemetry stations: site code, river kilometer (rkm), river, tributary, and dates of operation in the Methow Core Area during 2006.**

Site code	rkm	River	Tributary	Running		Intermittent		Dead	
				Start	Stop	Begin	End	From	To
LG	1.1	Methow	--	2005	current				
GS	10.6	Methow	--	22-Jun	current				
TG	64.4	Methow	--	17-Oct	current				
TR	2.1	Twisp	--	6-Jun	13-Dec				
MC	80.6	Methow	Chewuch	5-Apr	current				
LC	37.5	Chewuch	Lake Cr.	5-Jun	30-Aug				
WC	1.4	Wolf Cr.	--	6-Jun	13-Dec				
LW	117.5	West Fork	Lost	5-Apr	17-May				
<i>LW</i>				23-Jun	30-Nov	30-Nov	5-Dec	5-Dec	14-Dec
<i>LW</i>				14-Dec	16-Dec	16-Dec	21-Dec		
<i>LW</i>				21-Dec	current				

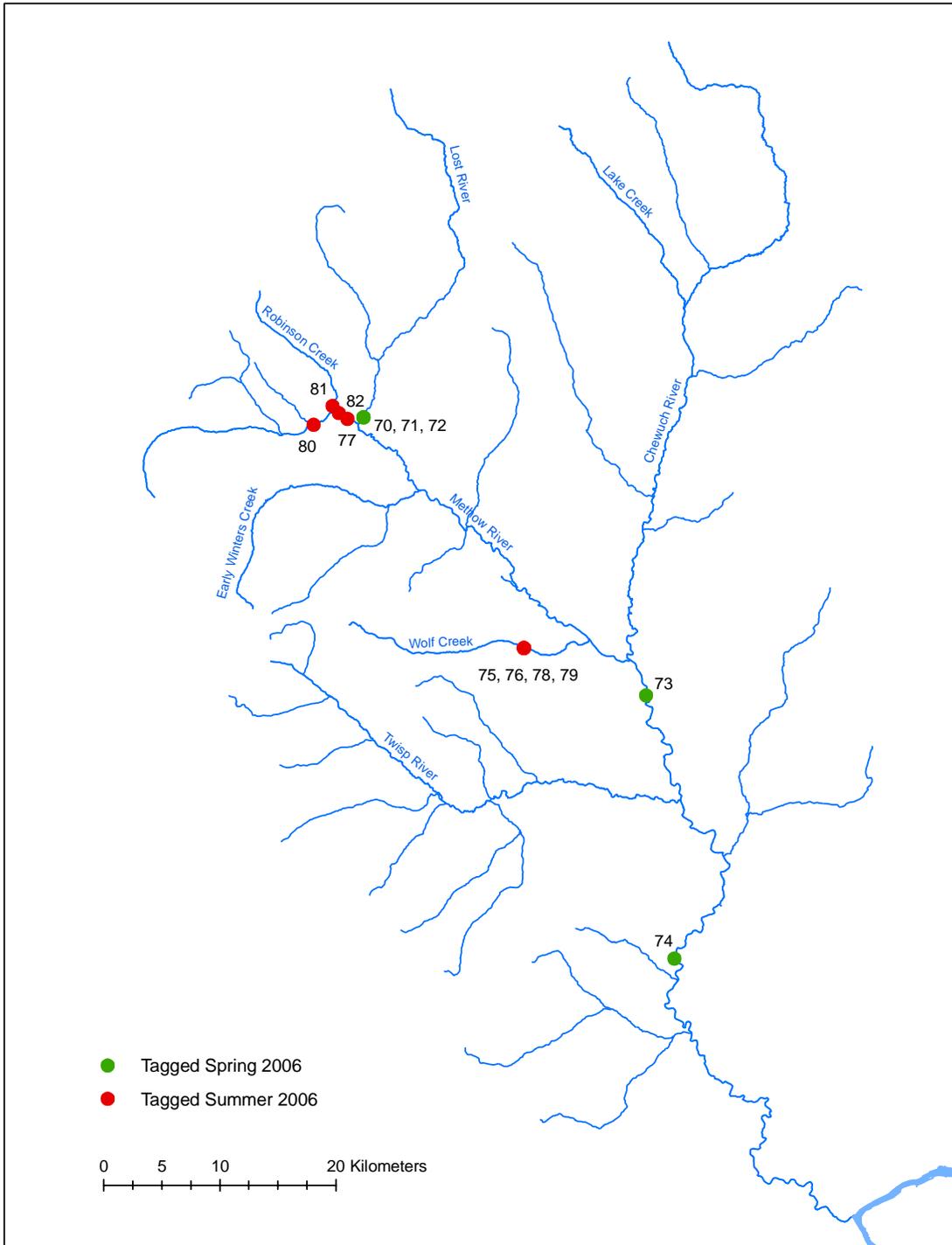
## Results

### ***Radio-Tagging***

We tagged a total of 13 bull trout in the Methow River watershed in 2006 (Table 2). Five were tagged during spring (codes 70-74) before high stream flows prevented further angling. Eight were tagged during summer (codes 75-82) after the hydrograph declined. Tagging locations were in the Lost River, mainstem Methow, West Fork Methow, and Wolf Creek (Figure 11).

**Table 2. Bull trout tagged by USFWS: Tag channel and code, tagging location, date, fork length and weight of bull trout radio tagged in the Methow River watershed in 2006.**

Channel	Code	River Tagged	Date Tagged	Length (mm)	Weight (kg)
1	70	Lost	4/04/2006	601	1.850
1	71	Lost	4/04/2006	641	2.350
1	72	Lost	4/04/2006	643	2.050
1	73	Methow	4/06/2006	520	1.525
1	74	Methow	4/12/2006	563	1.900
1	75	Wolf Creek	7/18/2006	475	1.075
1	76	Wolf Creek	7/18/2006	590	2.000
1	77	West Fork Methow	7/19/2006	455	0.950
1	78	Wolf Creek	7/25/2006	585	1.875
1	79	Wolf Creek	7/25/2006	540	2.475
1	80	West Fork Methow	7/26/2006	630	2.750
1	81	Robinson Creek	8/01/2006	447	1.100
1	82	West Fork Methow	8/02/2006	448	0.975



**Figure 11. Locations where fluvial bull trout were tagged by USFWS in the Methow River in 2006.**

### ***Columbia River***

The Douglas County PUD radio-tagged 7 bull trout at Wells Dam in 2006 and 1 bull trout in 2005 that entered the Methow River in 2006 (Table 3). The Chelan County PUD radio-tagged 6 bull trout in 2006 (at Rocky Reach Dam) and 3 bull trout in 2005 (1 at Rock Island and 2 at Rocky Reach) that utilized the Methow River in 2006 (Table 4).

**Table 3. Bull trout tagged by Douglas PUD: Tag channel and code, tagging location, date, fork length and weight of bull trout tagged at Wells Dam that utilized the Methow River in 2006.**

Channel	Code	River Tagged	Dam	Date	Length (mm)	Weight (kg)
1	4	Columbia	Wells	6/02/2005	560	2.200
1	50	Columbia	Wells	5/24/2006	570	2.600
1	52	Columbia	Wells	5/16/2006	700	3.900
1	56	Columbia	Wells	5/16/2006	560	2.140
1	58	Columbia	Wells	5/19/2006	660	3.100
1	60	Columbia	Wells	5/21/2006	430	0.980
1	62	Columbia	Wells	5/24/2006	555	1.890
1	64	Columbia	Wells	5/19/2006	610	2.540

data: BioAnalysts (2006)

**Table 4. Bull trout tagged by Chelan PUD: Tag channel and code, tagging location, date, length and weight of bull trout tagged at Rock Island and Rocky Reach Dams that utilized the Methow River in 2006.**

Channel	Code	River Tagged	Dam	Date Tagged	Length (mm)	Weight (kg)
14	3	Columbia	RI	5/30/2005	450	1.244
14	31	Columbia	RR	5/31/2005	520	1.586
14	44	Columbia	RR	6/27/2005	465	1.259
14	171	Columbia	RR	5/25/2006	650	3.308
14	174	Columbia	RR	5/26/2006	585	2.752
14	177	Columbia	RR	5/30/2006	580	2.394
14	180	Columbia	RR	5/31/2006	550	2.136
14	184	Columbia	RR	6/05/2006	530	1.814
14	188	Columbia	RR	6/22/2006	450	1.040

data: BioAnalysts (2006)

The bull trout we tagged in the spring averaged 593.6 mm and 1.935 kg (range 520- 643 mm and 1.525 – 2.350 kg) and the bull trout we tagged during summer averaged 521.2 mm and 1.650 kg (range 447 – 630 mm and 0.950 – 2.750 kg) (Table 2). The bull trout tagged by DPUD at Wells Dam that used the Methow in 2006 averaged 572.8 mm and 2.315 kg (range 430 – 700 mm and 0.980 – 3.900 kg) (Table 3). Bull trout tagged at Rocky Reach and Rock Island Dams by CPUD that used the Methow in 2006 averaged 525 mm and 1.877 kg (range 450 – 650 mm and 1.040 – 3.308 kg) (Table 4). In general, bull trout tagged in the Methow weighed less at longer lengths than bull trout tagged in the Columbia River, and those tagged in the spring showed the lowest correlation between weight and length (Figure 12).

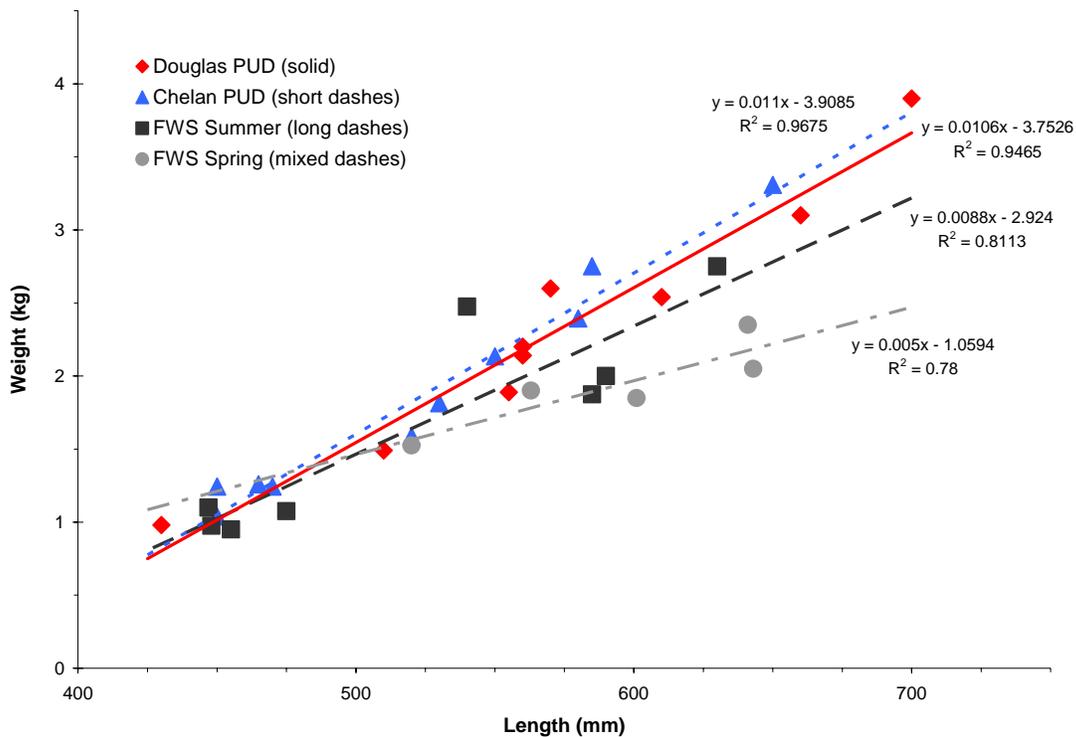


Figure 12. Scatter plot of weights and lengths of bull trout tagged in the Methow and Columbia Rivers that used the Methow Core Area in 2006.

### ***Methow River watershed***

**Lost River-** On April 4, we caught and tagged 3 bull trout (codes 70, 71, and 72) in the Lost River at rkm 1, upstream of the Lost River Road Bridge (Figure 11). These bull trout spent the winter in the upper Methow system due to isolation by the dry reach that seasonally exists in the Methow River. On April 5, as spring runoff re-watered the dry reach, we snorkeled and observed 3 untagged adult fluvial bull trout in the same pool. By April 6, water was flowing through the entire length of the formerly dry reach.

*Mainstem Methow River-* On April 6, we caught and tagged 1 bull trout (code 73) in a stretch of the Methow River known locally as “Brandenburg Run” at rkm 77 (Figure 11). On April 12 we caught and tagged 1 bull trout (code 74) in the Methow River at the Carlton Public Fishing Area at rkm 43.9 (Figure 11).

*Wolf Creek-* Four bull trout were caught and tagged in a small pool downstream of a log jam located at rkm 6.6 of Wolf Creek, downstream of the Wolf Creek Irrigation District diversion (Figures 4 and 11). On July 11, we snorkeled in the pool and up to the diversion, and observed one 650 mm male bull trout in the pool downstream of the log jam, but upstream of the log jam to the diversion we only observed one 150 mm bull trout. On July 18, we caught and tagged 2 bull trout (codes 75 and 76) in the log jam pool. We also angled from the log jam upstream to the diversion but did not catch or observe any migratory bull trout. On July 25, we caught and tagged 2 more bull trout (codes 78 and 79) in the log jam pool, but none were observed or caught upstream of the logjam to 200 m upstream of the diversion.

*West Fork Methow River-* We caught and tagged 3 bull trout in pools of the lower West Fork Methow River (Figure 11). Bull trout code 77 was tagged on July 19 at rkm 1.1, code 80 on July 26 at rkm 4.8 (Figure 3), and code 82 on August 2 at rkm 2.1.

*Robinson Creek-* On August 1, we caught and tagged 1 bull trout (code 81) downstream of the cascades in Robinson Creek at approximately rkm1 (Figure 11). We fished this area on the advice of Bob Adams, USFWS, who caught “Dolly Varden” there when he was a boy. The temperature in Robinson Creek at 16:00 was 10.5 °C.

### ***Radio-Tracking***

#### ***Total mobile tracking effort***

We spent 62 days on mobile tracking surveys in the Methow River system in 2006, including 60 days of foot or truck surveys by MCRFRO and 2 aerial surveys by CPUD. A total of 373 locations of 30 tagged bull trout were determined during mobile surveys, including 313 locations by truck tracking, 40 locations by foot tracking, and 20 locations by aerial survey.

#### ***Movements of individual bull trout***

We tracked the movements of 30 radio tagged bull trout. See Appendix 2 for descriptions and maps of the movements of individual radio-tagged bull trout.

#### ***Fixed station data***

We recorded 102 movements of 26 radio-tagged bull trout migrating past fixed telemetry stations (Tables 4 – 11). Four radio tagged bull trout (codes 77, 82, 81 and 177) were not recorded at any stations.

*LG fixed station (rkm 1.1 of Methow River)*- Bull trout radio-tagged in the Columbia River migrated into the Methow River and passed the LG station (maintained by DPUD at rkm 1.1) from May 23 – July 2, 2006 (Table 5) (LGL 2007a, 2007b, BioAnalysts 2007). Bull trout entered the Methow River after peak flows subsided and stream discharge at entry dates declined from 12,900 - 2,960 ft<sup>3</sup>/sec (Appendix 1, Figure 19). Bull trout code 31, tagged in 2005 and over-wintered in Wolf Creek, exited the Methow River on May 25, 2006. Code 74, tagged in the Methow River in April, moved downstream into the Columbia River in late May, re-entered the Methow River in early June and then exited again on July 17, 2006. During the fall out-migration, radio-tagged bull trout were detected exiting the Methow River from September 28 – December 10, 2006. Two bull trout (codes 62 and 180) were not detected as they migrated out of the Methow River.

**Table 5. LG Fixed Station Data: dates and times in 2006 that radio-tagged adult bull trout first arrived during migrations past the receiver station located at rkm 1.1 of the Methow River.**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
DPUD	1	60	LG	upstream	Methow	23-May-06	13:30
DPUD	1	58	LG	upstream	Methow	24-May-06	12:35
DPUD	1	62	LG	upstream	Methow	25-May-06	02:45
CPUD	14	31	LG	downstream	Methow	24-May-06	15:01
CPUD	14	44	LG	upstream	Methow	24-May-06	16:55
DPUD	1	50	LG	upstream	Methow	26-May-06	09:33
DPUD	1	56	LG	upstream	Methow	27-May-06	14:39
DPUD	1	52	LG	upstream	Methow	7-Jun-06	00:45
CPUD	14	180	LG	upstream	Methow	7-Jun-06	06:33
CPUD	14	174	LG	upstream	Methow	7-Jun-06	23:54
DPUD	1	64	LG	upstream	Methow	14-Jun-06	17:02
CPUD	14	184	LG	upstream	Methow	19-Jun-06	20:46
CPUD	14	188	LG	upstream	Methow	2-Jul-06	12:26
CPUD	14	171	LG	upstream	Methow	no detection	--
USFWS	1	74	LG	downstream	Methow	17-Jul-06	14:34
USFWS	1	76	LG	downstream	Methow	28-Sept-06	05:13
CPUD	14	188	LG	downstream	Methow	31-Oct-06	01:39
DPUD	1	52	LG	downstream	Methow	1-Nov-06	09:08
CPUD	14	44	LG	downstream	Methow	9-Nov-06	23:07
CPUD	14	174	LG	downstream	Methow	9-Nov-06	10:08
DPUD	1	56	LG	downstream	Methow	17-Nov-06	17:31
CPUD	14	184	LG	downstream	Methow	9-Dec-06	16:12
CPUD	14	171	LG	downstream	Methow	10-Dec-06	14:47
DPUD	1	62	LG	downstream	Methow	no detection	--
CPUD	14	180	LG	downstream	Methow	no detection	--

*GS fixed station (rkm 10.6 of Methow River)*- This station in the USGS gage station at rkm 10.6 was not operational until June 22, 2006, so it missed most of the in-migration (Table 6). Code 188 was recorded migrating upstream on July 5. Code 74 was detected moving up and downstream on July 5 and 16. In the fall, radio-tagged bull trout were recorded migrating downstream past the station from September 26 – December 7, 2006.

**Table 6. GS Fixed Station Data: dates and times in 2006 that radio-tagged adult bull trout first arrived during migrations past the receiver station located in the USGS gage house at rkm 10.6 of the Methow River.**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
CPUD	14	188	GS	upstream	Methow	5-Jul-06	05:21
USFWS	1	74	GS	upstream	Methow	5-Jul-06	18:17
USFWS	1	74	GS	downstream	Methow	16-Jul-06	22:36
USFWS	1	76	GS	downstream	Methow	26-Sep-06	20:13
CPUD	14	188	GS	downstream	Methow	24-Oct-06	04:04
CPUD	14	3	GS	downstream	Methow	25-Oct-06	01:31
DPUD	1	52	GS	downstream	Methow	31-Oct-06	03:48
DPUD	1	56	GS	downstream	Methow	7-Nov-06	07:11
CPUD	14	174	GS	downstream	Methow	8-Nov-06	02:35
CPUD	14	44	GS	downstream	Methow	9-Nov-06	15:46
CPUD	14	180	GS	downstream	Methow	11-Nov-06	19:48
DPUD	1	62	GS	downstream	Methow	12-Nov-06	20:07
CPUD	14	184	GS	downstream	Methow	5-Dec-06	22:16
CPUD	14	171	GS	downstream	Methow	7-Dec-06	22:52

*TG fixed station (rkm 64.4 of Methow River)*- This fixed telemetry station was set up in the USGS gage station at rkm 64.4 of the Methow River and was not operational until October 17, 2006. It recorded bull trout migrating downstream past the station from November 7 to November 20, 2006 (Table 7).

**Table 7. TG Fixed Station Data: dates and times in 2006 that radio-tagged adult bull trout first arrived during migrations past the receiver station located in the USGS gage house at rkm 64.4 of the Methow River.**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
DPUD	1	58	TG	downstream	Methow	7-Nov-06	05:43
CPUD	14	184	TG	downstream	Methow	7-Nov-06	16:29
CPUD	14	44	TG	downstream	Methow	7-Nov-06	21:56
CPUD	14	180	TG	downstream	Methow	8-Nov-06	12:57
DPUD	1	62	TG	downstream	Methow	9-Nov-06	18:13
USFWS	1	71	TG	downstream	Methow	13-Nov-06	00:05
CPUD	14	171	TG	downstream	Methow	13-Nov-06	00:08
USFWS	1	70	TG	downstream	Methow	20-Nov-06	00:47

*TR fixed station (rkm 2.1 of Twisp River)* - This fixed telemetry station was set up in the Methow Salmon Recovery Foundation pump house at rkm 2.1 of the Twisp River on June 6, 2006. It recorded 9 radio-tagged bull trout migrating upstream past the station from June 24 – July 4, 2006 (Table 8). Bull trout entered the Twisp River after peak flows subsided and stream discharge at entry dates declined from 912 – 537 ft<sup>3</sup>/sec (Appendix 1, Figure 23). Code 3 was not detected during the up-migration and may have over-wintered in the Twisp River system. In the fall, 7 radio-tagged bull trout were recorded migrating downstream past the station from September 15 – November 8, 2006 (Table 8). Tagged bull trout that were isolated upstream of the dry reach were able to migrate after heavy rains re-watered the reach and were last to exit the Twisp River (Appendix 1, Figure 23).

**Table 8. TR Fixed Station Data: dates and times in 2006 that radio-tagged adult bull trout first arrived during migrations past the receiver station located in the MSRF pump house at rkm 2.1 of the Twisp River.**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
CPUD	14	180	TR	upstream	Twisp	24-Jun-06	03:18
DPUD	1	50	TR	upstream	Twisp	26-Jun-06	00:35
DPUD	1	52	TR	upstream	Twisp	29-Jun-06	23:51
DPUD	1	56	TR	upstream	Twisp	30-Jun-06	15:05
DPUD	1	58	TR	upstream	Twisp	30-Jun-06	23:12
DPUD	1	64	TR	upstream	Twisp	2-Jul-06	23:37
CPUD	14	184	TR	upstream	Twisp	3-Jul-06	01:44
DPUD	1	4	TR	upstream	Twisp	3-Jul-06	02:46
CPUD	14	174	TR	upstream	Twisp	4-Jul-06	00:51
DPUD	1	52	TR	downstream	Twisp	15-Sep-06	20:23
DPUD	1	56	TR	downstream	Twisp	30-Sep-06	21:19
CPUD	14	3	TR	downstream	Twisp	8-Oct-06	00:24
CPUD	14	174	TR	downstream	Twisp	10-Oct-06	04:18
DPUD	1	58	TR	downstream	Twisp	7-Nov-06	00:28
CPUD	14	184	TR	downstream	Twisp	7-Nov-06	16:02
CPUD	14	180	TR	downstream	Twisp	8-Nov-06	05:28

*MC fixed station (rkm 80.6 of Methow River)* - In the spring of 2006, 4 radio-tagged bull trout were detected moving downstream past this station at rkm 80.6, the confluence of the Chewuch and Methow Rivers (Table 9). Codes 70, 71, and 72 were tagged on April 4 in the Lost River, and migrated downstream when the dry reach was re-watered on April 5 and 6. They passed the MC station from April 13 – April 28, 2006. Code 31 passed the station on May 22, after over-wintering in Wolf Creek. Nine radio-tagged bull trout migrated upstream past the station from June 13 – July 16, 2006, but only one bull trout (code 73) entered the Chewuch River. In the fall, 7 bull trout migrated downstream past the station from September 19 – November 11, 2006.

**Table 9. MC Fixed Station Data: dates and times in 2006 that radio-tagged bull trout first arrived during migrations past the receiver station located at rkm 80.6, the confluence of the Methow and Chewuch Rivers.**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
USFWS	1	70	MC	downstream	Methow	13-Apr-06	04:42
USFWS	1	72	MC	downstream	Methow	25-Apr-06	00:41
USFWS	1	71	MC	downstream	Methow	28-Apr-06	10:47
CPUD	14	31	MC	downstream	Methow	22-May-06	09:33
USFWS	1	73	MC	upstream	Chewuch	13-Jun-06	02:42
CPUD	14	44	MC	upstream	Methow	19-Jun-06	22:09
USFWS	1	71	MC	upstream	Methow	22-Jun-06	22:44
DPUD	1	62	MC	upstream	Methow	26-Jun-06	00:37
CPUD	14	171	MC	upstream	Methow	28-Jun-06	01:32
DPUD	1	60	MC	upstream	Methow	28-Jun-06	02:26
USFWS	1	70	MC	upstream	Methow	13-Jul-06	01:22
USFWS	1	72	MC	upstream	Methow	16-Jul-06	23:58
CPUD	14	188	MC	upstream	Methow	16-Jul-06	01:31
USFWS	1	76	MC	downstream	Methow	19-Sep-06	02:17
CPUD	14	188	MC	downstream	Methow	2-Oct-06	00:28
USFWS	1	78	MC	downstream	Methow	8-Oct-06	21:42
USFWS	1	73	MC	downstream	Chewuch	22-Oct-06	04:19
USFWS	1	70	MC	downstream	Methow	8-Nov-06	21:03
DPUD	14	171	MC	downstream	Methow	10-Nov-06	03:24
USFWS	1	71	MC	downstream	Methow	11-Nov-06	03:45

*LC fixed station (rkm 37.5 of Chewuch River)*- One radio-tagged bull trout was detected at the LC station at the confluence of Lake Creek and Chewuch River (rkm 37.5). Bull trout code 73 was recorded moving upstream past the station on June 28, 2006 (Table 10), but analysis of the signals recorded at each antenna did not clearly indicate whether it continued up the Chewuch River or entered Lake Creek. (See Appendix 2 for description of the movements of code 73). This station was removed on August 30, 2006, due to the Tripod Complex wildfire, so the timing of the downstream migration of bull trout code 73 is unknown.

**Table 10. LC Fixed Station Data: dates and times in 2006 that radio-tagged adult bull trout first arrived during migrations past the receiver station located at the confluence of Lake Creek and Chewuch River (rkm 37.5).**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
USFWS	1	73	LC	upstream	Chewuch	28-Jun-06	21:34

*WC fixed station (rkm 1.4 of Wolf Creek)*- The fixed telemetry station at rkm 1.4 of Wolf Creek was set up on June 6, 2006. It recorded the upstream migration of code 188 on July 17 (Table 11). Codes 75, 76, 78, and 79 were tagged in Wolf Creek. All the tagged bull trout migrated downstream and passed the station from September 13 – October 17, 2006.

**Table 11. WC Fixed Station Data: dates and times in 2006 that radio-tagged adult bull trout first arrived during migrations past the receiver station located at rkm 1.4 of Wolf Creek.**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
CPUD	14	188	WC	upstream	Wolf Creek	17-Jul-06	06:58
USFWS	1	79	WC	downstream	Wolf Creek	13-Sep-06	04:28
USFWS	1	76	WC	downstream	Wolf Creek	18-Sep-06	20:23
CPUD	14	188	WC	downstream	Wolf Creek	1-Oct-06	05:06
USFWS	1	78	WC	downstream	Wolf Creek	7-Oct-06	06:47
USFWS	1	75	WC	downstream	Wolf Creek	17-Oct-06	19:09

*LW fixed station (rkm 117.5 of Methow River)*- Two of the 3 bull trout tagged in Lost River in the spring migrated downstream before this station at the confluence of West Fork Methow River and Lost River was operational on April 5, but code 72 was detected migrating downstream on April 12 (Table 12). Radio-tagged bull trout were detected migrating upstream from June 30 – July 26, 2006. Code 71 was detected moving downstream on August 11, back upstream in the Lost on August 12, and then again downstream on September 30, when the signal indicated it entered the West Fork Methow River. Tagged bull trout migrated downstream past the station on November 6, when heavy rain and flooding re-watered the dry reach in the upper Methow River.

**Table 12. LW Fixed Station Data: dates and times in 2006 that radio-tagged adult bull trout first arrived during migrations past the receiver station located at rkm 117.5, the confluence of Lost and West Fork Methow Rivers.**

Agency	Channel	Code	Station	Migration	River	First Hit Date	Time
USFWS	1	72	LW	downstream	Lost	12-Apr-06	20:48
CPUD	14	44	LW	upstream	West Fork	30-Jun-06	23:49
DPUD	1	62	LW	upstream	West Fork	6-Jul-06	23:29
USFWS	1	70	LW	upstream	Lost	22-Jul-06	03:24
USFWS	1	71	LW	upstream	Lost	23-Jul-06	01:49
USFWS	1	72	LW	upstream	Lost	26-Jul-06	01:51
USFWS	1	71	LW	downstream	Lost	11-Aug-06	00:47
USFWS	1	71	LW	upstream	Lost	12-Aug-06	21:25
USFWS	1	71	LW	downstream	Lost	30-Sep-06	20:45
USFWS	1	71	LW	downstream	West Fork	6-Nov-06	03:27
DPUD	1	62	LW	downstream	West Fork	6-Nov-06	06:37
CPUD	14	44	LW	downstream	West Fork	6-Nov-06	07:02
USFWS	1	70	LW	downstream	Lost	6-Nov-06	11:44
USFWS	1	80	LW	downstream	West Fork	6-Nov-06	13:58

### Spawning locations

Twenty-two of the 30 tagged bull trout in the Methow Core Area in 2006 were radio-tracked near or on spawning grounds. Redd location coordinates were recorded during spawning ground surveys (USFS 2006, Nelson and Conlin 2006, USFWS 2007).

*Twisp River*- Five radio-tagged bull trout from the Columbia River (codes 4, 50, 58, 180, 184) were located in the vicinity of redds on the spawning grounds upstream of the dry reach and 4 tagged bull trout were located near redds downstream of the dry reach (codes 3, 52, 64, 174) (Figure 14). One tagged bull trout (code 56) moved downstream, apparently prior to the start of spawning, and was located near the confluence of Buttermilk Creek on September 12 and 29, so it is uncertain if this fish spawned.

*Chewuch River*- Access to the upper Chewuch River was closed due to the Tripod Complex wildfire, and by the time restrictions were lifted, bull trout code 73 had already moved downstream, so it is not known if it visited the spawning grounds.

*Wolf Creek*- All 5 tagged bull trout (codes 75, 76, 78, 79, 188) did not pass a log jam obstacle at rkm 6.6 and did not reach the best spawning area in Wolf Creek (Figure 14). A 7DADMax water temperature of 16.3°C was recorded just upstream of the log jam on July 27 and water temperature of 9 °C, signaling the onset of spawning, was recorded on September 13 (Figure 13). Of the 18 redds observed in Wolf Creek during the 2006 spawning ground survey, 7 redds were located downstream of the log jam seasonal barrier, and all 5 tagged bull trout may have spawned.

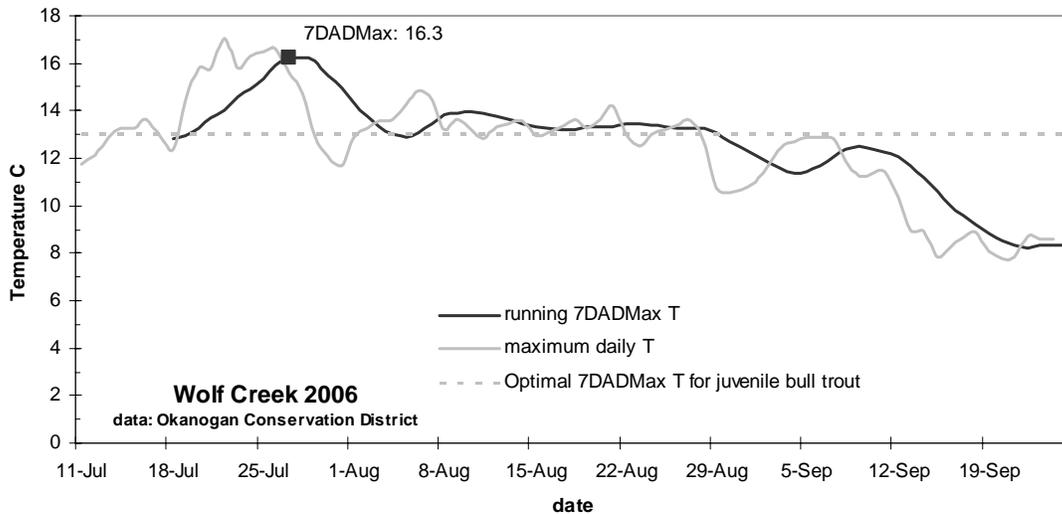
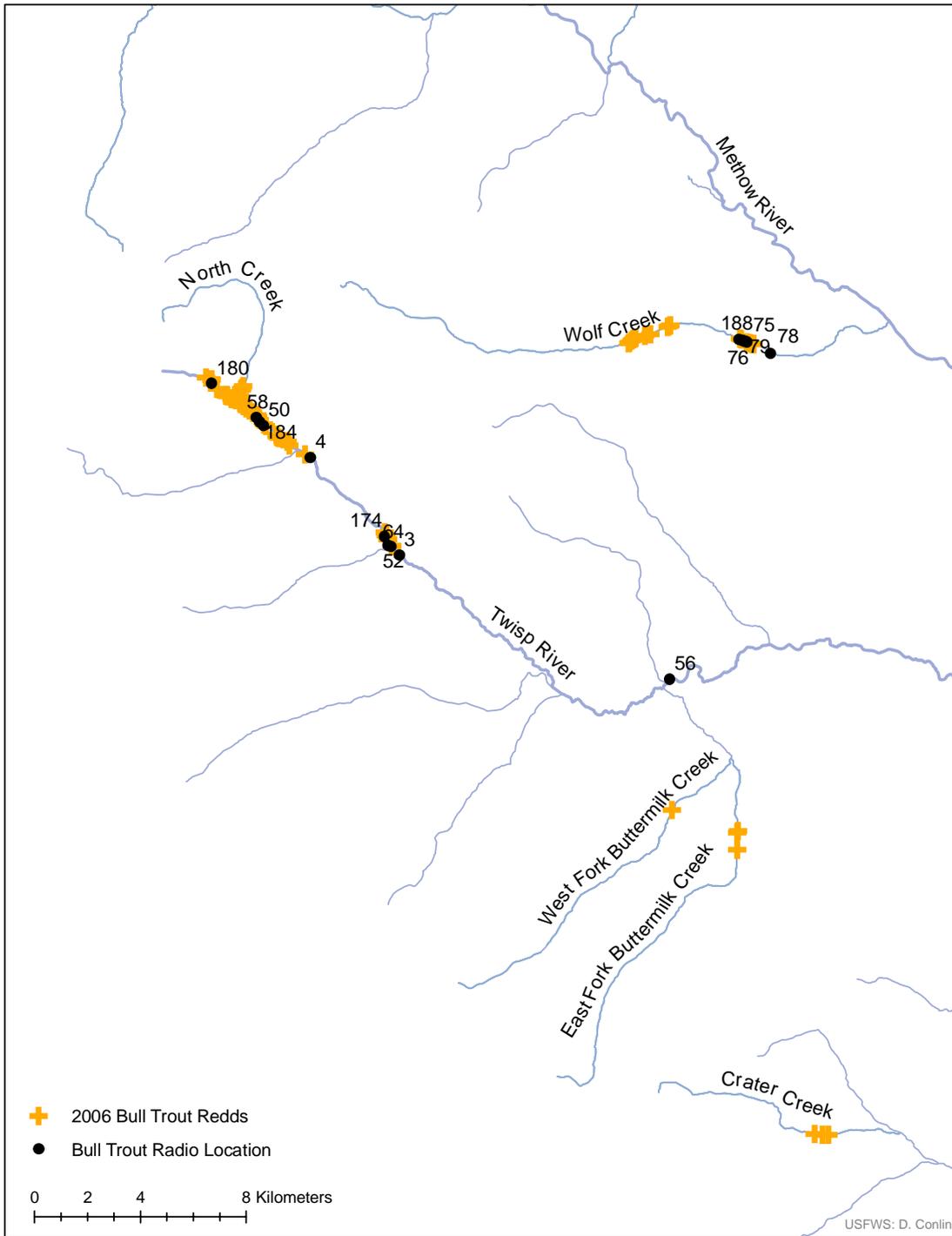


Figure 13. Maximum daily and running 7DADMax temperatures in Wolf Creek at rkm 6.7, July 11 - September 25, 2006.



**Figure 14. Radio-tagged bull trout telemetry locations and bull trout redd locations in spawning areas of Twisp River and Wolf Creek during September - October, 2006.**

*Goat Creek-* During a spawning ground survey we conducted on September 13, bull trout code 60 was radio-tracked on the spawning grounds and located near two migratory-sized redds (Figure 15).

*Early Winters Creek-* One Rocky Reach tagged bull trout (code 171) was located on the migratory spawning grounds downstream of the barrier falls and the resident population of Early Winters Creek (Figure 15).

*West Fork Methow River-* Six tagged bull trout were located on the West Fork Methow River spawning grounds (Figure 15): 1 was tagged at Rocky Reach (code 44), 1 at Wells (code 62), 1 in Lost River during spring (code 72), 1 in Robinson Creek (code 81) and 2 in West Fork in the summer (codes 80 and 82).

*Lost River-* On September 28, we walked the lower Lost River to Eureka Creek (rkm 6.3), and conducted a redd survey while radio tracking. We observed code 71 at rkm 2.1 but did not observe any bull trout redds. Code 70 was located in the Lost River Gorge during the aerial survey flown by BioAnalysts on September 19, but it is unknown if that area is a bull trout spawning ground. In 2005, bull trout code 10 was also located near the gorge and Monument Creek (rkm 11.4).

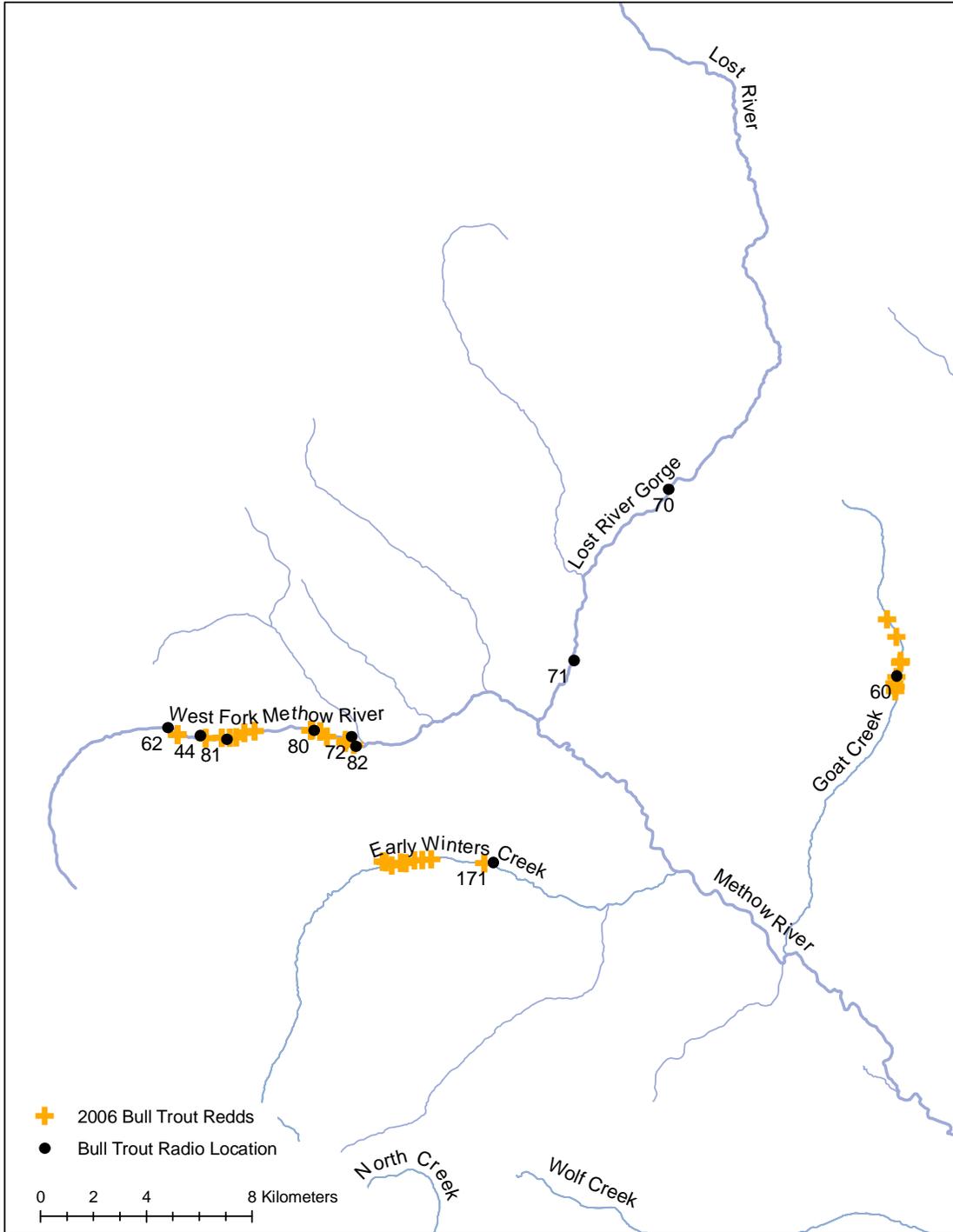
#### ***Motionless or recovered tags***

Seven of the 13 tags implanted in adult fluvial bull trout by USFWS-MCRFRO in 2006 were recovered or motionless (Figure 16).

*Code 77-* On September 14, the tag of code 77 was recovered on the bank in the lower West Fork Methow River at rkm 2.0 and the presence of rib bones indicated the bull trout was depredated or scavenged.

*Code 74-* On September 19, tag code 74 was recovered in the Columbia River downstream of Wells Dam. An analysis by LGL and DPUD of telemetry data from the fixed station at the tailrace of the dam suggested that angling was a probable cause of mortality of the tagged bull trout and the USFWS Central Washington Field Office concurred it was not related to the operation of the dam (see Appendix 3).

*Code 72-* On October 12, the intact carcass of code 72 was recovered downstream of the spawning reach in the West Fork Methow River at rkm 7.5. It was a 100 % spawned out female, with little fat in the body or around the pyloric caecae, and the stomach was empty. The condition and position of the body indicated the fish actively choose its final resting spot under a log near a midstream gravel bar, suggesting post-spawning mortality. The PIT tag was not in the body cavity and may have been expelled with the eggs. The surgical wound was healed with no signs of infection.



**Figure 15. Radio-tagged bull trout telemetry locations and bull trout redd locations in spawning areas in Goat Creek, Early Winters Creek, and West Fork Methow River during September - October, 2006.**

*Code 79-* On October 17, tag code 79 was recovered at river kilometer 39.1 of the Methow River. The bull trout had been active at this location from September 19 – October 13. The tag was recovered in the river near the right bank, lying on the bottom at a depth of 0.7 m. There were no clues to determine the fate of the bull trout or indicate mortality.

*Code 81-* On November 16, code 81 was recovered in the Methow River at rkm 116.5, downstream of the West Fork and Lost River confluence. The tag was lying on the bottom at a depth of 1 meter in the thalweg. There were no clues to determine the fate of the bull trout or indicate mortality.

*Code 76-* On November 29, code 76 transmitted the motionless signal code 176 in the Columbia River in the immediate vicinity of the fishing docks in Pateros, WA. The tag was not recovered.

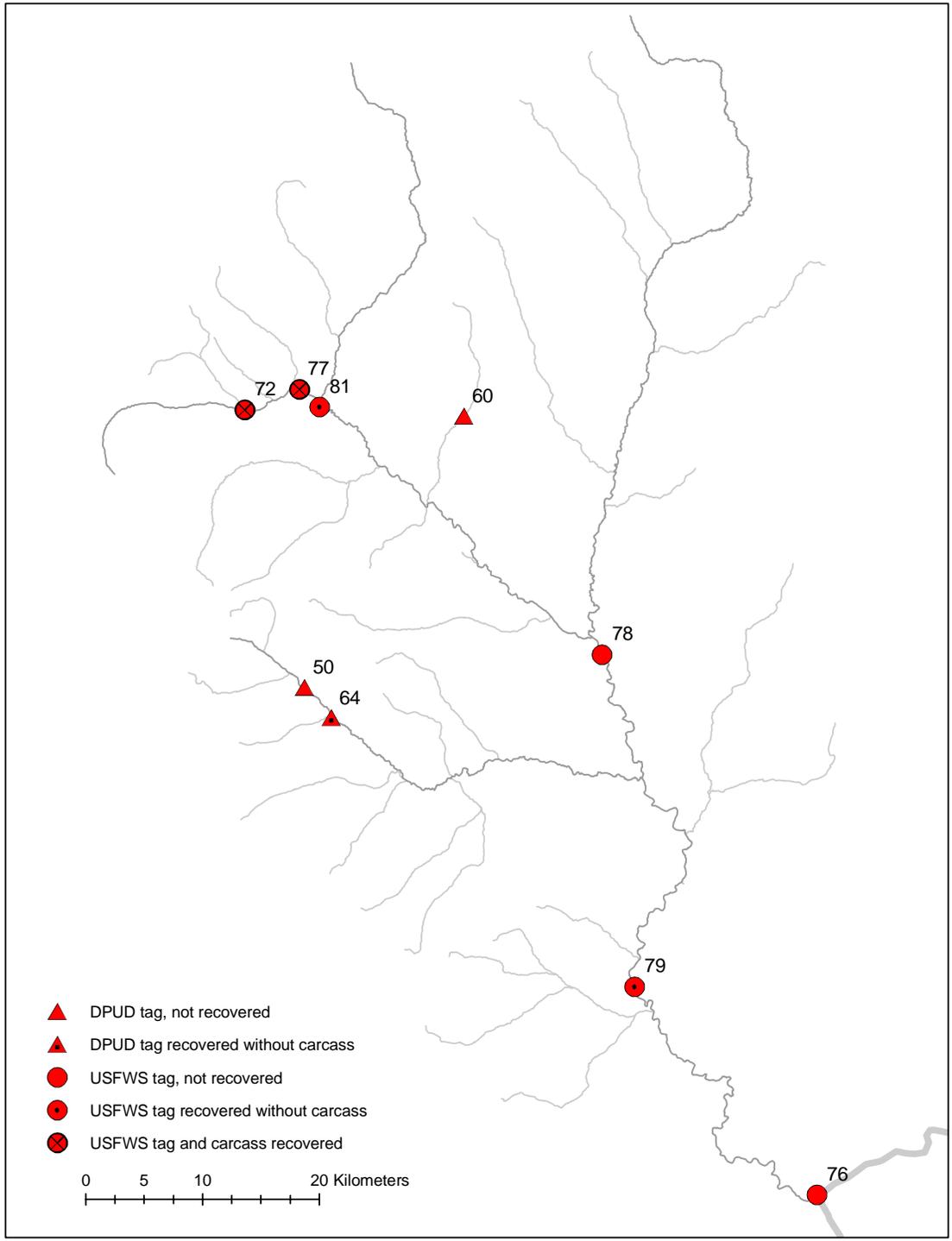
*Code 78-* On November 29, code 78 transmitted the motionless signal code 178 in the Methow River at rkm 78.4. It was at this location from October 10 – November 16 before it became motionless. The signal emanated from a LWD pile near the bank, but ice stymied the recovery attempt. The fate of this bull trout is unknown.

Three of 17 PUD tags were recovered or are transmitting motionless signals (Figure 16).

*Code 64-* On October 11, code 64 was recovered in Reynolds Creek (tributary to Twisp River) in the pool downstream of the hanging culvert under FR 4435 (Figure 17). The tag was recovered at the edge of the pool, in shallow water under a branch. There were no clues to determine the fate of the bull trout or to indicate mortality.

*Code 60-* On November 9, code 60 transmitted the motionless signal code 160 in Goat Creek at rkm 9. The tag was tracked to LWD jam on the right bank, and we determined it was under the bank in the roots of a fir tree and could not be recovered. A small den or hole was discovered under the roots, suggesting that the bull trout may have been depredated or scavenged by a mink.

*Code 50-* On November 15, code 50 transmitted the motionless signal code 150 in the Twisp River at rkm 34.9, upstream of Poplar Flat Campground. Triangulation of the signal from the road indicated the tag was in the vicinity of the formerly dry edge of the seasonal dry reach, but deep snow and time limitations prevented recovery and a return trip to investigate. Circumstances suggest that the bull trout may have been stranded near the edge and perished as the dry edge expanded and the water froze.



**Figure 16. Locations of recovered or motionless radio tags in the Methow Core Area, 2006.**



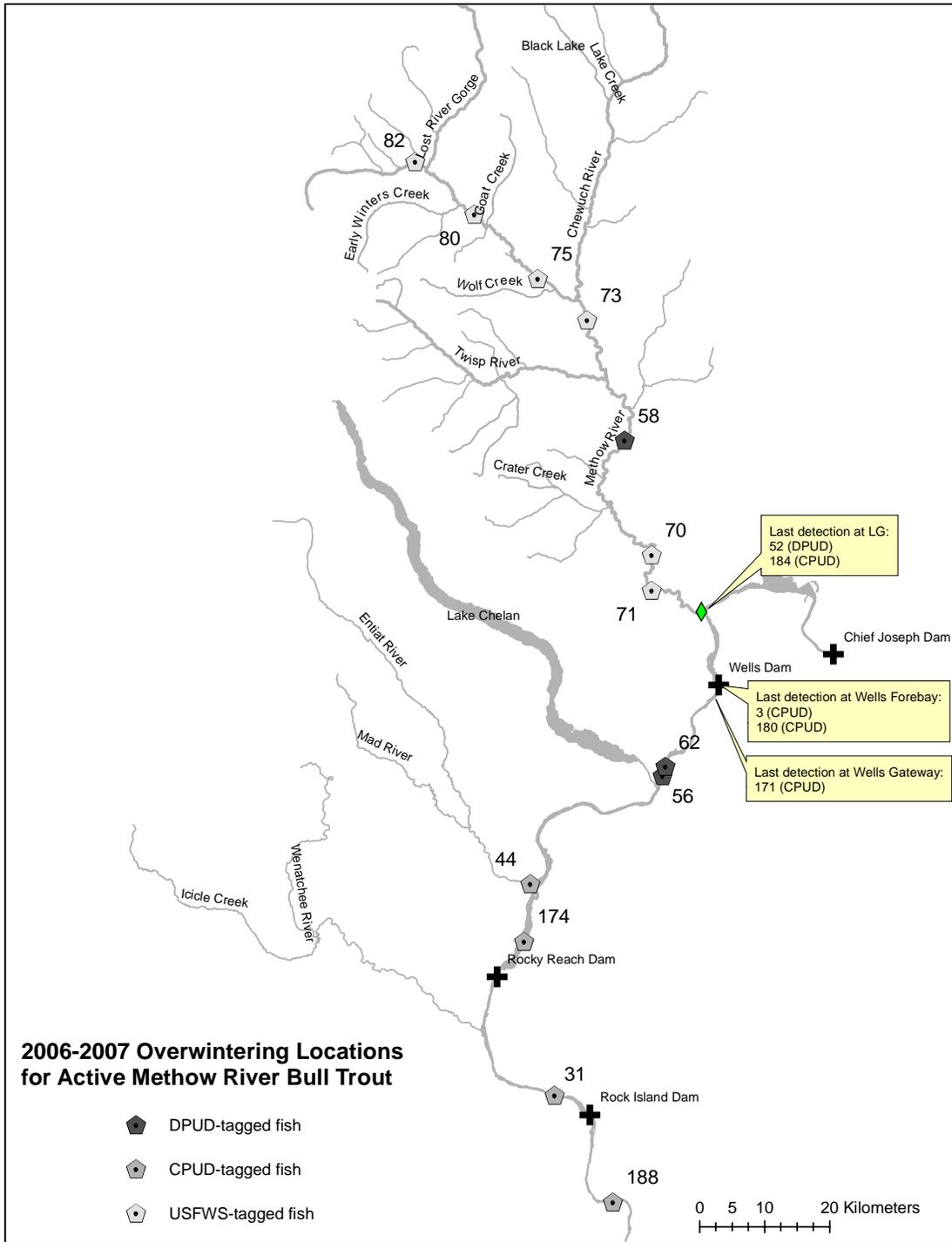
**Figure 17. Pool and hanging culvert where bull trout tag code 64 was recovered in Reynolds Creek, tributary to Twisp River, on October 11, 2006.**

***Over-wintering locations and post-spawning migration distances***

*USFWS tagged bull trout-* All 6 active USFWS bull trout tagged in the Methow Core Area over-wintered within the Methow River watershed (Figure 18). After the spawning period, these tagged bull trout migrated an average distance of 50.1 km (SD 48.0). The shortest post-spawning movement was 6.1 km and the longest was 110.1 km (Table 13).

*DPUD tagged bull trout-* Three of the 4 active DPUD tagged bull trout migrated out of the Methow River Core Area. Bull trout code 58 remained in the Methow River watershed and bull trout codes 52, 56, and 62 returned to the Columbia River (Figure 18). The last known detection for code 52 was in the Methow River at the LG station at rkm 1.1 and we assume it entered the Columbia River, so we used that detection to calculate a known minimum post-spawning migration distance; the true distance would be longer. Post-spawning migrations averaged 111.3 km (SD 50.4); the shortest movement was 47.5 km and the longest was 162.9 km (Table 13).

*CPUD tagged bull trout-* All 8 active CPUD tagged bull trout migrated out of the Methow River Core Area and returned to the Columbia River (Figure 18). The over-wintering locations for bull trout codes 3, 171, 180, and 184 are unknown and their last known detection locations were used to calculate a minimum post-spawning migration distance, so the true distances would be longer. Post-spawning migrations averaged 152.4 km (SD 45.6); the shortest movement was 105.6 km and the longest was 221.6 km (Table 13).



**Figure 18. Map of the over-wintering locations of active radio-tagged bull trout that used the Methow River Core Area in 2006.**

**Table 13. Post spawning migration distances of USFWS, DPUD and CPUD radio-tagged adult bull trout in 2006. Distances are calculated from last known locations and thus are minimum distances moved.**

Code	Tagging agency	Date tagged	Tagging location	Destination tributary	Over-winter location	Post-spawn migration (km)
70	USFWS	4-Apr-06	Lost R	Lost R	Methow R	110.1
71	USFWS	4-Apr-06	Lost R	Lost R	Methow R	109.9
73	USFWS	6-Apr-06	Methow R	Chewuch R	Methow R	41.7
75	USFWS	18-Jul-06	Wolf Cr	Wolf Cr	Methow R	10.1
80	USFWS	26-Jul-06	WF Methow	WF Methow	Methow R	22.7
82	USFWS	2-Aug-06	WF Methow	WF Methow	WF Methow	6.1
52	DPUD	16-May-06	Wells	Twisp R	Columbia R	97.4
56	DPUD	16-May-06	Wells	Twisp R	Columbia R	137.6
58	DPUD	19-May-06	Wells	Twisp R	Methow R	55.4
62	DPUD	24-May-06	Wells	WF Methow	Columbia R	162.9
3	CPUD	30-May-05	Rock Is	Twisp R	Columbia R	111.7
44	CPUD	27-Jun-05	Rocky Reach	WF Methow	Entiat R	197.0
171	CPUD	25-May-06	Rocky Reach	Early Win	Columbia R	135.2
174	CPUD	26-May-06	Rocky Reach	Twisp R	Columbia R	177.2
180	CPUD	31-May-06	Rocky Reach	Twisp R	Columbia R	121.4
184	CPUD	5-Jun-06	Rocky Reach	Twisp R	Columbia R	105.6
188	CPUD	22-Jun-06	Rocky Reach	Wolf Cr	Columbia R	221.6

## Discussion

*Movement patterns-* The adult bull trout we tagged in the Methow River system exhibited different movement patterns than the bull trout tagged by the PUDs in the Columbia River in 2006. Only 2 of the 13 bull trout we tagged in the spring and summer migrated to the Columbia River, but the tags coded motionless before their winter destinations were determined. All 6 of the remaining active bull trout we tagged in 2006 did not migrate out of the Methow Core Area. Two of our 3 remaining spring bull trout returned to over-winter in the same locations they occupied during the summer, while the third moved further downstream but stayed in the Methow River. Of the 3 remaining active bull trout we tagged during summer, all are over-wintering in the Methow River upstream of rkm 86. In contrast, only 1 of the 12 remaining active Columbia River tagged bull trout is over-wintering in the Methow River and the other 11 migrated downstream and are over-wintering in the Columbia River, including 1 downstream of Rock Island Dam. These new observations were possible because of the cooperative and simultaneous telemetry studies being conducted by USFWS and Chelan and Douglas PUDs.

*Spawning locations-* This year our study documented the first known use of Early Winters and Goat Creek during the spawning period for Columbia River migratory bull trout. In Early Winters Creek, the migratory spawning grounds are isolated downstream of the resident spawning grounds by the barrier waterfalls at rkm 12, but in Goat Creek,

migratory and resident bull trout share the same spawning reach. Both of these creeks are located within the seasonal dry reach in the upper Methow system. Columbia River migratory bull trout have now been documented on the spawning grounds in Twisp River, Wolf Creek, Goat Creek, Early Winters Creek, and West Fork Methow River (BioAnalysts 2002, 2004, Nelson 2004, Nelson and Nelle 2007). Radio tracking in 2006 confirmed that Twisp River is the largest spawning aggregation of fluvial bull trout migrating from the Columbia River (Nelson 2004).

It still unknown if fluvial bull trout spawn in the lower Lost River. Bull trout redd surveys were conducted by USFS in the lower Lost River (Eureka Creek to Monument Creek) on September 15, 1995 and October 8, 1998 and no redds were observed (USFS 2006). One 18" BT was observed about 2 miles above the mouth during the 1998 survey. To date, one Columbia River bull trout (code 10 in 2005) migrated to lower Lost River, but no bull trout spawning areas have yet been identified there. Of the 3 bull trout we tagged in the Lost River in April, all migrated downstream and stayed in the Methow River. When these bull trout migrated back upstream code 72 spawned in the West Fork Methow River, code 71 returned to the lower Lost River (but apparently visited the West Fork in late September), and code 70 migrated up the Lost River to the Lost River Gorge. A large landslide in the Gorge near rkm 14 (Kohn 1987) is apparently a barrier to further migrations up the Lost River (USFWS 2004), and the seasonal dry reach in the upper Methow River may play a role in movements of bull trout between Lost River and West Fork Methow River. Genetic analyses may clarify the relationship of bull trout from these tributaries.

*Bull trout response to seasonal dry reaches-* Individual bull trout exhibited distinctly different movement behaviors upstream of the seasonal dry reaches in the Twisp and upper Methow Rivers in 2006. Some tagged bull trout moved downstream and held near the dry reach after the spawning period, while others stayed on the spawning grounds or moved only a short distance downstream and stayed considerably upstream of the dry area. For example, after bull trout code 44 moved to the dry edge, we observed it and an untagged bull trout isolated in a small pool in the West Fork and both probably would have been stranded and perished if the heavy rains had not fallen and increased stream discharge on November 6. While never observed, code 50 in the Twisp moved downstream very near the dry edge and circumstances suggest that it too was isolated but stranded and died before the rain event. In contrast, bull trout code 180 hardly moved from its location in the spawning reach near North Creek until the Twisp River dry reach was re-watered, and then it and other tagged bull trout moved quickly downstream and migrated out. After rains increased discharge in the upper Methow, some tagged bull trout quickly migrated, while others moved slowly and one did not migrate at all. The Early Winters tagged bull trout did not move until the rain came and increased stream discharge. It appears that the behavior of some bull trout may reduce the chance of stranding and fewer isolated bull trout may be at risk than previously thought (Nelson 2004).

*Chewuch River bull trout-* Since the start of the Chelan and Douglas PUD telemetry studies of Columbia River bull trout in 2001, no Columbia River bull trout have been

documented migrating into the Chewuch River (BioAnalysts 2002, 2004, Nelson and Nelle 2007). The only tagged adult bull trout known to migrate into the Chewuch is bull trout code 73, tagged in the Methow River at rkm 77 in 2006. Its spawning destination in the Chewuch is unknown, due to bridge washouts and the Tripod Fire closures. In the fall, code 73 migrated out of the Chewuch and over-wintered at its tagging location in the Methow River.

Most of the available information on movements of Chewuch River bull trout has been collected by the Washington Department of Fish and Wildlife (WDFW) Methow Salmon Hatchery during collection of their brood stock. In 2005, 30 bull trout were caught in the WDFW trap at the Fulton Diversion at rkm 1.3 of the Chewuch River. Bull trout were first captured on May 16, peak numbers were captured on June 13, and the last on June 24 (WDFW 2006; Appendix 4, Figure 58). By comparison, in 2005, Columbia River tagged bull trout did not enter the Methow River (80.6 rkm downstream) until May 26, June 2, 3, 7, and 28 (LGL and DPUD 2006). In 2006, Code 73 entered the Chewuch on June 13, but Columbia River bull trout did not migrate past the Chewuch confluence until June 19 – July 16. Although the sizes of the Chewuch bull trout captured at the trap in 2005 were estimations, the average size of those bull trout was smaller than the average size of radio-tagged Columbia River and upper Methow River bull trout (Figure 59 in Appendix 4). These telemetry and trap observations suggest that Chewuch River bull trout may be a distinct migratory subpopulation separate from the stocks that migrate to the Columbia River. The Fulton Dam was rebuilt in 2006 and the trap was removed, so the opportunity to enumerate or radio-tag bull trout at this location was lost.

*Tag recoveries and mortality-* The motion sensing tags proved useful for quick response to monitor status of the bull trout. The discovery of rib bones of bull trout code 77 and the carcass of bull trout code 72 may not have been possible without the motionless signal. However, even with the motion sensor, it is still difficult to assign a fate to a recovered or motionless tag. Therefore, we must emphasize that any discussion of most recovered tags relies on circumstantial evidence and speculation. For the purposes of discussion, we speculate that two bull trout were possibly depredated or scavenged, one bull trout died due to post-spawning stress, and one bull trout was stranded and died. There is no direct evidence, but based solely on the area where the tags were recovered or immobile, two losses may be related to angling. Angling injuries can be a contributing factor to tag loss in bull trout (Salow and Hostettler 2004). Three transmitters were recovered in-stream with no other clues, suggesting that tag expulsion was possible. Transmitter expulsion was observed during an earlier Columbia River bull trout study (BioAnalysts 2004), and expulsion rates have been estimated at 3 – 28 % in other bull trout studies (Elle et al. 1994, Swanberg 1997, Elle 1998, Clayton 2001, Mendel et al. 2003, Salow and Hostettler 2004). We will continue to monitor the PIT data collected at the Mid-Columbia Dams to determine if any PIT tags associated with these codes are detected. In addition, until a tag is recovered, we cannot rule out the possibility of malfunctions of the motion switch on immobile tags. Some bull trout move very little at over-wintering sites, and it is possible the fish may still be alive so we will continue to monitor un-recovered tags.

*Barriers and obstacles to migration-* To date, our radio tracking has identified only one manmade probable barrier to bull trout migrations in the Methow Core Area: the hanging culvert in Reynolds Creek under FR 4435. This culvert potentially blocks migration to only a short section of creek, since high vertical bedrock falls at rkm 0.8 terminate the upstream passage of fish in Reynolds Creek (Mullan et al 1992). However, during surveys in 1982 and 1990, one “adfluvial” and 4 resident bull trout were observed in the pool below the falls (Mullan et al. 1992).

Several natural obstacles and seasonal barriers to migration of bull trout have been identified. The seasonal dry reaches in the Methow Core Area isolate a significant number of migratory bull trout (Nelson 2004, Nelson and Nelle 2007), but these subsurface flows are apparently natural occurrences. Nelson (2004) found documentation on the Twisp dry reach dating to only 1986 (Kohn 1987), but we located documentation from at least 1941 for both the Twisp and Methow dry reaches (Cox 1941). The Lost River goes subsurface between Drake Creek (rkm 18.8) and Monument Creek (rkm 12.4) (Kohn 1987), and intermittent flows sometimes extend as far downstream as Eureka Creek (rkm 6.4) (WDFW et al. 1990 *cited in* WSCC 2000). The remote and rugged nature of the Lost River make radio-tracking and redd surveys difficult, so there is still little information about bull trout in this reach.

Radio telemetry indicates the log jam at rkm 6.6 of Wolf Creek becomes a barrier to upstream migration at low stream flow. The Okanogan Conservation District cannot measure discharge at high flows, and on July 11, 2006, when measurements were first recorded near rkm 6.7 in Wolf Creek, discharge was 63 ft<sup>3</sup>/sec (OCD 2007, Figure 25). It appears that stream flow must be at a higher level for bull trout to pass and migrate to the best spawning habitat near North Fork Wolf Creek (rkm 11.1). Bull trout did spawn in lower Wolf Creek in 2006, as 7 of the 18 redds identified in Wolf Creek were downstream of the log jam (USFWS 2007), but it is uncertain if these redds will contribute any juveniles and increase the effective population size of bull trout in Wolf Creek. During surveys conducted from 1987 – 1990, Mullan et al. (1992) collected 2 bull trout and 185 rainbow trout at stations in rkm 0 – 9.2 and 51 bull trout and 0 rainbow trout at rkm 11.6, indicating that few bull trout utilized lower Wolf Creek. In 2006, the 7DADMax temperature recorded near rkm 6.7 was 16.3 °C (OCD 2007, Figure 13), compared to the optimal 7DADMax of about 13.0 °C for juvenile bull trout (Selong et al. 2001, WDOE 2002, Essig et al. 2003), suggesting that water temperature may be a limiting factor for juvenile bull trout in lower Wolf Creek.

*Areas of focus in 2007-* In 2007, we will attempt to capture additional bull trout from the Methow Core Area and implant radio transmitters. We will focus our tagging efforts primarily in the Chewuch River (7 -10 tags), Wolf Creek ( $\leq$  5 tags), West Fork Methow River ( $\leq$  5 tags), and Early Winters Creek ( $\leq$  5 tags). We will track both new and existing radio tagged bull trout and attempt to determine the migration patterns in the Chewuch River, observe movement windows at the Wolf Creek log jam, and monitor the response of bull trout to isolation by the seasonal dry reaches.

In 2007, Douglas and Chelan PUDs will complete radio tagging of bull trout at their Columbia River Hydroelectric Projects, but will continue their bull trout monitoring programs into 2008 (LGL and DPUD 2006) and 2009 (CPUD 2005). Contingent on funding, our project is scheduled to be completed at the end of FY 2011, and we will continue our cooperative efforts to radio-track and monitor bull trout in the Methow Core Area and increase our knowledge base of the migratory movements of bull trout in the Columbia River and the Upper Columbia Bull Trout Recovery Unit.

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## Literature Cited

- Adams, N.S., D.W. Rondorf, S.D. Evans, J.E. Kelly, and R.W. Perry. 1998. Effects of surgically and gastrically implanted radio transmitters on swimming performance and predator avoidance of juvenile chinook salmon (*Oncorhynchus tshawtscha*). *Canadian Journal of Fisheries and Aquatic Sciences* 55:781-787.
- BioAnalysts. 2004. Movement of bull trout within the Mid-Columbia River and tributaries 2001-2004-final. Prepared by BioAnalysts, Inc., Boise Idaho, for Chelan, Douglas, and Grant PUDs. May 26, 2004.
- BioAnalysts. 2006. *2006-Comprehensive Tagging File-final.xls*. Unpublished spreadsheet of bull trout tagged by CPUD, DPUD, and USFWS 2005-2006. Maintained and distributed by John Stevenson, BioAnalysts, Inc., Boise ID.
- BioAnalysts. 2007. *Bulltrout\_20070212\_Full.mdb*. Unpublished bull trout location data in Access database. Maintained and distributed to CPUD, DPUD, and USFWS by John Stevenson, BioAnalysts, Inc., Boise ID.
- CPUD (Chelan County Public Utility District). 2005. Rocky Reach comprehensive bull trout management plan. Final. Rocky Reach Hydroelectric Project. FERC Project No. 2145. September 25, 2005. Public Utility District No. 1 of Chelan County. Wenatchee WA.
- Clayton, T. 2001. Movements and status of bull trout (*Salvelinus confluentus*) in the Belly River, Alberta and Montana. Pages 141-145 in Brewin, M.K., A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings, Trout Unlimited Canada, Calgary, Alberta.
- Cox, B. 1941. Report of salmon conference at Seattle, Washington. March 6, 1941. Document # PAS0021 in the library of the Mid-Columbia River Fishery Resource Office, USFWS, Leavenworth, WA.
- Elle, S. 1998. Annual performance report. Project 6. Bull trout investigations. Subproject 1. Rapid River bull trout movement and mortality studies. January 1998. IDFG 98-5. Idaho Department of Fish and Game, Coeur d'Alene, ID.
- Elle, S., R. Thurow, and T. Lamansky. 1994. Job performance report. Rivers and streams investigations: subproject 2, study 4, job 1. Rapid River bull trout movement and mortality studies. November 1994. IDFG 94-33. Idaho Department of Fish and Game, Coeur d'Alene, ID.
- Essig, D. A., C. A. Mebane, and T. W. Hillman. 2003. Update of bull trout temperature requirements. Final Report April 30, 2003. Idaho Department of Environmental Quality.

- Kohn, M. 1987. Spring and summer Chinook spawning ground surveys, Methow and Okanogan River Basins. Yakama Indian Nation Fisheries Resource Management. Toppenish, WA.
- LGL (LGL Limited Environmental Research Associates). 2007a. Memo to DCPUD re: 2006 Bull trout travel analysis #9. Data through 30 Jan 2007. Date: February 14, 2007. Prepared by Dave Roubichaud, LGL Limited. Sidney, BC, Canada.
- LGL (LGL Limited Environmental Research Associates). 2007b. Memo to DCPUD re: USFWS and CCPUD Bull trout #3. Data through 30 Jan 2007. Date: February 14, 2007. Prepared by Dave Roubichaud. LGL Limited. Sidney, BC, Canada.
- LGL and DPUD (LGL Limited Environmental Research Associates and Douglas County Public Utility District). 2006. Wells bull trout monitoring and management plan 2005 annual report. Wells Hydroelectric Project, FERC No. 2149. Public Utility District No. 1 of Douglas County, East Wenatchee, Washington.
- Mendel, G., C. Fulton, R. Weldert. 2003. An investigation into the migratory behavior of bull trout (*Salvelinus confluentus*) in the Touchet River Basin. October 2003. Washington Department of Fish and Wildlife.
- Mulcahy, D.M. 2003. Surgical implantation of transmitters into fish. *ILAR Journal* 44(4):295-306.
- Mullan, J.W., K.R. Williams, G. Rhodus, T.W. Hillman, J.D. McIntyre. 1992. Production and habitat of salmonids in Mid-Columbia River tributary streams. USFWS Monographs I. Leavenworth, Washington.
- Nelson, M.C. 2004. Movements, habitat use, and mortality of adult fluvial bull trout isolated by seasonal subsurface flow in the Twisp River, WA. U.S. Fish and Wildlife Service, Leavenworth, WA.
- Nelson, M.C. 2006. A hitch mounted mobile telemetry system. Unpublished report. U.S. Fish and Wildlife Service, Leavenworth, WA.
- Nelson, M.C. and D.B. Conlin. 2006. Goat Creek bull trout spawning ground survey 2006. U.S. Fish and Wildlife Service, Leavenworth, WA.
- Nelson, M.C. and R.D. Nelle. 2007. Upper Columbia Recovery Unit Bull Trout Telemetry Project: 2005 Progress Report for the Methow Core Area. January 24, 2007. U.S. Fish and Wildlife Service, Leavenworth, WA.
- NPCC (Northwest Power and Conservation Council). 2004. Methow Subbasin Plan. Final Report. November 2004.
- OCD (Okanogan Conservation District) 2007. Discharge and temperature

- measurements of Wolf and Early Winter Creeks. Unpublished data in Excel spreadsheet. Provided by Erin Kaczmarczyk and Dwight Burton, Okanogan Conservation District, Okanogan, Washington.
- Rieman, B. E., and J. D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. U.S. Forest Service Intermountain Research Station, General Technical Report INT-302, Odgen, Utah.
- Ross, M. J. and C. F. Kleiner. 1982. Shield-needle technique for surgically implanting radio-frequency transmitters in fish. *Progressive Fish Culturist* 44: 41-43.
- Salow, T. and L. Hostettler. 2004. Movement and mortality patterns of adult adfluvial bull trout (*Salvelinus confluentus*) in the Boise River Basin, Idaho. Technical report for Arrowrock Dam Biological Opinion #1009.0405 OALS #00-912 and Upper Snake River Biological Opinion #1009.2700. Interim Summary Report for the Arrowrock Dam Valve Replacement Project. September 2004. U.S. Department of the Interior, Bureau of Reclamation. Snake River Area Office, Boise, Idaho
- Selong, J. H., T. E. McMahon, B. E. Rieman, and W. L. Thompson. 2001. Effect of temperature on growth and survival of bull trout, with application of an improved method for determining thermal tolerance in fishes. *Transactions of the American Fisheries Society*. 130:1026-1037.
- Stevenson, J.R., D.J. Snyder, and P. Westhagen. 2006. Bull trout radiotelemetry monitoring associated with up and downstream passage through Rocky Reach and Rock Island Dams and reservoirs, 2005. Annual report prepared for Chelan County Public Utility District, Wenatchee, WA 98801.
- Summerfelt, R.C. and L.S. Smith. 1990. Anesthesia, surgery, and related techniques. Pages 213-272 in C.S. Schreck and P.B. Moyle, editors. *Methods for fish biology*. American Fisheries Society, Bethesda, Maryland.
- Swanberg, T. 1997. Movements and habitat use by fluvial bull trout in the Blackfoot River, Montana. *Transactions of the American Fisheries Society* 126:735-746.
- USDOI (United States Department of the Interior). 1998. Endangered and threatened wildlife and plants; determination of threatened status for the Klamath River and Columbia River distinct population segments of bull trout. *Federal Register*: June 10, 1998. Volume 63(111):31647 – 31674.
- USDOI (United States Department of the Interior). 1999. Endangered and threatened wildlife and plants; determination of threatened status for bull trout in the coterminous United States; final rule. *Federal Register*: November 1, 1999. Volume 64(210):58909 - 58933.

- USFWS (U.S. Fish and Wildlife Service) 2002. Chapter 22, Upper Columbia Recovery Unit, Washington. 113 p. *in* U.S. Fish and Wildlife Service Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.
- USFWS (U.S. Fish and Wildlife Service) 2004. Recovery team meeting notes from January 29, 2004 and February 19, 2004. Judy DeLaVergne, Recovery Team Unit Lead, Central Washington Field Office, Wenatchee WA. 14p.
- USFWS (U.S. Fish and Wildlife Service) 2007. Unpublished Wolf Creek 2006 bull trout redd locations map faxed to M. Nelson, Mid Columbia River Fishery Resource Office on March 8, 2007 by J. Delavergne, Central Washington Field Office, Wenatchee, WA.
- USFS (United States Forest Service) 2006. Methow sub-basin bull trout redd survey report 2006. Report compiled and distributed by Dave Hopkins, Methow Valley Ranger District, Okanogan Wenatchee National Forest, Winthrop WA.
- USFS (United States Forest Service). 2007. Unpublished bull trout spawning ground reports for Crater Creek, Twisp River, North Creek, Buttermilk Creek, Chewuch River, Lake Creek, Early Winters Creek, West Fork Methow River. Compiled by Dave Hopkins, Methow Valley Ranger District, Okanogan Wenatchee National Forest, Winthrop, WA.
- USGS (U.S. Geological Survey). 2007. National Water Information System: Web Interface. Provisional data for Washington Methow River Basin *at* <http://waterdata.usgs.gov/wa/nwis/current/?type=methow>.
- WDFW (Washington Department of Fish and Wildlife) 2004. Washington salmonid stock inventory. Appendix: Bull Trout/Dolly Varden. October 2004. Washington Department of Fish and Wildlife. Olympia WA.
- WDFW (Washington Department of Fish and Wildlife) 2006. Unpublished data from files. Methow Salmon Hatchery, Winthrop, WA.
- WDFW (Washington Department of Fish and Wildlife), Yakama Indian Nation, and the Colville Confederated Tribes. 1990. Methow and Okanogan Rivers Subbasin Salmon and Steelhead Production Plan. Columbia Basin System Planning, Northwest Power Planning Council, Portland OR. 158 p.
- WDOE (Washington State Department of Ecology). 2002. Evaluating standards for protecting aquatic life in Washington's surface water quality standards- Temperature criteria. Draft discussion paper and literature summary. Prepared by Mark Hicks, Washington State Department of Ecology Water Quality Program. October 2002.
- WSCC (Washington State Conservation Commission). 2000. Salmon, steelhead, and bull

trout habitat limiting factors. Water Resource Inventory Area 48. Final report prepared by Carmen Andonaegui. 232 p.

Wedemeyer, G. 1970. Stress of anesthesia with MS-222 and benzocaine in rainbow trout (*Salmo gairdneri*) . *Journal of Fisheries Research Board of Canada* 27:909-914.

Winter, J.D. 1996. Advances in underwater biotelemetry. Pages 555-590 *in* B.R. Murphy and D.W. Willis, editors. *Fisheries Techniques*. Second Edition. American Fisheries Society, Bethesda, Maryland.

## **APPENDICES**

**Appendix 1:** Hydrographs and dry reaches in the Methow River System in 2006

**Appendix 2:** Descriptions and maps of movements of individual radio-tagged bull trout in 2006

**Appendix 3:** Emails re: recovery of tag code 74 downstream of Wells Dam

**Appendix 4:** Numbers and date of migrating bull trout captured in the Chewuch River at the WDFW Fulton trap in 2005.

## **Appendix 1:**

Hydrographs and dry reaches in the Methow River System in 2006.

### ***Hydrographs***

*Methow River near Pateros*- The peak discharge (19400 ft<sup>3</sup>/sec) was recorded on May 19 at this USGS gage station located at rkm 10.6 (Figure 19). Flows declined until the summer low (301 ft<sup>3</sup>/sec) was recorded on September 11. Fall stream discharge peaked (3,850 ft<sup>3</sup>/sec) on November 8, 2006.

*Methow River at Twisp*- The peak discharge (17900 ft<sup>3</sup>/sec) was recorded on May 19 at this USGS gage station located at rkm 64.4 (Figure 20). Flows declined until the summer low (240 ft<sup>3</sup>/sec) was recorded on September 11. Fall stream discharge peaked (4,750 ft<sup>3</sup>/sec) on November 7, 2006.

*Methow River at Winthrop*- The peak discharge (17700 ft<sup>3</sup>/sec) was recorded on May 18 at this USGS gage station located at rkm 80.1 (Figure 21). Flows declined until the summer low (198 ft<sup>3</sup>/sec) was recorded on September 13. Fall stream discharge peaked (3470 ft<sup>3</sup>/sec) on November 7, 2006.

*Methow River above Goat Creek near Mazama*- This USGS gage station at rkm 102.7 recorded the re-watering of the 2005/2006 upper Methow seasonal dry reach on April 8, 2006 (Figure 22). Peak discharge (6600 ft<sup>3</sup>/sec) was recorded on May 18, and the decline to no flow was recorded on October 3. Flood stage was detected on November 6, as the dry reach was re-watered by heavy rain and runoff.

*Twisp River near Twisp*- This USGS gage station on the Twisp River is located at rkm 2.6, downstream of diversions. Peak discharge (3230 ft<sup>3</sup>/sec) was recorded on May 18 and flows declined to lowest discharge (23 ft<sup>3</sup>/sec) on September 13 (Figure 23). Fall stream discharge peaked (1600 ft<sup>3</sup>/sec) on November 7 after heavy rain.

*Chewuch River at Winthrop*- This USGS gage station on the Chewuch River is located at rkm 0.3 in the town of Winthrop. Peak discharge (6430 ft<sup>3</sup>/sec) was recorded on May 18 and summer flows declined to low discharge (60 ft<sup>3</sup>/sec) on September 13 (Figure 24). Fall peak discharge (569 ft<sup>3</sup>/sec) was recorded on November 7 and a winter peak (1810 ft<sup>3</sup>/sec) was recorded on December 26, 2006 (or station was affected by ice?).

*Wolf Creek*- From July 11 – September 25, 2006, the Okanogan Conservation District (OCD) measured discharge in Wolf downstream of diversion. Flow was 63.3 ft<sup>3</sup>/sec on July 11 and declined to 15.1 ft<sup>3</sup>/sec on September 13 (Figure 25).

*Early Winters Creek*- OCD measured stream discharge from April 25 to September 18, 2006. Due to safety concerns, measurement was not conducted May 9 to June 26, so peak flow was not recorded. Highest flow (495 ft<sup>3</sup>/sec) was recorded on June 27 and lowest (22 ft<sup>3</sup>/sec) on September 18 (Figure 26).

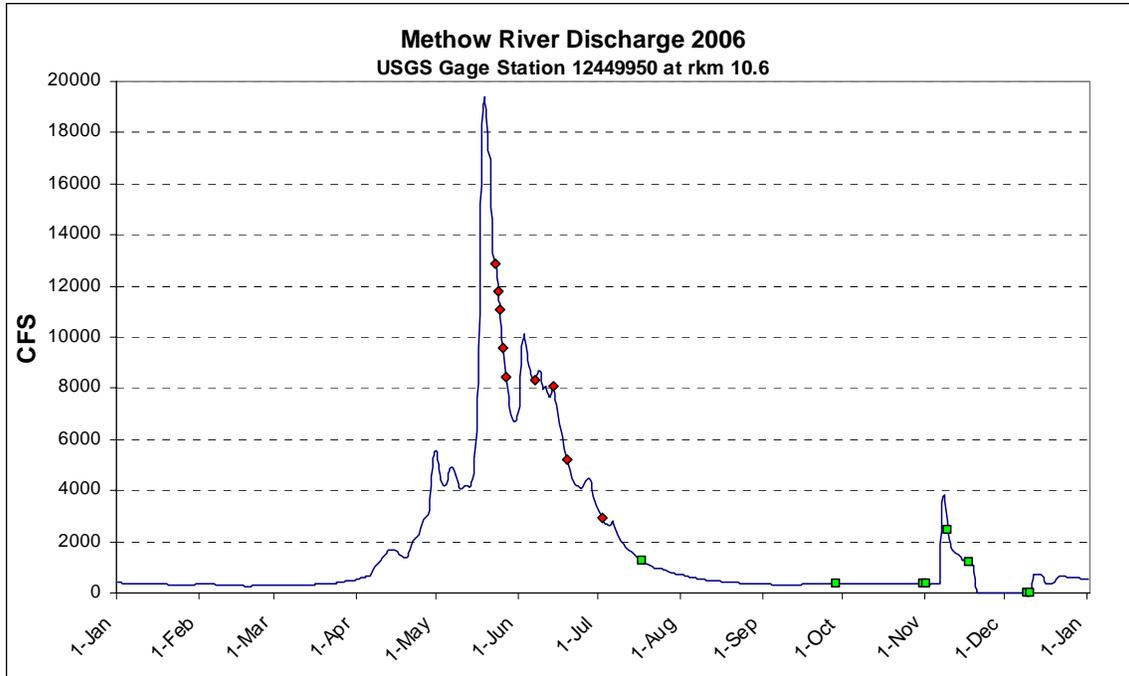


Figure 19. 2006 Hydrograph of the Methow River at the USGS gage station near Pateros, WA at rkm 10.6. Red diamonds indicate discharge at entry dates and green squares indicate discharge at exit dates of radio tagged bull trout at mouth. Ice affected readings and data is unavailable from November 20 – December 11.

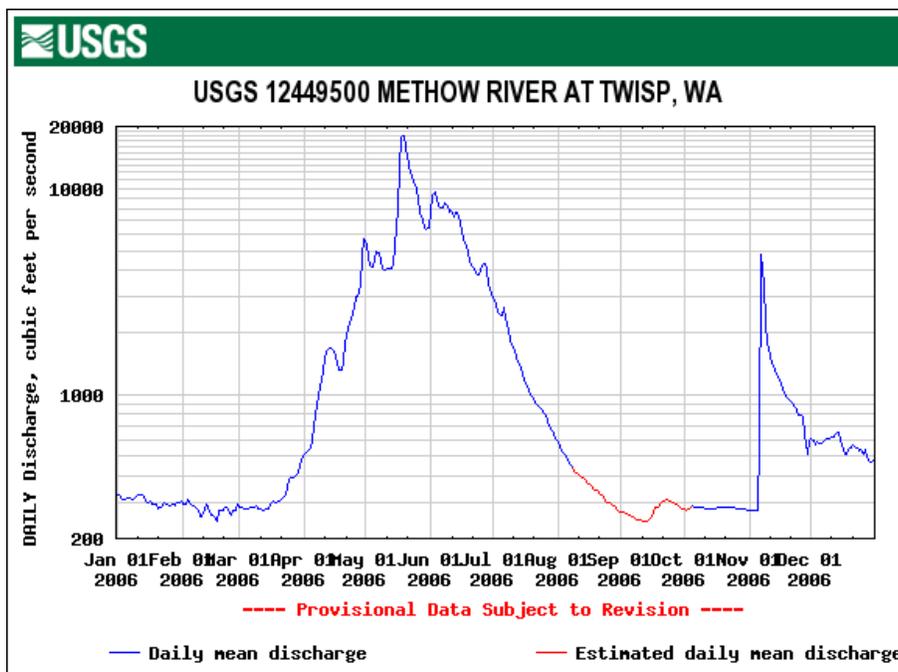


Figure 20. 2006 Hydrograph of the Methow River at the USGS gage station at rkm 64.4.



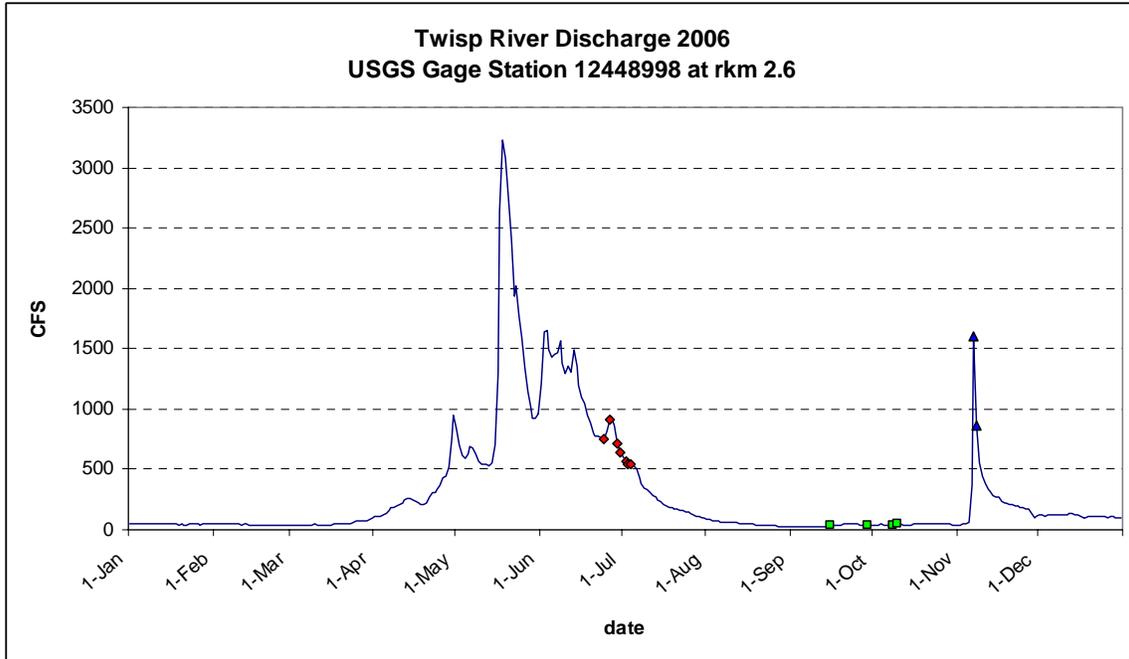


Figure 23. 2006 Hydrograph of the Twisp River at the USGS gage station near Twisp at rkm 2.6. Red diamonds indicate discharge at entry dates of radio tagged bull trout. Green squares indicate discharge at exit dates for bull trout that spawned downstream of the dry reach and blue triangles indicate discharge at exit dates for bull trout that were isolated and spawned upstream of dry reach.

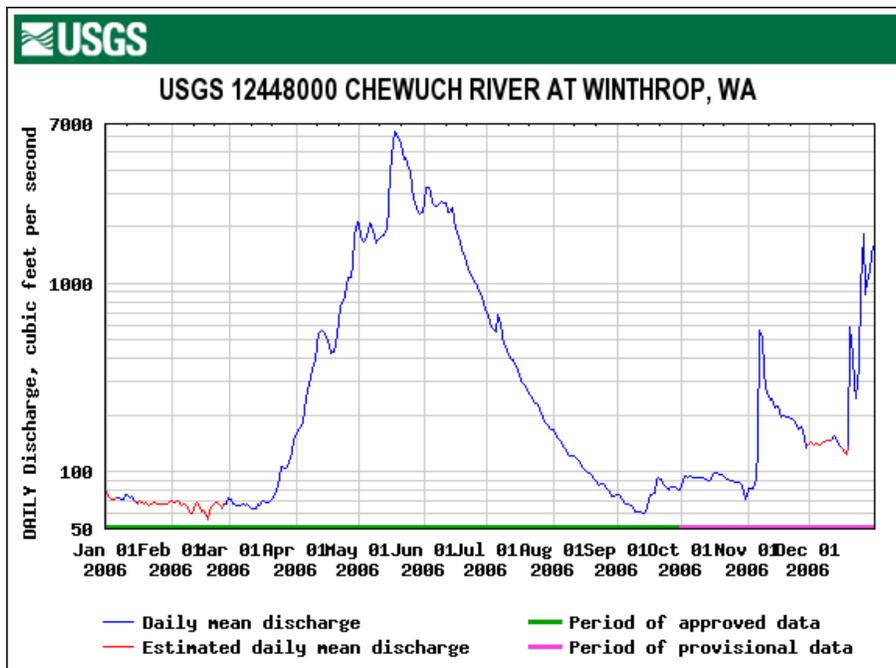


Figure 24. 2006 Hydrograph of the Chewuch River at the USGS gage station at Winthrop.

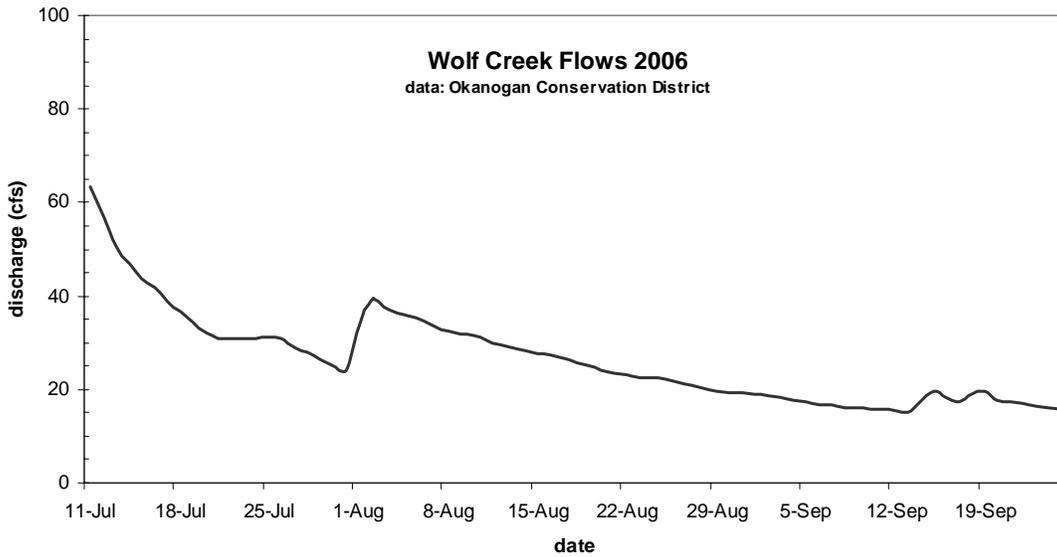


Figure 25. Hydrograph of Wolf Creek at rkm 6.7, July 11 to September 25, 2006.

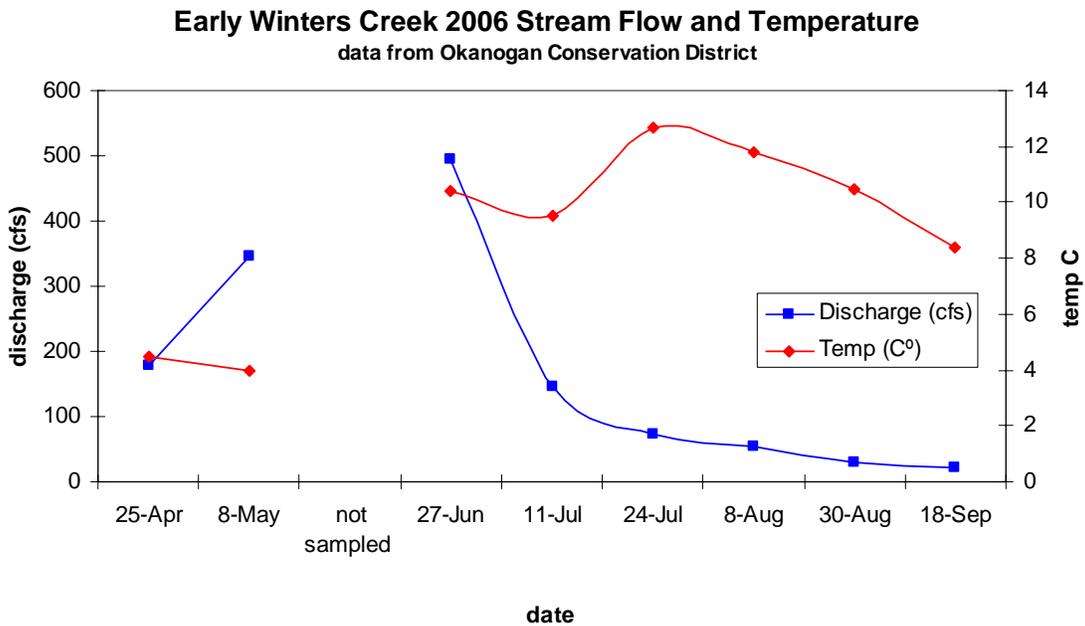
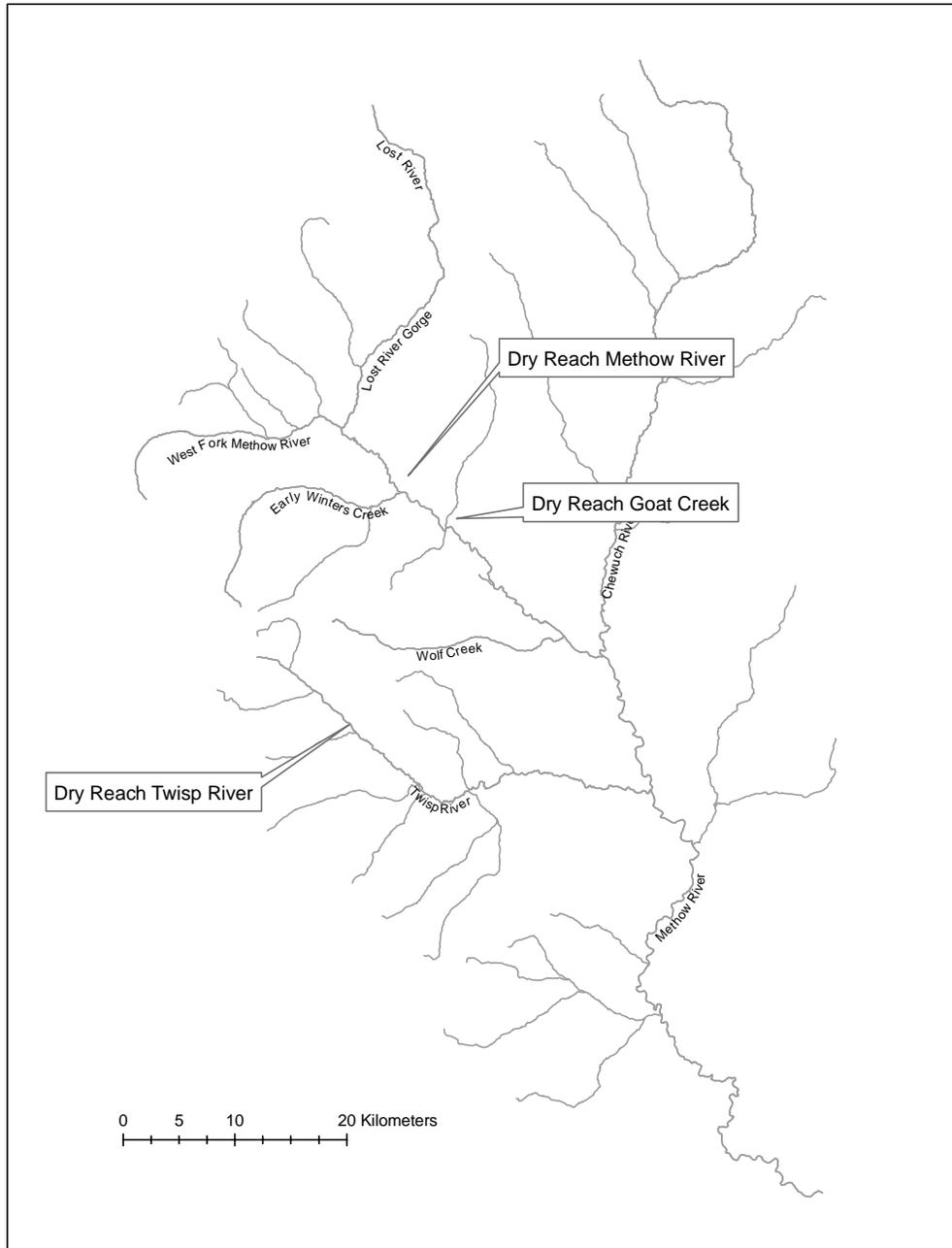


Figure 26. Stream flow and temperature measurements of Early Winters Creek, April 25 to September 18, 2006.

**Dry reaches**

The seasonal dry reach that developed during 2005 in the upper Methow and persisted through the winter of 2006 was re-watered by snow melt and runoff on April 6. Seasonal dry reaches developed in the upper Twisp River, upper Methow River, and lower Goat Creek (Figure 27). The exact date when flows went subsurface in 2006 is unknown but Twisp was observed dry at Poplar Flats on August 23 and Methow River upstream of Mazama was observed dry on September 13. These dry reaches persisted until November 6, when rains re-watered the reaches.



**Figure 27. Map of 2006 dry reaches in the Methow River watershed.**

## **Appendix 2:**

Descriptions and maps of movements of individual radio-tagged bull trout in 2006.

***USFWS bull trout-***

*Code 70-* (Figure 28). On April 4, 2006, this bull trout was the 1<sup>st</sup> of 3 tagged in the Lost River at river km 1.0 (the Lost River enters the Methow River at rkm 117.5). This bull trout had over-wintered in the upper watershed, isolated by the seasonal dry reach in the upper Methow River, and after tagging, it moved downstream when the reach was re-watered by snow melt on April 5, 2006. It passed the MC station at rkm 80.6 on April 13, and continued migrating downstream until April 20, when it stopped at rkm 18.8 in the Methow River. It stayed at this location from April 20 to June 28, 2006 during the spring runoff when flows peaked at 19,400 cfs on May 19 (USGS 2007) (Figure 19). After June 28, it migrated back upstream and on July 13, it passed the MC station at rkm 80.6. On July 22, it passed the LW station at rkm 117.5 and entered the Lost River. The seasonal dry reach in the upper Methow River developed on about September 13. Code 70 was located at rkm 11.4 near the Lost River Gorge during the aerial survey flown by BioAnalysts on September 19, 2006. Rain re-watered the dry reach on November 6, 2006. Code 70 migrated downstream and passed the LW station at rkm 117.5 on November 6, passed the MC station at rkm 80.6 on November 8, and passed the TG station at rkm 64.4 on November 20. From November 29, 2006 – March 7, 2007 (most recent survey), it was located during mobile surveys back at rkm 18.8, the same location where it was during spring in 2006. Code 70 moved a minimum known distance of 319.8 kilometers in 2006 after it was tagged and all of the movements were within the Methow River Core Area. It was twice isolated in the Lost River by the seasonal dry reach in the upper Methow River.

*Code 71-* (Figure 29). This bull trout was the 2<sup>nd</sup> of 3 tagged in the Lost River at rkm 1.0 on April 4, 2006. It had over-wintered in the upper watershed, isolated by the seasonal dry reach in the upper Methow River, and after tagging, it moved downstream when the reach was re-watered by snow melt on April 5, 2006. It passed the MC station at rkm 80.6 on April 28, and was then located during mobile surveys at rkm 73.2 of the mainstem Methow River from May 11 to June 9, 2006, during the spring runoff when flows peaked at 17,700 cfs on May 18 (USGS 2007) (Figure 21). After June 9, code 71 migrated back upstream, passed the MC station at rkm 80.6 on June 22, passed the LW site at rkm 117.5 on July 23, and entered the Lost River. On August 11 and 12, it was recorded moving downstream and then back upstream in the Lost River past the LW station. It was located in the Lost River at rkm 4 during the aerial survey flown by BioAnalysts on September 19, 2006. On September 28, we observed code 71 in pool alongside a log jam at rkm 1.1 in the Lost River. On September 30, it moved downstream past the LW station and then apparently entered and moved upstream in the West Fork Methow River. On November 6, after rain re-watered the dry reach, code 71 migrated downstream and passed the LW station at rkm 117.5, the MC station at rkm 80.6 on November 11, and the TG station at rkm 64.4 on November 13. It was located in the Methow River near Black Canyon Creek at rkm 12 during mobile surveys from November 15, 2006 – March 7, 2007 (most recent survey). Code 71 moved a minimum known distance of 203.9 km after it was tagged in 2006 and all of the movements were within the Methow River Core Area. It was twice isolated in the Lost River/West Fork Methow River by the seasonal dry reach in the upper Methow River.

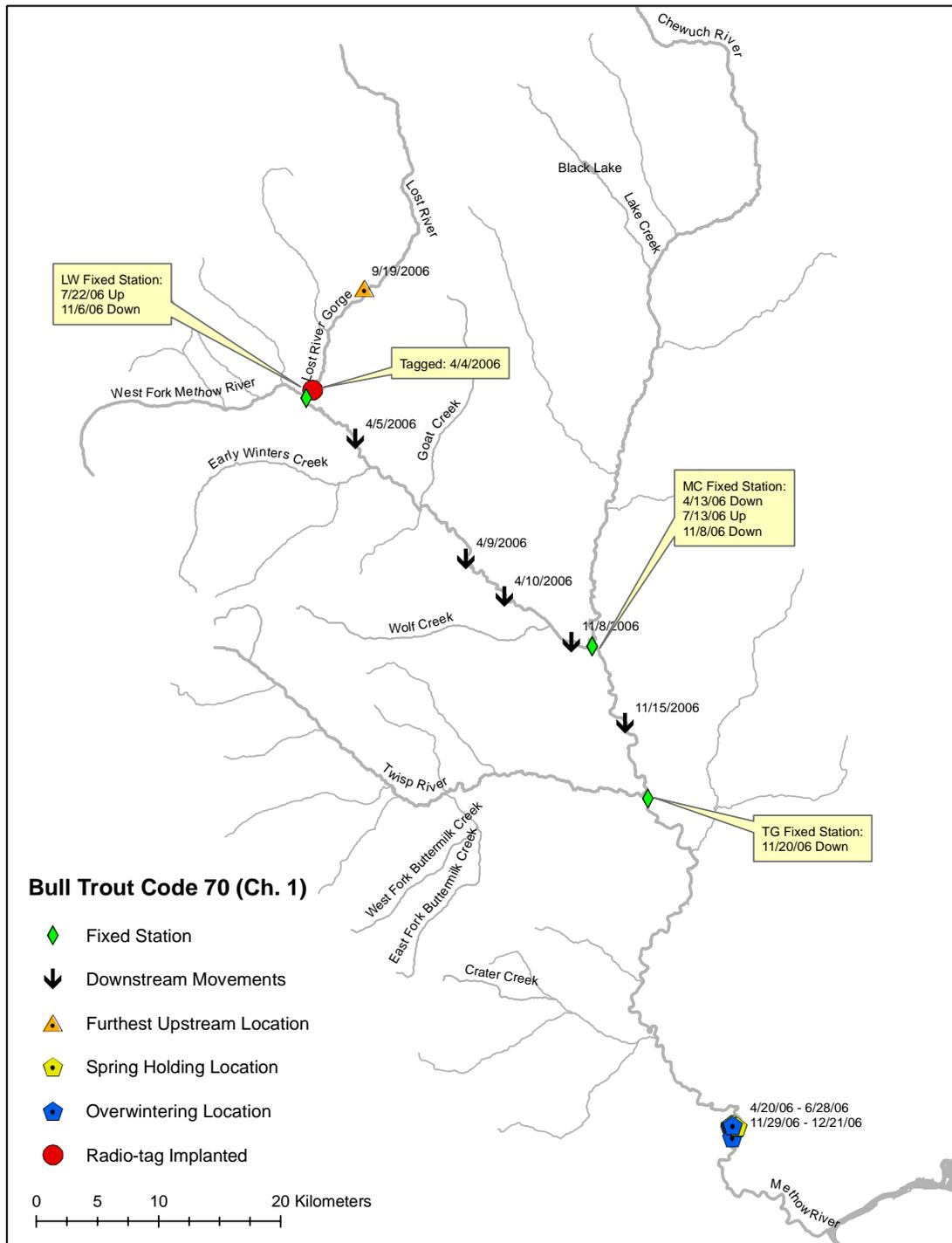


Figure 28. Map of radio-telemetry locations of USFWS bull trout code 70 in 2006.

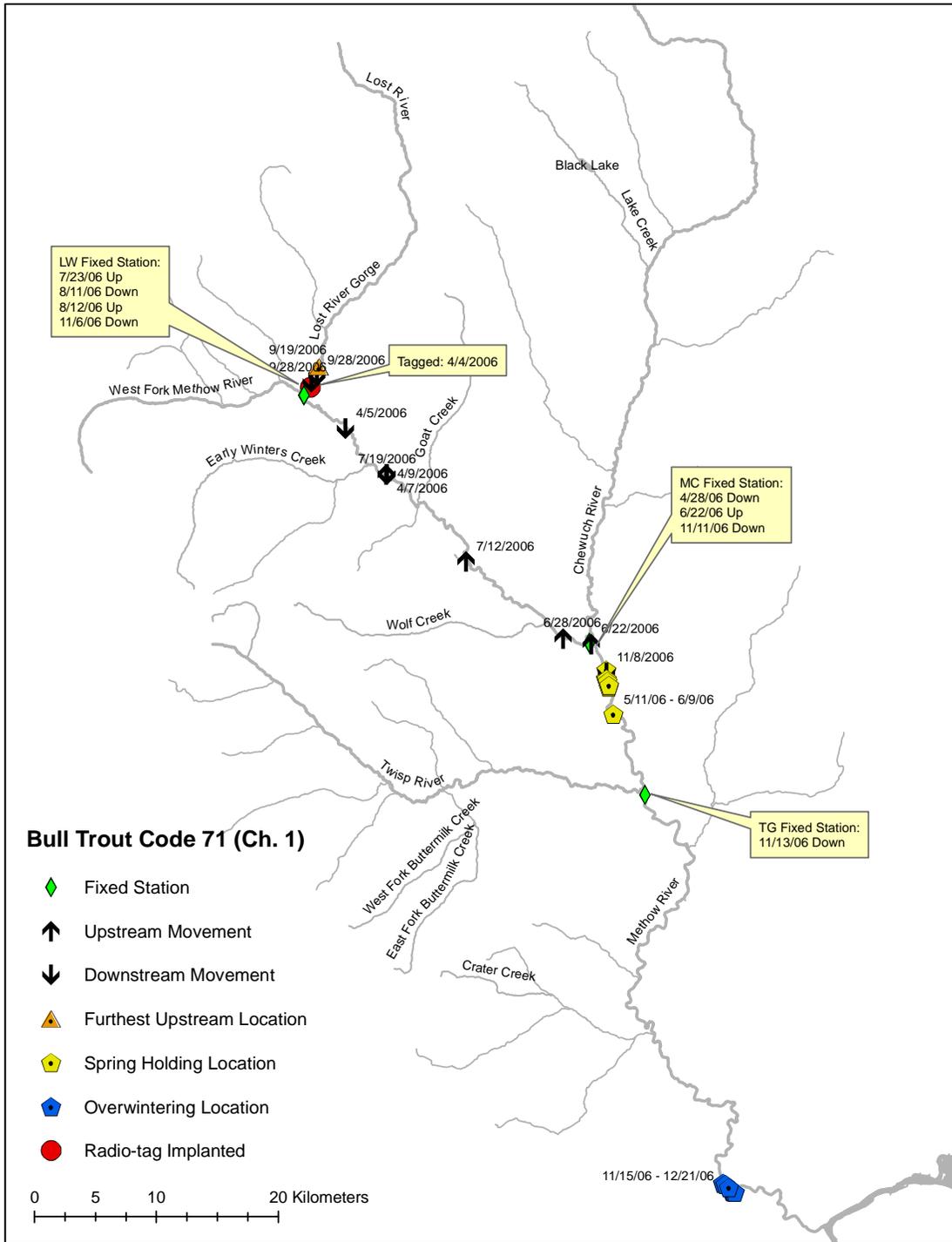


Figure 29. Map of radio-telemetry locations of USFWS bull trout code 71 in 2006.

*Code 72-* (Figure 30). Code 72 was the 3<sup>rd</sup> of 3 tagged in the Lost River at river km 1.0 on April 4, 2006. The bull trout had over-wintered in the upper watershed, isolated by the seasonal dry reach in the upper Methow River, and moved downstream when the reach was re-watered by snow melt on April 5, 2006. Its initial downstream movement was short, as it moved 0.1 km to a small pool downstream of the Lost River Bridge where it stayed until April 12. It migrated downstream and passed the MC site at rkm 80.6 on April 25 and was located in the Methow River at rkm 47.5 during a truck mobile survey on April 27. During subsequent truck mobile tracking, code 72 was monitored at this same location through June 9, 2006, during the spring runoff when flows peaked at 17,900 cfs on May 19 (USGS 2007) (Figure 20). It migrated back upstream and was recorded on the MC station at rkm 80.6 on July 16 and at the LW station at rkm 117.5 on July 26. It entered the West Fork Methow River and was located during a foot mobile survey at rkm 13.4 on August 25. It was located in the spawning reach at rkm 7.7 during the aerial survey flown by BioAnalysts on September 19, 2006. During a foot mobile survey on October 12, it was transmitting code 172, and the intact carcass and tag were recovered at rkm 7.5, just downstream of the spawning reach in the West Fork Methow River. It was a 100 % spawned out female, with little body fat and no fat deposits around the pyloric caecae, and the stomach was empty. The condition and position of the body indicated the fish actively choose its final resting spot under a log near a midstream gravel bar, suggesting post-spawning mortality. The PIT tag was not in the body cavity and may have been expelled with the eggs. A pectoral fin ray was taken for age determination. Code 72 moved a minimum known distance of 157.7 km from tagging in April to tag recovery in 2006.

*Code 73-* (Figure 31). On April 6, 2006, code 73 was tagged at “Brandenburg Run” at rkm 77 of the Methow River. It remained at this general location, with short up and downstream movements from April 7 to June 9, 2006, during the spring runoff when flows peaked at 17,700 cfs on May 18 (USGS 2007) (Figure 21). On June 13, code 73 migrated passed the MC station at rkm 80.6 and entered the Chewuch River. It passed the LC station at the confluence of Lake Creek at rkm 37.5 on June 28. The station data was inconclusive as to whether it continued upstream in the Chewuch River or entered Lake Creek. We conducted a mobile survey up to Andrews Creek, but we were unable to drive further up the Chewuch due to the washout of the Andrews Creek Bridge. After the bridge was repaired in mid-August, managers of the Tripod Complex wildfire closed all access to the upper Chewuch drainage. At the request of Incident Command, we removed the LC station receiver on August 30. On August 31, we were allowed to conduct a foot telemetry survey on the Lake Creek trail up to 3 Prong Creek, above Black Lake. We did not locate any radio signals. On September 26, as we went to replace the receiver, code 73 was located near rkm 17 in the Chewuch River, downstream of the Lake Creek confluence. It was located during mobile surveys in this general area from September 27 to October 19, 2006. It migrated past the MC station and entered the Methow River on October 22. It returned to its tagging location and was located there during mobile surveys from November 8, 2006 – March 7, 2007 (most recent survey). Code 73 moved a minimum known distance of 82.7 km while migrating after it was tagged in 2006.

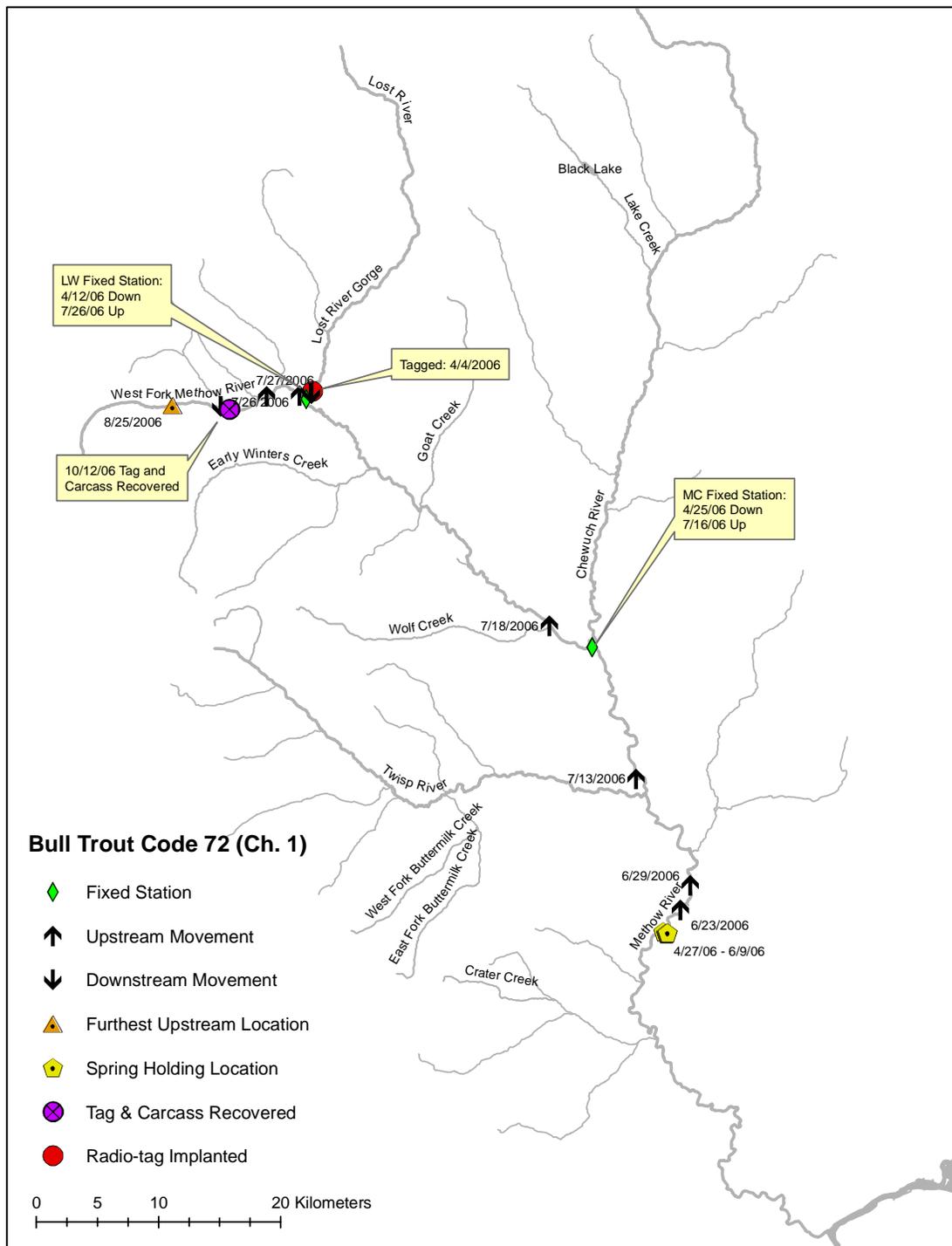


Figure 30. Map of radio-telemetry locations of USFWS bull trout code 72 in 2006.

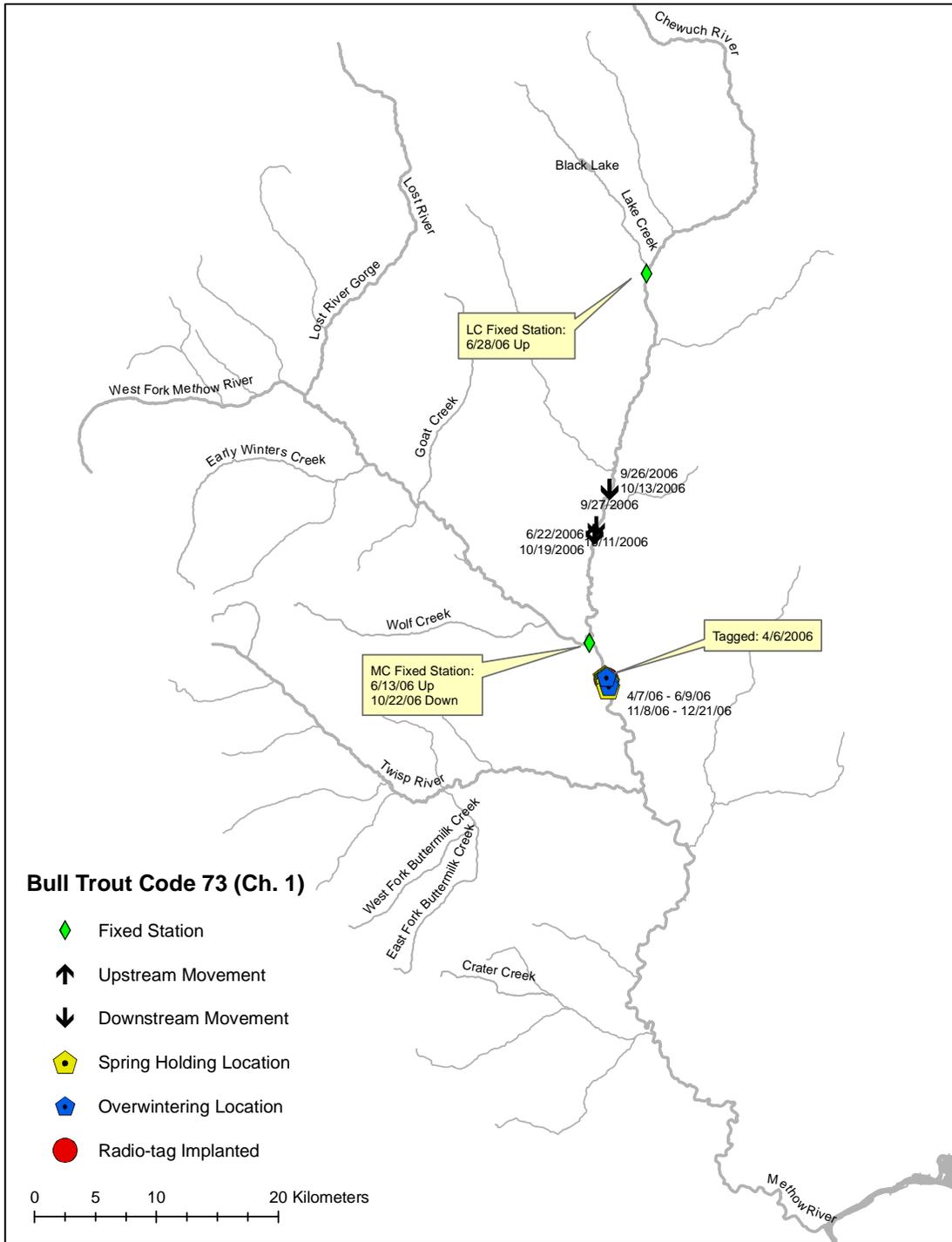


Figure 31. Map of radio-telemetry locations of USFWS bull trout code 73 in 2006.

*Code 74-* (Figure 32). On April 12, 2006, code 74 was tagged at the Carlton Public Fishing Area at rkm 43.9 of the Methow River. During truck mobile surveys on April 20 – May 11, it was located in the Methow River downstream of Gold Creek. It passed the LG station undetected and was located in the Columbia River on May 24 at rkm 837.6 and June 1 at rkm 840.9 during mobile truck surveys. Code 74 re-entered the Methow River undetected at the LG station and was located at rkm 6.4 on June 28. It moved upstream and passed the GS station at rkm 10.6 on July 5 and was located in the Methow River near Black Canyon Cr. at rkm 13.2 on July 13. It then moved downstream and was detected at the GS station at rkm 10.6 on July 16 and at the LG station at rkm 1.1 on July 17. It entered the Columbia River, moved downstream and was detected by DPUD at the Wells Dam. The detections at Wells Dam were: at the forebay on July 19 at 15:00 hours and then the tailrace at 19:00 hours; detected repeatedly in the right tailrace until July 25; then moved to the right tailrace; transmitting code 174 from August 11 until September 17 (LGL 2007). On September 15, LGL determined that the tag was on the right bank, and on September 19, the tag was recovered without the carcass. After analysis of their telemetry data, DPUD speculated that the likely probable cause was angling related mortality and USFWS Central Washington Field Office concurred that the mortality was unrelated to operation of Wells Dam (see Appendix 3).

*Code 75-* (Figure 33). This bull trout was the 1<sup>st</sup> of 4 caught and tagged in a small pool downstream of a log jam located at rkm 6.6 of Wolf Creek, downstream of the Wolf Creek Irrigation District diversion. Code 75 was tagged on July 18, 2006, and during foot surveys from July 18 – October 11 and the aerial survey on September 19 it was located downstream of the log jam. It migrated downstream and passed the WC site at rkm 1.4 of Wolf Creek on October 17, 2006. It was not picked up on any of the other downstream receiver stations and its location was unknown until it was located in the Methow River at rkm 85 during the aerial survey flown by BioAnalysts on December 20, 2006. It was transmitting the motion signal, but the power was weak, and due its distance from roads, it cannot be received during truck mobile surveys. This is the only tagged bull trout which moved upstream in the fall. Code 75 moved 10.1 km after it was tagged in 2006.

*Code 76-* (Figure 34). Code 76 was the 2<sup>nd</sup> of 4 bull trout caught and tagged in a small pool downstream of a log jam located at rkm 6.6 of Wolf Creek, downstream of the Wolf Creek Irrigation District diversion. It was tagged on July 18, 2006, and during foot surveys July 18 – September 1 code 76 was located just downstream of the log jam. It migrated past the WC fixed station at rkm 1.4 of Wolf Creek on September 18, entered the Methow River, passed the MC station at rkm 80.6 on September 19 and passed the GS station at rkm 10.6 on September 26. It was detected at the mouth of the Methow River and at the LG station from September 28 to October 1. On November 8, it was located in the Columbia River at rkm 843.6, off the fishing docks in Pateros, WA, and was transmitting the motionless signal code 176. There is no direct evidence, but circumstances suggest possible angling related tag loss. The tag was not recovered and was still transmitting code 176 as of March 7, 2007. Bull trout code 76 moved a total of 91.9 km before becoming motionless.

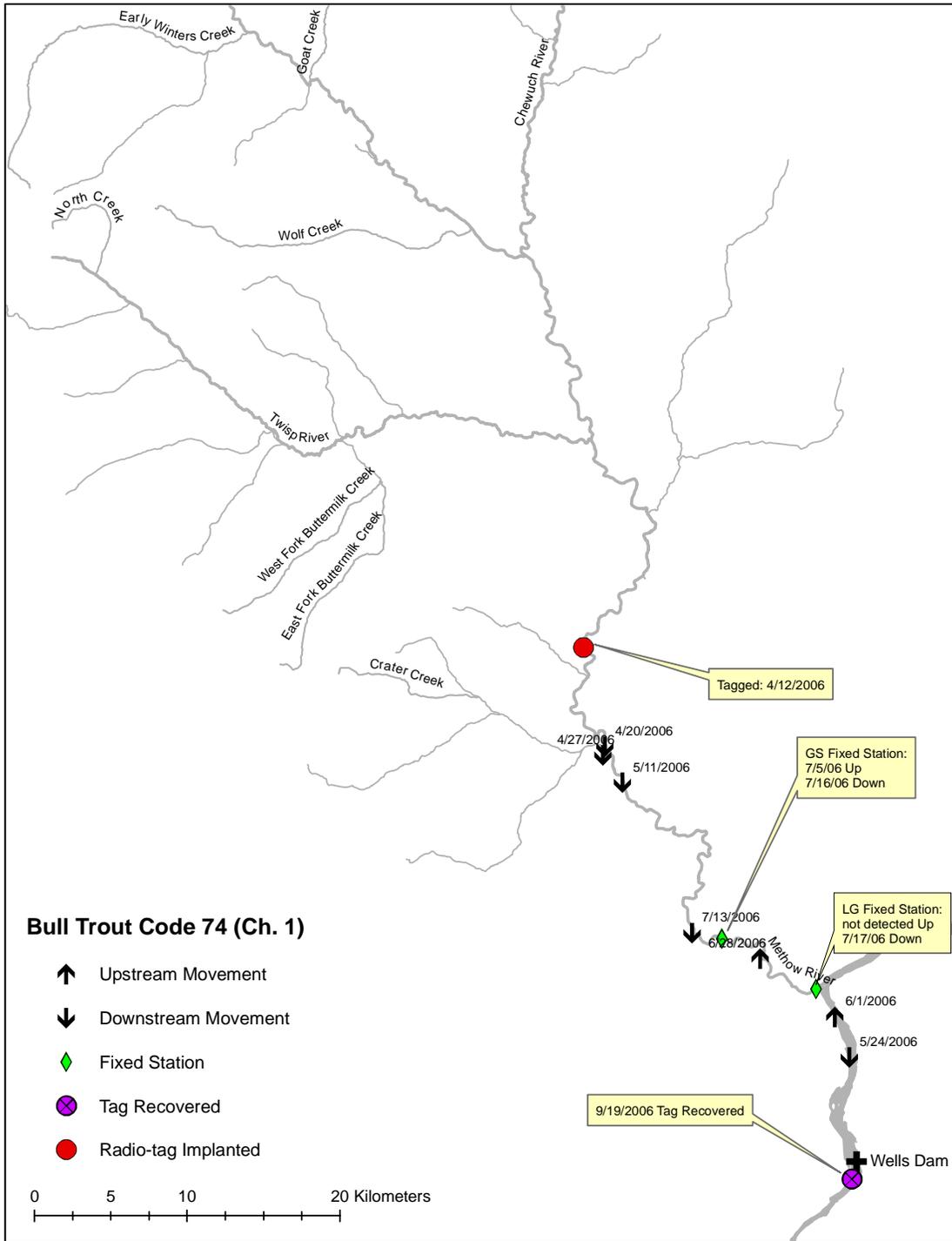


Figure 32. Map of radio-telemetry locations of USFWS bull trout code 74 in 2006.

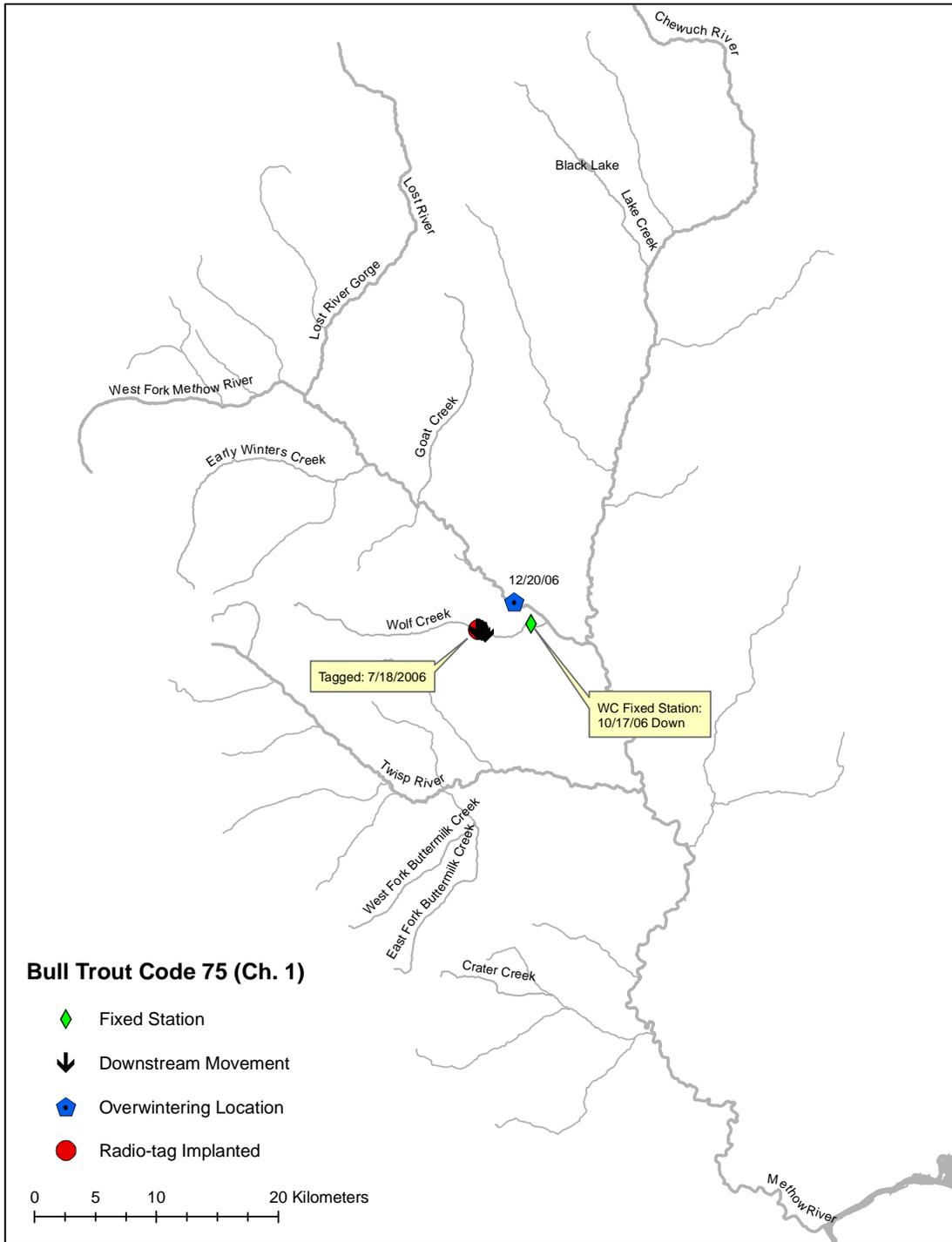


Figure 33. Map of radio-telemetry locations of USFWS bull trout code 75 in 2006.

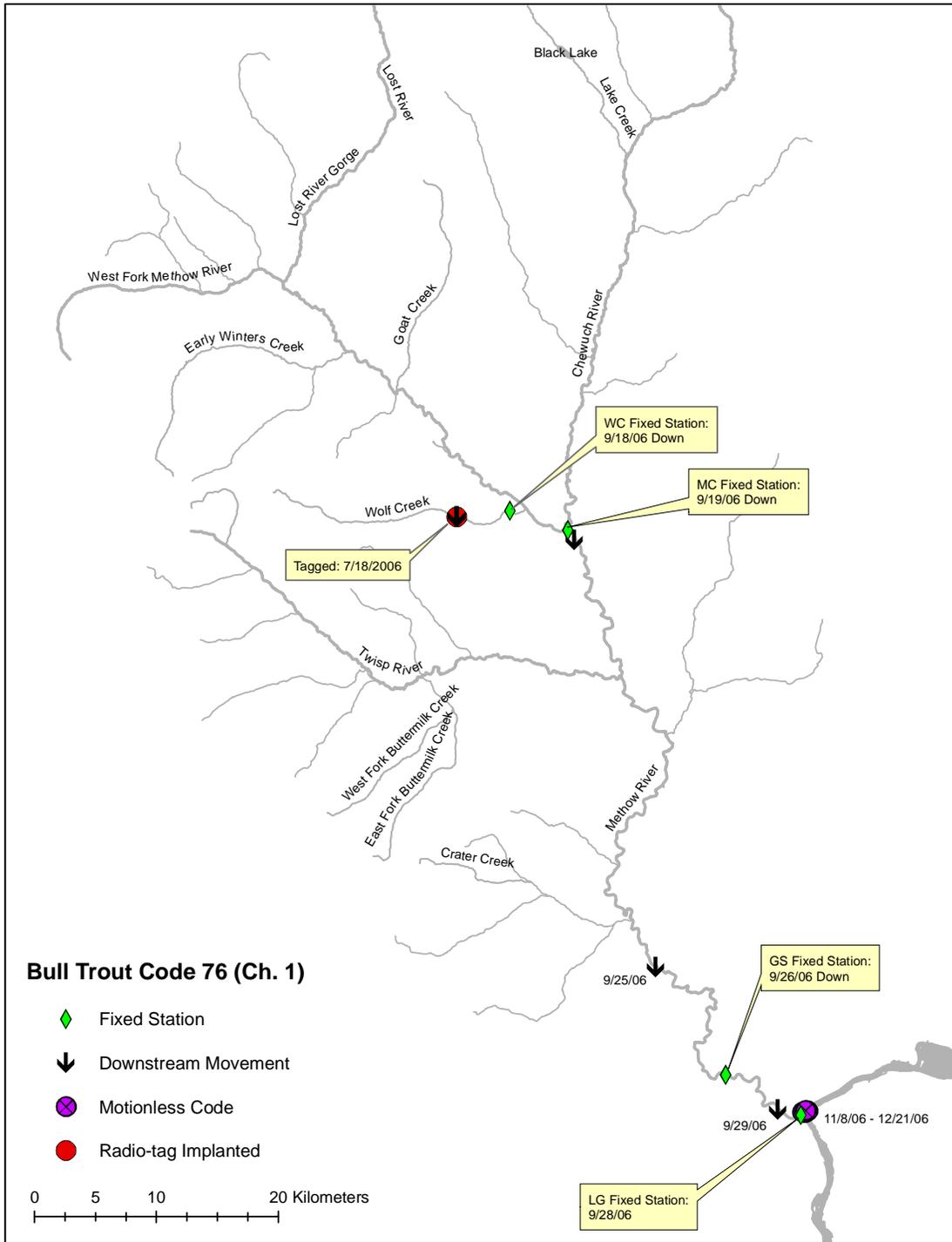


Figure 34. Map of radio-telemetry locations of USFWS bull trout code 76 in 2006.

*Code 77-* (Figure 35). Code 77 was tagged in the West Fork Methow River at rkm 1.1 on July 19, 2006. The bull trout was located in the West Fork Methow River at rkm 8.8 on August 3 and in lower Robinson Creek at rkm 1.0 on August 24. During a mobile survey on September 14, it was transmitting code 177 and the tag was recovered in the West Fork Methow River at rkm 2.0. The tag was on the bank out of the water, and the fish's rib bones were found next to the tag. No other body parts were discovered. Circumstances indicate probable predation or scavenging. Code 77 moved 15.4 km before the tag was recovered.

*Code 78-* (Figure 36). Code 78 was the 3<sup>rd</sup> of 4 bull trout caught and tagged in a small pool downstream of a log jam located at rkm 6.6 of Wolf Creek, downstream of the Wolf Creek Irrigation District diversion. It was tagged on July 25, 2006 and during foot surveys from July 25 – September 26 and the aerial survey on September 19 it was located downstream of the log jam. It migrated past the WC fixed station at rkm 1.4 of Wolf Creek on October 7, entered the Methow River and passed the MC station at rkm 80.6 on October 8. During truck mobile surveys, it was located at rkm 78.4 from October 10 – November 16. It was transmitting motionless signal code 178 during the truck mobile on November 29 and an attempt to recover the tag was unsuccessful due to ice and its location under a LWD pile along the bank. It alternately transmitted code 178 or code 78 between different truck surveys in December and January, but it transmitted only code 178 from February 13 – March 7, 2007. This bull trout move 13.2 km before becoming motionless.

*Code 79-* (Figure 37). Code 79 was the 4<sup>th</sup> of 4 bull trout caught and tagged in a small pool downstream of a log jam located at rkm 6.6 of Wolf Creek, downstream of the Wolf Creek Irrigation District diversion. It was tagged on July 25, 2006 and during foot surveys from July 25 – September 1 it was located downstream of the log jam. It migrated past the WC fixed station at rkm 1.4 of Wolf Creek on September 13 and entered the Methow River, but was not detected as it moved past the MC station at rkm 80.6. On September 19, it was located in the Methow River at rkm 39.1. It was monitored at this location during mobile surveys from September 19 – October 13, and on October 17 it was transmitting motionless signal code 179. The tag was recovered in stream near the right bank, but no carcass was found. Code 79 moved a total of 52.5 km after it was tagged.

*Code 80-* (Figure 38). This bull trout was tagged in the West Fork Methow River at rkm 4.8 on July 26, 2006. It was located in the spawning reach of the West Fork Methow River at rkm 10 during the aerial survey flown by BioAnalysts on September 19, 2006. On November 6, after rain re-watered the dry reach, code 80 migrated downstream and passed the LW station at rkm 117.5. It was located in the Methow River at rkm 104.8 during a truck mobile survey on November 8, and was still located at that location on March 7, 2007 (most recent survey). Code 80 moved a total of 27.8 km since it was tagged in 2006.

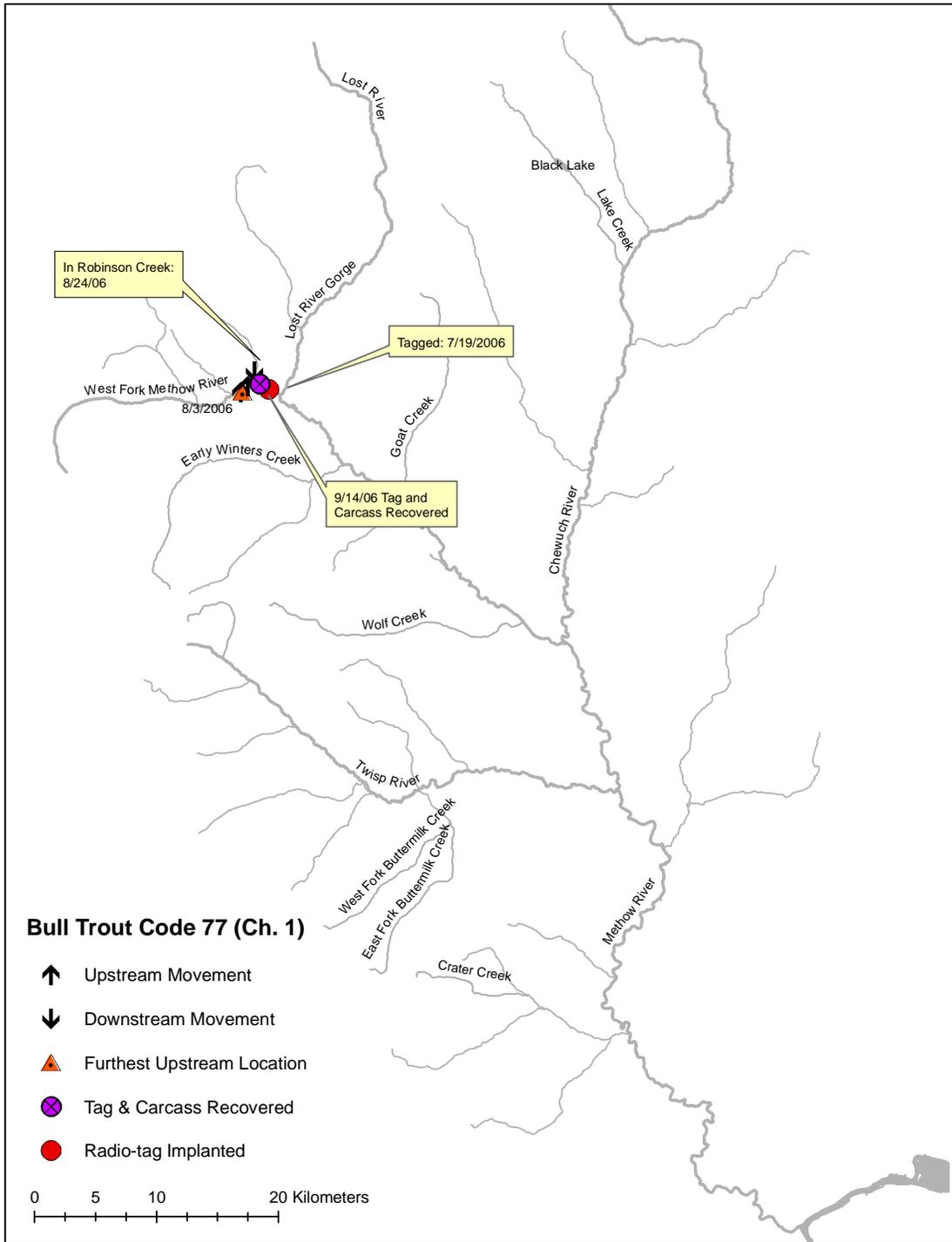


Figure 35. Map of radio-telemetry locations of USFWS bull trout code 77 in 2006.

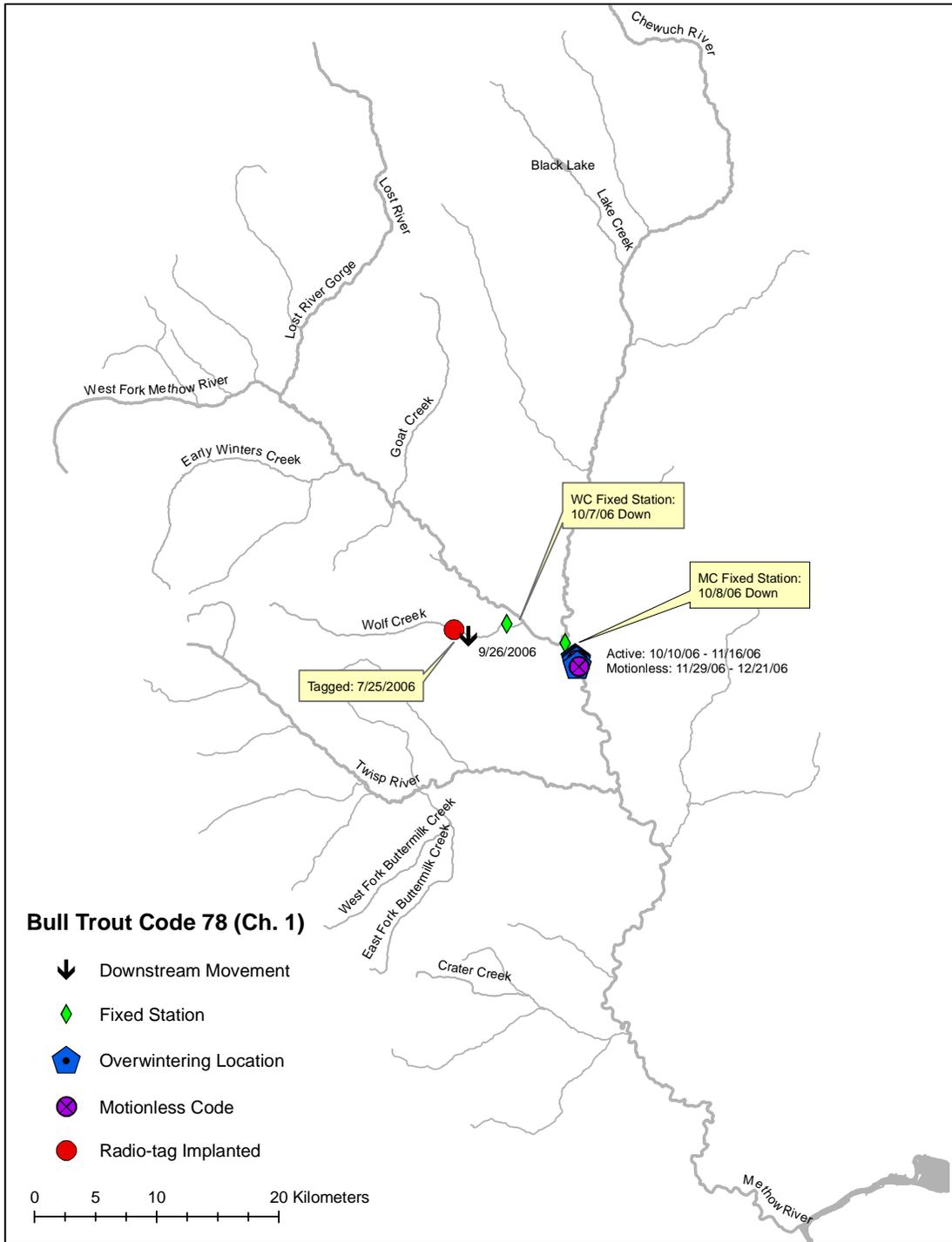


Figure 36. Map of radio-telemetry locations of USFWS bull trout code 78 in 2006.

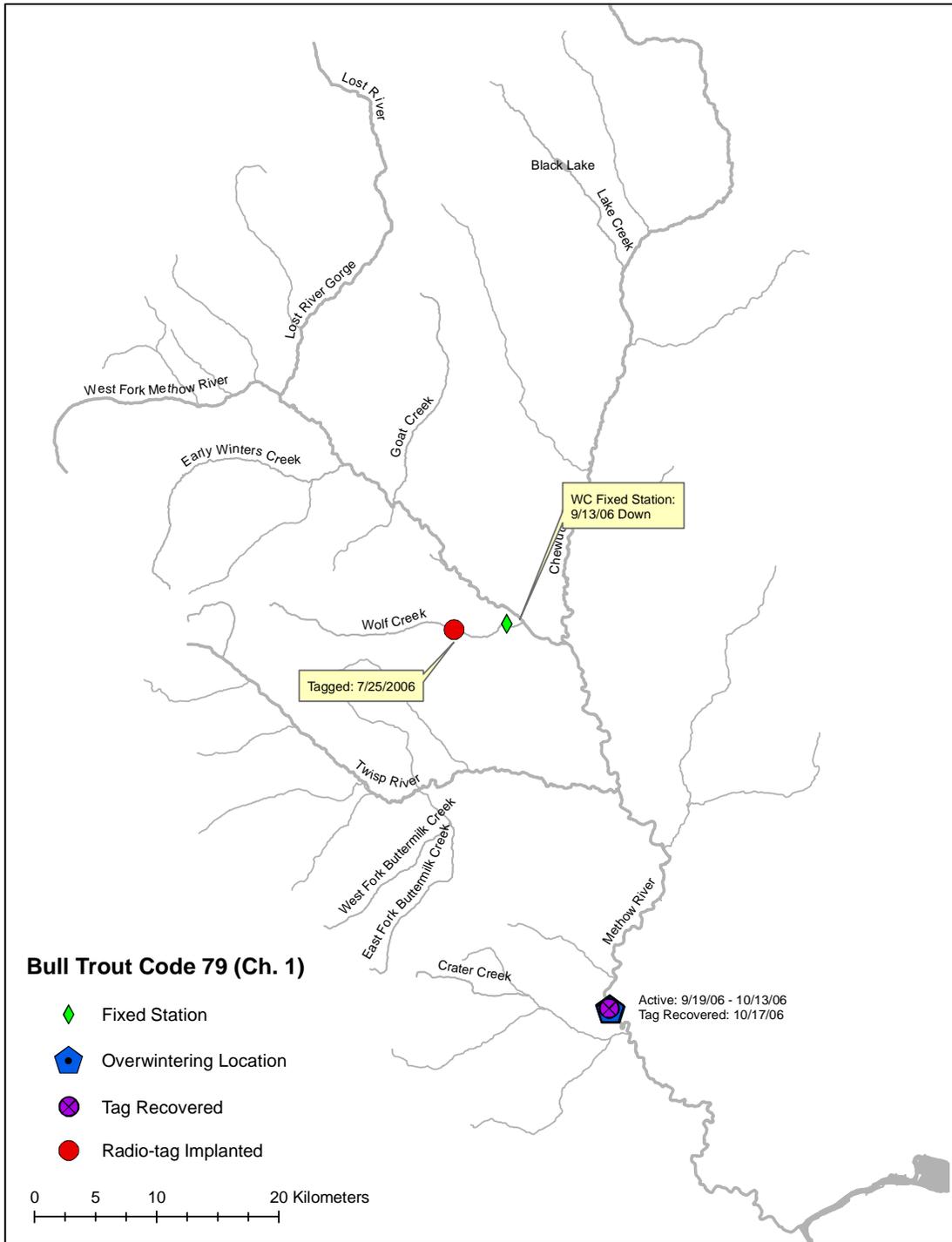


Figure 37. Map of radio-telemetry locations of USFWS bull trout code 79 in 2006.

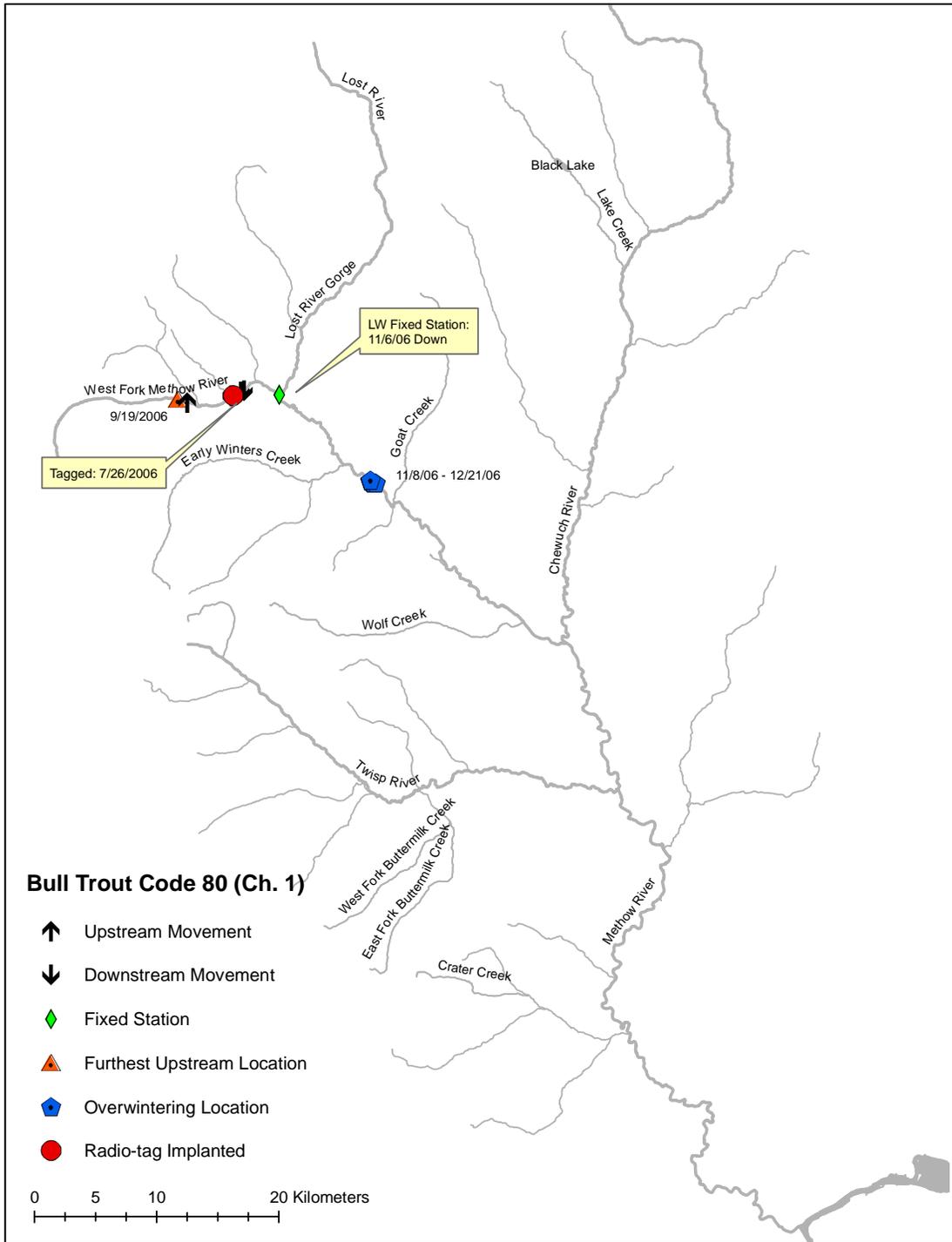


Figure 38. Map of radio-telemetry locations of USFWS bull trout code 80 in 2006.

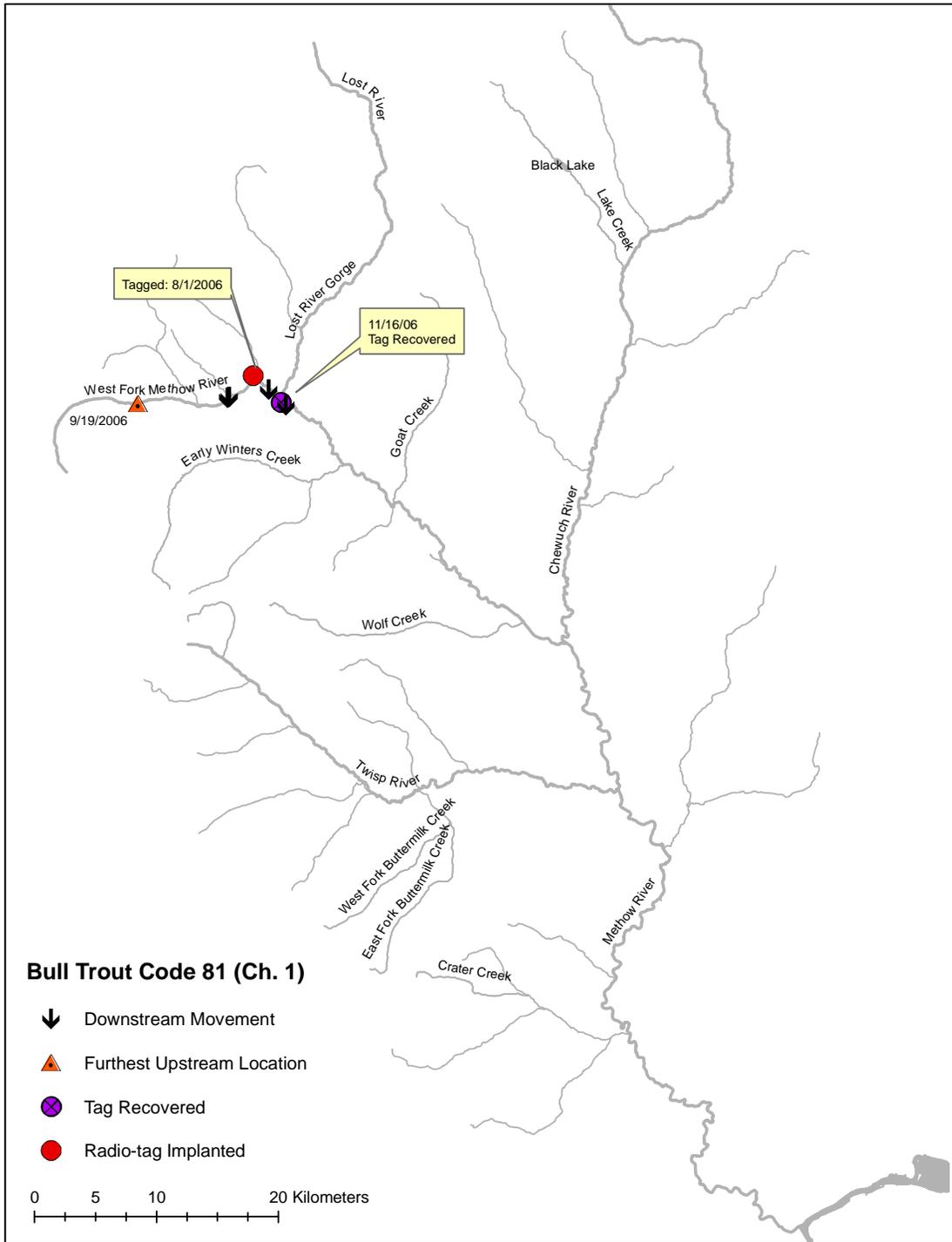
*Code 81-* (Figure 39). Bull trout code 81 was tagged in Robinson Creek, downstream of the cascades at rkm 0.8, on August 1, 2006. It moved into the West Fork Methow River and was located on the spawning grounds at rkm 13.5 during the aerial survey flown by BioAnalysts on September 19, 2006. Code 81 moved downstream and was located near River Bend Campground during truck surveys on October 12 and 19. It moved a short distance after rains on November 6 and was located downstream of Robinson Creek on November 8. On November 16, it transmitted code 181 and the tag was recovered in the Methow River at rkm 116.5, downstream of the confluence of the West Fork and Lost River. It was not detected as it passed the LW station. The tag was in the thalweg, lying on the bottom at a depth of 1 meter. There were no clues to determine the fate of the bull trout or to indicate mortality. Code 81 moved 26.4 km before the tag was recovered.

*Code 82-* (Figure 40). Code 82 was tagged in the West Fork Methow River at rkm 2.1 on August 2, 2006. It moved upstream and was located at rkm 6.4 during mobile foot surveys on August 24 and 25. On September 14, it was located at rkm 8.4 in the spawning area during a mobile foot survey. It moved downstream and was located near rkm 4.8 from October 12 to November 9. It was located near its tagging location at rkm 2.1 of the West Fork Methow River during the aerial survey flown by BioAnalysts on December 20, 2006. Bull trout code 82 stayed upstream of the seasonal dry reach, and moved a total of only 12.4 km in 2006.

***Douglas County PUD bull trout-*** We tracked 8 bull trout tagged by DPUD that entered the Methow Core Area in 2006. We report on their movements in the Methow River, but include some information in the Columbia River gathered during our truck surveys. We also include LG station data (LGL 2007a) and information gathered during aerial and boat surveys conducted by the PUDs on the Columbia (BioAnalysts 2007). (*Note: bull trout movements at the dams are reported by the PUDs in their annual reports*).

*Code 4-* (Figure 41). Bull trout code 4 was tagged at Wells Dam on June 2, 2005. In 2005, we tracked this fish in the Twisp River to near Reynolds Creek, downstream of the seasonal dry reach (Nelson and Nelle 2007). During truck surveys, it was located in the Columbia River upstream of Beebe Bridge from May 11 – June 5, 2006. The 2006 entry date into the Methow was not recorded by the LG station. We located code 4 in the Methow near Black Canyon Creek during truck surveys on June 21, 22, and 23, 2006. On June 28, the bull trout was detected upstream of Libby Creek, and on June 29, near Beaver Creek. Code 4 migrated into the Twisp River and passed the TR station at rkm 2.1 on July 3, 2006. During a truck survey on July 13, it was located near Reynolds Creek, and on July 27 it was near South Creek, upstream of the reach that seasonally goes subsurface in the Twisp River. On August 23, it was located in the spawning area near North Creek. It was last detected during a truck survey on September 29, 2006, in the Twisp River near South Creek, and we suspect the radio battery may have died.

*Code 50-* (Figure 42). Bull trout code 50 was tagged at Wells Dam on May 24, 2006. It entered the Methow River and passed the LG station at rkm 1.1 on May 26. It was located upstream of the mouth during a truck survey on June 1. On June 5 and 6 it moved upstream and by June 9 it was upstream of Black Canyon Creek. On June 22,



**Figure 39. Map of radio-telemetry locations of USFWS bull trout code 81 in 2006.**

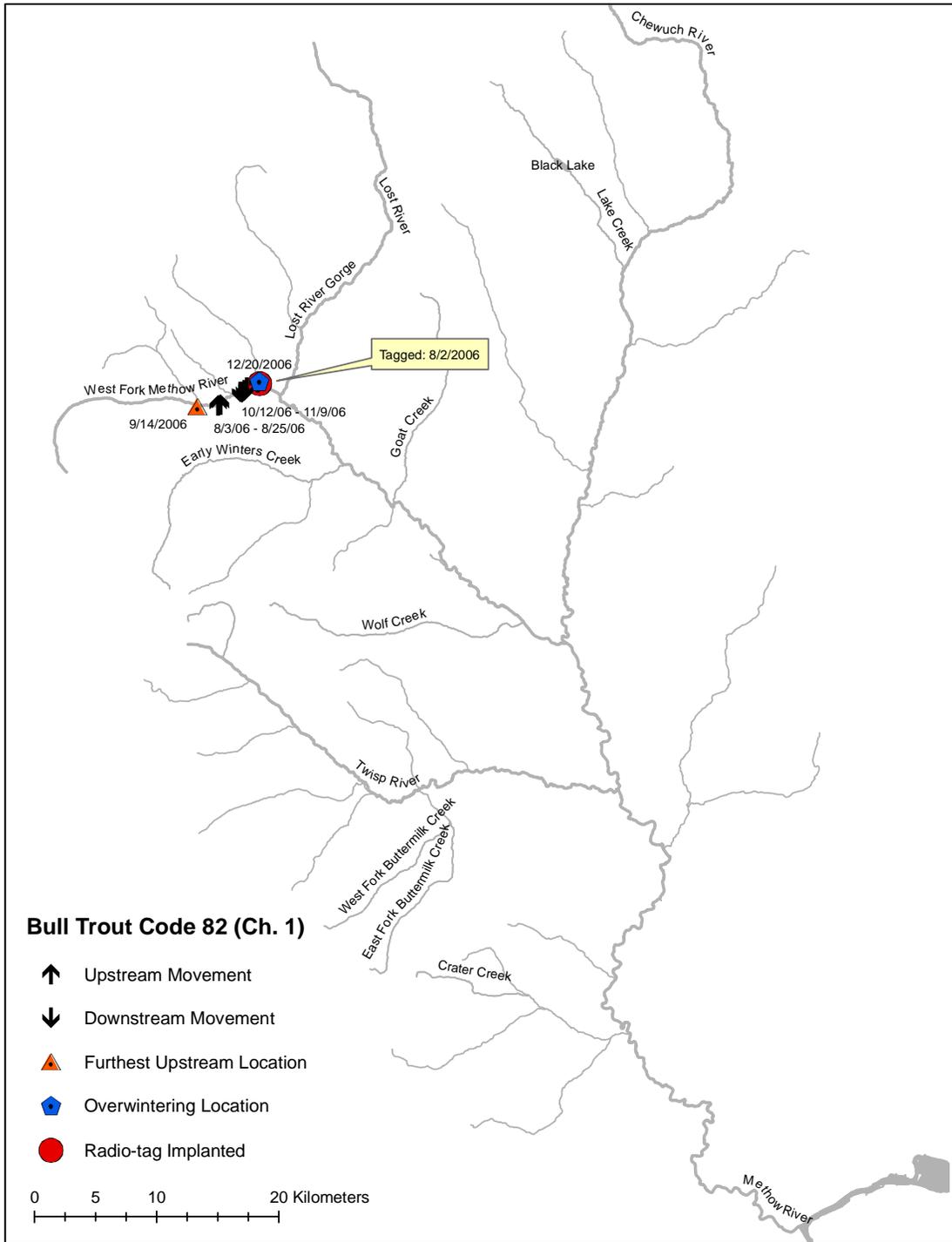


Figure 40. Map of radio-telemetry locations of USFWS bull trout code 82 in 2006.

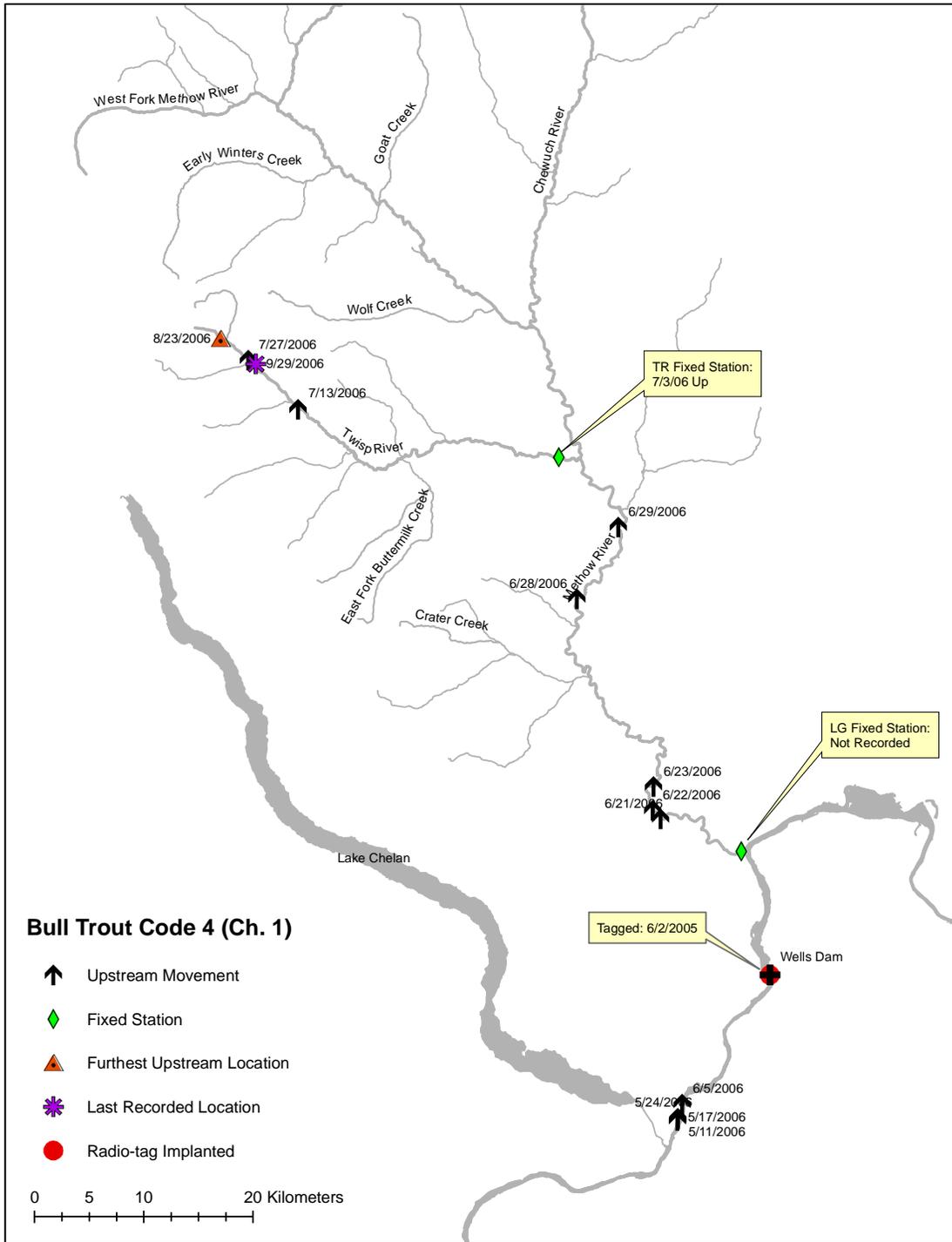


Figure 41. Map of radio-telemetry locations of DPUD bull trout code 4 in 2006.

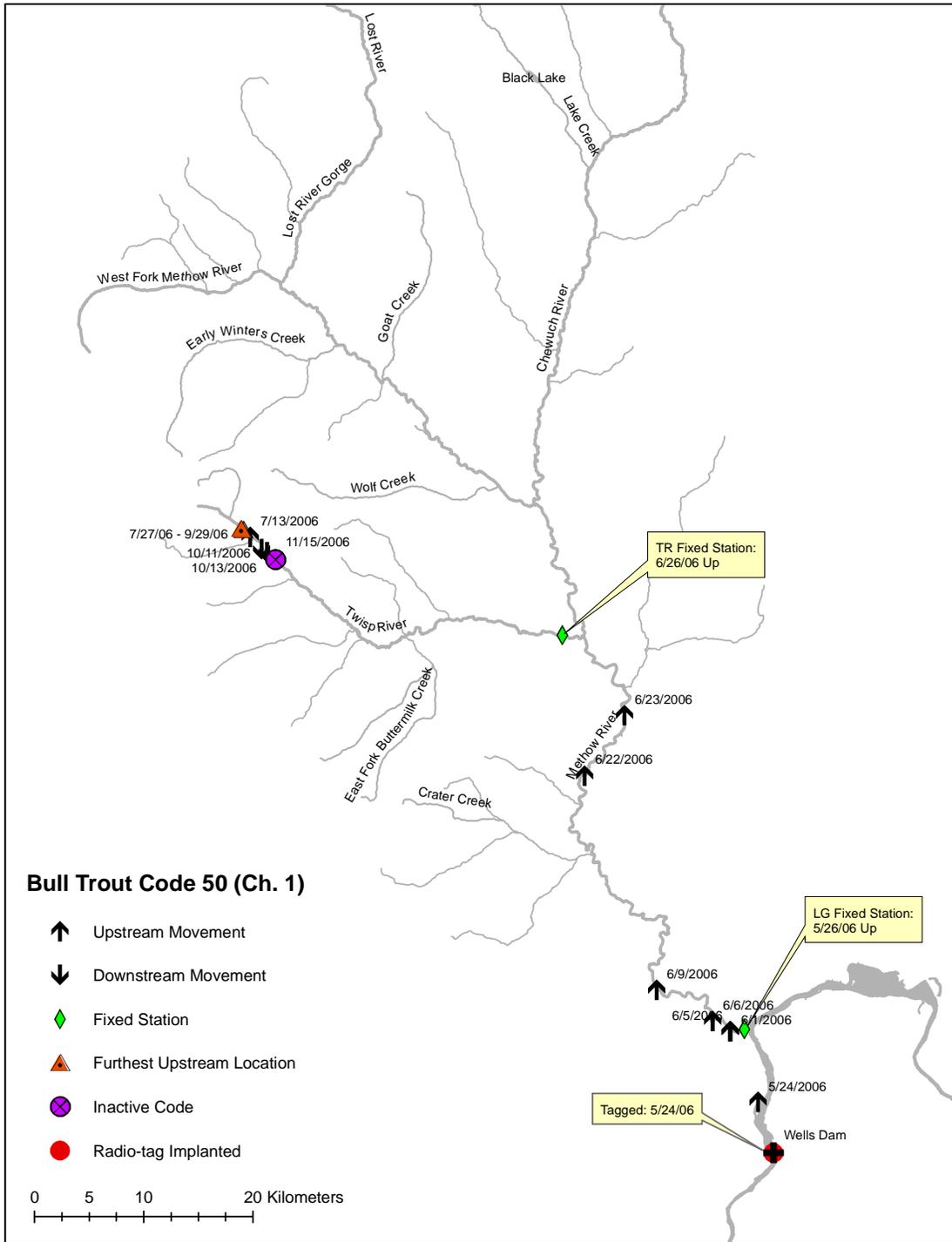


Figure 42. Map of radio-telemetry locations of DPUD bull trout code 50 in 2006.

it was located upstream of Libby Creek, and on June 23 it was near Beaver Creek. Code 50 entered the Twisp River and migrated past the TR fixed station at rkm 2.1 on June 26. On July 13, it was located in the spawning area upstream of South Creek. It was in this general area during truck surveys from July 27 – September 29. After the spawning period, code 50 moved downstream and was located near Scatter Creek (upstream of the dry reach) during truck surveys on October 11 and 13. On November 6, heavy rains re-watered the dry reach. During a truck survey on November 15, the tag was transmitting motionless signal code 150 at rkm 34.9, upstream of Poplar Flat Campground. Triangulation of the signal from the road indicated the tag was in the vicinity of the formerly dry edge of the seasonal dry reach, but deep snow and time limitations prevented recovery as well as a return trip to investigate. Circumstances suggest that the bull trout may have been stranded near the edge and perished as the dry edge expanded and the water froze.

*Code 52-* (Figure 43). Bull trout code 52 was tagged at Wells Dam on May 16, 2006. It was located in the Columbia River near the mouth of the Methow River during our truck survey on May 24, and was located near the Highway 97 Bridge, downstream of the LG station, during truck surveys on June 1<sup>st</sup>, 5<sup>th</sup>, and 6<sup>th</sup>. On June 7, code 52 migrated past the LG station at rkm 1.1, and on June 22 and 23, was located near Gold Creek. It migrated into the Twisp River and passed the TR station at rkm 2.1 on June 29. During mobile surveys on July 13 and 27, it was located upstream of War Creek. On August 23, it was located near Reynolds Creek, and during a foot survey on September 12, it was observed on the spawning grounds near redds. Code 52 migrated downstream and passed the TR station at rkm 2.1 on September 15 and entered the Methow River. By September 25, it was located near Gold Creek and it slowly moved downstream, passing the GS station at rkm 10.6 on October 31. It migrated past the LG station at rkm 1.1 on November 1, and entered the Columbia River. Its over-wintering location is currently unknown.

*Code 56-* (Figure 44). Bull trout code 56 was tagged at Wells Dam on May 16, 2006. During truck surveys, we detected it in the Columbia River on May 17 and 24. Code 56 entered the Methow River and passed the LG station on May 27. It was located in the lower Methow downstream of Black Canyon Cr. during truck surveys on June 1, 5, 6, and 9. On June 22 and 23, it was located moving upstream of Black Canyon Cr. and on June 29 it was in the Methow River downstream of Twisp, WA. Code 56 migrated into the Twisp River and passed the TR fixed station at rkm 2.1 on June 30. On July 13, it was located near Reynolds Creek, and on July 27, it was detected upstream of South Creek, near the spawning area. Code 56 left the spawning area prior to spawning period and was located on August 23 in the Twisp River near Buttermilk Creek (rkm 20.4). It was detected in this same area during truck surveys on September 12 and 29. It moved downstream and was detected migrating past the TR fixed station at rkm 2.1 on September 30. During truck surveys on October 10, 13, and 19, it was located in the Methow River downstream of Beaver Creek. It migrated past the GS fixed station at rkm 10.6 on November 7. Code 56 was detected upstream of the mouth on November 9, 15, and 16 and passed the LG fixed station on November 17, 2006, when it entered the Columbia River. During truck surveys from December 1, 2006 to March 7, 2007, it was detected in the Columbia River upstream of the Chelan River confluence.

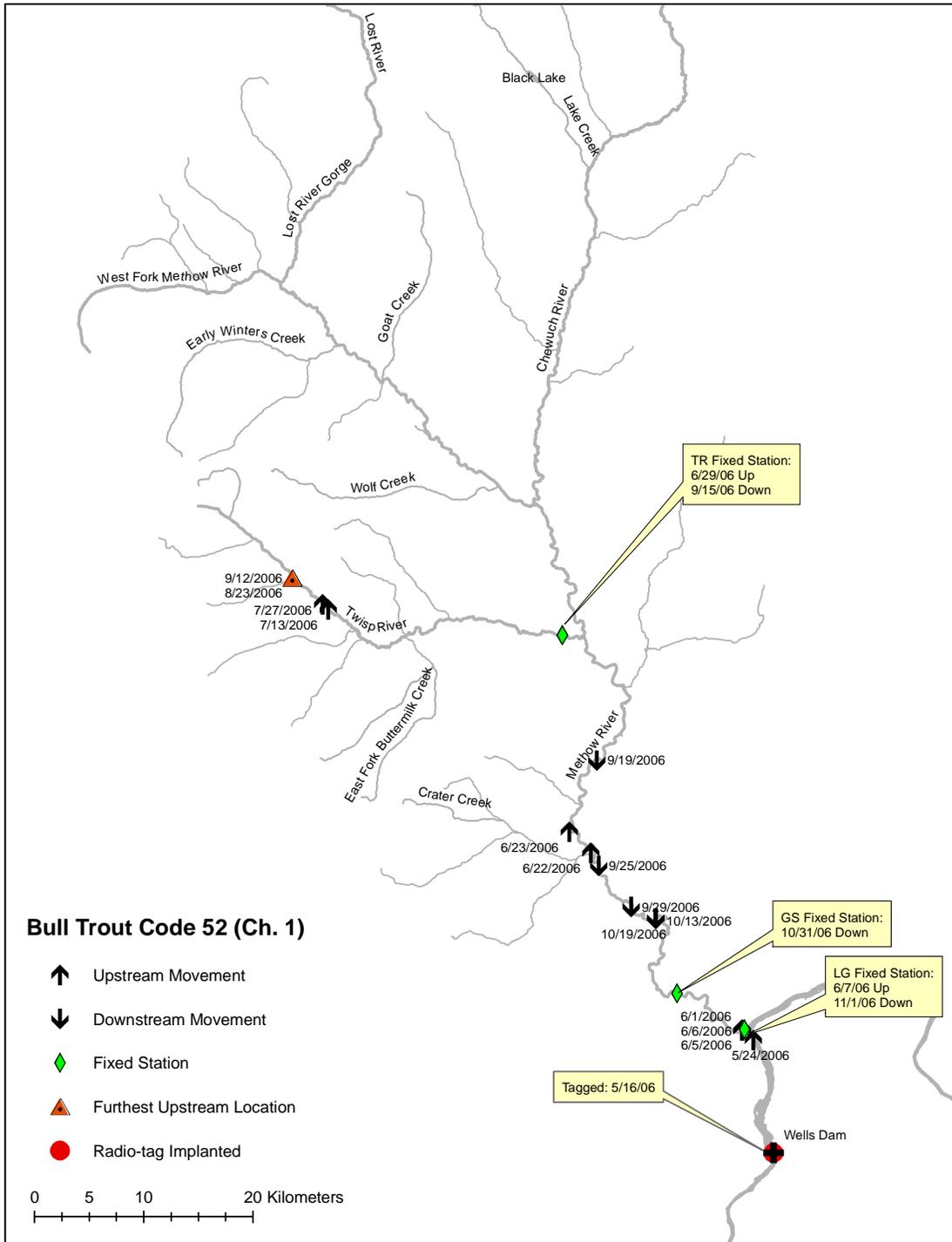


Figure 43. Map of radio-telemetry locations of DPUD bull trout code 52 in 2006.

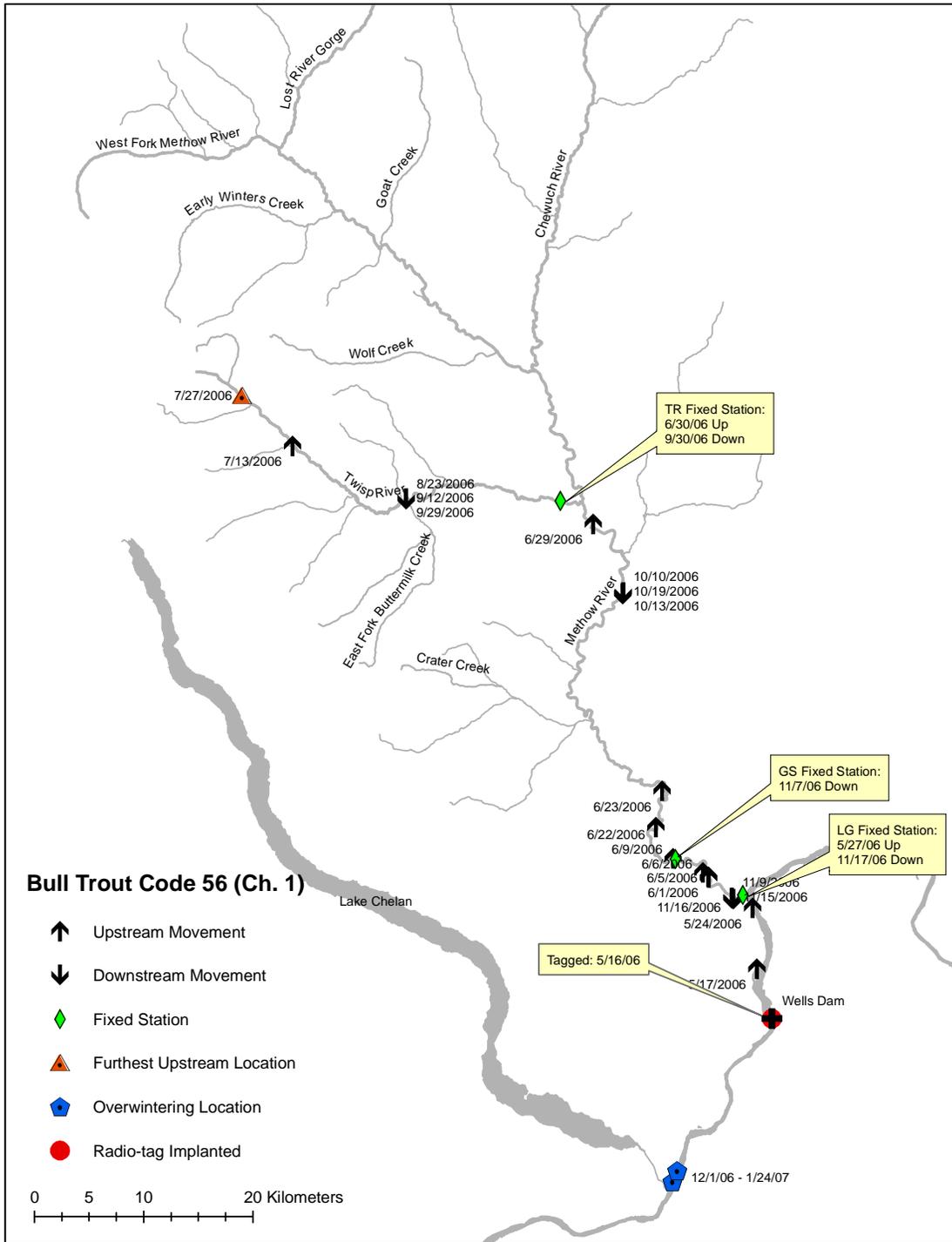


Figure 44. Map of radio-telemetry locations of DPUD bull trout code 56 in 2006.

*Code 58-* (Figure 45). Bull trout code 58 was tagged at Wells Dam on May 19, 2006. It entered the Methow River and passed the LG station at rkm 1.1 on May 24. It was located upstream of the mouth during truck surveys on June 1<sup>st</sup>, 5<sup>th</sup>, 6<sup>th</sup>, and 9<sup>th</sup>, and on June 22 it was located near Gold Creek. Code 58 migrated into the Twisp River and passed the fixed station at rkm 2.1 on June 30. On July 13, it was located near War Creek during a truck survey. It was located in the spawning area (upstream of the seasonal dry reach) from July 27 – October 13, 2006. After heavy rains re-watered the dry reach on November 6, code 58 migrated quickly downstream and passed the TR fixed station at rkm 2.1 on November 7. It entered the Methow River and passed the TG fixed station on November 7, slowly moved downstream and on December 13 it was located at rkm 58.6. By December 21, it moved further downstream and was located in the Methow River at rkm 50.7, where it is over-wintering as it was located there on March 7, 2007.

*Code 60-* (Figure 46). Bull trout code 60 was tagged at Wells Dam on May 21, 2006. It entered the Methow River and passed the LG station at rkm 1.1 on May 23. It was located during truck surveys upstream of the mouth on May 24 and near Black Canyon Creek on June 1. On June 5, 6 and 9, it was located upstream of Black Canyon Creek, and on June 22 it was upstream of Gold Creek. It migrated past the MC station at rkm 80.6 on June 28 and on June 29 it was located upstream of Wolf Creek. Code 60 entered Goat Creek and was detected near Long Creek on July 12 during a truck survey. On September 13, it was tracked during the bull trout spawning ground survey, and was located under a log near 2 bull trout redds. It moved downstream from the spawning area and was detected downstream of Vander Pool Crossing on September 27. During a truck survey on October 18, it was transmitting motionless code 160 in Goat Creek at rkm 9. The tag was tracked to a LWD jam on the right bank, and we determined it was under the bank in the roots of a fir tree and could not be recovered. A small den or hole was discovered under the roots, and we speculate that the bull trout may have been depredated or scavenged by a mink. During the truck survey on November 9, the tag was transmitting motion code 60, and we walked in and determined it was still in the same spot, that some kind of disturbance reactivated the motion option, and that the tag was still unrecoverable at that time.

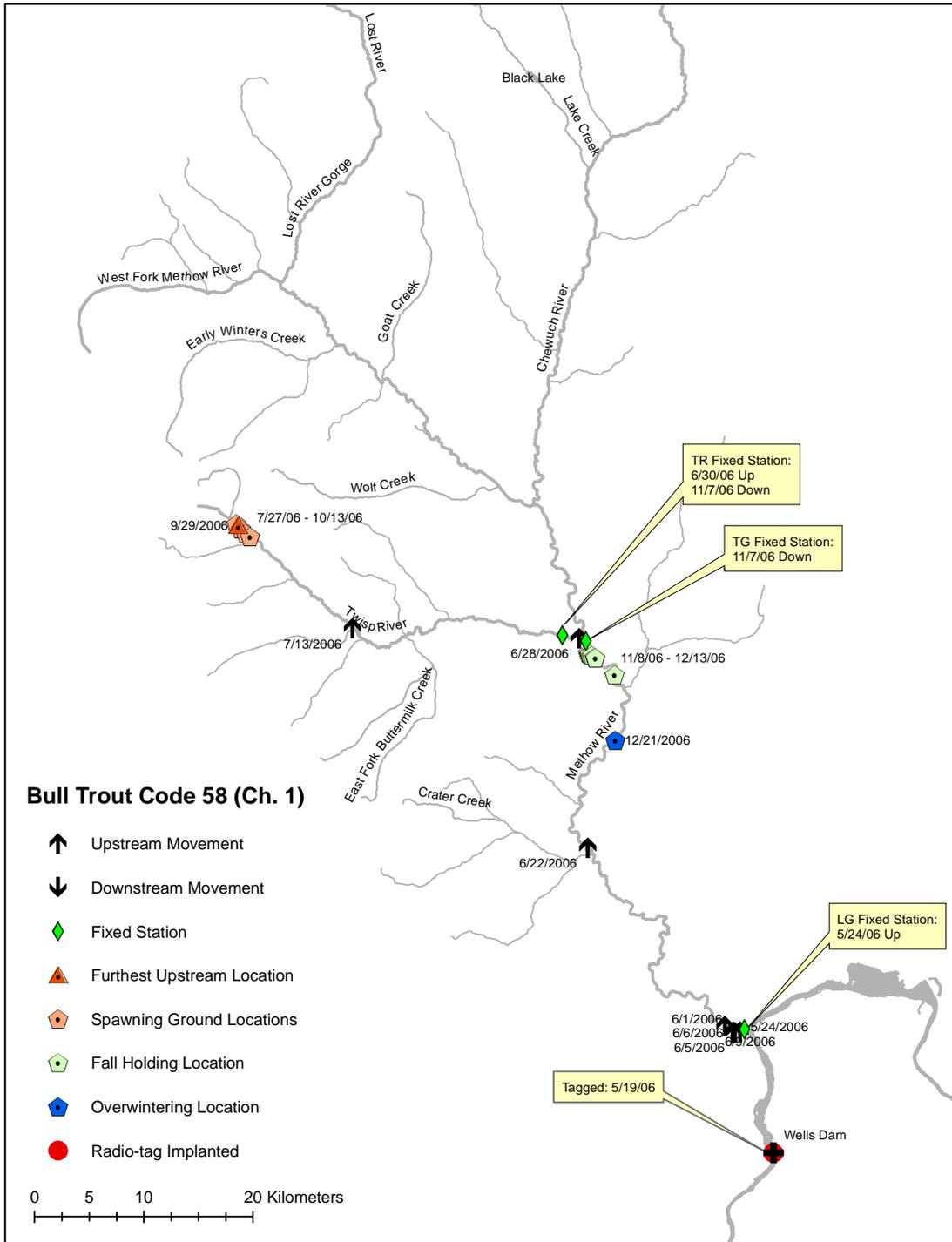


Figure 45. Map of radio-telemetry locations of DPUD bull trout code 58 in 2006.

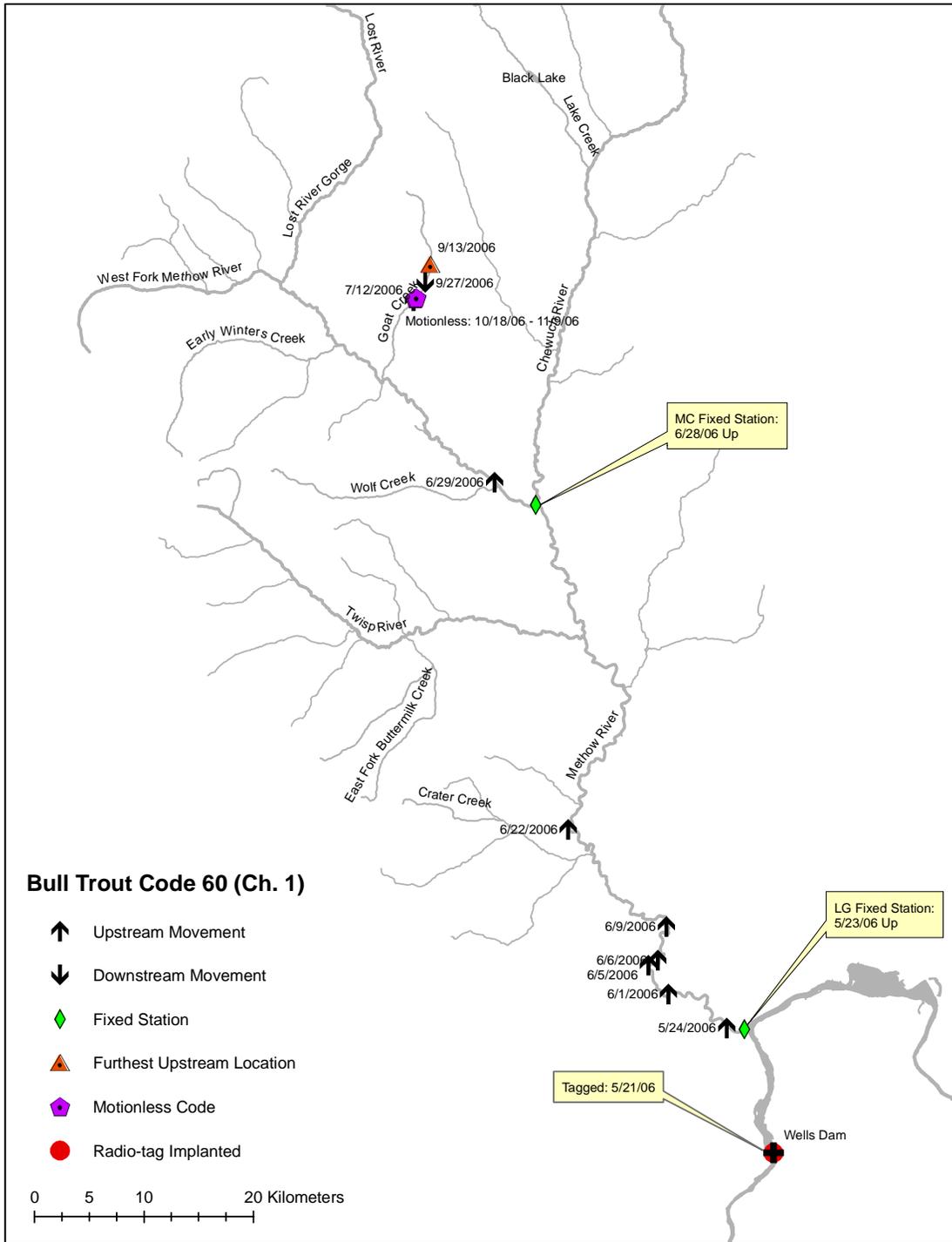


Figure 46. Map of radio-telemetry locations of DPUD bull trout code 60 in 2006.

*Code 62-* (Figure 47). Bull trout code 62 was tagged at Wells Dam on May 24, 2006. It entered the Methow River and passed the LG fixed station at rkm 1.1 on May 25. It was detected in the Methow River upstream of Black Canyon Creek during mobile surveys conducted on June 1, 5, 6, and 9. On June 23, it was detected near the confluence of the Twisp River and on June 26 it migrated past the MC fixed station at rkm 80.6. On July 6, it was recorded moving past the LW fixed station at rkm 117.5 and migrated into the West Fork Methow River. It was located at rkm 13.6 near Cataract Creek during a foot survey on August 25. During the aerial survey flown by BioAnalysts on September 19, it was still located on the spawning grounds. It moved downstream and was detected in the West Fork Methow River near Robinson Creek during truck surveys on October 12 and 19. Heavy rains on November 6 re-watered the dry reach in the upper Methow River, and code 62 migrated past the LW fixed station at rkm 117.5 on November 6. It was not recorded on the MC fixed station, but was detected during the truck survey on November 8 downstream of Winthrop, WA. It migrated past the TG fixed station at rkm 64.4 on November 9 and passed the GS fixed station at rkm 10.6 on November 12. It was not detected at the LG station. During truck surveys, it was located in the Columbia River upstream of the Beebe Bridge from December 1, 2006 – March 7, 2007.

*Code 64-* (Figure 48). Bull trout code 64 was tagged at Wells Dam on May 19, 2006. It entered the Methow River and passed the LG fixed station at rkm 1.1 on June 14. It was located during truck surveys upstream of Black Canyon Creek on June 21 – 23, and upstream of Libby Creek on June 28. It migrated into the Twisp River and passed the TR station at rkm 2.1 on July 2. It was located in the lower Twisp River during truck surveys on July 13 and 27. It migrated to the spawning area near Reynolds Creek, downstream of the seasonal dry reach, and was located there during a truck survey on August 23. During a foot survey on September 12, code 64 was located near rkm 32.9, under a log upstream of Mystery Campground. On September 29, it was located downstream of Reynolds Creek during a truck survey. On October 11, it was transmitting motionless signal code 164 and the tag was recovered in Reynolds Creek in the pool downstream of the hanging culvert under FR 4435 (Figure 17). The tag was recovered at the edge of the pool, in shallow water under a branch. There were no clues to determine the fate of the bull trout or to indicate mortality. After recovering the tag, we surveyed Reynolds Creek from the pool to the Twisp River confluence and did not observe any bull trout redds.

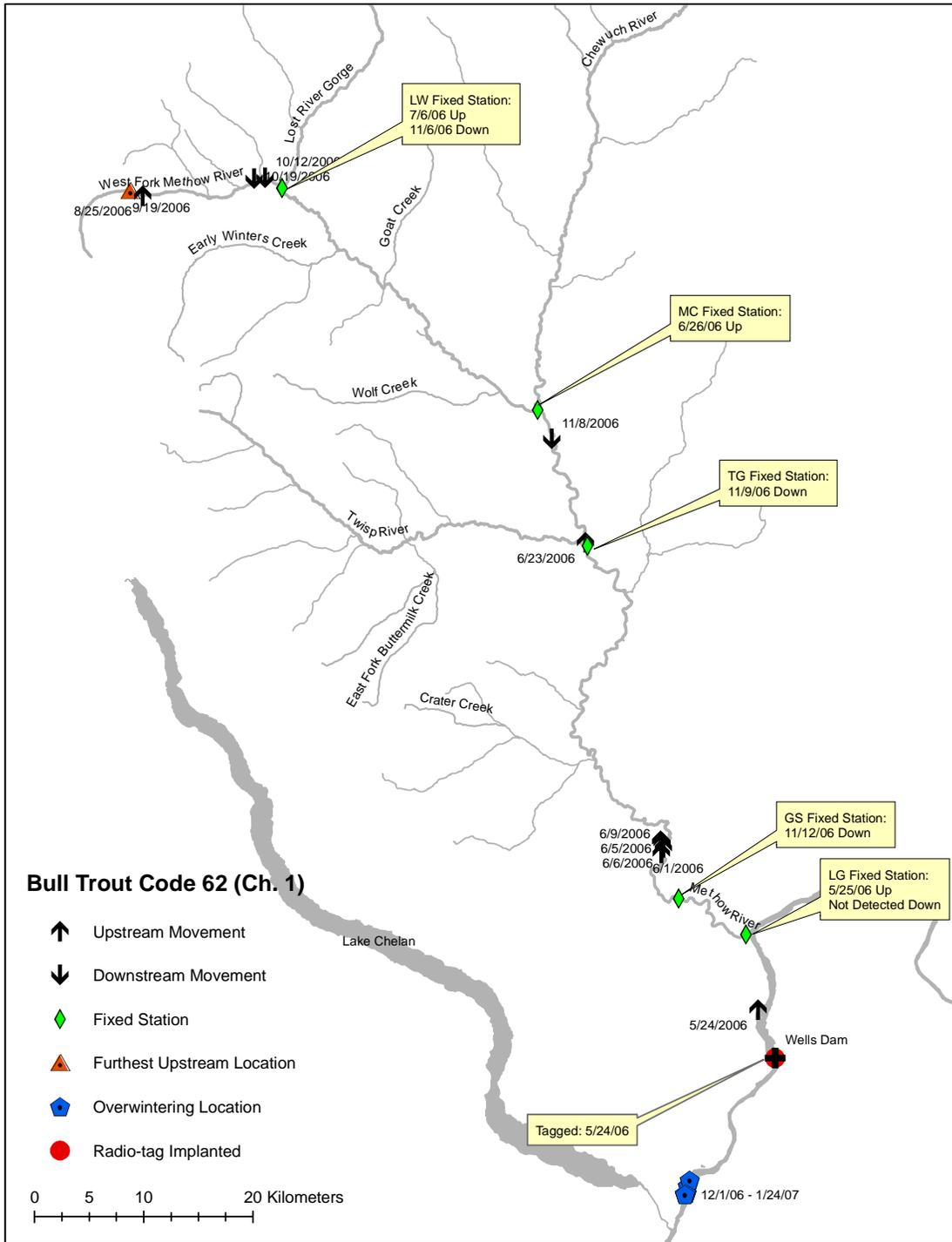


Figure 47. Map of radio-telemetry locations of DPUD bull trout code 62 in 2006.

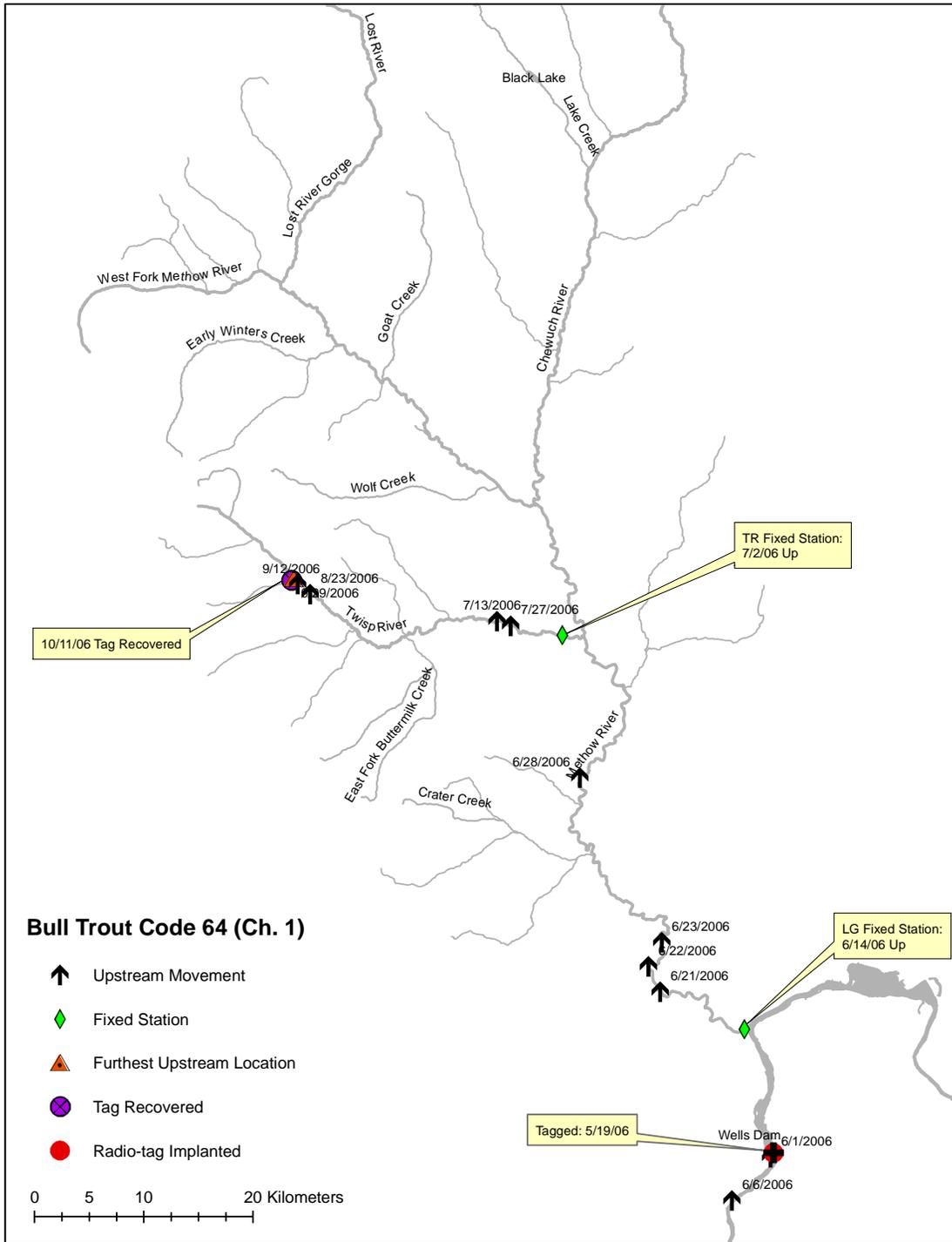


Figure 48. Map of radio-telemetry locations of DPUD bull trout code 64 in 2006.

***Chelan County PUD bull trout-*** We tracked 9 bull trout tagged by CPUD (channel 14) that used the Methow Core Area in 2006. We report mainly on their movements within the Methow, but include some information in the Columbia River gathered during our truck surveys. We also include LG station data (LGL 2007b) and information gathered during aerial and boat surveys conducted by the PUDs on the Columbia (BioAnalysts 2007). (*Note: information on bull trout movements at the dams are reported by the PUDs in their respective annual reports*).

*Code 3-* (Figure 49). Bull trout code 3 was tagged at Rock Island on May 30, 2005. It was detected migrating past the LG station at rkm 1.1 of the Methow River on June 29, 2005, but it was not located in the Methow system again in 2005 (Nelson and Nelle 2007). On July 13, 2006, code 3 was first detected during a truck survey in the Twisp River near Poorman Creek (rkm 6.8). It was not recorded at the TR station at rkm 2.6, nor during mobile surveys in the Methow River, so we suspect it entered the Twisp undetected in 2005, over-wintered, and did not leave the Twisp River system. Code 3 was located on the spawning area near Reynolds Creek, downstream of the seasonal dry reach, during truck surveys from July 27 – September 29. It was observed during a foot survey on September 12, and the bull trout exhibited an orange spawning coloration. It migrated downstream and passed the TR fixed station at rkm 2.6 on October 8. It was detected in the lower Methow River on October 19, and passed the GS fixed station at rkm 10.6 on October 25. Its last detection in the Methow River was at rkm 5 during a truck survey on November 16, and it was not recorded migrating past the LG fixed station at rkm 1.1.

*Code 31-* (Figure 50). Bull trout code 31 was tagged at Rocky Reach Dam on May 31, 2005. It entered the Methow River and migrated past the LG station at rkm 1.1 on June 27, 2005. It was detected in Wolf Creek at rkm 9 during a foot survey on September 13, 2005 and again on September 27, 2005 during an aerial survey (Nelson and Nelle 2007). Code 31 was next detected in the Methow River migrating downstream past the MC fixed station at rkm 80.6 on May 22, 2006. It was not detected in the Methow during several truck surveys from April to mid-May, so presumably it over-wintered in Wolf Creek. Code 31 was detected on May 24 upstream of the mouth of the Methow River during a truck survey. It migrated past the LG station on May 24, was detected in the Columbia River upstream of Wells Dam during truck surveys June 1 – 9, and downstream of Wells on June 29. Code 31 entered the Wenatchee River, passed the WR fixed station operated by CPUD at rkm 12.5 on August 30, and was detected near Monitor, WA during truck surveys on August 30 and September 1. During mobile surveys from September 19 – October 20, code 31 was located in the Wenatchee River at rkm 20.9 and on November 2 at rkm 11.7. It migrated past the WR station at rkm 12.5 on November 4, moved into the Columbia River and was located at rkm 749.6 on November 30, 2006 and at rkm 736.4 on January 11, 2007 during mobile surveys conducted by BioAnalysts. Code 31 traveled a minimum known distance of 390.4 km from its tagging location in 2005 to its over-winter location in 2006/2007.

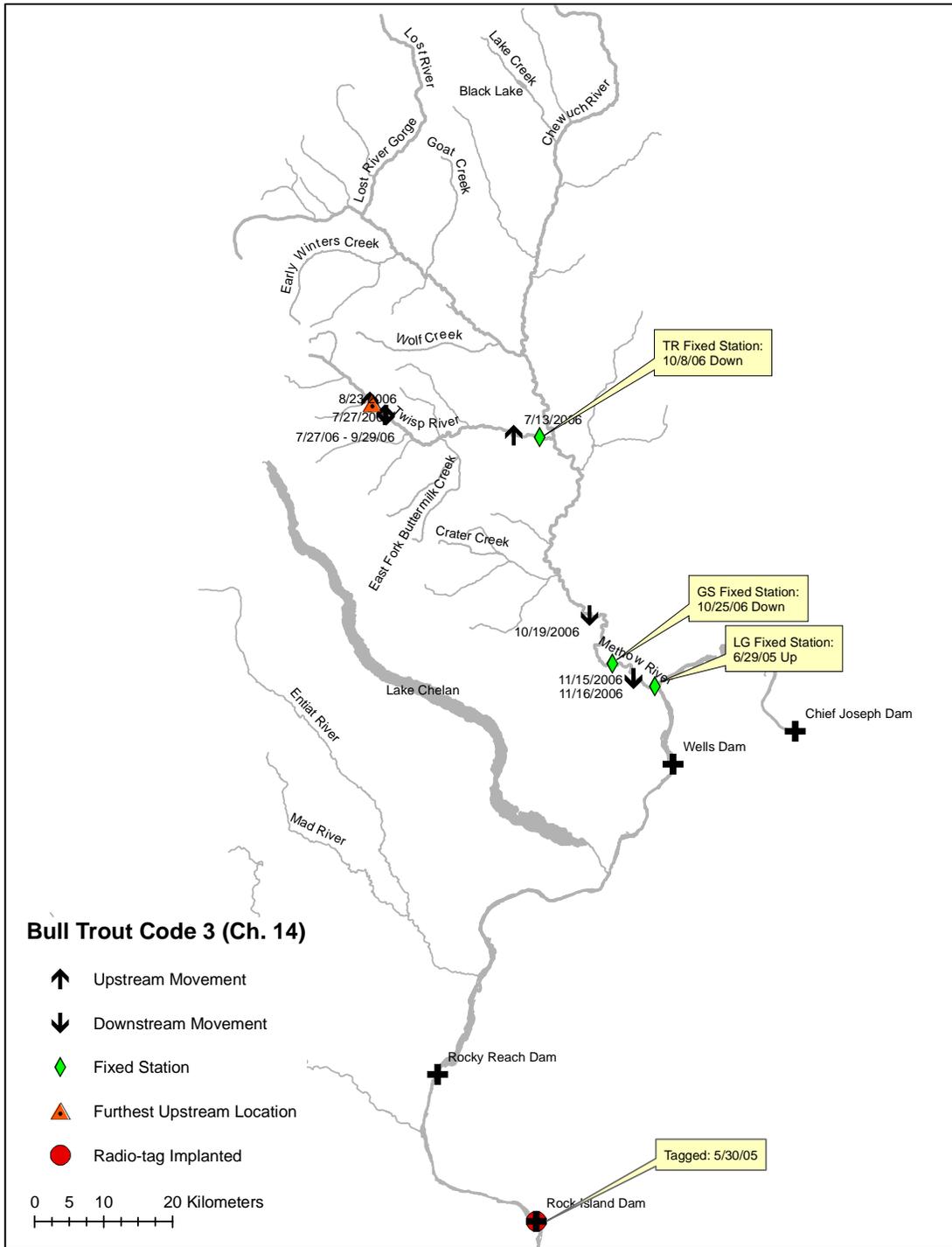


Figure 49. Map of radio-telemetry locations of CPUD bull trout code 3 in 2006.

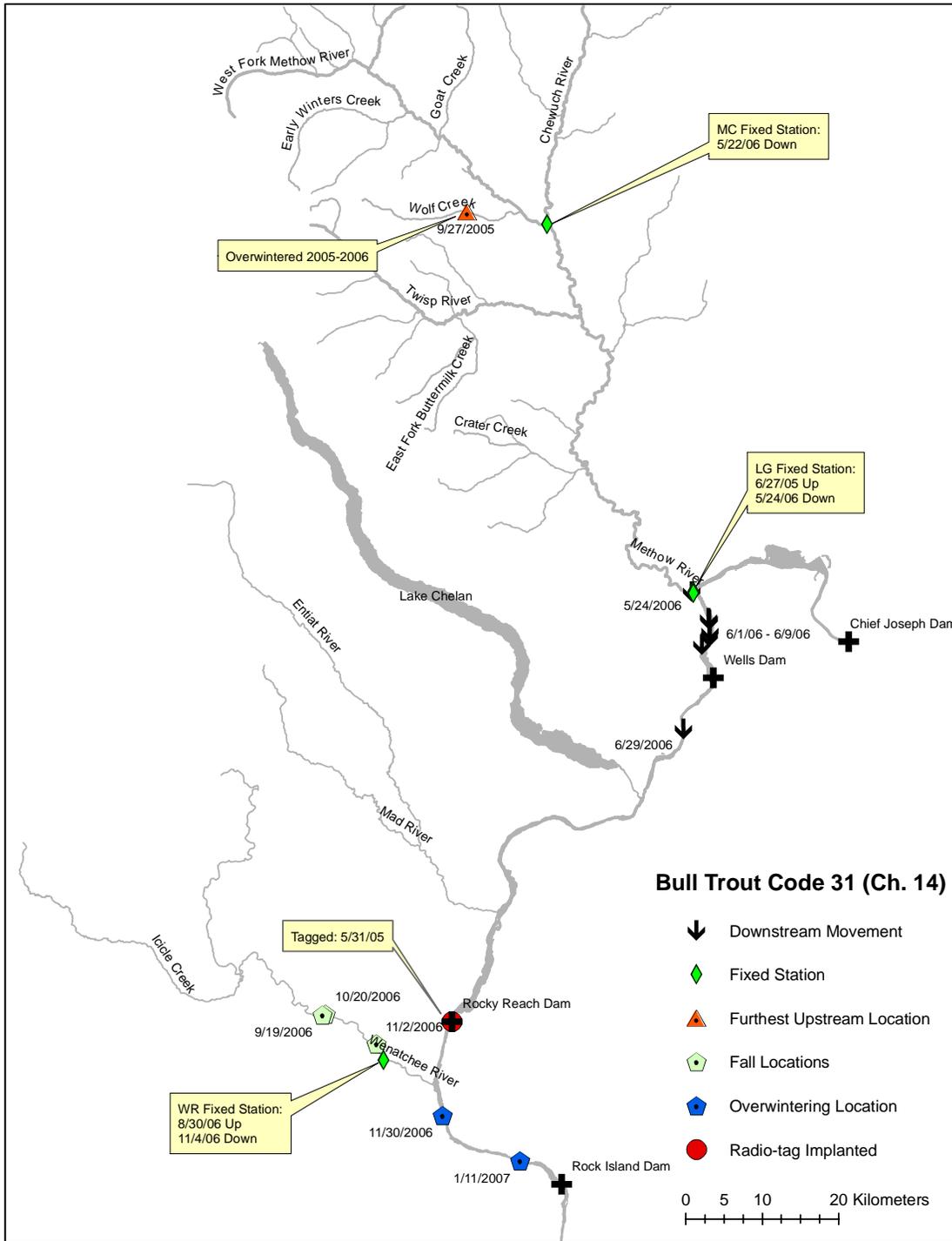


Figure 50. Map of radio-telemetry locations of CPUD bull trout code 31 in 2006.

*Code 44-* (Figure 51). Bull trout code 44 was tagged at Rocky Reach Dam on June 27, 2005. It was located in the Columbia River downstream of Wells Dam from July 20 – October 19, 2005, and near the Chelan River from November 8 – December 7, 2005 (BioAnalysts 2007). Code 44 was detected in the Columbia River near rkm 816 during a truck survey on May 17, 2006. It migrated into the Methow River and was detected on May 24 at the LG station at rkm 1.1. It was located near Gold Creek during truck surveys on June 1, 5, 6, and 9. It migrated past the MC station at rkm 80.6 on June 19, was detected near Wolf Creek on June 23, and near Early Winters Creek on June 29. It passed the LW station on June 30 as it migrated into the West Fork Methow River. It was located in the spawning area during a foot survey on August 25 and an aerial survey flown by BioAnalysts on September 19. It was detected in the lower West Fork Methow River near the upstream edge of the dry reach on October 12. On October 19, it was observed with an untagged bull trout in a small pool isolated by low flows in the lower West Fork Methow River. On November 6, heavy rains re-watered the dry reach and code 44 migrated past the LW fixed station at rkm 117.5. It was not recorded at the MC station at rkm 80.6, but was detected at the TG station at rkm 64.4 on November 7. It migrated past the GS station at rkm 10.6 and the LG station on November 9. It was detected in the Columbia River upstream of Wells Dam during a truck survey on November 15. During truck surveys from December 20, 2006 – January 24, 2007, it was located in Entiat River upstream of the Columbia River confluence. Code 44 traveled a minimum known distance of 410.1 km during migrations from its tagging location in 2005 to its over-wintering location in 2006/2007.

*Code 171-* (Figure 52). Bull trout code 171 was tagged at Rocky Reach on May 25, 2006. It was detected in the Columbia River at the mouth of the Entiat River on May 31 during a truck survey. It was not detected at the LG station at rkm 1.1, but was located in the Methow River between rkm 5 – 12 during truck surveys on June 5, 6, and 9. It was detected near Gold Creek on June 22 and upstream of Libby Creek on June 23. It migrated past the MC station at rkm 80.6 on June 28. It was first detected in Early Winters Creek near rkm 4 on July 12. During truck surveys from July 19 – October 19, it was located in Early Winters Creek between Klipchuck Campground and Varden Creek, downstream of the barrier falls (rkm 12.1). On September 26, we observed code 171 holding under a log in a small pool at rkm 8.2, near the area where redds were located during the USFS bull trout spawning ground survey. On November 6, heavy rains re-watered the upper Methow dry reach, and code 171 migrated downstream. It passed the MC station at rkm 80.6 on November 10 and the TG station at rkm 64.4 on November 13. As it slowly moved downstream it was located in the Methow River during truck surveys from November 15 – December 1. It migrated past the GS fixed station at rkm 10.6 on December 7 and was last detected when it passed the LG station at rkm 1.1 on Dec 10 as it exited the Methow River.

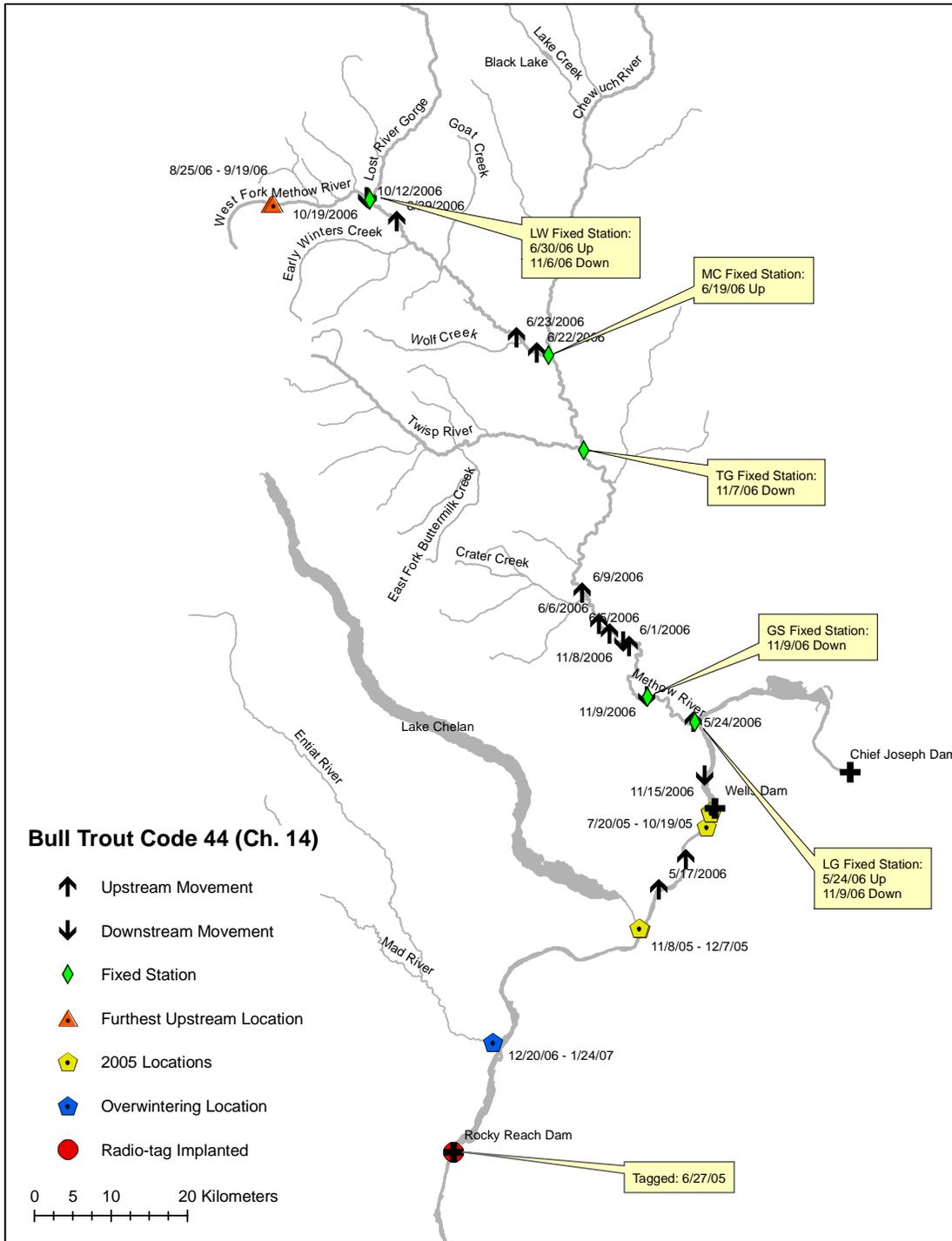


Figure 51. Map of radio-telemetry locations of CPUD bull trout code 44 in 2005 and 2006

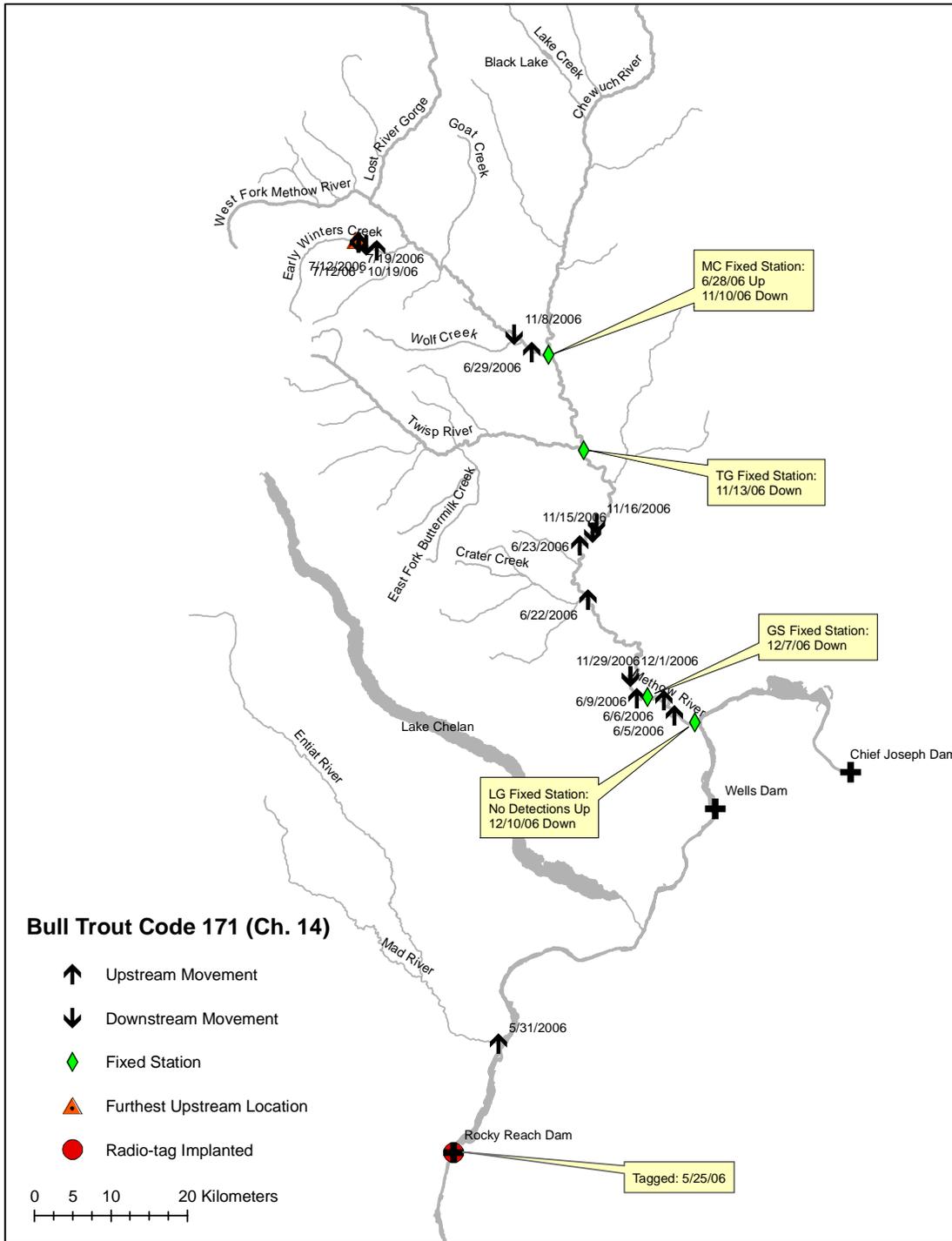


Figure 52. Map of radio-telemetry locations of CPUD bull trout code 171 in 2006.

*Code 174-* (Figure 53). Bull trout code 174 was tagged at Rocky Reach Dam on May 26, 2006. On June 6, it was detected in the Columbia River upstream of Wells Dam during a truck survey, and on June 7 it migrated into the Methow River past the LG station at rkm 1.1. It was located upstream of the mouth of the Methow River on June 9, and on June 22 – 23 it was located near Black Canyon Creek during truck surveys. On June 28, it was detected near Gold Creek, and on July 4, it migrated into the Twisp River and passed the TR station at rkm 2.6. It was located in the vicinity of War Creek on July 13 and 27. During truck and foot surveys from August 23 – September 29 it was located on the spawning area near Reynolds Creek, downstream of the seasonal dry reach. On September 12, it was observed in a LWD pile behind a boulder upstream of Mystery Campground. Code 174 migrated downstream, passed the TR station at rkm 2.6 on October 10, and was located in the Methow River downstream of Beaver Creek from October 17 – 19. It migrated past the GS station at rkm 10.6 on November 8 and passed the LG station at rkm 1.1 on November 9. During a truck survey on November 15, it was detected in the Columbia River near Wells Dam. Code 174 was located upstream of Rocky Reach Dam near rkm 769 during the December 20 aerial survey flown by BioAnalysts and was at the same location during a truck survey on December 21.

*Code 177-* (Figure 54). Code 177 was tagged at Rocky Reach Dam on May 30, 2006. It was detected in Columbia River upstream of the Entiat River during a mobile survey conducted by BioAnalysts on May 31. Code 177 was not detected at the LG station in the Methow River at rkm 1.1. During truck surveys it was detected in the Methow River near rkm 4.8 on June 9 and near Gold Creek on June 23. These were the only detections we recorded in the Methow River during 2006, and the current location of code 177 is unknown. We speculate that the transmitter may be malfunctioning.

*Code 180-* (Figure 55). Bull trout code 180 was tagged at Rocky Reach Dam on May 31, 2006. It migrated into the Methow River and was detected at the LG fixed station at rkm 1.1 on June 7. During truck surveys, it was detected at rkm 10 on June 9 and upstream of Beaver Creek on June 22. It entered the Twisp River and passed the TR station at rkm 2.1 on June 24. It was located near North Creek in the spawning area upstream of the dry reach during truck surveys conducted from July 13 – October 11. It was observed and photographed under a log during a foot survey on October 11. On November 6, heavy rains re-watered the dry reach, and code 180 migrated downstream and passed the TR station at rkm 2.1 on November 8. It entered the Methow River and passed the TG station at rkm 64.4 on November 8 and the GS station at rkm 10.6 on November 11. It was not detected at the LG station at rkm 1.1, but was detected on November 15 in the Columbia River near the mouth of the Methow River.

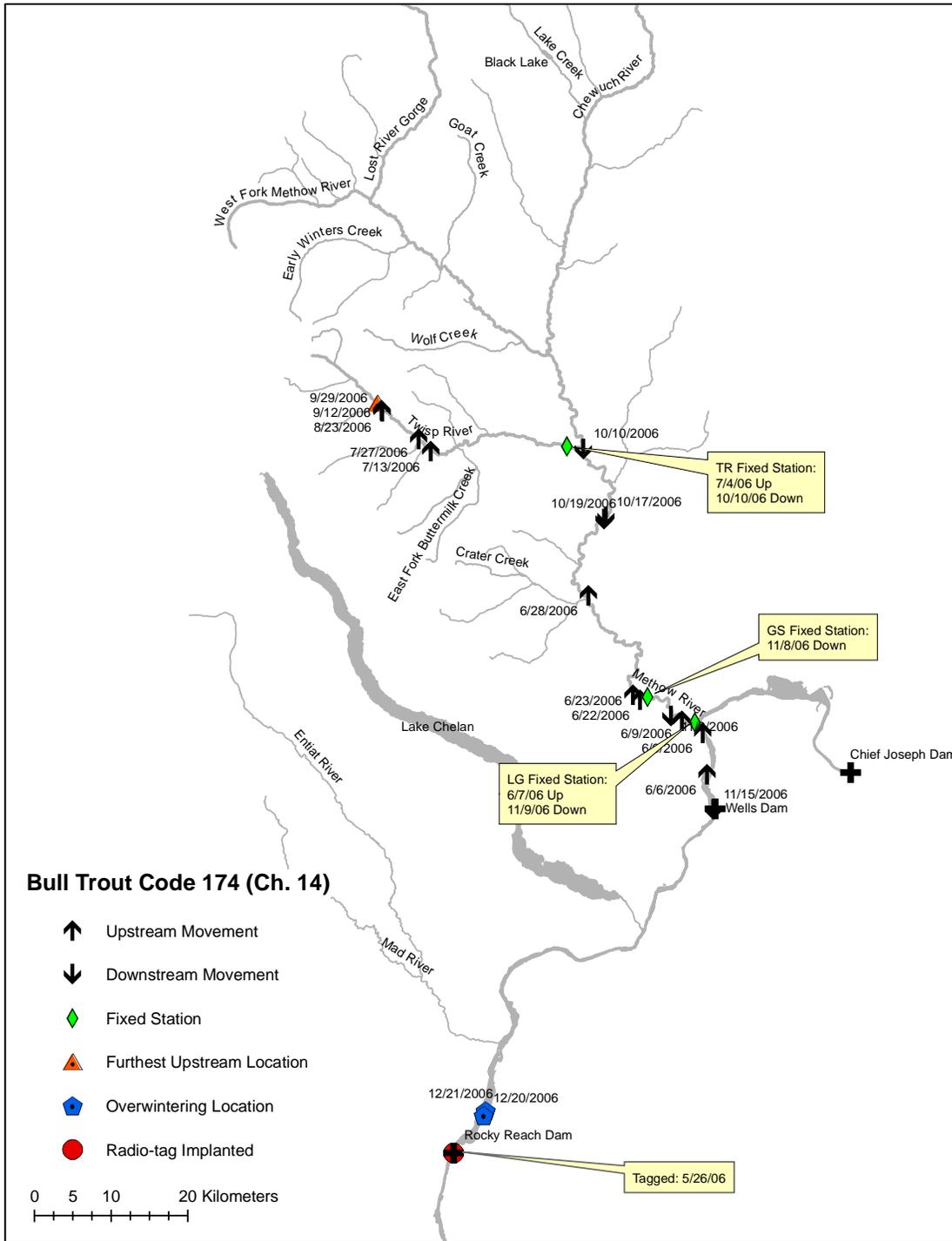


Figure 53. Map of radio-telemetry locations of CPUD bull trout code 174 in 2006.

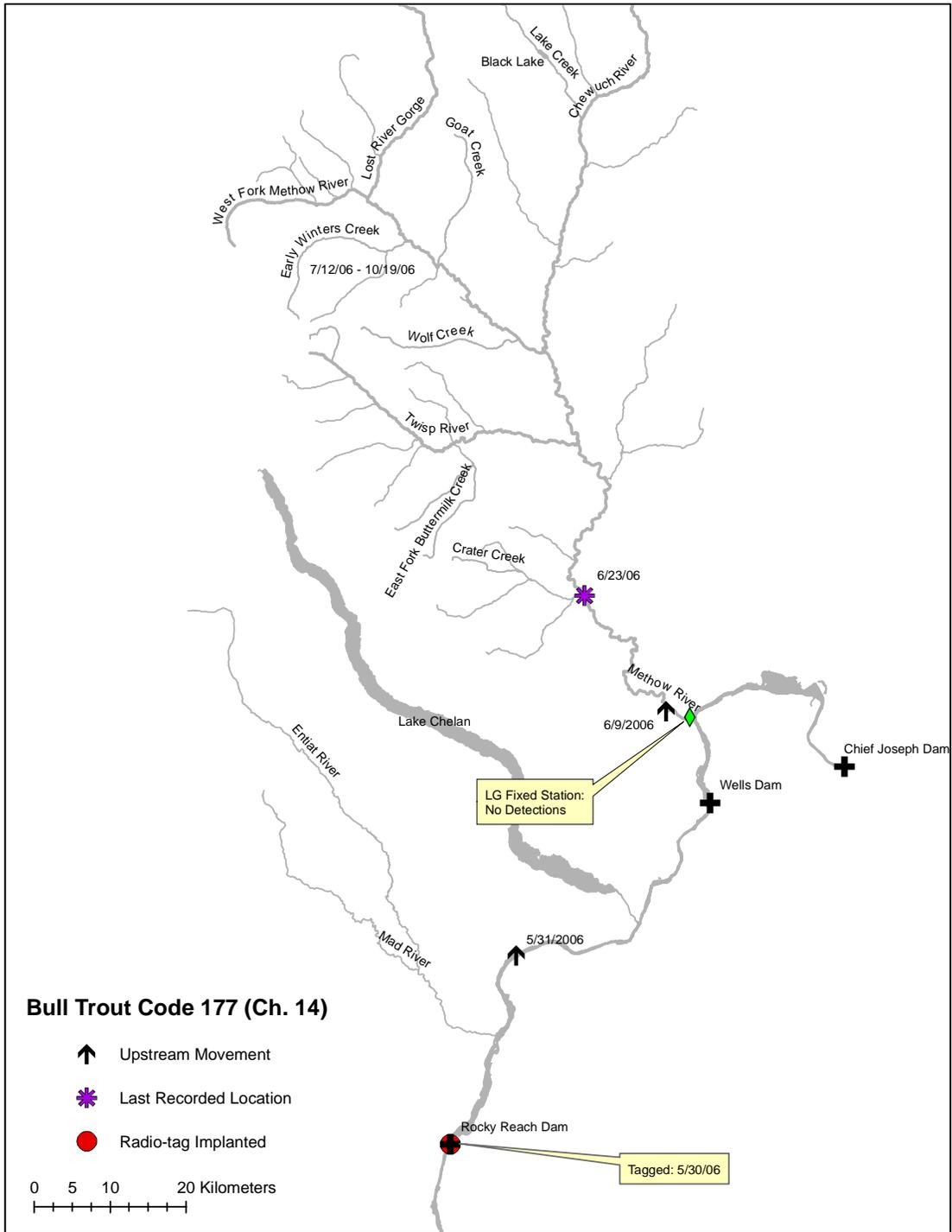


Figure 54. Map of radio-telemetry locations of CPUD bull trout code 177 in 2006.

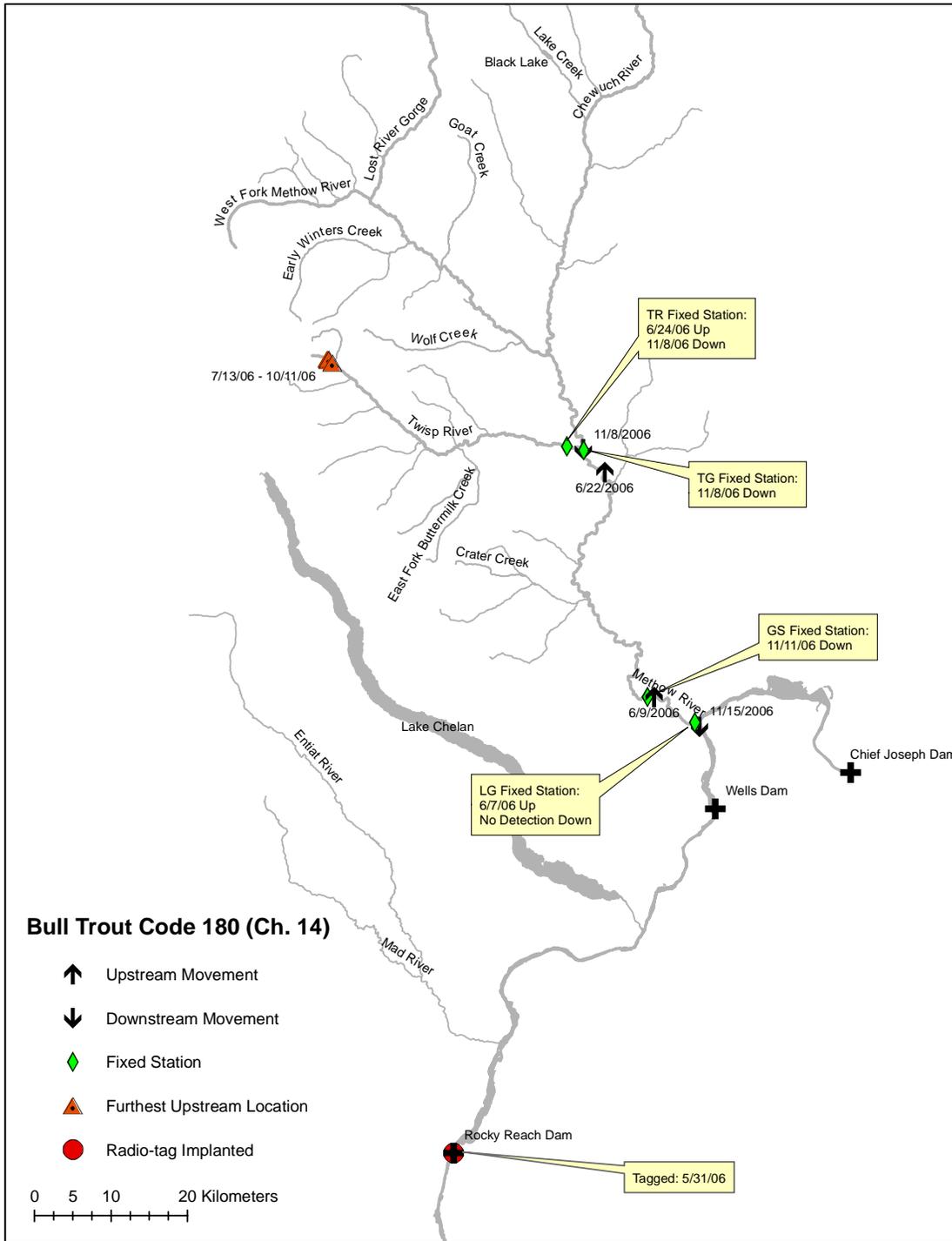


Figure 55. Map of radio-telemetry locations of CPUD bull trout code 180 in 2006.

*Code 184-* (Figure 56). Bull trout code 184 was tagged at Rocky Reach Dam on June 5, 2006. During mobile surveys, it was detected in the Columbia River near the mouth of the Entiat River on June 6 and near Wells Dam on June 15. Code 184 migrated to the Methow River and passed the LG station at rkm 1.1 on June 19. During truck surveys, it was detected in the Methow River at rkm 11 on June 21, upstream of Black Canyon Creek on June 22 and 23, and near Libby Creek on June 28 and 29. Code 184 migrated into the Twisp River and passed the TR station on July 3. It was located upstream of War Creek on July 13 and near South Creek on July 27. It was located in the spawning area near North Creek, upstream of the seasonal dry reach, from August 23- September 29. It moved downstream and on October 11 it was observed in the pool at the confluence of South Creek. Heavy rains on November 6 re-watered the dry reach, and code 184 migrated downstream and passed the TR station on November 7. It slowly migrated downstream and was detected from November 15 – December 1 in the Methow River near Gold Creek. It migrated past the GS station at rkm 10.6 on December 5 and passed the LG station at rkm 1.1 on December 9.

*Code 188-* (Figure 57). Bull trout code 188 was tagged at Rocky Reach Dam on June 22, 2006. During a mobile survey on June 29, it was located in the Columbia River near Wells Dam. It migrated into the Methow River and passed the LG station at rkm 1.1 on July 2 and the GS station at rkm 10.6 on July 5. It was located during truck surveys near Libby Creek on July 10 and upstream of the Twisp River on July 13. It migrated past the MC station at rkm 80.6 on July 16, entered Wolf Creek and passed the WC station at rkm 1.4 on July 17. It was located in lower Wolf Creek during truck surveys on July 18 and 25. It moved upstream and was located downstream of the log jam at rkm 6.6 during foot surveys from August 22 – September 26 and during the aerial survey on September 19. It migrated downstream past the WC station at rkm 1.4 on October 1, entered the Methow River and passed the MC station at rkm 80.6 on October 2. It migrated downstream and passed the GS station at rkm 10.6 on October 24 and the LG station at rkm 1.1 on October 31. It entered the Columbia River, migrated downstream and was located downstream of Rock Island Dam during the aerial survey flown by BioAnalysts on December 20, 2006.

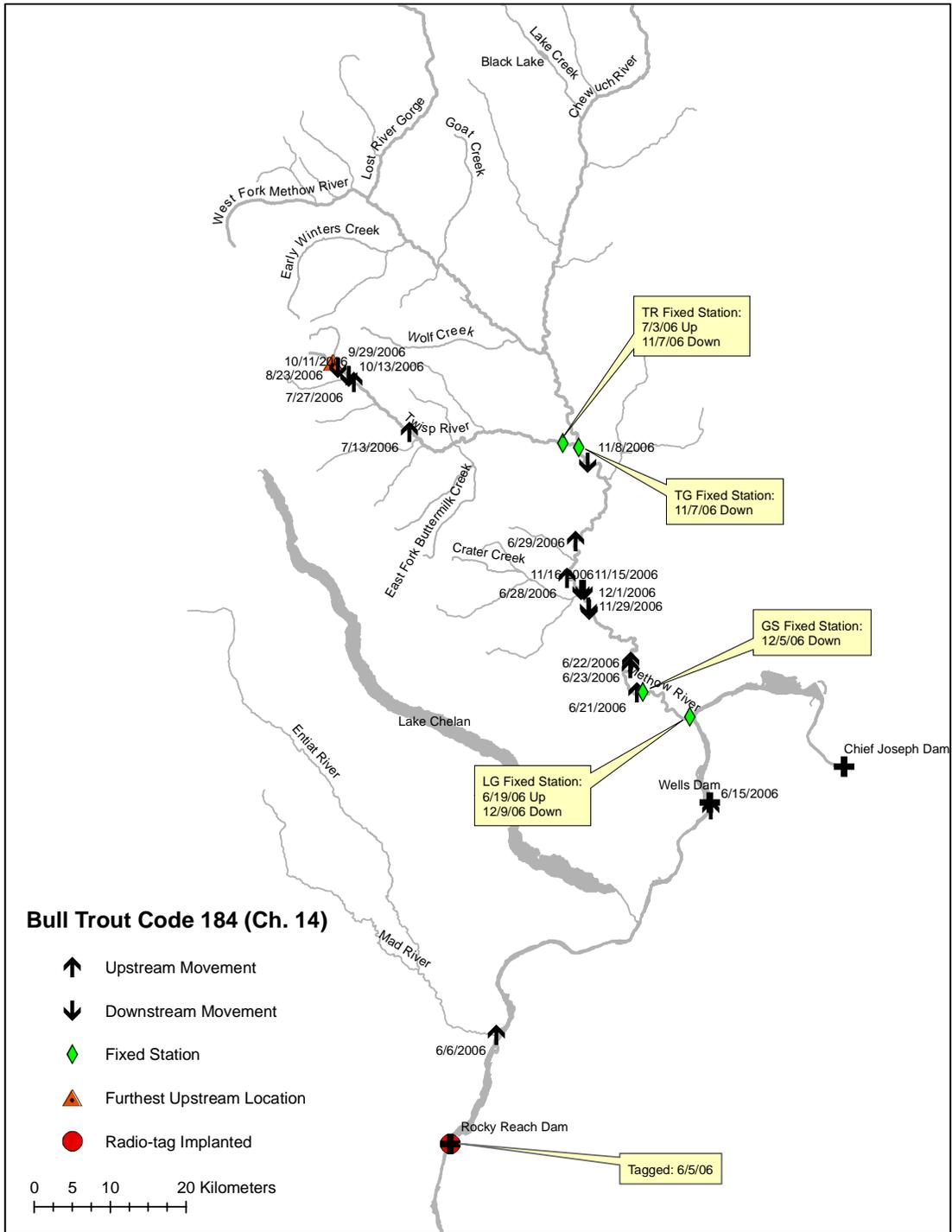


Figure 56. Map of radio-telemetry locations of CPUD bull trout code 184 in 2006.

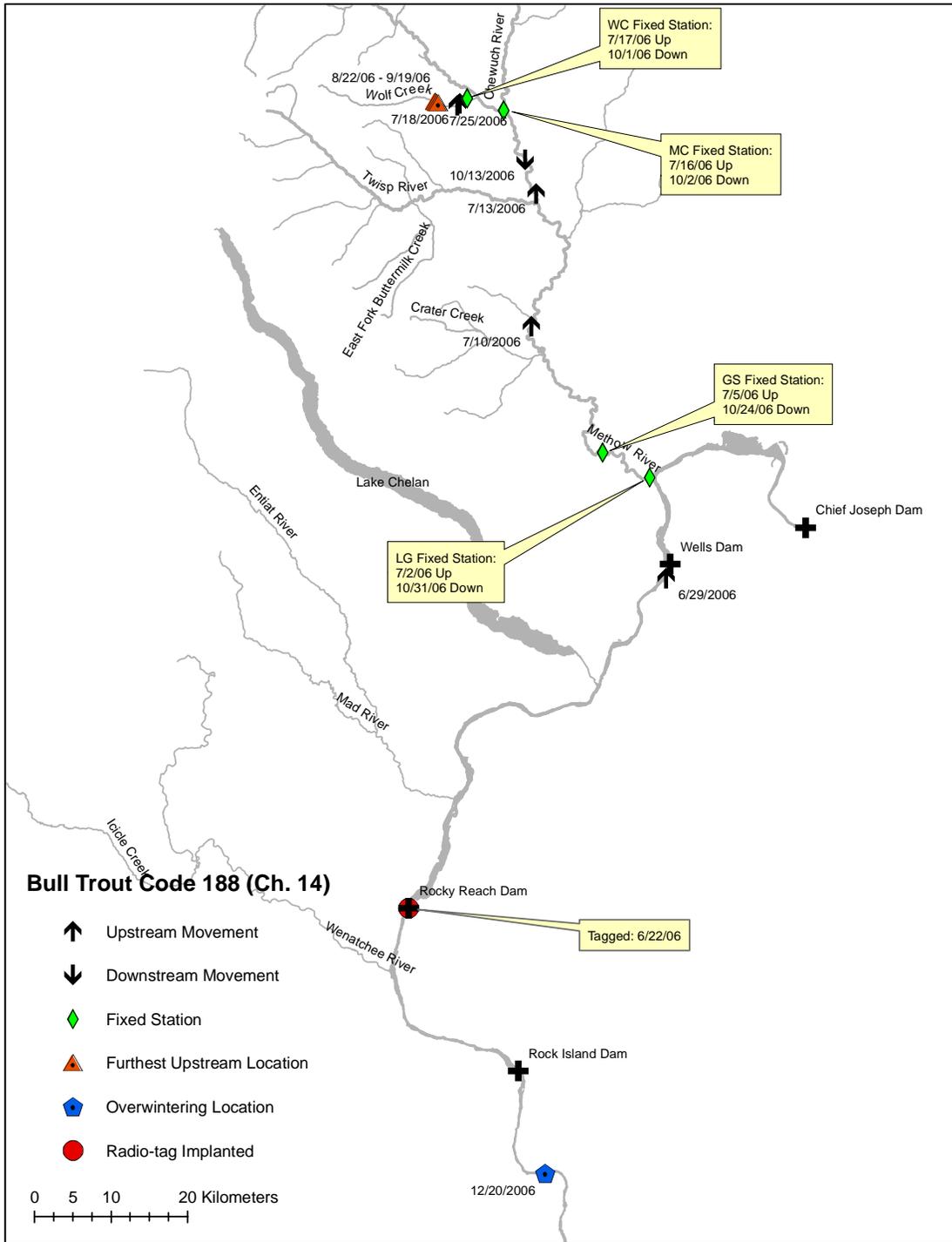


Figure 57. Map of radio-telemetry locations of CPUD bull trout code 188 in 2006.

### **Appendix 3:**

Emails re: recovery of tag code 74 downstream of Wells Dam

**"Bao Le" <baol@dcpud.org>**

09/19/2006 02:08 PM

To: Gregg\_Kurz@fws.gov,  
<Stephen\_Lewis@fws.gov>,  
<RD\_Nelle@fws.gov>, mark\_nelson@fws.gov  
Cc: "Bryan Nass" <bnass@lgl.com>, "Shane  
Bickford" <ShaneB@dcpud.org>, "Bob Clubb"  
<BobC@dcpud.org>, "Scott Kreiter"  
scottk@dcpud.org

**Subject: FWS bull trout code 74**

Gentlemen,

As was discussed with the Wenatchee field office last week (Gregg and Steve), our consultant, LGL had detected a FWS tagged bull trout (code 74) in the Wells Dam tailrace emitting a mortality signal. Last Friday, Bryan Nass (LGL) went out to Wells Dam to download the detection history and to try and locate and retrieve this fish. I spoke with Bryan yesterday and although he was unable to retrieve the tag, he provided me with detailed information as to where he thought the fish was located. This morning, Douglas PUD and LGL staff went back to the site and were able to locate the tag. It was located on the right bank, downstream of Wells Dam near the USGS gauging station. No fish or remnants of a fish were associated with this tag. The tag was clean and found in large cobble substrate in what is likely several feet of water when the Rocky Reach pool is up but luckily today, the pool was down which allowed us access to the site.

In review of the tag history (attached file) and in discussions with LGL, this bull trout passed downstream through Wells Dam on July 19<sup>th</sup> and for a period of approximately one week, was being detected in the right tailrace (possibly the Wells hatchery outfall where bull trout have been observed before). It was then detected in the left tailrace from 7/25-7/26 before disappearing from detection for 3 days and then being re-detected on 7/29 in the left tailrace. This pattern of detection/no detection/detection occurs 3 more times from 7/30-8/2, 8/2-8/9, and 8/14-8/18 suggesting that this fish was moving in and out of detection zones. On 8/18, the signal consistently began emitting the mortality signal (1204 on the spreadsheet) with a stable max power. Given the tag detection history, the immense fishing pressure that is currently occurring in the Wells Dam tailrace, and the condition of the recovered tag (without any trace of fish), the most likely scenario is that this bull trout was caught by anglers and the tag thrown into the nearshore area. Since I live up in Leavenworth, I will deliver the tag to the Leavenworth field office sometime this week. If you have any questions or would like to discuss this further, please feel free to give me a call. Thanks. Bao

Bao Le  
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Tag history for FWS code74.xls

**Gregg Kurz/WNES/R1/FWS/DOI**

09/19/2006 02:57 PM

To: "Bao Le" baol@dcpud.org  
cc: "Bryan Nass" <bnass@lgl.com>, "Bob Clubb" <BobC@dcpud.org>, mark\_nelson@fws.gov, RD\_Nelle@fws.gov, "Scott Kreiter" <scottk@dcpud.org>, "Shane Bickford" <ShaneB@dcpud.org>, Stephen\_Lewis@fws.gov

Subject: Re: FWS bull trout code 74

Bao,

Thank you for the update. Your speculation regarding the cause of the mortality is well founded considering the high level of fishing pressure the area receives during this time of year. Given the pattern of detection in the tailrace for a period lasting just one day shy of a month, the Service definitely agrees with your assessment that the mortality of this fish cannot be attributed directly to project effects. The loss of this tagged individual will not be included in calculations of incidental take limits in accordance with the terms set forth in our biological opinion for implementation of the Mid-Columbia HCP. I will add this information to the administrative record here in our office. Thanks again for your prompt attention to this matter and for keeping us in the loop the whole way through.

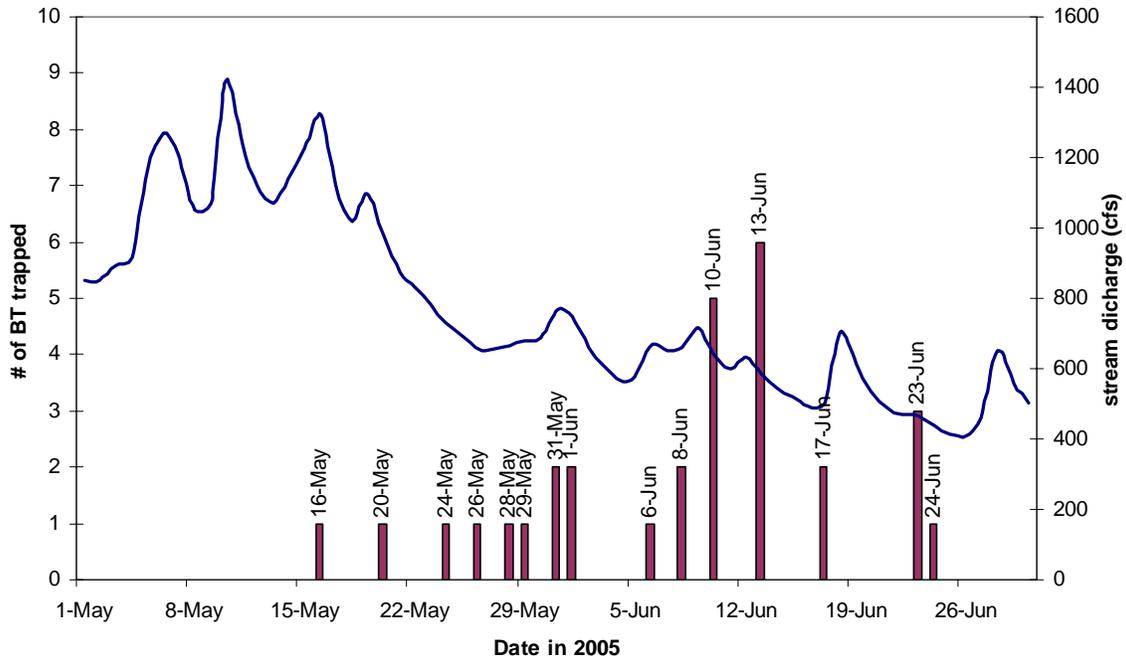
Best,  
Gregg

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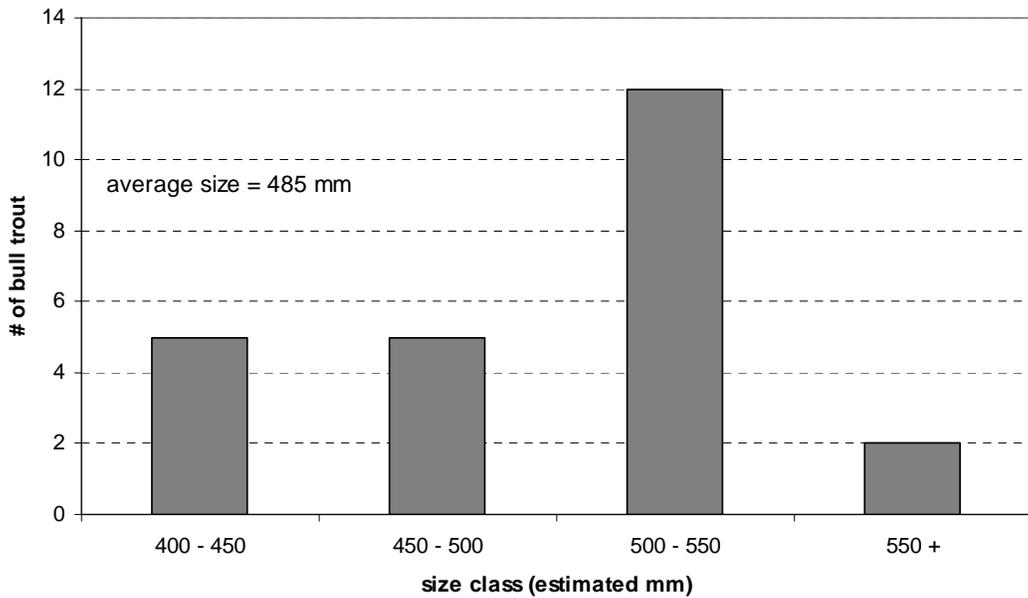
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## **Appendix 4:**

Numbers and date of migrating bull trout captured in the Chewuch River at the WDFW  
Fulton trap in 2005.



**Figure 58. Stream flow and dates of bull trout captured in the Chewuch River at the Fulton Trap in 2005 by WDFW.**



**Figure 59. Size classes of bull trout captured in the Chewuch River at the Fulton trap in 2005 by WDFW.**

**U. S. Fish and Wildlife Service  
Mid-Columbia River Fishery Resource Office  
7501 Icicle Road  
Leavenworth, WA**



**April 2007**