NorthWestern Energy, 1801 South Russell Street, Missoula, Montana 59806

NorthWestern Energy
Delivering a Bright Future

NWE-Mystic-3376

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street
Washington, D.C. 20426

May 12, 2016

RE: NorthWestern Energy files Mystic Lake Project Renewed Six Year (2016-2021) Fisheries Plan and Six Year (2010-2015) Fisheries Monitoring Report

Dear Secretary Bose:

Herein attached, per U.S. Forest Service Appendix B Condition 16 of the December 17, 2007 Commission Order Issuing New License, is NorthWestern Energy's Renewed Six Year (2016-2021 Fisheries Plan and Six Year (2010-2015) Fisheries Monitoring Report for the Mystic Lake Project. Signatures of approval from the U.S Forest Service (USFS), Montana Fish, Wildlife and Parks (MFWP), and Montana Department of Environmental Quality (MDEQ) for this Plan and Report filing appear on page 2.

NorthWestern Energy proposes to file a renewed Fisheries Plan and Report with the Commission every six years for the term of the Mystic Project license. Annual reports under this Plan will continue to be submitted to the USFS, MFWP and MDEQ, and posted to the NorthWestern Mystic Lake Project public website.

Sincerely,

Jon H. Jourdonnais,
Leader, Hydropower License Compliance

Cc: Brent Mabbott, NWE
Andy Welch, NWE
John Tabaracci, NWE
Mary Gail Sullivan, NWE
Ken Coffin, USFS
Clint Sestrich, USFS
Jason Garber, MDEQ
Ken Frazier, FWP
Mike Ruggles, FWP
Jason Rhoten, FWP
Ginger Gillin, GEI
Kristi Webb, New Wave

By signature of approval below, the USFS, MDEQ and MFWP approve the Renewed Six Year (2016-2021) Fisheries Plan and Six Year (2010-2015) Fisheries Monitoring Report for the Mystic Lake Project as filed herein with the Commission.

Mary C Eustis
Name

Forest Supervisor Custer Gallatin
USFS Position

5/5/16
Date

Name

Water Protection Bureau Chief
MDEQ Position

May 6, 2016
Date

Name

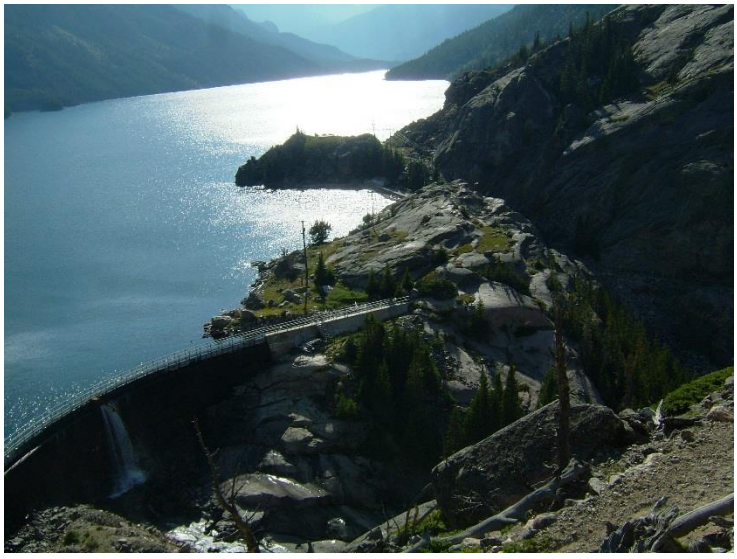
Fisheries Div. Admin.
MFWP Position

5/12/16
Date

6-Year Fisheries Monitoring Report
2010-2015

Mystic Lake Hydroelectric Project
FERC Project Number 2301

April 2016
Public



Submitted by:
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Butte, Montana

With Assistance From:
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Portland, Oregon

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Acronyms

°	degrees
7DADM	maximum 7-day average of the daily maxima
AG	Arctic grayling
APH	above Powerhouse
Avg.	average
BPH	below Powerhouse
BWRL	below West Rosebud Lake
C	Celsius
cfs	Cubic feet per second
CI	Confidence Interval
Commission	Federal Energy Regulatory Commission
CPUE	catch per unit effort
DEQ	Montana Department of Environmental Quality
DNA	deoxyribonucleic acid
EB	Brook trout
EPA	Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera
F	Fahrenheit
FERC	Federal Energy Regulatory Commission
FWP	Montana Fish, Wildlife and Parks
g	grams
kg	kilogram
lb	pound
Licensee	NorthWestern Energy Corporation
LL	Brown trout
LN SU	Longnose suckers
mi.	mile
mm	millimeter
MWMT	Maximum Weekly Maximum Temperature
MFISH	Montana Fisheries Information System
MWF	Mountain whitefish
N	North
NorthWestern	NorthWestern Energy Corporation
NA	Not Available
No.	number
PCR	polymerase chain reaction
PEI	
PPL Montana	PPL Montana, LLC
Project	Mystic Lake Hydroelectric Project No. 2301
RB	Rainbow trout
TAC	Technical Advisory Committee
UCI	Upper confidence interval
U.S.	United States of America
USGS	U.S. Geological Survey
USFS	U.S. Forest Service

W	West
W_r	relative weight
YCT	Yellowstone cutthroat trout

Executive Summary

Mystic Lake Hydroelectric Project No. 2301 (Project) is operated and owned by NorthWestern Energy Corporation (NorthWestern or Licensee). On December 17, 2007 the Federal Energy Regulatory Commission (FERC or Commission) issued a new license to PPL Montana, the Licensee (now NorthWestern as of November 18, 2014), for the Mystic Lake Hydroelectric Project No. 2301 effective January 1, 2010. The new license includes U.S. Forest Service (USFS) Section 4(e) Terms and Conditions filed on May 3, 2007. Section 4(e) Condition 16 requires the Licensee to prepare and implement a Fisheries Monitoring Plan that must be approved by the Mystic Lake Fisheries, Aquatic Habitats, and Water Quality Technical Advisory Committee known as the TAC and including agency representation from the USFS, Montana Department of Environmental Quality (DEQ), and Montana Fish, Wildlife and Parks (FWP).

On August 2, 2010, the Licensee filed the TAC-approved Fisheries Monitoring Plan with the Commission (PPL Montana, 2010). The Commission approved the Fisheries Monitoring Plan on September 30, 2010. The 6-Year Fisheries Monitoring Plan called for the following activities to be implemented between 2010 and 2015:

Mystic License
2010-2015 Fisheries Monitoring Plan
6-Year Schedule

	Sampling Effort						
Year	**A**	**B**	**C**	**D**	**E**	**F**	**G**
2010			X	X	X		X
2011		X				X	
2012	X		X				X
2013				X	X	X	
2014		X	X				X
2015	X					X	

A= Mystic Lake fish monitoring
B= West Rosebud Creek fish survey between the dam and powerhouse
C= West Rosebud and Emerald lakes fish monitoring
D= West Rosebud Creek below Emerald Lake fish survey
E= West Rosebud Creek habitat monitoring
F= West Rosebud Creek spring and fall redd counts
G= West Rosebud Creek water temperature monitoring

Following the submittal of the monitoring schedule shown above, the License, in cooperation with the TAC, modified the schedule slightly such that West Rosebud Creek redd counts were implemented annually *versus* every other year, habitat monitoring was completed in 2012 instead of 2013, and West Rosebud Creek fisheries survey (below Emerald Lake) was re-sampled in

2014 due to hazardous conditions in 2013. This report summarizes the fisheries monitoring activities completed between 2010 and 2015.

Mystic Lake Monitoring

The Licensee completed a fisheries survey in Mystic Lake in 2003, 2009, 2012, and 2015. Each survey included both gillnetting and angling efforts in two sections of Mystic Lake. The fish data from Mystic Lake were summarized by catch per unit effort (CPUE), length-frequency histograms, weight-length relationships, and condition.

The fish species composition in Mystic Lake is characterized as a hybrid swarm population of rainbow trout (*Oncorhynchus mykiss*) and Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*). For reporting purposes, the hybrid swarm is referred to as rainbow trout.

Between 2003 and 2015, CPUE when angling ranged from 4.0 to 7.9 fish per hour while CPUE when gillnetting ranged from 0.5 to 1.6 fish per hour. CPUE yielded higher rates while angling than gillnetting during each year of sampling.

Gillnetting appears to capture a wider size range of rainbow trout than results generated when angling. Overall, the length-frequency histogram data between 2003 and 2015 show there is a good distribution of size classes based on both sampling methods combined and that larger fish (> 350 millimeters [mm] or 13.8 inches) are not common. Rainbow trout appear to be growing slowly over time and continue to reproduce based on the wide-ranging size distribution observed via gillnetting and angling.

As anticipated, the length-weight relationship for rainbow trout show that fish are less round as length increases. The logarithmic weight-length regression analysis revealed condition of rainbow trout was greater in 2015 than in previous years. Between 2003 and 2012, there were no discernable differences in condition of fish based on the logarithmic weight-length regression analysis with the predicted weight for a 250 mm fish estimated to be between 130 and 137 grams (g). In 2015, fish condition appeared to increase with the estimated weight for a fish measuring 250 mm at approximately 162 g.

A new species, Utah chub (*Gila atraria*) was observed and recorded in Mystic Lake for the first time during the 2012 survey. The number of Utah chub are low in comparison to rainbow trout with only five fish captured in 2012 and one fish captured in 2015 during the gillnetting efforts in Mystic Lake. No Utah chub have been collected via angling. FWP and the Licensee will continue to monitor for Utah chub in Mystic Lake; however, at this time distribution and presence of this species appears to be limited by the cool lake temperatures and spawning habitat.

West Rosebud Creek Bypass Fisheries

The bypass section (upper and lower reaches) of West Rosebud Creek (between Mystic Lake and the powerhouse) was surveyed in 2011, 2012, and 2014. Since 2011, only rainbow trout were observed in the upper bypass reach with population estimates ranging between 124 fish per 300 feet in 2012 to 161 fish per 300 feet in 2014. The average size of rainbow trout in the upper bypass reach has ranged between 145 mm or 5.7 inches to 151 mm (5.9 inches) during the 3 years of sampling. Size distribution (length frequency analysis) for rainbow trout in the upper bypass shows a diverse range of sizes. The size distribution has remained relatively similar over the years.

In 2012 and 2014, rainbow trout and brown trout (*Salmo trutta*) were recorded in the lower bypass reach. No data were available for the lower bypass in 2011 due to equipment malfunction. Rainbow trout population estimates varied between 30 fish per 300 feet in 2012 to 44 fish per 300 feet in 2014. The average size of rainbow trout in both years were very similar, 170 mm (6.7 inches) in 2012 and 169 mm (6.7 inches) in 2014. Brown trout population estimates were seven fish per 300 feet in 2012 and 15 fish per 300 feet in 2014. Based on the two sample years, the average size of brown trout was greater in 2012 at 300 mm (11.8 inches) and smaller in 2014 at 174 mm (6.9 inches). As in the upper bypass, rainbow trout size distribution in the lower bypass has remained diverse between 2012 and 2014. However, the size distribution of brown trout has shifted from larger fish in 2012 to smaller fish in 2014.

West Rosebud and Emerald Lakes Fisheries

West Rosebud Lake and Emerald Lake fisheries have been monitored every other year since 2006, with the most recent sampling completed in May 2014. In both lakes, gillnetting efforts have consistently captured five species since 2006, including brook trout (*Salvelinus fontinalis*), brown trout, rainbow trout, mountain whitefish (*Prosopium williamsoni*), and longnose sucker (*Catostomus catostomus*). In 2014, two Yellowstone cutthroat trout were also recorded for the first time in West Rosebud Lake; it is likely a result of annual stocking since 2011. Through the years, brook trout and brown trout remain the most abundant species sampled in West Rosebud Lake. In Emerald Lake, the proportion of species has been more variable over time. In 2006, 2012, and 2014, brown trout were the most abundance species. In 2008, mountain whitefish were the most abundant species, while in 2010 brook trout and mountain whitefish were the most abundant species in Emerald Lake (based on number of fish caught per hour of netting).

West Rosebud Creek Water Temperature

Starting in 2010, stream temperatures in West Rosebud Creek at four designated locations have been monitored every other year between April and October in conjunction with fish sampling efforts in West Rosebud and Emerald lakes. Monitoring in 2010, 2012, and 2014 indicates that West Rosebud Creek has a mean weekly maximum temperature (MWMT) less than 16 degrees Celsius (°C) or 60.8 degrees Fahrenheit (°F) in all four sites. The data collected in the monitoring

locations in 2010, 2012, and 2014 indicate water temperatures, specifically summer temperatures, are in the preferred range for salmonids in West Rosebud Creek and are not limiting for salmonid species present. However, growth may be limited for some species as a result of food availability and/or cold water temperature.

West Rosebud Creek (Mackay Flat) Fisheries

In the Mackay Flat section of West Rosebud Creek, electrofishing efforts along a 1.5-mile reach were completed in September 2010, October 2013, and in early May 2014. Due to hazardous conditions in 2013, electrofishing efforts were delayed. FWP decided to postpone sampling until spring 2014 when sampling could develop a resident brown trout population estimate.

During the 2014 sampling effort, three species were recorded in the Mackay Flat section (listed in order of abundance): brown trout, rainbow trout, and brook trout. The most abundant size class of brown trout in 2014 were between 250 mm (9.8 inches) and 350 mm (13.8 inches), which was larger than in 2010 when the most abundant size class was between 100 mm (3.9 inches) and 150 mm (5.9 inches). Between 1986 and 2014, estimates ranged from 402 to 705 brown trout (age 2 +) per mile. In 1998, sampling was completed in the spring (as in 2014) and the population estimate was approximately 652 brown trout (age 2 +) per mile. In May 2014, there were approximately 269 brown trout (age 2 +) per mile. The 2014 spring sample resulted in the lowest population estimate calculated for all sample years. However, the majority of samples taken in previous years were completed in the fall (1986, 2004, 2007, and 2010) when the presence of brown trout is likely higher due to migrants that have entered the reach for spawning.

West Rosebud Creek Redd Counts

The Mackay Flat section of West Rosebud Creek serves as an important spawning area for both resident West Rosebud Creek fish and migratory rainbow and brown trout from the Stillwater and Yellowstone rivers. Although the monitoring plan scheduled redd (spawning area or nest of trout) counts for every other year, the Licensee and FWP performed the spring and fall surveys annually between 2008 and 2015 with the exception of two fall surveys (2008, 2010) that were not completed.

Spring surveys enumerated rainbow trout redds and were generally completed in early May prior to the spring freshet. These redd counts varied from one to as many as 34 redds per year, but were most often in the single digits with two exceptions: 14 redds in 2010 and 34 redds in 2012. It is uncertain as to why the rainbow trout redd counts were so variable. The variability may be related to, but not limited to, whether the fish are resident of West Rosebud Creek or migrants from downstream, hydrologic conditions during the survey period, or other hydrologic conditions downstream in the Yellowstone and Stillwater rivers that may influence upstream migration of rainbow to spawning areas in West Rosebud Creek.

Fall surveys enumerated brown trout redds and were generally completed between mid- to late October to early November prior to ice development in the stream. Brown trout redd counts

ranged between six redds to 47 redds per year. The lowest count was in 2014 (6 redds) and the highest count was in 2012 with 47 redds. The most recent survey yielded 17 redds in 2015. With the exception of the 2014 fall survey, the brown trout redd counts resulted in less variability than the spring rainbow trout redd counts.

West Rosebud Creek Habitat Monitoring

Habitat monitoring in West Rosebud Creek included sediment core sampling and macroinvertebrate sampling in 2010 and 2012. In 2010 and 2012, the sediment core sampling collected from two sites in West Rosebud Creek illustrated that the Pine Grove Campground site has both larger particle sizes and a smaller percentage of fine sediment than the Allen Grade Bridge site. The Pine Grove Campground site is further upstream and would be expected to have larger sized substrate compared to the Allen Grade Bridge site. The percentage of fine sediment at the Allen Grade Bridge site was higher than the amount measured at Pine Grove Campground in each sampling year. The data from 2010 and 2012 indicate spawning habitat is of better quality in Pine Grove Campground site *versus* the Allen Grade Bridge site.

Macroinvertebrates were sampled and evaluated at five sites along West Rosebud Creek as part of the relicensing process, as well as both the fisheries and water quality monitoring programs implemented by the Licensee between 2010 and 2015. The data show West Rosebud Creek continues to supports a sparse, but generally healthy assemblage of aquatic macroinvertebrates. The macroinvertebrate community in West Rosebud Creek is typical of a soft-water mountain stream. The macroinvertebrate species composition varies between sites representing a typical longitudinal gradient. Species more common in small mountain streams are confined to the upper reaches and taxa more common to larger streams are limited to the lower reaches. Community composition also show localized influences from West Rosebud and Emerald lakes. The biotic index for all sites indicate excellent water quality throughout the study area. However, macroinvertebrate assemblages below the powerhouse and below the Re-Regulation Dam reveal levels of increased environmental stress compared to the other sites. There are few indications of environmental stress in the other sites.

Reporting and Compliance

NorthWestern has prepared this 6-year comprehensive report summarizing activities completed between 2010 and 2015 in compliance with the 6-Year (2010-2015) Fisheries Monitoring Plan. During this 6-year period, the Licensee prepared and submitted annual reports to the TAC. The annual reports, as well as this document, are posted to the Mystic Lake Project Coordination website (www.mysticlakeproject.com).

In consultation with the TAC, NorthWestern updated the 6-Year Fisheries Monitoring Plan for implementation between 2016 and 2021. NorthWestern proposes to continue to summarize and present the results of fisheries monitoring activities to the TAC annually. In 2022, NorthWestern will prepare a 6-year comprehensive report summarizing fisheries activities completed between

2016 and 2021. The comprehensive report will be submitted to the TAC for review and approval prior to filing with the Commission (no later than December 31, 2022). The annual reports prepared for the TAC and final reports filed with the Commission will be posted to the Mystic Lake Project Coordination website (www.mysticlakeproject.com).

1. Introduction

The Mystic Lake Hydroelectric Project No. 2301 (Project) is situated in south-central Montana, primarily located in Stillwater County with a very small portion within Carbon County. The Project is located in the Beartooth Mountain Range and surrounded on three sides by the Absaroka-Beartooth Wilderness Area. Mystic Lake is located at the head of a high mountain canyon at an elevation of 7,673.5 feet above mean sea level in the upper reaches of West Rosebud Creek. Within West Rosebud Creek drainage (213.4 square miles), Mystic Lake is the fourth and largest lake in a chain of six hydraulically connected lakes (listed in order going downstream: Star, Silver, Island, Mystic, West Rosebud, and Emerald lakes). The Beartooth Ranger District of the Custer National Forest manages approximately 124.7 square miles of the West Rosebud Creek drainage while the remaining 88.7 square miles is privately-owned land.

On December 17, 2007, the Federal Energy Regulatory Commission (FERC or Commission) issued a new license for the Mystic Lake Hydroelectric Project No. 2301 effective January 1, 2010. The new license includes the U.S. Forest Services (USFS) Section 4(e) Terms and Conditions filed on May 3, 2007. Section 4(e) Condition 16 requires the Licensee [now NorthWestern Energy Corporation (NorthWestern)] to prepare and implement a Fisheries Monitoring Plan that must be approved by the Mystic Fisheries, Aquatic Habitats, and Water Quality Technical Advisory Committee (TAC), represented by USFS, Montana Department of Environmental Quality (DEQ), and Montana Fish, Wildlife and Parks (FWP).

In 2010, the Licensee developed the 6-Year (2010-2015) Fisheries Monitoring Plan for the Mystic Lake Project (PPL Montana, 2010). On August 2, 2010, the Licensee filed the TAC-approved Fisheries Monitoring Plan with the Commission. On September 30, 2010, the Commission issued a letter approving the Fisheries Monitoring Plan with a request for the Licensee to file a copy of each annual report to the Commission. The Licensee filed copies of 2010, 2011, 2012, and 2013 annual reports (PPL Montana, 2011; 2012; 2013; 2014) to the TAC and Commission. Following the submittal of the 2013 annual report, the License requested to modify the reporting schedule and only file annual reports to the TAC followed by a 6-year summary filing with the Commission. The first 6-year summary is scheduled to be filed with the Commission by June 1, 2016, and every 6 years thereafter. In a letter issued by the Commission on July 30, 2014, FERC accepted the proposed reporting schedule.

The first 6-year cycle (2010-2015) of the Fisheries Monitoring Plan was completed in 2015. In compliance with the Fisheries Monitoring Plan, this document provides a comprehensive 6-year (2010-2015) summary report of all fisheries activities that occurred between 2010 and 2015. Each monitoring activity, as identified in Table 1-1, has its own section in this report. A map of the Mystic Hydroelectric Project FERC boundary and the locations of the 2010-2015 monitoring activities are shown in Figure 1-1. Following the submittal of the initial monitoring schedule outlined in the 2010-2015 Fisheries Monitoring Plan (PPL Montana, 2010), the Licensee, in

cooperation with the TAC, modified the schedule slightly such that West Rosebud Creek redd counts were implemented annually *versus* every other year, habitat monitoring was completed in 2012 instead of 2013, and West Rosebud Creek (below Emerald Lake) was re-sampled in 2014 due to hazardous conditions in 2013 (Table 1-1).

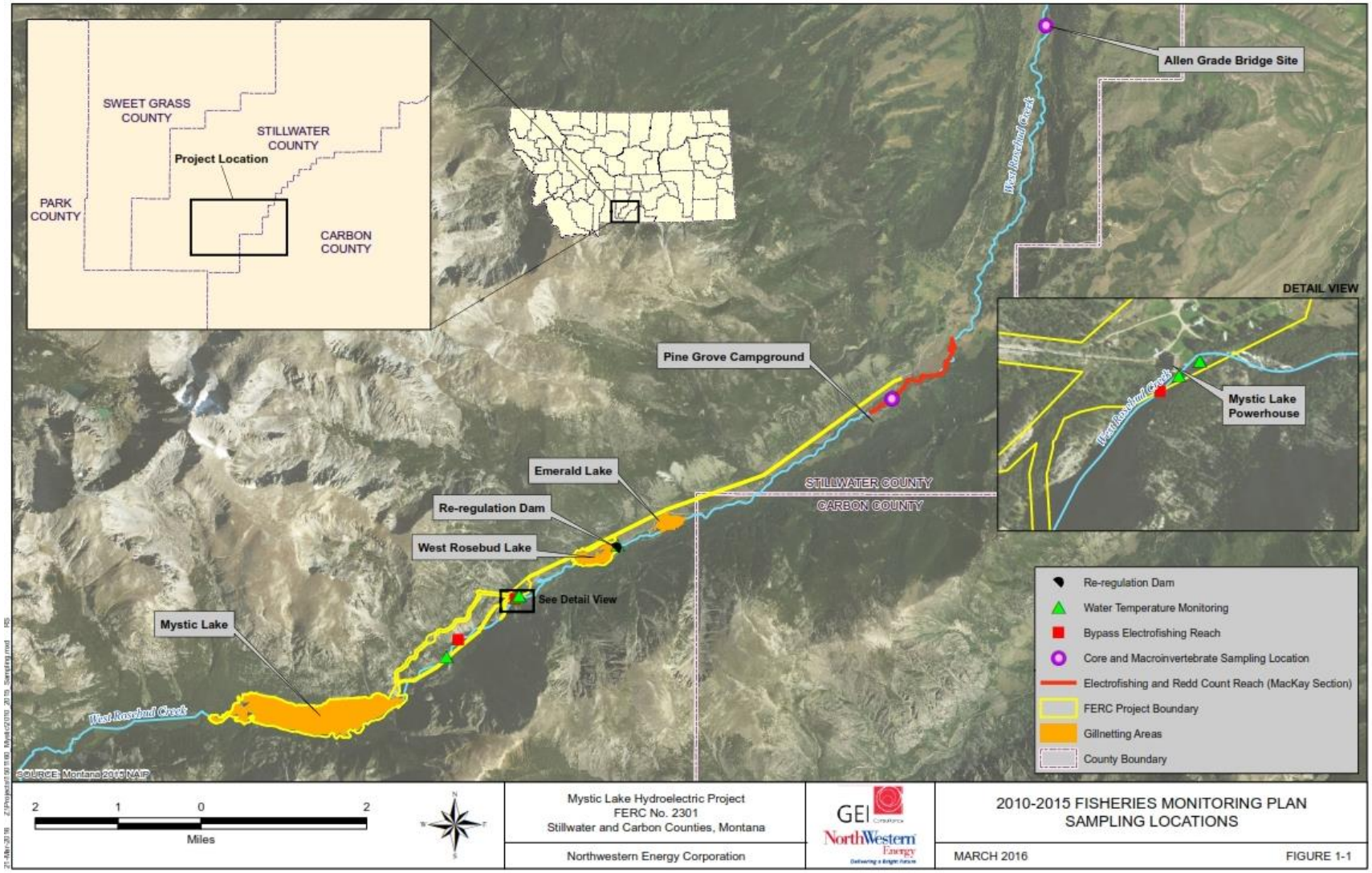
Table 1-1: Mystic License Proposed Fisheries Monitoring 6-Year Schedule (PPL Montana, 2010).

Sampling Effort							
Year	**A**	**B**	**C**	**D**	**E**	**F**	**G**
2010			X	X	X	X	X
2011		X				X	
2012	X		X		X (completed in 2012 vs. 2013)	X	X
2013				X		X	
2014		X	X	X (re-sampled in 2014)		X	X
2015	X					X	

A = Mystic Lake fish monitoring (Section 2)
B = West Rosebud Creek fish survey between the dam and powerhouse (Section 3)
C = West Rosebud and Emerald lakes fish monitoring (Section 4)
D = West Rosebud Creek fish survey below Emerald Lake (Section 6)
E = West Rosebud Creek habitat monitoring (Section 8)
F = West Rosebud Creek spring and fall redd counts (Section 7)
G = West Rosebud Creek water temperature monitoring (Section 5)

NorthWestern has revised the 6-year Fisheries Monitoring Plan, in consultation with the TAC, for implementation between 2016 and 2021. NorthWestern proposes to continue to provide a summary of the previous year's fisheries activities to the TAC annually, followed by a 6-year summary report that will be filed with the Commission, and every 6-years thereafter for the term of the license. Annual summaries to the TAC and reports filed with the Commission will be posted to the Mystic Lake Project Coordination website (www.mysticlakeproject.com). The next 6-year summary report will be filed with the Commission no later than December 31, 2022. In addition, every 6 years, the TAC will re-evaluate and update the Fisheries Monitoring Plan, as necessary for the term of the Project license.

Figure 1-1: 2010-2015 Fisheries Monitoring Plan sampling locations.



2. Mystic Lake Monitoring

The rainbow trout (*Oncorhynchus mykiss*) population in Mystic Lake is characterized as a hybrid swarm population of rainbow trout and Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*). The Wild Trout and Salmon Genetics Laboratory at the University of Montana performed a genetic evaluation on 25 rainbow trout captured by the Licensee in Mystic Lake and 20 rainbow trout captured in Silver Lake (upstream of Mystic Lake). Genetic data in the form of polymerase chain reaction (PCR) amplification of paired interspersed nuclear deoxyribonucleic acid (DNA) elements was used to determine Mystic Lake rainbow trout genetic characteristics at multiple regions of the nuclear DNA. The results indicate that the genetic contributions of rainbow trout were 87 percent and 86 percent, while Yellowstone cutthroat trout contribute 13 percent and 14 percent for Mystic Lake and Silver Lake, respectively (PPL Montana, 2006).

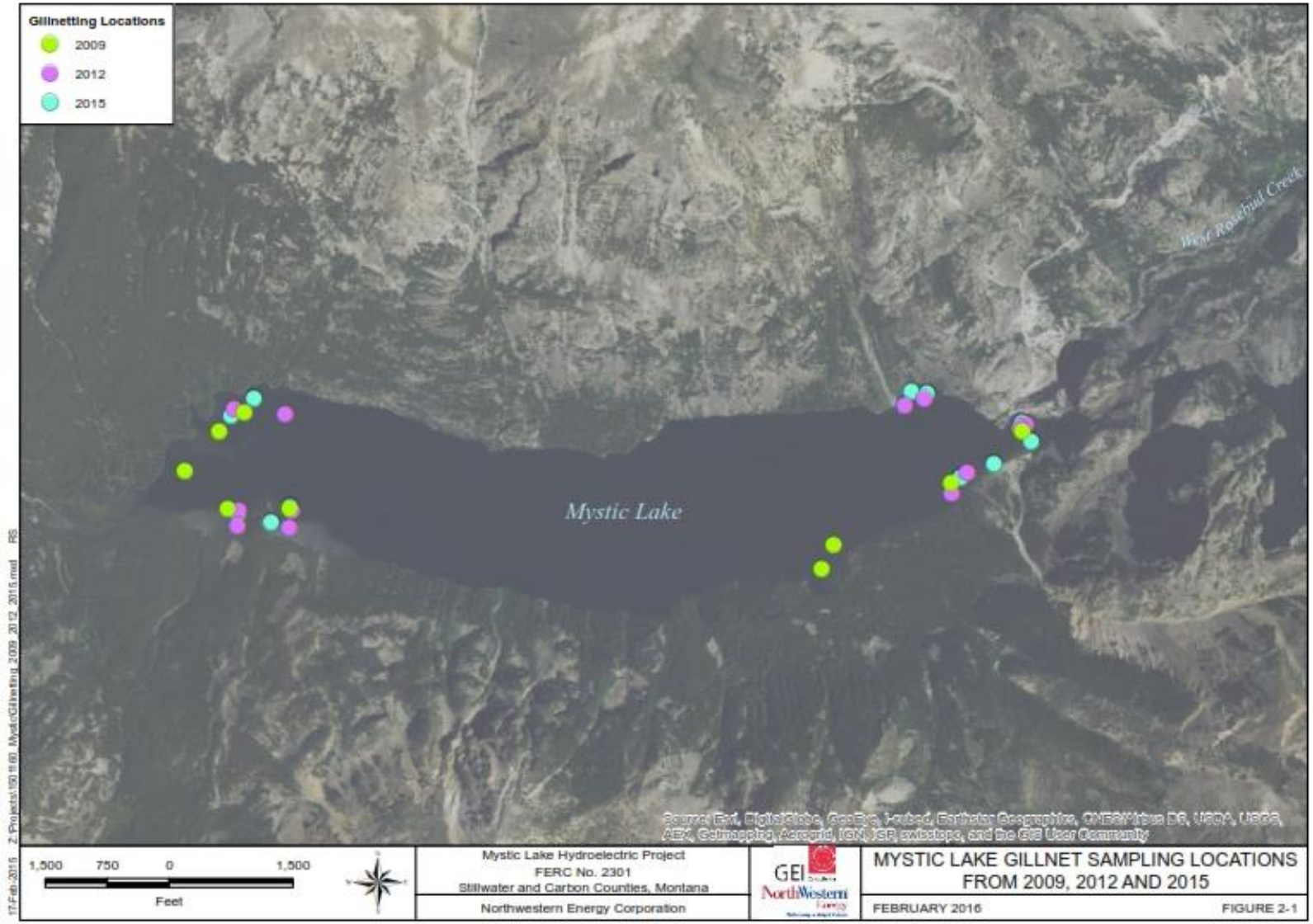
2.1 Data Collection

As outlined in the Fisheries Monitoring Plan (PPL Montana, 2010), Mystic Lake monitoring occurred every third year (2009, 2012, 2015) to record resident fishery trends. Data collection in Mystic Lake included:

- Summer netting with experimental floating and sinking gillnets in two standardized locations. Biological data collected included the number of fish caught by species and length and weight.
- Angling to capture fish in the upper and lower areas of Mystic Lake. Biological data collected included catch per unit effort (CPUE), length and weight, and physical characteristics.

The Licensee provided a summary in the Mystic Lake Final License Application (PPL Montana, 2006) of historic fisheries data from Mystic Lake that was collected in 1983 and 1984 by Schollenberger (1984) and in 2003 by the Licensee and FWP. In August 2009, 2012, and 2015, the Licensee completed fisheries surveys. The sampling locations and methodologies from 2003, 2009, 2012, and 2015 are similar and these data have been summarized below and comparisons have been provided, when applicable. The gillnet locations for sampling efforts completed in 2009, 2012, and 2015 are shown in Figure 2-1. Locations of net sets from 2003 were not available. The 1983-84 data are not included for comparison because the sampling methodologies and sampling site locations most likely differed.

Figure 2-1: Mystic Lake gillnet sample locations from 2009, 2012, and 2015.



2.2 Results

The Licensee completed a fisheries survey in Mystic Lake in 2003, 2009, 2012, and 2015. Each survey included both gillnetting and angling efforts. The data refer to the hybrid swarm rainbow trout population (referred to as rainbow trout in this report) observed in Mystic Lake and have been summarized by CPUE (fish per hour), length-frequency histograms, weight-length relationships, and condition. In addition, a separate section provides a life history summary and information for a new species, Utah chub (*Gila atraria*), that was observed and recorded in Mystic Lake for the first time in 2012.

2.2.1 *Catch per Unit Effort (CPUE)*

A summary of the total number of rainbow trout captured, total duration of effort (hours), and CPUE (fish per hour) via gillnetting and angling in Mystic Lake in 2003, 2009, 2012, and 2015 is presented in Table 2-1 and Figure 2-2.

Utah chub were also observed in Mystic Lake in 2012 and 2015 via gillnetting. A total of five Utah chub were captured in 2012 and one Utah chub was captured in 2015. Details of these fish are discussed and summarized separately in Section 2.2.5 and are not included in the CPUE values in this section.

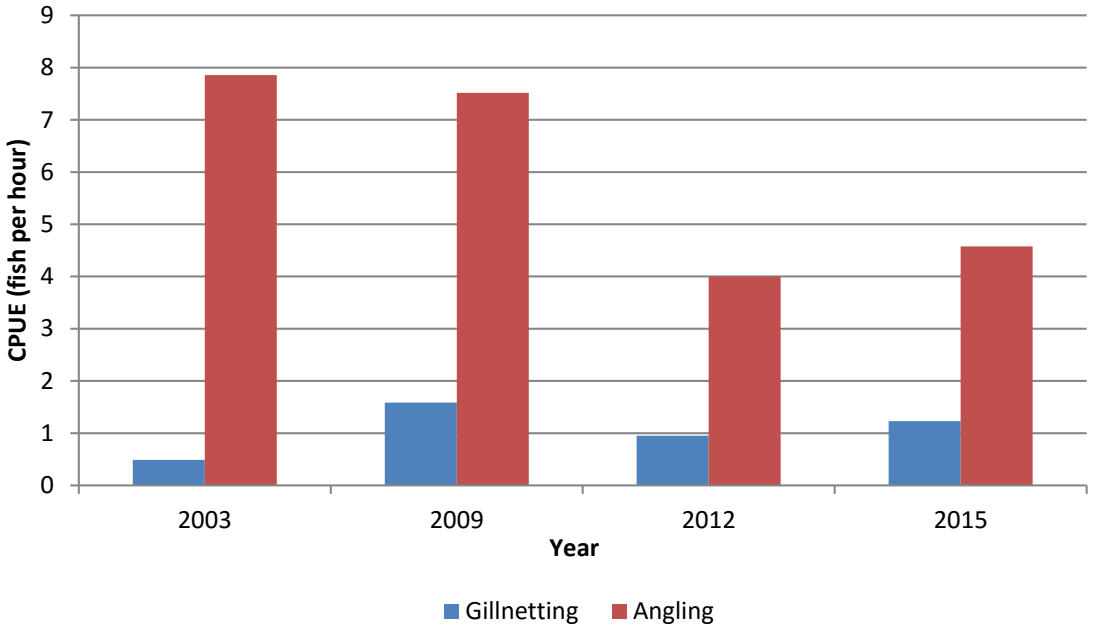
Table 2-1: Summary of the total fish, total hours of effort, and total CPUE (fish per hour) for angling and gillnetting efforts completed in Mystic Lake in 2003, 2009, 2012, and 2015.

Year	Sampling Method	Total Fish Caught	Total Hours	Fish / Hour
2003	Angling	733	93.3	7.9
2003	Gillnetting	86	176.2	0.5
2009	Angling	124	16.5	7.5
2009	Gillnet	254	160.1	1.6
2012	Angling	52	13	4.0
2012	Gillnet	141	148.4	1.0
2015	Angling	86	18.8	4.6
2015	Gillnet	221	180.4	1.2

Between 2003 and 2015, CPUE when angling ranged from 4.0 fish per hour to 7.9 fish per hour while CPUE when gillnetting ranged from 0.5 fish per hour to 1.6 fish per hour. CPUE yielded higher rates while angling than gillnetting during each year of sampling. Angling CPUE rates were greatest in 2003 and 2009 (7.9 fish per hour and 7.5 fish per hour, respectively) and declined to 4.0 fish per hour and 4.6 fish per hour in 2012 and 2015, respectively. Gillnetting CPUE rates remained low and relatively constant since 2003 ranging between 0.5 fish per hour and 1.6 fish per hour.

Declining CPUE when angling does not appear to indicate declining abundance of rainbow trout in Mystic Lake, as the gillnetting CPUE does not show a comparable trend. Angling success can vary significantly as a result of transitory conditions such as weather and time of day.

Figure 2-2: Summary of CPUE (fish per hour) via gillnetting and angling in Mystic Lake in 2003, 2009, 2012, and 2015.



2.2.2 *Length-Frequency Distribution*

Length-frequency histograms for rainbow trout captured in Mystic Lake via angling and gillnetting in 2003, 2009, 2012, and 2015 are shown in Figures 2-3 and 2-4, respectively.

The length-frequency distribution (Figure 2-3) suggests a shift in the size class from 2009 to 2015, likely representing an aging (and growing) cohort of fish. In 2009, the most abundant size class of fish captured via angling was approximately 280 mm (11 inches), and in 2012 the majority of the rainbow trout were approximately 300 mm (11.8 inches); in 2015 the most abundant size class of the rainbow trout was 340 mm (13.4 inches). In addition, there appear to be few smaller fish (< 220 mm [8.7 inches]) and larger fish [greater than 350 mm (13.8 inches)] collected by angling rather than by gillnetting. Angling is size-selective for the mid-range size of fish.

Figure 2-3: Length-frequency for rainbow trout sampled via angling in Mystic Lake in 2003, 2009, 2012, and 2015.

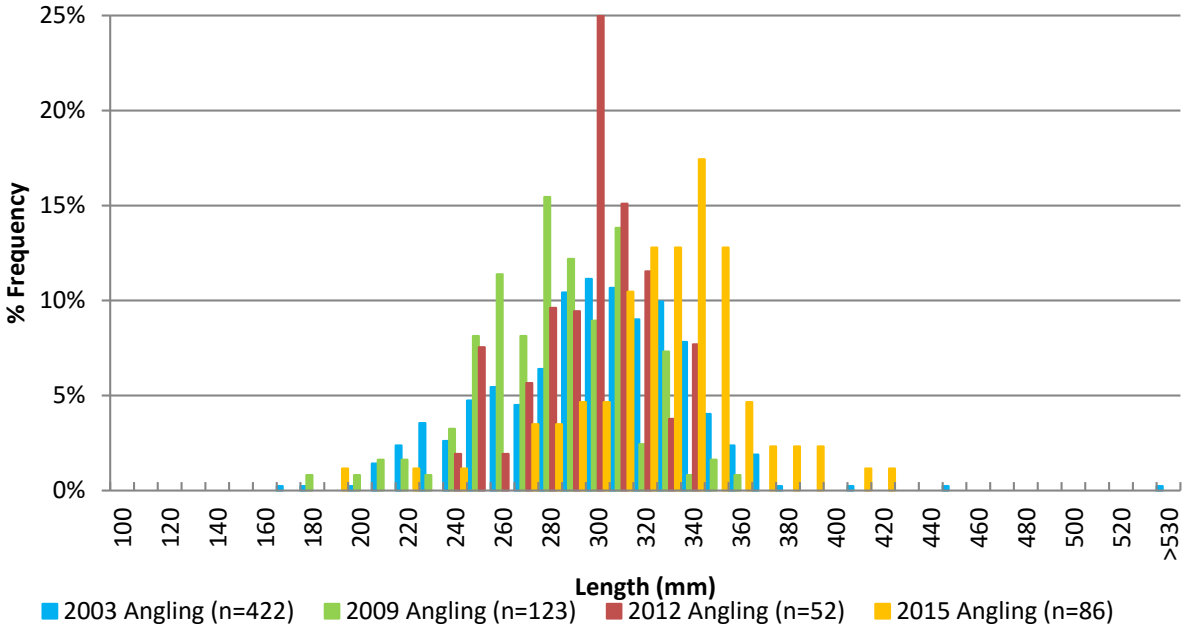
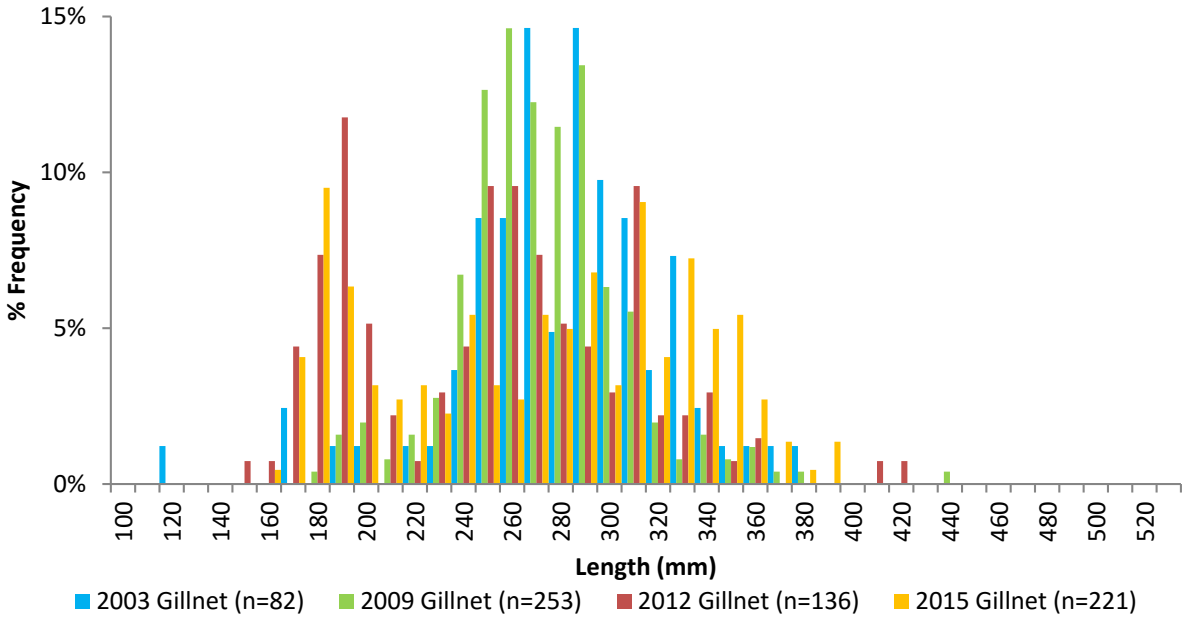


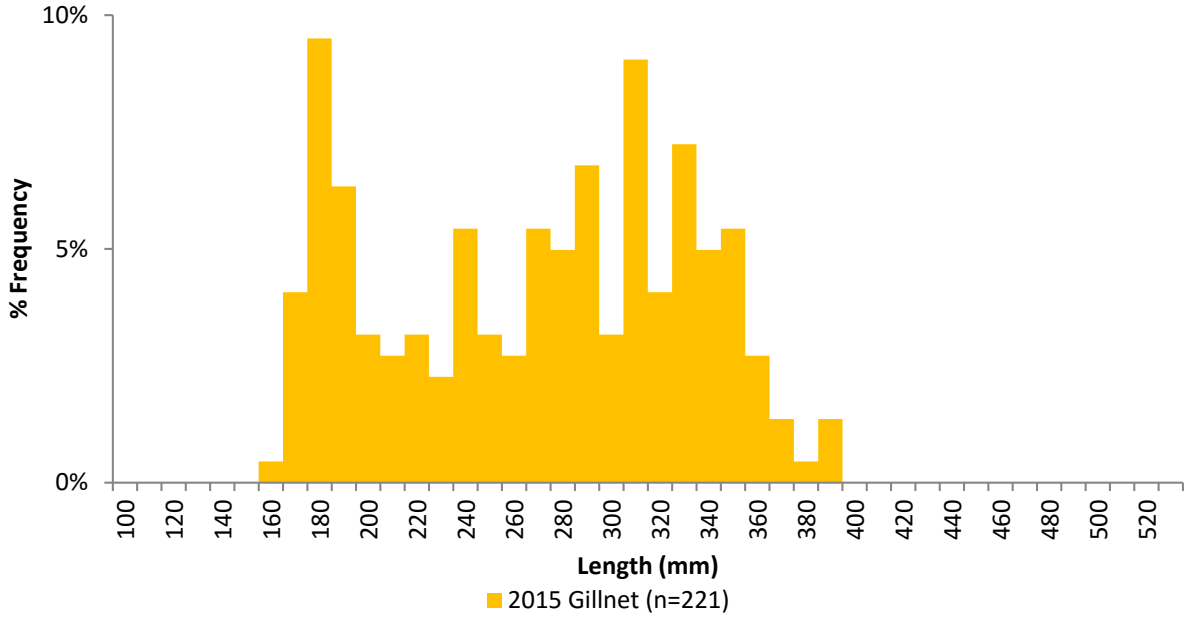
Figure 2-4: Length-frequency for rainbow trout sampled via gillnetting in Mystic Lake in 2003, 2009, 2012, 2015.



The length-frequency histogram for rainbow trout captured via gillnetting sampling completed between 2003 and 2015 is shown in Figure 2-4. The length-frequency distribution results from gillnetting show a bimodal length distribution from each sampling year, although this trend is weaker in 2003 and 2009 than in 2012 and 2015. To more clearly illustrate the bimodal size

distribution, the 2015 gillnetting efforts are shown in Figure 2-5. In 2012 and 2015, there was a greater percentage of smaller fish captured (lengths less than 210 mm or 8.3 inches) than in 2009 and 2003. Overall, gillnetting appears to capture a wider size range of rainbow trout than what is captured by hook-and-line sampling.

Figure 2-5: Example of the bi-modal length-frequency distribution for rainbow trout sampled via gillnetting in Mystic Lake in 2015.



Overall, the length-frequency histograms show there is recruitment of young fish into the population. Rainbow trout larger than 350 mm (13.8 inches) are not common. The rainbow trout population appears to be growing slowly over time and continues to reproduce based on the range of the size distribution observed via gillnetting and angling.

2.2.3 *Weight – Length Relationship*

Weight-length relationships are often used to describe the mathematical relationship between length and weight and to measure the variation from the expected weight for a given length as an indication of the relative "fatness" or condition of a fish (Le Cren, 1951 as cited in Anderson and Neumann, 1996). The relationship between total weight (W) and total length (L) for rainbow trout (and most fishes) can be expressed as a power function,

$$W = aL^b$$

where *L* is length, *a* is a constant, and *b* is an exponent usually between 2.5 and 4.0 [b = 3.0 for isometric growth (the length and weight of a fish grows at a same rate throughout development), *b* > or < 3.0 indicates allometric growth (the length and weight of a fish grow at different rates)]. The functional exponent *b* is generally different among species and may vary between sexes or

localities within the same species, as well as show sensitivity to abiotic and biotic influences (Pope and Kruse, 2007).

Figure 2-6: Weight–length relationship and nonlinear regression equation for rainbow trout in Mystic Lake in 2003, 2009, 2012, and 2015.

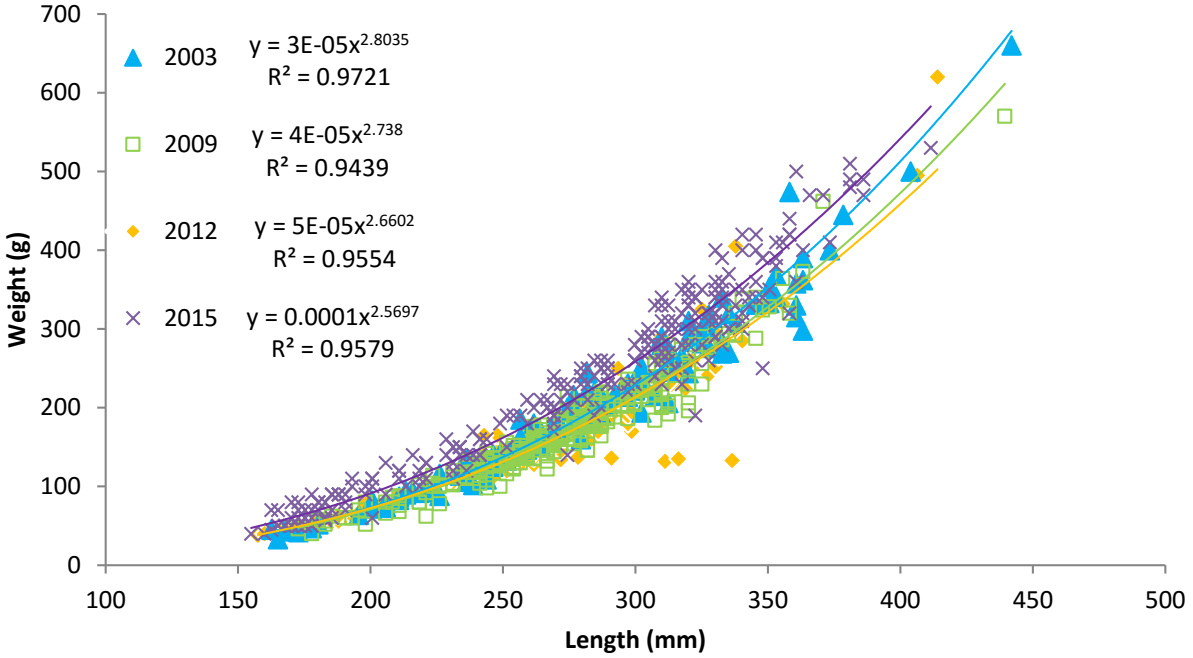


Figure 2-6 illustrates the weight-length relationships for all rainbow trout captured via angling and gillnetting in 2003, 2009, 2012, and 2015. The non-linear regression line and equation are provided for each year (*see* Figure 2-6). The functional exponent *b* is less than 3.0 for each year (range 2.6–2.8) indicating fish are less rotund as length increases. In 2012, there are three fish that appear to be notable outliers in the weight-length relationship. These fish measured 311 mm (12.2 inches), 336 mm (13.2 inches), and 316 mm (12.4 inches) in length and 132 g, 133 g, and 135 g (approximately 0.3 pound [lb]) in weight, respectively. Compared to other fish captured in 2012, the majority of fish measuring between 311 and 336 mm (12.2 and 13.2 inches) in length weighed between 240 and 350 g (0.5 and 0.8 lb). These three individual fish were substantially less rotund than what was typically observed in the 2012 sample, as well as in 2015, 2009, and 2003 samples.

2.2.4 *Condition of Fish*

The literature often refers to three condition indices, including Fulton's condition factor (Ricker, 1975), relative condition factor (K_n) (Le Cren, 1951 as cited in Anderson and Neumann, 1996), and relative weight (W_r) (Wege and Anderson, 1978 as cited in Anderson and Neumann, 1996). Each condition index has set assumptions about the sample weight-length relationships that often make these indices difficult to use (Cone, 1989).

To address condition and statistically compare fitness of rainbow trout sampled in Mystic Lake each year (2003, 2009, 2012, and 2015), an ordinary least-squares regression was calculated using the log-transformed weight-length data (Cone, 1989; Pope and Kruse, 2007). Below is a summary of the results.

The analysis included calculating the linear regression of the weight-length data after the logarithmically transforming the data for each sample year. The transformed weight-length data provides a more precise estimation of fish weight than can be obtained by nonlinear regression of the untransformed data and is a useful tool for inferring changes in overall condition (weight) (Pope and Kruse, 2007). The transformed equation is:

$$\mathbf{Log_{10}\,(W) = b*Log_{10}(L) + a}$$

where *W* is the weight in grams, *L* is the length in millimeters, *b* is the slope and *a* is the intercept. Figure 2-7 provides a graphical view of the logarithmic weight-length relationship and the linear regression equation.

Figure 2-7: Logarithmic weight–length relationship and linear regression equation for rainbow trout in Mystic Lake in 2003, 2009, 2012, and 2015.

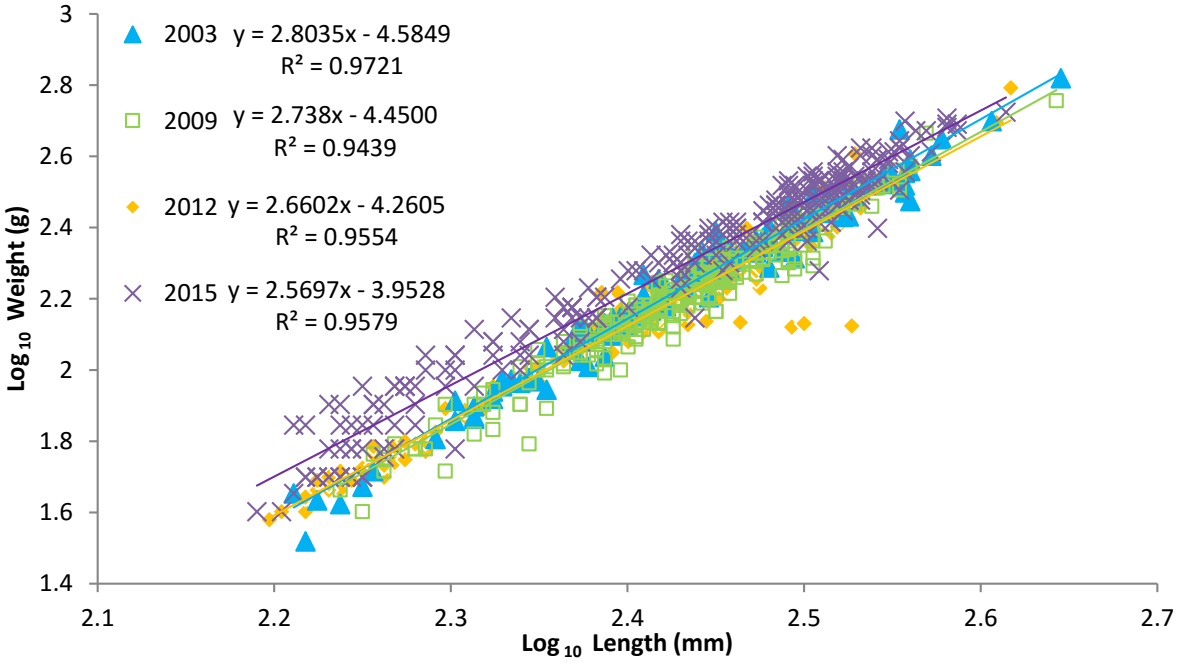


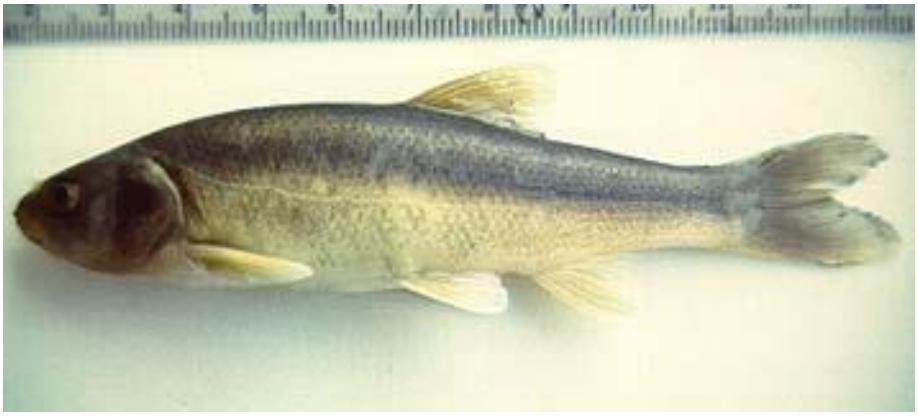
Table 2-2 provides a summary of the regression analysis for each year of sampling. Between 2003 and 2012, there was no discernable differences in condition of fish based on the regression analysis with the predicted weight for a 250 mm fish estimated to be between 130 and 137 g. In 2015, fish condition appeared to increase with the estimated weight for a fish measuring 250 mm at approximately 162 g.

Table 2-2: Summary of the regression analysis completed for rainbow trout collected in Mystic Lake in 2003, 2009, 2012, and 2015.

Parameter	2003	2009	2012	2015
Sample Size (N)	132	282	186	260
Intercept *a* (+/- 95% CI)	-4.58 (+/- 0.20)	-4.45 (+/- 0.19)	-4.26 (+/-0.10)	-3.95 (+/-0.08)
Slope *b* (+/- 95% CI)	2.80 (+/- 0.083)	2.74 (+/- 0.079)	2.66 (+/- 0.042)	2.57 (+/-0.034)
Standard Error	0.04058	0.04086	0.05414	0.05817
R Square	0.954	0.972	0.9554	0.9579
P – value	<0.0001	<0.0001	<0.0001	<0.0001
Example: Fish L=250 mm	**W = 137 g**	**W = 130 g**	**W = 131 g**	**W=162 g**
Note that the sample size for the regression analysis varied from the overall number of fish captured per sample event because not all fish recorded included measurements of both length and weight.				

2.2.5 *Utah Chub*

Utah chub were introduced into Hebgen Lake, Montana in the early 1930s and have since dispersed downstream in the Madison River/Missouri River drainages (Holton and Johnson, 2003). The Utah chub were introduced into Hebgen Lake from a fisherman's bait bucket (MNHP, 2012). Below is a photograph of a Utah chub (UDWR, 2012).



Photograph 2-1: Utah chub (UDWR, 2012).

2.2.5.1 Life History

The Utah chub is a minnow native to Utah in the Bonneville Basin and the upper Snake River drainage in Wyoming and Idaho (Brown, 1971). Utah chub are omnivorous fish that can grow up to 907 grams (2 lbs) (MNHP and FWP, 2012). Utah chub feed primarily on zooplankton when young (until approximately 152.4-177.8 mm [6-7 inches] in length) and then consume a variety of foods including macroinvertebrates, mollusks, fish, and plant material (UDWR, 2012). Male Utah chub reach maturity in 3 years with females reaching maturity at 4 years of age (Brown, 1971). The following table (Table 2-3) identifies the approximate size and associated age class of Utah chub in Montana (Brown, 1971).

Table 2-3: Utah chub approximate age class and size in Montana (Brown, 1971).

Age	Length (mm)	Length (inches)
1	38.1	1.5
2	88.9	3.5
3	152.4	6
4	203.2	8
5	241.3	9.5
6	279.4	11
7	317.5	12.5
8	342.9	13.5

Spawning takes place from mid-May through mid-August in Montana when water temperatures exceed 12.2 °C (54 °F), with peaks in late June through early July (MNHP and FWP, 2012). Female Utah chub broadcast eggs in shallow water over various substrates and the eggs hatch in approximately 1 week (UDWR, 2012). Utah chub are considered an undesirable species as they have become very abundant in some areas and may compete for food with trout (MNHP and FWP, 2012).

The habitat of Utah chub includes streams and lakes with maximum temperatures ranging from 15.6 to 31.1 °C (60 – 88 °F) (Brown, 1971). The Utah chub prefers slow-moving or still water with areas maintaining abundant aquatic macrophytes (Holton and Johnson, 2003). Utah chub spawn in littoral waters typically less than 0.6 m (2 feet) deep (Brown, 1971). Areas of rooted aquatic macrophytes are important as spawning and rearing areas for Utah chub (MNHP and FWP, 2012).

2.2.5.2 Utah Chub in Mystic Lake

On August 6 and 7, 2012, five Utah chub were captured during gillnetting efforts in Mystic Lake (Table 2-4). This was the first time this species was recorded or observed in Mystic Lake and in the West Rosebud River drainage.

Table 2-4: Summary of the Utah chub recorded during the gillnetting efforts in Mystic Lake in 2012.

Date	Gillnet ID	Location	Length (inches)	Length (mm)	Weight (g)
8/6/2012	1	Upper Mystic	5.7	145	35
8/6/2012	2	Upper Mystic	6.1	155	36
8/6/2012	4	Upper Mystic	6.4	163	40
8/6/2012	5	Upper Mystic	6.2	157	42
8/7/2012	9	Lower Mystic	6.7	170	40

An age analysis was completed by FWP in 2013/14 based on scales and otoliths taken from each fish sampled from Mystic Lake in 2012. The age evaluation indicated that four of the five fish were age 2 and one was estimated to be age 1. Aging fish via scales proved challenging and the

accuracy of the age estimates is unknown. When comparing the estimated age from the scales/otoliths to the length-at-age relationship developed for Utah chub in the Madison River drainage (*refer to* Table 2-3), the Utah chub were estimated to be older and likely closer to age 3. If the Utah chub sampled in Mystic Lake in 2012 were approximately 3 years old (approximately 152.4 mm [6 inches] in length), this suggests that these fish were likely at or near spawning age (3 years old for males, 152.4 mm [approximately 6 inches long] and 4 years old for females, approximately 203.2 mm [8 inches] long).

During the 2013 TAC meeting, the TAC agreed to target sample for Utah chub during the summer of 2014. The objective of the sampling was to verify the species identification. FWP and the Licensee set five nets in September 2014, which resulted in the capture of 73 rainbow trout and two Utah chub. The two Utah chub specimens measured 155 mm and 170 mm. The Utah chub specimens were transported and delivered to Dr. Bramblett of Montana State University in Bozeman, Montana to confirm the species identification. Dr. Bramblett concluded that the specimens were Utah Chub based on fin ray counts and lack of barbels (B. Bramblett, MSU, personal communication, 2015). The specimens remain frozen an in possession of USFS Custer Gallatin National Forest office in Livingston, Montana in the event that any additional analysis or evaluation is requested/required.

2.2.5.3 Utah Chub Habitat in Mystic Lake

Mystic Lake appears to provide suitable habitat for Utah spawning. Areas of shallow water, 0.6-meter-deep, (< 2 feet) that are identified as spawning habitat for Utah chub are present around the shoreline of Mystic Lake. Preferred spawning and rearing habitat for Utah chub also includes areas with abundant aquatic macrophytes. A pedestrian survey of the Mystic Lake shoreline identified very few aquatic macrophytes with presence limited to the upper lake near the inlet. Although a comprehensive distribution and density survey for aquatic macrophytes has not been completed at Mystic Lake, the distribution and presence of aquatic macrophytes is likely rare and limited in Mystic Lake. The annual lake draw down of 30 feet may limit the presence of aquatic macrophytes in the lake.

Mystic Lake thermal conditions provide an opportunity for the establishment of a Utah chub population. Assuming 12.2 °C (54 °F) is the thermal minimum for Utah chub spawning (as reported for Hebgen Lake, Montana), Mystic Lake surface water temperatures typically exceed 12.2 °C (54 °F) beginning the first part of July and extending into September (PPL Montana, 2004; 2010a; 2013a). Thermal conditions during the summer in Mystic Lake appear to provide a period of time suitable for Utah chub spawning, although the spawning season may be delayed until July and shorter in duration than in Hebgen Lake. An abbreviated spawning season (July through August *vs*. mid-May through August) may limit the establishment for Utah chub in Mystic Lake.

3. West Rosebud Creek Bypass Fisheries

As part of the relicensing effort for the Mystic Hydroelectric Project, studies were completed in 2004 to determine the status of the fisheries in the bypass reach of West Rosebud Creek, which extends downstream of Mystic Lake Dam to the powerhouse, and to evaluate the impacts of power production on the fishery. The fisheries data collected in 2004 indicated that current alterations in the hydrograph of West Rosebud Creek in the bypass reach did not cause substantial negative effects on the fish population (PPL Montana, 2004). Overall, in all four sections sampled in the bypass reach in 2004, the fishery appeared to be in excellent condition despite high gradient, very large substrate and low winter flows, and there appeared to be suitable habitat for spawning, rearing, and over-wintering.

Between 2010 and 2015, the Fisheries Monitoring Plan included monitoring activities in the lower bypass reach (first reach surveyed in 2004) and upper bypass reach (third reach surveyed in 2004) once every 3 years (PPL Montana, 2010). Monitoring activities were scheduled for 2011 and 2014. The first year of monitoring was completed in 2011 and 2012 (PPL Montana, 2012 and 2013) and the second year of monitoring was completed in 2014 (NorthWestern, 2015). Due to equipment issues in 2011, FWP re-surveyed both reaches in 2012. The lower and upper bypass reaches are illustrated in Figure 1-1.

3.1 Data Collection

On September 23, 2011, the upper bypass reach was electrofished and a multi-pass depletion population estimate was completed. The population estimate was provided by FWP and the analysis was completed using FA+ software. However, due to equipment issues, the Licensee and FWP were unable to successfully complete the population estimate of the lower bypass reach. FWP scheduled to re-survey the bypass section in 2012. In 2012, FWP personnel electrofished the upper and lower reaches of the bypass section on September 12, 2012. Two passes were completed at each reach. Fish population estimates were completed using the Zippin K pass removal estimate. On September 14, 2014, FWP personnel (along with USFS and Licensee staff) surveyed the upper and lower bypass reaches via electrofishing. Details of the 2011, 2012, and 2014 sample events are provided in the respective annual report (PPL Montana, 2012; 2013; NorthWestern, 2015). The following text summarizes and compares results from the 2011, 2012, and 2014 electrofishing efforts in the upper and lower bypass reach.

3.2 Results – Upper Bypass

Rainbow trout is the only species of fish detected in the upper bypass reach. The rainbow trout population in the upper bypass reach appears to be stable with the population estimate ranging between 112 and 161 fish per 300 feet (123 and 176 fish per 100 meters) with the highest population estimate in 2014 and the lowest population estimate in 2012 (Table 3-1). The average

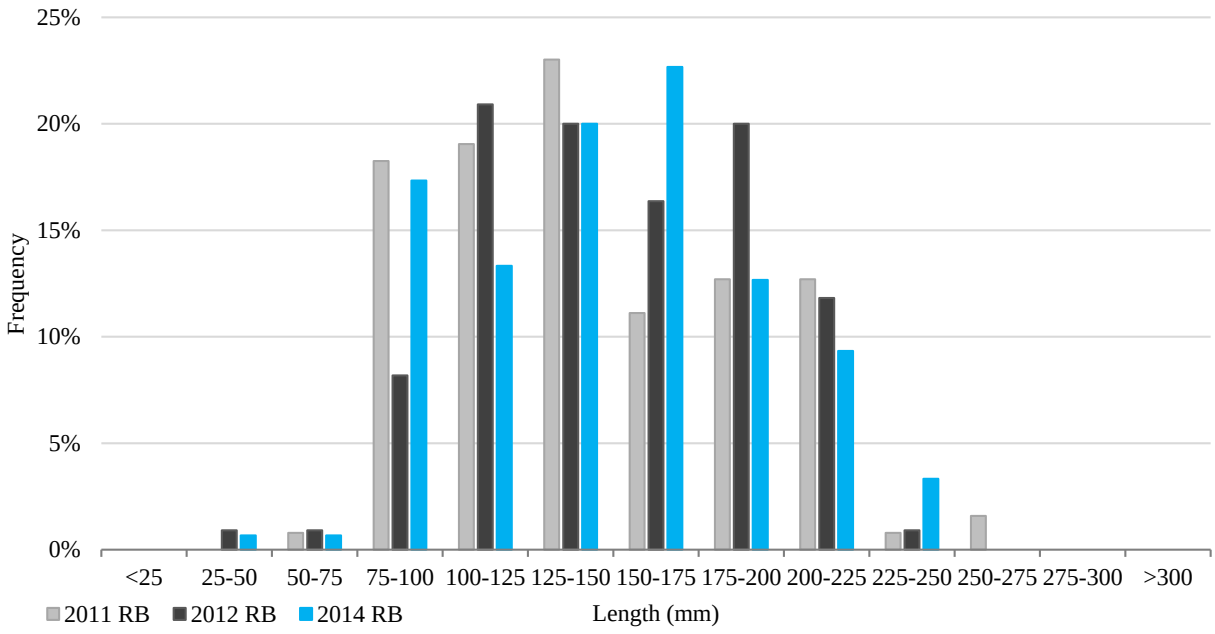
length of the rainbow trout sampled each year has also remained similar over the years, ranging between 145 mm (5.7 inches) and 151 mm (5.9 inches).

Table 3-1: Summary of the upper bypass reach sampling, including the species, sample year, population estimate per the 300-foot reach, population estimate per 100 meters, and upper confidence interval (UCI), and average length of sample size for efforts completed in 2011, 2012, 2014.

Year	Species	Population Estimate per 300 feet	Population Estimate per 100 meters	95% UCI	Avg. Length (mm)
2011	Rainbow	124	136	127	145
2012	Rainbow	112	123	116	151
2014	Rainbow	161	176	173	147

A summary of the length frequencies for rainbow trout observed in the upper bypass reach in September 2011, 2012, and 2014 is provided in Figure 3-1. The rainbow trout population in the upper bypass reach includes multiple age classes, which is a general indicator of a healthy system with a naturally reproducing and rearing population. The multiple age-class structure was also observed and recorded in previous sample years (2011, 2012) and in August 2004 by PPL Montana (2005).

Figure 3-1: Summary of the length frequencies by 25 mm length groups for the rainbow trout observed in the upper bypass reach in September 2011, 2012, and 2014.



3.3 Results - Lower Bypass

Two species of fish, including rainbow trout and brown trout (*Salmo trutta*) were observed in the lower bypass reach during surveys completed in 2012 and 2014. However, brown trout were less abundant than rainbow trout in this section (Table 3-2).

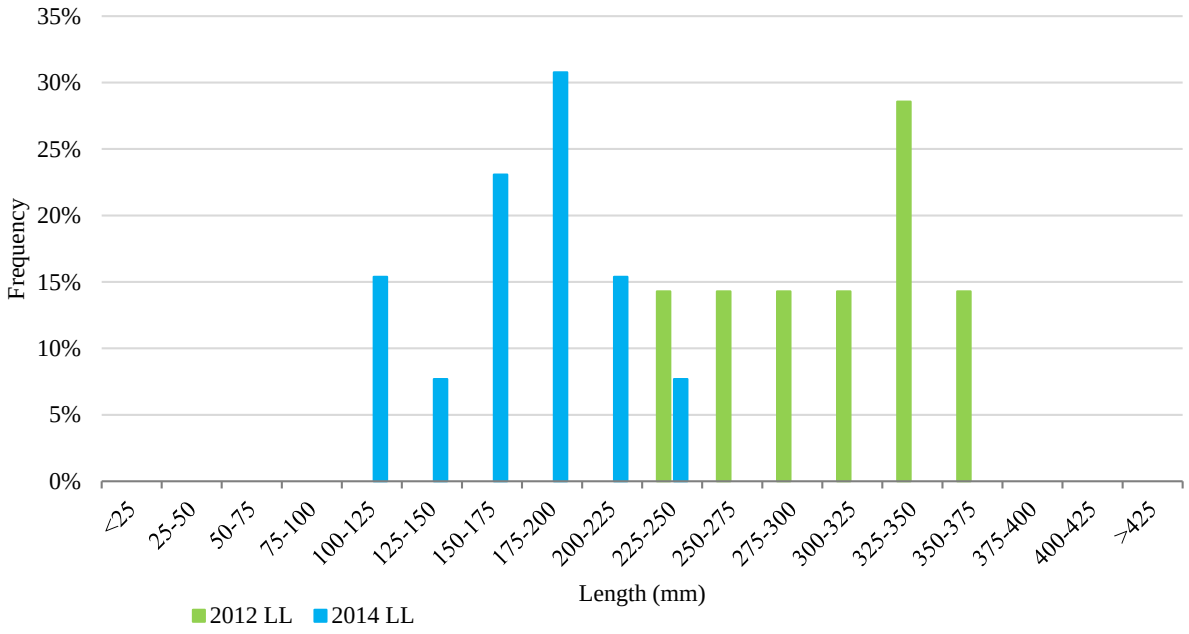
Population estimates for both species increased from 2012 to 2014. Rainbow trout population estimates increased from 30 fish per 300 feet (33 fish per 100 meters) in 2012 to 44 fish per 300 feet (48 fish per 100 meters) in 2014. Brown trout population estimates increased from 7 fish per 300 feet (8 fish per 100 meters) in 2012 to 15 fish per 300 feet (16 fish per 100 meters) in 2014.

While the brown trout population size increased over time (albeit still relatively low densities), the average size of brown trout in 2014 (174 mm; 6.9 inches) was nearly half the average calculated in 2012 (300 mm; 11.8 inches). The shift observed in the average size of brown trout from 2012 to 2014 was also observed in the length-frequency histogram in Figure 3-2.

Table 3-2: Summary of the lower bypass reach sampling, including the species, sample year, population estimate per the 300-foot reach, and upper confidence interval (UCI), and average length of sample size for efforts completed in 2012 and 2014.

Year	Species	Population Estimate per 300 feet	Population Estimate per 100 meters	95% UCI	Avg. Length (mm)
2012	Brown	7	8	8	300
2014	Brown	15	16	19	174
2012	Rainbow	30	33	34	170
2014	Rainbow	44	48	48	169

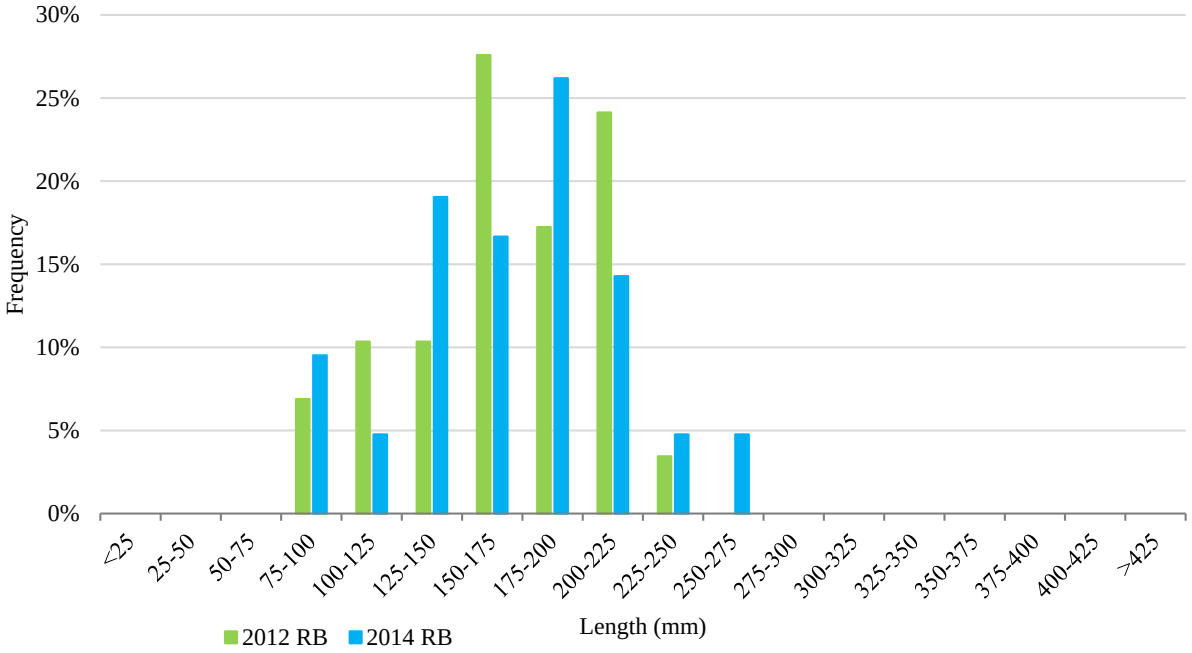
Figure 3-2: Summary of the length frequencies by 25 mm length groups for the brown trout observed in the lower bypass reach in September 2012 and 2014.



The population estimate for rainbow trout in 2014 increased from 2012 while the average size of rainbow trout in 2014 remained similar to 2012 (*see* Table 3-2). The length-frequency histogram

for rainbow trout provided in Figure 3-3, show the similar age-class structure for rainbow trout in the lower bypass reach in 2012 and 2014. No data is available for 2011 due to equipment issues during sampling.

Figure 3-3: Summary of the length frequencies by 25 mm length groups for the rainbow trout (RB) observed in the lower bypass reach in September 2012 and 2014.



4. West Rosebud and Emerald Lake Fisheries

As outlined in the 2010-2015 Fisheries Monitoring Plan (PPL Montana, 2010), West Rosebud Lake and Emerald Lake fish populations were scheduled for sampling every other year. Data were collected during the relicensing process in 2006 and 2008, and continued every other year once the license was issued in 2010. Data collected in 2006, 2008, and 2010 were summarized in the 2010 Annual Fisheries Monitoring Report (PPL Montana, 2011). Data collected in 2012 were summarized in the 2012 Annual Fisheries Report (PPL Montana, 2013) and data collected in 2014 were summarized in the 2014 Annual Fisheries Report (NorthWestern, 2015). Below is an overview of the data collected between 2006 and 2014.

4.1 Data Collection

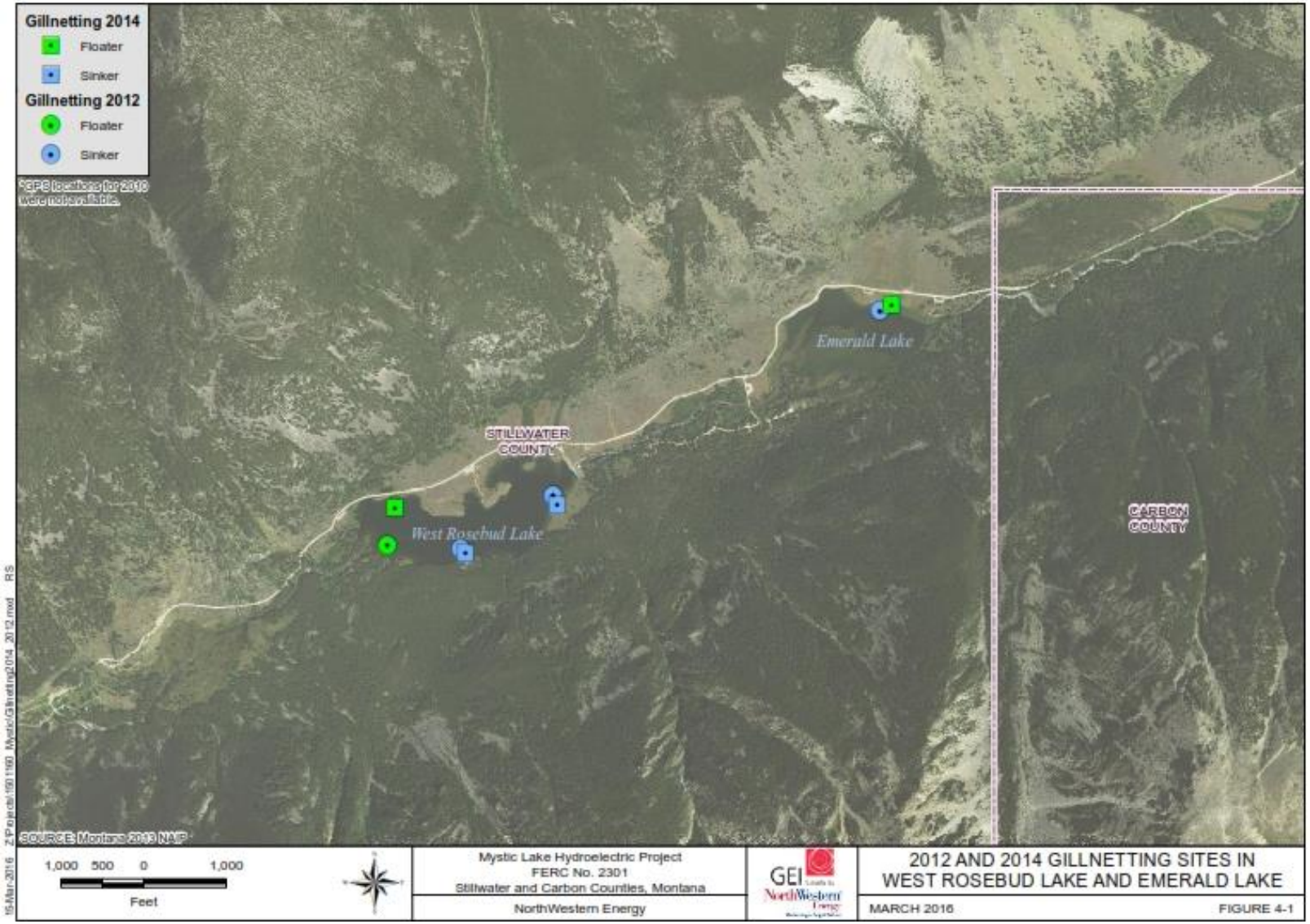
Sampling conducted by FWP in West Rosebud and Emerald lakes has been used as a trend indicator of relative changes to the fish assemblages. Sampling efforts in 2010, 2012, and 2014 were completed using floating and sinking experimental gillnets (one floater and two sinkers in West Rosebud Lake, one sinker in Emerald Lake) in standardized locations (Figure 4-1).

In 2010, 2012, and 2014, FWP and USFS personnel sampled fish populations in West Rosebud and Emerald lakes in early May. Gillnetting efforts were implemented between May 7 and May 11 during each sample year. Gillnets were set for approximately 17 to 18 hours in West Rosebud Lake and approximately 17 to 21 hours in Emerald Lake during each sampling event.

Biological data collected includes species length and weight. Scales for aging were not collected. The CPUE was calculated combining the total hours for the three nets in West Rosebud Lake and total hours for the one sinker net in Emerald Lake.

FWP stock West Rosebud Lake and Emerald Lake with fish annually to support recreational fishing. Although stocking records for West Rosebud Lake and Emerald Lake date back to 1931 and 1930, respectively, stocking data from FWP's Montana Fisheries Information System (MFISH) were evaluated for the period between 2005 to 2014. Stocking history is presented for West Rosebud Lake in Table 4-1 and for Emerald Lake in Table 4-2.

Figure 4-1: 2012 and 2014 gillnetting sites in West Rosebud Lake and Emerald Lake.



4.2 West Rosebud Lake – Fish Stocking

Three species of fish have been stocked in West Rosebud Lake since 2005, including rainbow trout, Arctic grayling (*Thymallus arcticus*), and Yellowstone cutthroat trout (Table 4-1). Rainbow trout were stocked annually, Yellowstone cutthroat trout were stocked annually since 2011, and Arctic grayling were only stocked once in 2009.

In August 2009, approximately 270 Arctic grayling (average 241 mm or 9.5 inches) were stocked in West Rosebud Lake (Table 4-1). At least a few of these fish overwintered in West Rosebud Lake and were collected in the gillnet samples collected the following May (2010) (PPL Montana, 2011). A total of 4,638 Yellowstone cutthroat were stocked in West Rosebud Lake since 2011 with an average size of 151 mm (5.9 inches). Between 2005 and 2014, 30,202 rainbow trout with an average size of approximately 199 mm (7.8 inches) were stocked in West Rosebud Lake. On average, approximately 3,020 rainbow trout are stocked in West Rosebud Lake annually.

Table 4-1: Summary of fish stocking in West Rosebud Lake from 2005 through 2014. (Source: MFISH, http://fwp.mt.gov/fip/plants/plant_input.action).

Date	Species	Number	Avg. Length (mm)
5/19/2005	RB	1,012	201
6/14/2005	RB	1,012	175
7/15/2005	RB	1,137	185
2005 Total		**3,161**	
5/3/2006	RB	1,018	175
6/22/2006	RB	1,000	185
7/21/2006	RB	1,022	183
2006 Total		**3,040**	
5/4/2007	RB	1,036	178
6/20/2007	RB	998	188
7/25/2007	RB	821	211
2007 Total		**2,855**	
5/13/2008	RB	1,002	185
6/24/2008	RB	1,000	180
7/16/2008	RB	855	191
2008 Total		**2,857**	
5/22/2009	RB	1,008	206
6/29/2009	RB	1,006	180
7/20/2009	RB	1,004	206
8/19/2009	GR	270	241
2009 Total		**3,288**	
5/19/2010	RB	1,006	193
6/28/2010	RB	1,019	194

Date	Species	Number	Avg. Length (mm)
7/20/2010	RB	1,012	210
2010 Total		**3,037**	
5/18/2011	RB	1,013	222
8/17/2011	RB	2,008	195
10/13/2011	YCT	1,015	146
2011 Total		**4,036**	
5/14/2012	RB	1,126	258
6/25/2012	RB	1,008	225
7/18/2012	RB	1,007	252
10/10/2012	YCT	1,578	141
2012 Total		**4,719**	
5/13/2013	RB	1,013	213
6/24/2013	RB	1,000	191
7/13/2013	RB	1,036	196
10/11/2013	YCT	1,090	164
2013 Total		**4,139**	
5/5/2014	RB	1,021	186
6/23/2014	RB	1,004	194
7/16/2014	RB	998	211
10/10/2014	YCT	955	152
2014 Total		**3,978**	

4.3 Emerald Lake – Fish Stocking

As in West Rosebud Lake, Arctic grayling were also stocked once in Emerald Lake in 2009 [200 fish with an average length of 241 mm (9.5 inches)]. However, no Arctic grayling were observed during gillnetting efforts in Emerald Lake in 2010, 2012, or 2014. Rainbow trout were the only other species stocked in Emerald Lake between 2005 and 2014. An average of 1,752 rainbow trout, with an average length of 193 mm (7.6 inches), were stocked annually between 2005 and 2014. During this time period, a grand total of 17,521 rainbow trout were stocked in Emerald Lake.

Table 4-2: Summary of fish stocking in Emerald Lake from 2005 through 2014. (Source: MFISH, http://fwp.mt.gov/fip/plants/plant_input.action)

Date	Species	Number	Avg. Length (mm)
5/19/2005	RB	607	201
6/14/2005	RB	604	175
7/15/2005	RB	682	185
2005 Total		**1,893**	
5/3/2006	RB	603	175

Date	Species	Number	Avg. Length (mm)
6/22/2006	RB	606	178
7/21/2006	RB	614	183
2006 Total		**1,823**	
5/4/2007	RB	612	178
6/20/2007	RB	603	188
7/25/2007	RB	495	211
2007 Total		**1,710**	
5/13/2008	RB	812	185
6/24/2008	RB	800	180
7/16/2008	RB	118	191
2008 Total		**1,730**	
5/22/2009	RB	600	206
6/29/2009	RB	602	180
7/20/2009	RB	607	206
8/19/2009	GR	200	241
2009 Total		**2,009**	
5/19/2010	RB	604	193
6/28/2010	RB	623	194
7/20/2010	RB	616	210
2010 Total		**1,843**	
5/18/2011	RB	600	222
7/7/2011	RB	606	206
7/25/2011	RB	608	216
2011 Total		**1,814**	
5/15/2012	RB	652	259
6/25/2012	RB	612	225
7/18/2012	RB	600	252
2012 Total		**1,864**	
5/13/2013	RB	595	213
7/17/2013	RB	600	196
2013 Total		**1,195**	
5/5/2014	RB	638	186
6/23/2014	RB	603	194
7/16/2014	RB	599	211
2014 Total		**1,840**	

4.4 West Rosebud Lake – Fisheries

The biennial gillnetting efforts in West Rosebud Lake between 2006 and 2014 have resulted in 87 to 185 fish captured per sampling event. Five species, including brook trout (*Salvelinus fontinalis*), brown trout, rainbow trout, mountain whitefish, and longnose sucker (*Catostomus*

catostomus) were observed during each sampling event with the addition of Arctic grayling also observed in 2010 and two Yellowstone cutthroat trout observed in 2014.

A summary of the gillnetting data including the species, number of fish captured, catch rate (per hour), average length, range of lengths, average weight, and range of weights from 2006, 2008, 2010, 2012, and 2014 is provided in Table 4-3. Gillnetting efforts in West Rosebud Lake occur in early May and generally prior to annual stocking efforts implemented by FWP in May, June, and July (*refer to* Table 4-1). Thus the gillnetting efforts likely do not capture the influx of fish into the system via stocking.

Table 4-3: Summary of gillnetting data (cumulative net hours for all 3 nets), including species (LL=brown trout, EB=brook trout, RB=rainbow trout, MWF=mountain whitefish, GR=Arctic grayling, LN SU=longnose sucker, YCT = Yellowstone cutthroat trout), number captured, net hours, catch rate per hour, average length, range of lengths, average weight, range of weight, collected in May 2006, 2008, 2010, 2012, 2014 in West Rosebud Lake

2006 Species	Number Caught	Net hours	No. Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	21	54	0.39	310	218-460	304	NA
EB	39	54	0.72	324	221-399	386	NA
RB	14	54	0.26	264	236-302	195	NA
MWF	33	54	0.61	361	244-498	481	NA
LN SU	9	54	0.17	341	246-442	449	NA

2008 Species	Number Caught	Net hours	No. Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	67	55.5	1.21	297	152-541	308	64-1,533
EB	59	55.5	1.06	296	185-373	318	36-671
RB	7	55.5	0.13	267	264-274	186	163-263
MWF	30	55.5	0.54	335	236-498	381	73-1,084
LN SU	22	55.5	0.40	357	188-485	603	91-1,338

2010 Species	Number Caught	Net hours	No. Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	63	53.41	1.18	300	225-386	236	104-540
EB	27	53.41	0.51	269	188-338	200	54-363
RB	7	53.41	0.13	267	241-290	191	122-249
MWF	31	53.41	0.58	336	295-401	340	213-553
GR	5	53.41	0.09	272	246-292	163	118-218
LN SU	16	53.41	0.30	377	300-457	630	304-1,080

2012 Species	Number Caught	Net hours	No. Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	24	52.45	0.46	325	239-676	431	136-2,722
EB	29	52.45	0.55	277	163-328	249	45-417
RB	4	52.45	0.08	254	246-274	163	136-204
MWF	13	52.45	0.25	351	249-401	445	145-617
LN SU	17	52.45	0.32	338	185-452	508	145-1,106

2014 Species	Number Caught	Net hours	No. Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	37	53.4	0.69	331	244-564	380	172-1,919
EB	40	53.4	0.75	293	241-340	287	154-440
RB	8	53.4	0.15	239	185-307	168	91-259
MWF	11	53.4	0.21	353	305-404	452	263-626
LN SU	13	53.4	0.24	338	229-411	518	150-885
YCT	2	53.4	0.04	253	244-262	177	181-626

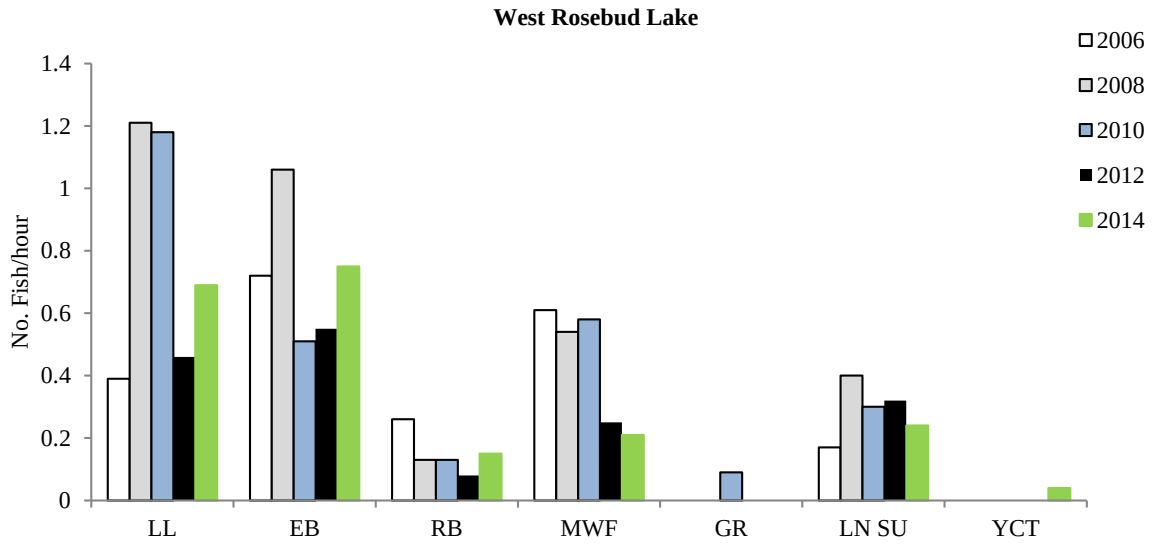
The number of fish captured per hour via gillnetting in West Rosebud Lake varied by species and years (Figure 4-2). The 2014 catch per unit effort for brook trout, brown trout, and rainbow trout increased slightly from 2012 rates, while rates for mountain whitefish and longnose suckers were slightly lower in 2014 than 2012. The catch rates for mountain whitefish in 2012 and 2014 were approximately half the catch rates observed in 2006, 2008, and 2010. Overall, the CPUE for brown trout, brook trout, rainbow trout, and longnose suckers in 2014 were all within the range of values observed in previous years. After 3 years of annual stocking, Yellowstone cutthroat trout were recorded for the first time during the gillnet survey (*refer to* Table 4-1). Arctic grayling were only detected in 2010 and stocking has not occurred since 2008.

The average length of all fish species captured between 2006 and 2014 ranged between 239 mm (9.4 inches) and 377 mm (14.8 inches). The average length of brown trout was the greatest in 2014 compared to previous sample years. The average length of brook trout and mountain whitefish increased slightly in 2014 from 2012. The average length for longnose suckers remained the same in 2014 as in 2012, while the average length for rainbow trout in 2014 declined from previous years. Yellowstone cutthroat trout average length was within the range observed for rainbow trout between 2006 and 2014.

The average weight of fish (Table 4-3) showed similar trends as the average length and ranged between 163 g (0.4 lb) and 630 g (1.4 lbs) for all species sampled between 2006 and 2014. The average weight for brook trout, rainbow trout, mountain whitefish, and longnose suckers was greater in 2014 than in 2012. The average weight for brown trout declined slightly in 2014 from the 2012 average, but remained greater than previous sample years (2006, 2008, and 2010).

Overall the average weight measured in 2014 was within the range of values observed in previous sample years.

Figure 4-2: Number of fish, by species, caught per hour gillnetting in 2006, 2008, 2010, 2012, 2014 in West Rosebud Lake. (LL=brown trout, EB=brook trout, RB=rainbow trout, MWF=mountain whitefish, GR=Arctic grayling, LN SU=longnose sucker, YCT = Yellowstone cutthroat trout).



4.5 Emerald Lake Fisheries

In Emerald Lake, biennial gillnetting efforts between 2006 and 2014 resulted in 37 to 58 fish captured per sampling event. As in West Rosebud Lake, five species, including brook trout, brown trout, rainbow trout, mountain whitefish, and longnose suckers were observed each sampling year, with the exception of 2008 when no rainbow trout were sampled and in 2014 when no brook trout were sampled. In 2014, 37 fish were captured during gillnetting and brown trout were the most common species sampled.

A summary of the gillnetting data including the species, number of fish captured, catch rate (per hour), average length, range of lengths, average weight, and range of weights from 2006, 2008, 2010, 2012, and 2014 is provided in Table 4-4. Gillnetting efforts in Emerald Lake occur in early May and generally prior to annual stocking efforts implemented by FWP (*refer to* Table 4-2). Thus the gillnetting efforts likely do not capture the influx of fish into the system via stocking.

The average length of all species captured since 2006 has ranged between 188 mm (7.4 inches) and 410 mm (16.1 inches). The average length of brown trout, mountain whitefish, and longnose suckers in 2014 was either within the range of averages observed in previous sample years or greater. The average length of rainbow trout was the only species observed in 2014 with a decline from previous sample years.

Table 4-4: Summary of gillnetting data, including species (LL=brown trout, EB=brook trout, RB=rainbow trout, MWF=mountain whitefish, LN SU=longnose sucker), number captured, net hours, catch rate per hour, average length, range of lengths, average weight, range of weight, collected in May 2006, 2008, 2010, 2012, and 2014 in Emerald Lake.

2006 Species	Number Caught	Net hours	Number Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	30	21	1.43	361	196-490	640	73-6,214
EB	15	21	0.71	321	246-371	354	172-540
RB	2	21	0.10	310	269-351	340	209-472
MWF	9	21	0.43	358	315-409	426	290-599
LN SU	1	21	0.05	381	381	649	649

2008 Species	Number Caught	Net hours	Number Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	15	21.5	0.70	358	112-625	585	14-2,268
EB	13	21.5	0.60	316	221-386	345	59-585
MWF	20	21.5	0.93	369	203-470	553	118-1,039
LN SU	2	21.5	0.09	387	356-419	708	485-925

2010 Species	Number Caught	Net hours	Number Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	6	17.5	0.34	280	183-348	254	59-399
EB	21	17.5	1.20	284	125-399	299	23-708
RB	2	17.5	0.11	267	226-307	227	122-331
MWF	18	17.5	1.03	395	343-506	621	417-1,166
LN SU	11	17.5	0.63	380	345-434	680	417-989

2012 Species	Number Caught	Net hours	Number Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	18	18.75	0.96	333	201-506	408	73-1,202
EB	8	18.75	0.43	274	188-345	231	45-431
RB	3	18.75	0.16	343	249-480	508	132-1,143
MWF	8	18.75	0.43	188	180-198	59	45-73
LN SU	1	18.75	0.05	302	302	336	336

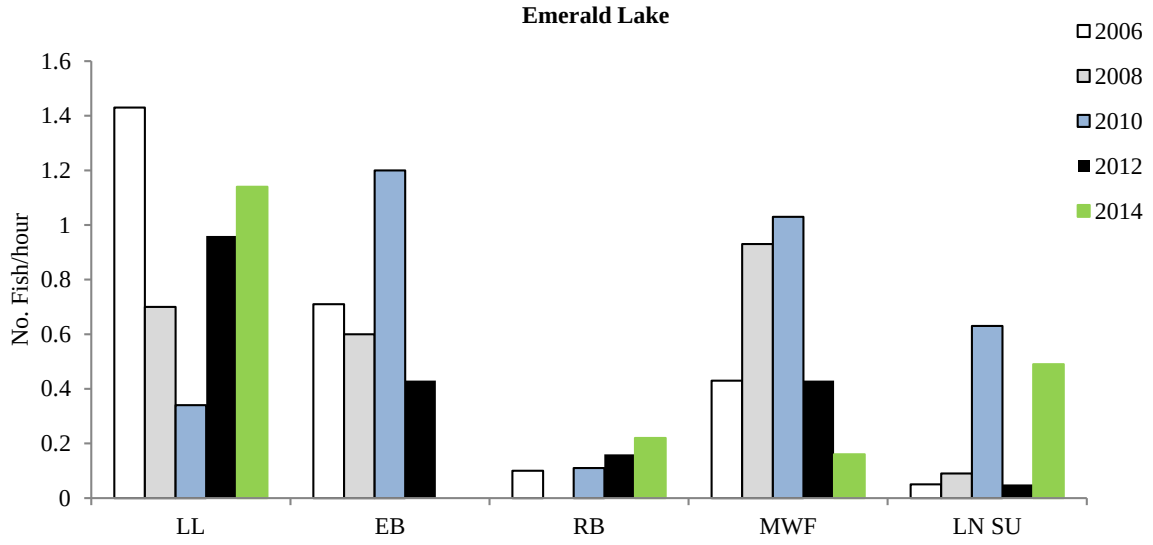
2014 Species	Number Caught	Net hours	Number Fish/hour	Avg. Length (mm)	Range Length (mm)	Avg. Weight (g)	Range Weight (g)
LL	21	18.5	1.14	361	292-389	454	227-562
EB	-	18.5	-	-	-	-	-
RB	4	18.5	0.22	204	196-211	109	100-127
MWF	3	18.5	0.16	388	338-447	611	372-943
LN SU	9	18.5	0.49	410	333-462	906	503-1,225

The average weight and length of fish captured in Emerald Lake showed similar trends between 2006 and 2014 (Table 4-4). When the average length of a fish declined or increased, the average weight also declined or increased. The average weigth of brown trout and mountain whitefish in 2014 were within the averages recorded in previous sample years. As with the average length, the average weight of longnose suckers in 2014 was greater than all previous sample years. The average weight of rainbow trout in 2014 was less than previous sample years.

The number of fish captured per hour via gillnetting in Emerald Lake varied by species and year (Figure 4-3). Catch per unit effort (fish per hour) was greater in 2014 for brown trout, rainbow trout, and longnose suckers compared to 2012. Rainbow trout catch rate in 2014 was greater than all previous sample years, but still relatively low compared to other species. Brown trout and longnose suckers catch per unit effort in 2014 were the second highest (highest value was in 2006 and 2010, respectively) compared to all sample years. Mountain whitefish catch rate declined in 2014 and was the lowest recorded in all sample years. No brook trout were sampled in 2014 and previous sample years had resulted in relatively low catch rates for brook trout (0.4-1.2 brook trout per hour).

Although rainbow trout catch rates increased in 2014 (Figure 4-3), the average size of rainbow trout was smaller than previous sample years (Table 4-4). In contrast, brown trout and longnose suckers catch rates increased in 2014 along with the average size of each species. Mountain whitefish catch rates declined in 2014, but their average size increased.

Figure 4-3: Number of fish, by species, caught per hour gillnetting in 2006, 2008, 2010, 2012, and 2014 in Emerald Lake. (LL=brown trout, EB=brook trout, RB=rainbow trout, MWF=mountain whitefish, LN SU=longnose sucker).



5. West Rosebud Creek Water Temperature

West Rosebud Creek temperature monitoring was scheduled to occur concurrently with West Rosebud Lake and Emerald Lake fish surveys (2010, 2012, and 2014). The stream temperature monitoring time period extended from April to late October at four designated sites, including West Rosebud Creek in the upper bypass (below Mystic Lake), West Rosebud Creek above the powerhouse (APH), West Rosebud Creek below the powerhouse (BPH), and West Rosebud Creek below West Rosebud Lake/Re-regulation Dam (BWRL) (*refer to* Figure 1-1).

5.1 Data Collection

Stream temperature data were recorded in West Rosebud Creek in 2010, 2012, and 2014. The majority of the temperature data recorded information from early April through October, but in some instances the data collection periods in 2010 and 2012 were reduced in some sites due to equipment issues (Table 5-1). In 2010, stream temperature data were collected in 30-minute increments, while in 2012 and 2014 stream temperature data were collected in 15-minute increments. Data were collected using HOBO water temperature Pro v2 Data Loggers.

In 2010, there were some technical issues with the temperature loggers used to collect temperature data from APH and BWRL in 2010. Thus, the upper bypass and the U.S. Geological Survey (USGS) gage station #06204070 at West Rosebud Creek below Emerald Lake were used to best represent these water stations and data were only available from three sites (upper bypass, BPH, and below Emerald Lake).

In 2014, the battery life for each temperature logger installed in the APH and BPH sites did not extend through the season, thus resulting in a shorter period of data collection. The temperature loggers used at the sites had internal lithium batteries that could not be replaced. NorthWestern proposes to use temperature loggers with replaceable batteries to remedy this issue during future monitoring efforts.

Table 5-1: Duration of water temperature analyzed in each of the sites along West Rosebud Creek in 2010, 2012, 2014.

West Rosebud Creek Sites	Start Date	End Data
Upper Bypass	May 29, 2014	October 31, 2014
	April 4, 2012	October 31, 2012
	May 4, 2010	October 29, 2010
APH	April 3, 2014	June 30, 2014
	April 4, 2012	October 31, 2012
BPH	April 3, 2014	July 17, 2014
	April 4, 2012	October 31, 2012
	April 7, 2010	July 17, 2010

West Rosebud Creek Sites	Start Date	End Data
BWRL	April 3, 2014	October 31, 2014
	April 4, 2012	October 31, 2012
Below Emerald Lake (USGS Gauge)	April 7, 2010	October 31, 2010

5.2 Maximum Weekly Maximum Temperature

One metric commonly used to assess the suitability of water temperature for aquatic life is the Maximum Weekly Maximum Temperature (MWMT), also known as the maximum 7-day average of the daily maxima (7DADM). This metric is often used as a standard because it describes the maximum temperatures in a stream, but is not overly influenced by the maximum temperature of a single day. Thus, it reflects an average of maximum temperatures that fish are exposed to over a week-long period (EPA, 2003).

A summary of the MWMT is provided in Table 5-2. The majority of the temperature data reflect data collected between April and October with the exception of the BPH site in 2010 and 2014, when data were only available between April and July 17 in both years, and in APH in 2014, when data were only available between April and June 30.

Table 5-2: Seasonal MWMT recorded at each monitoring site along West Rosebud Creek in 2010, 2012, 2014.

Year	MWMT (°C)			
	Upper Bypass	APH	BPH	BWRL
2010	15.0	No Data	12.0**	14.4*
2012	15.7	15.9	14.6	14.8
2014	14.5	10.2**	12.5**	13.1

*2010 Data is from USGS Gage #06204070
**Data only available through June/July

When comparing MWMT among monitoring years (2010, 2012, 2014), it appears that 2012 was the warmest water year and 2014 was the coolest water year. MWMT values in the West Rosebud Creek sites ranged between 14.6 °C and 15.9 °C (58.3 °F and 60.6 °F) in 2012 and MWMT ranged between 10.2 °C and 14.5 °C (50.4 °F and 58.1 °F) in 2014 (Table 5-2). Although, the temperature data for the 2014 season (April–October) were incomplete for the APH and BPH sites (data only recorded through June 30 and July 17, respectively), the data from the upper bypass and BWRL sites still indicate 2014 was a cooler water year compared to 2010 and 2012.

In West Rosebud Creek, the highest MWMT each year (2010, 2012, and 2014) was consistently recorded in the bypass reach, which recorded a MWMT between 14.5 °C and 15.7 °C (58.1 °F and 60.3 °F). The higher water temperatures in this reach are most likely due to the lower mass of the water body in the bypass reach. Mid-summer stream flow is higher downstream of the

powerhouse because water is conveyed from the intake at Mystic Lake to the powerhouse and released back to the creek immediately downstream of the powerhouse (circumventing the bypass reach). The intake is located at depth in Mystic Lake such that water starts out cooler in the summer. The higher stream flow downstream of the powerhouse results in a lower MWMT downstream of the powerhouse and downstream of West Rosebud Lake and Emerald lakes. MWMT downstream of the powerhouse (in BPH, BWRL sites) has remained less than 15 °C (59 °F) annually (Table 5-2).

5.3 Maximum Daily Temperature

A summary of the maximum daily temperature for each year (2010, 2012, and 2014) of stream temperature monitoring in West Rosebud Creek is provided in Table 5-3. The majority of the temperature data reflect data collected between April and October with the exception of the BPH site in 2010 and 2014 when data were only available between April and July 17 in both years and in APH in 2014 when data were only available between April and June 30. The maximum daily temperature recorded at all the sites in 2010, 2012, and 2014 was 16.2 °C (61.2 °F).

Table 5-3: Seasonal maximum daily water temperature recorded at each monitoring site along West Rosebud Creek in 2010, 2012, and 2014.

Year	Maximum Daily Temperature (°C)			
	Upper Bypass	APH	BPH	BWRL
2010	15.9	No Data	12.6**	14.8*
2012	16.1	16.2	15.2	15.6
2014	15.3	10.5**	13.3**	13.8

*2010 Data is from USGS Gage #06204070
**Data only available through June/July

In 2010, maximum daily stream temperatures were generally warmer downstream of Emerald Lake than in the upper bypass and BPH monitoring locations during the spring months (April, May, June) (Figure 5-1). Between April and June 2010, maximum daily temperatures ranged between freezing and 11.3 °C (52.3 °F). In July and August 2010, the maximum daily temperatures were similar among the three sites and ranged between 9.6 and 15.9 °C (49.3; 60.6 °F) at all locations. No 2010 data was available for the BPH site after July 17, 2010. Between late July and mid-August, maximum daily temperatures were greater in the upper bypass than below Emerald Lake, but did not exceed 16 °C (60.8 °F). From mid-August through October 2010, the converse was true and the maximum daily temperatures below Emerald Lake were consistently greater than those recorded in the upper bypass. Maximum daily temperatures from mid-August through October 2010, at both sites, remained below 14.8 °C (58.6 °F). In 2010, the differences in maximum daily temperatures between the upper bypass and below Emerald Lake were greatest in the spring.

Figure 5-1: Maximum daily stream temperatures recorded in West Rosebud Creek monitoring sites in 2010.

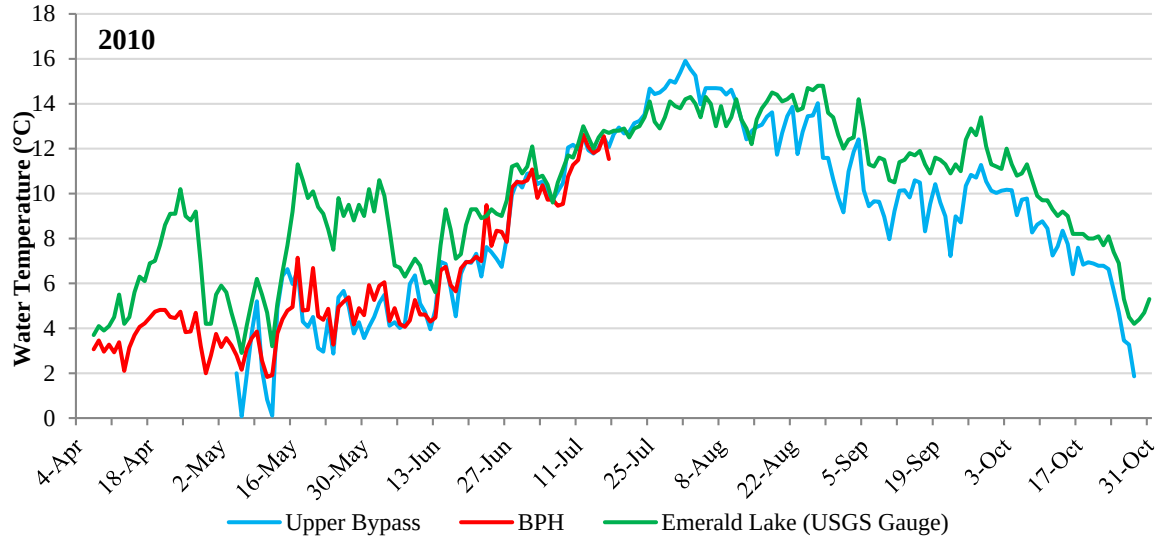
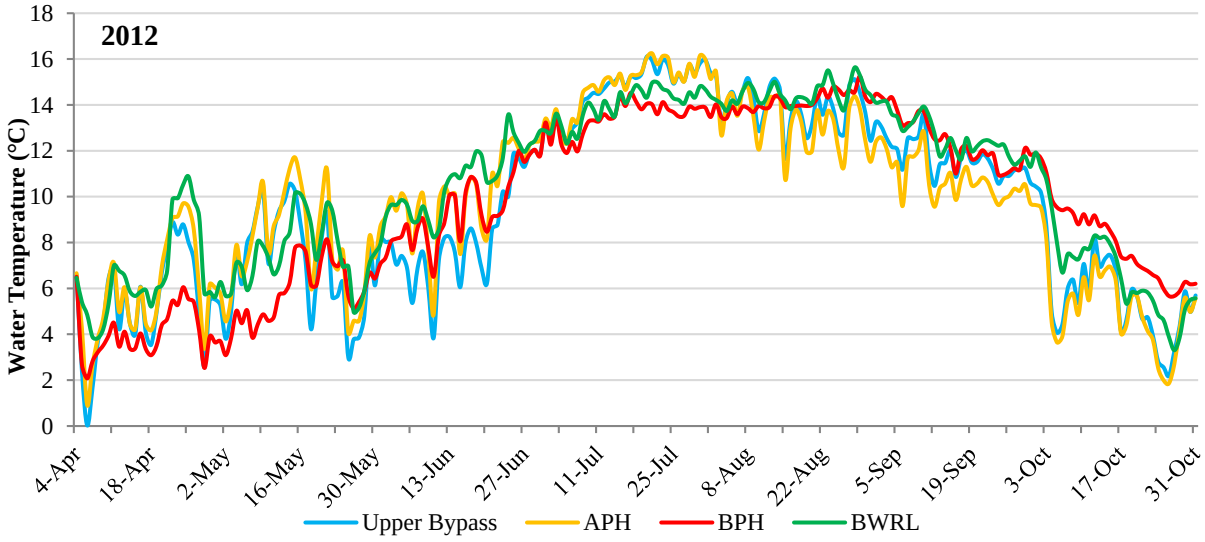


Figure 5-2: Maximum daily stream temperatures recorded in West Rosebud Creek monitoring sites in 2012.

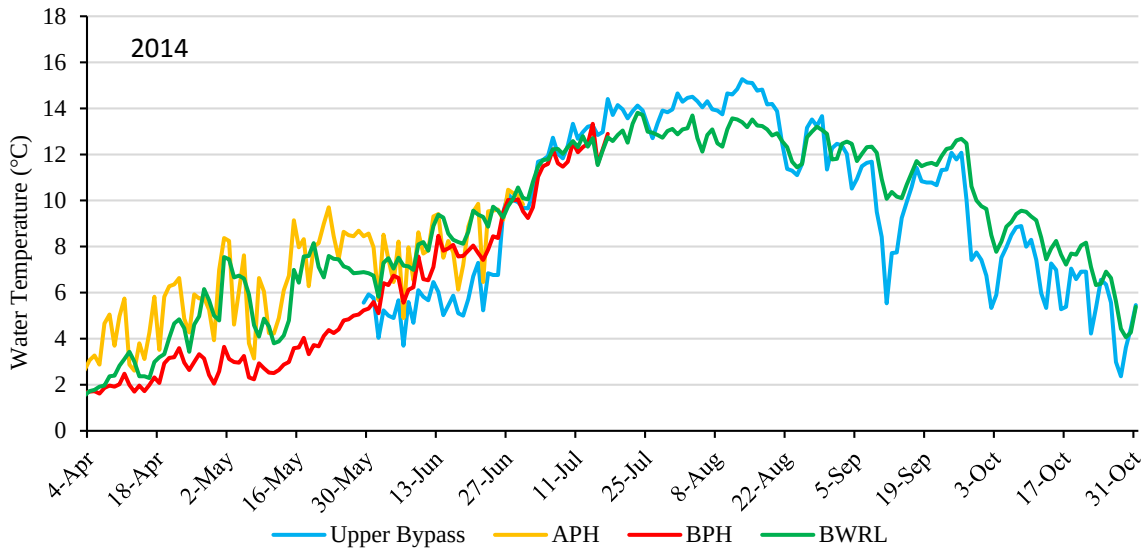


In 2012, spring maximum daily temperatures were generally greater in the BWRL and APH sites compared to the upper bypass and BPH sites (Figure 5-2). During April and May 2012, the maximum daily temperatures at the four monitoring locations ranged between freezing and 11.7 °C (53 °F). In June, maximum daily temperatures ranged between 9 and 13.6 °C (48.2–56.5 °F), with the warmer temperatures recorded at the BWRL and APH sites. In July and early August, maximum daily temperatures in the upper bypass and APH sites were greater than BWRL and BPH sites. The coolest maximum daily temperatures in the summer (approximately July 17–August 2) were recorded at the BPH site. Summer (July and August) maximum daily temperatures did not exceed 16.2 °C (61.1 °F). By mid-August, maximum daily temperatures in

the upper bypass and APH sites were cooler than the BPH and BWRL sites. In October, the BPH maximum daily temperatures were greater than the other three sites.

In 2014, spring temperatures were greatest in the APH and BWRL sites compared to the upper bypass and BPH sites (Figure 5-3). However, spring data in the upper bypass were limited and started at the end of May. In addition, the APH dataset ended on June 30. In July, water temperatures in the upper bypass, BPH, and BWRL sites were very similar and ranged between 9.2 and 14.6 °C (48.6–58.3 °F). The BPH dataset ended on July 17. The peak summer temperature was 15.3 °C (59.5 °F) on August 13 in the upper bypass. During the summer months (July and August), water temperatures were cooler in the BWRL site (range 10.1–13.8 °C [50.2–56.8 °F]) compared to the upper bypass (range 9.7–15.3 °C [49.5–59.5 °F]). Temperatures in the BWRL and upper bypass sites in September and October ranged between 2.4 and 12.7 °C (36.3–54.9 °F).

Figure 5-3: Maximum daily stream temperatures recorded in West Rosebud Creek monitoring sites in 2014.



As observed in the MWMT data, the maximum daily water temperatures in West Rosebud Creek were greatest in 2012 and lowest in 2014. Trends that were observed in 2010 and 2012 were also observed in 2014. In all years, there was greater variance in spring maximum daily temperatures between monitoring locations than in the summer months.

5.4 Discussion

Water temperature is of interest primarily because of its potential to influence salmonids' behavior and survival. Salmonids are cold-water fish with specific temperature requirements. Although some populations of salmonids have adapted to warmer temperatures, in general salmonids are not present if summer water temperatures consistently exceed 22 °C (71.6 °F) (Griffith, 1999). The U. S. Environmental Protection Agency (EPA) Region 10 has published "Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards" (EPA,

2003). In this guidance document, EPA recommends a 16 °C (60.8 °F) maximum MWMT criterion to: (1) safely protect juvenile salmon and trout from lethal temperatures; (2) provide upper optimal conditions for juvenile growth under limited food during the period of summer maximum temperatures and optimal temperatures for other times of the growth season; (3) avoid temperatures where juvenile salmon and trout are at a competitive disadvantage with other fish; (4) protect against temperature-induced elevated disease rates; and (5) provide temperatures that studies show juvenile salmon and trout prefer and are found in high densities (EPA, 2003).

Although EPA (2003) suggests warmer MWMT limits in some circumstances (such as migratory corridors with low density mid-summer juvenile rearing), the 16 °C (60.8 °F) standard would be appropriate for a non-degraded, headwater habitat such as West Rosebud Creek. Monitoring in 2010, 2012, and 2014 indicates that West Rosebud Creek has an MWMT less than 16 °C (60.8 °F) in all sites.

There is variation in temperature preferences between salmonid species. Brown trout can survive in warmer waters, 18 to 24 °C (64–75 °F), compared to other species of trout (Wydoski and Whitney, 2003). Optimal growth for brown trout has been reported at temperatures ranging between 14 and 17 ºC [57.2 and 62.6 °F (Forseth and Jonsson, 1994)]. These optimum growth temperatures indicate stream temperatures in West Rosebud Creek are in the optimum range for brown trout only during the warmest portion of the summer.

Rainbow trout generally prefer temperatures less than 21 °C (70 °F) (Wydoski and Whitney, 2003) and achieve optimal growth around 13.1 °C (95% CI, 6.8-18.2) (Bear, 2005). Water temperature in West Rosebud Creek during the warmest part of the summer is occasionally above the optimum growth temperature for rainbow trout, but are well within the preferred temperature range.

In conclusion, temperatures from 2010, 2012, and 2014 appear to be within the preferred range for salmonids in West Rosebud Creek; however, growth may be limited for some species as a result of food availability and/or cold water temperature.

6. West Rosebud Creek (Mackay Flat) Fisheries

The Mackay Flat section, located near the Custer National Forest boundary, of West Rosebud Creek extends 7,900 feet (1.5-mile) from the Pine Grove Campground (N 45.27567, W 109.64538) downstream to the first set of cabins and bridge at the Mackay Ranch (N 45.28834, W 109.62402). Brown trout, rainbow trout, brook trout, mountain whitefish, and sculpin (*Cottus* sp.) are present in this section with brown trout being the predominant fish. Fishing pressure within this section, particularly on the upstream end near the Pine Grove Campground, is relatively heavy. The section is also known to be an important spawning area for both resident fish and migratory rainbow and brown trout from the Yellowstone and Stillwater rivers. Many of the larger fish caught in this section may have spent at least a portion of their lives in the Yellowstone or Stillwater rivers.

Between 2010 and 2015, a fisheries monitoring of the Mackay Flat section of West Rosebud Creek was scheduled to occur every 3 years starting in 2010. The objective of these surveys was to evaluate changes or trends in the fish community over time.

6.1 Data Collection

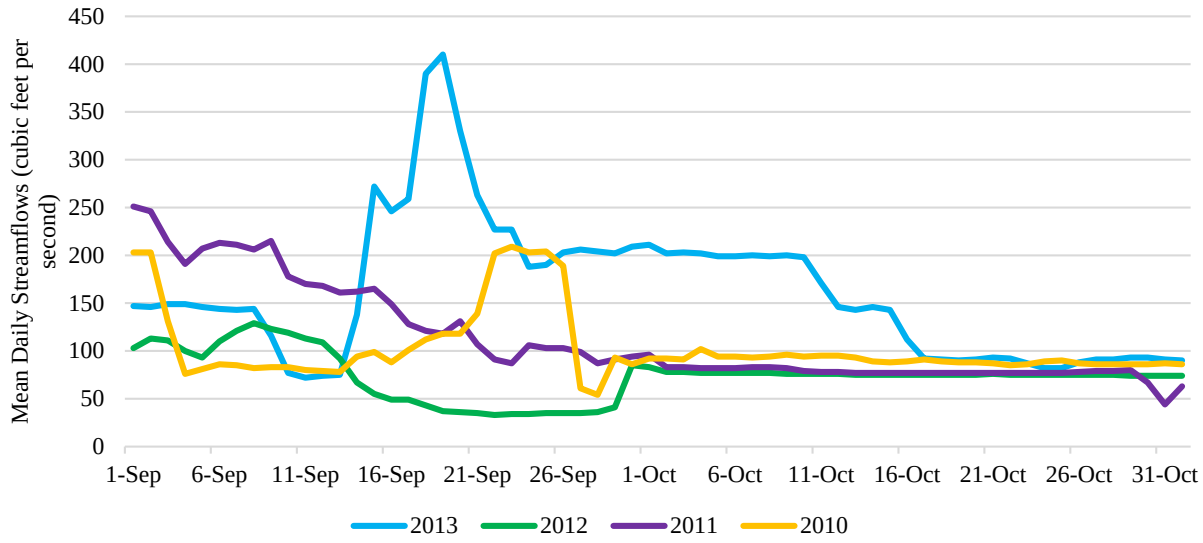
FWP personnel electrofished the Mackay Flat section of West Rosebud Creek (*see* Figure 1-1) in September 2010, October 2013, and May 2014. Due to elevated flows creating hazardous electrofishing sampling conditions in 2013, electrofishing was delayed until October.

The above average streamflows in September 2013 created conditions too hazardous for electrofishing resulting in delay. A single-pass survey was completed on October 23, 2013. Mean daily streamflows in West Rosebud Creek measured at Emerald Lake Campground (USGS stream gage #06204070) between September 1 through November 1 in 2010, 2011, 2012, and 2013 reveal how streamflows were higher than normal during the fall months in 2013 compared to previous years (Figure 6-1).

Based on the 2013 data collected, FWP concluded to further postpone sampling until the spring of 2014 when recapture sampling could be completed to more accurately develop a resident brown trout population estimate. In 2014, FWP completed the spring survey in May with the first electrofishing run (marking) completed on May 1 and the second electrofishing run (recapture) completed on May 8.

The 2010 survey efforts were summarized in the 2010 Annual Fisheries Monitoring Report (PPL Montana, 2011); the 2013 efforts were summarized in the 2013 Annual Fisheries Monitoring Report (PPL Montana, 2014); and the 2014 efforts were summarized in the 2014 Annual Fisheries Monitoring Report (NorthWestern, 2015). The following text provides an overview of the data collected and compares results among the years, as applicable.

Figure 6-1: Mean daily streamflow in West Rosebud Creek at the Emerald Lake Campground (USGS #06204070) between September 1 and November 1 in 2010, 2011, 2012, and 2013.

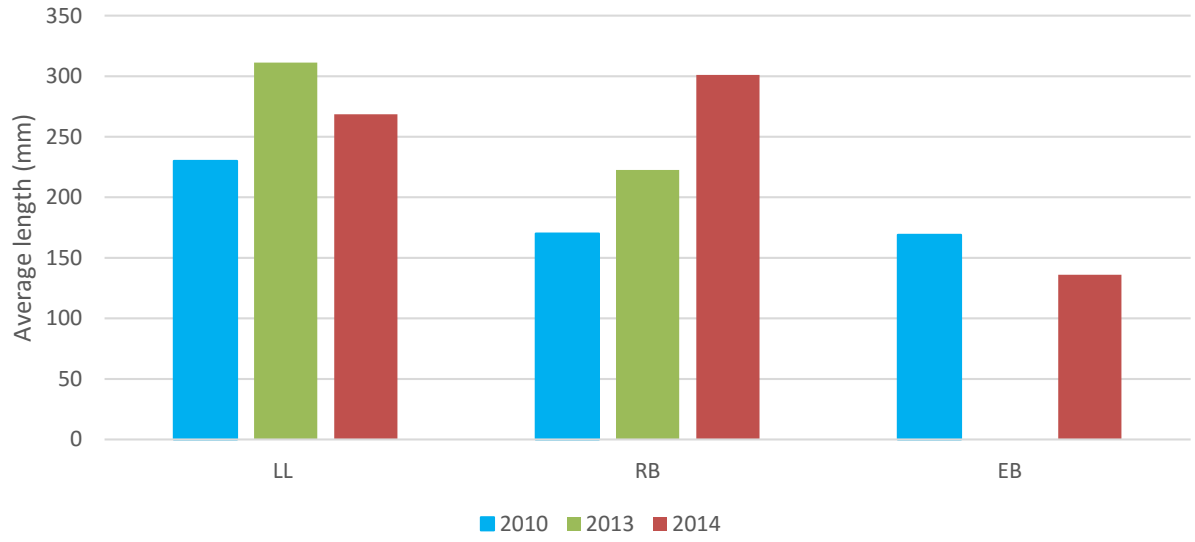


6.2 Results

On September 7, 2010, 499 brown trout, 52 rainbow trout, and 30 brook trout were captured via electrofishing the Mackay Flat section of West Rosebud Creek. The average size for each species was 230 mm (9.1 inches) for brown trout, 170 mm (6.7 inches), and 169 mm (6.7 inches) for brook trout. The October 2013 survey resulted in the capture of 300 brown trout averaging 311 mm (12.3 inches) in length, 25 rainbow trout averaging 222 mm (8.8 inches) in length. No brook trout were observed during the sampling efforts in 2013. In May 2014, the average length for the 260 brown trout recorded was 269 mm (10.6 inches), for the 28 rainbow trout was 301 mm (11.9 inches), and for the eight brook trout was 136 mm (5.4 inches). A summary of the average length for fish captured during the electrofishing efforts in 2010, 2013, and 2014 are provided in Figure 6-2.

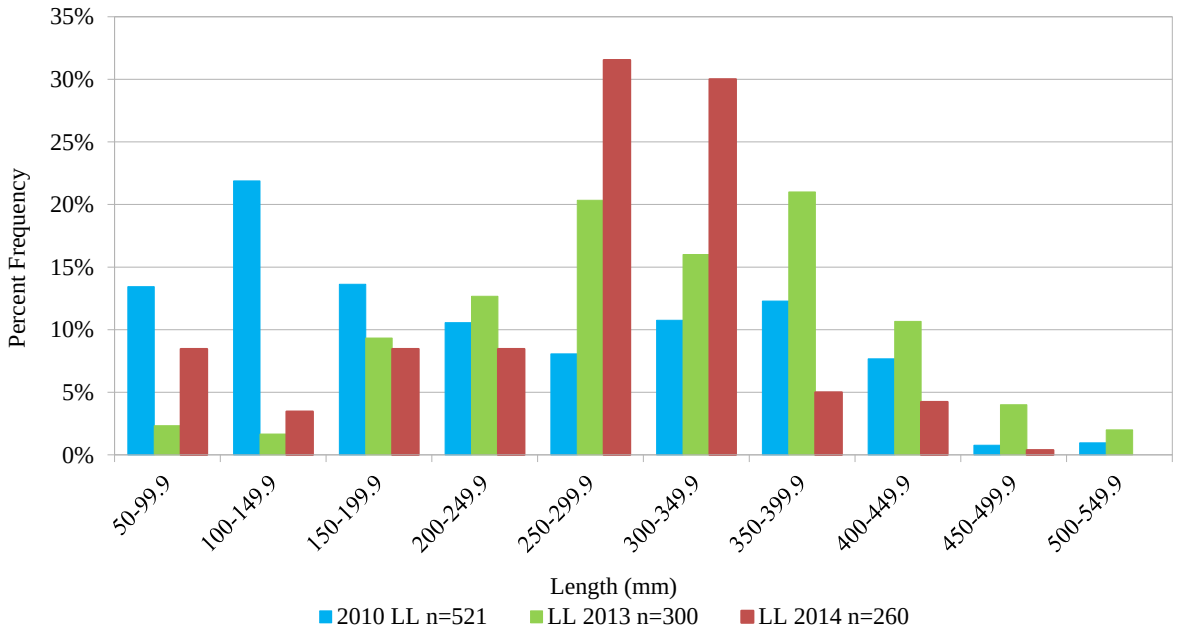
The average size of the fish sampled between 2010 and 2014 in the Mackay Flat section increased slightly for brown trout, decreased slightly for brook trout, and nearly doubled for rainbow trout (Figure 6-2).

Figure 6-2: Average length for brown trout (LL), brook trout (EB), and rainbow trout (RB) sampled in 2010, 2013, and 2014 in the McKay Flat section of West Rosebud Creek.



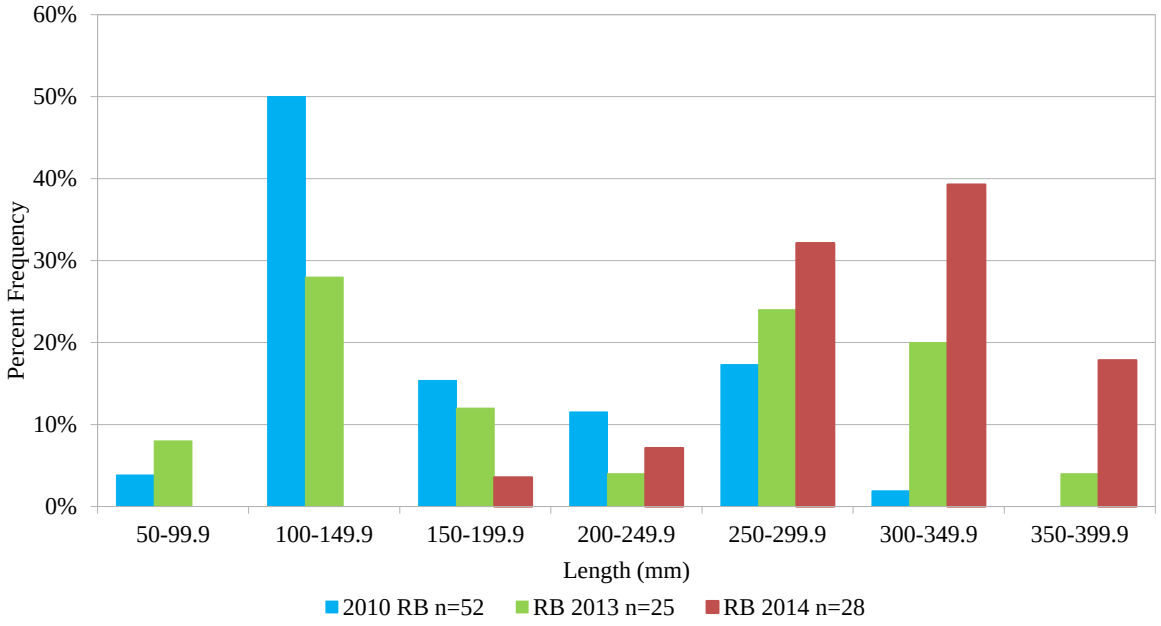
Length-frequency histograms for brown trout sampled in the Mackay Flat section in 2010, 2013, and 2014 are presented in Figure 6-3. Brown trout measuring greater than 250 mm (9.8 inches) were the more abundant in 2013 and 2014 than in 2010. In 2010, nearly half of the brown trout sampled were less than 200 mm (7.8 inches).

Figure 6-3: Length frequency of brown trout sampled in McKay Flat section in 2010 (n=521), 2013 (n=300), and 2014 (n=260).



Length-frequency histograms for rainbow trout sampled in the Mackay Flat section in 2010, 2013, and 2014 are presented in Figure 6-4. The length frequency distribution for rainbow trout sampled between 2010 and 2014 shifted from the majority of fish measuring between 100 mm (3.9 inches) and 150 mm (5.9 inches) in 2010 to the majority rainbow trout measuring greater than 250 mm (9.8 inches) in 2014. In 2010, no rainbow trout over 350 mm (13.8 inches) was recorded and in 2014 no rainbow smaller than 150 mm (5.9 inches) was recorded. In 2013, rainbow trout length-frequency distribution included a more diverse range of sizes, including both smaller and larger fish observed in 2010 and 2014 (Figure 6-4).

Figure 6-4: Length frequency of rainbow trout (RB) sampled in McKay Flat section in 2010 (n=52), 2013 (n=25), and 2014 (n=28).



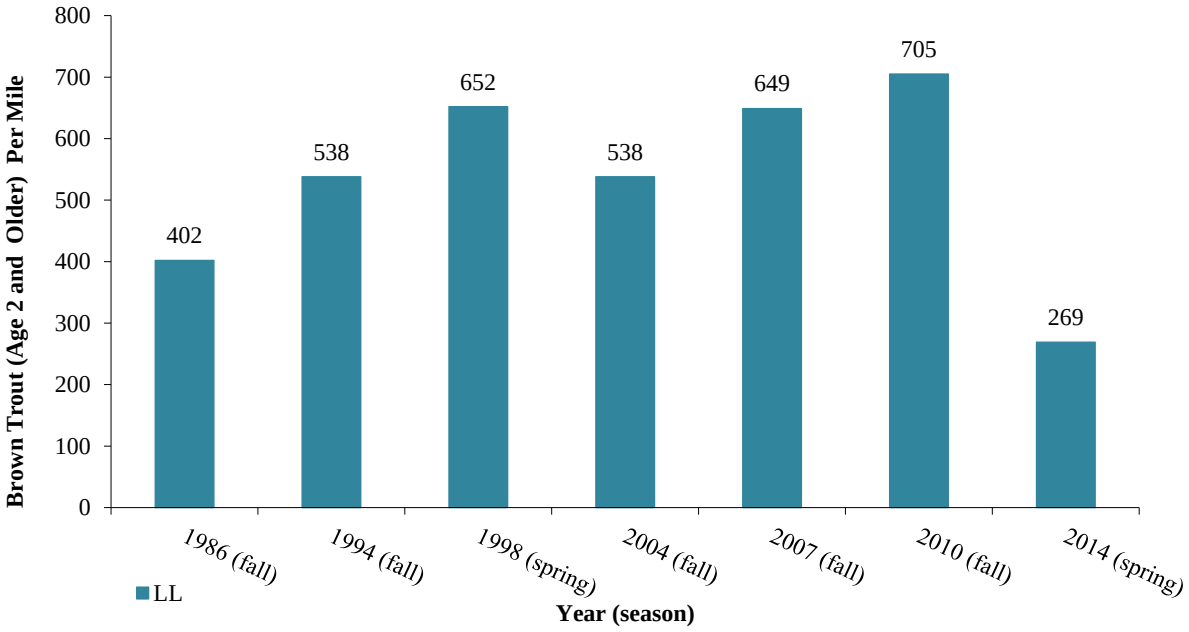
Between 1986 and 2014, the majority of the fish sampling in the Mackay Flat section was completed in the fall (1986, 2004, 2007, and 2010) and resulted in population estimates ranging from 402 to 705 brown trout (age 2 +) (> 167.6 mm or 6.6 inches) per mile (25–44 brown trout per 100 meters). The largest population estimate occurred in 2010; however, there were few recaptured fish during the 2010 sample event, thus reducing the statistical accuracy of the population estimate.

In 1998, sampling was completed in the spring (as in 2014) and the population estimate was approximately 652 brown trout (age 2+) per mile (40.5 brown trout per 100 meters). In May 2014, there were approximately 269 brown trout age 2 and older per mile (approximately 17 fish per 100 meters) estimated in the Mackay Flat section of West Rosebud Creek. The 2014 spring sample resulted in the lowest population estimate for all sample years (Figure 6-5).

Population estimates from all years are illustrated in Figure 6-5. The data from 1998 and 2014 should be interpreted cautiously since the sample periods were in the spring and not the fall as in

most years prior. Due to the life history of brown trout, migrating in the fall to spawn, fall and spring population estimates likely vary. It is possible that the fall population estimates are higher compared to spring population due to spawning. Although, the natural variation between fall and spring has not been evaluated in the Mackay Flat section and the previous spring sample in 1998 indicate the brown trout population estimate was within the population estimates derived during fall sampling.

Figure 6-5: Population estimate of brown trout (LL) age 2 and older from the Mackay Flat section in West Rosebud Creek between 1986 and 2014. (Source: FWP).



7. West Rosebud Creek Redd Counts

The 2010-2015 Fisheries Monitoring Plan (PPL Montana, 2011) scheduled spring and fall redd counts in West Rosebud Creek for every other year. However, following the submittal of the monitoring plan, the Licensee and FWP modified the schedule and conducted redd counts annually. Annual redd surveys began in 2008 and a summary of the data collected between 2008 and 2015 is presented in this section.

The reach surveyed was a 1.5-mile-long reach of West Rosebud Creek between the Pine Grove Campground and the bridge on the Mackay's property, referred to as the Mackay Flat section and the same section discussed in Section 6.0.

The Mackay Flat section serves as an important spawning area for both resident West Rosebud Creek fish and migratory rainbow and brown trout from the Stillwater and Yellowstone rivers. Redd counts are performed in the spring for rainbow trout and in the fall for brown trout.

In 2015, FWP completed one spring redd survey on May 11 and one fall redd survey on October 27. NorthWestern Energy also completed one fall redd survey on November 5. The spring 2015 survey resulted in a total count of one rainbow trout redd and the fall 2015 survey resulted in a minimum of 17 brown trout redds. Additional details of annual redd count data collected between 2008 and 2014 are provided in the 2010, 2011, 2012, 2013, and 2014 annual reports (PPL Montana, 2011; 2012; 2013; 2014), all of which are available on the Mystic Lake Project Coordination website (www.mysticlakeproject.com).

The summary of the redd counts completed in the spring and the fall in the Mackay Flat section between 2008 and 2015 is provided in Table 7-1. In spring of 2012, a minimum of 34 redds were identified. This was the highest number of rainbow trout redds since surveying began in 2008. Previously, the highest count had been 14 redds identified in 2010. It is uncertain as to why the rainbow trout redd count numbers are so variable. Depending on whether the spawning fish are resident of West Rosebud Creek or migrants from downstream, other factors such as hydrological conditions in the Yellowstone and Stillwater rivers may also be contributing to upstream migration of rainbow trout to spawning areas in West Rosebud Creek.

Brown trout redd counts have been less variable than rainbow trout redd counts. However, results from 2014 (6 redds within the survey reach) was substantially lower than 2015 and previous years and lower than the mean value (28 redds) for the 6 years of available data (Table 7-1). No fall survey data was available for 2008, and early ice conditions prevented redd counts during fall 2010.

Table 7-1: Summary of redd counts from 2008 to 2015 in West Rosebud Creek.

Year	Spring Survey Dates	Rainbow Trout Redds	Fall Survey Dates	Brown Trout Redds
2015	May 11	1	Oct 27, Nov 5	17
2014	Apr 29, May 22	2	Oct 29	6 + 1 outside the survey reach
2013	May 2, 8, 14, 22	4	Oct 12, Nov 7	37
2012	Apr 11, 17, 25; May 2, 7, 12	34	Oct 31; Nov 14, 15	47
2011	Apr 21, 27; May 3, 16	3	Oct 31; Nov 1, 15	26
2010	Apr 26, May 3, 13	14	-	early ice development Oct 5 - no survey
2009	May 5	6	Nov 11	34
2008	May 15, 23	1	-	no survey
Mean		**8**		**28**
Range		**1-34**		**6-47**

8. West Rosebud Creek Habitat Monitoring

The Mystic Lake Fisheries Monitoring Plan (PPL Montana, 2010) scheduled the West Rosebud Creek fish habitat monitoring to occur every third year beginning in 2010. The Licensee collected data in 2010 and in 2012 (instead of 2013). These data are summarized below.

The 2010 and 2012 fish habitat monitoring efforts in West Rosebud Creek include the following:

- Core sampling at two established locations (Pine Grove Campground and Allen Grade Bridge) to monitor temporal changes in sediment deposition in spawning gravels.
- Sampling of aquatic insects to monitor health and temporal changes that maybe occurring in the macroinvertebrate community.

Measurements of embeddedness of streambed substrate (Pine Grove Campground and Allen Grade Bridge) to monitor temporal changes in streambed habitat were not collected in 2012. Data collected from 2010 and 2012 for sediment core sampling and macroinvertebrates are presented for comparison in Sections 8.1 and 8.2, respectively.

8.1 Sediment Core Sampling

8.1.1 *Methods*

In early October 2010 and 2012, five sediment core samples were taken in West Rosebud Creek at both the Pine Grove Campground and Allen Grade Bridge sites. Core samples were completed using a 12-inch diameter McNeil sampler at individually selected salmonid spawning habitats. The McNeil sampler was placed approximately 7 to 8 inches below the streambed at each sample location. All sediments within the core were then removed and placed in 5-gallon buckets. The position of each sample was fixed with a handheld GPS unit and recorded. A narrative description of the location of the sample site in relation to other obvious landmarks was also recorded. The sediment samples from each core were labeled and sent to Piedmont Engineering, Inc. (PEI) in Belgrade, Montana for particle size analysis.

8.1.2 *Results*

In October 2010 and 2012, PPL Montana collected 10 core samples each sample year along West Rosebud Creek at two sites (5 samples from Pine Grove Campground and five samples from Allen Grade Bridge). Both sites are located downstream of Emerald Lake with the Pine Grove Campground located further upstream (*see* Figure 1-1). Results of the 2010 and 2012 core sample analysis from the Pine Grove Campground site are plotted logarithmically in Figures 8-1 and 8-2, respectively. Results of the 2010 and 2012 core sample analysis from the Allen Grade Bridge site are plotted logarithmically in Figures 8-3 and 8-4, respectively.

In 2010, the core samples indicated more variability among smaller particle sizes (< 10 mm) at Allen Grade Bridge and more variability among larger particle sizes (> 10 mm) at Pine Grove Campground. In 2012, there was less variability among particle sizes at each site compared to the 2010 results.

The average distribution of grain size at both study sites in 2010 and in 2012 are presented in Figures 8-5 and 8-6, respectively. From these two figures, it is clear that the Pine Grove Campground site has both larger particle sizes and a smaller percentage of fine sediment than the Allen Grade Bridge site. These results are consistent with visual stream substrate composition recorded in 2008 (*data presented in* PPL Montana, 2011) and core samples taken in 2005 *(data presented in* PPL Montana, 2006). In 2008, streambed substrate composition was estimated to be larger at the Pine Grove Campground site (70% cobble; 30% gravel) and smaller at the Allen Grade Bridge site (48% cobble; 28% gravel; 13% sand) (PPL Montana, 2011).

In order to compare the distributions of gravel sizes, the median particle diameter (d_{50}) was estimated for each core sample as well as an average d_{50} for the two sample sites. Further, the d_{16} and d_{84} values for each sample were estimated. These two values represent the gravel sizes at which 16 percent and 84 percent of the sample, respectively, are finer and a higher number indicates larger particle sizes. Based on the 2010 and 2012 data as shown in Tables 8-1, respectively, Pine Grove Campground has larger particle sizes than Allen Grade Bridge.

Figure 8-1: Distribution of gravel sizes in five core samples collected at the Pine Grove Campground site in West Rosebud Creek in 2010.

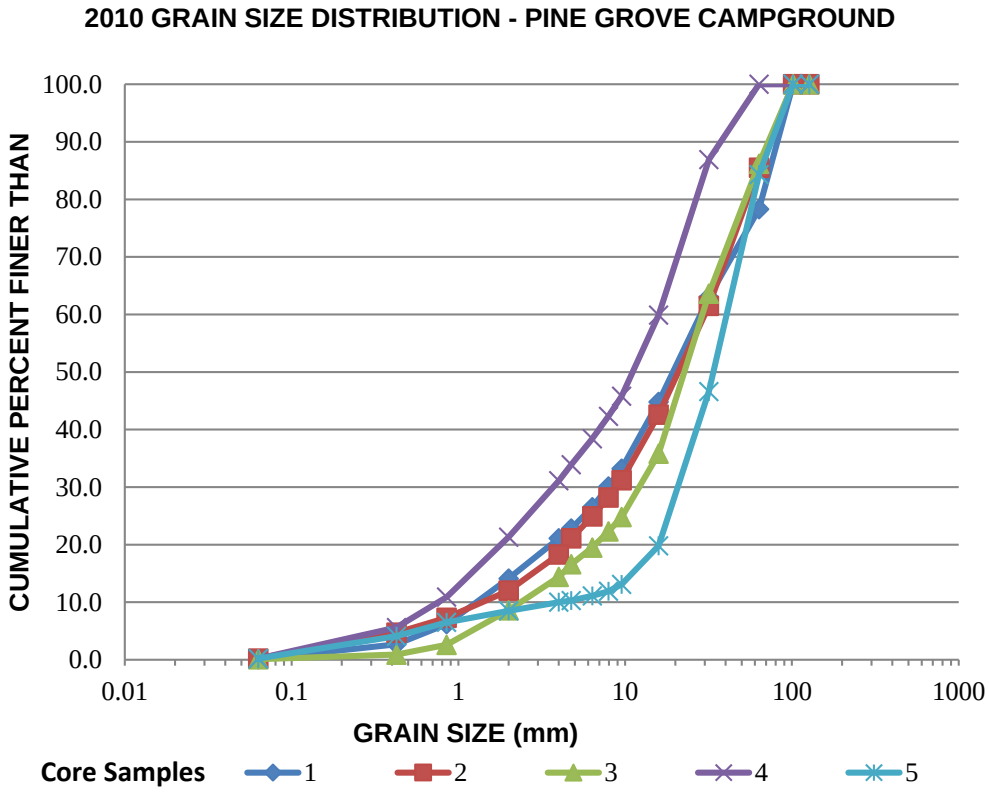


Figure 8-2: Distribution of gravel sizes in five core samples collected at the Pine Grove Campground site in West Rosebud Creek in 2012.

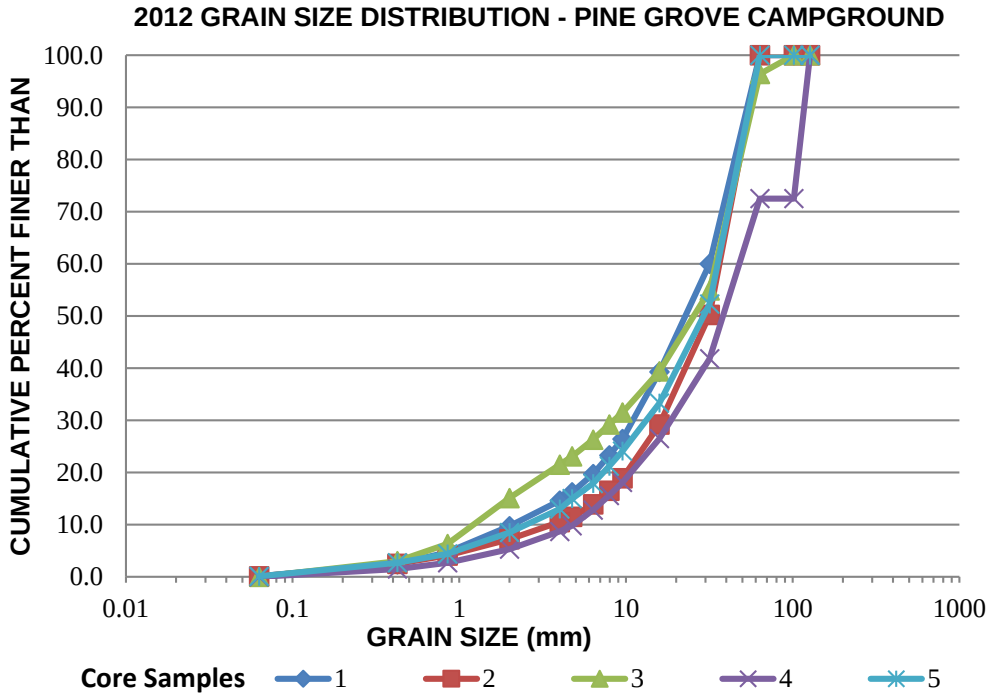


Figure 8-3: Distribution of gravel sizes in five core samples collected at the Allen Grade Bridge site in West Rosebud Creek in 2010.

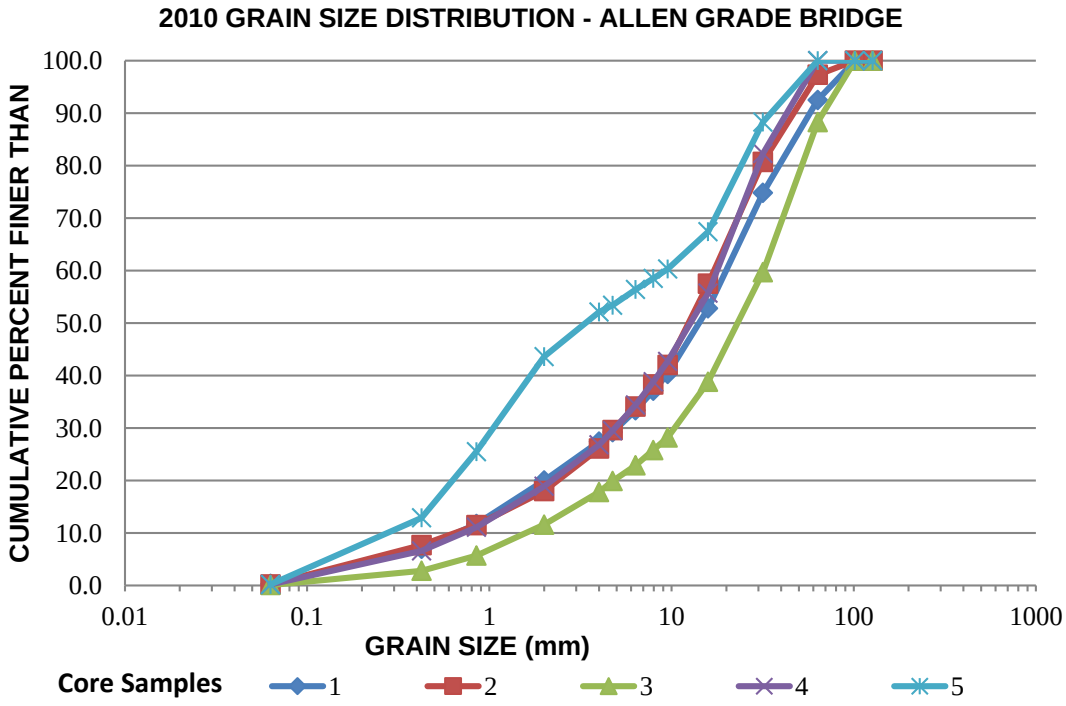


Figure 8-4: Distribution of gravel sizes in five core samples collected at the Allen Grade Bridge site in West Rosebud Creek in 2012.

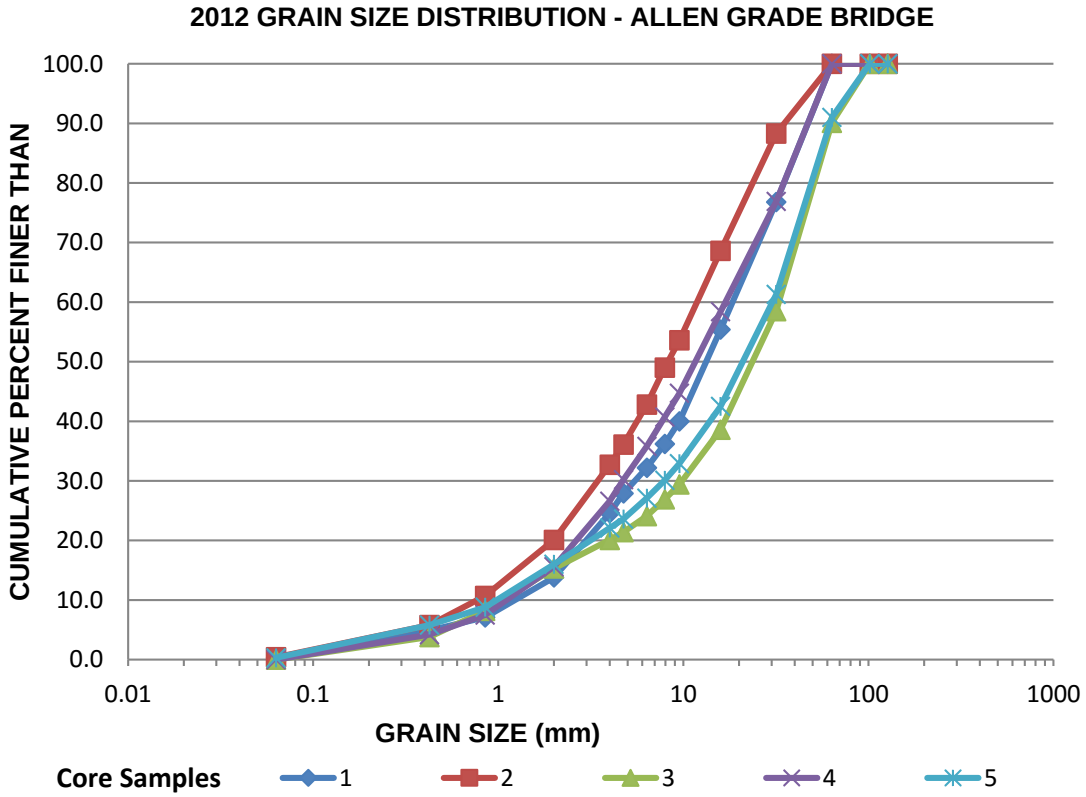


Figure 8-5: Average distribution of grain size at the two study sites (Pine Grove Campground and Allen Grade Bridge) along West Rosebud Creek in 2010.

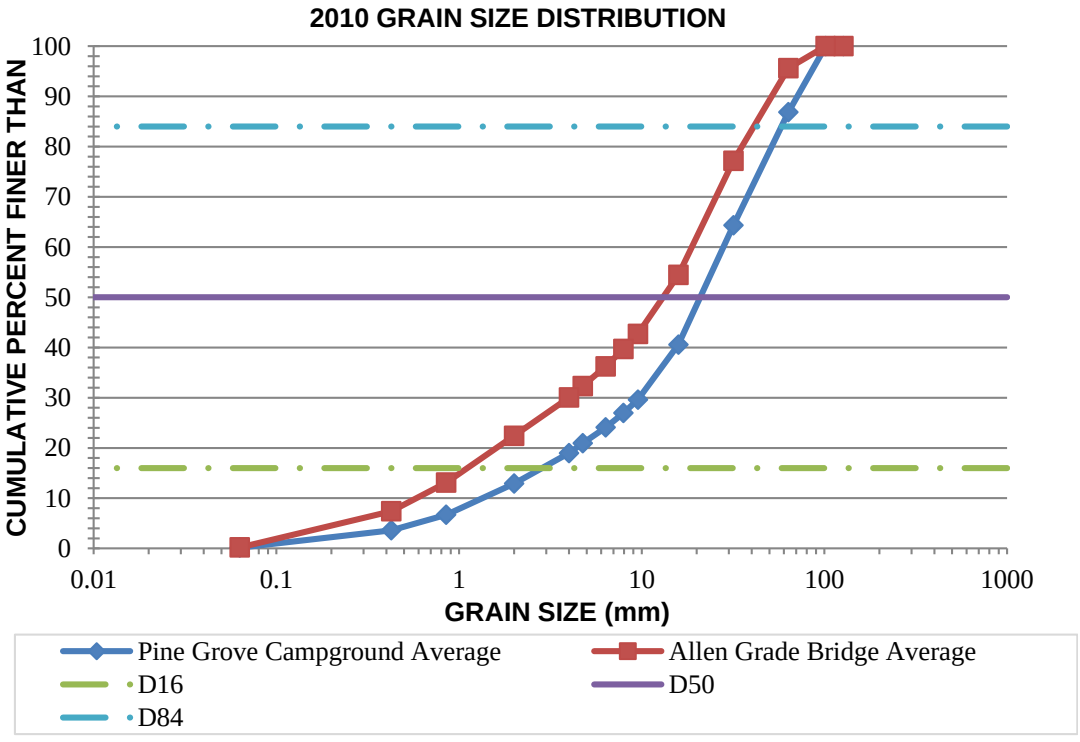


Figure 8-6: Average distribution of grain size at the two study sites (Pine Grove Campground and Allen Grade Bridge) along West Rosebud Creek in 2012.

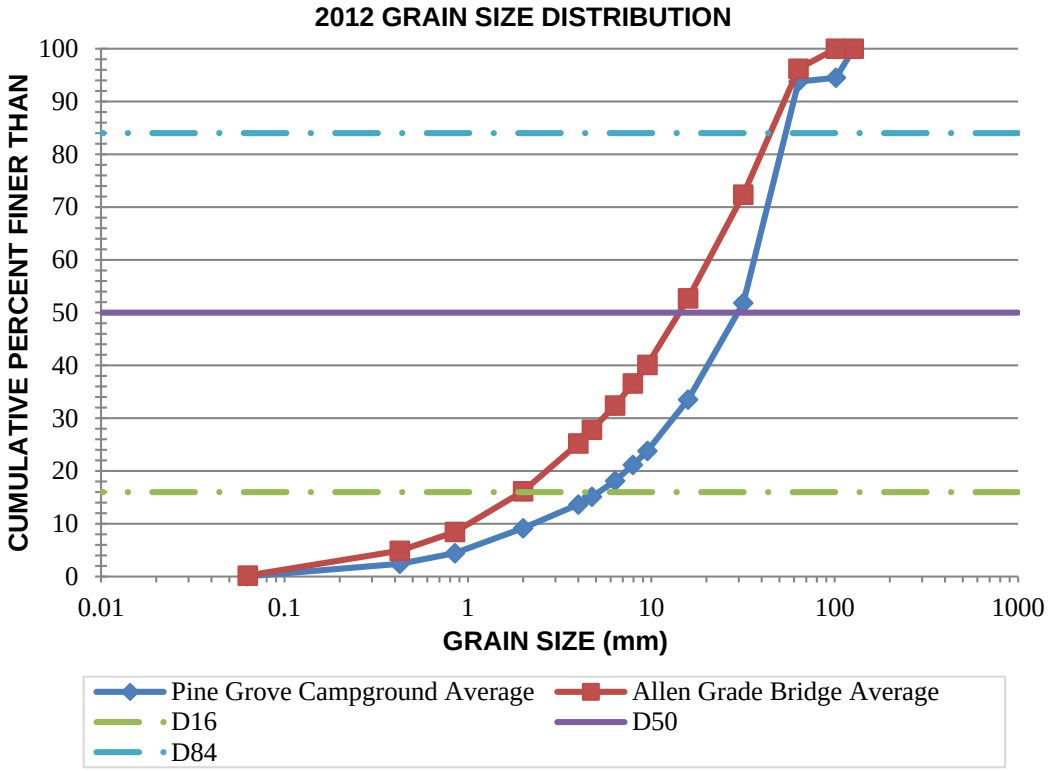


Table 8-1: Summary of average substrate characteristics from Pine Grove Campground and Allen Grade Bridge, West Rosebud Creek, 2010 and 2012.

SITE	d_{16} (mm)	d_{50} (mm)	d_{84} (mm)	Fredle Index
2010 Pine Grove Campground Average	4.9	21.7	56.9	7.2
2010 Allen Grade Bridge Average	1.7	13.4	39.6	2.8
2012 Pine Grove Campground Average	5.5	31.0	61.2	8.0
2012 Allen Grade Bridge Average	2.0	16.1	42.3	3.4

Lotspeich and Everest (1981) proposed the Fredle Index as a means to evaluate the reproductive potential of spawning gravel for salmonids and to provide comparisons of gravel quality between and within streams. Lotspeich and Everest's (1981) analysis of existing data estimates that a Fredle Index of 4 is equivalent to a survival-to-emergence of 60 percent for Coho salmon and 75 percent for steelhead trout and that the larger Fredle Indices are indicative of better conditions for salmonid survival.

A summary of the substrate characteristics at Pine Grove Campground and Allen Grade Bridge site in 2010 and 2012 is summarized in Table 8-1. At the Pine Grove Campground site, the average Fredle Index was 8.0 (range 3.8–11.3) in 2012 and 7.2 (range 2.1–17) in 2010. At the Allen Grade Bridge site, the average Fredle Index was 3.4 (range 2.3–4.2) in 2012, and 2.8

(range 0.8 to 5.6) in 2010. The data from both sample years indicate that the Pine Grove Campground site has substrate composition that would have higher salmonid survival-to-emergence than the Allen Grade Bridge site substrate.

Kondolf et al. (2008) reviewed literature documenting salmonid incubation and emergence success as it relates to substrate size. For fine sediments, Kondolf et al. (2008) calculated the maximum percentage present that corresponds to 50 percent emergence of salmonids. The maximum percentage of grains finer than 0.84 mm, 2.0 mm, and 6.35 mm corresponding to 50 percent emergence, as cited in Kondolf et al. (2008), are presented in Table 8-2. Additionally, Table 8-2 contains the corresponding percentage of fines for each sediment level measured at the two West Rosebud Creek study sites in 2010 and 2012.

Table 8-2: Fine sediment percentages corresponding to 50% emergence of salmonids in various studies, from Kondolf et al. (2008) and comparison to fine sediment levels measured in West Rosebud Creek, 2010 and 2012. Bold indicate values that are higher than mean values from the literature.

	Maximum percentage of grains finer than:		
	0.84 mm	**2.0 mm**	**6.35 mm**
LITERATURE REVIEW – Recommended Threshold			
Kondolf et al. (2008)	13.6	15.0	30.3
MYSTIC LAKE SITES			
Pine Grove Campground (2010)	6.6	12.9	24.2
Pine Grove Campground (2012)	4.4	9.2	18.2
Allen Grade Bridge (2010)	13.0	**22.4**	**36.3**
Allen Grade Bridge (2012)	8.4	**16.2**	**32.2**

Based on the 2010 and 2012 samples, fine sediments in West Rosebud Creek at the Pine Grove Campground site measured below thresholds presented by Kondolf et al. (2008) identified for 50 percent emergence success of salmonids. The percentage of fines per category (*in* Table 8-2) at the Allen Grade Bridge site were nearly double the amount measured at Pine Grove Campground for each respective sample year and exceed recommended thresholds by Kondolf et al. (2008) in two categories. The distance between the West Rosebud Lake Re-Regulation Dam and Pine Grove Campground and Allen Grade Bridge sites is approximately 6.0 kilometers (3.75 miles) and 16.4 kilometers (10.2 miles) downstream, respectively. Therefore, fines deposited at Allen Grade Bridge site are unlikely a result of Project operations at the Re-Regulation Dam. The data from 2010 and 2012 indicate spawning habitat is of better quality in Pine Grove Campground site *versus* the Allen Grade Bridge site.

8.2 Macroinvertebrates

The Licensee has evaluated macroinvertebrates in West Rosebud Creek since 2004. The initial sampling began during relicensing in August in 2004 and 2005. The schedule was later modified for sampling to be completed in October, and was implemented in 2006, 2007, 2008, 2010, and

2012. The monitoring sites have encompassed 5 locations (from upstream to downstream) including above the powerhouse, below the powerhouse, below West Rosebud Lake Re-Regulation Dam, Pine Grove Campground, and Allen Grade Bridge.

In 2010, two sites (Pine Grove Campground and Allen Grade Bridge) were included in the Fisheries Monitoring Plan (PPL Montana, 2010) while three of the sites (below powerhouse, above powerhouse, and below West Rosebud Lake Re-Regulation Dam) were included in the Water Quality Monitoring Plan (PPL Montana, 2010a).

Dan McGuire with McGuire Consulting has completed sampling for macroinvertebrates in the West Rosebud Creek drainage (all five sites) for the Licensee since sampling commenced in 2004.

8.2.1 *Methods*

Macroinvertebrates were collected with a Hess sampler enclosing 0.1-square meter (390 micron mesh). Three samples were taken per site. A scrub brush was used to dislodge macroinvertebrates from stones in the sampler. The number of cobbles, large gravels, and medium gravels removed from the sampler was recorded. The remaining substrate was stirred and sifted by hand to transport organisms into the collection net. All macroinvertebrate samples were collected, preserved, and analyzed by McGuire Consulting.

8.2.2 *Results*

Data collected in 2010 and 2012 from the three West Rosebud Creek sites in compliance with the Water Quality Monitoring Plan were summarized and are available in the 2010 and 2012 Water Quality Monitoring Report (PPL Montana, 2011a and 2013a), respectively. The summary of the 2010 sampling in the Pine Grove Campground and Allen Grade Bridge sites is provided in the 2010 Annual Fisheries Monitoring Report (PPL Montana, 2011). In 2012, all five sites were summarized in the 2012 Annual Fisheries Report with a detailed analysis prepared by McGuire Consulting provided in Appendix A (PPL Montana, 2013). Below is a summary of West Rosebud Creek's macroinvertebrate community based on McGuire Consulting's 2012 analysis.

The macroinvertebrate community in West Rosebud Creek is typical of a cold-water mountain stream. Since 2004, 122 taxa have been identified in the system. The macroinvertebrate species composition varies between sites representing a typical longitudinal gradient of species more common in small mountain streams confined to the upper reaches and taxa more common to larger streams limited to the lower reaches. Community composition also show localized influences from West Rosebud and Emerald lakes.

Indices such as percent EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]) provide an indication of environmental stress. Environmental stress may be occurring when percent EPT is less than 50 percent of the fauna. Percent EPT in West Rosebud Creek were evaluated between 2006 and 2012 and the mean EPT relative abundance ranged

between 41 to 95 percent among the five sites. The majority of the values indicated a healthy stream, and the lower values indicating some level of environmental stress were most common above (2006 and 2007) and below (2010, 2012) the powerhouse. The lower sites (Pine Grove Campground and Allen Grade Bridge) sites were approaching or above 75 percent EPT during each sample event.

The density of macroinvertebrates in West Rosebud Creek was sparse with values ranging between 200 to 800 organisms per 0.1 m^2 Hess sample.

Taxa richness was evaluated by the number of taxa collected per Hess sample. A minimum of 30 taxa per Hess sample is typical a healthy mountain stream. The average for all five sites between 2006 and 2012 was 27 taxa per Hess sample. The upper sites (above powerhouse, below powerhouse, and below West Rosebud Lake Re-Regulation Dam) revealed lower values for taxa richness than the two lower sites (Pine Grove Campground and Allen Grade Bridge).

As with taxa richness, mean values for EPT richness were greater in the lower sites (Pine Grove Campground and Allen Grade Bridge) than the upper sites (above powerhouse, below powerhouse, and below West Rosebud Lake Re-Regulation Dam). The EPT richness values calculated between 2006 and 2012 consistently revealed lower EPT richness below the powerhouse and below the Re-Regulation Dam compared to the other sites, indicating an increase in environmental stress at these two sites.

A biotic index provides a metric for organic pollution. The Montana version of this index (Bukantis, 1997) provides an indicator of trophic condition as it relates to water temperature, substrate embeddedness, and percent fine sediments (Bolman, 1998). The biotic index is on a scale from 0 to 10 with higher values indicating a more eutrophic system and lower values indicating a more oligotrophic system. Healthy mountain stream in Montana typically have a biotic index of 4 or less (McGuire, 1992). The biotic index for all five sites between 2006 and 2012 ranged from 1.7 to 3.9 with a mean of 2.5 for West Rosebud Creek. The biotic index at all sites indicated excellent water quality throughout West Rosebud Creek.

In summary, West Rosebud Creek supports a sparse but generally healthy assemblage of aquatic macroinvertebrates. Benthic assemblages were typical of soft-water mountain streams. The biotic index for all sites indicate excellent water quality throughout the study area. However, macroinvertebrate assemblages below the powerhouse and below the Re-Regulation Dam reveal levels of increased environmental stress compared to the other sites. There are few indications of environmental stress in the other sites.

9. Monitoring Schedule 2016-2021

NorthWestern will continue to prepare and submit annually a report summarizing the previous year's monitoring activities to the TAC and posting the reports on the Mystic Lake Project Coordination website (www.mysticlakeproject.com). A comprehensive 6-year (2016–2021) summary report with an updated 6-year (2022–2027) Fisheries Monitoring Plan will be prepared in 2022 and submitted to the TAC for review and approval prior to filing with the Commission. These two reports will be filed to the Commission no later than December 31, 2022. The final reports will also be posted on the Mystic Lake Project Coordination website (www.mysticlakeproject.com).

In a separate document, NorthWestern updated the Fisheries Monitoring Plan for the next 6-year cycle of fisheries monitoring activities scheduled to be implemented between 2016 and 2021. The proposed plan for the next 6 years is provided in Table 9-1. Details of each of the monitoring activities is also provided in the updated 6-Year (2016–2021) Fisheries Monitoring Plan (NorthWestern, 2016). Every 6 years, the TAC will re-evaluate and update the Fisheries Monitoring Plan, as necessary for the term of the Project License (40 years).

Table 9-1: Mystic License Proposed Fisheries Monitoring 6-Year Schedule.

Year	A	B	C	D	E	F
2016				X		X
2017		X	X		X	
2018	X					X
2019			X	X	X	
2020		X				
2021	X				X	

A = Mystic Lake fish monitoring
B = West Rosebud Creek between the dam and powerhouse electrofishing
C = West Rosebud and Emerald lakes fish monitoring
D = West Rosebud Creek below Emerald Lake electrofishing
E = West Rosebud Creek autumn redd survey
F = West Rosebud Creek water temperature monitoring

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