RECLAMATION

Managing Water in the West

2017 Annual Report

Bureau of Reclamation Report on Monitoring and Implementation Activities Associated with the USFWS 2005 Biological Opinion for Operation and Maintenance of the Bureau of Reclamation Projects in the Snake River Basin above Brownlee Reservoir

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Snake River Area Office
Boise, Idaho

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MISSION OF THE BUREAU OF RECLAMATION

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

Acronyms and Abbreviations

ADCP	acoustic Doppler current profile
BA	Biological Assessment
BACI	before/after, control/impact
cfs	cubic feet per second
CPUE	catch per unit effort
DO	dissolved oxygen
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
IDFG	Idaho Department of Fish and Game
ITS	incidental take statement
O&M	Operations and Maintenance
Opinion	Biological Opinion
Reclamation	Bureau of Reclamation
RM	river mile
RPM	reasonable and prudent measure
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WY	water year

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1. Introduction

The Bureau of Reclamation (Reclamation) consulted with the U.S. Fish and Wildlife Service (USFWS) pursuant to Section 7 of the Endangered Species Act (ESA) on 12 proposed actions involving the effects of future operations and routine maintenance at 12 Federal projects in the upper Snake River basin on six different listed species known to occur in the area at that time (Reclamation 2004). In March 2005, USFWS completed a non-jeopardy Biological Opinion (2005 Opinion) for Reclamation's operations and maintenance (O&M) activities in the Snake River basin above Brownlee Reservoir (USFWS 2005). The 2005 Opinion contained a 30-year incidental take statement (ITS) for bull trout and corresponding reasonable and prudent measures (RPMs) that outlined nondiscretionary actions to minimize take of species listed under the ESA that may be impacted by Reclamation's operations (USFWS 2005). The USFWS determined incidental take by correlating frequencies and magnitudes of streamflow and reservoir conditions at specific facilities with an estimate of population effects during critical seasonal time periods in the bull trout's life history. USFWS then described the amount or extent of incidental take at each facility based on operational thresholds.

At the time of the 2005 Opinion, bull trout (*Salvelinus confluentus*) were not known to exist in Phillips Reservoir[1] on the Powder River and therefore were not included in the 2005 Opinion or associated documents. In 2011, two bull trout were documented in Phillips Reservoir, necessitating Reclamation to consult with USFWS for bull trout in this area (Reclamation 2013b). The USFWS completed a non-jeopardy Biological Opinion in June 2014 (2014 Opinion) for Reclamation's O&M activities in the Powder River (USFWS 2014) as a companion document to the 2005 Opinion. The 2014 Opinion contains a 21-year ITS corresponding to the 2005 ITS and RPMs that outline nondiscretionary actions to minimize take of bull trout in Phillips Reservoir.

The 2014 Opinion also included consultation on bull trout critical habitat for the same area analyzed in the 2005 Opinion. The USFWS concluded that Reclamation's O&M of the upper Snake River projects is not likely to destroy or adversely modify designated critical habitat for bull trout.

In addition to bull trout, the 2005 Opinion also included consultation on the Snake River physa (*Physa* [*Haitia*] *natricina*, hereafter physa). Monitoring for physa was reinitiated in 2012, in response to the Minidoka Dam spillway replacement project. Construction was completed during the summer of 2015. Reclamation consulted on project operations following construction of the spillway. The consultation addressed Reclamation's impact to physa located in the Snake River above Brownlee Reservoir, including the Minidoka Dam spillway. Reclamation received a Biological Opinion (2015 Opinion) on May 8,

[1] Phillips Reservoir was referred to as Phillips Lake in the 2004 Assessment.

2015, finding that Reclamation's proposed operations are likely to adversely affect physa in the Minidoka Dam spillway. An ITS, Terms and Conditions, and RPMs were provided. The consultation was aligned with ongoing actions associated with the long-term O&M of the current 2005 Opinion (USFWS 2005) and is considered a supplement to the 2005 Opinion.

The ITS has two main components: 1) a monitoring component to ensure the action agency does not exceed the amount or extent of incidental take described in the ITS, and 2) RPMs to minimize the amount or extent of take without altering the basic design, location, scope, duration, or timing of the action. The 2005 Opinion requires Reclamation to provide an annual report to USFWS by December 31 of each year that documents incidental take monitoring efforts and implementation status of all RPMs and Terms and Conditions. At Reclamation's request (letter dated November 13, 2007), USFWS agreed to permanently change the submittal date from December 31 to March 31 of the following year.

This document is submitted as Reclamation's annual report for Water Year (WY) 2017 (October 1, 2016, to September 30, 2017).

1.1 Bull Trout

Bull trout are present in five of Reclamation's facilities in the upper Snake River basin. This report covers the four facilities assessed in Reclamation's 2004 Biological Assessment (BA) and 2005 Opinion (Anderson Ranch Dam and Reservoir; Arrowrock Dam and Reservoir; Deadwood Dam and Reservoir; and Agency Valley Dam and Beulah Reservoir), as well as Mason Dam and Phillips Reservoir, which was assessed in the 2013 BA and 2014 Opinion (Figure 1).

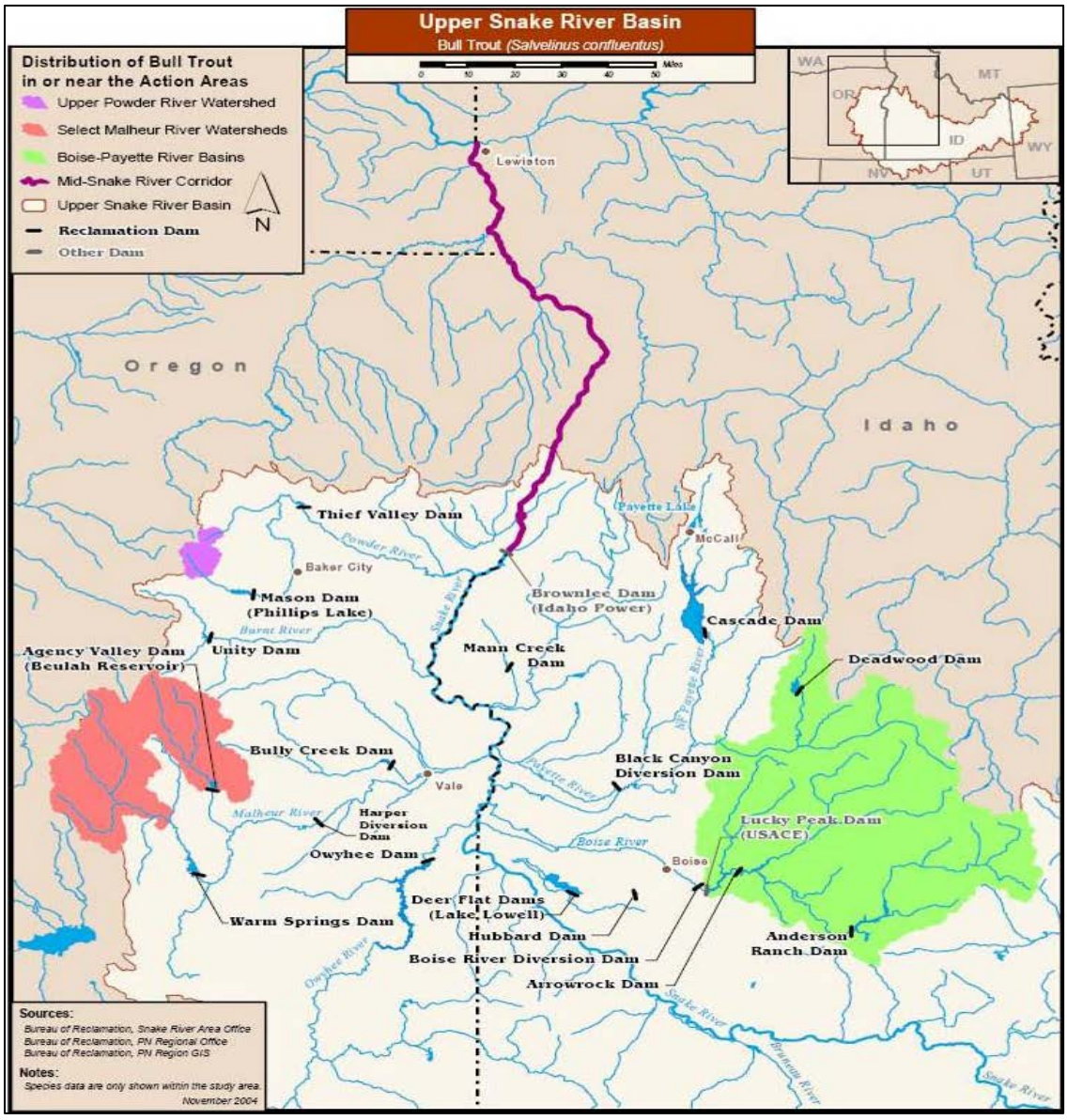

Figure 1. Known distribution of bull trout populations (shaded areas on map) associated with Reclamation facilities in the upper Snake River basin (Reclamation 2004).

1.1.1 Bull Trout Monitoring

This report describes operational thresholds, population monitoring, and other relevant bull trout work managed by Reclamation and work associated with projects that address specific RPMs. In addition, this report discusses other relevant bull trout work that is not managed by Reclamation but is directly relevant to bull trout or bull trout critical habitat within Reclamation's projects.

The Monitoring and Implementation Plan (Reclamation 2006) identifies how Reclamation will monitor bull trout throughout the duration of the 2005 Opinion. Monitoring elements include evaluating operational indicators and tracking population trends. To monitor

compliance with the operational thresholds defined in the ITS, operations for WY17 were monitored, evaluated, and summarized using Reclamation's Hydromet system (Reclamation 2017a).[2] Operational thresholds affecting the amount or extent of anticipated take are described in Section 3.

1.2 Snake River Snails

Previous annual reports to the USFWS documented two species of snails in the Snake River basin: Utah valvata (*Valvata utahensis*) and Snake River physa. USFWS determined that Utah valvata did not meet the definition of an endangered or threatened species under the ESA. The Utah valvata was removed from the ESA list, thereby removing all protections, and subsequent monitoring and reporting requirements, provided by the ESA (75 FR 52272). Accordingly, 2010 was the last year Reclamation monitored the Utah valvata.

The physa remains an ESA-listed species; however, the 2005 Opinion did not provide an ITS, monitoring requirements, or Terms and Conditions for physa due to the uncertainty of their presence in the action area. Subsequent to the 2005 Opinion, physa were confirmed in the action area. A supplemental consultation with USFWS to address possible effects to physa from long-term operation of the newly constructed spillway at Minidoka Dam was completed in 2015. (This supplemental consultation was initiated during construction of the spillway; construction began in 2011 and was completed in the spring of 2015.) The current take coverage for operations is covered under the *Biological Opinion for the Bureau of Reclamation, Operations and Maintenance above Brownlee Reservoir* (2015 Opinion) issued by the USFWS in May 2015 (USFWS 2015). Information reported in this document is related to the most recent requirements set forth in this 2015 Opinion.

Similar to efforts reported in Reclamation's 2013 through 2016 Annual Reports, the 2017 physa surveys were conducted to gather baseline data that will be used to determine trends of occurrence and abundance within the Minidoka reach (i.e., 10.5-mile reach extending from Minidoka Dam downstream to the I-84 bridge) of the Snake River; determine the effects of a range of spillway flows on physa in the Minidoka Dam spillway; further characterize physa habitats, and meet the reporting requirements of ESA Section 10 (Permit No. TE 056557-5). In 2017, environmental DNA sampling was experimentally incorporated into surveys; this sampling method is known to reliably produce species presence/absence results for other species, but its utility to also produce meaningful spatial results for this species is still being assessed for potential incorporation into future study design.

[2] See Reclamation's Hydromet website at: http://www.usbr.gov/pn/hydromet/select.html

1.3 Yellow-billed Cuckoo

Reclamation entered into informal ESA Section 7 consultation with USFWS in the fall of 2016 for the western Distinct Population Segment of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*), following the USFWS determination to list this species as threatened in November 2014 (79 FR 67154). A BA comprehensively evaluating effects to the yellow-billed cuckoo from Reclamation's operations in the Snake River basin above Brownlee Reservoir was submitted to USFWS in July of 2017. A Letter of Concurrence with that BA's findings that Reclamation operations are not likely to adversely affect the species, which fulfills Section 7 coverage for this species under the ESA, was issued to Reclamation by USFWS in August of 2017.

2. Summary of 2017 Operations

Early in WY 2017, the water supply conditions were near average to below average in the Snake River basin above Brownlee Reservoir. In the Payette, Boise, and Upper Snake basins, November carryover storage from 2016 was 91, 98, and 70 percent of average, respectively.

In the early winter, near normal precipitation fell in the Payette and Boise basins, while much above normal precipitation fell in the Upper Snake basin. However, much of the very early season precipitation in October fell as rain which did not add to the snowpack. This resulted in a below average snowpack in the Payette, a near average snowpack in the Boise, and an above average snowpack in the Upper Snake on January 1, 2017. Snowpack on January 1 in the Payette, Boise, and Upper Snake basins was 82, 94, and 118 percent of average, respectively. Wet conditions continued in January, February, and March, and by April 1, snowpack in all three basins was above average with 123, 140, and 137 percent of average, respectively.

Above average precipitation in the basins south and west of the Boise basin continued to help counter recent drought conditions and resulted in full reservoir systems in eastern Oregon.

Observed unregulated runoff for the April through July period was above average with 168 percent of average for the Payette River at Horseshoe Bend, 185 percent for the Boise River near Boise, and 166 percent for the Snake River at Heise. Flood control releases were required in the Payette, Boise, and Upper Snake basins in 2017. Flood control releases on the Payette began in early March and ran through late June. In the Boise, flood control began in the middle of February and ran through the end of June. In the Upper Snake, flood control releases were required starting the end of February and ran through early July.

The Upper Snake reservoir system above Milner essentially filled and reached a maximum combined physical storage content of 4,185,535 acre-feet, approximately 160 acre-feet below full capacity of 4,185,695 acre-feet. The Boise reservoir system nearly filled

reaching a maximum storage content of 925,232 acre-feet and would have filled but for early flow augmentation releases. The Boise reservoir system maximum storage content peaked at approximately 24,500 acre-feet below its full capacity of 949,700 acre-feet. The Payette reservoir system also nearly filled reaching a maximum storage content of 780,875 acre-feet and also would have filled but for early flow augmentation releases. The Payette reservoir system maximum storage content peaked at approximately 19,600 acre-feet below its full capacity of 800,452 acre-feet.

The above average precipitation in the Payette, Boise, and Snake basins allowed the higher threshold flow augmentation of 487,000 acre-feet to be targeted despite the near average to below average reservoir carryover conditions at the start of the WY.

2.1 Idaho

2.1.1 Boise River Basin Operational Indicators

Specific operations or conditions at Anderson Ranch and Arrowrock Dams and Reservoirs that are expected to result in the take of bull trout in the form of death, harm, sub-lethal harassment, injury, or displacement were listed in the USFWS 2005 Opinion. These operations or conditions are summarized as operational indicators for each dam in Table 1 and Table 2.

Three operational indicators were exceeded during the 2017 reporting period in the Boise River basin:

- Anderson Ranch Reservoir stored and released water (Table 1, Figure 2, and Figure 3); however, the 2005 Opinion granted Reclamation an exemption for this action for 30 out of 30 years for which the Opinion is valid.
- Anderson Ranch Dam released water over the spillway intermittently between May 11 and June 11, for a total of 20 days in 2017. The Opinion granted Reclamation an exemption for this action for 6 out of the 30 years for which the Opinion is valid.
- Arrowrock Dam released water over the spillway intermittently between May 12 and June 29, for a total of 49 days in 2017. The Opinion granted Reclamation an exemption for this action for 15 out of the 30 years for which the Opinion is valid.

Discharge from Arrowrock Dam exceeded 695 cubic feet per second (cfs) during the 2017 reporting period (Table 2 and Figure 5); however, the reservoir elevation did not drop below 3111 during the critical season (July through September) or during the period when discharge exceeded 695 cfs. Therefore, this operational indicator was not exceeded.

Table 1. Summary of amount or extent of anticipated take of bull trout associated with Reclamation's Anderson Ranch Dam and Reservoir facility operations during the 2017 reporting period.

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2017 Operations (October 2016 to September 2017)	Quick Reference: Number of times threshold has been exceeded
Up to 50 percent of the Middle and North Fork populations are affected by spillway discharges that disrupt timing of migration and spawning and that alter metabolic rates and up to 10 percent of bull trout in the reservoir are entrained into the South Fork Boise River	Water is discharged over the spillway	Spring	6 of 30 years	The spillway was used during the reporting period.	**3 of 6 years** 2006: 9 days 2014: 3 days 2017: 20 days
Up to 50 percent of the Middle and North Fork populations are affected by the altered flow and temperature regime that disrupts migration and spawning and that increases metabolic rates	Water is stored and released at Anderson Ranch Dam	Spring through fall	30 of 30 years	Anderson Ranch Reservoir elevations for WY17 are shown in Figure 2.	**11 of 30 years** Exceeds annually
Up to 4 percent of bull trout in the reservoir experience degraded water quality	Reservoir storage volume falls below 62,000 acre-feet (Figure 3).	Summer	2 of 30 years	Reservoir storage volume was maintained above 62,000 acre-feet (Figure 3).	**0 of 2 years**

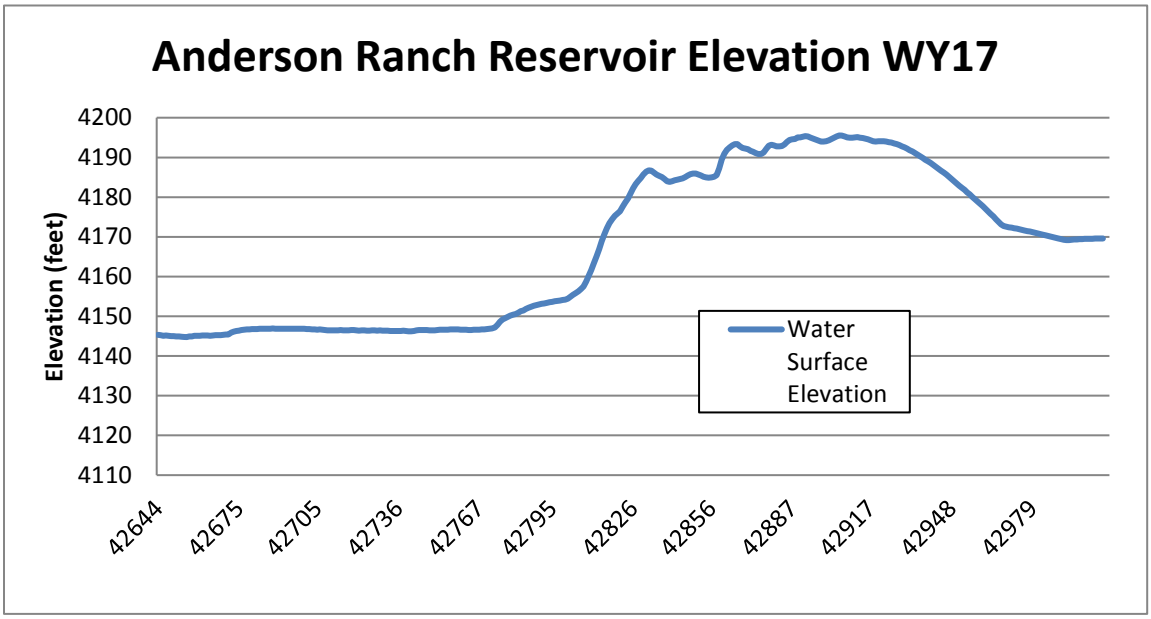

Figure 2. Anderson Ranch Reservoir elevation (feet above sea level) for WY17Anderson Ranch Reservoir elevation (feet above sea level) for WY17.

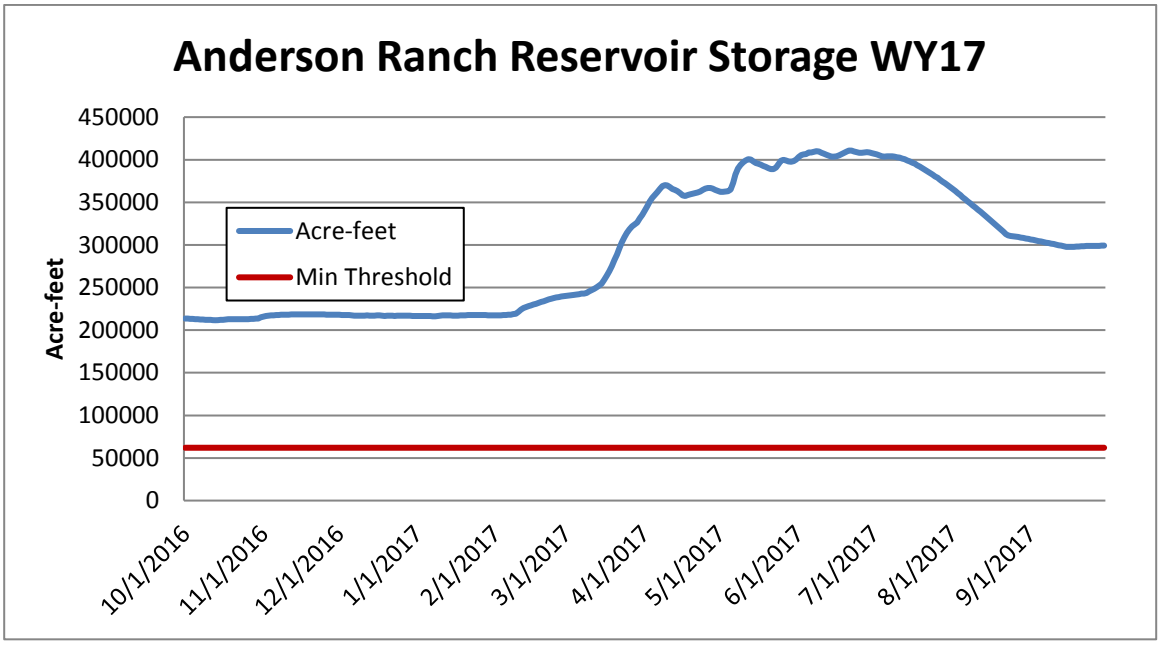

Figure 3. Anderson Ranch Reservoir storage volume (acre-feet) for WY17. The straight line represents Reclamation's Operational Indicator minimum threshold of 62,000 acre-feet of storage.

Table 2. Summary of amount or extent of anticipated take of bull trout associated with Reclamation's Arrowrock Dam and Reservoir facility operations during the 2017 reporting period.

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2017 Operations (October 2016 to September 2017)	Quick Reference: Number of times threshold has been exceeded
Up to 50 percent of the Middle and North Fork populations are affected by low reservoir productivity and decreased prey.	Reservoir volume of less than 200,000 acre-feet at the end of June	30 Jun	3 of 30 years	Reservoir volume was 257,368 acre-feet on June 30, 2016. It did not drop below 200,000 acre-feet until July 27, 2017 (Figure 4).	**4 of 3 years** 2007: yes (6/15) 2013: yes (4/24) 2015: yes (6/25) 2016: yes (6/23)
Up to 8 percent of bull trout in the reservoir are entrained into Lucky Peak Reservoir, as averaged over any consecutive 5-year period.	Water is discharged over the spillway.	March through June	15 of 30 years	The spillway was used during the reporting period.	**2 of 15 years** 2006: 9 days 2017: 49 days
Up to 2 percent of bull trout in the reservoir are entrained into Lucky Peak Reservoir	Discharge exceeds 695 cfs while the reservoir water surface elevation is less than 3,111 feet[3]	July through September	30 of 30 years	Discharge exceeded 695 cfs regularly from Feb 10-Sep 5, 2017. However, reservoir surface elevation did not drop below 3,111 feet during WY17 (Figure 5).	**10 of 30 years** Presumed to exceed annually

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2017 Operations (October 2016 to September 2017)	Quick Reference: Number of times threshold has been exceeded
Up to 20 percent of bull trout in the reservoir, as averaged over any 5 consecutive years, experience habitat degradation and predation	Mean daily reservoir elevation falls below 3,100 feet	September 15 through October 31	18 of 30 years	Reservoir surface elevation did not drop below 3100 feet during the reporting period in WY 2017 (Figure 5).	**0 of 18 years**
Up to 5 percent of bull trout in the reservoir are entrained into Lucky Peak Reservoir, as averaged over any consecutive 5-year period	Discharge exceeds 695 cfs while the reservoir water surface elevation is less than 3111 feet (Figure 5)[3]	Winter	20 of 30 years	Reservoir elevations did not drop below 3,111 feet in 2017 (Figure 5).	**0 of 20 years**

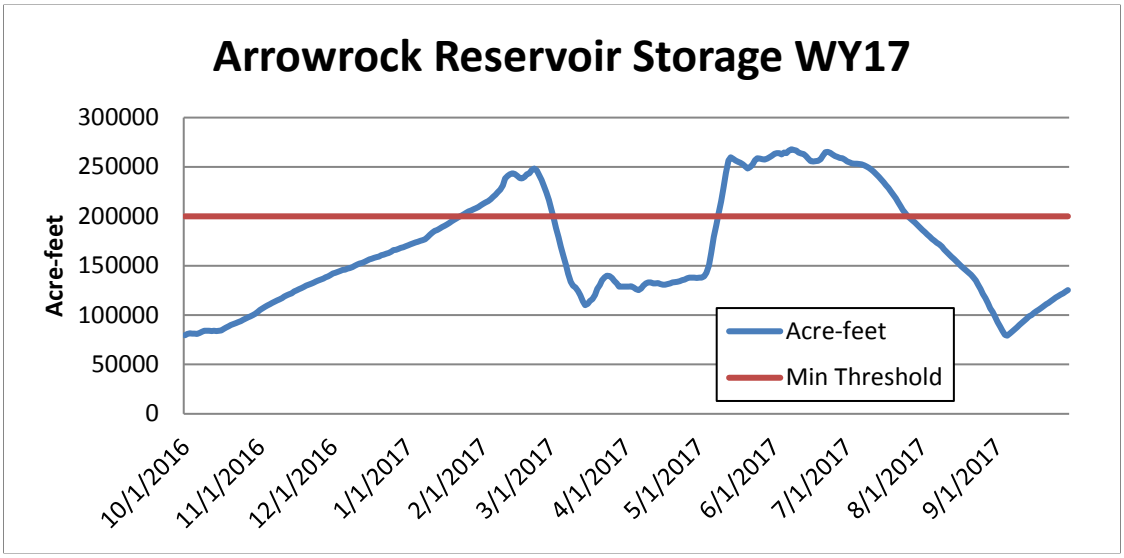

Figure 4. Arrowrock Reservoir storage volume (acre-feet) for WY17. The straight red line represents Reclamation's Operational Indicator of reservoir volume of 200,000 acre-feet; reservoir volume should exceed this minimum at the end of June. On June 30 2017, Arrowrock Reservoir storage volume was 257,367 acre-feet.

[3] Since the Opinion was issued, valve reconfigurations at Arrowrock Dam have caused the upper release conduits to no longer be used, making these operational indicators obsolete. This is described in further detail in Reclamation 2018a. Future annual reports will list these indicators as "No Longer Applicable."

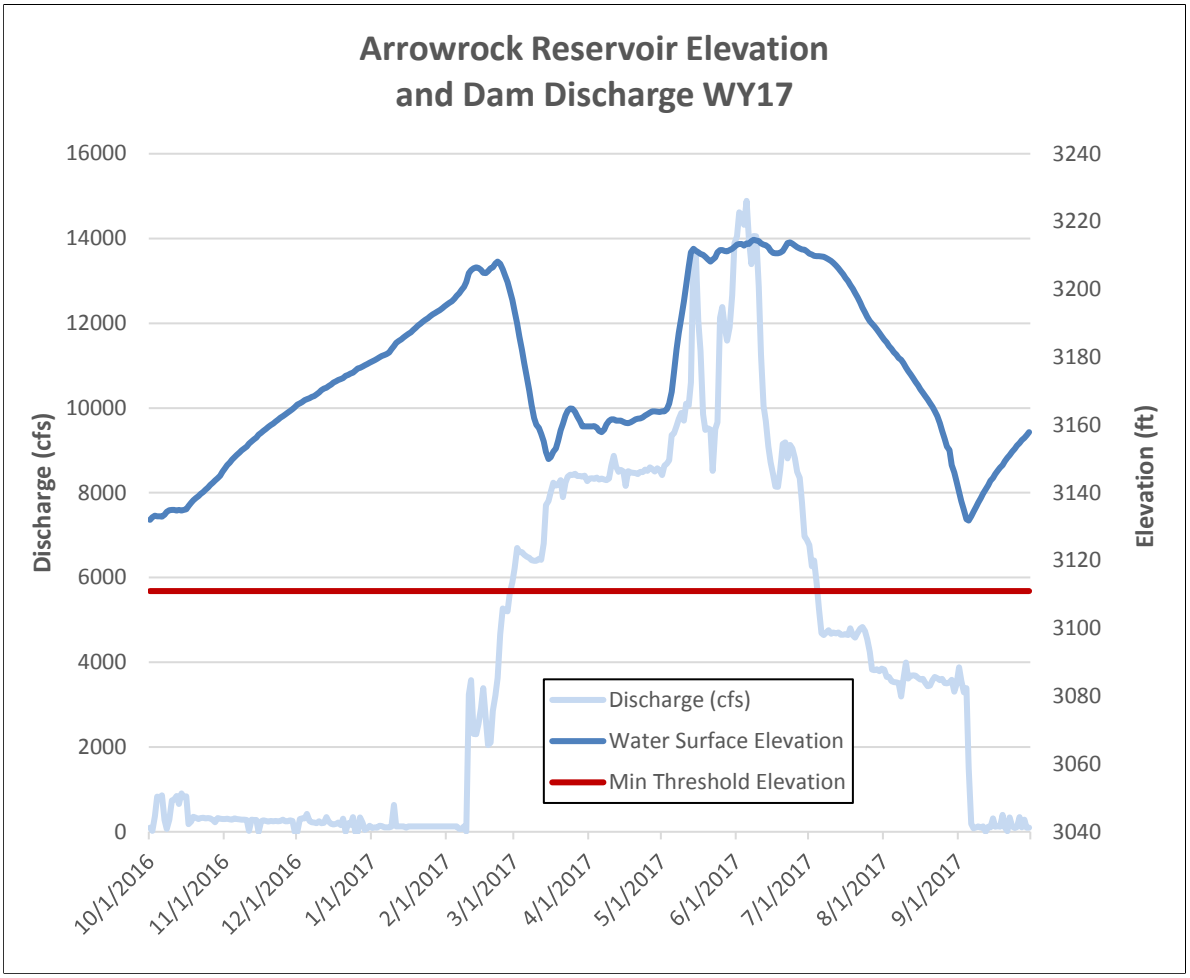

Figure 5. Arrowrock Reservoir surface elevation (feet above sea level) for WY17 and discharge (cfs). The straight red line represents Reclamation's Operational Indicator minimum elevation threshold (during discharges exceeding 695 cfs) of 3111 feet. Reclamation's fall minimum elevation threshold (Sep 15-Oct 31) is 3100 feet. Neither threshold was exceeded in WY17.

2.1.2 Payette River Basin Operational Indicators

Specific operations or conditions at Deadwood Dam and Reservoir that are expected to result in the take of bull trout in the form of death, harm, sub-lethal harassment, injury, or displacement were listed in the USFWS 2005 Opinion. These operations or conditions are summarized as operational indicators for Deadwood Dam and Reservoir in Table 3. Figure 6 illustrates Deadwood Reservoir storage volume in WY17.

One operational indicator was exceeded during the 2017 reporting period in the Payette River basin:

- Deep water releases occurred throughout the year at Deadwood Dam (Table 3); however, the 2005 Opinion granted Reclamation an exemption for this action for 30 of the 30 years for which the Opinion is valid.

Table 3. Summary of amount or extent of anticipated take of bull trout associated with Reclamation's Deadwood Dam and Reservoir facility operations during the 2016 reporting period.

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2016 Operations (October 2015 to September 2016)	Quick Reference: Number of times threshold has been exceeded
Up to 2 to 4 percent of bull trout in Deadwood Reservoir are entrained into the Deadwood River below the dam	Water is discharged over the spillway	Spring	11 of 30 years	Water was not discharged over the spillway during the reporting period in WY17.	**6 of 11 years** 2006: 32 days 2007: 33 days 2008: 33 day 2010: 15 days 2014: 69 days 2015: 50 days
Up to 2 to 4 percent of bull trout in Deadwood Reservoir are affected by degraded water conditions	Reservoir storage volume falls below 50,000 acre-feet	August through October	2 of 30 years	Reservoir storage volumes did not drop below 50,000 acre-feet during the reporting period in WY17 (Figure 6).	**0 of 2 years**
All bull trout in the Deadwood River downstream from the dam are affected by spillway discharges that disrupt timing of migration and spawning and that alter metabolic rates	Water is discharged over the spillway	May through July	11 of 30 years	Water was not discharged over the spillway during the reporting period in WY17.	**6 of 11 years** 2006: 32 days 2007: 33 days 2008: 33 day 2010: 15 days 2014: 69 days 2015: 50 days
All bull trout in the Deadwood River downstream from the dam are affected by low winter streamflows and temperatures that affect bull trout movement and growth and reproduction of bull trout and the prey base	Deep water releases at Deadwood Dam and low flows below the dam	Spring-temperature increases and flow decreases; Summer – temperature decreases and flow increases; Fall – temperature increases and flow reductions; Winter – temperature increases and flow reductions	30 of 30 years	All releases are deep water releases except for water discharged over the spillway	**12 of 30 years** Exceeds annually

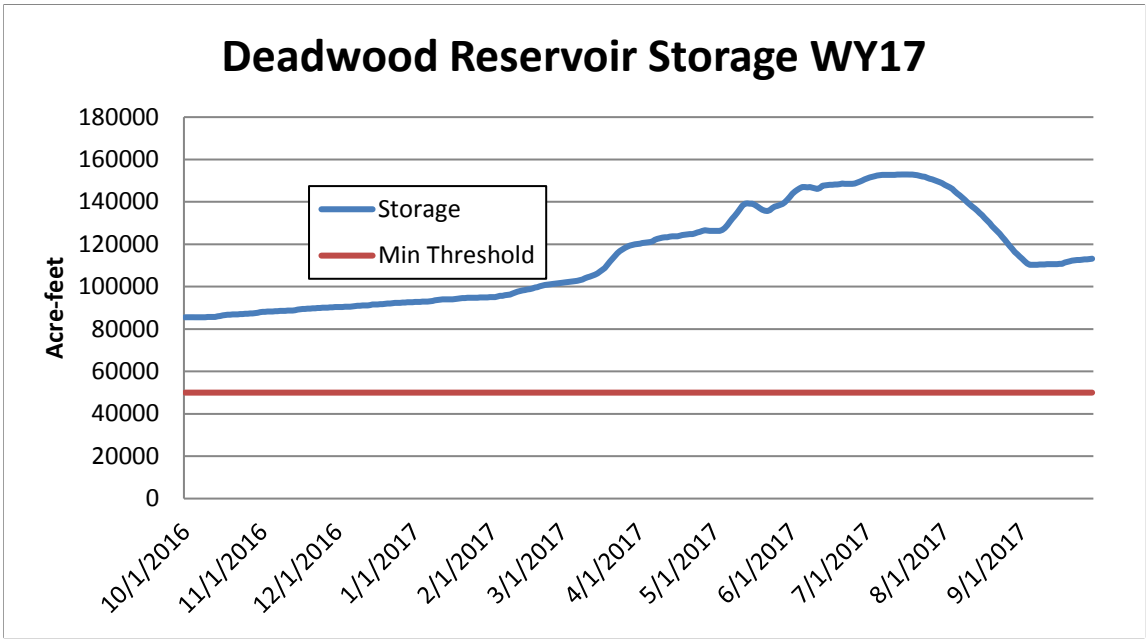

Figure 6. Deadwood Reservoir storage volume (acre-feet) for WY17. The straight red line represents Reclamation's Operational Indicator minimum threshold of 50,000 acre-feet of storage.

2.2 Oregon

Carryover storage in Beulah Reservoir for WY17 was 2,442 acre-feet above the conservation pool target of 2,000 acre-feet established in Reclamation 2018b[4]. Due to high snowpack and spring runoff in the Malheur River basin in WY17, Beulah Reservoir subsequently filled to near-capacity in the early spring of 2017 and remained at or above 98 percent capacity (58,027 acre-feet) from April 27 to May 27, 2017. The reservoir was only drafted to a low of 10,082 acre-feet (17 percent of reservoir capacity) by the end of September 2017 and did not fall below the 2,000 acre-foot conservation pool threshold at any point in WY17.

Flow information for WY17 (October 1, 2016 to September 30, 2017) can be found on Reclamation's Hydromet website. Reservoir water operations, including daily average reservoir elevations, contents in acre-feet, storage, and outflow for Reclamation facilities are discussed in detail later in this report.

2.2.1 Malheur River Basin Operational Indicators

Specific operations or conditions at Agency Valley Dam and Beulah Reservoir that are expected to result in the take of bull trout in the form of death, harm, sub-lethal harassment,

[4] Publication pending final review, expected publication April 2018.

injury, or displacement were listed by the USFWS 2005 Opinion. These operations or conditions are summarized as operational indicators in Table 4.

One operational indicator was exceeded during the 2017 reporting period in the Malheur River basin:

- Agency Valley Dam released water over the spillway intermittently in the spring of 2017. The Opinion granted Reclamation an exemption for this action for 3 out of the 30 years for which the Opinion is valid.

Table 4. Summary of amount or extent of anticipated take of bull trout associated with Reclamation's Agency Valley Dam and Beulah Reservoir facility operations during the 2017 reporting period.

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2017 Operations (October 2016 to September 2017)	Quick Reference: Number of times threshold has been exceeded
Up to 10 percent of bull trout in Beulah Reservoir are entrained into the North Fork Malheur River below the dam	Water is discharged over the spillway	May through June	3 of 30 years	The spillway was used during the reporting period.	**1 of 3 years** 2006: yes (non-discretionary spill in 2011, 2017)[5]
All bull trout returning to Beulah Reservoir to over-winter are affected by a reduced prey base	Reservoir storage falls below 2,000 acre-feet	August through October	10 of 30 years	Reservoir storage volume did not fall below 2,000 acre-feet in this reporting period (Figure 7).	**8 of 10 years** 2007: 60 days 2008: 34 days 2009: 53 day 2010: 28 days 2013: 45 days 2014: 56 days 2015: 35 days 2016: 15 days

[5] Only discretionary spillway use is applicable to the number of excepted years for this operational indicator. Spill in 2011 and 2017 was necessary under flood control operations, and was therefore not discretionary. In past reports the spill in 2011 was erroneously counted as one of the three excepted years; this has been corrected and the number adjusted in this report.

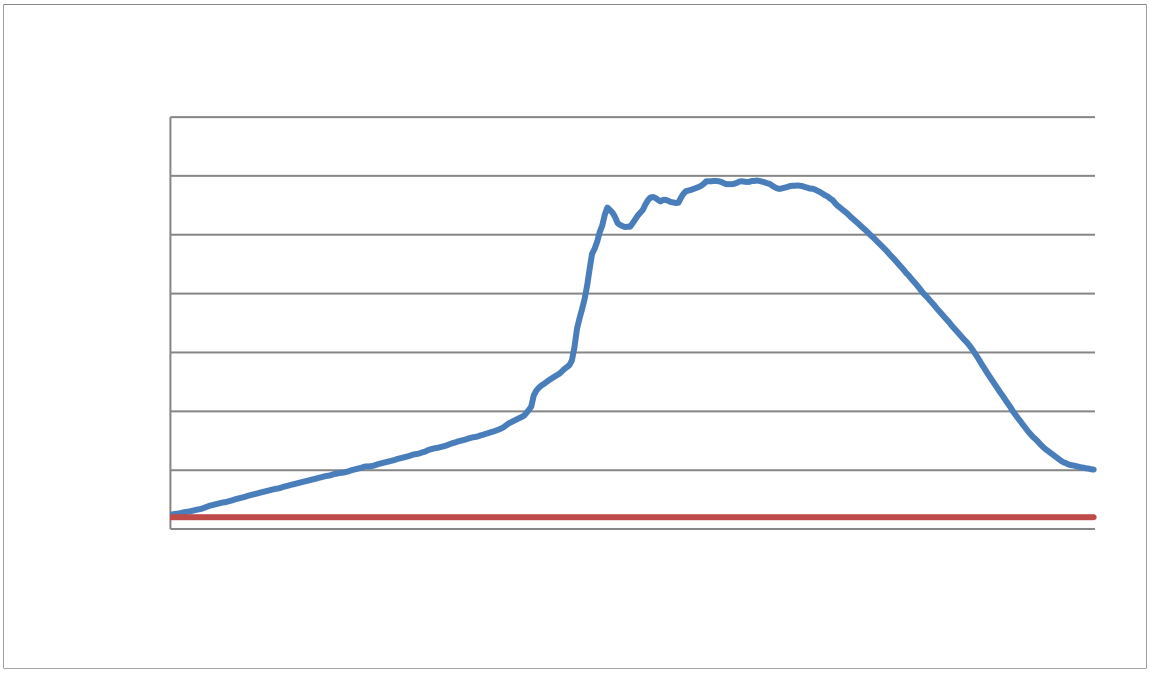

Figure 7. Beulah Reservoir storage volume (acre-feet) for WY17. The straight red line represents Reclamation's Operational Indicator minimum threshold of 2,000 acre-feet of storage.

2.2.2 Powder River Basin Water Year Summary

Bull trout were discovered in Phillips Reservoir in 2011, triggering a requirement that Reclamation consult with USFWS for bull trout and bull trout critical habitat in this area (Reclamation 2013b). The USFWS completed a non-jeopardy Biological Opinion in June 2014 for Reclamation's O&M activities in the Powder River (USFWS 2014) as a companion document to the 2005 Opinion. The 2014 Opinion contains a 21-year ITS and corresponding RPMs that outline nondiscretionary actions for bull trout in Phillips Reservoir. Specific operations or conditions at Mason Dam and Phillips Reservoir that are expected to result in the take of bull trout in the form of death, harm, sub-lethal harassment, injury, or displacement were identified in Reclamation's Bull Trout Monitoring and Reporting Plan for Phillips Reservoir (Reclamation 2016), which was finalized with USFWS in WY16. Anticipated take and operational indicators as identified in this monitoring plan are shown in Table 5. A summary of operations for WY17 are included in this report. Figures 8, 9, and 10 illustrate the water storage volume in acre-feet and reservoir elevation, respectively, and Powder River inflows into Phillips Reservoir during WY17.

One operational indicator was exceeded during the 2017 reporting period in the Powder River basin:

- Mean daily reservoir storage elevation at Phillips Reservoir was below 4,048 feet for 167 days in the 2017 reporting period (Figure 9); however, the 2016 Monitoring

and Reporting Plan granted Reclamation an exemption for this action, for 21 out of the 21 years for which the Opinion is valid.

Table 5. Summary of amount or extent of anticipated take of bull trout associated with Mason Dam and Phillips Reservoir facility operations during the 2016 reporting period, as included in the monitoring and reporting plan finalized in 2016.

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2017 Operations (October 2016 to September 2017)	Quick Reference: Number of times threshold has been exceeded
Up to 12 bull trout from resident headwater populations may be displaced during high flow events and be present in the reservoir	Powder River natural flows exceeding 856 cfs (from 2014 Opinion)	Spring through summer	27 percent (6 of 21 years)	Powder River flows did not exceed this threshold in the 2017 reporting period (Figure 10).	**0 of 6 years**
Up to 12 bull trout from resident headwater populations may be displaced during high flow events and be present in the reservoir	Mean daily reservoir elevation falls below 4,048 feet above sea level (from 2016 Monitoring and Reporting Plan)	Spring through summer	100 percent (21 of 21 years)	Reservoir surface elevation was below 4,048 feet during refill until April 27, and fell below this threshold again due to drafting on August 10 (167 days in the 2017 reporting period (Figure 9).	**3 of 21 years** Exceeds annually

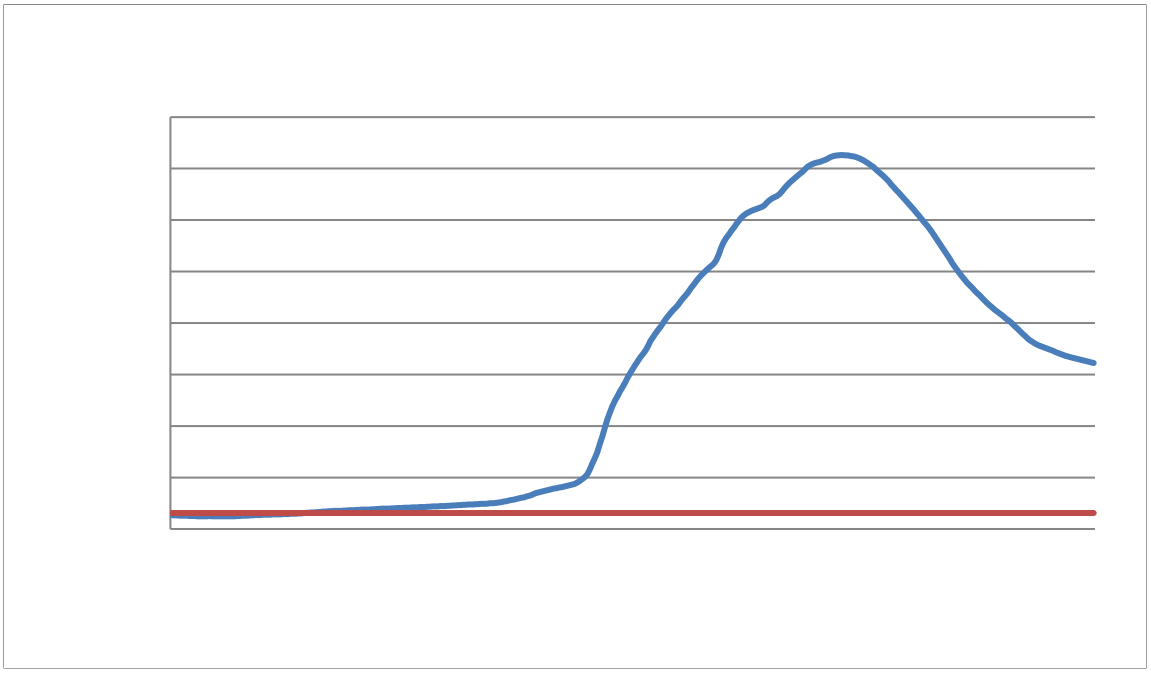

Figure 8. Phillips Reservoir storage volumes (acre-feet) for WY17. Minimum active storage occurs when pool elevation reaches 4,009 feet above sea level (3,100 acre-feet of storage), corresponding to the point of inactive storage, indicated by the red line.

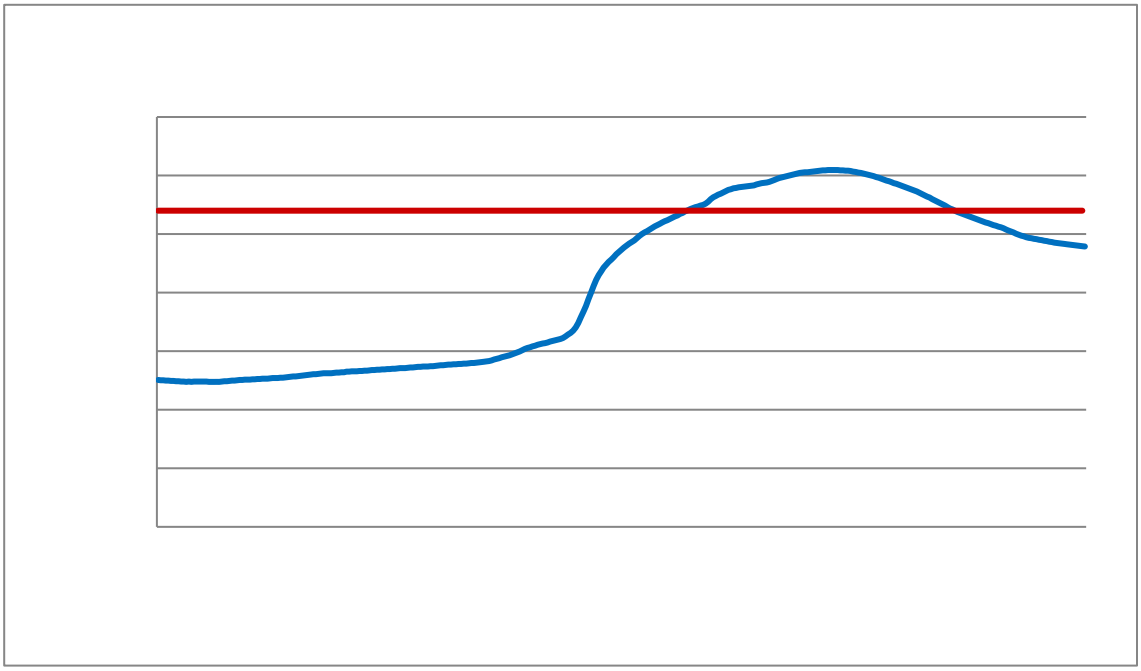

Figure 9. Phillips Reservoir surface elevation (feet above sea level) for WY17. The operational indicator spring/summer minimum for mean daily reservoir elevation of 4048 is indicated by the red line.

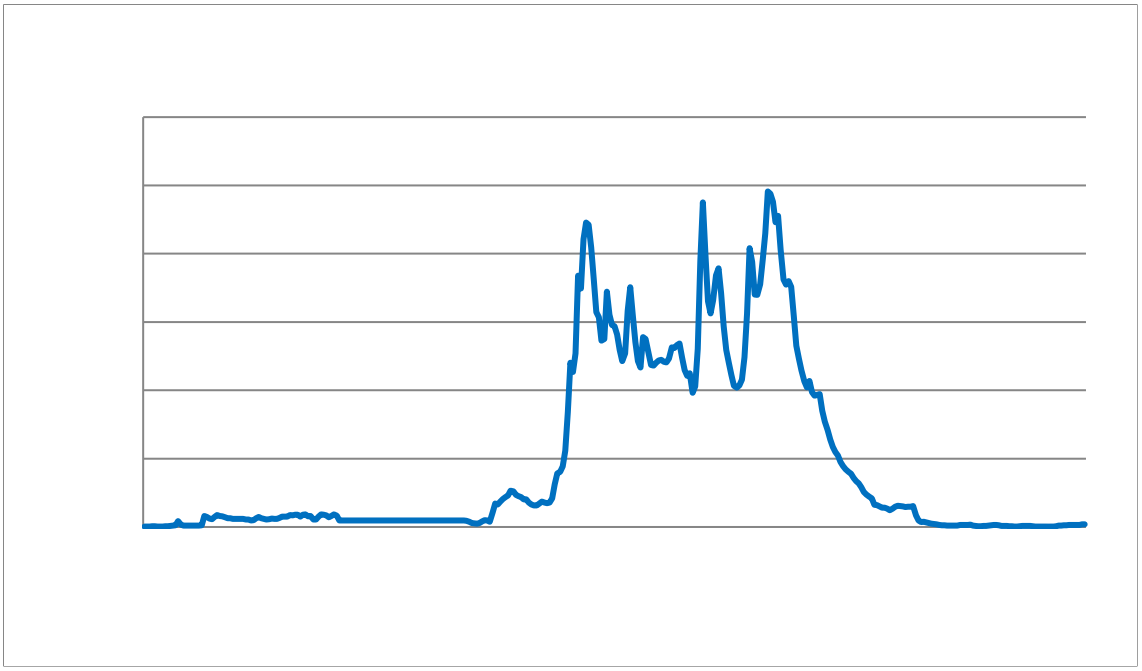

Figure 10. Powder River inflows to Phillips Reservoir in WY17, measured in cfs and recorded at USGS Gage #13275105, Powder River at Husdpeth Lane near Sumpter, Oregon.

3. Bull Trout

This chapter describes the bull trout ITS and RPMs, including monitoring efforts during WY17. The ITS includes four RPMs and their associated Terms and Conditions to minimize incidental take of bull trout related to O&M at Reclamation's facilities in the identified action areas where bull trout are present. Collected data may be used to satisfy the Terms and Conditions and/or monitoring requirements. For example, data collected during a fish sampling activity may be used to help monitor population trends. In 2017, Reclamation was involved with RPM activities and/or monitoring at Deadwood, Arrowrock, Anderson Ranch, Beulah, and Phillips Reservoirs.

3.1 Boise River Basin

For the purpose of this report, the Boise River basin study area includes Arrowrock Reservoir; Anderson Ranch Reservoir; the South Fork Boise River below Anderson Ranch Dam; and portions of the Middle and North Fork Boise Rivers; Lucky Peak Reservoir; and Grouse and Cottonwood Creeks, which are tributaries to Arrowrock Reservoir (Figure 11).

The 2005 Opinion identified five Terms and Conditions for Arrowrock Dam and two Terms and Conditions for Anderson Ranch Dam for minimizing the effect and/or amount of take associated with each dam's operation. Each of the Terms and Conditions addresses a different aspect of the effects of operations on bull trout or bull trout critical habitat. Most data collection efforts described in the following sections will be used to address Terms and

Conditions for both Arrowrock and Anderson Ranch Reservoirs because the influences of both facilities overlap.

Summary reports for the Arrowrock Hydroelectric Project (Federal License #4656) can be referenced at https://www.ferc.gov and fish stocking performed by the Idaho Department of Fish and Game (IDFG) can be referenced at https://idfg.idaho.gov/fish/stocking. An overview of both activities is also included in this report.

3.1.1 Boise River Basin Data Collection

Streamflow and water temperatures were monitored on the South Fork Boise River (Figure 11). In 2017, Reclamation continued funding the U.S. Geological Survey (USGS) to maintain flow/temperature stream gages at Neal Bridge (USGS Gage No. 13192200) on the South Fork Boise River for the purpose of monitoring tributary flow below Anderson Ranch Dam.

Reclamation is collecting data to develop a water quality model for Anderson Ranch Reservoir. This model will be similar to the one developed for Arrowrock Reservoir. The Anderson Ranch Reservoir Model will focus on spatial and temporal availability and variation in water temperatures and dissolved oxygen (DO) levels suitable for and preferred by bull trout.

Reclamation is finalizing a water quality model for Arrowrock Reservoir, using data collected in WY12 through WY16.

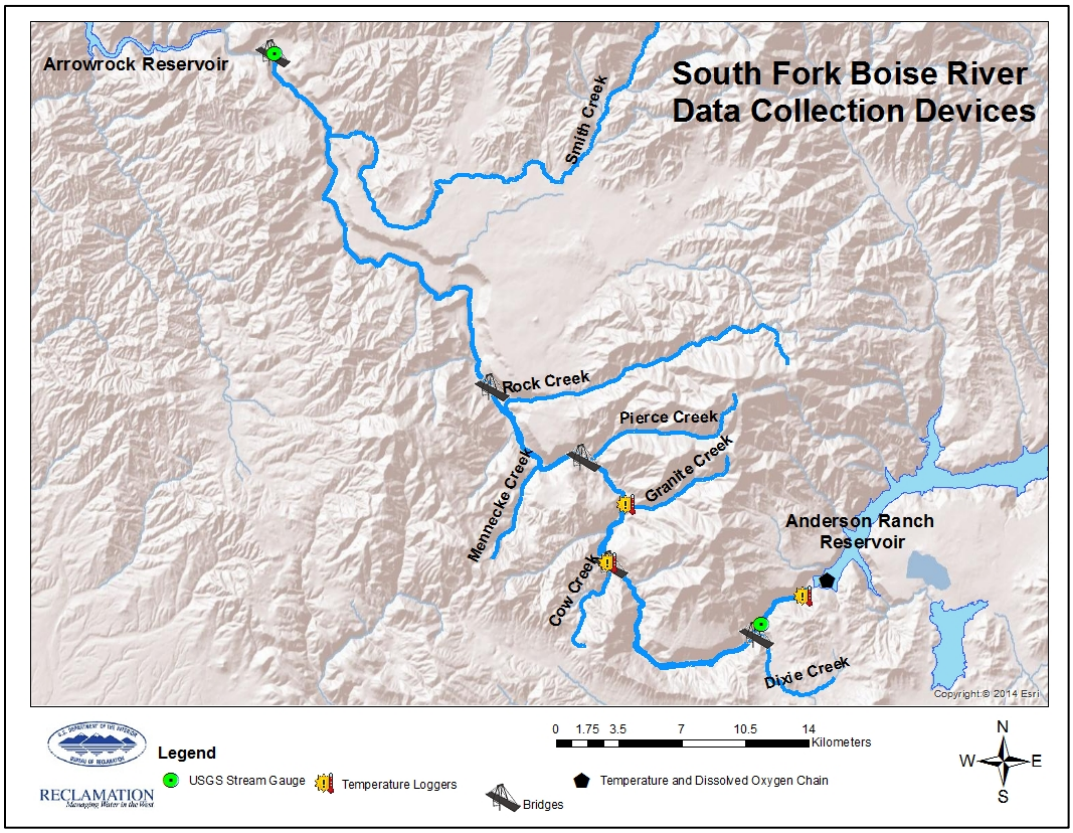

Figure 11. South Fork Boise River basin study area. Locations of Onset® TidbiT temperature loggers, a temperature and dissolved oxygen chain, pressure transducers and USGS gages are shown.

3.1.2 Fish Sampling

Fish sampling to address Term and Condition 1.c (entrainment) is integrated into trap-and-haul efforts to move potentially displaced (entrained) bull trout from Lucky Peak Reservoir back upstream into Arrowrock Reservoir. Trap-and-haul efforts are scheduled to occur in even-numbered years and any year in which the spillway is used.

3.1.3 Radio Telemetry

The use of radio transmitters and archival temperature tag technology was used in a study designed to address the Terms and Conditions outlined in the 2005 Opinion. Data collection for that study concluded in WY14, and data are being analyzed for inclusion in a future report. No further telemetry tracking occurred during 2017, nor are any telemetry studies currently planned for Arrowrock Reservoir or the Boise River in the near future.

3.1.4 Hydrology and Water Chemistry

Hydrology and water chemistry data were collected in Arrowrock and Anderson Ranch Reservoirs and select tributaries during the reporting period. These data are being used to model water quality in the reservoirs, to address requirements of the 2005 BiOp.

Arrowrock Reservoir

To facilitate water quality modeling, a semi-permanent water quality monitoring station was in operation during the ice-free seasons from 2012 to 2015 at Arrowrock Reservoir.

Limited water profiles, water samples, and phytoplankton and zooplankton samples were collected in 2016 to supplement data with the aim of resolving uncertainties in the Arrowrock Reservoir water quality model. Regular water quality sampling efforts have concluded at Arrowrock Reservoir; however, future water quality sampling may be conducted as needed for model completion and the development of long-term monitoring needs. The Arrowrock Water Quality Model is undergoing external peer review and is scheduled for finalization in 2018. Future data collection needs will be determined by Reclamation's Regional River and Reservoir Operations Group.

Anderson Ranch Reservoir

Two semi-permanent water quality monitoring stations, composed of Onset® TidbiT temperature thermographs and Minidot temperature/dissolved oxygen sensors arranged at fixed depths throughout the water column, were redeployed in the spring of 2017 to gather data on water quality conditions prior to, during, and after thermal stratification at Anderson Ranch Reservoir. Sampling stations were located just upstream from the dam at the deepest part of the reservoir (AND004), and in the middle of the upper bay, offshore from the Curlew Creek boat ramp (AND003) (Figure 12). Reservoir vertical profiles, as well as multiple hydrologic and water quality parameters, were also collected at approximately 6-week intervals throughout the ice-free season at these station locations, as well as at two mid-reservoir locations (AND 009 and AND 010) (Figure 12). Water quality parameters sampled/analyzed for inclusion in reservoir water quality modeling include:

- pH
- Conductivity
- Dissolved Oxygen
- Temperature
- Algal groups and biomass
- Zooplankton groups and biomass
- Turbidity
- Fluorescence
- Total suspended solids
- Total dissolved solids
- Total organic carbon
- Volatile solids
- Total phosphorous

- Chlorophyll-a
- Nitrate-nitrite
- Total Kjeldahl nitrogen
- Dissolved ammonia
- Dissolved organic carbon

Additional physical parameters measured include surface wind speed and direction (taken at multiple water surface points throughout the reservoir) and continuous flow measurements via MiniTroll loggers installed at the inflows of Fall Creek (BOI134) and Lime Creek (BOI131), and from USGS gages at both the reservoir inflow (BOI130) and outflow (AND101, below the dam) of the South Fork Boise River (Figure 12).

Sampling of hydrology and water quality parameters is now completed at Anderson Ranch Reservoir. There may be some additional intermittent sampling to clear up any uncertainties in the model, but in-depth sampling was completed in 2017. The Anderson Ranch Water Quality Model is scheduled for completion in 2018.

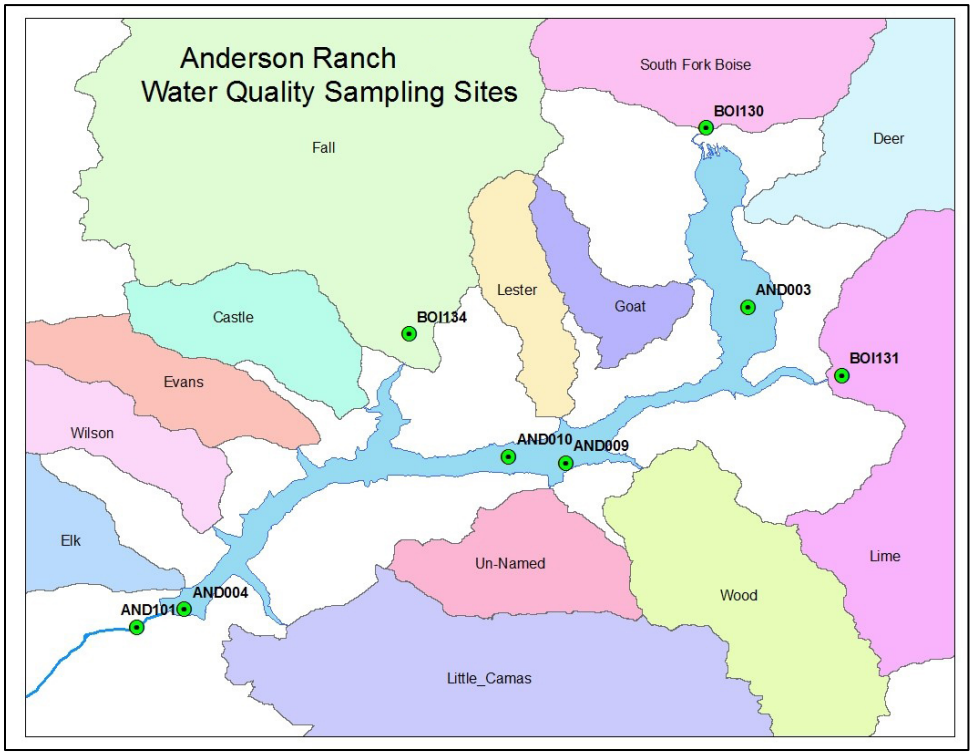

Figure 12. Map showing water quality sampling locations at Anderson Ranch Reservoir. Tributary watershed delineations are shown in differing colors.

3.1.5 Trap-and-Haul Efforts

Trap-and-haul efforts to relocate potentially displaced (entrained) bull trout from Lucky Peak Reservoir back into Arrowrock Reservoir are scheduled to occur in even-numbered years and as additionally necessitated by spillway usage, and when conditions under which entrainment is expected (discharge exceeding 695 cfs when water surface elevations are

less than 3111 feet) occur. Trap-and-haul efforts using gill netting methods were conducted during May and June 2017, as requested by USFWS (memo dated May 8, 2017). Due to the need for flood control operations in WY17, the spillway at Arrowrock Dam was in operation intermittently from May 12, 2017, through June 29, 2017, including all of the days thattrap and-haul efforts took place.

Lucky Peak trap-and-haul efforts were conducted on 6 separate days in WY17, on May 30 and 31, and June 19 through June 22, 2017. Sampling locations were selected based on known geographic and bathymetric conditions similar to those where bull trout were previously captured by Reclamation (2000–2012). Primary locations of historic bull trout capture are at the Arrowrock Dam tailrace and nearby locations.

The gill nets used were experimental in design and were constructed of six 12.5-foot panels of various mesh sizes ranging from 0.5 to 4 inches. Gill nets were deployed to remain perpendicular to the water surface and near or on the bottom of the reservoir. A 100-foot-length gill net soaked for 60 minutes was calculated at one full hour of effort. Individual soak times were targeted for 45 minutes and were always under 60 minutes to minimize injury and mortality to fish. Gill nets were retrieved, starting from the opposite end from which they were deployed, in order to limit soak time and increase fish survival. The GPS used for this effort malfunctioned and way points were unable to be offloaded for accurate positions of each gill net placement. Figure 13 shows locations of gill net deployments from 2016 efforts and are very similar to 2017 locations.

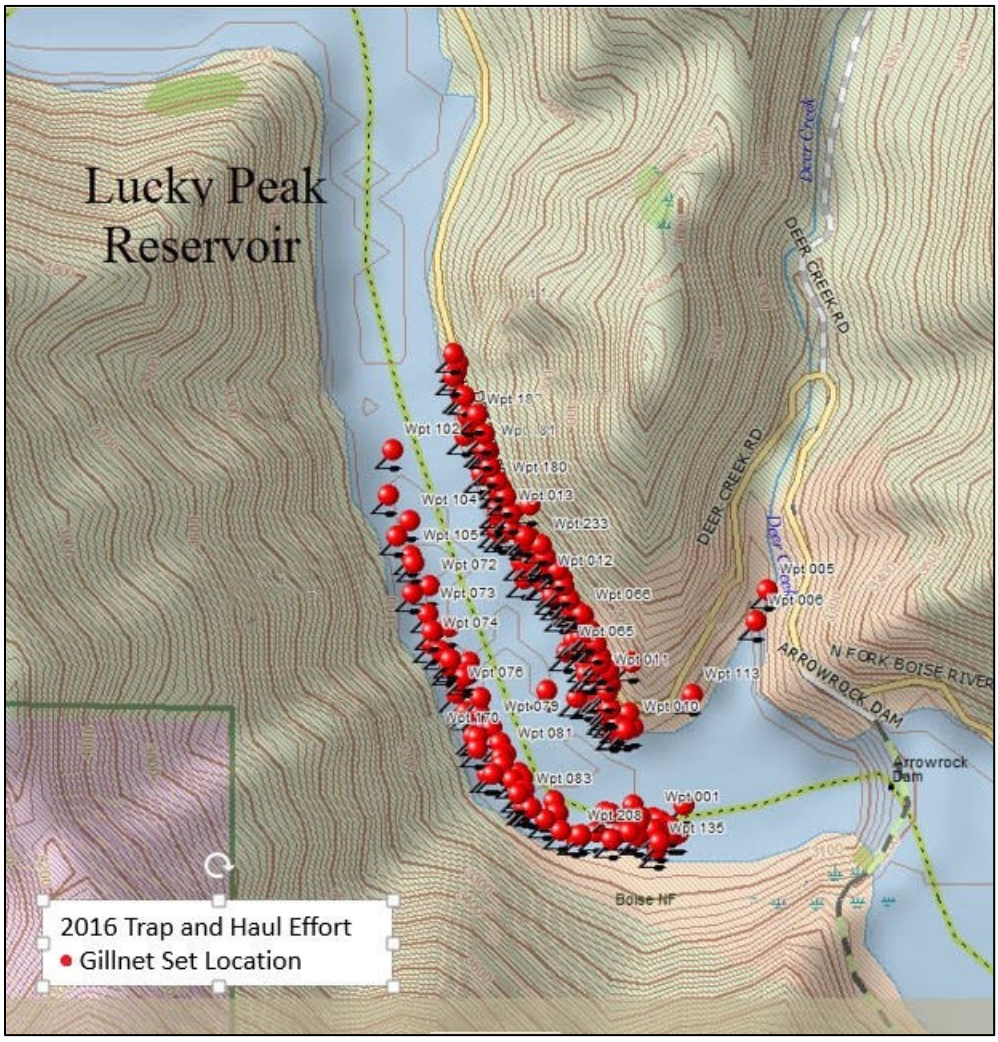

Figure 13. Locations of gill net deployments on Lucky Peak reservoir as part of 2016 trap-and-haul efforts, to which 2017 efforts were very similar. Due to a GPS malfunction, actual locations of 2017 gill net deployments were not properly recorded and could not be downloaded. This location map is included as it is representative of the similar general locations of net deployments in 2017.

A total of 314 fish including 12 species were captured via gill net and subsequently released, during a total of 134 effort hours, with a total catch per unit effort (CPUE) of 2.34. The unit of effort measured is one hour with each species CPUE rounded up to one tenth of a decimal for each species. Bridgelip sucker *(Catostomus columbianus)*, largescale sucker *(Catostomus macrocheilus)*, Redside Shiner (*Richardsonius balteatus*) and northern pikeminnow *(Ptychocheilus oregonensis)* comprised 88 percent of the total catch. A by-species breakdown of total catch is provided in Table 6.

Table 6. WY 2017 catch data for trap-and-haul effort on Lucky Peak Reservoir. Sampling periods included May and June. The unit of effort for CPUE is one hour.

Number caught	Total Soak Time (hours): 196		
	Totals	CPUE	Percent of total catch
Large Scale Sucker *(Catostomus macrocheilus)*	157	1.17	50
Bridge Lip Sucker *(Catostomus columbianus)*	62	0.51	20
Rainbow Trout *(Oncorhynchus mykiss)*	11	0.08	4
Red Sided Shiner *(Richardsonius baltreatus)*	31	0.23	10
Yellow Perch (*Perca flavescens)*	2	0.02	1
Mountain Whitefish *(Prosopium williamsoni)*	9	0.07	3
Small Mouth Bass (*Micropterus dolomieui)*	4	0.03	1
Northern Pike Minnow *(Ptychocheilus oregonensis)*	26	0.19	8
Chinook *(Oncorhynchus tshawytscha)*	1	0.01	0
Sockeye Salmon/Kokanee (*Oncorynchus nerka)*	1	0.01	0
Chisel Mouth *(Acrocheilus alutaceus)*	1	0.01	0
Bull Trout *(Salvelinus confluentus)*	9	0.07	3
Total:	**314**	**2.34**	**100**

Nine bull trout were caught and were transported from Lucky Peak Reservoir. Captured bull trout were held in the boat's live well with a recirculating pump drawing intake water directly from the tailrace (all other species captured were immediately released). Scales and DNA samples were collected from each bull trout, each individual was PIT tagged, weighed and measured, and then fish were transported and released in the North Fork of the Boise River. Care was taken to handle bull trout minimally and to ensure captured fish were not held in the workup/transport cooler for longer than two hours. Water temperature at the release site was monitored to ensure no significant temperature change between capture/transport and release site water temperatures. Table 7 presents the weight and measurements associated with each bull trout captured during the 2017 effort.

Table 7. Capture date, fork length, tail length, weight and PIT tag number of bull trout sampled during WY17 trap-and-haul effort.

Capture date	Fork length (mm)	Total length (mm)	Weight (g)	PIT tag #
6/15/2017	510	525	450	46062A0B47
6/15/2017	545	560	900	989001003035250
6/16/2017	510	527	400	4578076244
6/16/2017	528	552	395	45774C6B21
6/16/2017	510	540	565	N/A
6/16/2017	488	510	250	46066B113E
6/19/2017	527	550	570	45770E7D77
6/20/2017	576	586	420	45791D492E
6/21/2017	417	437	900	457723102A

Observed Trends in Lucky Peak Trap-and-Haul Efforts

In 2004, Reclamation replaced the lower ensign release valves at Arrowrock Dam with clamshell valves capable of handling higher discharge volumes. Following that replacement, the upper release valves were taken offline in 2005 (they remain operable but are used only for emergency release purposes). The result is that surface or near-surface

water releases, with the exception of uncontrolled spill, have been eliminated from Arrowrock operations.

Since 2004, trap-and-haul efforts had shown a corresponding consistent decline in bull trout catch, with no bull trout captured after 2010, suggesting that entrainment was not occurring with deep-water releases from Arrowrock Dam through the newer clamshell valves. The renewed detection of bull trout in Lucky Peak following spillway use in 2017 appears to further support this theory, indicating that bull trout entrainment is likely associated with surface water releases such as formerly occurred with the use of the upper release valves, and which still occur during spillway use at Arrowrock Dam.

The majority of the bull trout encountered during 2017 efforts were sampled on the north side of the reservoir, approximately 300 meters below the boom line, when gill nets were set in the morning shadows cast by the foothills. Bull trout were the only species in the net for majority of the sets in which they were captured. The few sets that contained other species when bull trout were captured included Bridge Lip Sucker, Large Scale Sucker, Northern Pike Minnow and Red Side Shiner. The surface water temperatures associated with each net set that captured bull trout varied from 10.5-17° C.

Current-year catch data and historic trends in trap-and-haul data are shown in Figure 14.

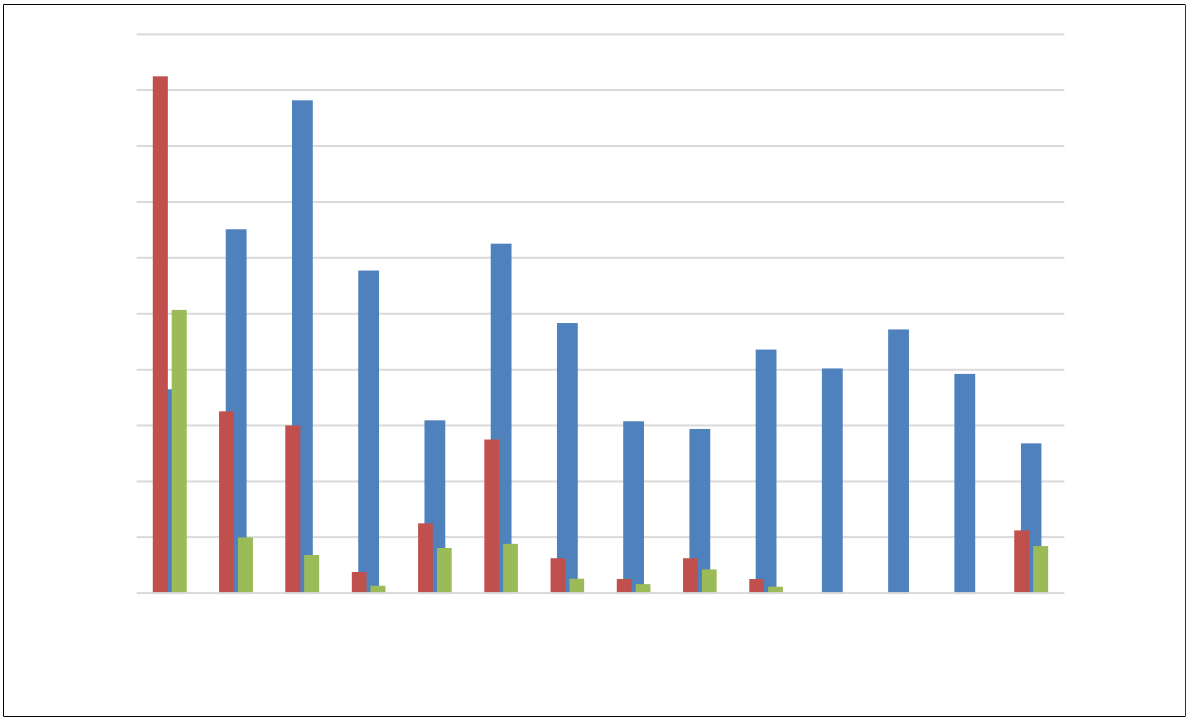

Figure 14. Lucky Peak trap-and-haul bull trout detection trends, from 1997–2017 data. Sampling frequency was reduced from yearly efforts to every other year following 2006 sampling. No bull trout were detected in 2012, 2014, or 2016 sampling efforts. Nine bull trout were detected in 2017, following spring spillway usage.

3.1.6 Other Activities

Cottonwood Recruitment Modeling—SF Boise River

Reclamation is working in collaboration with the University of Idaho and the U.S. Forest Service to validate the cottonwood recruitment model that was developed in Benjankar et al. 2017. The authors examined operational effects and assessed critical habitat in the South Fork Boise River as identified in the Terms and Conditions (2005 Opinion). This report discussed the development of a cottonwood recruitment model to assess recovery of riparian vegetation following wildfire. Work planned for 2018–2019 will validate model results and seek to identify whether natural regeneration is sufficient to maintain critical habitat for bull trout in the watershed.

Bioenergetics Evaluation of Migratory Bull Trout—Arrowrock Reservoir/SF Boise River

Reclamation is working in collaboration with the USGS to assess the energetic potential of migratory Bull Trout, which rely on Arrowrock Reservoir for foraging, migration, and overwintering habitat, to support upstream migration and spawning. This work is using bioenergetics modeling to evaluate whether current reservoir operations provide conditions that are likely to support successful spawning (Terms and Conditions in the 2005 Opinion).

Results from these studies and other available research will be used to identify how operational flexibilities can maximize benefits to bull trout and minimize other negative biological impacts system-wide, while still fulfilling Reclamation's nondiscretionary flood control and water provision obligations. This will guide the development of modified operational recommendations for Anderson Ranch and Arrowrock Reservoirs which

Arrowrock Dam Hydroelectric Project—Boise Project Board of Control

Arrowrock Dam Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) licensee No.4656-020, started operations in 2010. Among the requirements of the FERC license, the licensee (Boise Project Board of Control) was obligated to perform water temperature and dissolved oxygen monitoring in the Arrowrock stilling basin for 5 years, culminating in 2015. Future monitoring recommendations will be prepared by the Boise Board of Control and presented to FERC after review of the Arrowrock Hydro Team.

Annual meetings of the Arrowrock Hydro Team (IDFG, Reclamation, U.S. Army Corps of Engineers, and USFWS) are expected to continue.

Fish Stocking within Reclamation Projects—Boise River Basin IDFG

IDFG annually stocks fish in the Boise River basin for recreational angling. Stocking practices are determined solely by IDFG, and stocking is not performed to meet Reclamation objectives. A summary of fish stocking[6] for all fish types that occurred at

[6] Comprehensive stocking data for the state is provided by IDFG and is available at http://fishandgame.idaho.gov/public/fish/stocking/speciesByDate.cfm?region=3

Arrowrock and Anderson Ranch Reservoirs and in the South Fork Boise River in WY 2017 is shown in Table 8.

Table 8. Fish stocking by IDFG in WY 2017 in the Boise River basin for all fish types

Date Stocked	Species Type	Size	Number Stocked
Anderson Ranch Reservoir			
6/1/2017	Chinook Salmon	Fingerling (3-6 in.)	10,844
6/5/2017	Kokanee	Fingerling (3-6 in.)	200,311
Arrowrock Reservoir			
10/27/2016	Rainbow Trout	Catchable (6 in. +)	12,627
6/7/2017	Kokanee	Fingerling (3-6 in.)	103,579
10/2/2017	Rainbow Trout	Catchable (6 in. +)	27,137
South Fork Boise River (Above Anderson Ranch Reservoir)			
7/11/2017	Rainbow Trout	Catchable (6+ in.)	2454
8/7/2017	Rainbow Trout	Catchable (6+ in.)	467
8/18/2017	Rainbow Trout	Catchable (6+ in.)	1,860
8/24/2017	Rainbow Trout	Catchable (6+ in.)	1,302

3.2 Payette River Basin—Deadwood River System

The 2005 Opinion identified five Terms and Conditions for minimizing the effects to bull trout and the amount of take associated with the operation of Deadwood Dam and Reservoir. Each Term and Condition addresses a different aspect of the effects of operations on bull trout and makes assumptions regarding the effects to bull trout from reservoir operations. Examining the system as a whole allows Reclamation to understand the systemic impacts of individual operational changes. Consequently, Reclamation engaged in the multi-year Deadwood Reservoir Operations Flexibility Evaluation (Deadwood Study) to address the Terms and Conditions jointly, which will be made publicly available in 2018.

Evaluating the flexibility of operations and the effects of varied operational scenarios for Deadwood Dam on water quality conditions and aquatic fauna in both Deadwood Reservoir and the Deadwood River below Deadwood Dam requires an understanding of the potential overall ecosystem response to operational changes over time. Using modeling of physical and biological parameters measured over the course of this project allows for an ecosystem analysis of the Terms and Conditions for Deadwood Reservoir operations and their influence on bull trout populations. These efforts involved collaboration between multiple agencies and include annual activities not detailed in this report.

Conclusions from the *Final Deadwood Reservoir Operations Flexibility Evaluation* are currently being used to develop modified operational recommendations for Deadwood Dam. These operational recommendations seek to better utilize existing operational

flexibilities to maximize benefits to bull trout, and minimize other negative biological impacts system-wide, while still fulfilling Reclamation's nondiscretionary flood control and water provision obligations. The final report, *Operational Recommendations for Deadwood Dam,* is expected to be finalized in 2018.

Access to the lower Deadwood River (Julie Creek Trail) is still closed due to unstable hillslopes and hazard trees from the Pioneer Fire that occurred in 2016. The Bearskin Fire of 2017 limited access to the reservoir and upper river. Due to these two fires and associated safety issues none of the temperature loggers from the river or tributaries were downloaded in 2017.

3.2.1 Data Collection in the Deadwood River Basin

Physical, hydrologic, and water quality data were collected in Deadwood Reservoir, the Deadwood River below the dam, and selected tributaries, as shown in Figure 15. Due to the proximity of the 2017 Bearskin Fire, the only data obtained in 2016 were from the flow and temperature loggers associated with Reclamation's Hydromet system. TidbiT temperature loggers were still logging data, but access for downloads was not possible during 2017. An attempt to download all of the loggers will be made in fall of 2018. It is possible that debris flows and other fire-related events may preclude future data downloads if loggers are buried or displaced, or that potential logger burial or displacement may result in the logging of subsurface temperature data rather than flowing river temperatures. However, these outcomes will remain unknown until downloading access is possible and data can be checked for accuracy.

Hydrology and Water Chemistry

Data loggers at the locations in Figure 15 were logging data during 2017 and Reclamation will attempt to download these loggers in fall of 2018. Temperature data are stored at Reclamation's Snake River Area Office and are being used for biological and hydrologic modeling (Reclamation 2013a).

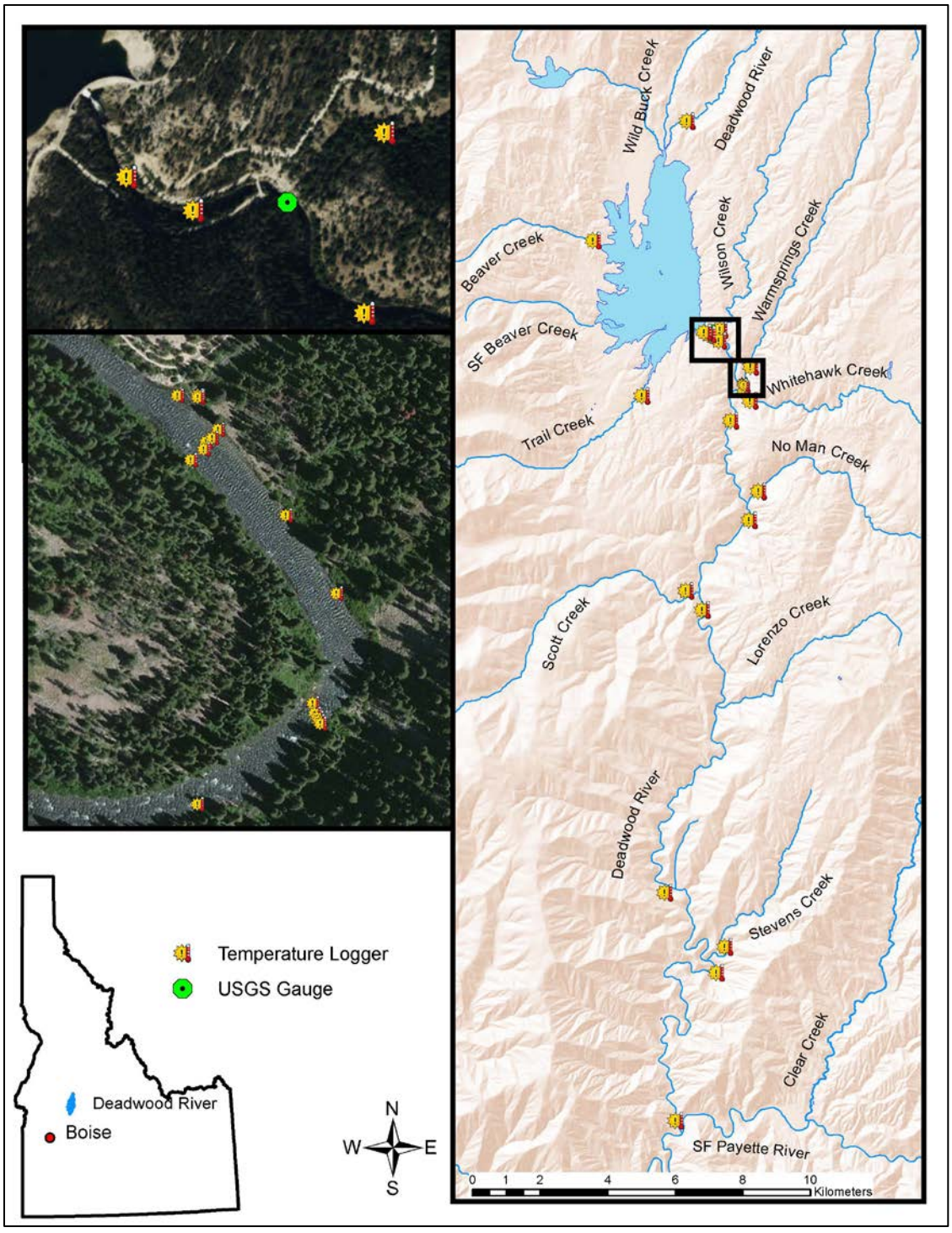

Figure 15. Data logger locations in the Deadwood study area, Idaho, 2016

Other Activities

In 2017, IDFG stocked Chinook, Kokanee, and Rainbow Trout into Deadwood Reservoir as a measure to supplement a sport fishery (Table 9).

Table 9. Fish stocking by IDFG in 2017 in Deadwood Reservoir for all fish types

Date Stocked	Species Type	Size	Number Stocked
6/22/2017	Chinook Salmon	Fingerling (3-6 in.)	3,987
6/28/2017	Kokanee	Fingerling (3-6 in.)	320,460
7/31/2017	Rainbow Trout	Fingerling (3-6 in.)	9,937

3.3 Malheur River Basin—Beulah Reservoir and the North Fork Malheur River

The 2005 Opinion identifies four Terms and Conditions for minimizing the effect and amount of take associated with the operation of Agency Valley Dam and Beulah Reservoir. Each of the Terms and Conditions addresses a different aspect of the effects of operations on bull trout. Reclamation is working with USFWS to finalize recommendations for a conservation pool in Beulah Reservoir that would maintain a prey base for bull trout that overwinter in the reservoir (Terms and Conditions 4.a and 4.c).

In 2010, USFWS approved a time extension to allow Reclamation to collect additional data at Beulah Reservoir and its tributaries. A 4-year study was initiated in 2010 to extend fish, invertebrate, zooplankton, and water quality sampling to lower drawdown levels and to complete bioenergetics modeling. Prey base and bull trout studies (Term and Condition 4.a) were conducted during the first 3 years. During the last year, data collected during this study was combined with previous sampling efforts to conduct bioenergetics modeling and to develop a defensible conservation pool recommendation for Beulah Reservoir and the efficacy of prey supplementation (Term and Condition 4.b).

The final reports for this work were completed in June 2015 under two covers and include results of the prey base (Reclamation 2015a) and bioenergetics modeling, and population sustainability (Reclamation 2015b). Results from these efforts will be used to develop the conservation pool recommendations, which are expected to be completed in fiscal year 2018. During the 2016 reporting period, no additional data were collected for this study.

3.3.1 Temporary Water Lease

In 2015, Reclamation entered into a 2-year temporary water lease with the Vale Oregon Irrigation District to maintain reservoir pool storage at or above 2,000 acre-feet until conservation pool recommendations are presented to the USFWS. (The 2015–2016 water lease extended the minimum study pool that occurred during the studies while the report is being completed.) The storage at Beulah Reservoir did not fall below 2,000 acre-feet during WY17 (Figure 7), and carryover into WY18 was 10,082 acre-feet on September 30, 2017.

3.3.2 Trap-and-Haul Efforts

Due to high runoff conditions in the spring that filled Beulah Reservoir to near-capacity, the spillway at Agency Valley Dam was used to release water intermittently in the spring of 2017. Due to this, Reclamation conducted a trap-and-haul effort to fulfill the Opinion's Term and Condition 4.d. Reclamation specialists conducted 56 hours of hook-and-line and 145 hours of fyke net sampling. Sampling was performed in four separate efforts over seven days between April 6 and June 2, 2017. Fyke nets were placed along both left and right banks at the downstream margin of the stilling basin and left for overnight sets no longer than 24 hours; hook and line sampling took place from both banks, from immediately below the dam to approximately 200 yards below the tailrace in the North Fork Malheur River.

A total of seven bull trout were captured in the tailrace below Agency Valley Dam. Captured bull trout were held in a workup/transport cooler with a recirculating pump drawing intake water directly from the tailrace (all other species captured were immediately released). Scales and DNA samples were collected from each bull trout, each individual was weighed and measured, and then fish were transported and released in a location approximately 100 meters above the inflow of the North Fork Malheur River into Beulah Reservoir. Care was taken to handle bull trout minimally and to ensure captured fish were not held in the workup/transport cooler for longer than two hours. Water temperature at the release site was monitored to ensure no significant temperature change between capture/transport and release site water temperatures.

The most effective hook and line tackle used were spinners; use of bait/worms was not effective. Reclamation staff noted that bull trout detections seemed to follow a declining trend with increasing time following spill events, suggesting that entrained fish may have rapidly moved downstream. Rainbow trout sampled exhibited a declining condition factor from the first to the last sampling event, indicating potentially worsening habitat conditions below the dam with increased time elapsed since spill and entrainment.

Sampling efforts concluded on June 2, 2017. Table 10 summarizes the sampling results of the 2017 trap-and-haul effort.

Table 10. Trap-and-haul sampling results from below Agency Valley Dam (Malheur River).

Species	Fyke net	Hook and Line	Total by species	% Overall Catch
Bull Trout *(Salvelinus confluentus)*	1	6	7	3.87
Rainbow Trout *(Oncorhynchus mykiss)*	10	32	42	23.2
Redside Shiner *(Richardsonius balteatus)*	61	0	61	33.7
Northern Pikeminnow *(Ptychocheilus oregonensis)*	12	0	12	6.63
Chiselmouth *(Acrocheilus alutaceus)*	32	0	32	17.68
Speckled Dace *(Rhinichthys osculus)*	2	0	2	1.10
Mountain Whitefish *(Prosopium williamsoni)*	25	0	25	13.81
Total sampling hours	145	56		
CPUE by sampling method	0.99	0.68		

3.3.3 Other Activities—Redd Counts

Reclamation participates as a partnering agency in annual survey counts of bull trout redds in the North Fork Malheur River basin, to satisfy coordination and basin monitoring requirements set forth in the 2005 Opinion. Carryover storage in Beulah Reservoir has been shown to affect the bull trout prey base (Rose and Mesa 2009); however, a direct link between carryover pool elevations and bull trout redd counts remains speculative. Figure 16 shows the number of redds observed in the North Fork Malheur River basin and the carryover of reservoir storage in Beulah Reservoir, from previous reporting years to the present. Following several years in which surveys had been precluded by fire conditions, Reclamation assisted redd counts conducted in the Malheur River basin in 2017 during the weeks of August 28–30 and other parties conducted surveys September 25–28. In total, 21 redds were observed over 13.15 surveyed stream miles throughout the North Fork Malheur River and nine smaller tributaries (average 1.6 redds/mile[7]).

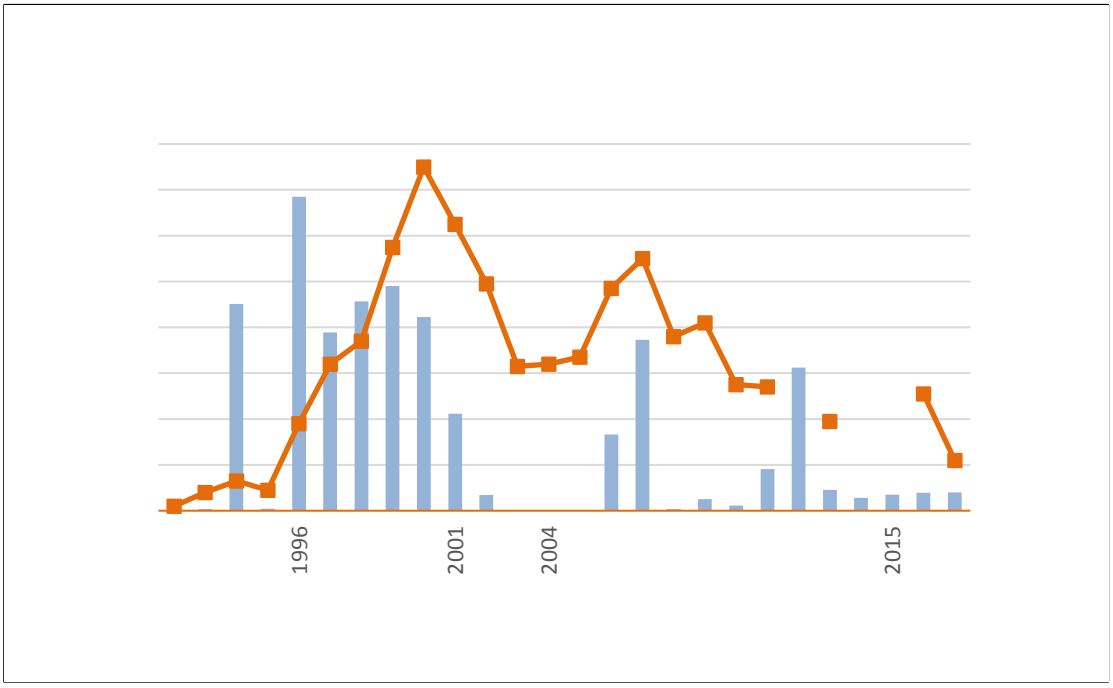

Figure 16. Data on bull trout redd trends observed in the North Fork Malheur River watershed (North Fork Malheur River), and carryover storage at the start of the WY in Beulah Reservoir, WY's 1992–2017. The number of redds observed after 2007 has been adjusted by one, to reflect reduced size of area surveyed. No redd count data exist for 2012, 2014, and 2015. See footnote as this graph has been modified and corrected for previous years.

[7] Redd count numbers from 2013 and 2016 were mis-represented in previous annual reports. Data shown in those reports erroneously included redd counts for both the Upper Malheur and the North Fork Malheur. The correct counts for the North Fork Malheur were 38 in 2013, and 50 in 2016. This figure reflects those adjustments. The alignment of this figure has also been adjusted to display carryover data by WY rather than calendar year. This was done to simplify interpretation, so that the carryover numbers shown correspond to the redd counts from the subsequent summer.

3.4 Powder River Basin—Phillips Reservoir

3.4.1 Bull Trout Monitoring

The 2014 Opinion identifies one Term and Condition associated with minimizing incidental take of bull trout resulting from operations of Phillips Reservoir (decreased water levels and increased temperatures) and from impaired fish migration above Phillips Reservoir. Reclamation accordingly finalized a 5-year Bull Trout Monitoring and Reporting Plan for Phillips Reservoir with USFWS in 2016 (Reclamation 2016b). This plan was developed in collaboration with Oregon Department of Fish and Wildlife in order to fulfill this Term and Condition. Reclamation continued in 2017 to work to enhance knowledge of project impacts to bull trout and to better determine bull trout use of Phillips Reservoir through fulfillment of this 5-year plan.

In accordance with this monitoring and reporting plan, Reclamation has continued to conduct monitoring of the Powder River gage (USGS gage 13275105 – Powder River at Hudspeth Lane near Sumpter, Oregon) to record the frequency of high inflow events that are expected to lead to bull trout migration into/through the reservoir, and recording the frequency of drawdown that seasonally affects access through the Deer Creek varial zone, through continued monitoring of pool elevation. In the 2017 reporting period, inflow measured at the Powder River gage did not exceed 856 cfs, the operational indicator identified in the monitoring plan.

Reclamation conducted 581 hours of fish sampling efforts at Phillips Reservoir between May 17 and June 14, 2017, in an ongoing effort to better determine bull trout use of Phillips Reservoir and assess fish community composition. Sampling took place at locations throughout the reservoir's inlet arm near the mouths of the mainstem Powder River and Deer Creek, and included 568 hours of sampling via fyke net, 6 hours of sampling via gill net, and 7 hours of sampling via hook and line methods. Fish species sampled included rainbow trout (*Oncorhyncus mykiss*), black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), redside shiner (*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis*), large scale sucker (*Catostomus macrocheilus*), bridgelip sucker (*Catostomus columbianus*), speckled dace (*Rhinichthys osculus*) and sculpins (*Cottidae* spp.) and juvenile suckers (Catostomus spp.) that were not identified to the species level. No bull trout were detected.

Data from this sampling effort are summarized in Table 11 and were entered into the National Marine Fisheries Service online system for Authorizations and Permits for Protected Species on December 15, 2017. The full 2017 report for sampling permit *OR STP#20271: Renew – Phillips Reservoir Bull Trout Monitoring and Agency Valley Trap and Transport* was submitted to the National Marine Fisheries Service online system for Authorizations and Permits for Protected Species in December 2017.

Table 11. Phillips Reservoir fish sampling data from 2017 effort, including total catch for each species (SPP) by sampling method and catch per unit effort (CPUE) by sampling method.

Species	Gill			
Largescale sucker	14	10	0	24
Yellow perch	1	552	0	553
Sucker (juvenile, spp. unknown)	0	2	0	2
Northern pikeminnow	18	175	0	193
Bridgelip sucker	2	6	0	8
Redside shiner	0	20	0	20
Smallmouth bass	0	0	0	0
Rainbow trout	3	25	1	29
Sculpin spp.	0	2	0	2
Speckled dace	0	9	0	9
Black crappie	0	1	0	1
Total sampling hours	**6**	**568**	**7**	**581**
Total fish caught	**38**	**802**	**1**	**841**
CPUE	**6.33**	**2.05**	**0.14**	**1.45**

3.4.2 Other Activities

In 2016, Reclamation implemented experimental eDNA sampling to supplement other sampling methods utilized at Phillips Reservoir as part of the 5-year sampling plan. Sampling took place at four locations including the mouth of the Powder River approximately 20 meters (66 feet) above its inflow into Phillips Reservoir, the mouth of Deer Creek approximately 20 meters (66 feet) above its inflow into Phillips Reservoir, and a sampling location on each bank (north and south) of the Powder River outflow, approximately 50 meters (164 feet) below the outflow from Mason Dam. The same locations were sampled for eDNA repeatedly during each of three sampling event weeks between May 17 and June 14, 2017. Complete results of this eDNA sample analysis will be provided at the conclusion of the sampling period.

4. Snake River Physa

4.1 Introduction and Background

The 2005 Opinion found that the proposed operations of Minidoka Dam may adversely affect physa in the Minidoka reach of the Snake River; however, insufficient information

existed to adequately predict impacts. One of Reclamation's proposed actions in the 2004 BA (Reclamation 2004) was to conduct presence/absence surveys of physa to characterize the environmental variables and physical habitats where physa are found. During surveys conducted from 2006 through 2008, more than 274 live physa specimens were found between Minidoka Dam downstream to above Milner Pool (Figure 17; Gates and Kerans 2010). Live physa were found in low densities, primarily among pebble and gravel substrates in the main channel (thalweg) of the Snake River from below Minidoka Dam downstream to above the Milner Pool. Physa were also found in the spillway area of Minidoka Dam, though sample sizes were too small to characterize habitat use and spatial distribution.

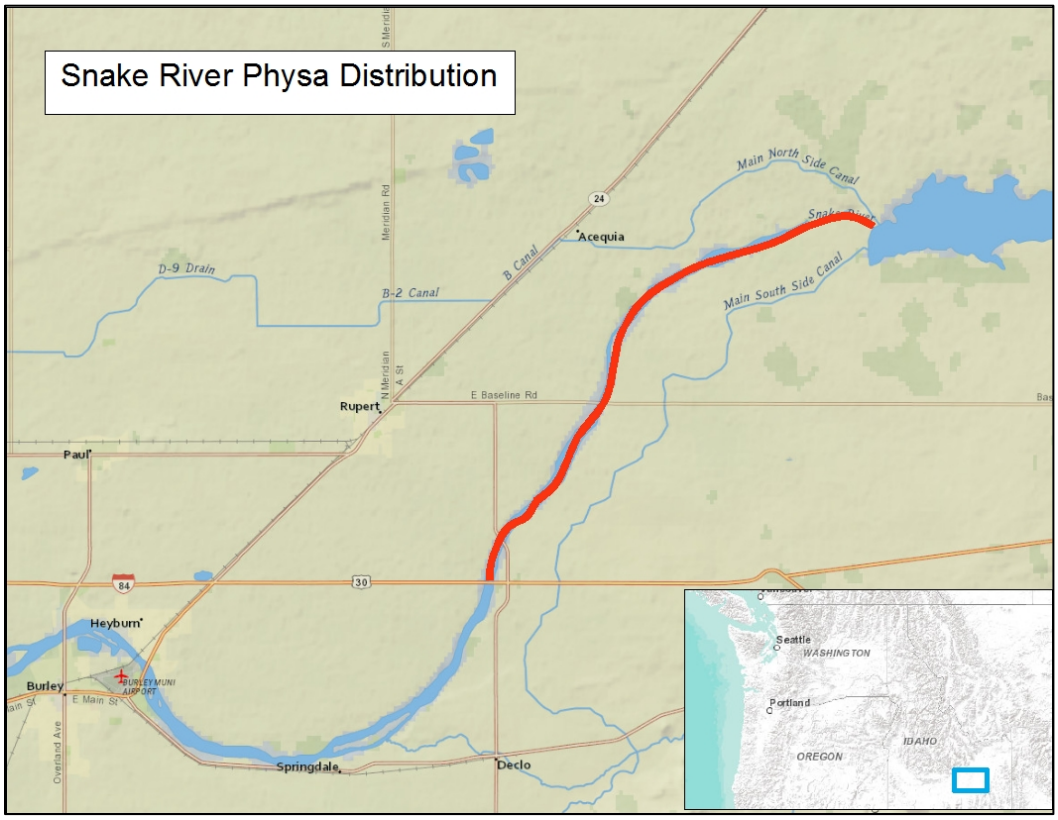

Figure 17. Red line represents the known distribution of Snake River physa in the Snake River above Milner Dam.

Physa surveys were not conducted from 2009 through 2011; however, during this time, data and specimens were analyzed and a completion report was prepared for physa identification, habitat characteristics, and distribution (Gates and Kerans 2010). Survey efforts were reinitiated in 2012 in response to the Minidoka Dam spillway replacement project. Under the current protocols a total of 237 Snake River Physa have been collected since 2012. Construction was completed during the summer of 2015. Post-construction operations may include the diversion of more water, when available, through the Inman Powerplant located at Minidoka Dam. In consultation with USFWS and a multi-agency technical team (Technical Team), Reclamation designed a multi-year proposal to reduce

minimum spillway flow (Table 12) and monitor physa to determine what effects, if any, reduced flow has on physa occurrence and abundance in the spillway. Due to the complexity of Reclamation's proposed action, Table 12 only identifies minimum spillway and powerplant flows and does not fully represent the proposed post-construction operations comprehensively. Water rights, provisions of spaceholder contracts, commitments to implement the existing biological opinions, and Total Maximum Daily Loads did not change as a result of the spillway replacement project.

Reclamation consulted on project operations following construction of the spillway. The consultation addressed Reclamation's impacts to physa located in the Snake River above Brownlee Reservoir, including the Minidoka Dam spillway. Reclamation received the 2015 Opinion on May 8, 2015, finding that Reclamation's proposed operations are likely to adversely affect physa in the Minidoka Dam spillway. Terms and Conditions and RPMs were provided. The consultation was aligned with ongoing actions associated with the long-term O&M of the current 2005 Opinion (USFWS 2005) and is considered a supplement to the 2005 Opinion. The primary purpose of Table 12 is to illustrate the proposed spillway flow reduction schedule identified in the 2015 Opinion.

The decision was made by Reclamation, in consultation with the Technical Team, to operate Minidoka Dam spillway consistent with previous, preconstruction operations, the first year following completion (2015) of the spillway to assess possible changes in flow patterns associated with the new structure. This was done to allow Reclamation and the Technical Team to discern which differences in flow patterns were attributable to the new structure, as opposed to changes in release rates. Spillway flows from 2014 that were identified in the 2015 Opinion (included in Table 12) were therefore implemented in 2015 as well. Spillway flows identified in the 2015 Opinion (also included in Table 12) for 2016 and 2017 were not able to be implemented due to an extended outage of the Inman Powerplant, through which flows are typically run instead of through the spillway. General maintenance that would not have altered flows was expected; however opening Unit 9 of the Inman Powerplant revealed that its condition required more extensive repairs than expected. Due to the inability to achieve the proposed flows in the spillway in 2016 and 2017, velocity measurements (a surrogate for habitat) were done after irrigation season in the fall of 2017 at the three target flows (1300, 1000, and 500 cfs).

Table 12. Current and proposed minimum spillway and powerplant flows at the Minidoka Dam

Mo.	Spillway Flow (cfs)						Powerplant Flow (cfs)					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Nov 01	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Dec 01	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Jan 01	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Feb 01	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Mar 01	<1	<1	<1	<1	<100	<100	400	400	400	425	425	425
Apr 01	<1,300	<1,300	<1,300	<1,300	<1,000	<500	<5,035	<5,035	<5,035	<5,035	<5,335	<5,835
Apr 15	1,300	1,300	1,300	1,300	1,000	500	<8,850*	<8,850	<8,850	<8,850	<8,850	<8,850
May 01	1,300	1,300	1,300	1,300	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Jun 01	1,300	1,300	1,300	1,300	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Jul 01	1,900	1,900	1,900	1,500	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Aug 01	1,900	1,900	1,900	1,500	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Sep 01	1,300	1,300	1,300	1,300	1,000	500	<8,850	<8,850	<8,850	<8,850	<8,850	<8,850
Sep 15	<1,300	<1,300	<1,300	<1,300	<1,000	<500	<5,035	<5,035	<5,035	<5,035	<5,335	<5,835
Oct 01	<1,300	<1,300	<1,300	<1,300	<1,000	<500	400	400	400	425	425	425

*Irrigation season powerplant flows are highly variable within and among years and are dependent upon several factors. Accurate monthly flows cannot be precisely expressed in a single table. The maximum powerplant capacity at Minidoka Dam is 8,850 cfs.

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The objectives of the Minidoka reach physa surveys in 2017 were to gather data that will be used to determine trends of occurrence and abundance within the Minidoka reach; further characterize physa habitats, and meet the reporting requirements of ESA Section 10, Permit No. TE 056557-5. Data collected in 2015 through 2017 will be compared to data from previous years to determine impacts to physa and their habitat in the Minidoka reach (Figure 17).

4.2 Survey Area

The survey area is located in south-central Idaho and includes the Snake River from Minidoka Dam downstream to the upper end of Milner Pool (Figure 17, river mile [RM] 675 to RM 663). The Minidoka Dam pool elevation ranges from 4236 to 4245 feet above sea level; however, elevations are generally held at 4245 feet above sea level to maximize power production. The pool elevation is reduced near the end of irrigation season (September) during low water years to avoid reducing American Falls Reservoir below 100,000 acre-feet. Minidoka Dam is operated by Reclamation and managed primarily for water storage and hydroelectric generation. Powerplant and spillway discharges from Minidoka Dam bifurcate flow between the original wetted channel of the Snake River and a series of bedrock outcrops not originally wetted. Flows through Minidoka Dam consist of regulated discharge through both the original powerplant building and the newer Inman Powerplant, as well as controlled discharge through the spillway structure. Flows from Minidoka Dam downstream to Milner Dam are almost entirely an artifact of controlled releases at Minidoka Dam, as there are no major tributaries or irrigation returns in the Snake River along this reach.

4.3 Methods

4.3.1 Sample Locations

Two long-term survey sites were selected at locations where physa were collected during previous surveys (Gates and Kerans 2010).

The downstream site (Control) near the demolished Jackson Bridge (RM 669) is in the original Snake River channel and consists primarily of gravel substrate within a wide, shallow, braided channel. The bankfull width of the Snake River along the Jackson Bridge site is more than 400 meters wide, with maximum depths of approximately 4 meters. As a result, approximately 30 percent of the river channel is exposed during non-irrigation season flows. Flows outside of irrigation season at the Jackson Bridge site typically consist of a minimum of 425 cfs through the powerplants. This regulated winter flow is approximately 1.2 meters lower than average August bankfull width flows.

The upstream site (Impact) is located at the Minidoka Dam spillway pool (RM 674.5). The spillway pool, wetted as a result of spillway releases since Minidoka Dam was constructed in 1906, is characterized by braided flows over primarily bedrock and sand substrate. Live

physa were discovered in a portion of the spillway area in 2005. It is unknown whether physa colonized the spillway from upstream or downstream, how long they have persisted in the spillway area, or whether they are ephemeral in this nonnative habitat.

Three randomly selected transects and one permanent reference transect were derived by dividing the shoreline length of each site into 1-meter-wide cross sections perpendicular to the channel. Each transect was divided into 1-square-meter segments, and 20 segments were randomly selected along each transect as potential sampling plots. The Jackson Bridge sampling plots were selected by sampling the first 10 plots occupied from south to north at depths equal to or greater than 1.2 meters deep, since previous surveys found virtually no physa in the seasonally dewatered channel (Gates and Kerans 2010). Spillway sampling sites were selected by sampling the first 10 plots occupied along each transect that were at least 1 meter deep, from north to south.

A before/after, control/impact (BACI) study design was originally proposed to examine changes in the occurrence and abundance of physa at the Minidoka Dam spillway before, during, and after planned reductions in spillway flow. Due to the unexpected powerplant maintenance, it was not possible to reduce spillway flows for this testing. After becoming aware of the flow constraints caused by the powerplant maintenance Reclamation worked with USFWS to develop a new plan. Low numbers of physa being captured in the snail pool also limited the confidence that statistically significant results could be obtained from the BACI study design. Previous research suggested a relationship between water velocity and physa presence/density. Existing data from both sites as well as data collected in 2017 at the Jackson Bridge site would be used to create a relationship between water velocity and physa presence/density. Funding for 2017 snail sampling in the Minidoka pool was diverted to cover surveys of water velocity at the three target flows described in the 2015 Opinion.

4.3.2 Snail Collection

Each station was sampled using a venturi suction dredge operated by a SCUBA diver. A 0.25-square-meter plot was excavated to approximately 2.5 centimeters deep at stations where the primary substrate consisted of unconsolidated material such as mud, sand, and gravel. At stations having consolidated substrates such as cobble, boulder, and bedrock, samples were suction-dredged for a timed duration of 60 seconds. Each sample was transported through flexible tubing and collected in a 1,000-micrometer sieve on board the boat or buoy station from which dive operations were conducted. Samples were immediately transferred to plastic trays and examined by trained samplers from Reclamation and USFWS, under the direction of John Keebaugh from the Orma J. Smith Museum of Natural History. Live physa from each plot were counted and returned in proximity to the location from which they were collected.

4.3.3 Habitat Measurements

Physical water quality measurements were made at each sampling plot. Water depth (meters), temperature (°C), and dissolved oxygen (milligrams per liter [mg/L]) were measured at each plot using a Hydrolab® Sonde DS5 meter and Surveyor® handheld monitor. Current velocity (meters per second [m/s]) was measured approximately 10 centimeters above the substrate at each plot using a SonTek® Argonaut ADV current meter, operated by USGS staff. Acoustic Doppler current profiles (ADCP) were also collected by USGS staff at each transect using a TRDI® Rio Grande ADCP operating at 12 kHz. Dominant and subdominant substrate types were classified by particle size as modified from Overton et al. (1997) (Table 13). Estimates of dominant and secondary substrate composition were made by direct observation of each sampling plot by a SCUBA diver and from inspection of the sieved contents of each sampling plot by snail collection samplers on board the dive vessel.

Table 13. Substrate classifications used to characterize suction dredge plots surveyed

Substrate Type	Size Class (mm)
Bedrock	Solid rock
Boulder	>256
Cobble	64-256
Pebble	16-64
Gravel	2-16
Sand	0.1-2
Silt	<0.1

4.4 Results and Discussion

During the 2017 sampling, 40 plots were sampled at the Jackson Bridge site. At the Jackson Bridge site (Control site), 15 plots (37.5 percent) contained live physa, with the collection of 4 or more live physa in seven plots and one or two live physa in each of the other eight plots (Figure 18). At the spillway pool site, velocity transects were collected with the ADCP at the test flows of 1300, 1000 and 500 cfs (Impact site; Figure 19). Similar to previous studies, physa were broadly distributed in low densities in the permanently wetted channel of the Snake River at the Jackson Bridge site.

Snake River physa shells were counted to serve as a possible surrogate to live snail locations. Although snail shells in general are prone to drifting in fluvial environments, analysis of previous Reclamation data has shown that concentrations of shells serve as indicators of species presence within the general vicinity of the search site. Physa shells were found in 87.5 percent (n=35) of the Jackson Bridge samples. Sites where shells were

not found were close to the shore. All of the live Snake River physa were returned to their respective collection location in apparently good condition.

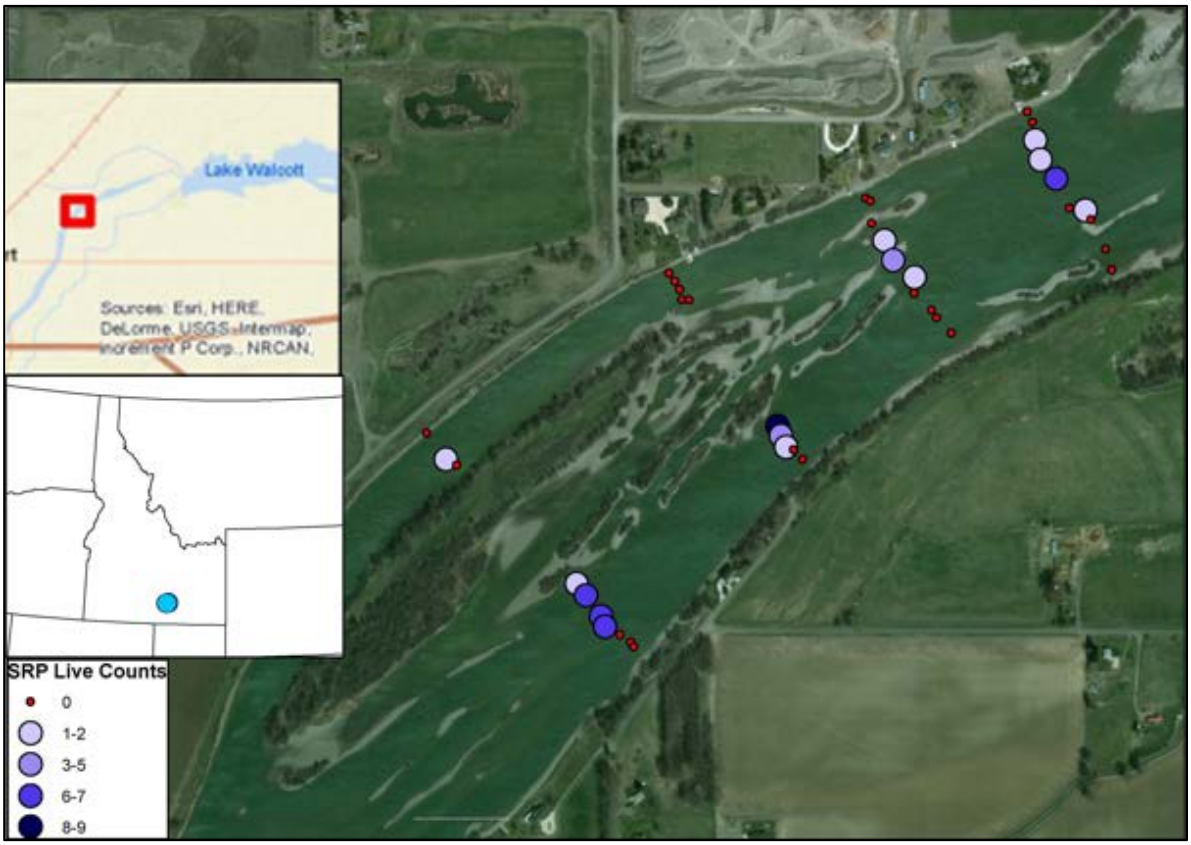

Figure 18. Distribution of Snake River physa at the Jackson Bridge monitoring site in 2017.

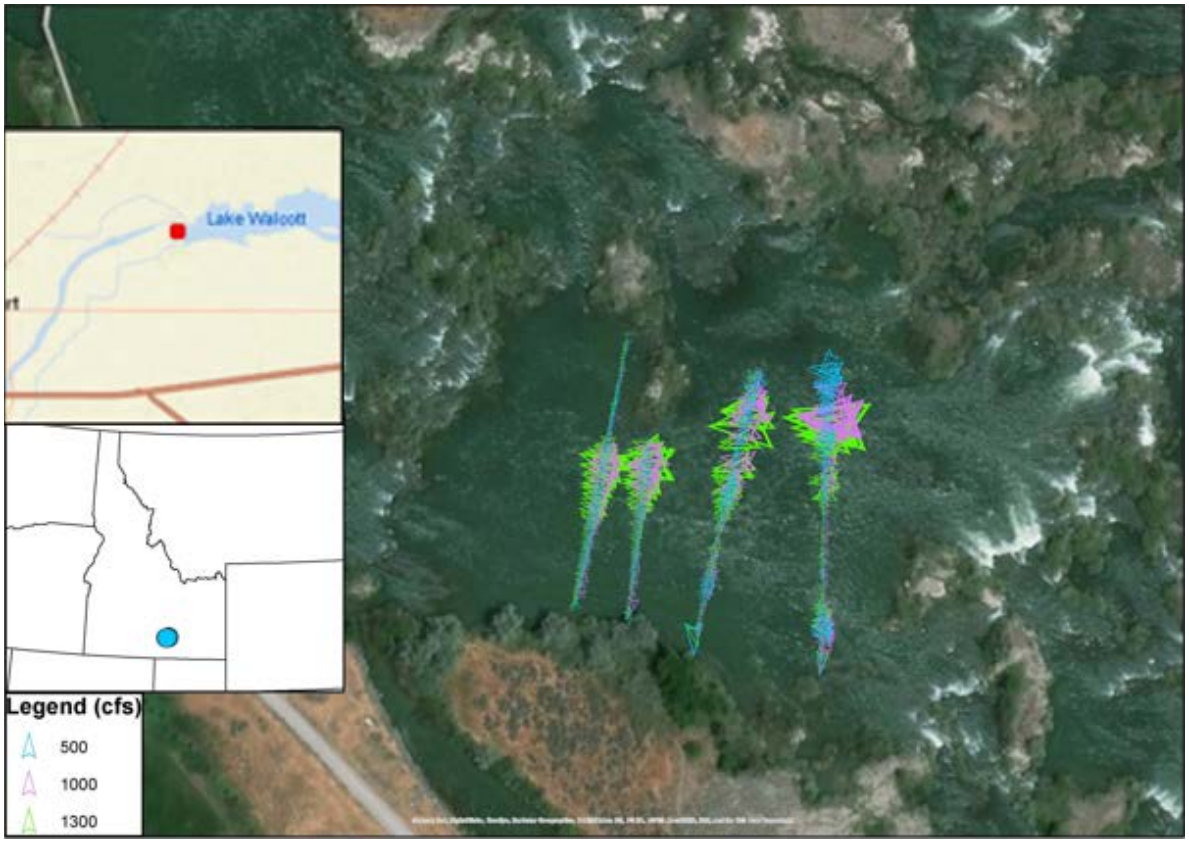

Figure 19. Water column velocities at the Minidoka Dam spillway pool monitoring site in 2017 at the three target flows from the 2015 BiOp. The size and direction of the arrows are related to the velocity and direction of the water flow.

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