Montana Department of Natural Resources and Conservation Forested State Trust Lands Habitat Conservation Plan 5-Year Monitoring Report

Reporting Period
January 1, 2017-
December 31, 2021

INTRODUCTION

The Montana Department of Natural Resources and Conservation (DNRC) Forested State Trust Lands Habitat Conservation Plan (HCP) is a plan DNRC developed in order for the United States Fish & Wildlife Service (USFWS) to issue an Incidental Take Permit (Permit) for a 50-year term.

A Habitat Conservation Plan (HCP) is a long-term management plan prepared under the Endangered Species Act (ESA) to conserve threatened and endangered species. Section 10 of the ESA authorizes a landowner to develop a conservation plan to minimize and mitigate, to the maximum extent practicable, the impacts of incidental take of threatened and endangered species while conducting lawful activities such as harvesting timber on state lands. DNRC applied for a Permit authorizing the take of terrestrial and aquatic species relative to forest management activities on forested state trust lands.

The HCP planning process began in 2003 and included extensive deliberation and collaboration between staff from DNRC and USFWS. DNRC's Permit application and HCP cover three species listed as threatened under the ESA: the grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), and bull trout (*Salvelinus confluentus*). Additionally, the HCP covers two unlisted species should these species become listed during the Permit term: westslope cutthroat trout (*Oncorhynchus clarkia lewisi*) and Columbia River (interior) redband trout (*Oncorhynchus mykiss gairdneri*). The HCP outlines conservation strategies the DNRC follows for the above-mentioned species on 632,941 acres of forested state trust land in western Montana for a Permit term of 50 years. In February 2012, the USFWS approved DNRC's application and issued DNRC a Permit. In the HCP, DNRC committed to provide the USFWS annual updates and 5-year monitoring reports for the duration of the plan.

In October 2015, DNRC entered into a settlement agreement with plaintiffs to resolve a lawsuit brought against the USFWS that pertained to grizzly bear management subzones in the Stillwater Block. In the settlement agreement, DNRC agreed to establish 22,007 acres of security zones free from management during the grizzly bear non-denning season in place of 4 management subzones that totaled approximately 19,400 acres. These changes effected revisions to existing Forest Management ARMs, and minor revisions to the HCP, Biological Opinion, Stillwater Block Transportation Plan, HCP implementation manual, and HCP Implementation Checklists. All of these revision have been accomplished with a significant ARMs revision completed in December 2020 which adopted all HCP conservation strategies into Administrative Rule.

PURPOSE OF THE MONITORING REPORT

The HCP is a "living plan" that will be monitored and adapted as new information is discovered or developed. According to the HCP (*Environmental Impact Statement, Volume II, Chapter 4*), DNRC shall provide annual updates and 5-year monitoring reports to the USFWS summarizing and evaluating the results of monitoring. In addition to reviewing annual updates and 5-year monitoring reports, the USFWS meets with DNRC annually following annual updates and 5-year reports whereby the results and evaluations of the effectiveness monitoring

are discussed. If the agencies find that the commitments are not effective at meeting the desired results, the management actions identified through adaptive management would be revised into HCP conservation commitments and implemented.

The 5-year monitoring reports will summarize the status of implementation monitoring, summarize the findings of implementation monitoring, and report the results of effectiveness monitoring and research programs in which DNRC has participated. DNRC will also report on the status of land transactions relative to the caps on removal of lands from the HCP project area within the transition lands strategy. The 5-year monitoring report and meeting is an important milestone, which will address progress during the specified 5 years of implementation and determine what changes are needed, if any, for the next 5 years. This document summarizes HCP monitoring results from January 1, 2017 through December 31, 2021 and is the second HCP 5-year monitoring report. According to the results reported in the following sections, DNRC has fulfilled its annual commitments for monitoring and reporting according to HCP Chapter 4 – Monitoring and Adaptive Management (DNRC 2010).

MONITORING AND ADAPTIVE MANAGEMENT

During development of the conservation strategies, DNRC and the USFWS included commitments to monitor key components of HCP conservation strategies. The monitoring and adaptive management program provides assurances that the HCP is being appropriately and effectively implemented and outlines a course of action if the conservation strategies are not yielding the desired results.

Monitoring

There are two types of monitoring: (1) implementation monitoring and (2) effectiveness monitoring. Implementation monitoring ensures implementation of DNRC's conservation commitments throughout the Permit term. Implementation monitoring represents DNRC's largest monitoring commitment associated with the HCP and involves tracking, reporting and evaluating whether the covered activities are being performed in compliance with the HCP requirements. Implementation is primarily documented through project-level HCP checklists and validated through office and field reviews (DNRC 2010).

Effectiveness monitoring typically involves evaluation of a particular conservation commitment or suite of commitments designed to have a desired effect on a target species or resource. This type of monitoring is intensive and requires considerable resources and expertise to conduct data collection and perform related analyses. Effectiveness monitoring for the HCP is fulfilled through a commitment by both DNRC and the USFWS to consider any new relevant research at annual meetings, and through DNRC's commitment to conduct monitoring to evaluate whether management prescriptions and conservation commitments are having the desired effect on the given species.

The monitoring tables in this update summarize both the implementation and effectiveness monitoring that took place during this reporting period. The tables contain information that must be reported annually as described in tables in the HCP Chapter 4 (DNRC 2010). The tables contain abbreviated descriptions of the HCP commitments that DNRC is required to report on annually. For full descriptions of those commitments, please see Chapter 2 of the HCP.

Adaptive Management

Adaptive management is a process whereby conservation commitments and management actions may be changed based on the results obtained from effectiveness monitoring and/or research. This process results in a feedback loop that incorporates better understanding into everyday practices. This update serves as a component of the adaptive management process.

HCP CHECKLISTS

To comply with HCP commitments, tools and protocols were developed. Many of the accomplishments listed in this update reflect the development and implementation of these tools and protocols. As time progresses, refinements will occur as new and improved methods are discovered.

HCP implementation checklists are the primary means by which the DNRC documents compliance with HCP commitments. These macro-enabled spreadsheets contain the HCP commitments specific to each field unit. The spreadsheets allow field practitioners to verify whether the commitments are being implemented, and they serve as prompts to ensure that all applicable commitments are considered and applied on each project. The checklists provide the opportunity for many of the HCP commitments to be tracked in one place. At the end of the reporting period the checklists can be compiled into a database that provides information required in the annual updates and 5-year reports. Much of the information in the following tables was compiled using the checklists and the associated database. There were 165 HCP checklists completed during this reporting period, all of which were associated with commercial timber harvests (including salvage).

MONITORING REPORT FORMAT

The monitoring report is divided into four sections, corresponding to the HCP conservation commitments: Grizzly Bear Monitoring and Adaptive Management, Lynx Monitoring and Adaptive Management, Aquatic Monitoring and Adaptive Management, and Transition Lands Monitoring.

GRIZZLY BEAR MONITORING

DNRC manages state trust lands located within grizzly bear habitat. The following table outlines the 5-year reporting requirements and results for grizzly bears.

TABLE 1- GRIZZLY BEAR REPORTING REQUIREMENTS AND RESULTS.

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
GB-PR1(3) Has DNRC trained employees on bear avoidance?	Submit training content and methods to the USFWS.	All staff that normally, or occasionally, perform duties associated with HCP-covered activities must view the approved bear training video and register their name and position. During the monitoring period, over 139 employees reviewed the required training video.	v.2.4-10
GB-PR2 Has DNRC restricted employees from carrying firearms?	Report number of employees authorized to carry a firearm.	No employees were granted special authorization to carry a firearm during the monitoring period.	v.2.4-10
GB-PR4 Did DNRC construct open roads in RMZs, WMZs, or avalanche chutes?	1) HCP implementation checklist occurred on each project. 2) All projects with such construction, and the circumstances, would be reported.	From HCP implementation checklist: Number of projects that were reviewed= 165 Number of projects had open road construction in one or more of these areas= 0	v.2.4-11
GB-PR5 If found, did DNRC suspend motorized forest management activities within 0.6 mile of active den sites until May 31?	Report active den sites found, including the following information (to the extent it is available): (1) location of the den, (2) when the bear was documented as present and by whom, (3) when the bear vacated the site (if known), and (4) a description of activities that were delayed as a result of the den site.	From HCP implementation checklist: Number of den sites encountered = 0	v.2.4-11
GB-PR8 Were helicopter flight paths designed to minimize disturbance to	Complete HCP implementation checklist review on each project. For all projects requiring helicopters, report whether the 1-mile threshold was met and the circumstances	From HCP implementation checklist: Number of projects involving use of helicopters= 0	v.2.4-11

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
bears? Were flight paths designed to be greater than 1 mile from these areas?	for any instances of impracticability.		
GB-NR1 Has DNRC minimized new open road construction in NROH?	Use HCP implementation checklist to document DNRC is adding fewest miles of road needed to implement forest management. Report open and total road miles in NROH by DNRC administrative unit at year 0 and every 5 years thereafter.	From HCP implementation checklist: Number of projects requiring construction of roads and circumstances = 33. The new construction will result in 0.01 miles of <u>new</u> open road miles.	v.2.4-12
GB-NR2 Has DNRC discouraged granting of easements as described in conservation strategy?	Report number and type of access easements granted by each administrative unit in NROH and grizzly bear recovery zones. Use easement checklist to evaluate how the easement was discouraged in recovery zone.	From HCP implementation checklist Total number of easements granted by Unit Office= 0	v.2.4-12
GB-NR3, GB-CY3 Has DNRC met spring management restrictions?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Report number of days for mechanical site preparation, road maintenance, and bridge repair by administrative unit.	From HCP implementation checklist, and individual Unit Grizzly Bear Tracking Spreadsheets Number of projects that complied with the spring commitments in Spring Habitat= 78 Number of projects where this measure was not applicable= 83 2 allowances were invoked during the reporting period. The first allowance involved an insect outbreak where 18 days were used in aggregate and the second allowance was for activities within 100 ft of an open road. **Spring Days Used for Admin. 2017 to 2021 (10-day annual limit - mech. site prep., bridge replacement, and road maint.)** Anaconda Unit = 0 Bozeman Unit = 0 Clearwater Unit = 0	v.2.4-12

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Dillon Unit = 0 Helena Unit = 0 Kalispell Unit = 0 Libby Unit (CYE) = 5 Plains Unit (CYE) = 28 Stillwater Unit = 22	
GB-NR4 Has DNRC maintained distance to cover as described in conservation strategy?	Use HCP implementation checklist to ensure compliance. Summarize and report instances of impracticability.	From HCP implementation checklist Number of projects that complied with the distance to cover requirement= 36 Number of projects where this measure was not applicable= 127 Number of instances of impracticability reported= 2	v.2.4-12
GB-NR5(2) Has DNRC cooperated in livestock carcass removal?	Verbally discuss concerns, problems, or changes as necessary at annual meetings.	No livestock carcass removal issues were noted during this monitoring period.	v.2.4-13
GB-NR6 Has DNRC limited active gravel pits and counted operations in pits more than 0.25 mile from an open road in the spring period toward the 10-day limit for low-intensity activities?	Report number of active pits by administrative unit in grizzly bear recovery zones and NROH. If pit operated more than 0.25 mile from an open road during the spring period, report number of operating days applied against the 10-day limit for low-intensity forest management activities during spring period (GB-NR3).	No operations occurred in pits more than 0.25 mile from an open road in the spring period during the monitoring period. Active Pits by Administrative Unit Anaconda= 0 Clearwater= 1 Missoula= 0 Kalispell= 0 Helena= 0 Dillon= 0 Plains= 0 Libby= 0 Stillwater= 4 Swan = 4	v.2.4-13
GB-RZ1 Has DNRC addressed habitat considerations in project planning as described in conservation strategy?	Use HCP implementation checklist for each project to ensure compliance.	From HCP implementation checklist Number of projects that addressed grizzly bear habitat considerations= 26 Number of projects that this measure was not applicable= 139	v.2.4-14

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
GB-RZ2 Has DNRC retained visual screening as described in conservation strategy?	Use HCP implementation checklist to ensure compliance. Report project names, number of instances of impracticability, and descriptions of impracticable situations.	From HCP implementation checklist Number of projects where visual screening commitment was applied= 21 Number of projects that this measure was not applicable= 139 Number of instances of impracticability reported= 5	v.2.4-14
GB-RZ3 Has DNRC examined road closures annually in the recovery zone and repaired damaged closures and corrected ineffective closures within 1 year of identifying the problem?	Prepare annual accomplishment report by administrative unit. Report structure status (intact, functioning as planned, breached), and when and how structure will be repaired if damaged or breached.	An average of 560 primary road closures were checked for effectiveness annually during the 5-year monitoring period (range 553 to 570). Annual differences in the number of closures checked was primarily due to locating, mapping and refining the key closures that needed to be checked across all work units. Overall closure effectiveness during the period averaged 96% and effectiveness for each DNRC administrative unit containing recovery zone lands ranged from 81% to 100%. Approximately 31 closures received repairs during the monitoring period.	v.2.4-15
GB-RZ5 Has DNRC implemented post-denning mitigation measures?	Use HCP implementation checklist and applicable contract language to ensure compliance.	From HCP implementation checklist Number of projects where applied= 8	v.2.4-15
GB-RZ6 Document how granting of easements was evaluated, alternate routes considered, and how mitigation measures were considered or applied.	Use easement checklist to evaluate the easement, review alternate routes, and identify mitigation measures applied. Annually compile the number of easements granted and associated miles of newly created open roads.	From HCP implementation checklist Number of projects where applied= 0	v.2.4-15
GB-ST1, GB-ST2, and GB-ST4	Report changes to the transportation plan: number, length, classification, and	Tables and figures are provided to report changes in the number, length, and classification of roads (See attachments GB-	v.2.4-16

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
Has DNRC adhered to the transportation plan as mapped in conservation strategy?	location of new roads for forest management, easements, and found roads.	1 and GB-2). Minor changes to the Stillwater transportation plan have occurred as a result of slight difference between the transportation plan and actual on-the-ground location. DNRC plans to formally adopt the existing road system within the Lazy-Swift acquisition area upon permit amendment.	
GB-ST1(1) Has DNRC limited temporary roads to 8 miles at one time?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Maintain system to track temporary road amounts present through time.	Rigorous monitoring and annual reporting was conducted during the monitoring term, and active temporary road segments were limited to 8 miles or less at all times. The current amount of Active Temp Road in the Transportation Plan area is 6.2 miles in active use with an additional 1.4 miles constructed, but impassible with effective closures (7.6 miles total).	v.2.4-16
GB-ST1(2) Has DNRC installed bear presence signs? Is DNRC maintaining these signs?	Number and locations included in accomplishment report for Stillwater Unit. Provide informal updates on maintenance issues as needed.	Stillwater Unit has 6 mapped sign locations for the Stillwater Block that were reported to the USFWS in 2012. Four signs located at key locations have been maintained on the main block during the monitoring period, and two signs were installed on the Coal Creek State Forest during the 2018 operating season. During the monitoring period, significant progress was made in providing signs at gates and seasonal access locations. Bear awareness signs and food storage information was also maintained at several information kiosks on the forest. The degree of vandalism experienced during the monitoring period has generally been low.	v.2.4-16
GB-ST4 Has DNRC followed spring period administrative use restriction on 39.6-mile subset of roads?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Track compliance with restricting administrative use on 39.6 miles of the entire set of spring roads closed for spring habitat	From HCP implementation checklist Number of projects where applied= 22 One spring restriction off-set was applied and approved for the Mystery Fish prescribed burn project which offset 1.65 miles of spring restricted road to allow	v.2.4-17

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
	by documenting that no motorized administrative use occurred on the standard subset of roads. If motorized administrative use during the spring period was required on the standard subset of roads, the alternate segment of road restricted from spring motorized administrative use will be identified and reported internally on an annual basis and reported to the USFWS on a 5-year basis.	administrative use for the burn in the spring of 2021.	
GB-ST5 Gravel Operations Has DNRC limited active gravel pits to five? Has DNRC implemented appropriate mitigation measures when operating a pit more than 0.25 mile from an open road on Class B lands without following the transportation plan restrictions?	Report number and location of active pits. If a pit is operated more than 0.25 mile from an open road on Class B lands, report how DNRC minimized its distance away from an open roads and ceased activities on other pits, including the number of licensed third parties continuing operation.	No operations occurred in pits more than 0.25 mile from an open road in the spring period during the monitoring period. Active Pits: Ewing (33N24W S24) Chicken (33N 23W S14) Anchor (33N 22W S19) 156 Mile (33N 24W S06)	v.2.4-18
GB-SW1(1) Has DNRC adhered to the transportation plan as mapped?	Report changes to the transportation plan: number, length, classification, and location of new roads for forest management, easements, and found roads.	The primary associated metric required for grizzly bear-associated monitoring under the HCP is the mileage of open and restricted roads since the HCP and associated Swan River Transportation Plan was amended in 2018. Under this amended transportation plan, DNRC committed to road totals presented	v.2.4-19

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		in Table 2-3 of the Supplemental EIS. The current results are as follows: **<u>Permit Terms</u>** Total Open Roads: 54.4 (Includes Seasonally Restricted Roads) Total Restricted Roads: 454.0 miles Total Roads: 498.7 miles **<u>Current Values</u>:** Total Open Roads: 51.3 Total Restricted Roads: 404.4 Total Roads: 455.6 **DNRC has 43.1 miles of new road construction remaining under Permit terms.**	
GB-SW1(2) Has DNRC limited temporary roads to 6.5 miles at one time?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Maintain a system to track temporary road amounts present through time.	The current amount of Active Temp Road on the Swan Block is 2.18 miles in active use with an additional 0.6 miles constructed, but impassible with effective closures (2.78 miles total).	v.2.4-19
GB-SW1(3) Has DNRC installed bear presence signs? Is DNRC maintaining these signs?	Number and locations included in accomplishment report for Swan Unit. Provide informal updates on maintenance issues as needed.	The Swan Unit currently has 10 large bear awareness signs posted at key locations on open forest road systems. Vandalism and theft have occurred at some original sign locations. Smaller food storage signs continue to be maintained at four key locations.	v.2.4-19
GB-SW2 Has DNRC cooperated with adjacent landowners for conservation?	DNRC and the USFWS will discuss opportunities for cooperative management with neighboring landowners as they arise.	Cooperative management opportunities with the USFS – Flathead National Forest were discussed regarding road use in the Swan. DNRC sub-zone rest periods restricted road use for commercial activities and USFS project plans were not congruent with DNRC's HCP and ARM's.	v.2.4-10
GB-SW3 Has DNRC followed management/rest period schedule?	Provide listing of active/inactive subzones to demonstrate compliance with 3-year management/6-year rest commitment for each 5-year monitoring period.	Active subzones: Subzone 4 (active from 6/24/2019 – 12/31/2022) Subzone 5 (active from 9/28/2020 – 12/31/2021 Inactive subzones:	v.2.4-20

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
	Report use of the allowable 30 commercial operating days that are allotted for parcels in formal rest status and report these days to the USFWS at 5-year intervals. This information will also be available to the USFWS upon request. Report the number of times the management period was extended. When management period is extended due to allowable delays, DNRC will write an explanation of the delay and submit it to the USFWS immediately upon notice that a delay will be necessary. Requires USFWS review only.	Subzone 1, 2 and 3 Allowable minor project days used on resting parcels: Subzone 1 = 17 Subzone 2 = 0 Subzone 3 = 0 Subzone 4 = 0 Subzone 5 = 0 Management Period Extensions: The management period for Subzone 5 was extended from 7/1/2022 to 8/31/2022 due to the Whitetail Creek wildlife during the 2021 operating season that prevented the completion of activities.	
GB-SW4(2) Has DNRC implemented required mitigation measures for **extended salvage** projects as described in item (2) of the commitment?	Report number, location, and duration of salvage projects. Use Appendix B, Document B-1 (salvage checklist for projects in rest) to report compliance with commitment and additional mitigation measures applied to the project.	No extended salvage projects occurred in rested subzones during the reporting period.	v.2.4-21
GB-SW5 Has DNRC limited active gravel pits to four? Has DNRC implemented appropriate mitigation measures when operating a pit more than 0.25 mile from an open road in a rested subzone?	Report number and location of active pits. If a pit is operated more than 0.25 mile from an open road in a rested subzone, report how DNRC minimized its distance away from an open road and ceased activities on other pits, including the number of licensed third parties continuing operation.	No operations occurred in pits more than 0.25 mile from an open road in the spring period during the monitoring period. Active Pits: In-pah-ah (23N 17W S06) Goat Creek (23N 17W S10) County (23N 17W S18) South Woodward (23N 18W S24)	v.2.4-21

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
GB-SC1(1) Did DNRC adequately evaluate and justify need for open roads?	Compile and report information from Open Road Reduction checklist	From HCP implementation checklist Number of projects reviewed when applicable using open road reduction checklists= 18 See Attachments GB-1 and GB-2, which provide information regarding road amounts by road class, unit office and area office during the monitoring period as compared with baseline levels in 2012.	v.2.4-22
GB-SC1(2) Did DNRC maintain or decrease baseline open road amounts (total length) at the administrative unit level? Is DNRC making efforts to improve the GIS road layer?	Report open road amounts (tracked with GIS) at administrative unit level to compare with HCP baseline. GIS data quality and management reported at annual meeting.	Open road amounts have reduced on each administrative unit from the baseline open road amounts in 2012. *Miles of Open Road on Scattered Lands in the Recovery Zone by Unit from Table 1 in the 2012 ITP compared with 2016 and 2021 Amounts from Attachment GB-1.* Unit 2012 ITP 2016 2021 KAL 17.8 12.6 11.2 STW 1.8 1.7 1.7 CLW 16.8 9.5 13.9 MSO 4.1 0.0 0.0 HEL 0.2 0.1 0.1	v.2.4-22
GB-SC2, GB-CY1 Has DNRC followed management/rest period schedule? GB-CY3 Has DNRC followed more restrictive spring period management (10 days on 50% of parcels in CYE recovery zone and NROH)?	Provide current listing of active/inactive parcels to demonstrate compliance with 4-year management/8-year rest commitment for each 5-year monitoring period. Report use of the allowable operating days for minor projects by administrative unit that are allotted for parcels in formal rest status and report these days to the USFWS at 5-year intervals. This information will also be available to the USFWS upon request. Report the number of	From 4-year Active 8-year Rest Spreadsheet **4-Year Mgmt. and 8-year Rest Tracking** Clearwater Unit = 1 parcel had projects initiated during the monitoring period. All 11 parcels are currently in rest. Helena Unit = 1 parcel had management periods initiated during monitoring period. This parcel is currently in rest. Kalispell Unit = 5 parcels had projects initiated during the monitoring period. 2 are currently active and 19 parcels are currently in rest.	v.2.4-22

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
	times the management period was extended. When management period is extended due to allowable delays, DNRC will write an explanation of the delay and submit it to the USFWS immediately upon notice that a delay will be necessary. Requires USFWS review only. The number of times the management period was extended will be reported in 5-year report.	Libby Unit (CYE) = 1 parcel had projects completed during the monitoring period. All 25 parcels are currently in rest periods. Plains Unit (CYE) = 4 parcels had projects completed and rest periods started during the monitoring period. 1 parcel is currently in management and 17 in rest. Stillwater Unit (scattered lands) = 1 parcel had management periods initiated during monitoring period and is currently in management status. **Days Used During the Monitoring Period -- Minor Projects Parcels in Rest** Clearwater Unit = 8 Helena Unit = 0 Kalispell Unit = 17 Libby Unit (CYE) = 50 Plains Unit (CYE) = 25 Stillwater Unit (scattered lands) = 0 Number of projects where applied on CYE Units = 6	
GB-SC3(2), GB-CY2 Has DNRC implemented required mitigations for extended salvage projects as described in item (2) of the commitment?	Report number, location, and duration of salvage projects. Use Appendix B, Document B-1 (salvage checklist for projects in rest) to report compliance with commitment and additional mitigation measures applied to the project.	From HCP implementation checklist 8 salvage projects were conducted on rested parcels. Libby Unit: **2017 Libby Bug Salvage** (15 days) – T28N R29W Section 36 & T29N R27W Section 12 **Upper McGinnis Fire Salvage** (22 days) – T25N R28W Section 16 Kalispell Unit: **Brosten Lane Blowdown Salvage-Foothills Salvage** (50 days) – T27N R19W Section 14	v.2.4-23

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Mud Lake Blowdown Salvage – Foothills Salvage (15 days) – T27N R19W Sections 2, 3, & 10 and T28N R19W Section 34 **Jewel Basin Blowdown Salvage** (17 days) – T27N R19W Sections 1 & 2 **Strawberry Lake Blowdown Salvage** (60 days) – T28N R19W Sections 21 & 28 Plains Unit: **Deep Corner** (5 days) – T23N R30W S16 **Little Sitting Bull** (15 days) – T25N R32W Section 36	
GB-SC4 Has DNRC implemented appropriate mitigation when operating a pit more than 0.25 mile from an open road in a rested parcel?	Report number and location of active pits. If a pit is operated more than 0.25 mile from an open road in a rested parcel, report how DNRC minimized its distance away from an open roads and ceased activities on other pits, including the number of licensed third parties continuing operation.	From HCP implementation checklist No minor projects in resting parcels required the use of gravel sources greater than 0.25 miles from an open road during the monitoring period.	v.2.4-23
GB-CY4 Has DNRC expedited reduction of open road densities for recovery zone parcels?	Compile and report information from Open Road Reduction Checklist (Appendix B, Document B-2) for all CYE recovery zone parcels (does not include CYE NROH parcels).	Completed in 2012 and again in 2018 additional lands added to HCP in CYE RZ.	v.2.4-25
GB-CY5 Were helicopter flight paths designed to avoid sensitive areas for bears? Were flight paths designed to be > 1 mile from these areas? Were short-duration activities	Complete HCP implementation checklist review on each project. For all projects requiring helicopter operation, document that the 1-mile threshold was met.	From HCP implementation checklist 0 projects requiring the use of helicopters occurred during the monitoring period.	v.2.4-25

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
appropriately limited to less than 48 hours?			

CANADA LYNX MONITORING

Some forested trust lands managed by DNRC occur within the distribution of Canada lynx, which was listed as threatened in 2000 by the USFWS. The following table outlines the reporting requirements and results for Canada lynx.

TABLE 2- CANADA LYNX REPORTING REQUIREMENTS AND RESULTS

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
LY-HB1 Has DNRC provided a lynx habitat map?	Provide tables that depict lynx habitat for each DNRC administrative unit and LMA for the 2018 baseline and end of 5-year monitoring period to reflect cumulative annual changes.	For comparison, results are provided for years 2018 and 2021 in habitat tables found in Attachments LY-1 and LY-2. Total potential habitat has changed minimally through the reporting period. Changes Can be attributed to stand re-delineation, habitat type updates and GIS data accuracy. Data for all land offices are presented in Attachment LY-2.	v.2.4-29
LY-HB2(1) Has DNRC followed Graham et al. (1994) for CWD retention and retained snags as described in conservation strategy?	Document compliance through HCP implementation checklist. Report amounts of snags, snag recruits, and CWD on a minimum of two projects (post-harvest) per year in lynx habitat when available. Monitor for the first 5 years of HCP implementation to ensure compliance. Review for compliance during post-harvest internal audits.	Implementation Checklist = 121 projects during the monitoring period applied snag and CWD measures, 34 projects occurred outside of lynx habitat, but still complied with applicable ARMs. 121/121 = 100 %, 10 projects incorporated allowances for broadcast burns. 155/165 = 94% <u>Projects with Allowances</u> Antice Knobs 2 Johnson's Yurt Antice Road Show Stryker Basin Lupfer Morrill Red Owl Salvage #2 Red Owl Blowdown Salvage ReDeemer Timber Sale Jim Junction Timber Sale Paterson Creek Blowdown	v.2.4-30

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Pre- and post-logging field monitoring of snags and CWD was conducted on 11 projects during the monitoring period. Approximately 10 of these projects occurred in forest cover types considered suitable habitat for Canada lynx. Of the 10 projects in vegetation community types that provide suitable habitat for lynx, the average for combined large live trees and snags >21 inches per acre was 2.8. With the inclusion of the next lower size class of snags and live trees (16 in to 21 in. dbh), the combined average was 3.0 trees and snags per acre. All sampled harvest units met the minimum requirements to retain at least two large snags and two large recruitment trees per acre. Where either large snags or live trees are lacking, substitutions may occur. Coarse woody debris amounts on the 11 sampled lynx-type stands averaged 10.1 tons per acre (range 3.2 to 26.6 tons). Counts of large logs greater than 15 in. diameter averaged greater than 1.5 per acre. (range 0 to 5.3 per transect). Counts of small logs (3 in to 15 in diameter) averaged 38.8 per transect on the sample stands post logging and they ranged from 11.0 to 59.3 per transect.	
LY-HB2(2) Has DNRC retained 1% of blowdown area unsalvaged?	Complete HCP implementation checklist review where specific blowdown projects occur. Report total acres of blowdown, total acres treated, and total acres retained.	From HCP implementation checklist Number of blowdown projects= 5 Number of projects in compliance= 5 (100%) Total definable flattened area associated with projects= 1028.6 acres Total blowdown acreage deferred= 20.45 % of total deferred= 2.0 %	v.2.4-30

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
LY-HB3 Has DNRC implemented den site protections as described for known active dens?	Document compliance through HCP implementation checklist Report active den sites associated with DNRC projects to the USFWS as DNRC becomes aware of them.	From HCP implementation checklist Number of projects where a den site was encountered= 0 No den sites known or reported to USFWS.	v.2.4-30
LY-HB4(1) Has DNRC retained some small, shade-tolerant trees (grand fir, subalpine fir, and spruce) in pre-commercial thinning units?	Use HCP implementation checklist prior to pre-commercial thinning projects in lynx habitat. Report number of projects that retained some shade tolerant tree species.	From HCP implementation checklist Number of PCT projects where some shade tolerant species were retained = 28	v.2.4-31
LY-HB4(2) Has DNRC retained some patches of advanced regeneration of shade-tolerant trees (grand fir, subalpine fir, and spruce) in commercial harvest units?	Use HCP implementation checklist to acknowledge requirement. Addressed through silvicultural prescriptions and contract specifications. Review for compliance during post-harvest internal audits.	From HCP implementation checklist Number of projects where shade tolerant trees were retained= 99 Number of projects that this measure was not applicable= 66	v.2.4-31
LY-HB5 Has DNRC maintained habitat connectivity as described?	Complete HCP implementation checklist review. Document the number of projects where habitat connectivity was retained for lynx. Document the number of allowances and circumstances under which connectivity could not be adequately maintained.	From HCP implementation checklist Number of projects where habitat connectivity was retained for lynx = 107 Projects with Allowances = 12 **Allowance Circumstances** **Sand Hollow**: Potential lynx habitat disconnected by unsuitable lynx habitat, large extent of grassland habitats exist along ridges and riparian areas **Line Cub Limited Access**: Suitable lynx habitats are not connected within and outside of the project area and are not located on ridgetops, saddles or SMZs	v.2.4-32

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Copper Kind Fire Salvage: Opportunities for connectivity are limited due to high burn severity **Camas Back**: Suitable lynx habitats within the project area are isolated, discontinuous, and bisected by unsuitable habitats **Hold the Mayo**: Limited lynx habitat in project area that is neither connected to suitable habitats inside or outside the project area, nor located along ridgetop, saddle or SMZ **Sliver Me Timber**: Limited lynx habitat in project area that is neither connected to suitable habitats inside or outside the project area, nor located along ridgetop, saddle or SMZ **Burr Saddle**: Limited lynx habitat in project area that is neither connected to suitable habitats inside or outside the project area, nor located along ridgetop, saddle or SMZ **Schwartz Cr**: Forested land exists in matrix of open habitats, no suitable links between forested habitats exist to maintain connectivity **Schmidt Creek Salvage**: Blowdown has removed most of suitable lynx habitat in the RMZs present **Bybee Carriage & Trappi Shack 612 Permits**: Suitable lynx habitats are bisected by unsuitable habitats and presence of decadent lodgepole pine necessitates removing stands from suitable types, however there is likelihood that some stands would meet other suitable lynx habitat types	

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Luke Mountain 2: Limited lynx habitat separated by non-lynx habitat, although minimal connectivity maintained through winter foraging habitat in SMZ **Rattler Gulch**: Potential lynx habitat disconnected by unsuitable lynx habitat, large extent of open habitats exists along ridges and riparian areas	
LY-HB6 Has DNRC maintained the 65/35% ratio of habitat suitability on scattered parcels outside LMAs?	Report acres and percentages of total potential lynx habitat, suitable lynx habitat, and temporary non-suitable habitat on scattered parcels outside the LMAs for each land office.	2021 Percentage Results for Suitable Habitat by Land Office CLO = 74% NWLO = 81% SWLO = 85% See Tables in Attachment LY-2 for acreages and percentages for other individual habitat classes.	v.2.4-32
LY-LM1 Has DNRC maintained the 65/35% ratio of habitat suitability in LMAs?	Report acres and percentages of total potential lynx habitat, suitable lynx habitat, and temporary non-suitable habitat on HCP project area parcels within each LMA.	2021 Percentage Results for Suitable Habitat by LMAs STW West = 90% STW East = 85% STW South = 93% * Coal Creek = 74 % Swan = 78 % Seeley Lake = 80 % Garnet = 86 % See Tables in Attachment LY-1 for acreages and percentages for individual habitat classes. ** Lands in the Stillwater South are currently not covered under DNRC's HCP. Amendment process should be complete in 2022, thus baseline conditions are reported here for this LMA.*	v.2.4-33
LY-LM2 Has DNRC limited habitat conversion to 15% per decade?	Report total potential habitat, **15% allowable quota per decade**, and number of acres of suitable habitat converted to temporary non-suitable habitat in the 5-year monitoring period on HCP	**Acres, and Percent Suitable Habitat Converted (EA-analyzed acres) – 2012 to 2021** **STW East** = TPH 34,877 acres; Conv Ac 3,699 acres, 10.7 **%**	v.2.4-33

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
	project area parcels within each LMA.	**STW West** = TPH 34,115 acres; Conv Ac 1,979 acres, 5.6 **%** **STW South** = TPH 13,032 acres; Conv Ac 0 acres, 0% * **Coal** = TPH 12,612 acres; Conv Ac 394 acres, 3.0 **%** **Swan** = TPH 50,804 acres; Conv Ac 7,108.2 acres, 13.9 **%** **Garnet** = TPH 4,063 acres; Conv Ac 37 acres, 1.0 **%** **Seeley** = 4,431 acres; Conv Ac 33 acres, 0.1 **%** ** Lands in the Stillwater South are currently not covered under DNRC's HCP. Amendment process should be complete in 2022, thus baseline conditions are reported here for this LMA.*	
LY-LM3(1) Has DNRC maintained 20% of total potential habitat as winter foraging habitat?	Report acres of total potential habitat and current percentage and acres of winter foraging habitat on HCP project area parcels within each LMA.	2021 Percentage Results for Winter Foraging Habitat by LMA **STW West** = 51% **STW East** = 58% **STW South** = 24% * **Coal Creek** = 44% **Swan** = 53% **Seeley Lake** = 43% **Garnet** = 41% See Tables in Attachment LY-1 for acreages and percentages for individual habitat classes. ** Lands in the Stillwater South are currently not covered under DNRC's HCP. Amendment process should be complete in 2022, thus baseline conditions are reported here for this LMA.*	v.2.4-34
LY-LM3(2) Has DNRC retained as un-thinned, 20% of the area in each pre-commercial thinning project targeting saplings in lynx habitat?	Report number of pre-commercial thinning projects targeting samplings in lynx habitat. For each project, report total number of acres thinned and acres left un-thinned.	From HCP implementation checklist Number of projects where un-thinned areas were retained = 6 **Kozy Korner** Acres thinned= 394 Acres Un-thinned= 100 (20%) **West Chamberlain PCT and Other Projects**	v.2.4-35

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Acres thinned= 240 Acres Un-thinned= 702 (75%) **909 Pre-Commercial Thinning** Acres thinned= 460 Acres Un-thinned= 134 (22%) **Washoe Projects** Acres thinned= 86 Acres Un-thinned= 22 (26%) **Ewing Face PCT** Acres thinned= 195 Acres Un-thinned= 48 (20%) **Stryker Bull** Acres thinned= 27 Acres Un-thinned= 12 (31%)	

AQUATICS MONITORING

The aquatic conservation strategies were developed by DNRC with the technical assistance of the USFWS. The process was initiated by identifying a specific biological goal applicable to the three HCP fish species. The identified biological goal was to protect bull trout, westslope cutthroat trout and Columbia redband trout populations and their habitat and to contribute to habitat restoration or rehabilitation, as appropriate, which may have been affected by past DNRC forest management activities. Commitments were developed to address known scientific information and uncertainties in scientific knowledge, as well as existing data gaps (DNRC 2010). The following table outlines the reporting requirements and results for the Aquatics Conservation Strategy.

TABLE 3- AQUATIC CONSERVATION STRATEGY REPORTING REQUIREMENTS AND RESULTS

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
AQ-RM Has DNRC implemented RMZ commitments?	Complete HCP implementation checklist review on all sites.	From 2017 to 2021, 89 individual projects had Class 1 RMZs delineated within the timber sale area. Only 43 projects had RMZ harvest for a total of 310.1 acres.	v.2.4-39
AQ-RM (2)	Track and compile acres of Class 1 RMZs, acres of Class	From 2017-2021, 10 individual projects invoked RMZ harvest	v.2.4-39

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
Have allowances for Class 1 RMZ harvest been invoked?	1 RMZs harvested under allowances, and RMZ area in non-stocked or seedling/sapling size class by aquatic analysis unit.	allowances on a total of 85.6 acres. Percent total non-stocked, seedling-sapling size class/AAU: **Bitterroot:** 38.1 % **Blackfoot:** 3.7 % **Flathead Lake:** 16.5 % **Lower Clark Fork:** 0.0 % **Middle Clark Fork:** 6.7 % **Lower Kootenai:** 8.1 % **Middle Kootenai:** 3.8 % **Upper Kootenai:** 6.1 % **North Fork Flathead:** 21.2 % **Rock Creek:** 7.1 % **Stillwater:** 6.5 % **Swan:** 4.3 % **Upper Missouri:** 7.5 %	
AQ-RM (3) Has DNRC used allowance for cable corridors in the 50-foot, no-harvest buffer?	No more than 15% of the buffer area may be affected, and corridors must be spaced a minimum of 150 feet apart. If invoked, DNRC would monitor 3 sites every 5 years and report total acres of riparian harvest, total acres affected, and distance between corridors.	No cable corridor allowances were invoked during the 2017-2021 reporting period.	v.2.4-39
AQ-SD Has DNRC implemented sediment delivery reduction commitments?	Track and report the amount of road newly constructed, relocated, abandoned, and reclaimed.	Road activities included in timber sale contracts sold from January 2017-December 2021 include: 87.1 miles of new, permanent road construction 30.6 miles of temporary road construction 17.7 miles of road reclamation 1.8 miles of road abandonment 55.0 miles of road reconstruction 840.0 miles of Best Management Practices (BMP) maintenance (See Attachment SD-1; Road Activities Included in DNRC	v.2.4-40

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Timber Sale Contracts Sold in 2017, 2018, 2019, 2020, and 2021.) A list of individual road activities included in DNRC timber sale contracts sold during the reporting period and individual timber sale contract maps are available upon request.	
AQ-SD(2) Road inventories completed on all watersheds supporting bull trout within 10 years. All road inventories completed within 20 years. Classification and prioritization of corrective actions. Corrective actions to high-risk sites completed in bull trout watersheds within 15 years. Corrective actions to high-risk site located in other watersheds within 25 years.	Update status of all inventory projects and BMP audits. Complete accomplishment report detailing progress of road inventories, classification, and corrective actions.	At the end of 2021, 94.8% of bull trout and 84.6% of Westslope Cutthroat watersheds (3,133 miles in total) have completed road inventories. 568 miles or 15% of roads in HCP priority watersheds have yet to be inventoried and DNRC estimates that all inventoried will be completed by the end of 2023. It was found from these inventories that 2,843 miles or 91% of all inventoried road meet BMP standards. Of the 3,132 miles of road inventoried, 5.7 miles or <1% of all inventoried road had a moderate or high risk of direct sediment delivery to streams. Of the 4,977 culverts inspected, 1,181 or 24 % of all inventoried culverts did not meet BMP standards. Of all inventoried culverts, 302 or 6% posed a moderate or high risk of direct sediment delivery to a perennial or intermittent stream. During the first 10 years of HCP Implementation 1,630 miles (44% of HCP priority watershed road miles) have had BMP upgrades and maintenance performed.	v.2.4-40

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
AQ-SD(3) Statewide and internal BMP audits and contract administration inspections completed on all applicable forest management activities.	BMP application rate included in accomplishment report.	Between 2017 and 2021, 1,505 Best Management Practices were audited on State lands, either internally or through statewide audit efforts. Results of these efforts documented that 99% of the practices were adequately applied and 99% of the practices adequately protected soil and water resources. Minor departures of BMP application or effectiveness was observed on 34 practices and no practices had major departures in application or effectiveness. One gross neglect was noted.	v.2.4-40
AQ-SD(4) Has DNRC limited development of medium gravel pits in RMZs in the Stillwater Block or Swan River State Forest?	Report number of medium non-reclaimed pits and reclaimed pits within RMZs in Stillwater Block or Swan River State Forest.	There are currently 0 medium non-reclaimed RMZ gravel pits on the Stillwater Block. 0 reclaimed gravel pits are within the RMZ on the Stillwater Block. There are currently 0 medium non-reclaimed or reclaimed RMZ gravel pits on the Swan River State Forest.	v.2.4-40
AQ-FC Has DNRC implemented fish connectivity commitments? Every 5 years, one-sixth of all sites needing improvement have been implemented, planned, or designed. All priority 1 sites improved to provide connectivity within 15 years. All sites provide connectivity within 30 years.	Maintain planning schedule. Report accomplishments in context of completed or planned improvements.	DNRC completed a preliminary inventory of stream crossing sites in 2006 and the results were reported in HCP/EIS. The original HCP baseline included 106 inventoried stream crossing sites in need of corrective actions. To date, 54 new sites have been added to the inventory for a total of 160 crossing sites. Currently, sites have been removed from the planning schedule (See Attachment AQ-1; HCP Fish Connectivity Conservation Strategy Update). This includes 24 sites where corrective actions have been implemented (see Attachment AQ-2; Fish Connectivity Effectiveness Monitoring Update). There are 72	v.2.4-41

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		sites remaining in need of corrective actions or assessment. All bull trout fish passage sites have been addressed prior to the 2027 deadline identified in the HCP. Based on AQ-FC1.8, 1/6 of the total number of fish passage sites are to be improved every 5 years. To date, 88 of the 160 total sites have either implemented corrective actions to provide passage, or were removed from inventory due to being non-fish bearing, or supporting only non-native fish.	
AQ-GZ Has DNRC implemented grazing conservation commitments?	Provide update on status of grazing evaluations, verifications completed, and corrective actions implemented. Report on results of grazing evaluations and implementation of corrective actions.	For the period from 2017 to 2021, 282 grazing evaluations were completed on HCP parcels. Of these evaluations, 86 (30%) support an HCP fish species. During the review of grazing evaluation data, 11 parcels (3.9%) showed evidence that further verification was necessary. On-site verification by a resource professional of these sites flagged for verification concluded that no further action was warranted on 8 (73%) of these parcels for various documented reasons. The remaining 3 sites have had corrective actions applied to them to improve riparian habitat conditions. For a summary of inspections see Attachment AQ-3; Annual Summary Statistics of Grazing Verifications and Corrective Actions.	v.2.4-41
AQ-CWE Has DNRC implemented the CWE commitments?	Report number, type and location of CWE analysis completed. Provide documentation of mitigation measures or alternatives developed for projects with moderate or high CWE risks.	CWE analyses were completed for 138 timber sales and timber permits during between 2017 and 2021. For 109 of these projects a Level 1 CWE analysis (coarse filter) was determined to be sufficient level of analysis due to determination of low risks.	v.2.4-41

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		More detailed analysis was completed on the other 29 projects where the CWE Coarse filter analysis determined that there was potential for moderate to high levels of risk.	
Riparian Timber Harvest Conservation Strategy (See Attachment AQ-4)			
Assess the potential LWD recruitment in post-harvest stands and determine whether in-stream LWD targets will be met. Initial assessments will be conducted on five or more riparian harvest sites.	80% of the RMZ acres harvested will meet LWD targets.	DNRC has completed pre- and post-harvest LWD monitoring on 14 sites under HCP/SMZ law harvest prescriptions. Post-harvest LWD levels met or exceeded targets on all streams. A brief description of each individual RMZ/SMZ Harvest monitoring project is available in Attachment AQ-4.	v.2.4-42
Evaluate levels of in-stream cover provided by riparian harvest strategy. Complete in conjunction with LWD and stream temperature assessments.	Thresholds for adequate stream shade will be determined through stream temperature monitoring.	DNRC has completed pre- and post-harvest instream cover monitoring on 14 sites under HCP/SMZ law harvest prescriptions. Post-harvest shade monitoring indicates that current management is adequate to maintain suitable stream temperature regime for HCP-covered fish. A brief description of each individual RMZ/SMZ Harvest monitoring project is available in Attachment AQ-4.	v.2.4-42
Monitor stream temperatures to evaluate if levels of in-stream cover are adequate to maintain stream temperatures. Initial assessments will be conducted on five or more riparian harvest sites.	Temperature increases not to exceed peak seasonal or diel criteria for non-temperature-sensitive streams and no significant temperature difference for temperature-sensitive streams	DNRC has completed pre- and post-harvest stream temperature monitoring on 12 sites under HCP/SMZ law harvest prescriptions. Post-harvest monitoring indicated that 10 of 12 sites met thresholds identified in the HCP (Table 4.8). Two sites did not meet the chronic threshold, while one site did not meet the acute temperature threshold. A brief description of each individual RMZ/SMZ Harvest monitoring project is available in Attachment AQ-4.	v.2.4-42

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
Sediment Delivery Reduction Conservation Strategy			
BMP Audits on all applicable projects	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Between 2017 and 2021, 1,505 Best Management Practices were audited on State lands, either internally or through statewide audit efforts. Results of these efforts documented that 99% of the practices were adequately applied and 99% of the practices adequately protected soil and water resources. Minor departures of BMP application or effectiveness was observed on 34 practices and no practices had major departures in application or effectiveness. One gross neglect was noted.	v.2.4-43
Timber sale inspections on all applicable projects.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Between the 2017 and 2021 period, 1,816 timber sale inspection reports were recorded on active timber sales. These reports reviewed 21,922 individual contract items. Of these inspected contract requirements, 98.7% were found satisfactory, 1.2% in need of improvement and only 0.1% in violation of contract requirements.	v.2.4-43
Ongoing quantitative studies at two sites.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Two turbidity monitoring sites have been active each year of HCP implementation. These studies are designed to document the effectiveness of BMP's to mitigate sediment production and subsequent delivery to streams. A summary from these efforts can be found in Attachment AQ-5 and at MT AWRA 2017 Proceedings.	v.2.4-43
Case studies monitoring the effectiveness of corrective actions in reducing sediment from existing sources.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Two turbidity monitoring sites have been active each year of HCP implementation. These studies are designed to document the effectiveness of BMP's to mitigate sediment production and subsequent	v.2.4-43

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		delivery to streams. A summary from these efforts can be found in Attachment AQ-5.	
Fish Connectivity Conservation Strategy			
Determine if fish connectivity conservation strategy is effective.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Corrective actions have been implemented on 24 fish passage structures. DNRC has completed 2-year, 5-year, and 10-year effectiveness monitoring on appropriate improved sites, with no corrective actions identified and implemented during the reporting period (see Attachment AQ-2; Fish Connectivity Effectiveness Monitoring Update).	v.2.4-43
Grazing Conservation Strategy			
Determine if corrective actions for the grazing conservation strategy are effective.	Annual updates will consist of a summary status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	For the monitoring report period, 282 HCP parcels have been inspected for riparian condition on parcels licenses for forest grazing. 86 (30.4%) supported an HCP fish species. Verification on 11 parcels lead to the implementation of 3 corrective actions to date. For a summary of inspections see Attachment AQ-3; Annual Summary Statistics of Grazing Verifications and Corrective Actions.	v.2.4-43
Evaluate redd trampling risk on classified forest grazing licenses with HCP-covered species present.	Complete redd-risk assessment by 5-year monitoring report, include potential corrective actions to decrease redd trampling risks.	Initial redd-risk assessment identified 192 classified forest grazing parcels containing stream segments with HCP-covered species present. Redd-risk were assigned to all parcels, with 76 total parcels identified for potential corrective actions. (see Attachment AQ-6; Redd Trampling Risk Assessment)	v.2.4-55
Cumulative Watershed Effects Conservation Strategy			
DNRC and USFWS meet to evaluate effectiveness of CWE process.	DNRC and USFWS meet to evaluate effectiveness of CWE process.	See meeting notes for accomplishments and action items.	v.2.4-44

TRANSITION LANDS MONITORING

Since the inception of the DNRC HCP in 2012, DNRC has disposed and/or exchanged 8,957 acres or 1.6% of the original baseline acres originally covered by the HCP. In this same period, DNRC also acquired 81,206 acres and transitioned those lands in the Incidental Take Permit (ITP). This amounts to 14.8% addition over the 2012 baseline acreage. Below is a summary of those land transactions. DNRC is within the transitional lands cap for disposals for this first 10-year period of the HCP.

Baseline and Amendments	**Acres**	**Year**
Original HCP	548,646	2012
Transitional Lands Amendment #1 - Montana Legacy Project	81,206	2018
Total DNRC HCP Acres	**629,852**	
Dispositions and Exchanges		
Disposition - CSKT Tribe Exchange	5,548	2019
Disposition - Other Lands (Cabin Sites, Lolo Land Exchange)	2,769	2015-2018
Disposition - Libby Asbestos Parcel Exchange	640	2017
Total DNRC Disposition (2012-2021)	**8,957**	
Total DNRC HCP Cover Lands under ITP	**620,895**	
Total DNRC HCP GIS Acres as of June 2022	**620,898**	

APPENDIX I - RESOURCE ATTACHMENTS

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Attachment GB-1: Miles of Road in Various Grizzly Bear Management Areas

Recovery Zone

2018 HCP BASELINE DATA - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Recovery Zones (Scattered or Blocked Status)	Linear Miles of Road in Recovery Zones						Area		Road Density* ($mi/mi^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**200.6**	**630.7**	**51.7**	**18.8**	**43.9**	**879.9**	**252.0**	**161,835**	**3.5**
Kalispell Unit NCDE (Scattered)	17.8	28.2	0.0	2.6	0.0	42.8	10	6,465	**4.2**
Libby Unit CYE (Scattered)	0.0	8.2	0.1	0.4	0.2	8.3	4	2,848	**1.9**
Plains Unit CYE (Scattered)**	7.7	6.2	0.0	3.1	0.0	13.9	5	3,517	**2.8**
Stillwater Unit NCDE (Blocked)	122.0	192.0	42.1	12.5	13.4	356.1	141	90,432	2.5
Stillwater Unit NCDE (Scattered)	1.8	11.1	0.0	0.0	0.0	13.1	4	2,474	**3.4**
Swan Unit NCDE (Blocked)**	51.3	385.0	9.5	0.1	30.2	445.8	88	56,099	**5.1**
SWLO	**20.9**	**26.0**	**2.8**	**7.4**	**1.8**	**42.8**	**10**	**6,330**	**4.3**
Clearwater Unit NCDE (Scattered)**	16.8	26.0	2.8	7.4	1.8	42.8	10	6,330	4.3
Missoula Unit NCDE (Scattered)	4.1	0.0	0.0	0.0	0.0	0.0	0	-	N/A
CLO	**0.1**	**0.2**	**0.0**	**0.0**	**0.7**	**0.3**	**1**	**639**	**0.3**
Helena Unit NCDE (Scattered)	0.2	0.3	0.0	0.0	0.5	0.5	1	639	0.5
** Does not include Abandoned or Reclaimed Roads*									
***land acquisition and subsequent transition into the HCP have created a new baseline for these management units in 2018.*									

2021 - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Recovery Zones (Scattered or Blocked Status)	Linear Miles of Road in Recovery Zones						Area		Road Density* (mi/mi^2)
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (Sqr. Miles)	Acres	
NWLO	**181.7**	**741.7**	**59.9**	**23.8**	**56.0**	**983.2**	**273.0**	**175,289**	**3.6**
Kalispell Unit NCDE (Scattered)	11.2	27.3	0.0	1.9	7.0	38.5	10.0	6,457	**3.9**
Libby Unit CYE (Scattered)	0.0	5.8	0.1	0.4	1.2	5.9	4.0	2,846	**1.5**
Plains Unit CYE (Scattered)	7.7	6.2	0.0	3.1	0.0	13.9	5.0	3,517	**2.8**
Stillwater Unit NCDE (Blocked)	109.7	295.8	50.3	17.2	13.9	455.8	162.0	103,887	**2.8**
Stillwater Unit NCDE (Scattered)	1.7	11.7	0.0	0.0	0.0	13.4	4.0	2,483	**3.4**
Swan Unit NCDE (Blocked)	51.3	394.9	9.5	1.2	33.9	455.6	88.0	56,099	**5.2**
SWLO	**13.9**	**26.0**	**2.8**	**7.4**	**1.9**	**42.6**	**10.0**	**6,650**	**4.3**
Clearwater Unit NCDE (Scattered)	13.9	26.0	2.8	7.4	1.9	42.6	10.0	6,330	**4.3**
Missoula Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	320	**0.0**
CLO	**0.1**	**0.2**	**0.0**	**0.0**	**0.7**	**0.3**	**1.0**	**639**	**0.3**
Helena Unit NCDE (Scattered)	0.1	0.2	0.0	0.0	0.7	0.3	1.0	639	**0.3**
** does not include abandoned or reclaimed*									

Non-Recovery Occupied (NROH)

2018 HCP BASELINE DATA - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Non Recovery Occupied Zone (Scattered or Blocked Status)	Linear Miles of Road in Non Recovery Occupied Zones						Area		Road Density* (mi/mi$^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**102.8**	**147.6**	**3.0**	**12.5**	**7.7**	**250.1**	**58.0**	**37,682**	**4.3**
Kalispell Unit NCDE (Scattered)	17.9	9.0	0.0	0.3	2.1	27.0	9	5,950	2.9
Libby Unit CYE (Scattered)	23.3	49.0	1.2	0.0	0.0	73.4	15	9,856	4.8
Libby Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0	0	N/A
Plains Unit CYE (Scattered)**	7.1	9.0	1.8	0.2	0.7	17.9	4	2,237	4.5
Plains Unit NCDE (Scattered)	6.9	9.7	0.0	1.2	0.0	13.4	4	2,813	3.0
Stillwater Unit NCDE (Scattered)	47.6	70.9	0.0	10.8	4.9	118.4	26	16,826	4.5
SWLO	**69.7**	**358.1**	**17.6**	**47.6**	**12.9**	**445.4**	**91**	**58,369**	**4.9**
Anaconda Unit NCDE (Scattered)	6.7	14.4	0.0	0.0	0.0	21.1	9	6,011	2.3
Clearwater Unit NCDE (Scattered)**	63.0	343.7	17.6	47.6	12.9	424.3	82	52,358	5.2
Missoula Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0	0	N/A
CLO	**10.3**	**68.2**	**0.1**	**7.3**	**1.9**	**78.5**	**53.0**	**33,717**	**1.5**
Bozeman Unit GYE (Scattered)	5.0	6.0	0.1	0.0	0.0	11.0	13	8,129	0.9
Dillon Unit GYE (Scattered)	1.5	51.9	0.0	6.7	0.0	53.4	31	19,627	1.7
Helena Unit NCDE (Scattered)	3.8	10.3	0.0	0.6	1.9	14.1	9	5,961	1.5
** Does not include Abandoned or Reclaimed Roads*									
***land acquisition and subsequent transition into the HCP have created a new baseline for these management units.*									

2021 - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Non Recovery Occupied Zone (Scattered or Blocked Status)	Linear Miles of Road in Non Recovery Occupied Zones						Area		Road Density* (mi/mi^2)
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (Sqr. Miles)	Acres	
NWLO	**104.9**	**159.7**	**3.1**	**13.3**	**11.7**	**267.7**	**56.0**	**36,737**	**4.8**
Kalispell Unit NCDE (Scattered)	19.9	17.3	0.1	0.3	2.3	37.3	9.0	5,613	**4.1**
Libby Unit CYE (Scattered)	24.1	56.2	1.2	0.3	0.2	81.4	15.0	9,831	**5.4**
Libby Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	**0.0**
Plains Unit CYE (Scattered)	7.1	9.0	1.8	0.2	0.7	17.9	3.0	2,237	**6.0**
Plains Unit NCDE (Scattered)	5.8	5.4	0.0	0.6	0.0	11.2	3.0	2,212	**3.7**
Stillwater Unit CYE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	**0.0**
Stillwater Unit NCDE (Scattered)	47.9	71.8	0.1	11.9	8.5	119.8	26.0	16844.0	**4.6**
SWLO	**62.7**	**387.5**	**17.4**	**50.3**	**18.4**	**467.5**	**92.0**	**59,143**	**5.1**
Anaconda Unit NCDE (Scattered)	1.3	33.7	0.0	2.4	3.0	35.0	9.0	6,011	**3.9**
Clearwater Unit NCDE (Scattered)	61.3	353.7	17.4	47.9	15.4	432.5	83.0	53,132	**5.2**
Missoula Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0
CLO	**16.1**	**70.6**	**1.0**	**1.2**	**9.1**	**87.6**	**53.0**	**33,700**	**1.7**
Bozeman Unit GYE (Scattered)	5.9	12.2	0.0	0.6	0.4	18.2	13.0	8,142	**1.4**
Dillon Unit GYE (Scattered)	4.0	52.9	1.0	0.0	1.8	57.9	31.0	19,628	**1.9**
Helena Unit NCDE (Scattered)	6.1	5.5	0.0	0.6	6.9	11.6	9.0	5930.0	1.3
** Does not include abandoned or reclaimed roads.*									

Lands Outside Grizzly Bear Zones

2018 HCP BASELINE DATA - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices Outside Grizzly Bear Zones (Scattered Status)	Linear Miles of Road in Non Grizzly Bear Designated Areas						Area		Road Density* ($mi/mi^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**255.6**	**318.1**	**3.4**	**28.3**	**15.0**	**577.0**	**138.0**	**88,293.0**	**4.2**
Kalispell Unit	110.4	71.9	0.0	9.8	10.9	182.3	44.0	27,980	4.1
Libby Unit	29.2	75.6	0.3	0.0	0.0	105.1	24.0	15,341	4.4
Plains Unit**	116.0	170.6	3.1	18.5	4.1	289.6	70	44,972	4.1
SWLO	**249.4**	**777.7**	**13.9**	**79.6**	**11.5**	**1,040.9**	**242.0**	**154,299**	**4.3**
Anaconda Unit	78.2	63.4	0.0	2.0	0.8	141.6	61.0	38,760	2.3
Clearwater Unit**	17.7	42.1	5.2	5.6	1.4	65.0	12	7,880	5.4
Hamilton Unit**	32.9	114.4	3.7	56.4	7.0	151.0	37	23,496	4.1
Missoula Unit**	120.5	557.7	5.0	15.5	2.4	683.3	132	84,163	5.2
CLO	**44.9**	**142.8**	**1.9**	**13.1**	**1.7**	**189.6**	**122.4**	**78,358**	**1.5**
Bozeman Unit	6.0	21.0	1.6	0.8	0.0	28.5	13.0	8,363	2.2
Dillon Unit	20.1	100.7	0.3	12.2	1.5	121.1	79.0	50,474	1.5
Helena Unit	18.8	21.2	0.0	0.0	0.2	40.0	31.0	19,520	1.3
** Does not include Abandoned or Reclaimed Roads*									
***land acquisition and subsequent transition into the HCP have created a new baseline for these management units.*									

2021 - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices Outside Grizzly Bear Zones (Scattered Status)	Linear Miles of Road in Non Grizzly Bear Designated Areas						Area		Road Density* (mi/mi^2)
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (Sqr. Miles)	Acres	
NWLO	**246.1**	**362.9**	**3.2**	**28.3**	**15.0**	**612.2**	**138**	**88,021**	**4.4**
Kalispell Unit	97.9	113.6	0.0	9.9	9.9	211.6	44	27,952	**4.8**
Libby Unit	32.8	78.5	0.1	0.0	0.3	111.4	24	15,099	**4.6**
Plains Unit	115.4	170.7	3.1	18.5	4.8	289.2	70	44,970	**4.1**
SWLO	**177.3**	**850.5**	**15.2**	**97.7**	**18.0**	**1043.0**	**240**	**153,675**	**4.3**
Anaconda Unit	20.3	131.4	0.0	14.8	3.7	151.7	59	38,056	**2.6**
Clearwater Unit	10.5	35.8	5.0	5.5	1.4	51.3	12	7,880	**4.3**
Hamilton Unit	32.4	114.6	3.7	61.0	7.3	150.7	37	23,496	**4.1**
Missoula Unit	114.1	568.7	6.5	16.3	5.6	689.3	132	84,243	**5.2**
CLO	**68.2**	**100.6**	**4.7**	**8.1**	**11.2**	**173.4**	**123**	**78,883**	**1.4**
Bozeman Unit	11.8	16.7	1.6	0.0	1.3	30.1	13	8,368	**2.3**
Dillon Unit	32.4	83.8	3.0	8.1	9.6	119.3	80	51,000	**1.5**
Helena Unit	24.0	0.0	0.0	0.0	0.2	24.0	30	19,515	**0.8**
						** does not include abandoned or reclaimed*			

Attachment GB-2: Grizzly Bear closure inspection results 2012-2021

Year	Clearwater		Kalispell		Libby		Plains		Stillwater		Swan		Summary By Year	
	Closures Inspected	Effective (%)	Closures Inspected	Effective (%)	Closures Inspected	Effective (%)	Closures Inspected	Effective (%)	Closures Inspected	Effective (%)	Closures Inspected	Effective (%)	Closures Inspected	Effective (%)
2012	15	87%	45	93%	41	98%	35	97%	178	90%	193	93%	**507**	**92%**
2013	16	88%	46	96%	49	94%	29	93%	180	92%	223	98%	**543**	**95%**
2014	24	96%	45	100%	48	83%	27	96%	200	96%	242	99%	**586**	**96%**
2015	24	100%	45	98%	51	86%	28	96%	198	96%	240	99%	**586**	**97%**
2016	23	100%	33	91%	48	94%	28	100%	196	96%	229	95%	**557**	**96%**
2017	22	100%	50	86%	49	100%	27	100%	195	96%	227	98%	**570**	**96%**
2018	22	100%	48	94%	46	98%	27	96%	183	97%	227	96%	**553**	**96%**
2019	21	100%	46	91%	49	100%	28	100%	193	100%	227	95%	**564**	**97%**
2020	21	100%	43	81%	46	89%	28	100%	191	95%	226	96%	**555**	**94%**
2021	21	100%	44	100%	47	94%	27	89%	195	95%	224	98%	**558**	**96%**
Summary By Unit	**209**	**97%**	**445**	**93%**	**474**	**94%**	**284**	**97%**	**1909**	**95%**	**2258**	**97%**	**5,579**	**96%**

Attachment LY-1: Composition of current (February 2022) lynx habitat data, using the HCP lynx habitat definitions, on LMAs in the HCP project area

2018 HCP BASELINE - DNRC lands in the HCP Project Area (Data from March 6, 2019)												
Habitat Class	**Proposed LMA's (Land Office)**											
	Stillwater West (NW)		**Stillwater East (NW)**		**Coal Creek (NW)**		**Swan (NW)**		**Seeley Lake Area (SW)**		**Garnet Area (SW)**	
Winter Foraging Habitat	17,505	50%	21,136	62%	5,672	44%	27,095	53%	1,865	42%	1,669	41%
Summer Foraging Habitat	10,114	29%	5,922	17%	2,169	17%	7,927	16%	187	4%	250	6%
Other Suitable Habitat	3,540	10%	3,057	9%	1,676	13%	5,021	10%	806	18%	1,555	38%
Suitable Habitat Subtotal	**31,159**	**89%**	**30,115**	**89%**	**9,517**	**74%**	**40,042**	**79%**	**2,858**	**64%**	**3,475**	**86%**
Temporary Non-Suitable Habitat	3,772	11%	3,913	11%	3,396	26%	10,763	21%	1,581	36%	588	14%
Total Potential Lynx Habitat	**34,931**	**91%**	**34,028**	**93%**	**12,914**	**86%**	**50,806**	**91%**	**4,439**	**45%**	**4,063**	**45%**
Non-Habitat	3,644	9%	2,629	7%	2,057	14%	5,292	9%	5,480	55%	4,873	55%
DNRC Total Acres	**38,575**	**100%**	**36,657**	**100%**	**14,970**	**100%**	**56,098**	**100%**	**9,919**	**100%**	**8,936**	**100%**

2021 HCP Annual Report - DNRC lands in the HCP Project Area (Data from February 4, 2022)														
	Proposed LMA's (Land Office)													
Habitat Class	**Stillwater West (NWLO)**	**%**	**Stillwater East (NWLO)**	**%**	**Stillwater South (NWLO)**	**%**	**Coal Creek (NWLO)**	**%**	**Swan (NWLO)**	**%**	**Seeley Lake (SWLO)**	**%**	**Garnet Area (SWLO)**	**%**
Winter Foraging	17,627	51%	19,753	58%	3,183	24%	5,569	44%	26,845	53%	1,909	43%	1,669	41%
Summer Foraging	9,553	27%	5,955	17%	5,033	39%	1,988	16%	6,864	14%	184	4%	187	5%
Other Suitable Habitat	4,268	12%	3,149	9%	3,897	30%	1,827	14%	5,888	12%	1,460	33%	1,619	40%
Suitable Habitat Subtotal	**31,447**	**90%**	**28,857**	**85%**	**12,113**	**93%**	**9,385**	**74%**	**39,596**	**78%**	**3,553**	**80%**	**3,475**	**86%**
Temporary Non-Suitable Habitat	3,430	10%	5,259	15%	920	7%	3,227	26%	11,208	22%	878	20%	588	14%
Total Potential Lynx Habitat	**34,877**	**90%**	**34,115**	**93%**	**13,032**	**98%**	**12,612**	**86%**	**50,804**	**91%**	**4,431**	**45%**	**4,063**	**45%**
Non-Habitat	3,744	10%	2,610	7%	247	2%	2,049	14%	5,294	9%	5,506	55%	4,873	55%
DNRC Total Acres	**38,621**	**100%**	**36,725**	**100%**	**13,279**	**100%**	**14,661**	**100%**	**56,098**	**100%**	**9,937**	**100%**	**8,936**	**100%**

Attachment LY-2: Acres of existing lynx habitat on Non-LMA parcels, using HCP lynx habitat definitions, on DNRC lands by Land Office in the HCP Project Area

2018 HCP BASELINE DATA - DNRC lands in the HCP Project Area (Data from March 6, 2019)							
Habitat Class	HCP Project Area (%)						
	NWLO		SWLO		CLO		Total
Winter Foraging Habitat	38,974	59%	18,289	48%	0	0%	57,263
Summer Foraging Habitat	5,023	8%	6,306	17%	0	0%	11,329
Other Suitable Habitat	12,390	19%	7,594	20%	0	0%	19,984
Suitable Habitat Subtotal	**56,388**	**86%**	**32,188**	**84%**	**27,355**	**79%**	**115,931**
Temporary Non-Suitable Habitat	9,346	14%	6,014	16%	7,435	21%	22,795
Total Potential Lynx Habitat	**65,734**	**47%**	**38,202**	**19%**	**34,790**	**31%**	**138,726**
Non-Habitat (includes non forested)	74,591	53%	162,663	81%	78,434	69%	315,688
DNRC Total Acres	**140,325**	**100%**	**200,865**	**100%**	**113,224**	**100%**	**454,414**

2021 HCP ANNUAL REPORT - DNRC lands in the HCP Project Area (Data from February 4, 2022)							
Habitat Class	HCP Project Area (%)						
	NWLO		SWLO		CLO		Total
Winter Foraging	35,340	54%	18,077	47%	0	0%	53,417
Summer Foraging	4,584	7%	5,124	13%	0	0%	9,707
Other Suitable Habitat	13,628	21%	9,424	25%	0	0%	23,051
Suitable Habitat Subtotal	**53,551**	**81%**	**32,624**	**85%**	**25,779**	**74%**	**111,954**
Temporary Non-Suitable Habitat	12,224	19%	5,553	15%	8,848	26%	26,626
Total Potential Lynx Habitat	**65,775**	**47%**	**38,178**	**19%**	**34,627**	**31%**	**138,580**
Non-Habitat (includes non forested)	74,352	53%	162,767	81%	77,964	69%	315,083
DNRC Total Acres	**140,127**	**100%**	**200,945**	**100%**	**112,591**	**100%**	**453,663**

Attachment SD-1: Road Activities Included in DNRC Timber Sale Contracts from 2012-2021

2021 HCP ANNUAL REPORT - DNRC LANDS IN THE HCP PROJECT AREA											
Road Activity	HCP PROJECT AREA: ROAD ACTIVITIES (MILES) BY REPORTING PERIOD										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total Road Activities**
Permanent Road Construction	15.7	25.6	23.0	27.2	26.0	23.7	9.9	15.1	17.8	20.6	204.6
Temporary Road Construction	5.3	10.9	9.3	6.0	9.2	10.5	1.6	4.4	7.0	7.1	71.3
Road Reclamation	4.3	4.6	1.9	0.2	0.0	0.0	1.7	2.1	8.5	5.4	28.7
Road Abandonment	0.0	0.0	1.0	1.7	0.1	0.0	0.0	0.5	1.3	0.0	4.5
Road Reconstruction	10.8	11.1	11.3	19.7	16.6	6.6	9.4	15.6	12.1	11.3	124.5
BMP Maintenance	120.2	111.3	204.6	177.9	176.3	199.8	153.3	171.7	175.7	139.5	1,630.3
Total Road Activities	**156.3**	**163.5**	**251.1**	**232.7**	**228.2**	**240.6**	**175.9**	**209.4**	**222.3**	**183.9**	**2,063.9**

Attachment SD-2: Road Inventory Status by Aquatic Analysis Unit and Priority Watershed

EIS AAU	6th Code Watersheds	2021 Total DNRC Road Miles**	2015 Inventoried (mi)	2015 Inventoried (%)	2016 Inventoried (mi)	2016 Inventoried (%)	2017 Inventoried (mi)	2017 Inventoried (%)	2018 Inventoried (mi)	2018 Inventoried (%)	2019 Inventoried (mi)	2019 Inventoried (%)	2020 Inventoried (mi)	2020 Inventoried (%)	2021 Inventoried (mi)	2021 Inventoried (%)
Bitterroot	27	230.8	126.8	55.1%	141.5	61.5%	179.2	77.9%	179.2	77.9%	186.0	80.9%	188.9	82.1%	208.0	90.1%
Blackfoot	52	965.2	346.9	36.1%	350.0	36.5%	366.7	38.2%	376.5	39.2%	865.9	90.2%	884.1	92.1%	932.5	96.6%
Flathead Lake	10	71.1	20.7	29.1%	20.7	29.1%	21.3	30.0%	21.3	30.0%	26.3	37.0%	28	39.4%	35.8	50.4%
Lower Clark Fork	15	23.1	5.4	23.0%	5.4	23.0%	5.4	23.0%	5.5	23.2%	4.9	20.8%	5.6	23.8%	18.6	80.5%
Lower Kootenai	7	15.3	4.5	29.4%	4.6	30.2%	4.9	32.0%	4.9	32.0%	4.9	32.0%	4.9	32.0%	13.0	84.8%
Middle Clark Fork	84	590.2	143.9	24.2%	227.8	38.4%	290.2	48.9%	298.0	50.2%	345.7	58.3%	372.4	62.8%	457.0	77.4%
Middle Kootenai	25	225.8	75.9	33.6%	76.3	33.8%	82.3	36.5%	97.6	43.2%	103.6	45.9%	104.2	46.2%	162.1	71.8%
NF Flathead	15	68.2	2.1	3.1%	2.4	3.5%	2.4	3.5%	2.4	3.5%	39.0	57.4%	39.7	58.4%	60.4	88.6%
Rock Creek	8	23.5	12.3	54.4%	12.3	54.4%	14.6	65.0%	15.1	67.3%	15.1	67.2%	15.1	67.1%	23.4	99.6%
Stillwater	18	466.9	129.5	27.7%	131.7	28.2%	138.1	29.6%	230.5	49.4%	331.5	71.0%	337.2	72.2%	425.1	91.1%
Swan	10	522.5	148.1	28.3%	173.7	33.2%	178.8	34.2%	219.0	41.9%	390.3	74.7%	420.9	80.6%	494.9	94.7%
Upper Clark Fork	55	249.8	123.5	49.8%	135.2	54.6%	139.5	56.3%	140.6	56.7%	190.2	76.7%	196.2	79.1%	212.8	85.2%
Upper Kootenai	19	94.0	37.8	40.2%	38.7	41.2%	39.6	42.1%	39.6	42.1%	37.3	39.7%	41.8	44.5%	65.4	69.6%
Upper Missouri	51	154.7	2.9	1.9%	3.3	2.2%	5.2	3.4%	5.2	3.4%	8.9	5.8%	14.8	9.6%	23.4	15.1%
Total	**396**	**3,701**	**1,180.1**	**31.9%**	**1,323.6**	**35.8%**	**1,468.3**	**39.7%**	**1,635.4**	**44.3%**	**2,549.6**	**69.0%**	**2,653.8**	**71.8%**	**3,132.4**	**84.6%**

***Reflects land ownership and associated road miles at the calendar year end of 2019 reflecting increased acres of DNRC HCP Amendment #1*

Watershed Priority*	6th Code Watersheds	Total DNRC Road Miles**	2015 Inventoried (mi)	2015 Inventoried (%)	2016 Inventoried (mi)	2016 Inventoried (%)	2017 Inventoried (mi)	2017 Inventoried (%)	2018 Inventoried (mi)	2018 Inventoried (%)	2019 Inventoried (mi)	2019 Inventoried (%)	2020 Inventoried (mi)	2020 Inventoried (%)	2021 Inventoried (mi)	2021 Inventoried (%)
1A	13.0	89.5	21.7	27.2%	21.9	27.4%	24.7	31.0%	33.9	42.4%	34.6	38.7%	34.6	38.7%	82.9	92.6%
1B	10.0	28.7	5.3	23.2%	5.5	24.0%	9.2	40.5%	13.1	57.5%	12.9	44.9%	13.1	45.6%	26.9	93.7%
1C	74.0	2,280.6	813.3	50.9%	904.7	56.7%	998.1	62.5%	1,120.6	70.2%	1,735.8	76.3%	1,799.3	79.1%	2,164.6	94.9%
BT Watershed Summary	**97.0**	**2,398.8**	**840.3**	**49.5%**	**932.1**	**54.9%**	**1,032.1**	**60.7%**	**1,167.6**	**68.7%**	**1,783.3**	**74.5%**	**1,847.0**	**77.1%**	**2,274.4**	**94.8%**
2A	7.0	85.9	37.0	44.5%	37.4	44.9%	38.3	46.1%	39.4	47.4%	42.7	49.7%	42.7	49.7%	44.2	51.5%
2B	192.0	1,216.3	302.8	33.2%	354.2	38.8%	397.9	43.6%	428.4	47.0%	723.5	59.6%	763.8	62.9%	813.9	66.9%
WCT Watershed Summary	**286.0**	**3,672.3**	**1,174.9**	**44.0%**	**1,318.1**	**49.3%**	**1,459.1**	**54.6%**	**1,622.3**	**60.7%**	**2,536.6**	**69.2%**	**2,640.4**	**72.0%**	**3,105.6**	**84.6%**
CRB Watershed Summary	**7.0**	**85.9**	**37.0**	**44.5%**	**37.4**	**44.9%**	**38.3**	**46.1%**	**39.4**	**47.4%**	**42.7**	**49.7%**	**42.7**	**49.7%**	**44.2**	**51.5%**
All Priority Totals	**296.0**	**3,701.0**	**1,180.1**	**43.8%**	**1,323.6**	**49.1%**	**1,468.3**	**54.5%**	**1,635.4**	**60.7%**	**2,549.5**	**69.0%**	**2,653.5**	**71.8%**	**3,132.5**	**84.6%**

**Inventory Priority by Fish Species: 1A = BT, CRB,WCT 1B = BT 1C = BT, WCT 2A = WCT, CRB 2B= WCT*

***Reflects land ownership and associated road miles at the calendar year end of 2021 reflecting increased acres of DNRC HCP Amendment #1 and Amendment #2*

Attachment SD-3: Road Inventory Results and Summary

All Roads on DNRC HCP lands in 6th code watersheds supporting an HCP Fish Species					
Year	Total Roads	Total Inventory	% Inventoried	Inventoried Road	
				Meeting BMP's	% Meeting BMPS
2015	2,597	1,180	45%	915	78%
2016	2,735	1,324	48%	1,069	81%
2017	2,687	1,468	55%	1,179	80%
2018	2,729	1,635	60%	1,422	87%
2019*	3,722	2,550	69%	2,336	92%
2020	3,722	2,654	71%	2,378	90%
2021	3,701	3,133	85%	2,843	91%
**HCP Transistional Lands Amendment #1*					

Roads within 300' of a stream in 6th code watersheds supporting HCP Fish Species					
Year	Total Roads	Total Inventory	% Inventoried	Inventoried Road	
				Meeting BMP's	% Meeting BMPS
2015	304.5	125.8	41%	88.2	70%
2016	316.6	138.7	44%	105.2	76%
2017	304.4	149.8	49%	114.0	76%
2018	305.9	177.9	58%	151.9	85%
2019*	377.5	263.2	70%	222.1	84%
2020	377.1	270.4	72%	224.4	83%
2021	377.0	321.6	85%	272.5	85%
**HCP Transistional Lands Amendment #1*					

Crossing Structure Summary						
Crossing Type	Inventory Summary			Sediment Risk		
	Meets BMP's	Not Meeting BMP's	Total Inventory	Low	Moderate	High
Road Ditch Relief Culverts	2,350	618	2,968	2,893	62	13
Ephemeral Draw Crossings	591	175	766	744	19	3
Intermittent Stream Crossing	248	130	378	315	47	16
Perennial Stream Crossing	376	193	569	448	69	52
Seep or Spring	231	65	296	275	16	5
Summary	**3,796**	**1,181**	**4,977**	**4,675**	**213**	**89**
Summary (% of Total)	**76%**	**24%**	**100%**	**94%**	**4%**	**2%**

Inventoried Sediment Delivery Points						
Inventory Year	Moderate Risk Sites	Moderate Risk Length (ft)	High Risk Sites	High Risk Length (ft)	Repaired Sites	Repair Sites Length (ft)
2015	3	1,040	0	0	1	500
2016	37	7,885	18	3,685	4	840
2017	3	250	14	3,710	1	500
2018	18	3,145	11	1,145	1	40
2019	14	2,390	29	4,130	0	0
2020	4	1,010	2	140	2	130
2021	13	749	11	730	0	0
Summary	**92**	**16,469**	**85**	**13,540**	**9**	**2,010**
% of Roads Within 300' of a Stream	0.83%		0.68%		0.10%	

Attachment AQ-1: Fish Connectivity Conservation Strategy Update

Conservation Strategy: The goal of the fish connectivity conservation strategy is to address movement barriers that prevent or impede upstream or downstream fish migration. Objectives include: 1) establish an inventory of every road-stream crossing within known and suspected native fish habitat, 2) collect sufficient data to develop assessment of fish connectivity, 3) conduct detailed analysis of each site and compile results into a database, 4) develop maintenance planning schedule focusing on stream crossing status and the need to provide connectivity at those sites.

HCP Commitments: The following are specific conservation commitments under this conservation strategy:

1. Strategy applies to HCP project area lands and roads and stream crossings the DNRC has access and sole ownership. On crossings and roads with shared ownership, DNRC will work with cooperators to address fish passage issues.
2. Improved crossings will provide connectivity to adult and juvenile bull trout (BT), westslope cutthroat trout (WCT), and Columbia redband trout (CRT) during low to bankfull flow by emulating streambed for and function at stream crossing sites.
3. Inventory and assess all existing stream crossings on known and presumed BT, WCT, and CRT not included in the initial Fish Passage Assessment Project.
4. Prioritize road-stream crossing improvements based on existing levels of connectivity, as well as species status and population biological goals. Two levels of prioritization will occur:
    a. Coarse filter
        i. Priority 1: Any BT life stage
        ii. Priority 2: Genetically pure WCT or CRT
        iii. Priority 3: Unknown purity WCT or CRT
        iv. Priority 4: 80-99% pure WCT or CRT
    b. Fine filter
        i. Determine if culvert removal or replacement meets conservation objectives while considering goals of other organizations.
        ii. Determine existing connectivity for different life stages
        iii. Improvements may be based on management opportunities.
5. Maintain a planning schedule containing a list of all sites to be addressed by this strategy.
6. Priority 1 sites improved in the first 15 years that the HCP and Permit are in effect
7. All crossings addressed within the first 30 years of the HCP and Permit
8. Every 5 years complete corrective actions on 1/6 of the sites not meeting objectives of the strategy.
9. Design of road-stream crossings will be determined by DNRC based on channel form and function, costs, long-term environmental risk, and anticipated use.

10. Crossings constructed on BT, WCT, and CRT habitat will include mitigations to minimize disturbance during spawning, salvage and exclude fish from construction sites, slowly reintroduce stream flow to newly installed crossing structures to allow substrate to adjust to stream energies, meet Montana Forestry BMPs, and provide training on design and construction techniques for field staff responsible for installation.

Results:

Current status of road-stream crossing inventory within each Aquatic Analysis Unit is found in Table 1. The initial inventory of road-stream crossings included in the HCP was 106 sites. Through land acquisitions and subsequent road inventory, 54 additional sites were added to the inventory resulting in a total of 160 crossings. To date, 24 sites have been improved under the fish connectivity conservation strategy. Of these improvements, 2 structures were modified into barriers to protect native fish populations, 10 structures were removed, and channel conditions were restored based on reference reach conditions, 10 structures were removed and replaced with fish passage structures, and 3 culverts were removed and replaced with armored fords. Based on hydrological and fisheries surveys, 64 sites have been removed from consideration for replacement based on factors including; 1) dry stream channel, and 2) no fish presence documented upstream or downstream from the crossing structure. The remaining inventory is 72 structures. All known Priority 1 fish passage sites have been addressed, prior to the 2027 commitment deadline. Of the remaining fish passage sites, all are Priority 2 or lower, with a corrective action timeline of 2042, 30-years post-implementation of the HCP. Based on the timeline and remaining inventory, DNRC would need to address 3 to 4 sites per year to meet the fish passage commitment, similar to the estimated timeline when the commitment was developed.

Table 1: Summary of stream crossing improvements made during the first 5 years of the Fish Connectivity Conservation Strategy (AQ-FC).

Aquatic Analysis Unit	Inventory Start 2021		Sites Added to Inventory 2021		Sites Removed from Inventory 2021		Corrective Actions Completed 2021		Inventory End 2021	
	Priority 1	Priority 2-5	Priority 1	Priority 2-5	Priority 1	Priority 2-5	Priority 1	Priority 2-5	Priority 1	Priority 2-5
Bitterroot	0	1	0	0	0	0	0	0	0	1
Blackfoot	0	9	0	4	0	0	0	0	0	13
Flathead Lake	0	2	0	0	0	0	0	0	0	2
Lower Clark Fork	0	0	0	0	0	0	0	0	0	0
Middle Clark Fork	0	9	0	0	0	2	0	0	0	7
Upper Clark Fork	0	4	0	0	0	0	0	0	0	4
Lower Kootenai	0	0	0	0	0	0	0	0	0	0
Middle Kootenai	0	0	0	0	0	0	0	0	0	0
Upper Kootenai	0	1	0	0	0	0	0	0	0	1
North Fork Flathead	0	1	0	0	0	0	0	0	0	1
Rock Creek	0	1	0	0	0	0	0	0	0	1
Swan	0	12	0	0	0	0	0	0	0	12
Stillwater	1	28	0	1	0	0	1	0	0	29
Upper Missouri	0	1	0	0	0	0	0	0	0	1
Total Crossings	1	69	0	5	0	2	1	0	0	72

2021 Completed Activities

- Replaced Priority 1 crossing on Swede Creek
- Removed two Priority 3 crossings from inventory on non-fish bearing tributaries to East Fork Twelvemile Creek (St. Regis)
- Added five Priority 3 sites to inventory on fish-bearing reaches of Bear Creek (Blackfoot)

2022 Planned Activities

- Electrofishing surveys on multiple streams to evaluate current fish assemblage and appropriate prioritization level
- Remove one crossing on Dry Cottonwood Creek, Clearwater Unit (WCT)
- Remove one crossing on Pearson Creek, Clearwater Unit (WCT)
- Replace two crossings on unnamed tributaries to Swift Creek, Stillwater State Forest (WCT)
- Survey 2-3 sites for future corrective actions
- Develop list and report of locations where allowances to Fish Passage Commitment will be invoked on Stillwater State Forest

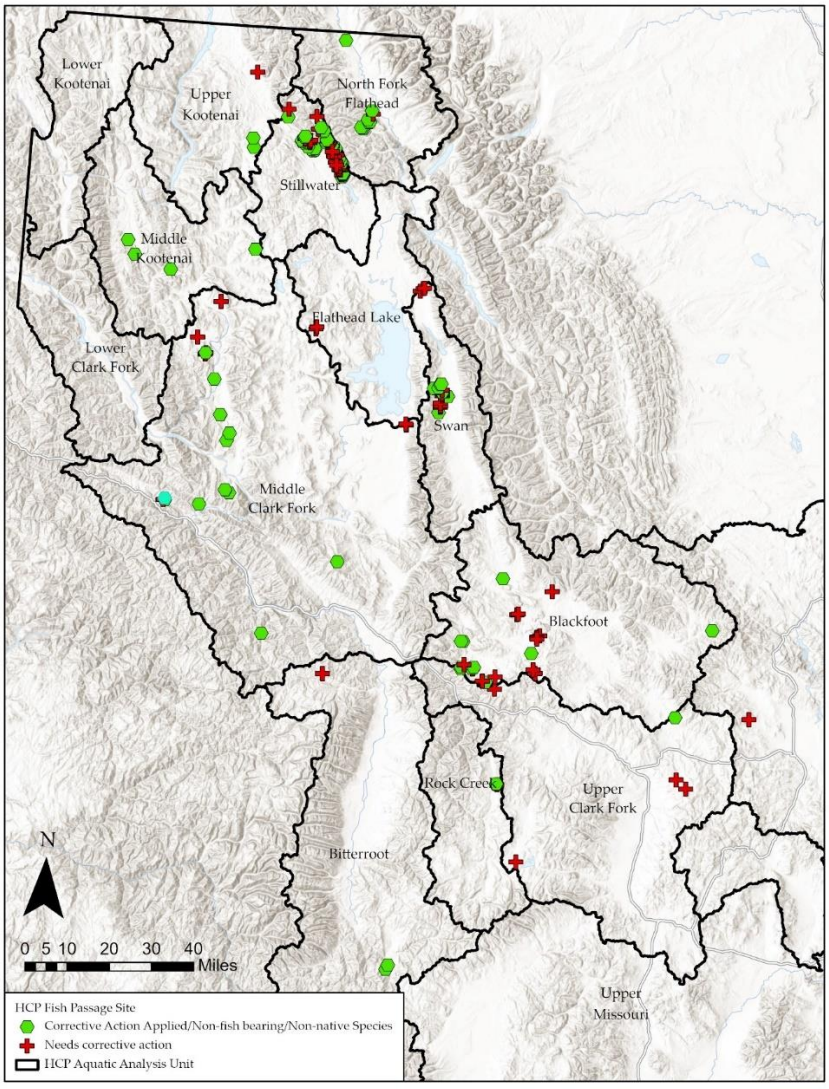

Figure 1: Fish passage sites included under the HCP within each Aquatic Analysis Unit.

Attachment AQ-2: Fish Connectivity Effectiveness Monitoring Update

Monitoring Action: Conduct effectiveness monitoring within 2 years, again at 5 years for CMP structures or 10 years for non-CMP structures following installation or removal of a structure, or following a 25-year storm event for any improved structure.

Effectiveness Threshold: Improved or removed structure accommodates background ranges of stream form and function within and immediately adjacent to the structure.

Management Response: New technical surveys to determine the cause of the departure from background condition completed within 1 year.

Monitoring Assessment: Under the Fish Connectivity Conservation Strategy (AQ-FC), a total of 22 structures have been removed or replaced with fish passage structures during the first period of the HCP. Additionally, two sites that were previously fish barriers were modified into intentional fish barriers to protect populations of Westslope cutthroat trout. Based on the completed effectiveness monitoring, only one structure has not met design standards to emulate background stream form and function. The site was a culvert removal which did not simulate upstream and downstream channel conditions. Corrective actions were implemented in 2014, and the timeline for this structure was reset. Based on monitoring conducted in 2017, the structure currently meets design standards, and will remain in the current management timeline with 10-year monitoring to occur in 2024. Multiple sites will be monitored for 10-year effectiveness in 2022.

Table 1: Sites improved under AQ-FC Conservation Strategy on HCP-covered lands containing streams or stream segments occupied or available to HCP-covered species.

Site ID	Year Improved	Corrective Action	Completed Effectiveness Monitoring				Corrective Action Needed
			2-year	5-year	10-year	25-year flow event	
129	2012	Barrier	N/A	N/A	N/A	N/A	No
924	2011	Barrier	N/A	N/A	N/A	N/A	No
369	2012	Ford	Yes	N/A	2022	N/A	No
370	2012	Ford	Yes	N/A	2022	N/A	No
371	2012	Ford	Yes	N/A	2022	N/A	No
973	2020	Remove	2022	N/A	2030	N/A	-
378	2019	Remove	Yes	N/A	2029	N/A	No
930	2016	Remove	Yes	N/A	2026	N/A	No
944	2016	Remove	Yes	N/A	2026	N/A	No
417	2013	Remove	Yes	N/A	2023	N/A	No
852	2013	Remove	Yes	N/A	2023	N/A	No
823	2012	Remove	Yes	N/A	2022	N/A	No
279	2012	Remove	Yes	N/A	2022	N/A	No
276	2012	Remove	Yes	N/A	2022	N/A	No
128	2012	Remove	Yes	N/A	2022	N/A	No
229	2021	Replace	2023	2026	N/A	N/A	No
379	2019	Replace	Yes	N/A	2029	N/A	No
931	2016	Replace	Yes	N/A	2026	N/A	No
947	2016	Replace	Yes	N/A	2026	N/A	No
864	2013	Replace	Yes	N/A	2023	N/A	No
269	2012	Replace	Yes	N/A	2022	N/A	No
270	2012	Replace	Yes	N/A	2022	N/A	No
24	2012	Replace	Yes	N/A	2022	N/A	No
228	2012	Replace	Yes	N/A	2022	N/A	No

Attachment AQ-3: Summary Statistics of Grazing Inspections, Verifications, and Implemented Corrective Actions

Calander Year	Midterm Evaluations	Renewal Evaluations	Total Evaluations	HCP Parcels	% HCP	Supporting HCP Fishery?	% HCP Fishery	Verification Completed	% Verification	Corrective Action Implemented	Cumlative Corrective Actions
2012	19	81	100	83	83%	30	36%	12	12%	0	0
2013	63	60	123	98	80%	24	24%	10	8%	5	5
2014	33	25	58	39	67%	13	33%	3	5%	3	8
2015	17	26	43	27	63%	7	26%	3	7%	2	10
2016	42	62	104	76	73%	13	17%	2	2%	0	10
2017	55	28	83	65	78%	16	25%	4	5%	0	10
2018	51	69	120	96	80%	37	39%	4	3%	1	11
2019	25	31	56	37	66%	12	32%	2	4%	0	11
2020	25	17	42	26	62%	7	27%	0	0%	1	12
2021	61	19	80	58	73%	14	24%	1	1%	1	13
Totals/Averages	**391**	**418**	**809**	**605**	**72%**	**173**	**28%**	**30**	**5%**	**13**	**13**

Attachment AQ-4: Narrative Summary of Implemented Grazing Corrective Actions, 2012-2021

Applied Corrective Actions to Date

License #	Location	Legal	Stream Name	Fishery	Coarse Filter Trigger	Status	Narrative
3050492	NWLO/PLN	17N 21W S16	North Fork Valley Creek*	WCT	Stream bank alteration -23%	Corrective Action Applied in 2013	Identied as needing verification in 2012. Site was visited in 2013 and corrective action was designed. AUMs reduced from 113 to 80.
3053085	NWLO/KAL	26N 23W S26	Two Unnamed Tribes to Mount Creek	WCT	Stream bank alteration (50%), Browse Utilization (40% M, 40% Heavy)	Corrective Action Applied in Spring 2013	AUM's decreased and season of use shortened.
3060364	SWLO/MSL	5N 14W S16	Little Trout Creek	WCT	Stream bank alteration (45%)	Corrective Action Applied in Fall 2013	Grazing has been deferred until riparian enclosure is installed. Planned corrective action implementation summer 2013.
3060453	SWLO/ANA	9N 14W S16	Cottonwood Creek	WCT	Browse Utilization - 80% Moderate	Corrective Action Applied in 2013	AUM's decreased and season of use shortened.
3060518	SWLO/HAM	02N 19W S22	Lyman Creek	WCT	Streambank trampling	Corrective Action Applied in Fall 2014. Mgmt Plan impemented in 2019 for renewal.	Streambank trampling was verified during midterm review to be excessive. Corrective actions will be planned with stakeholders in the Spring of 2014.
3060530	SWLO/HAM	11N 20W S12	Squaw Creek	WCT	Streambank trampling	Corrective Action Applied in Spring 2013	Electric fence was installed during grazing period to exclose impacted stream segemnt during the 2013 grazing season and planned to continue into the future.
3060905	SWLO/ANA	8N 15W S16	Unnamed Trib of Upper Willow Creek	WCT	Stream bank alteration -20%	Corrective Action Applied in 2014	Brush Barricade applided along SMZ to limit access.
3060911	SWLO/HAM	02N 19W S15	Hart Creek	WCT	Streambank trampling	Corrective Action Applied in Fall 2014. Mgmt Plan impelmented in 2019 for renewal.	Streambank trampling was verified during midterm review to be excessive. Corrective actions will be planned with stakeholders in the Spring of 2014.
3061243	SWLO/CLW	12N 11W S16	Unnamed Trib to Cottonwood Creek	None	Streambank Trampling, Browse Utilization	Corrective Action Applied in Spring 2015	AUM's decreased.
3070361	CLO/DIL	14S 4W S36	Bean Creek	WCT	Streambank trampling	Corrective Action Applied in Summer of 2015	Riparian excolsure installed on Bean Creek in association with the Pistol Pete Timber Sale.
3062881	SWLO/CLW	14N 8W S22	Blackfoot River	BT,WCT	Unstable Banks	Corrective Action Applied in the Fall of 2018	Midterm Review found fencing livestock access to Blackfoot river would support long-term recovery of unstable banks. Existing fence in place needs repair plus minimal additional fencing. No Verification needed.
3069619	SWLO/MIS	13N 16W S33	Arkansas Creek	WCT	Culvert Removal site	Temporary corrective action applied in 2020 at site of culvert removal to facilitate vegetation establishment and reduce bank trampling	Electric fence was installed during grazing season in 2020 and will be planted in 2021 to faciliate vegetation establishment at the site of a culvert removal.

Attachment AQ-5: Riparian Timber Harvest Conservation Strategy Report

Riparian Timber Harvest Conservation Strategy (AQ-RM1)
10-year Status Report; April 2022
Executive Summary

Riparian management zone (RMZ) harvest monitoring was established under HCP commitment AQ-RM1, which set guidelines for establishment of riparian buffers along streams adjacent to timber harvest units. As a part of the conservation strategy, monitoring commitments were outlined to determine the efficacy of riparian buffers at protecting fisheries habitat. Metrics monitored under this conservation strategy include; 1) large woody debris recruitment, 2) stream shading, in the form of the amount of solar radiation blocked by riparian vegetation, and 3) stream temperature which is largely a function of alterations to stream shading and subsequent changes in the amount of solar radiation reaching the stream. During the first 10 years of HCP implementation, 29 sites were established to monitor RMZ harvest during DNRC timber sales. Of these sites, 14 were discontinued due to lack of RMZ harvest. Monitoring has been completed at 13 sites which were evaluated pre- and post-timber harvest. Riparian management zone timber harvest monitoring is ongoing at two sites, with final results for one site expected in fall 2023, and pre-harvest collection continuing at a second site in 2022.

Monitoring results indicate that the conservation strategy is effective at minimizing potential effects of riparian timber harvest on fisheries habitat. Large woody debris monitoring found that loading rates met target levels in all sites during post-harvest monitoring. Evaluation of stream shading indicated significant increases in solar radiation reaching the stream at 10 of the 12 sites where the metric was monitored. Acute and chronic stream temperature threshold established in the HCP were met at 90 percent of the sites, one site failed to meet acute and chronic thresholds, and one site failed to meet chronic thresholds in year-2 of post-harvest monitoring. Thresholds were met at this site during subsequent years of stream temperature data collection. Assessment of the relationship between changes in riparian stream shading and stream temperature changes yielded varied results, suggesting that site-specific variables not monitored may be influencing changes in stream temperature in monitoring reaches.

RMZ monitoring will continue during the next 5-year period to continue to develop datasets focused on long-term trends in large woody debris recruitment and retention and validate simulation results to forecast loading rates over time. Several monitoring sites have been identified to begin monitoring during the next several years across multiple stand types and stream channel types.

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BACKGROUND

Conservation Strategy: Evaluation of Conservation Strategy AQ-RM1 will occur through three main objectives; 1) provide adequate levels of large woody debris recruitment, 2) maintain adequate levels of in-stream shade, and 3) maintain in-stream temperature regimes suitable to support HCP-covered fish species.

HCP Commitments: Effectiveness monitoring for large woody debris and shade will be completed by monitoring five or more sites with riparian timber harvest adjacent to Class 1 streams during the first 10 years of the HCP. If the thresholds are met after 10 years, monitoring may be reduced to ongoing monitoring at one active site through year-25 of the HCP. LWD monitoring will include; 1) site-specific LWD targets using baseline data or local reference reach data, 2) assessment of pre-harvest stand conditions within the riparian management zone (RMZ) and pre-harvest LWD, 3) evaluate post-harvest in-stream LWD and RMZ stand conditions, and 4) use model projections to evaluate pre-harvest stand conditions and harvest prescriptions. Shade monitoring will be conducted pre-harvest and post-harvest using a Solar Pathfinder, which measures solar radiation during the months of June–September. Stream temperature data will be collected to evaluate potential changes in temperature associated with increased solar radiation resulting from timber harvest.

INTRODUCTION

Riparian timber stands have direct influence on stream habitat characteristics that define fish population structure, distribution, abundance, and growth. Primary direct influence on physical habitat from riparian stands is the recruitment of large woody debris (LWD) to the stream channel. Large wood is one of the primary factors defining habitat complexity, providing physical habitat for fish and aquatic invertebrates, and moderating the effects of stream velocity on instream habitat. Riparian stands also influence stream temperature regimes, through varying levels of stream shading, measured as the percentage of solar radiation blocked by the riparian canopy.

Riparian timber harvest operations in Montana prior to implementation of the HCP were defined by the Streamside Management Zone (SMZ) law (MCA 77-5-301) under which varying timber harvest levels were permitted. To identify the allowable level of timber harvest, streams were classified as Class-1, Class-2, or Class-3 based on whether the stream is fish-bearing, a perennial or intermittent flow regime, and downstream connection to other waters. After classification of the stream segment, a riparian buffer was established, either 50-feet for slopes under 35 percent, or 100-feet for slopes exceeding 35 percent. Within this buffer, adjacent to Class-1 streams, timber harvest was allowed up to 50 percent of the existing stand, or 10 trees per 100-feet of stream, whichever is greater. Following implementation of the HCP, additional riparian buffers were applied on Class-1 streams. Under the HCP commitment AQ-RM1, Riparian Management Zones (RMZ) are established adjacent to any Class-1 stream or lake on HCP covered tracts. The width of the RMZ is determined prior to harvest based on the 100-year site index tree height. During project planning, tree height and age are determined from multiple open-grown, dominant trees within the riparian area and compared to regional site index curves. Determination of the average 100-year site index tree height was then used to establish the total width of the RMZ. Management within the RMZ varies based on the distance from the ordinary high-water mark (OHWM), with

no harvest from the OHWM to 50-feet (unmanaged portion RMZ), and allowable harvest from 50-feet to either 80-feet or the 100-year site index height (managed portion RMZ), whichever is greater. Within the managed portion of the RMZ, all sub-merchantable trees and shrubs are retained and at least 50 percent of the merchantable timber (>8 inch diameter at breast height (DBH)) is retained. Under the HCP commitment, five allowances were identified that allow for harvest within the unmanaged portion of the RMZ and allow harvest levels to exceed the 50 percent retention levels. Allowances included 1) insect and disease infestation, 2) severe or stand-replacement fire, 3) promote shade intolerant species to achieve, or maintain, desired future condition for the timber stand, 4) cable corridors for line-logging units, and 5) individual hazard trees. If allowances are invoked, acreage and the type of allowance are tracked under AQ-RM1.

METHODS

Riparian Stand Condition

To estimate the amount of riparian stand harvest that occurred in each monitoring site, randomly assigned fixed-diameter timber cruise plots were established in the unmanaged and managed portions of the RMZ. Fixed-diameter plots were 16.7 feet radius, with plot center established at least 17 feet from the outside edge of the buffer to ensure that the entire plot was within the RMZ. Trees at each site were identified to species, measured for DBH, and noted whether dead or alive. Based on the plot data, Trees per Acre (TPA), basal area (ft^2), and quadratic mean diameter (QMD) were calculated. Cruise plot data were averaged across each study site to estimate stand condition throughout the RMZ harvest reach.

Large Woody Debris Monitoring

Target levels for LWD loading were established in the HCP based on stream channel morphology (Rosgen 1996) and forest stand type (DNRC 2010). Target LWD loading rates were identified for three different forest types (Helena NF, Bitterroot/Lolo NF, and Flathead NF), which encompassed the majority of potential RMZ monitoring sites under the HCP. Large woody debris was characterized in each site based on protocols described in Overton et al. (1997), where single pieces of LWD were included in a count if the piece was at least 3.0 m in length, or two-thirds of the study stream wetted width, and at least 0.1 m diameter one-third of the length of the piece from the base. For aggregated LWD, individual pieces were counted to the maximum extent possible without disturbing the aggregate. Reaches where LWD counts occurred varied in length based on harvest unit area and geometry, as such a standardized measure of pieces of LWD per 1,000 feet of stream was calculated for comparison across study sites.

Stream Shade

Stream shade measurements were collected with a Solar Pathfinder, which provides a measure of the amount of solar radiation blocked by the riparian canopy. Measurements were taken near the center of the wetted channel at between 5 and 20 sites per monitoring reach. The Solar Pathfinder provides proportional shade contribution on a half-hourly basis, summation of each half-hourly cell results in a total monthly shade of 100 percent. Stream shade data were recorded as the total percentage of stream shading for the months of June, July, August, and September. For each monitoring site, stream shade measurements were averaged across the entire monitoring reach to estimate total shade within the RMZ monitoring site.

Stream Temperature Monitoring

Stream temperature monitoring was completed using Onset HOBO Pendant and Pro v2 temperature loggers installed at the upstream and downstream boundaries of harvest units to capture relative temperature change over the monitoring reach. Temperature loggers were programmed to record stream temperature on 30-minute intervals. Stream temperature monitoring period, during which temperature changes are subject to commitments described in the HCP, extended from June 19 through September 5 annually, a total of 78 monitoring days. Actual deployments of temperature loggers generally extended for multiple weeks prior to, and following, the monitoring period in an effort to capture a more comprehensive view of thermal regimes in each study site, however data only from the monitoring period are included in this report. Reaches were typically greater than 1,000 feet in length, allowing sufficient distance to evaluate specific harvest prescriptions. Stream temperature data were used to calculate mean weekly maximum stream temperature (MWMT) which is a rolling 7-day average of daily maximum stream temperature and provides a quantitative assessment of thermal conditions which may be altering the distribution, abundance, or assemblage structure of fisheries populations. Pre-harvest temperature data were used to establish a site-specific threshold for allowable stream temperature increases based on the highest observed MWMT. Specific thresholds for both chronic and acute temperature exceedances are presented in Table 1. Calculation of the rate of temperature change was calculated as the difference between MWMT data collected from the upstream to downstream boundaries of the harvest unit.

Table 1. Post-harvest stream temperature exceedance thresholds for non-temperature sensitive streams included in riparian management zone timber harvest monitoring.

Pre-harvest MWMT	Chronic Exceedance	Acute Exceedance
Less than 15.5°C	MWMT not to exceed 1.0°C increase more than 25% of the monitoring period, no more than 9 consecutive days	Intra-day temperatures not to exceed 6 consecutive 30-minute intervals greater than 18.6°C
Between 15.5°C and 18.0°	MWMT not to exceed 0.6°C increase more than 10% of the monitoring period, no more than 9 consecutive days	Intra-day temperatures not to exceed 6 consecutive 30-minute intervals greater than 16.5°C
Greater than 18.0°C	MWMT not to exceed 0.3°C for more than 10% of the monitoring period	Intra-day temperatures not to exceed 6 consecutive 30-minute intervals greater than pre-harvest peak MWMT by greater than 0.3°C

RESULTS

Between 2006 and 2021, twenty-nine potential RMZ harvest sites were monitored along reaches of Class-1 stream on HCP parcels on DNRC Northwest, Southwest, and Central land offices. Monitoring sites were selected based on timber harvest plans that included some level of RMZ harvest adjacent to a Class-1 stream. Pre-harvest data were collected at each of the 29 monitoring sites for at least one year prior to harvest to establish baseline measures for LWD and stream shade, thresholds for allowable stream temperature change, and existing riparian stand condition. Of the 29 sites where RMZ monitoring was initiated, 14 were discontinued due to lack of RMZ harvest or cancelled timber sales, 13 sites were completed through pre- and post-harvest monitoring, and two sites are ongoing. Ongoing monitoring sites are both in the Blackfoot River watershed, with one site entering the first year of post-harvest monitoring while the second site will begin the second year of pre-harvest monitoring in June 2022. Pre-harvest data from

discontinued sites are included in Appendix 1 but will not be discussed in detail in this report due to lack of post-harvest data for comparison.

Completed sites included a variety of slopes adjacent to the RMZ and encompassed both line- and tractor-based harvest methods. The monitoring sites encompass the majority of western Montana including elevations ranging from approximately 3,500 feet to over 7,000 feet. Precipitation rates varied across sites ranging from 12 inches in southwest Montana to 48 inches on the Swan River State Forest. Stream characteristics of the completed sites ranged from first-order headwater streams with 2–3 foot bankfull width to third-order Bull trout spawning streams with bankfull widths of 20–25 feet. Completion of the thirteen monitoring sites where pre- and post-harvest data were collected satisfies the first objective of the HCP commitment, under which five or more sites with riparian harvest would be evaluated to determine the efficacy of the conservation strategy.

Riparian Stand Condition

Riparian timber cruise plots were established in twenty-four monitoring sites during the pre-harvest period to estimate trees per acre (TPA), quadratic mean diameter (QMD), and basal area (BA). At each site the number of cruise plots ranged from 5 to 17 plots, with data pooled across all monitoring sites due to low sample size. Pre-harvest cruise data collected from sites where harvest did not occur were omitted from analysis. Pre-harvest TPA averaged 680 ± 153.6, decreasing slightly to 624 ± 120.1 post-harvest. The decrease between the pre- and post-harvest period were not significant (Figure 1; $P = 0.59$). Pre-harvest QMD averaged 7.4 ± 0.51 inches, increasing to 7.7 ± 0.75 inches during the post-harvest period. The slight increase in QMD was not significant between pre- and post-harvest periods (Figure 1; $P = 0.56$). Pre-harvest BA averaged 189.2 ± 25.6 ft^2 and increased during the post-harvest period to 192.3 ± 30.8 ft^2. There was no significant difference between pre- and post-harvest periods (Figure 1; $P = 0.88$).

The lack of significant change in riparian stand conditions between pre- and post-harvest periods reflects a common finding among monitoring sites. Due to the low sample size, as well as the broad geographic scope of the monitoring sites across western Montana, variability in stand characteristics during pre- and post-harvest time periods appear to be driven largely by local conditions, forest type, and precipitation levels, rather than actual timber harvest. Additionally, utilization of random allocation of riparian cruise plots may have contributed to the observed variability. The increases observed in QMD and BA during the post-harvest period suggest that larger tree retention may have occurred in the RMZ, however due to the random selection of plot locations, a single large tree may skew both the QMD and BA estimates. In future monitoring sites, the number of riparian cruise plots will increase to at least 10 plots per site, and establishment of fixed plots may provide a better estimate of actual timber removed during RMZ harvest.

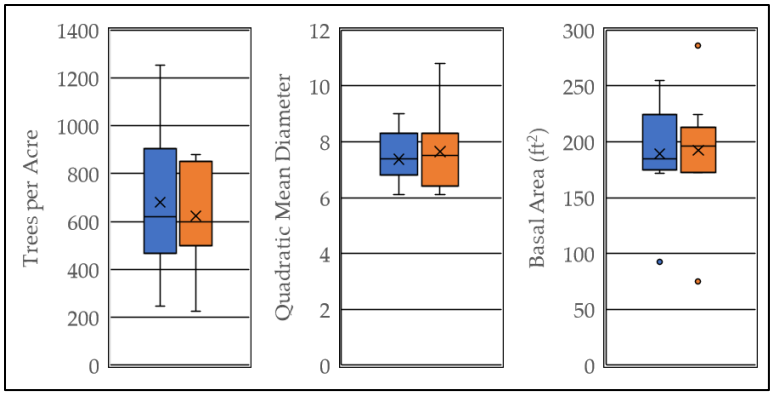


Figure 1. Results of pre-harvest (blue) and post-harvest (orange) riparian timber cruise plots associated with riparian management zone timber harvest monitoring sites, where boxplot whiskers represent upper and lower 95 percent confidence limits.

Large Woody Debris

Large woody debris was collected during pre- and post-harvest time periods at 14 monitoring sites. Monitoring sites were established on a range of stream types (Rosgen 1996) ranging from first-order headwater streams to third-order streams supporting Bull trout spawning habitat. Pre-harvest LWD averaged 98.1 ± 26.9 pieces per 1,000 feet of stream. There was a wide range of pre-harvest loading rates from 10 pieces to 177 pieces per 1,000 feet of stream. One pre-harvest site (Tributary to Willow Creek, 10 pieces per 1,000 feet) did not meet loading rates identified in the HCP for the stream and forest type, with the remainder exceeding estimated levels in the HCP (DNRC 2010). Post-harvest LWD increased to 110.4 ± 22.7 pieces per 1,000 feet of stream (Figure 2). Following the post-harvest period, all sites met target loading rates from the HCP, with the tributary to Willow Creek increasing to 38 pieces per 1,000 feet of stream. The observed increase between pre- and post-harvest time periods was not significant (Figure 2; P = 0.51).

Observed LWD loading rates during the first 10-years of RMZ monitoring indicate that target levels identified in the HCP are generally being met during both pre- and post-harvest time periods. LWD loading increased during the post-harvest period in 10 of 14 monitoring sites, with an average increase of 24.6 pieces per 1,000 feet. In monitoring sites where LWD decreased between pre- and post-harvest time periods, the average decrease was 18.5 pieces per 1,000 feet of stream. Based on the results of the modeling of pre-harvest riparian timber stand condition, there would be an expected increase in LWD at most sites, with an initial increase during the first 10-year period, where the FVS model projects stand mortality rates and removal based on the proposed timber harvest. Subsequent 10-year time steps in the model project a relatively constant mortality rate, and based on the estimated recruitment rate, in combination with estimated rates of decay and loss indicate slow accumulation of LWD over time. In an effort of validate the LWD model, loading rates for completed RMZ monitoring sites will be repeated on a 10-year interval. Results of these repeated LWD measurements will be reported in future HCP monitoring reports.

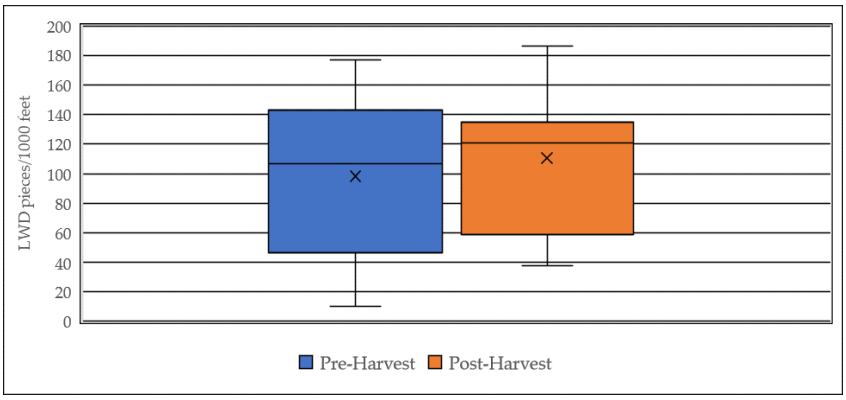


Figure 2. Results of pre-harvest and post-harvest large woody debris counts conducted as a part of riparian management zone timber harvest monitoring sites.

Stream Shade

Stream shade measurements were collected at 14 monitoring sites during pre- and post-harvest time periods. Estimated shade was collected for summer months (June-September) at twelve sites, with two sites having data from July and August only. Two-factor ANOVA (Analysis of Variance) was utilized to evaluate differences in pre- and post-harvest shade, while assessing the variability among sampling months. Pre-harvest shade averaged 71.5 ± 7.2, 76.0 ± 6.6, 79.5 ± 6.3. and 84.4 ± 4.6 percent for June, July, August, and September respectively (Figure 3). Post-harvest shade averaged 65.4 ± 7.8, 68.2 ± 6.7, 72.1 ± 6.3, and 78.8 ± 6.1 percent for the summer months. Pooling data across all sites found a statistically significant reduction in shade between pre- and post-harvest time periods of approximately 7 percent (Figure 3; $P = 0.02$). Similarly, variation among sample month noted a significant difference between months, as shade increased progressively between June and September as the solar path declined toward the horizon.

Based on initial monitoring results, the significant decline in stream shade between pre- and post-harvest period appears to be the most appropriate metric to determine the actual effect of riparian harvest on instream habitat. During data collection, stream shade measurements were collected throughout the monitoring reaches on a defined interval, allowing at least 10 measurements of shade throughout the reach. While the decrease in shade was significant, with the exception of two monitoring sites, discussed in further detail in the site-specific summaries, the reduction in stream shade does not appear to be sufficient to realize subsequent increases in stream temperature that would exceed thresholds identified in the HCP (Table 1). At the two monitoring sites where stream temperature exceedances were noted, both noted significant reduction in shade.

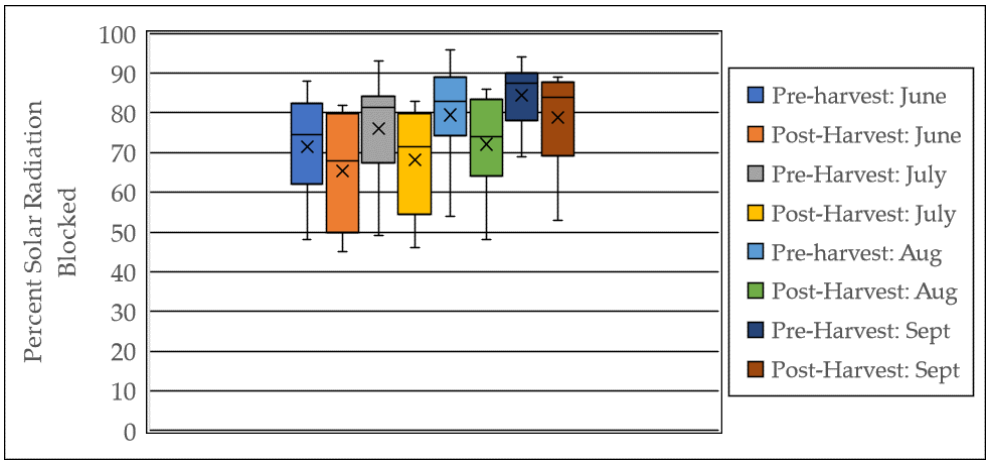


Figure 3. Pre-harvest and post-harvest stream shade measurements collected from riparian management zone timber harvest monitoring sites.

Stream Temperature

Stream temperature monitoring under AQ-RM1 was completed at ten sites during the first five years of HCP implementation. All monitoring sites were on non-temperature sensitive sites as outlined in the HCP (AQ-RM1; Commitment 5). Pre-harvest temperature monitoring on these sites resulted in stratification of the ten sites into all three temperature threshold categories, with six sites in threshold A (Peak MWMT <15.6°C), two sites in threshold B (Peak MWMT 15.6-18.0°C), and two sites in threshold C (Peak MWMT >18.6°C). No chronic or acute threshold exceedances were noted for threshold A or C sites during this monitoring period. Chronic temperature exceedances were observed in two sites during this monitoring period in East Fork Timber Creek and an unnamed tributary to upper Willow Creek. East Fork Timber Creek exceeded the chronic threshold during year-2 of post-harvest monitoring, while the tributary to upper Willow Creek exceeded chronic thresholds during all four years of post-harvest monitoring. Acute thresholds were also exceeded in the tributary to upper Willow Creek on two occasions in year-2 of the monitoring period (Table 2). Detailed summaries of each site are provided below in the site-specific narrative.

Table 2. Stream temperature threshold results for streams monitored during riparian management zone timber harvest monitoring.

				Exceedance							
				Acute (# of Occurrences)				Chronic (% Monitoring Period)			
Aquatic Analysis Unit	Stream	Pre-harvest MWMT	HCP Threshold	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4
Stillwater	Swede	6.7	A	0	0	-	-	0	0	-	-
	Upper Dog Creek	13.4	A	0	0	0	-	0	0	0	-
	Lower Dog Creek	13.8	A	0	0	0	-	0	0	0	-
	Tributary to Dog Creek, North	20.1	C	0	0	0	0	0	0	0	0
	Tributary to Dog Creek, South	19.2	C	0	0	0	0	0	0	0	0
Middle Clark Fork	East Fork Timber Creek	16.2	B	0	0	0	-	0	19%	0	-
	Colonite Creek	14.6	A	0	0	-	-	0	0	-	-
Rock Creek	Bear Creek	9.6	A	0	0	0	0	0	0	0	0
	Lower Beaver Creek	14.7	A	0	0	-	-	0	0	-	-
	Upper Beaver Creek	10.4	A	0	0	0	-	0	0	0	-
	Tributary to Willow Creek	15.6	B	0	2	0	0	15%	11%	50%	88%
Blackfoot	Upper Dry Cottonwood Creek[1]	9.3	A	-	-	-	-	-	-	-	-
	Warm Springs Creek[1]	16.2	B	-	-	-	-	-	-	-	-

1': Pre-harvest data complete, no post-harvest data collected to date.

Swede Creek is a Class-1 tributary to Swift Creek on the Stillwater State Forest. Average bankfull width ranges from 6- to 10-feet throughout the monitoring reach. The stream is classified according to Rosgen (1996) as a B3 and currently supports populations of Bull trout, Westslope cutthroat trout, and Eastern brook trout. Riparian management zone harvest occurred along Swede Creek as a part of the Upper Whitefish timber sale. RMZ harvest occurred along the northwest side of the stream during fall 2014, with a seed tree (8-12 trees/acre) prescription in the 15-acre harvest unit (Figure 4). The timber sale was completed in November 2016.

Riparian stand conditions on Swede Creek were collected pre-harvest in 2012, and post-harvest in 2017. Pre-harvest riparian stands averaged 454 trees per acre, with QMD of 9.0 inches, and an average of 202 ft^2 BA. Post-harvest stands averaged 350 trees per acre, with QMD of 10.8 inches and 224 ft^2 of basal area (Table 3). Based on these estimates, trees per acre declined by approximately 23 percent, QMD increased slightly by 1.8 inches and BA increased by 10 percent. The reduction in TPA is expected, with no harvest in the unmanaged portion of the RMZ and 50 percent retention in the managed portion, TPA would be expected to decrease by approximately 25 percent. Increased QMD and BA may be a factor of favoring larger trees for retention or simply a result of random assignment of plot locations within the RMZ.

Table 3. Riparian timber stand characteristics measured during pre- and post-harvest monitoring, Swede Creek, Stillwater State Forest, Flathead County, Montana.

Swede Creek	Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
Pre-Harvest	454	9	202
Post-Harvest	350	10.8	224
Post-Harvest Change	-104	1.8	22

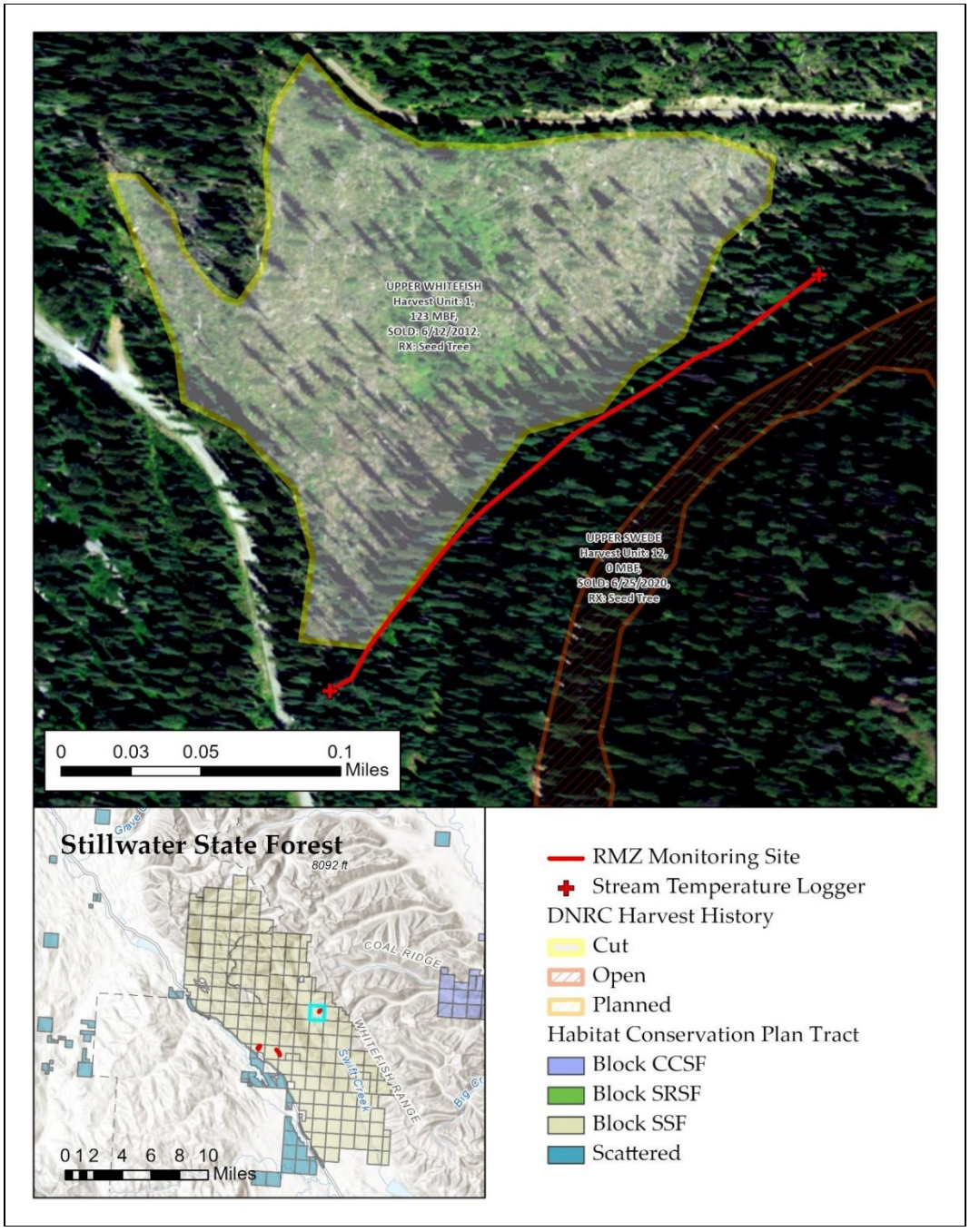


Figure 4. Swede Creek riparian management zone timber harvest monitoring site, Stillwater State Forest, Flathead County, Montana.

Pre-harvest LWD surveys conducted in 2008 found initial loading rates of 171 pieces per 1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016 and found an increase in LWD to 186 pieces per 1000′. These findings were similar to simulation results which indicated an increase under the harvest scenario to 194 pieces per 100′ at year 10 of the simulation. LWD loading rates in Swede Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 85 pieces per 1000′ (Figure 5).

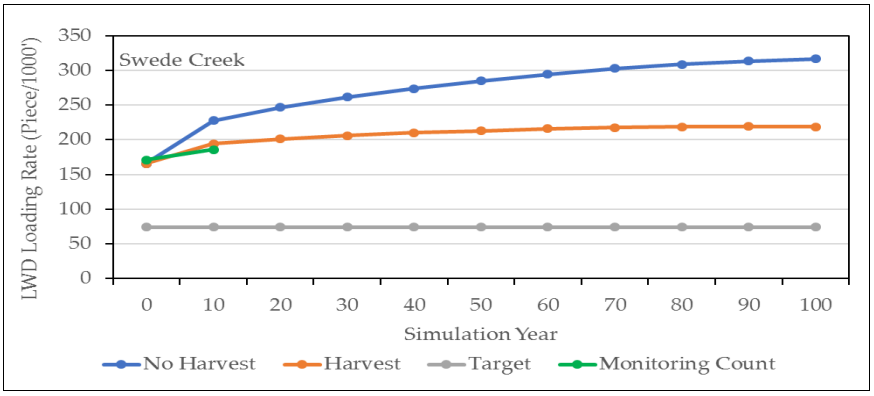


Figure 5. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Swede Creek.

Pre-harvest stream shading measurements were collected from five sites on Swede Creek in 2012. Between June and September, pre-harvest stream shading was 77.1 percent ± 6.0. Post-harvest monitoring stream shading increased slightly to 78.7 percent ± 3.5. Assessment of monthly differences in shade between pre- and post-harvest also reflect no statistically significant change in shade (P = 0.26) following timber harvest (Figure 6).

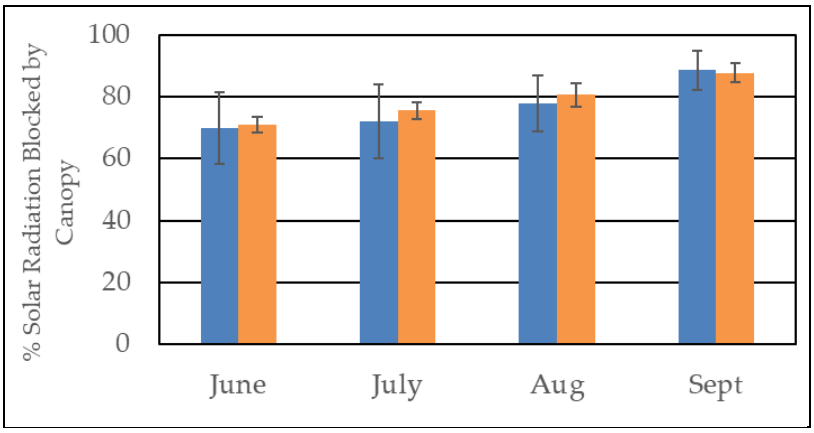


Figure 6. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Pre-harvest stream temperature monitoring in Swede Creek occurred in 2012 and 2013, with peak pre-harvest mean weekly maximum temperature of 6.7°C. Average rate of change in the monitoring reach was 0.5°C with a maximum change of 0.6°C (Figure 7). Based on pre-harvest data, a post-harvest threshold of 1.0°C increase over the existing stream temperature was established. Post-harvest monitoring began in 2014 and was completed in 2015. No threshold exceedances were noted in the monitoring site during post-harvest monitoring (Table 2). The maximum temperature change observed during the two-year post-harvest monitoring period was 0.5°C, well below the threshold of 1.0°C (Figure 7).

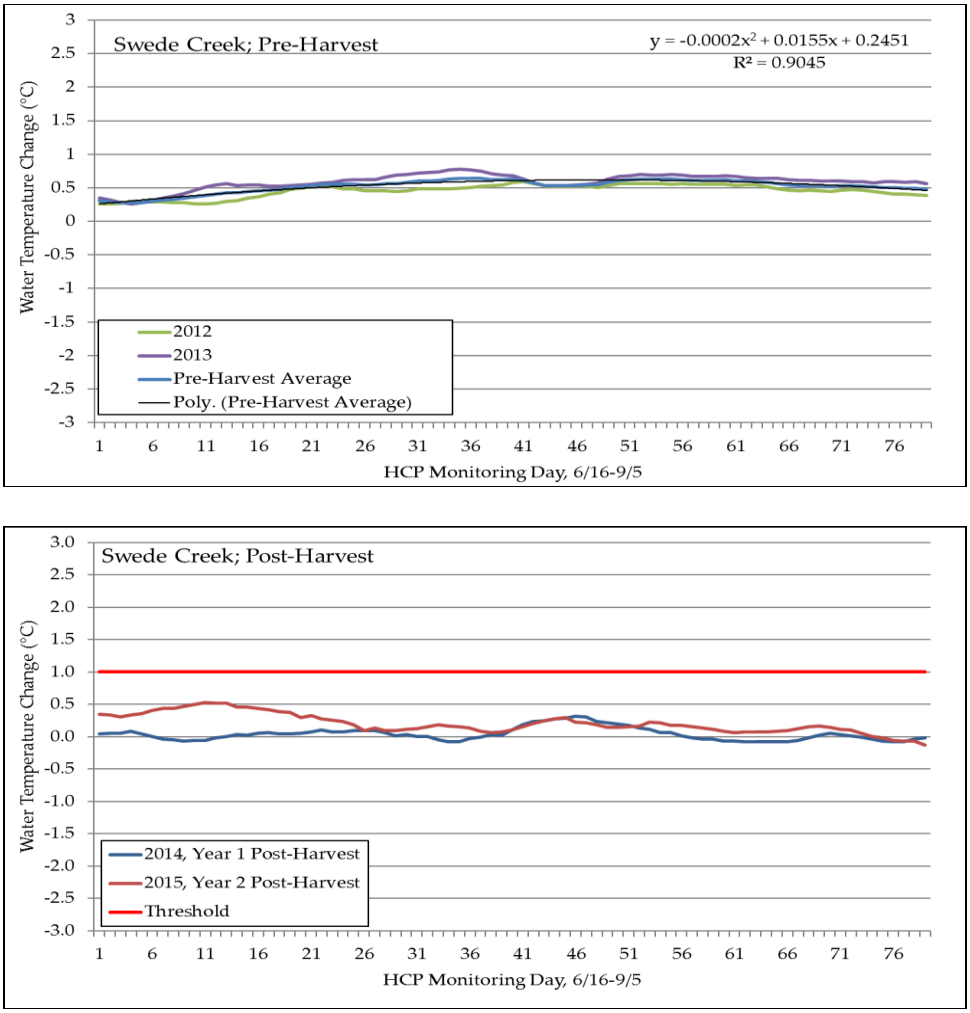


Figure 7. Pre- and Post-harvest water temperature change collected from the upper RMZ monitoring site on Swede Creek in 2014 and 2015. Red line indicates the chronic temperature threshold established from pre-harvest temperature data.

Dog Creek is a Class-1 C4 (Rosgen 1996) tributary to the Stillwater River on the Stillwater State Forest, supporting Westslope cutthroat trout and Eastern brook trout. Two riparian management zone monitoring sites were established adjacent to Dog Creek (upper and lower) in 2013 to collect pre-harvest data. Two harvest units were established adjacent to the upper site (7.5-acre harvest unit) and lower site (10.0 acres) were assessed (Figure 8). Harvest prescriptions included approximately 1.5 acres of RMZ harvest, associated with the Mistle Dog Timber Sale, adjacent to approximately 2,100 feet of Dog Creek (900 feet; upper site, 1,200 feet; lower site).

Riparian stand condition in the RMZ on Dog Creek were collected pre-harvest in 2013, and post-harvest in 2021. Pre-harvest riparian stands averaged 760 and 1,253 trees per acre at the upper and lower sites respectively, QMD was 6.5 inches at the upper site and 6.1 inches at the lower site, while basal area averaged 176.7 ft^2 and 255 BA ft^2. Post-harvest monitoring at the upper site noted 15 percent increase in TPA, reduction in QMD by 0.2 inches, and an 8 percent increase in BA (Table 4). The increase in TPA and decrease in QMD, is likely a result of regeneration of trees on the boundary of the harvest unit, while the increase in BA may be a result of inclusion of 1 or 2 large trees measured in post-harvest plots. Post-harvest monitoring at the lower site noted a 39 percent reduction in TPA, an increase in QMD of 2.2 inches, and increased BA by approximately 12 percent. The reduction in TPA is within the range of what might be expected to be removed during RMZ harvest. Increased QMD and BA may be a factor of favoring larger trees for retention or simply a result of random assignment of plot locations within the RMZ.

Table 4. Riparian timber stand characteristics measured during pre- and post-harvest monitoring, upper and lower Dog Creek, Stillwater State Forest, Flathead County, Montana.

Dog Creek		Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
Upper Site	Pre-Harvest	760	6.5	176.7
	Post-Harvest	881	6.3	192.1
	Post-Harvest Change	121	-0.2	15.4
Lower Site	Pre-Harvest	1253	6.1	255
	Post-Harvest	775	8.3	286
	Post-Harvest Change	-478	2.2	31

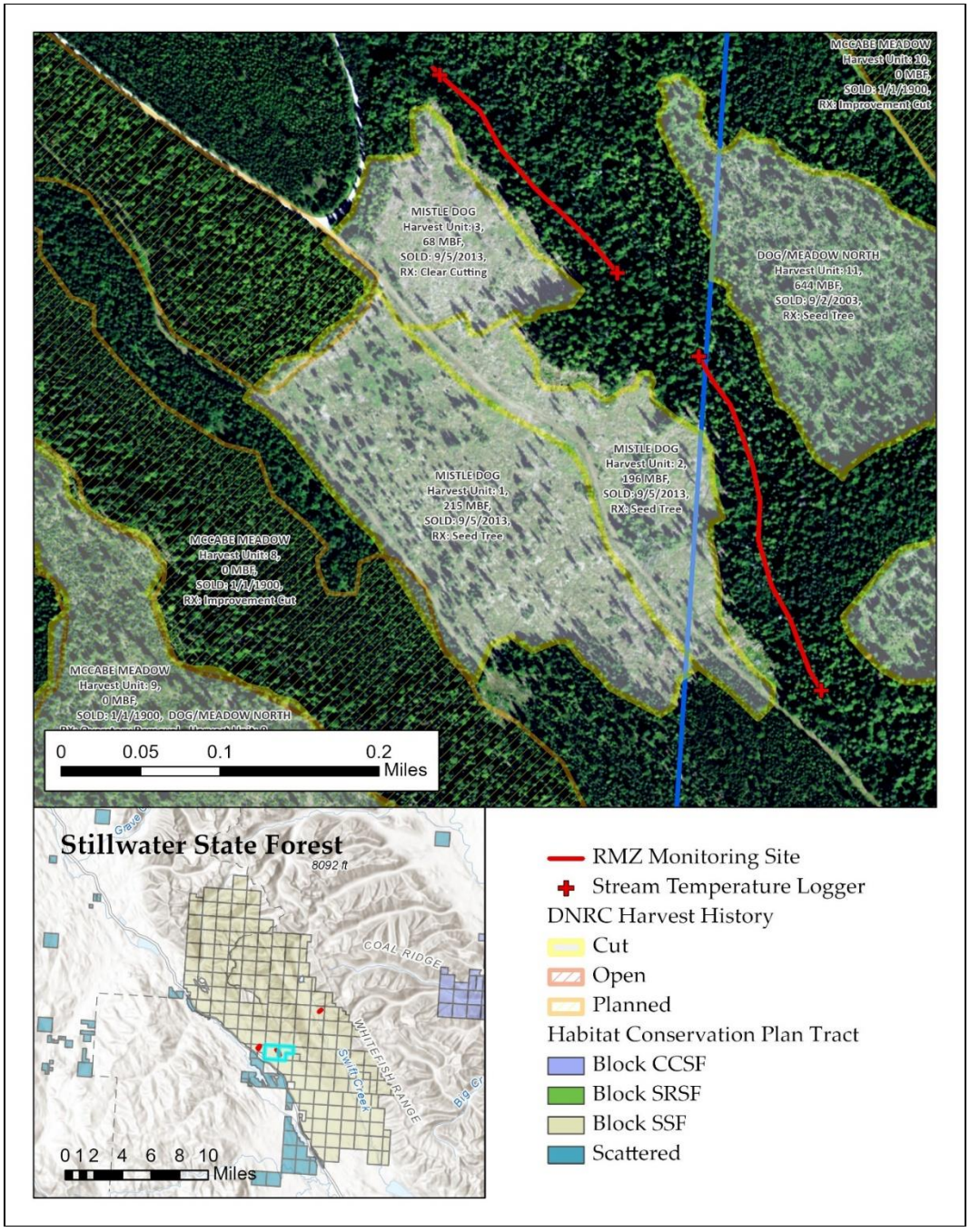


Figure 8. Riparian management zone timber harvest monitoring sites on Dog Creek, Stillwater State Forest, Flathead County, Montana.

Pre-harvest LWD surveys in Upper Dog Creek conducted in 2013 found initial loading rates of 114 pieces per 1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016 and found an increase in LWD to 126 pieces per 1000′. These findings were greater than simulation results which indicated LWD loading under the harvest scenario of 109 pieces per100′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 126 pieces per 1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 49 pieces per 1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Upper Dog Creek were considerably

higher than the target established in the HCP for this forest and stream channel type which was 61 pieces per 1000′ (Figure 9).

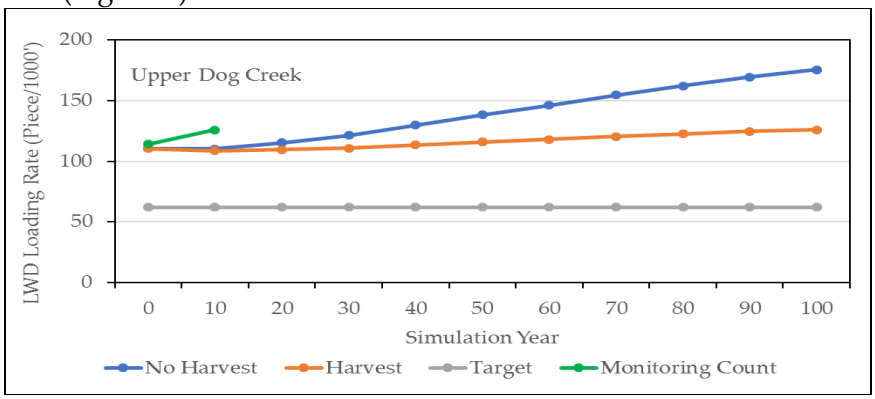


Figure 9. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Upper Dog Creek, Stillwater State Forest.

Pre-harvest LWD surveys in Lower Dog Creek conducted in 2013 found initial LWD loading rates of 116 pieces per 1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016 and found a slight decrease in LWD to 110 pieces per 1000′. These findings were similar to simulation results which indicated LWD loading under the harvest scenario of 111 pieces per 1000′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 150 pieces per 1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 69 pieces per 1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Lower Dog Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 61 pieces per 1000′ (Figure 10).

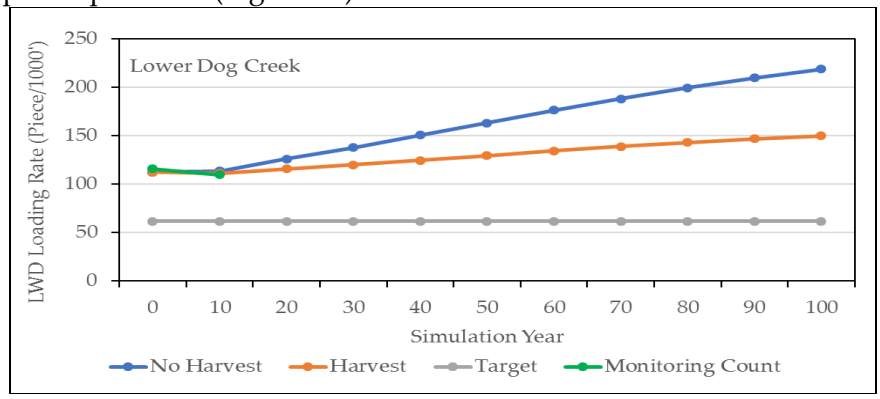


Figure 10. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Lower Dog Creek, Stillwater State Forest.

Pre-harvest stream shade measurements were collected from six sites on both upper and lower Dog Creek in 2013. Between June and September, pre-harvest stream shading was 89.1 percent ± 2.2 and 83.2 percent ± 3.4 for the upper and lower sites respectively. Post-harvest monitoring stream shading decreased significantly to 82.2 percent ± 2.2 in the upper site ($P = 0.008$) and decreased to 77.7 percent ± 6.8 in the lower site, which was not a significant reduction ($P = 0.12$). The reduction in stream shade observed in the upper site was likely a result of reductions observed during June and July, as later season shade measurements were similar. Assessment of monthly differences pre- and post-harvest in the lower site indicate that a reduction in stream

shading occurred during all four months, as well as an increase in variability during post-harvest monitoring (Figures 11 and 12).

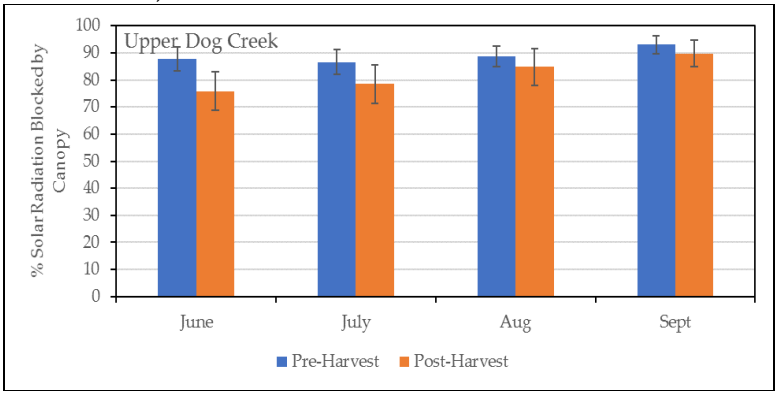


Figure 11. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

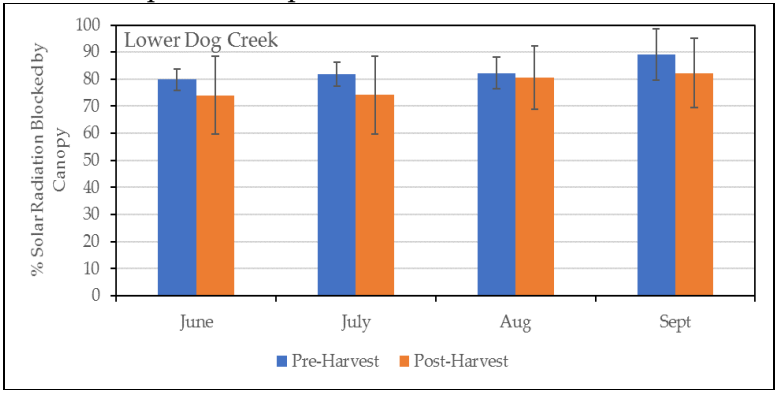


Figure 12. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Pre-harvest monitoring was limited to one year of temperature data at both the upper and lower sites. Pre-harvest data established a threshold of 1.0°C increase over the existing 0.2°C maximum temperature change in the upper site (Figure 13). In the lower site, the threshold was also established at a 1.0°C increase over the 0.19°C maximum temperature change observed in 2013 (Figure 14). Pre-harvest temperature change in the upper study site averaged 0.08°C, the maximum observed temperature change was 0.2°C. Pre-harvest average temperature change in the lower monitoring site was also 0.08°C, with a maximum temperature change of 0.2°C. Post-harvest monitoring began in 2014 and were completed in 2016. No threshold exceedances were noted in either the upper or lower site during post-harvest monitoring (Table 2). The average post-harvest temperature change was 0.1°C in the study reach, a 0.04°C increase over pre-harvest conditions. The maximum temperature change observed during the three-year post-harvest monitoring period was 0.2°C, well below the threshold of 1.2°C (Figure 13). No chronic or acute threshold exceedances were noted in the lower monitoring site during post-harvest monitoring (Table 2). The average post-harvest temperature change was 0.06°C, a slight decrease over pre-harvest conditions. The maximum temperature change observed during the three-year post-harvest monitoring period was 0.2°C which was also well below the established threshold of 1.0°C (Figure 14).

Based on results of monitoring data collected, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Repeat LWD counts will be conducted on a 10-year interval to evaluate long-term retention and recruitment. Stream shade and temperature results also

suggest that timber harvest levels on both upper and lower Dog Creek did not impact fisheries habitat through increased stream temperature. While significant reductions in stream shade were noted at the upper site on Dog Creek, no coincidental increases in stream temperature were observed. The observed thermal regime indicated a stable stream system largely dominated by cold groundwater input. Water temperature in both the upper and lower sites rarely exceeded 15.0°C (<1.0 percent total observations). No future shade or stream temperature monitoring is anticipated associated with this RMZ harvest site.

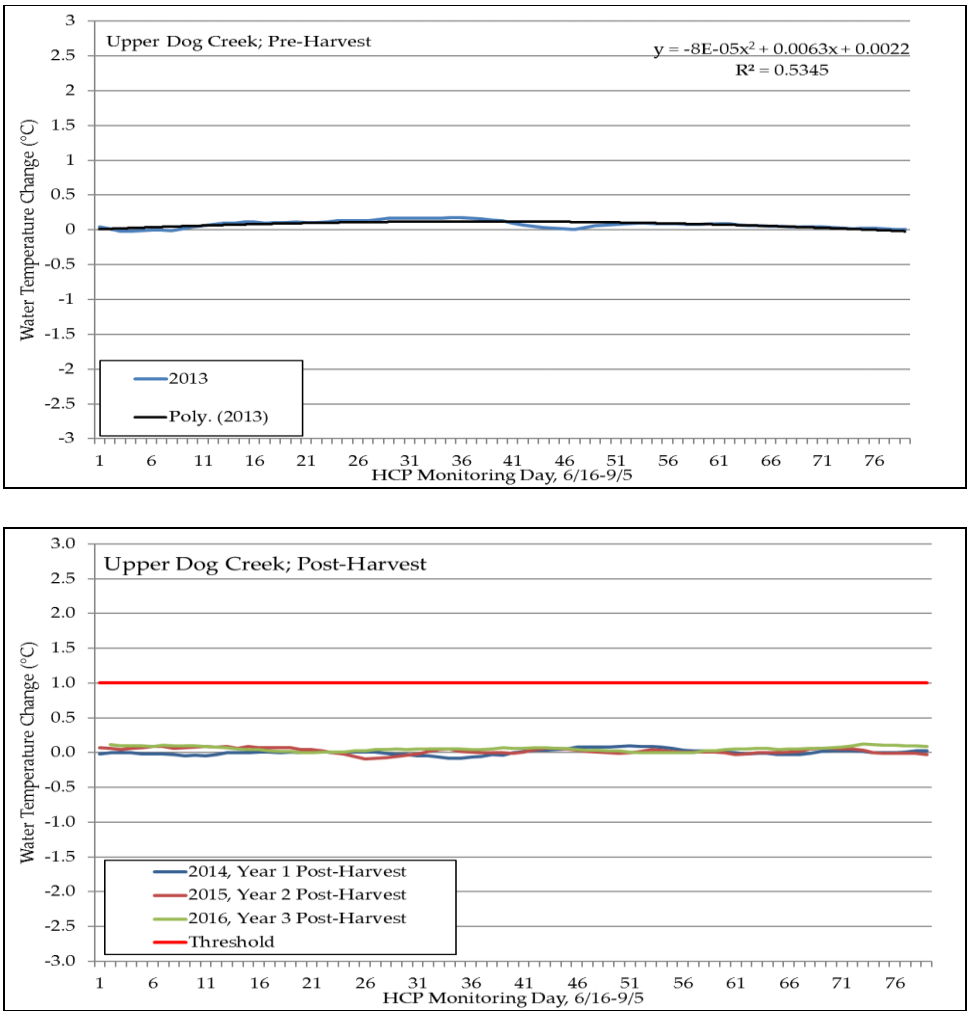
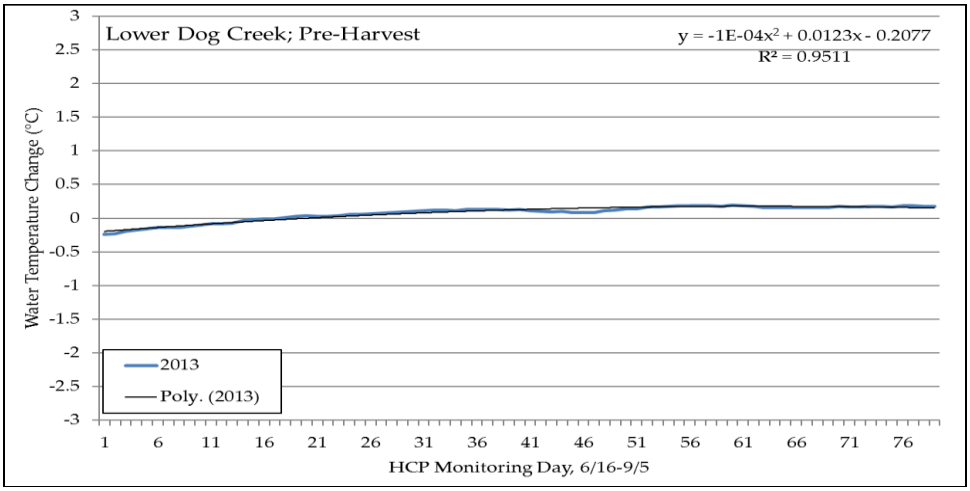


Figure 13. Pre- and Post-harvest water temperature change collected from the upper RMZ monitoring site on Dog Creek from 2014–2016. Red line indicates the temperature change threshold established from pre-harvest temperature data.



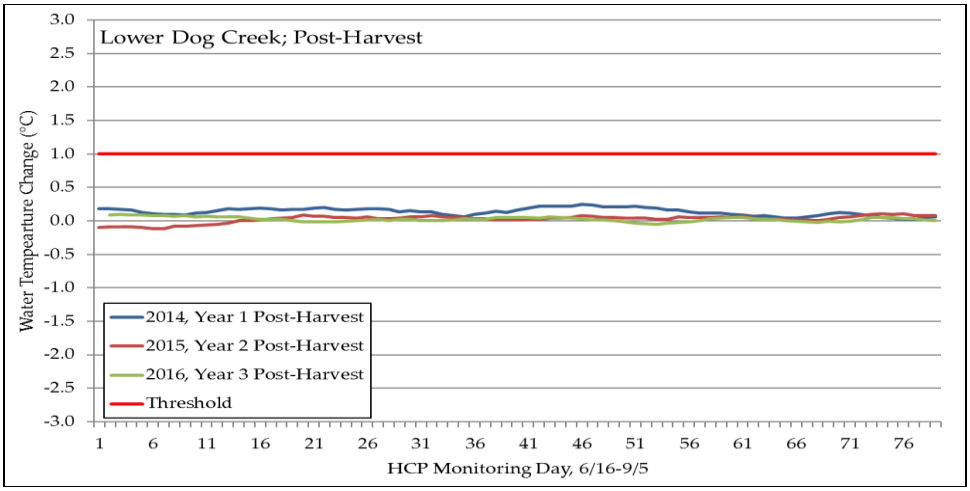


Figure 14. Pre- and Post-harvest water temperature change collected from the lower RMZ monitoring site on Dog Creek from 2014–2016. Red line indicates the temperature change threshold established from pre-harvest temperature data.

NWLO – Stillwater Unit
North and South tributaries to Dog Creek

Two RMZ monitoring sites were established on two tributaries to upper Dog Creek, referred to as North and South tributaries through the remainder of this discussion. Both streams are C4 type streams (Rosgen 1996) supporting Westslope cutthroat trout and Eastern brook trout. Monitoring sites were established in 2007 to evaluate a single timber harvest unit (24.8 acres) that encompassed RMZs on both streams (Figure 15). Due to the similarity in stream type, harvest prescription, and general proximity, pre-harvest data for riparian stand condition and stream shade were collected from the North tributary and were considered representative of conditions observed at the South tributary.

Pre-harvest riparian stand condition data collected in 2007 noted 903 TPA, average QMD of 6.8 inches, and 224.5 ft^2 BA (Table 5). Post-harvest riparian stand data were collected in 2021 for both the North and South sites. Reduction in TPA was noted for both the North (6 percent reduction) and South tributaries (2.5 percent reduction). This is lower than would be expected under a full 50 percent removal of timber from the managed portion of the RMZ. Quadratic mean diameter also decreased at both sites, by 0.7 inches on the North tributary, and 0.4 inches on the South tributary, both of which are expected results given protection of sub-merchantable timber. Basal area decreased by 23.2 percent and 12 percent at the North and South sites respectively (Table 5).
Table 5. Riparian timber stand characteristics measured during pre- and post-harvest monitoring on two unnamed tributaries to Dog Creek, Stillwater State Forest, Flathead County, Montana.

Tributaries to Dog Creek		Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
North tributary	Pre-Harvest	903	6.8	224.5
	Post-Harvest	851	6.1	172.6
	Post-Harvest Change	-52	-0.7	-51.9
South tributary	Pre-Harvest	903	6.8	224.5
	Post-Harvest	879	6.4	197.6
	Post-Harvest Change	-24	-0.4	-26.9

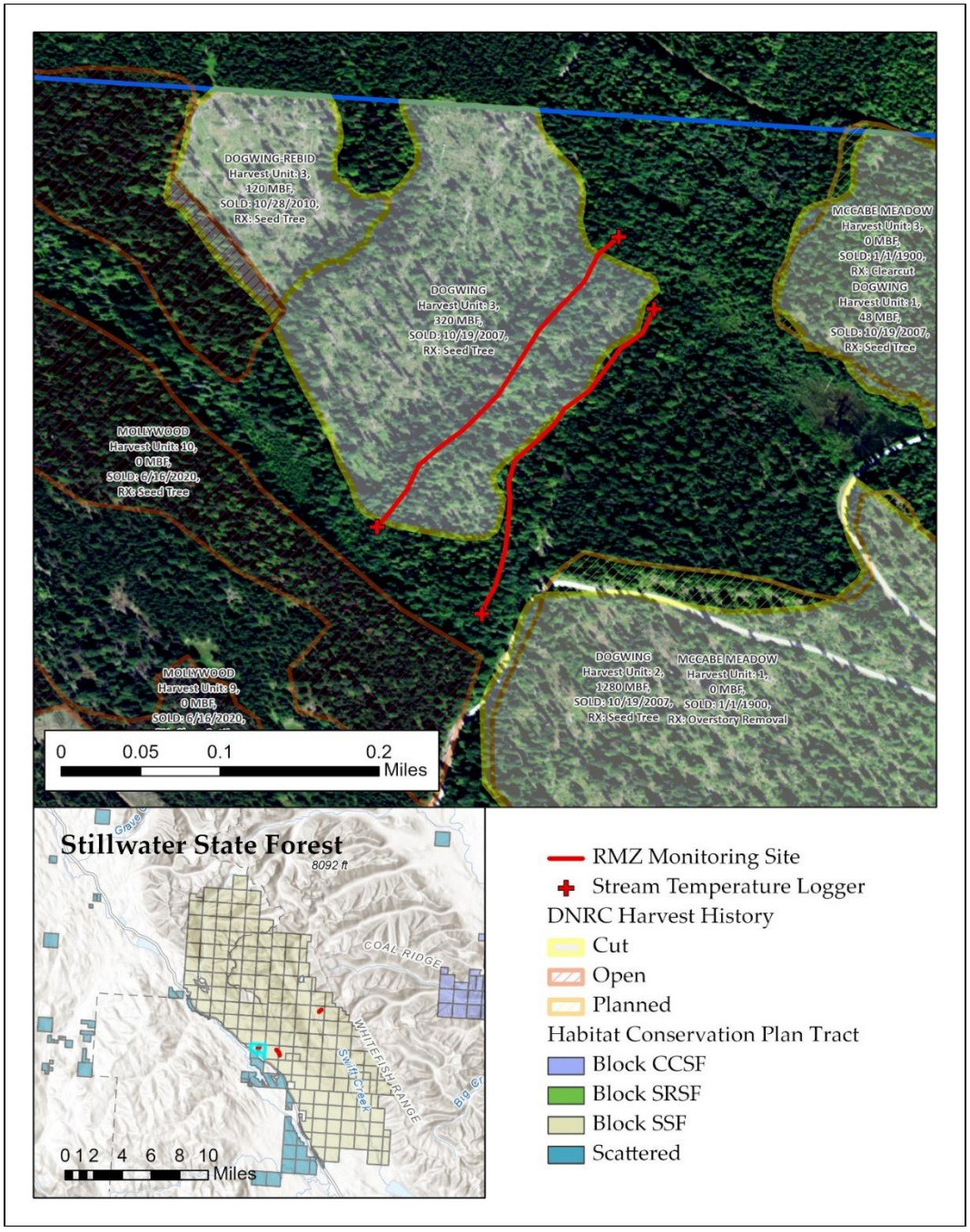


Figure 15. Riparian management zone timber harvest monitoring sites on North and South tributaries to Dog Creek, Stillwater State Forest, Flathead County, Montana.

Pre-harvest surveys conducted in 2007 on the North tributary site found initial LWD loading rates of 94 pieces per 1000′ in the monitoring reach. RMZ harvest occurred along the southwest side of the stream during winter 2008-spring 2009, with a selection harvest prescription with hand felling and winch skidding in the harvest unit. Post-harvest LWD monitoring was conducted in 2011 and found an increase in LWD to 146 pieces per 1000′. These findings were greater than simulation results which indicated LWD loading under the harvest scenario of 97 pieces per 1000′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 142 pieces per 1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 70 pieces per 1000′ at the end of the

simulation as a result of new stand establishment and decreased tree mortality. Post-harvest simulations were also run for the stand based on riparian timber cruise data collected in 2009. Significant increases in LWD load were noted in this simulation resulting in projected loading of 482 pieces per 1000' at year-100. Both harvest simulation results and monitoring data collected from North Tributary to Dog Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 61 pieces per 1000' (Figure 16).

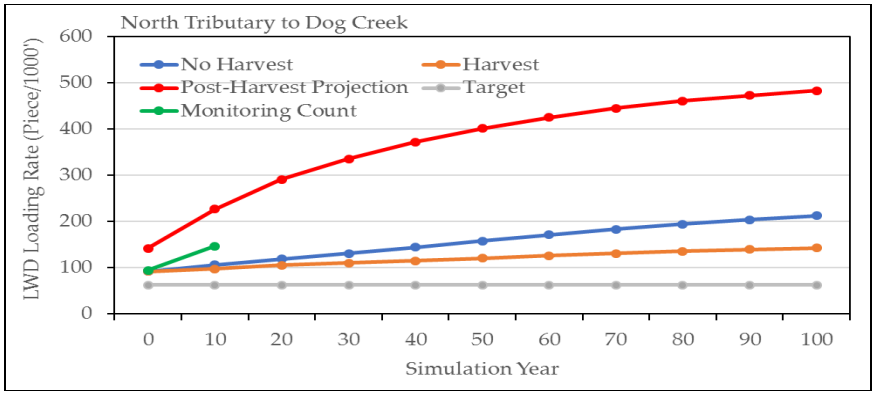


Figure 16. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from North Tributary to Dog Creek, Stillwater State Forest.

Pre-harvest LWD surveys conducted in 2007 on the South tributary site found initial loading rates of 108 pieces per 1000' in the monitoring reach. RMZ harvest occurred during winter 2008-spring 2009, with a selection harvest prescription with hand felling and winch skidding in the harvest unit. Post-harvest LWD monitoring was conducted in 2011, and found an increase in LWD to 130 pieces per 1000'. Both pre- and post-harvest LWD loading rates were significantly higher than HCP target levels of 61 pieces per 1000'. LWD simulations were not completed for this site as pre-harvest timber cruise data from the North Tributary to Dog Creek were used, which would have yielded similar loading simulation results.

Pre-harvest stream shade measurements were collected from 14 sites on the North Tributary to Dog Creek in 2007. Between June and September, pre-harvest stream shading was 85.7 percent ± 2.1. Post-harvest monitoring stream shading decreased to 83.9 percent ± 2.2, which was not statistically significant ($P = 0.49$; Figure 17). Due to lack of pre-harvest shade at the South tributary site, no comparison to post-harvest was conducted. Mean stream shade was similar to that observed at the North site, with an average of 82 percent in June, 83 percent in July, 86 percent in August, and 88 percent in September. These may be slight reductions compared to pre-harvest data from the North tributary site, but given the observed in stream temperature datasets, was not likely sufficient to alter the thermal regime of the stream.

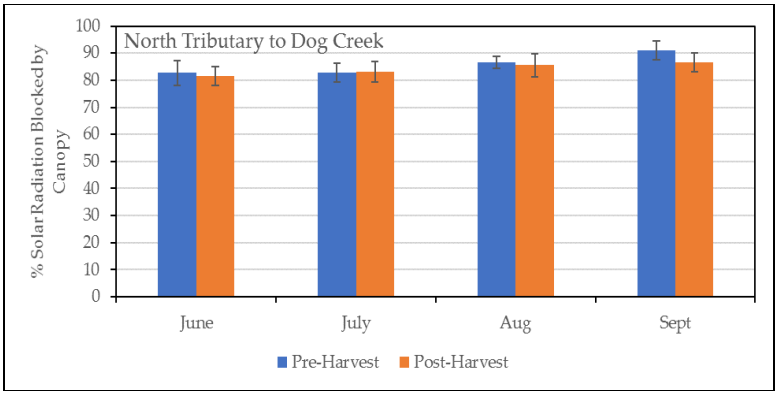
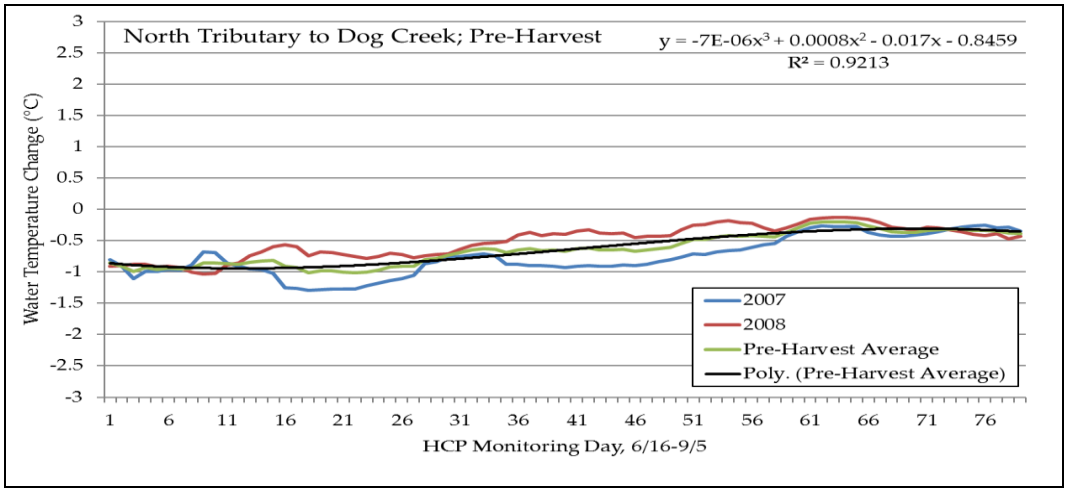


Figure 17. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Two temperature loggers were installed in the North and South tributaries to Dog Creek in 2007 to evaluate pre-harvest stream temperature. Pre-harvest monitoring occurred in 2007 and 2008 at both monitoring sites. Pre-harvest peak MWMT observed was 20.06°C in 2007 for the North tributary (Figure 18) and 19.2°C in the South tributary (Figure 19), establishing post-harvest threshold of 0.3°C increase over existing condition. Both tributaries were found to be a cooling reaches, with all pre-treatment observations indicating cooler water temperatures at the lower temperature logger than observed at the upper temperature logger. Because the reaches were cooling, the thresholds were set at -0.33°C and -0.48°C for the North and South tributaries respectively. which was the average pre-harvest temperature change (-0.63°C and -0.78°C) plus 0.3°C.

Post-harvest monitoring began in 2009 and was completed in 2012 for both sites. No threshold exceedances were noted in the monitoring sites during post-harvest monitoring. The average post-harvest temperature change was -1.2°C, and -1.14 °C in the North and South tributaries respectively. The maximum temperature change observed during the four-year post-harvest monitoring period was -0.56°C, below the threshold of -0.33°C for the North site (Figure 18). The maximum temperature change observed during the four-year post-harvest was -0.48°C, below the threshold of -0.33°C for the South site (Figure 19). No acute threshold exceedances were noted in either monitoring site during post-harvest monitoring (Table 2).



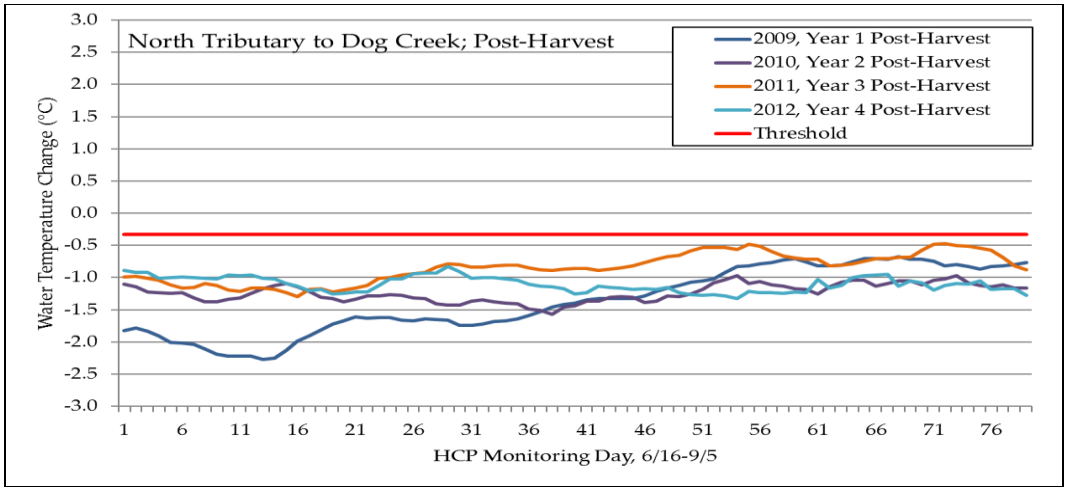
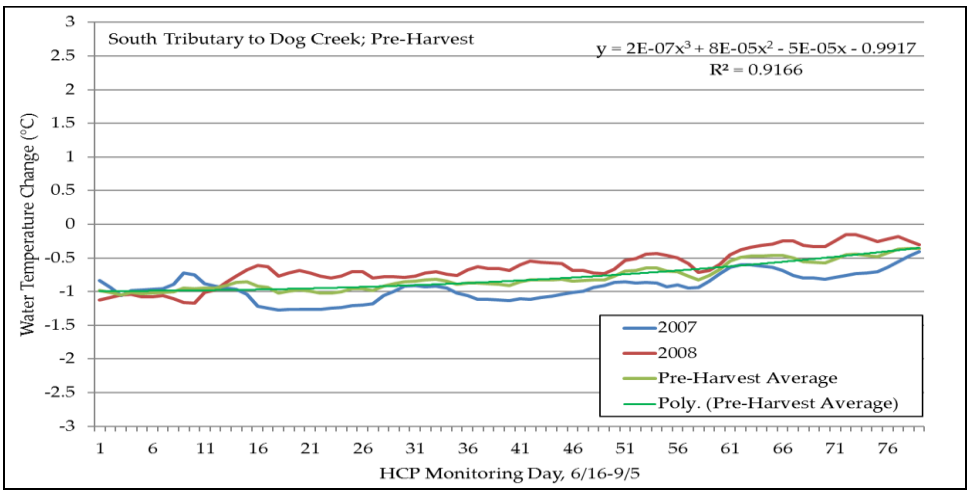


Figure 18. Pre- and Post-harvest water temperature change collected from the upper RMZ monitoring site on North Tributary to Dog Creek from 2007 to 2012. Red line indicates the temperature change threshold established from pre-harvest temperature data.



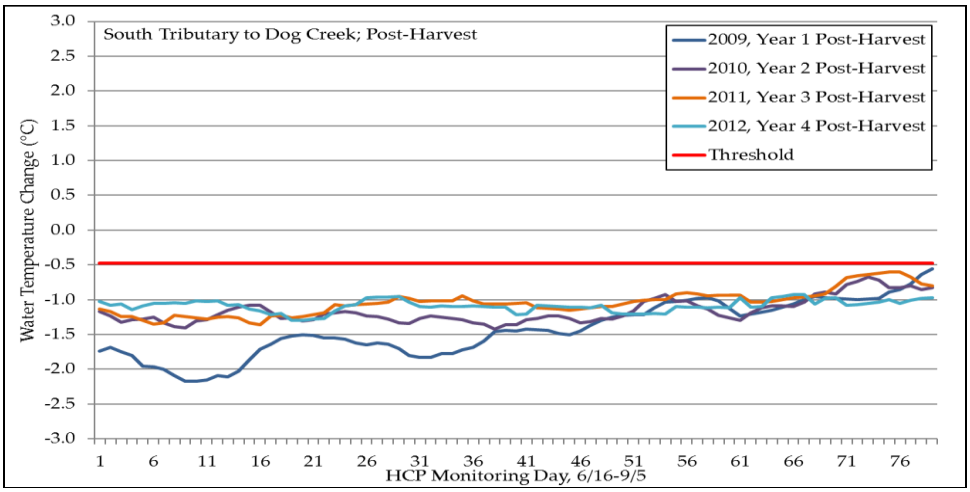


Figure 19. Pre- and Post-harvest water temperature change collected from the upper RMZ monitoring site on South Tributary to Dog Creek from 2009–2012 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Based on results of monitoring data collected in both the North and South tributaries to Dog Creek, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Continued monitoring is needed to evaluate the accuracy of the LWD simulation to predict future loading rates in the North tributary. Repeat LWD counts will be conducted on a 10-year interval to evaluate the simulation. Stream shade and temperature results also suggest that timber harvest levels surrounding both sites did not impact fisheries habitat through increased stream temperature. No significant reductions in stream shade were noted at the North Tributary to Dog Creek site, and minimal changes in stream temperature were noted at both sites. The observed thermal regime indicated a stable stream system largely dominated by cold groundwater input. No future shade or stream temperature monitoring is anticipated associated with this RMZ harvest site.

NWLO – Libby Unit
Colonite Creek

Colonite Creek is a second-order tributary to East Fisher Creek in the Middle Kootenai River watershed (Figure 20). The stream is an A4 type stream (Rosgen 1996) supporting Westslope cutthroat trout. RMZ monitoring was established in 2014 to evaluate two timber harvest units on the northwest and southeast aspects of the stream and included approximately 25 acres of harvest. The RMZ monitoring site encompassed approximately 1,800 feet of Colonite Creek.

Riparian stand condition in the RMZ on Colonite Creek were collected pre-harvest in 2014, and post-harvest in 2021. Pre-harvest riparian stands averaged 467 trees per acre, QMD was 8.5 inches, and basal area averaged 185.5 ft^2 (Table 7). Post-harvest monitoring at the upper site noted 42 percent increase in TPA, reduction in QMD by 1.1 inches, and an 8 percent increase in BA. The increase in TPA and decrease in QMD, is likely a result of regeneration of trees on the boundary of the harvest unit, while the increase in BA may be a result of inclusion of large trees measured in post-harvest plots. Increased QMD and BA may be a factor of favoring larger trees for retention or simply a result of random assignment of plot locations within the RMZ.

Table 7. Riparian timber stand characteristics measured during pre- and post-harvest monitoring, Colonite Creek, Libby Unit, Lincoln County, Montana.

Colonite Creek	Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
Pre-Harvest	467	8.5	185.5
Post-Harvest	667	7.4	199
Post-Harvest Change	200	-1.1	13.5

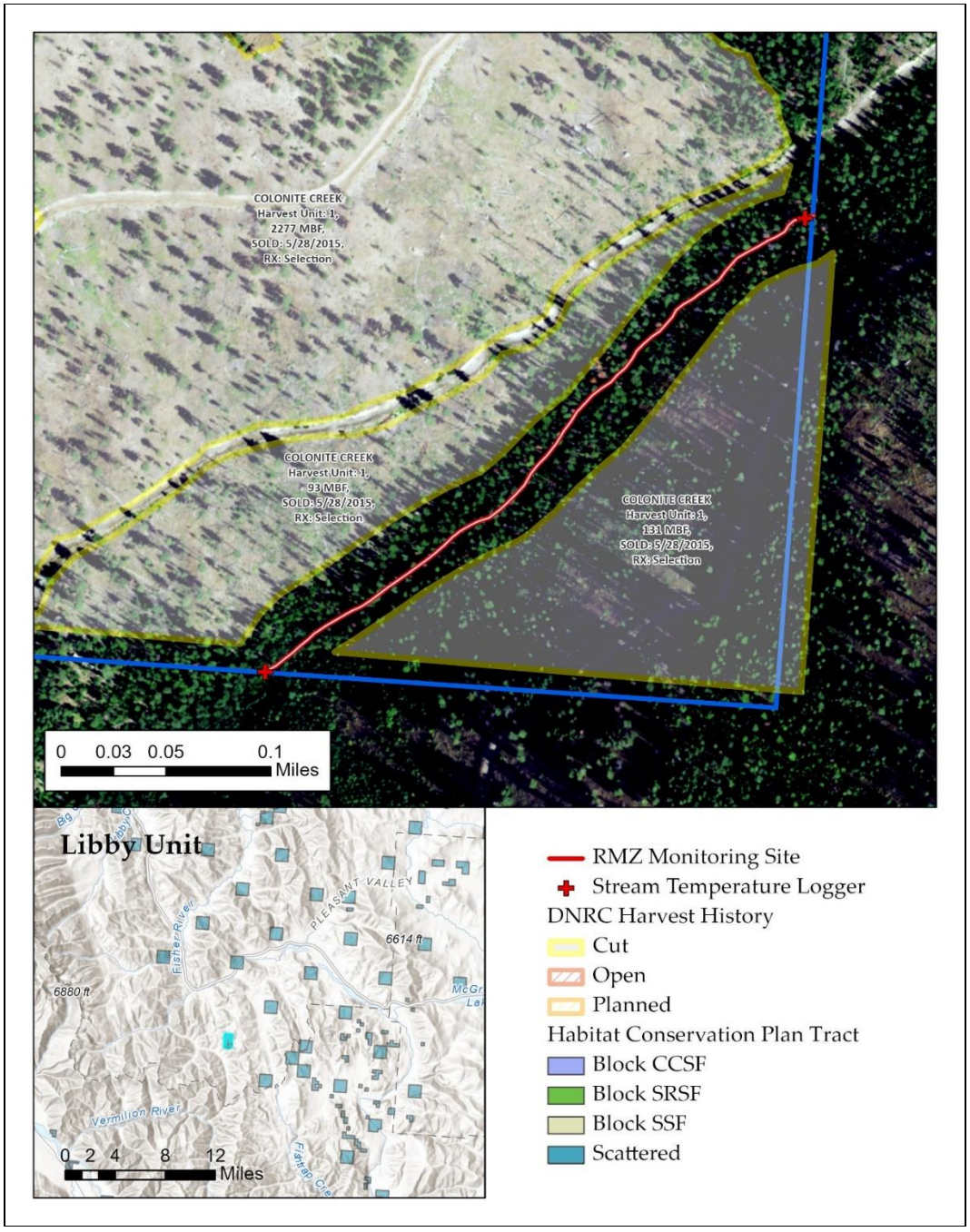


Figure 20. Colonite Creek RMZ monitoring site, Libby Unit, Lincoln County, Montana.

Pre-harvest surveys conducted in 2014 found initial LWD loading rates of 139 pieces per 1000' in the monitoring reach. RMZ harvest occurred along both sides of the stream during 2015 and 2016, with a selection harvest-tree prescription in both harvest units. Post-harvest LWD monitoring noted a slight decline in LWD to 131 pieces per 1,000 feet, lower than simulation results which indicated LWD loading under the harvest scenario of 175 pieces per 1000' at year 10 post-harvest. Projected LWD loading during the 100-year simulation peaked in year-100 at 217 pieces per 1000'. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 210 pieces per 1000' at the end of the simulation as a result of new stand establishment and decreased tree mortality (Figure 21). Loading rates exceeded target levels identified for this stream type, which was projected to be 61 pieces per 1,000 feet of stream.

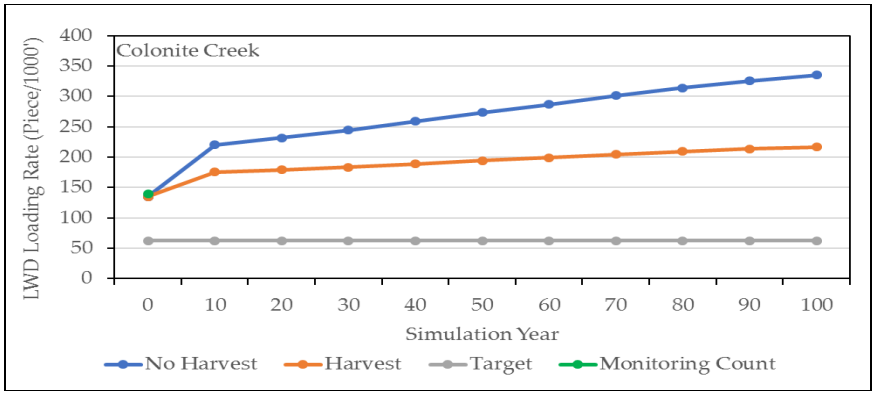


Figure 21. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Colonite Creek, Northwest Land Office.

Pre-harvest stream shading measurements were collected from twelve sites on Colonite Creek in 2014. Between June and September, pre-harvest stream shading was 87.3 percent ± 2.2. Post-harvest monitoring stream shading decreased to 83.8 percent ± 2.3, which was a significant reduction compared to pre-harvest conditions (P = 0.007) (Figure 22).

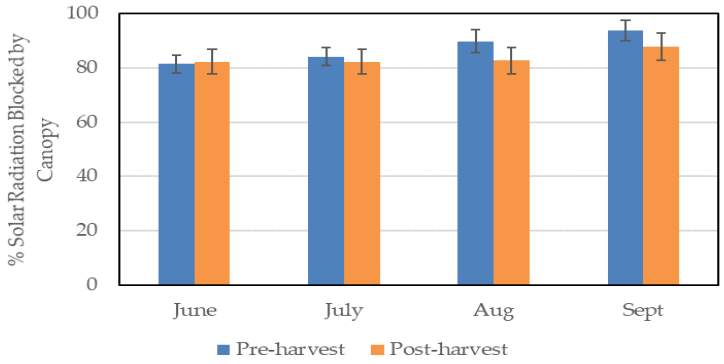


Figure 22. Stream shade measurements collected pre- and post-harvest in Colonite Creek, Libby Unit, Northwest Land Office.

Pre-harvest stream temperature monitoring in Colonite Creek occurred in 2014 and 2015, with peak pre-harvest mean weekly maximum temperature of 14.6°C. Average rate of change in the monitoring reach was 0.5°C with a maximum change of 0.6°C (Figure 23). Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2016 and was completed in 2017. No threshold exceedances were noted in the monitoring site during post-harvest monitoring (Table 2). The maximum temperature change observed during the two-year post-harvest monitoring period was 0.52°C, well below the threshold of 1.0°C (Figure 23).

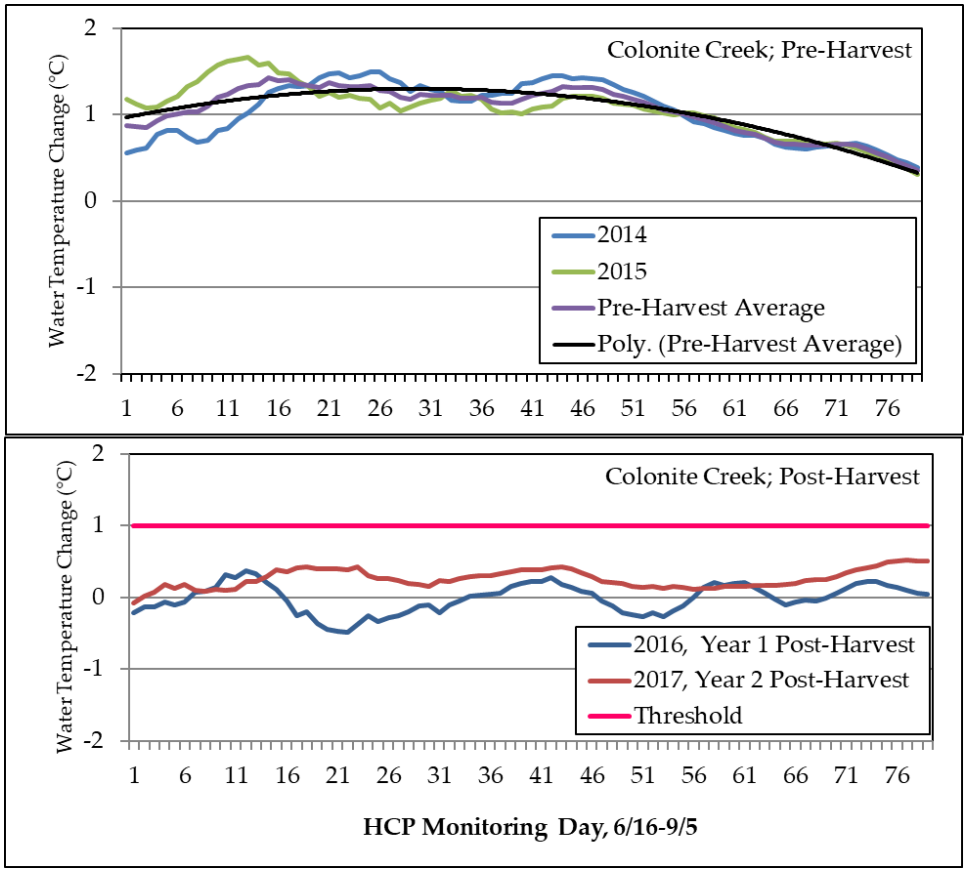


Figure 23. Pre- and Post-harvest water temperature change collected from the RMZ monitoring site on Colonite Creek from 2014–2017 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Based on results of monitoring data collected in Colonite Creek, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Continued monitoring is needed to evaluate the accuracy of the LWD simulation to predict future loading rates. Repeat LWD counts will be conducted on a 10-year interval to evaluate the simulation. Stream shade and temperature results also suggest that timber harvest levels surrounding both sites did not impact fisheries habitat through increased stream temperature. While significant reductions in stream shade were noted Colonite Creek, minimal change in stream temperature was observed post-harvest. The observed thermal regime indicated a stable stream system largely dominated by cold groundwater input. No future shade or stream temperature monitoring is anticipated associated with this RMZ harvest site.

SWLO – Missoula Unit
East Fork Timber Creek

East Fork Timber Creek is a B4 perennial second order tributary to Timber Creek in the Middle Clark Fork River watershed. The stream supports Westslope cutthroat trout and Eastern brook trout. RMZ harvest occurred along East Fork Timber Creek as a part of the West Fork Timber Creek timber sale. Timber harvest occurred along the southwest side of the stream during winter 2013-2014, with a 60-acre shelterwood harvest unit focused on removing small to intermediate sized trees from the RMZ (Figure 24).

Riparian stand condition in the RMZ on East Fork Timber Creek were collected pre-harvest in 2013, and post-harvest in 2021. Pre-harvest riparian stands averaged 556 trees per acre, QMD was 7.5 inches, and basal area averaged 171.9 ft^2 (Table 6). Post-harvest monitoring at the upper site noted 10 percent decrease in TPA, increase in QMD by 1.2 inches, and a 21 percent increase in BA. Based on the harvest prescription, the harvest met the objective of reducing the number of small trees in the RMZ as evidence by decreasing TPA and increased QMD and BA.

Table 6. Riparian timber stand characteristics measured during pre- and post-harvest monitoring, East Fork Timber Creek, Missoula Unit, Mineral County, Montana.

East Fork Timber Creek	Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
Pre-Harvest	556	7.5	171.9
Post-Harvest	500	8.7	209.4
Post-Harvest Change	-56	1.2	37.5

Pre-harvest surveys conducted in 2013 found initial LWD loading rates of 41 pieces per 1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016 and found an increase in LWD to 53 pieces per 1000′. These findings were greater than simulation results which indicated LWD loading under the harvest scenario of 43 pieces per 1000′ at year-10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 87 pieces per 1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 62 pieces per 1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from East Fork Timber Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 35 pieces per 1000′ (Figure 25).

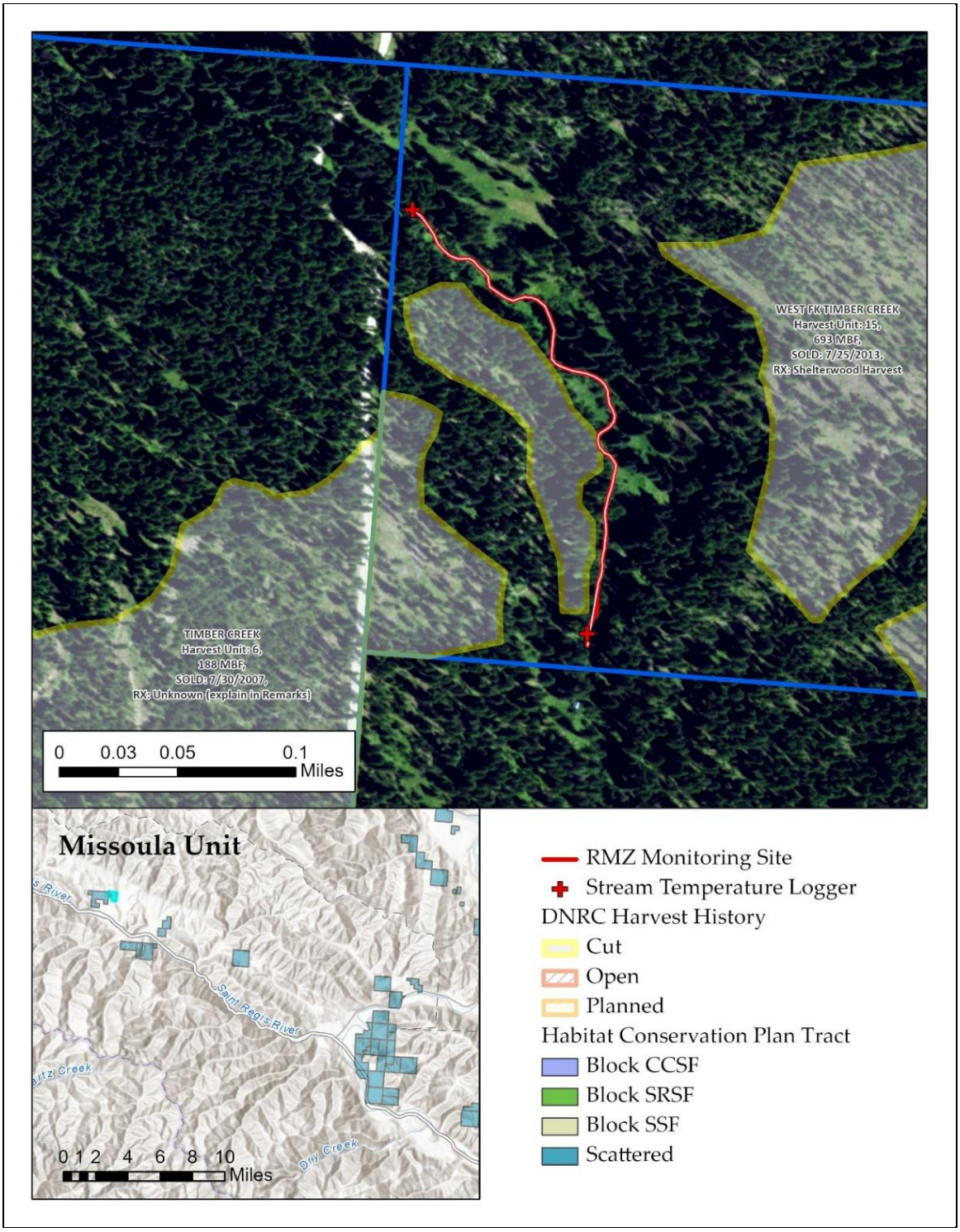


Figure 24. East Fork Timber Creek RMZ Monitoring site, Missoula Unit, Mineral County, Montana.

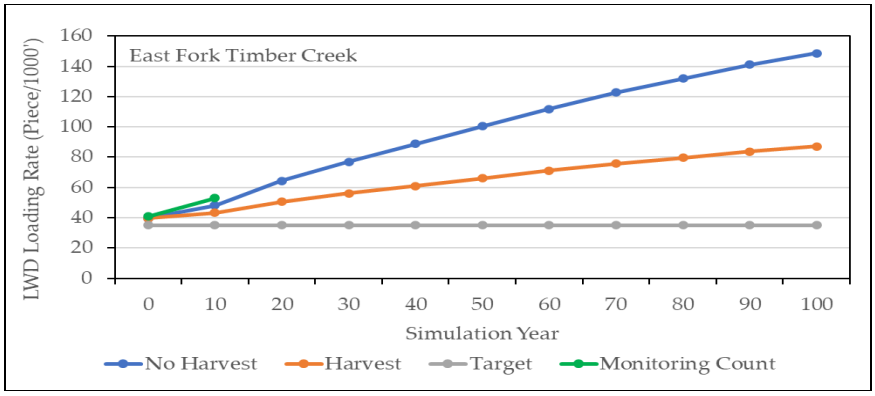


Figure 25. Large woody debris simulation, target loading rates for the forest and stream channel type, and monitoring results from East Fork Timber Creek.

Pre-harvest stream shade measurements were collected from 10 sites on the East Fork Timber Creek in 2013. Between June and September, pre-harvest stream shading was 70.6 percent ± 3.6. Post-harvest monitoring stream shading decreased to 66.5 percent ± 3.7, the decrease in shade was statistically significant (P = 0.014; Figure 26). Reductions in shade were noted across all monitoring months, ranging from -2.6 percent in August to -5.4 percent in June.

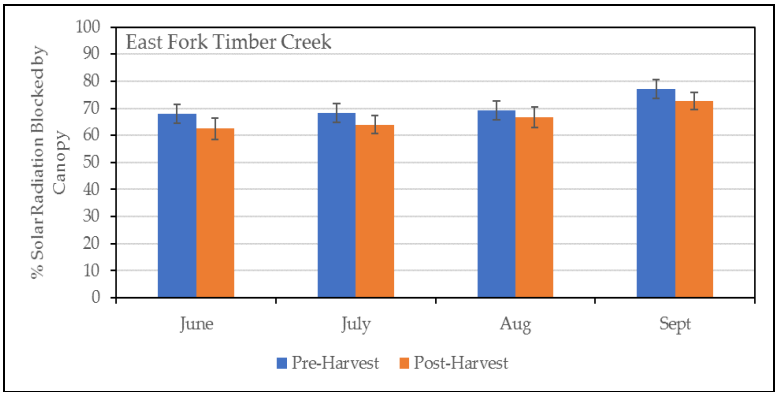
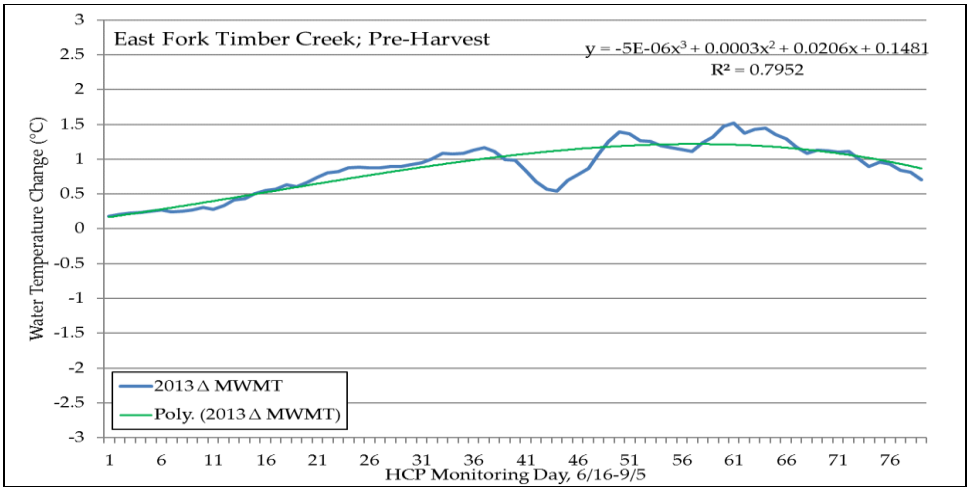


Figure 26. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Two temperature loggers were established in East Fork Timber Creek in 2013 to evaluate pre-harvest stream temperature prior to the timber sale. Peak pre-harvest mean weekly maximum temperature of 16.2°C (Table 2). Average rate of change in the monitoring reach was 0.9°C with a maximum change of 1.5°C (Figure 27). Based on pre-harvest data, a post-harvest threshold of 0.6°C increase over the existing condition was established.

Post-harvest monitoring began in 2014 and was completed in 2016. No acute threshold exceedances were noted in the monitoring site during post-harvest monitoring. Chronic exceedance was noted in year-2 post-harvest (Table 2). Threshold exceedances occurred over a period of 11 consecutive days in late June-early July, and again on single days in late July. The maximum observed rate of temperature change during this period was 0.9°C (Figure 27). During the period of 2015 that stream temperature exceeded the chronic threshold, mean weekly maximum temperature averaged 17.2°C, and did not exceed 18.3°C. These observed temperatures are greater than the optimal growth rates of westslope cutthroat trout, but less than potentially lethal temperatures (Bear et al. 2007). While the chronic threshold was exceeded in 2015, conditions in 2016 indicated that the monitoring reach was cooler than the pre-harvest, with a lower average rate of temperature change. These results suggest that increases in stream temperature may have been a result of timber harvest or other environmental influences during 2015, as thermal data from 2014 and 2016 were considerably different and indicated that the reach was cooling for a large portion of both years.

Based on results of monitoring data collected East Fork Timber Creek, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Continued monitoring is needed to evaluate the accuracy of the LWD simulation to predict future loading rates. Repeat LWD counts will be conducted on a 10-year interval to evaluate the simulation. Significant reductions in stream shade were noted in this site, and one chronic exceedance threshold was not met during year-2 of monitoring. Decreased temperatures observed in year-3 indicated some stabilization of the thermal regime and that factors other than stream shading may be influencing stream temperatures in East Fork Timber Creek. No future shade or stream temperature monitoring is anticipated associated with this RMZ harvest site.



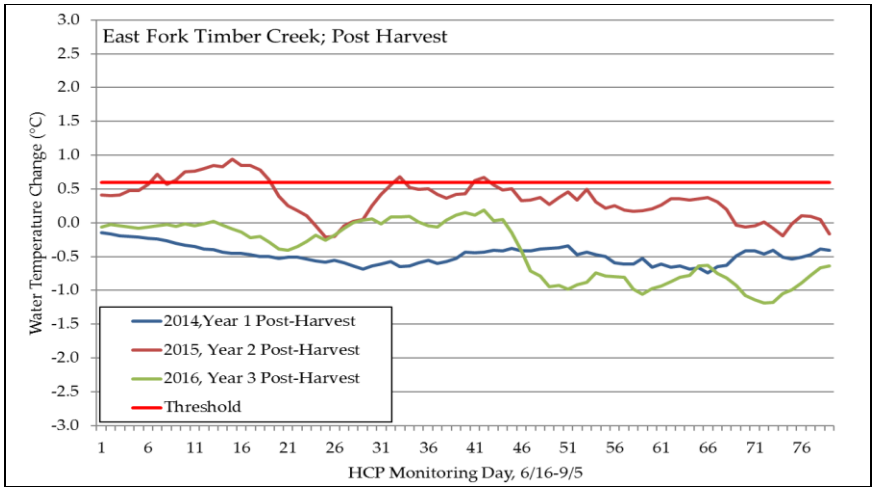


Figure 27. Pre- and Post-harvest water temperature change collected from the upper RMZ monitoring site on East Fork Timber Creek from 2014–2016 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Bear Creek is a second-order B4 type (Rosgen 1996) tributary to upper Willow Creek in the Rock Creek watershed, Granite County, Montana. Bear Creek supports populations of Westslope cutthroat trout and Eastern brook trout. Average bankfull width ranges from 3- to 6-feet throughout the monitoring reach. Pre-harvest monitoring in the RMZ began in 2010, with timber harvest occurring during winter 2010-2011. Post-harvest monitoring was conducted between 2011 and 2014. The timber harvest prescription in the RMZ stand adjacent to Bear Creek was a 110-acre clearcut, with approximately 3 acres in the managed portion of the RMZ (Figure 28).

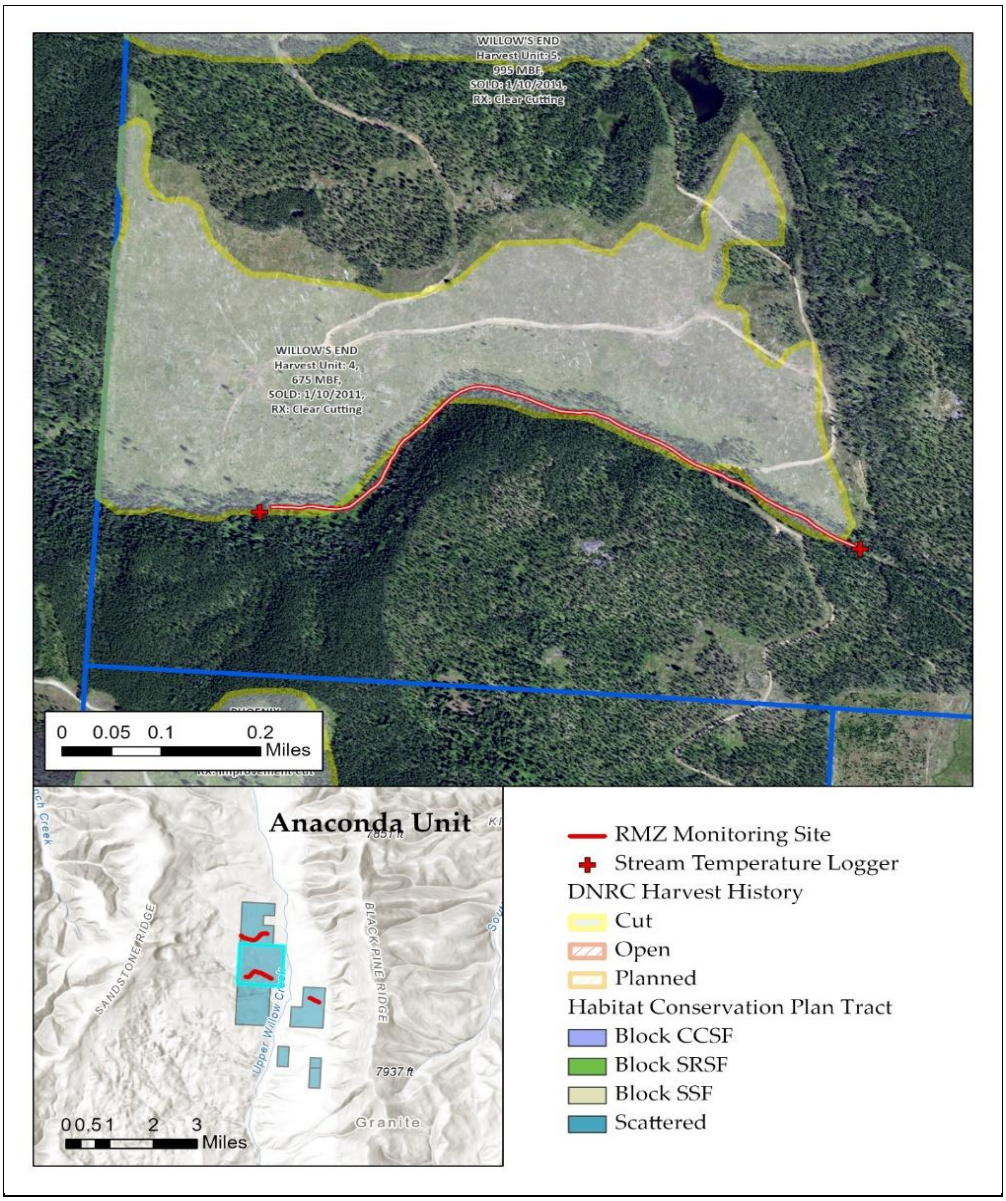


Figure 28. Riparian timber harvest monitoring site on Bear Creek, Anaconda Unit, Granite County, Montana.

Pre-harvest LWD loading rates found a total of 106 pieces per 1000′ of stream within the monitoring reach. Post-harvest monitoring indicated that loading rates had increased to 127 pieces per 1000′. Simulations of anticipated LWD loading rates were not completed for this site due to lack of riparian timber stand data needed to simulate mortality. Observed post-harvest loading rates were considerably higher than target loading rates for this forest/stream type of 35 pieces per 1000′ of stream outlined in the HCP RMZ commitment.

Pre-harvest riparian stream shade data were not collected in Bear Creek. Post-harvest data collected in 2013 found mean monthly stream shade ranging from 32.8–54.4 percent during the months of June-September (Figure 29). No analysis was completed for stream shading due to the lack of pre-harvest data.

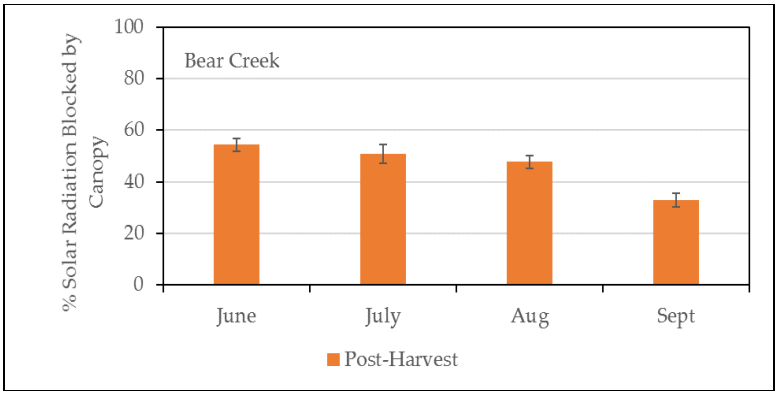


Figure 29. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Peak pre-harvest mean weekly maximum temperature in Bear Creek was 9.6°C, with a range of 6.5°C –11.8°C. Average rate of change in the monitoring reach was 1.6°C with a maximum change of 2.3°C (Figure 30). Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2011 and continued through 2014. The average rate of change in stream temperature was 1.9°C, with a maximum of 2.9°C, similar to observations prior to harvest. The corrected post-harvest rate of change indicated that no chronic or acute threshold exceedances occurred during the four years of post-harvest monitoring (Figure 30; Table 2). Timber harvest in this reach met the management objective, harvesting a portion of the RMZ and SMZ adjacent to the north side of Bear Creek. No future stream temperature monitoring is planned in this reach.

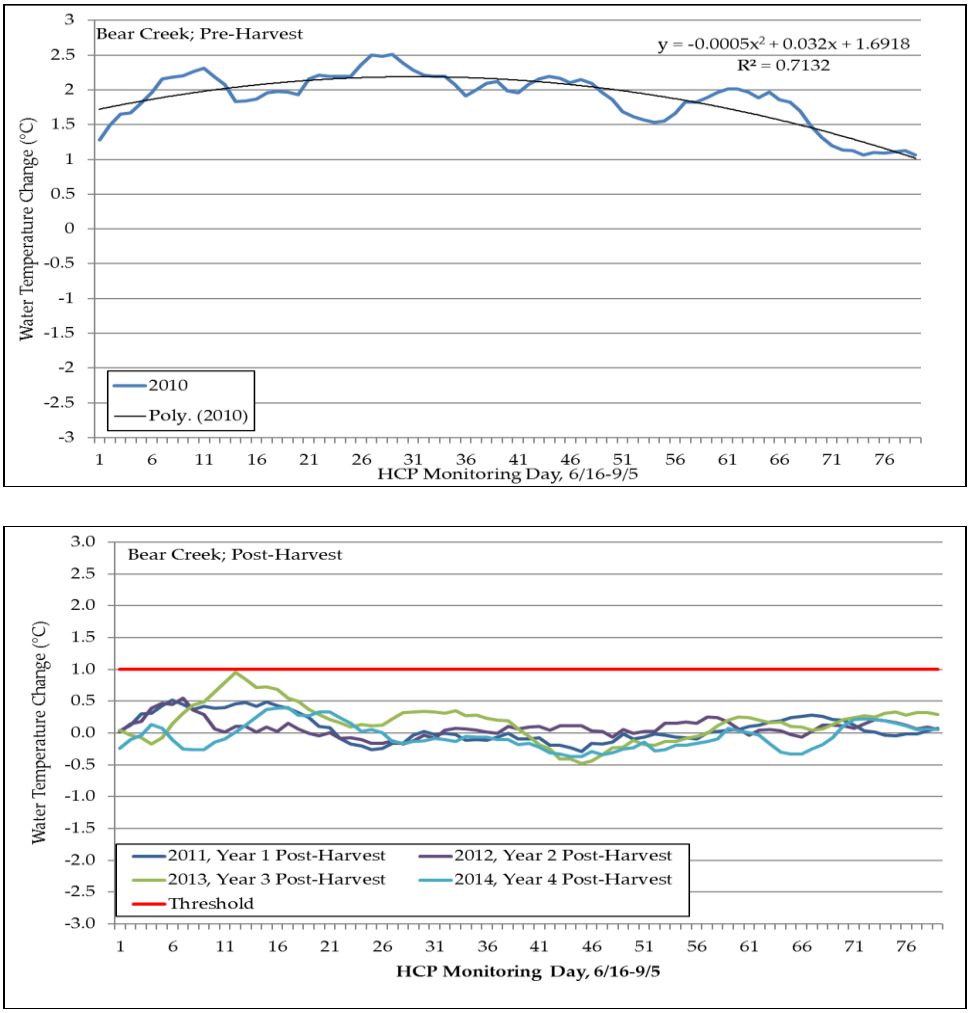


Figure 30. Pre-harvest and post-harvest water temperature change collected from the RMZ monitoring site on Bear Creek from 2011–2014 Red line indicates the temperature change threshold established from pre-harvest temperature data.

SWLO – Anaconda Unit
Beaver Creek

Beaver Creek is a second-order B-4 (Rosgen 1996) tributary to upper Willow Creek in the Rock Creek watershed, Granite County, Montana. Beaver Creek supports Bull trout, Westslope cutthroat trout, Longnose sucker, and Eastern brook trout. Average bankfull width in Beaver Creek is approximately 4- to 7-feet. Two monitoring sites were established, with the upper site having riparian harvest on both the north and south side of the stream, and harvest along the north side of the stream at the lower site. Timber harvest adjacent to the upper and lower sites included a single 225-acre clearcut unit that included approximately 4 acres of RMZ harvest adjacent to the upper site, and approximately 1.5 acres of RMZ harvest adjacent to the lower site (Figure 31). Pre-harvest data were collected in 2010, with post-harvest monitoring extending from 2011 to 2014.

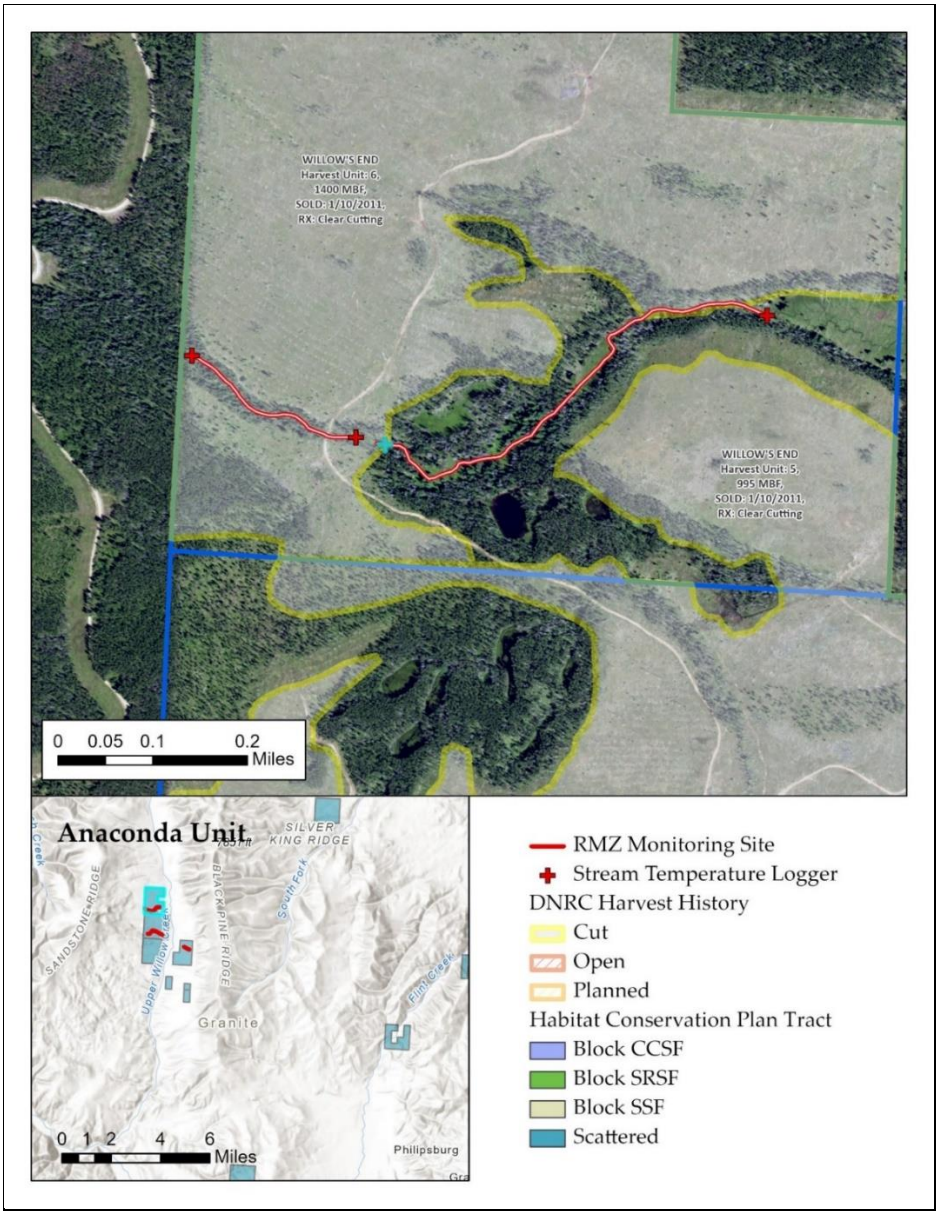


Figure 31. Beaver Creek riparian management zone timber harvest monitoring sites, Anaconda Unit, Granite County, Montana.

Riparian stand characteristics were estimated for pre-harvest baseline conditions using data collected during the planning process for the HCP. Pre-harvest data were collected through both the upper and lower reaches resulting in a single estimate of TPA, QMD, and BA that reflect the existing condition for Beaver Creek on DNRC ownership. Pre-harvest riparian stands averaged 620 trees per acre, 7.4 inch QMD, and 183.5 ft^2 of basal area. Post-harvest riparian stand monitoring noted declines in TPA and QMD, and a slight increase in BA (Table 8). The reduction in TPA was estimated at approximately 4 percent, below what would be expected under a full RMZ harvest. Slight reduction in QMD suggests that the timber harvest was representative of the tree sizes observed pre-harvest and did not decline significantly. The slight increase in BA from 183.5 ft^2 to 194.5 ft^2 likely reflects the random selection of riparian timber cruise plots, with potential inclusion of larger trees in the post-harvest monitoring period.

Table 8. Riparian timber stand characteristics measured during pre- and post-harvest monitoring, Beaver Creek, Anaconda Unit, Granite County, Montana.

Beaver Creek	Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
Pre-Harvest	620	7.4	183.5
Post-Harvest	600	7.2	194.5
Post-Harvest Change	-20	-0.2	11

Pre-harvest LWD loading rates found a total of 69 pieces per 1000' of stream within the monitoring reach. Post-harvest monitoring indicated that loading rates had increased to 116 pieces per 1000'. Observed post-harvest loading rates were considerably higher than target loading rates for this forest/stream type of 35 pieces per 1000' of stream outlined in the HCP RMZ commitment. Large woody debris was not modeled for the upper or lower sites as pre-harvest cruise data were combined across both monitoring sites, precluding site-specific estimates of long-term loading rates. Repeated LWD measurements will be conducted in 2022 to evaluate loading rates 10-years post-timber harvest.

Pre-harvest stream shade measurements were collected from 4 sites on upper Beaver Creek in 2010. Between June and September, pre-harvest stream shading was 81.4 percent ± 5.1. Post-harvest monitoring stream shading decreased to 70.6 percent ± 3.6, the decrease in shade was statistically significant ($P < 0.001$; Figure 32). Reduction in shade was noted during all monitoring months, with an average of 10.8 percent less stream shade during summer months in the post-harvest period (Figure 32).

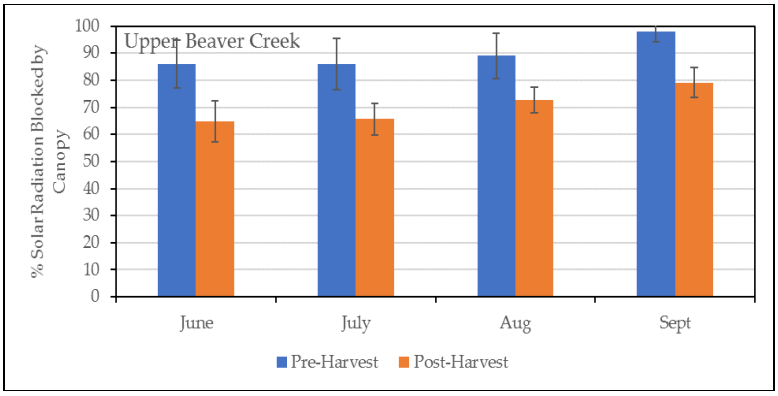


Figure 32. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Pre-harvest stream shade measurements were collected from 12 sites on lower Beaver Creek in 2010. Between June and September, pre-harvest stream shading was 55.4 percent ± 5.9. Post-harvest monitoring stream shading decreased to 43.9 percent ± 3.7, the decrease in shade was significant ($P < 0.001$; Figure 33). Stream shade measurements will be repeated in 2022 to estimate changes in condition 10-years after harvest was completed.

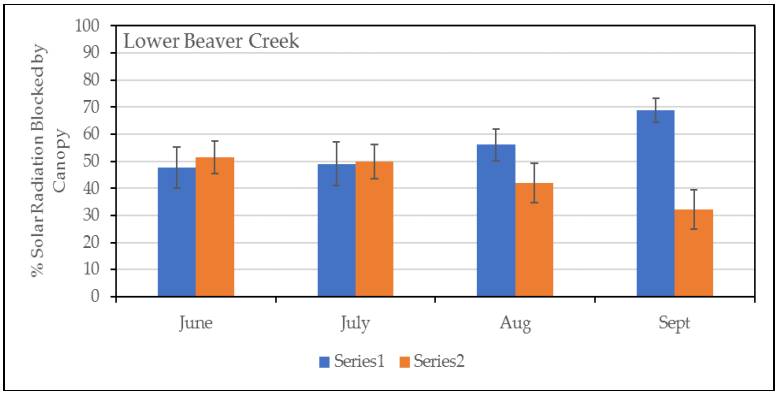
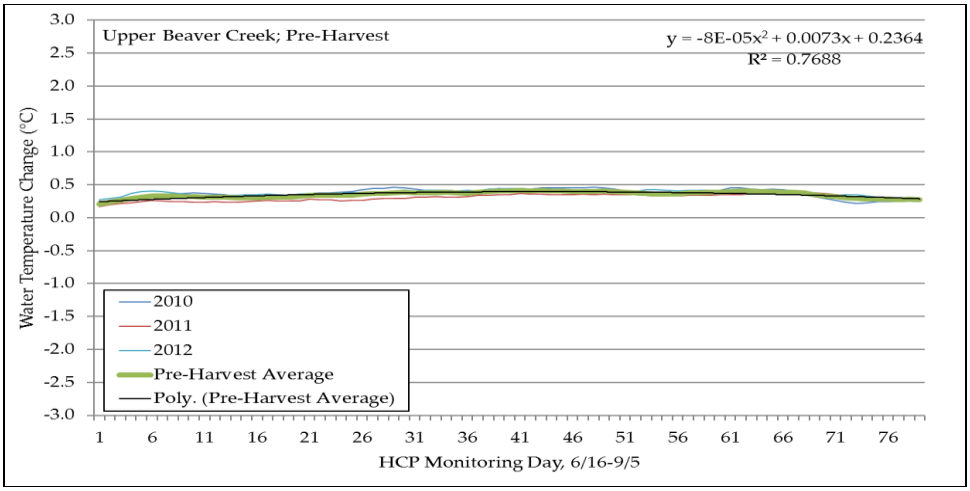


Figure 33. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Peak pre-harvest mean weekly maximum temperature between 2010 and 2012 in upper Beaver Creek was 9.3°C, with a range of 6.8°C –10.4°C. Average rate of change in the monitoring reach was 0.3°C with a maximum change of 0.5°C (Figure 34) Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2013 and was completed in 2014. The average rate of change in stream temperature during this period was 0.4°C, with a maximum of 0.6°C, similar to observations prior to harvest.

The corrected post-harvest rate of change indicated that no chronic or acute threshold were exceeded during the four years of post-harvest monitoring (Figure 34). Timber harvest in this reach met the management objective, harvesting a portion of the RMZ and SMZ adjacent to both sides of upper Beaver Creek. Peak pre-harvest mean weekly maximum temperature in 2010 and 2011 in lower Beaver Creek was 14.7°C, with an average of 11.8°C. Average rate of change in the monitoring reach was 2.4°C with a maximum change of 4.2°C (Figure 35). Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2012 and was completed in 2014. The average rate of change in stream temperature during this period was 2.26°C, with a maximum of 3.46°C, similar to observations prior to harvest. The corrected post-harvest rate of change indicated that no chronic or acute threshold were exceeded during the four years of post-harvest monitoring (Figure 35; Table 2). Timber harvest in this reach met the management objective, harvesting a portion of the RMZ and SMZ adjacent to the north side of lower Beaver Creek.

Based on monitoring results, RMZ harvest along upper Beaver Creek resulted in LWD loading rates greater than HCP target loading rates for the forest and stream type. While significant reductions in stream shading were observed during post-harvest monitoring at both the upper and lower sites, no coincidental increases in stream temperature were observed. These findings suggest that maintenance of stream shading greater than 70 percent were sufficient to minimize potential impacts to fisheries habitat in this reach. Continued post-harvest monitoring of LWD loading rates is necessary to evaluate long-term trends in accumulation and depletion of LWD following harvest.



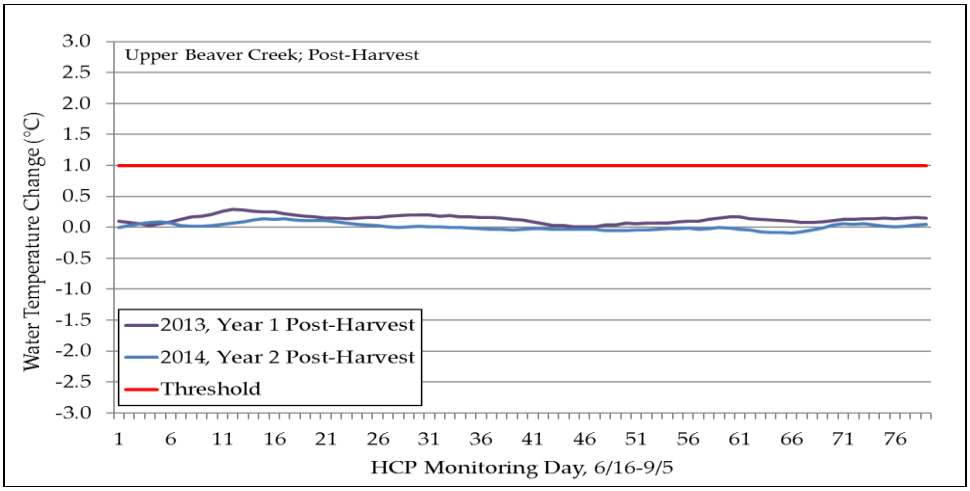
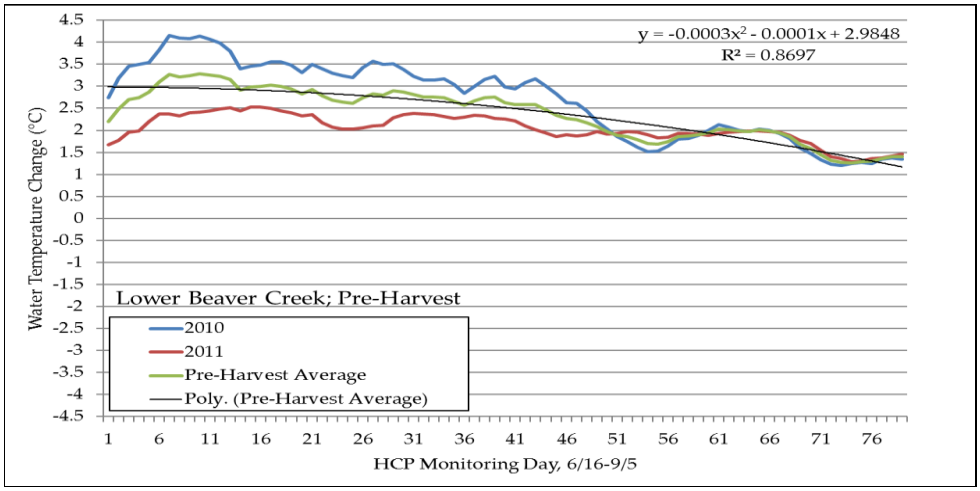


Figure 34. Pre- and Post-harvest water temperature change collected from the upper RMZ monitoring site on Beaver Creek from 2013–2014 Red line indicates the temperature change threshold established from pre-harvest temperature data.



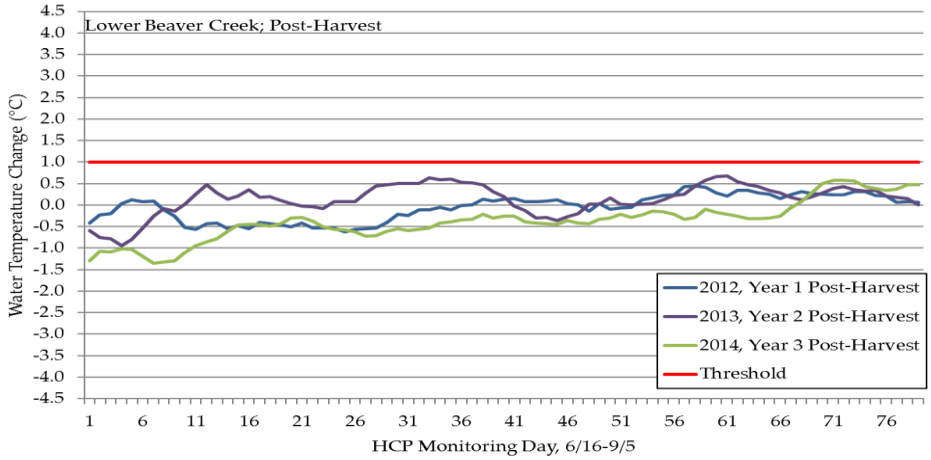


Figure 35. Pre- and Post-harvest water temperature change collected from the RMZ monitoring site on lower Beaver Creek from 2009–2012 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Riparian monitoring was conducted on an unnamed tributary to upper Willow Creek, Anaconda Unit, Granite County, Montana. The study stream is a first-order tributary to Willow Creek, with an average bankfull width of 2 to 5 feet. Based on Rosgen (1996), the stream is a B4 type stream. Riparian management zone timber harvest occurred on both the north and south sides of the stream in 2010-2011 as a part of the Upper Willow Salvage timber sale. Harvest prescription in the 210-acre harvest unit was designated as salvage harvest, due to infestation of mountain pine beetle, with clearcut harvest outside of the RMZ and 50 percent retention in the managed portion of the RMZ. Adjacent to the monitoring site, approximately 5 acres of RMZ were harvested (Figure 36). Following timber harvest, continued mortality associated with the mountain pine beetle infestation occurred in the riparian stand resulting in loss of most of the trees retained in both the unmanaged and managed portions of the riparian buffer.

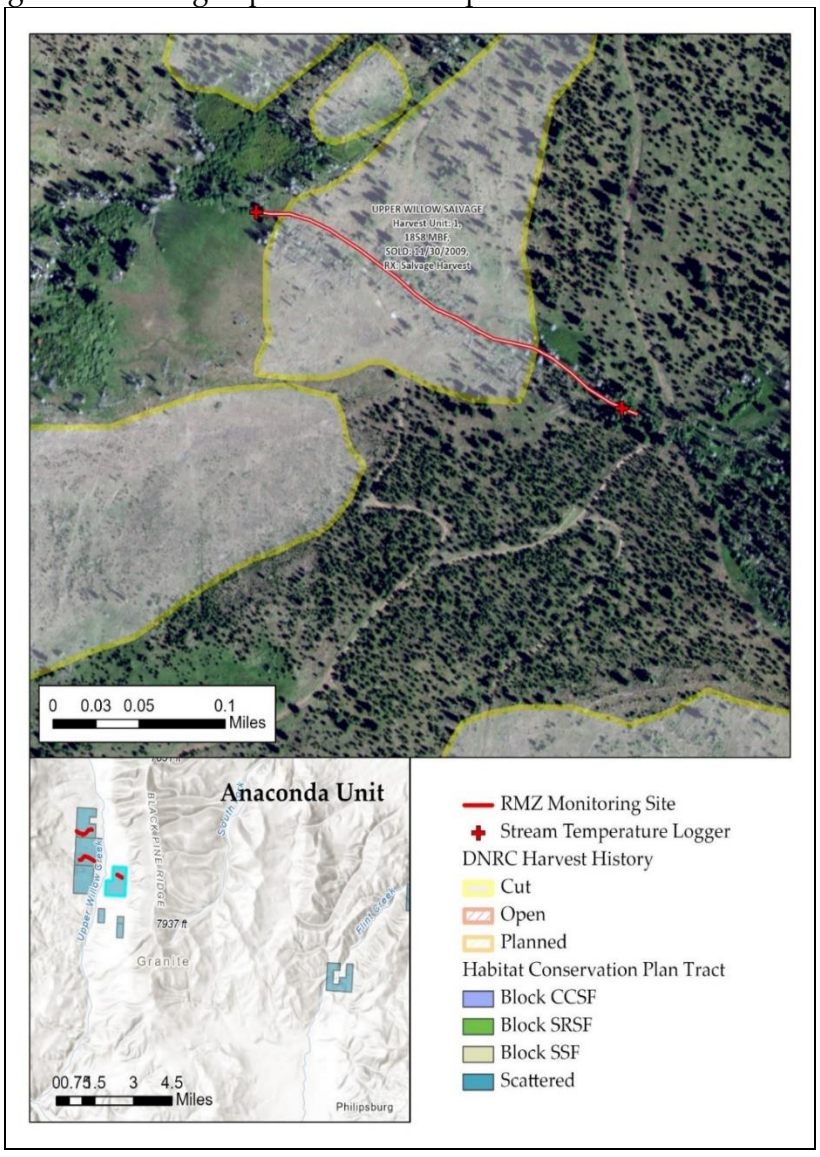


Figure 36. Riparian management zone timber harvest monitoring site on an unnamed tributary to upper Willow Creek, Anaconda Unit, Granite County, Montana.

Based on aerial imagery, the majority of stand mortality had occurred by 2013 or 2014, subsequent wind events have resulted in windthrow of the majority of the trees in the RMZ, with current standing dead or live trees likely at or slightly below standards outlined in the SMZ law of at least 10 trees per 100 feet of stream. RMZ monitoring at this site began in 2010, with a single year of pre-harvest data, followed by 4 years of post-harvest monitoring from 2011 to 2014. Following 2014, monitoring was discontinued at this site. Results from RMZ monitoring during the initial post-harvest period found both acute and chronic stream temperature exceedance, significant increase in LWD, and significant decrease in stream shade. Based on these results and given that this was the only stream temperature monitoring site which had both acute and chronic temperature exceedance, a further 5-year monitoring period was initiated in 2018 that would extend through 2022. Data collected between 2018 and 2021 are presented in this report.

Riparian stand conditions in the study stream were collected pre-harvest in 2010, and estimated 245 trees per acre, an average QMD of 8.3 inches, and 92.5 ft^2 of basal area (Table 9). Post-harvest stand data were collected in 2013 and found reduction in TPA of 8 percent to 226 trees per acre. QMD also declined by 6 percent to approximately 7.8 inches, and basal area declined by 20 percent to 75 ft^2 . Riparian timber cruise plots on this study site will be repeated in 2022 to determine stand characteristics 10-years post-harvest as well as to capture to stand condition following continued stand mortality and subsequent windthrow.

Table 9. Riparian timber stand characteristics measured during pre- and post-harvest monitoring collected in an unnamed tributary to upper Willow Creek, Anaconda Unit, Mineral County, Montana.

Unnamed tributary to Willow Creek	Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
Pre-Harvest	245	8.3	92.5
Post-Harvest	226	7.8	75
Post-Harvest Change	-19	-0.5	-17.5

Pre-harvest surveys conducted in 2010 found initial LWD loading rates of 10 pieces per 1000' in the monitoring reach, which was below the target level established for this forest/stream channel type in the HCP of 35 pieces per 1000'. Timber harvest occurred along both sides of the stream in 2010 and was focused on removing trees infested with mountain pine beetle. Post-harvest LWD monitoring was conducted in 2013 and found an increase in LWD to 38 pieces per 1000'. Post-harvest monitoring was repeated in 2017 and noted an increase in LWD to 78 pieces per 1000'. The increase in LWD during the first 7 years post-harvest exceeded anticipated loading rates from the simulation, likely due to significant windthrow events which have occurred following continued stand mortality. Simulation results which indicated LWD loading under the harvest scenario of 45 pieces per 1000' at year 10 of the simulation, which was similar to results observed in 2011. Projected LWD loading during the 100-year simulation peaked in year-100 at 54 pieces per 1000', measured loading rates in 2017 exceeded this projection by 30 percent (Figure 37). Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 47 pieces per 1000' at the end of the simulation as a result of new stand establishment and decreased tree mortality. LWD measurements will be conducted in 2022 to determine loading rates 10-years post-harvest.

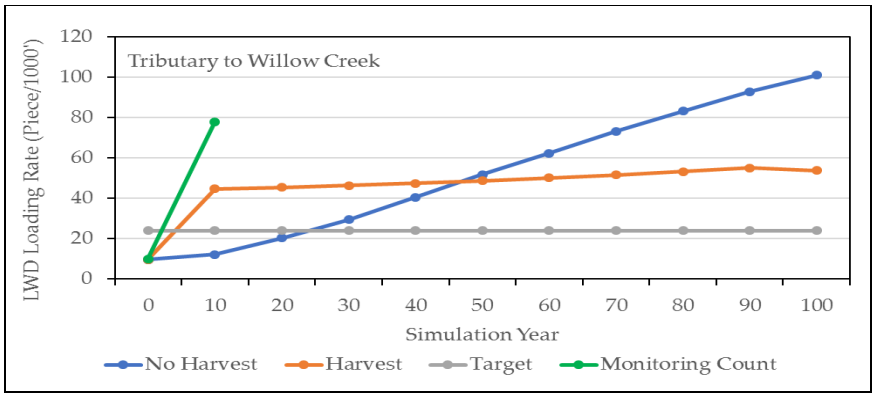


Figure 37. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Tributary to Willow Creek, Southwest Land Office.

Pre-harvest stream shade measurements were collected from 8 sites on the study stream in 2010. Between June and September, pre-harvest stream shading was 74.7 percent ± 3.7. Post-harvest monitoring in 2013 found a reduction in stream shade to 43.9 percent ± 3.7, the decrease in shade was significant ($P < 0.001$; Figure 38). Subsequent post-harvest monitoring was conducted in 2017, 2018, and 2020 and noted similar levels of shade as those observed in 2013 (Figure 38). Stream shade measurements will be repeated in 2022 to estimate changes in condition 10-years after harvest was completed.

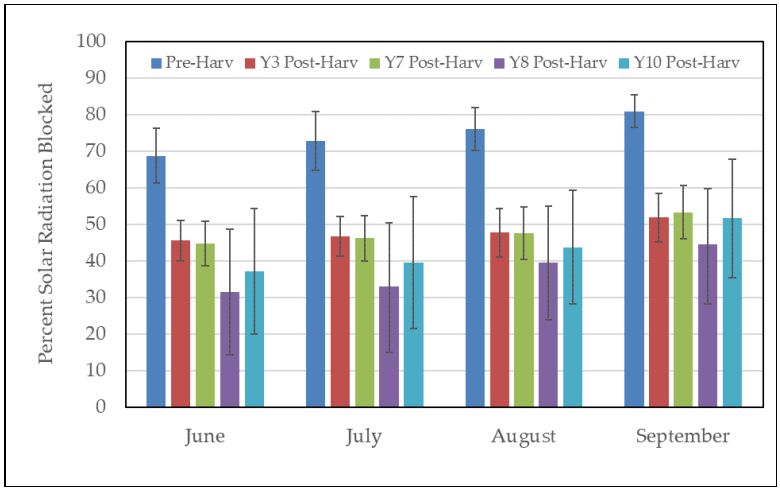
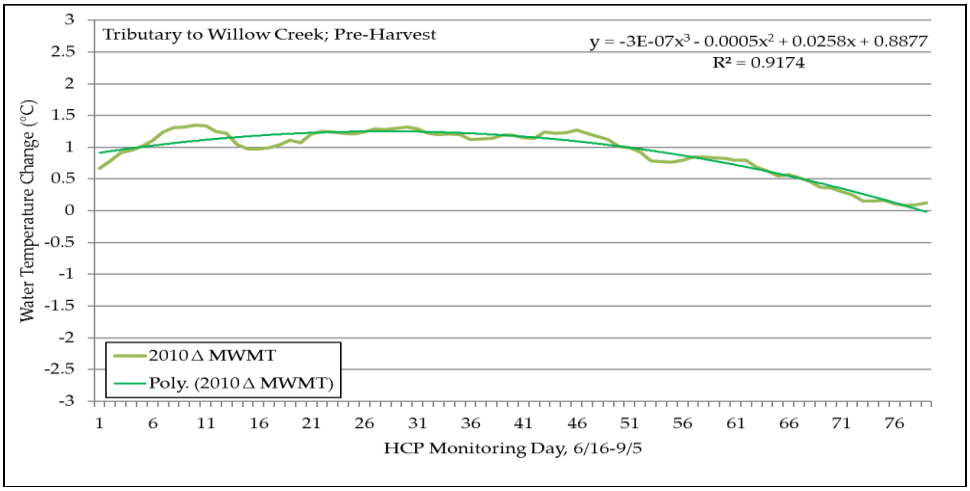


Figure 38. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Peak pre-harvest mean weekly maximum water temperature in the unnamed tributary to Willow Creek in 2010 was 15.6°C with an average MWMT of 13.5°C (Table 2). Average rate of change in the monitoring reach was 0.9°C with a maximum rate of change of 1.3°C (Figure 39). Based on pre-harvest data, the post-harvest threshold was set at a 0.6°C increase over the existing condition. Post-harvest monitoring took place from 2011–2014 (Figure 39). During this time, chronic thresholds were exceeded all four years of the monitoring period (Table 2). Threshold exceedance in the first-year post-harvest was 15 percent of the monitoring period, one period of 9 consecutive days occurred near the end of August, and 12 days total during the monitoring period. During the second post-harvest year, exceedances occurred on 9 days (11 percent of the monitoring period), with one period of 6 consecutive days occurring in late June. In the third and

fourth years post-harvest, threshold exceedance increased to 50 percent (40 days) and 88 percent (70 days) of the monitoring periods respectively. These results were unexpected based on the previous two years of post-harvest monitoring.

Acute threshold exceedance was also noted on two occasions during post-harvest year 2 of monitoring. The first acute exceedance occurred on July 1, during which water temperature was greater than 18.6°C for approximately 3.5 hours (7 temperature readings). The maximum temperature observed during this time was 19.6°C. The second exceedance occurred on July 3, during which temperatures were greater than 18.6°C for 3 hours (6 temperature readings). The maximum temperature observed during this period was 19.3°C. Air temperature data were obtained from the Combination Snotel site (Station ID: 410). Regression analysis of the maximum hourly temperature observed at this station and water temperature collected in the monitoring reach showed a strong pre-treatment correlation between air and stream temperature (Figure 40). During the first three days of July 2013, air temperatures recorded at the snotel location were greater than 28.5°C, with a maximum temperature of 32.5°C on July 2. The average daily maximum temperature during these three days was 30.4°C, 7.2 and 4.9°C warmer than the previous and subsequent 7-day periods, respectively. While timber harvest may have contributed to the acute threshold exceedance, it would be expected that this trend would have been observed in other post-harvest monitoring, specifically year 4 post-harvest when chronic thresholds were exceeded for nearly the entire monitoring period. The duration of fish exposure to warm temperatures was also limited to relatively short durations during the two days where thresholds were exceeded. Based on laboratory studies, westslope cutthroat trout survival was greater than 90 percent for up to 30 days at a constant temperature of 20°C (Bear et al. 2007).



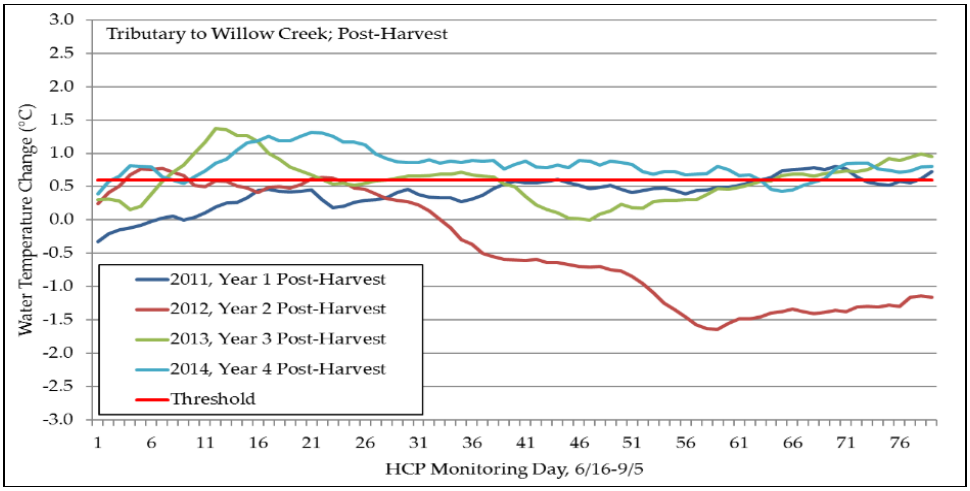


Figure 39. Pre- and Post-harvest water temperature change collected from the RMZ monitoring site on the unnamed tributary to Willow Creek from 2011–2014 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Based on results of monitoring data collected at this, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. The level to which post-harvest loading rates increased relative to other RMZ monitoring sites is likely a result of continued stand mortality and increased vulnerability to windthrow following harvest. Observed reductions in stream shading and coincidental increased stream temperatures, including both acute and chronic exceedances of HCP thresholds, were also likely due to stand blowdown. LWD, stream shade, and stream temperature monitoring will be repeated on this site to evaluate long-term recovery and evaluate potential effects on the fish population.

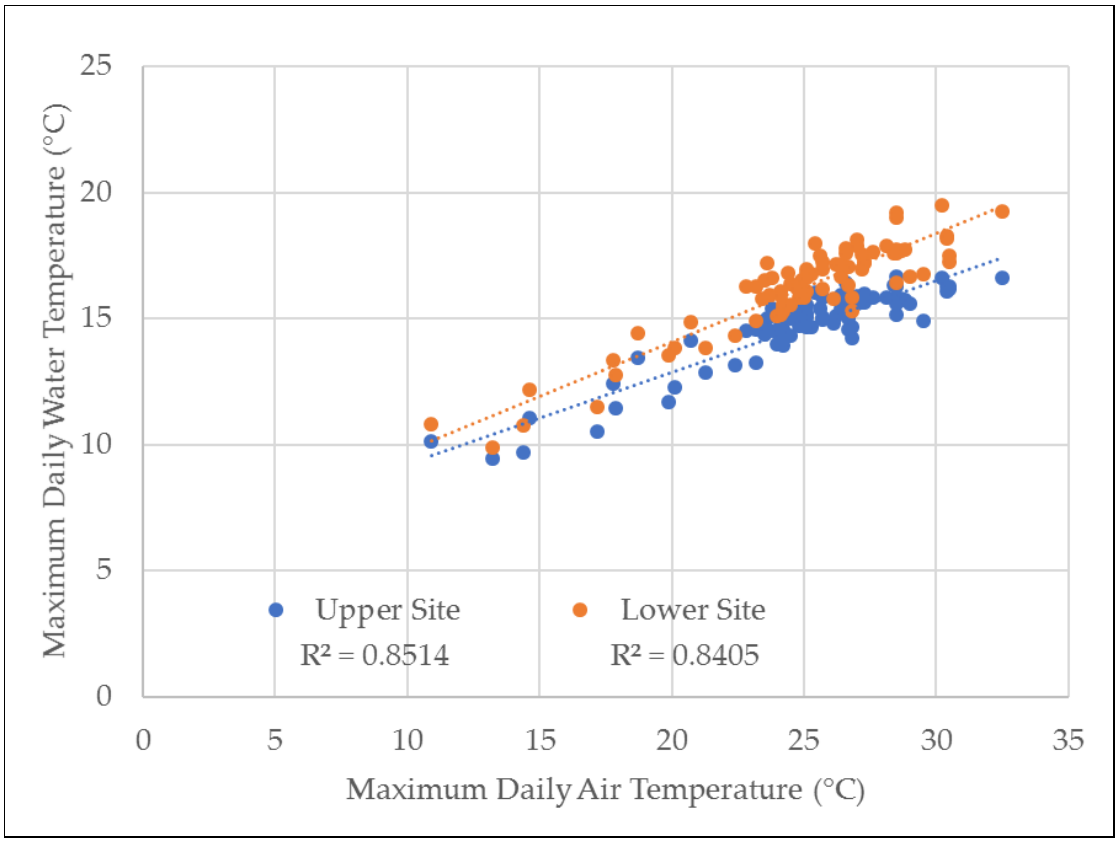


Figure 40. Regression analysis of daily air and water temperature to evaluate acute threshold exceedances observed in the unnamed tributary to Willow Creek.

SWLO – Clearwater Unit
Tributary to Bear Creek-Clearwater Unit

Riparian management zone timber harvest monitoring was conducted on a tributary to Bear Creek, upper Blackfoot River watershed, Powell County, Montana. The study stream is a first-order tributary to Bear Creek, and is non-fish bearing in the upper reaches, but supports a population of Westslope cutthroat trout near the confluence with Willow Creek. Average bankfull width in the monitoring reach ranged from 2 to 5 feet. Riparian timber harvest occurred on both the north and south sides of the stream, both harvest units adjacent to the stream were under seed-tree prescriptions outside of the RMZ and retained 50 percent of the stand in the managed portion of the RMZ. Approximately 5 acres of RMZ were included in the harvest units. Due to low discharge in the reach on DNRC ownership, no stream temperature monitoring was conducted at this monitoring site. Pre- and post-harvest riparian timber stand condition, stream shade, and large woody debris were completed to evaluate the timber harvest in the managed portion of the RMZ.

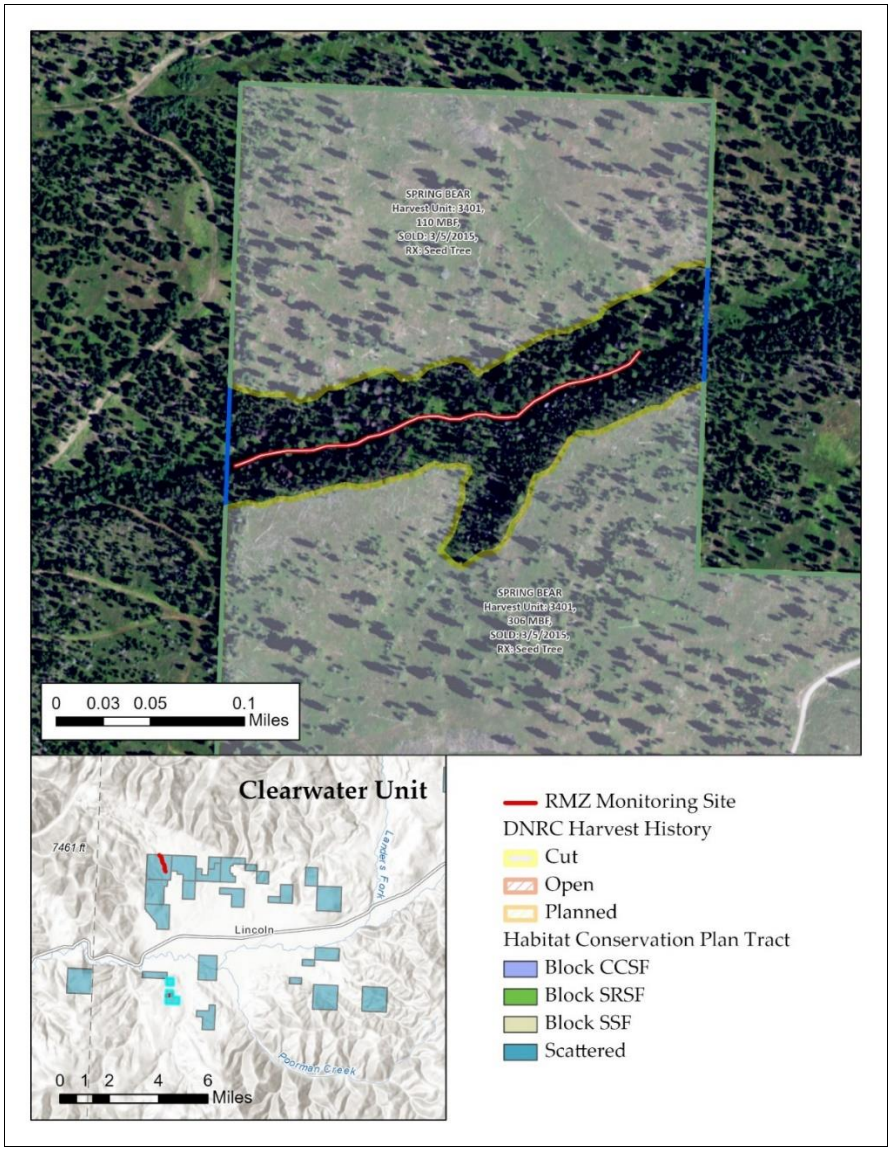


Figure 41. Riparian management zone timber harvest monitoring site on an unnamed tributary to Bear Creek, Clearwater Unit, Powell County, Montana.

Riparian stand conditions on the tributary to Bear Creek were collected pre-harvest in 2013, and post-harvest in 2017. Pre-harvest riparian stands averaged 706 trees per acre with QMD of 6.8 inches, and an average of 175.6 ft^2 BA. Post-harvest stands averaged 558 trees per acre, with QMD of 7.5 inches and 172.4 ft^2 of basal area (Table 10). Based on these stand estimates, trees per acre declined by approximately 23 percent, QMD increased slightly by 0.7 inches and BA decreased by 3 percent. The reduction in TPA is expected, with no harvest in the unmanaged portion of the RMZ and 50 percent retention in the managed portion, TPA would be expected to decrease by approximately 25 percent. Increased QMD and BA may be a factor of favoring larger trees for retention or simply a result of random assignment of plot locations within the RMZ.

Table 10. Riparian timber stand characteristics measured during pre- and post-harvest monitoring, Bear Creek, Clearwater Unit, Powell County, Montana.

Bear Creek	Trees per Acre	Quadratic Mean Diameter (inch)	Basal Area (Sq. ft)
Pre-Harvest	706	6.8	175.6
Post-Harvest	558	7.5	172.4
Post-Harvest Change	-148	0.7	-3.2

Pre-harvest surveys conducted in 2013 found initial LWD loading rate of 48 pieces per 1000′ in the monitoring reach. Post-harvest LWD monitoring conducted in 2017 found an increase in LWD to 61 pieces per 1000′. These findings were lower than simulation results which indicated LWD loading under the harvest scenario of 80 pieces per 1000′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 88 pieces per 1000′. Comparing the unharvested and harvested stand simulations indicate a decrease in LWD loading by 34 pieces per 1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Tributary to Bear Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 35 pieces per 1000′ (Figure 42).

Pre-harvest stream shading measurements were collected from eight sites on the Tributary to Bear Creek in 2013. Pre-harvest stream shading was 72.0 percent ± 4.8, post-harvest monitoring noted a decrease to 65.7 percent ± 6.7 that was statistically significant ($P = 0.0002$; Figure 43).
Based on RMZ monitoring results, timber harvest on Bear Creek met the goals of the HCP RMZ conservation strategy at maintaining instream fisheries habitat. LWD loading rates increased by approximately 20 percent, and stream shading was not significantly reduced through riparian timber harvest. No future monitoring at this site is anticipated.

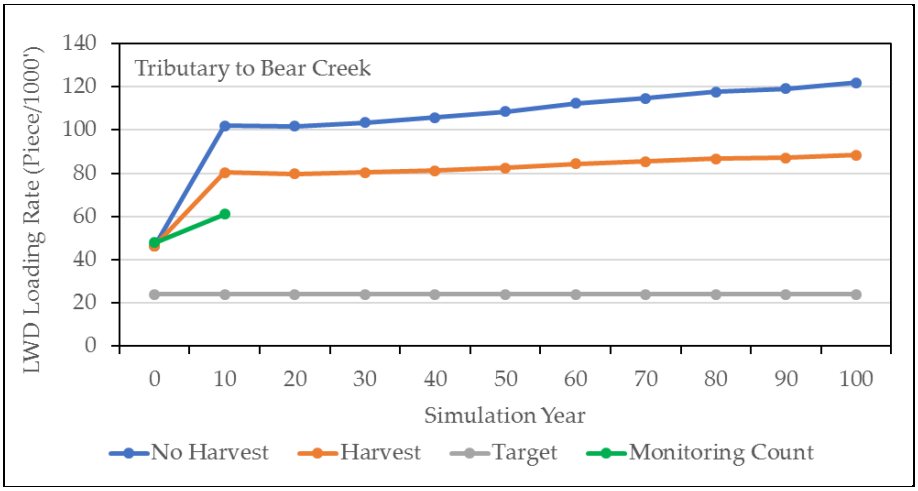


Figure 42. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Tributary to Bear Creek, Southwest Land Office.

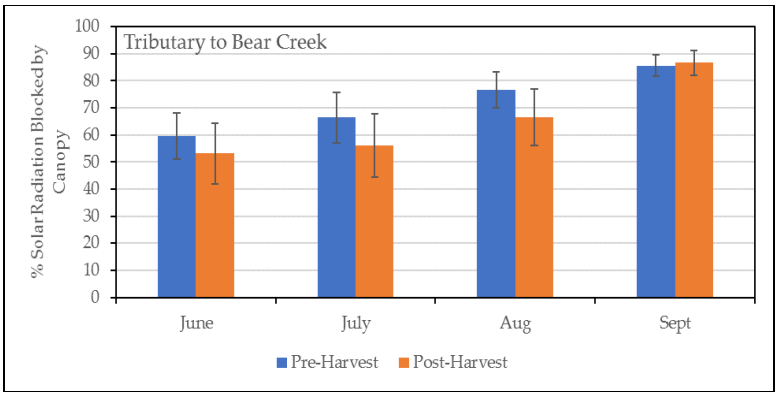


Figure 43. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Dingley Creek is a second-order A4 type stream (Rosgen 1996) in the Upper Missouri River watershed, Beaverhead County, Montana. Average bankfull width ranged from 4 to 8 feet through the monitoring reaches. The stream supports populations of native Westslope cutthroat trout and Eastern brook trout. Riparian management zone timber harvest occurred along both sides of Dingley Creek in 2007 as a part of a salvage harvest that was conducted to remove mountain pine beetle infested trees. Pre-harvest monitoring was conducted between 2004 and 2006, with timber harvest occurring.

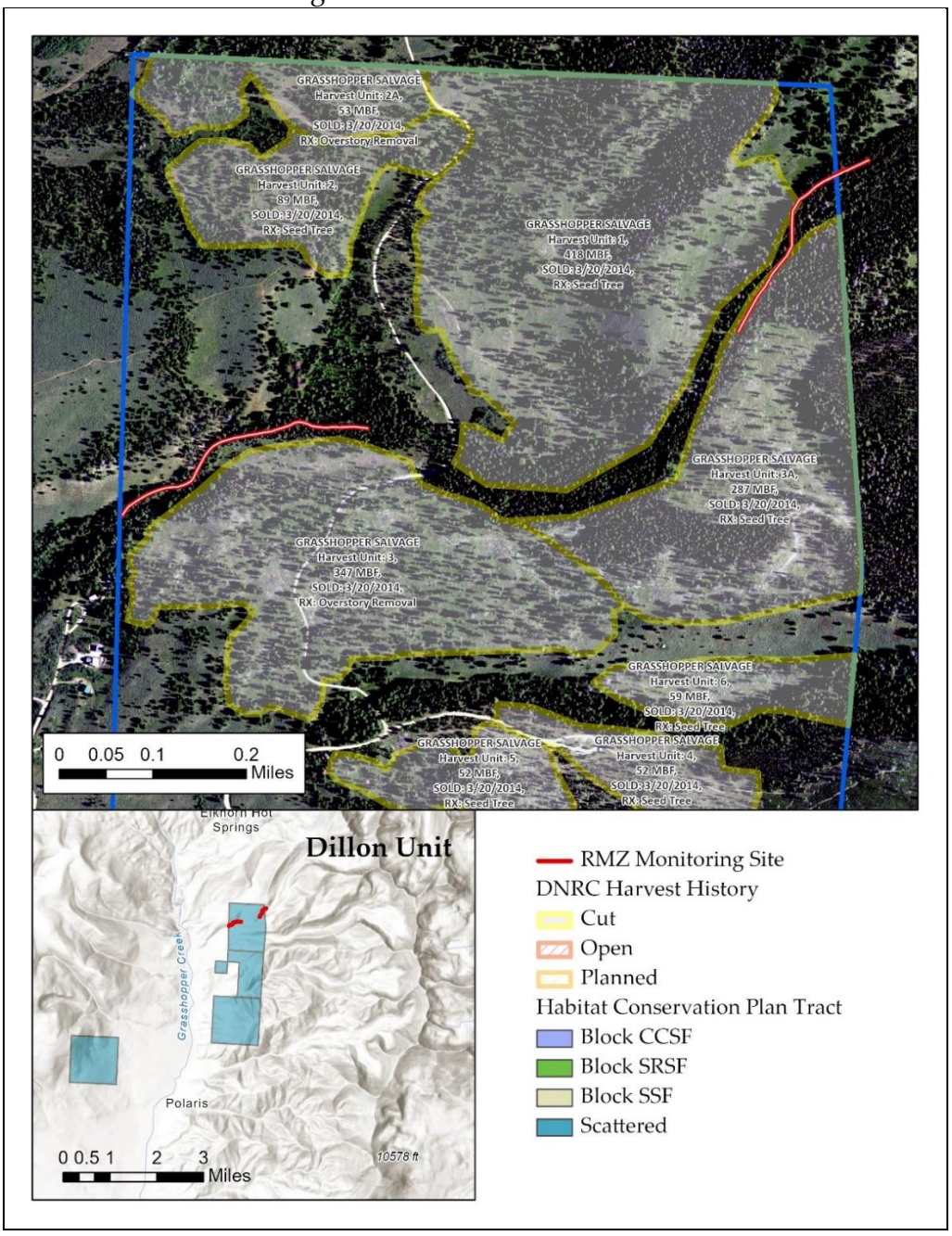


Figure 44. Dingley Creek riparian management zone timber harvest monitoring sites, Dillon Unit, Beaverhead County, Montana.

Pre-harvest surveys conducted in 2013 found initial LWD loading rates of 156 pieces per 1000′ in the monitoring reach. RMZ harvest occurred along the south side of the stream during 2015, with an HCP Class 1 harvest prescription. Post-harvest LWD monitoring was conducted in 2017, and found a decrease in LWD to 120 pieces per 1000′. These findings were lower than simulation results which indicated LWD loading under the harvest scenario of 171 pieces per100′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 207 pieces per 1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 78 pieces per 1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Upper Dingley Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 35 pieces per 1000′ (Figure 45).

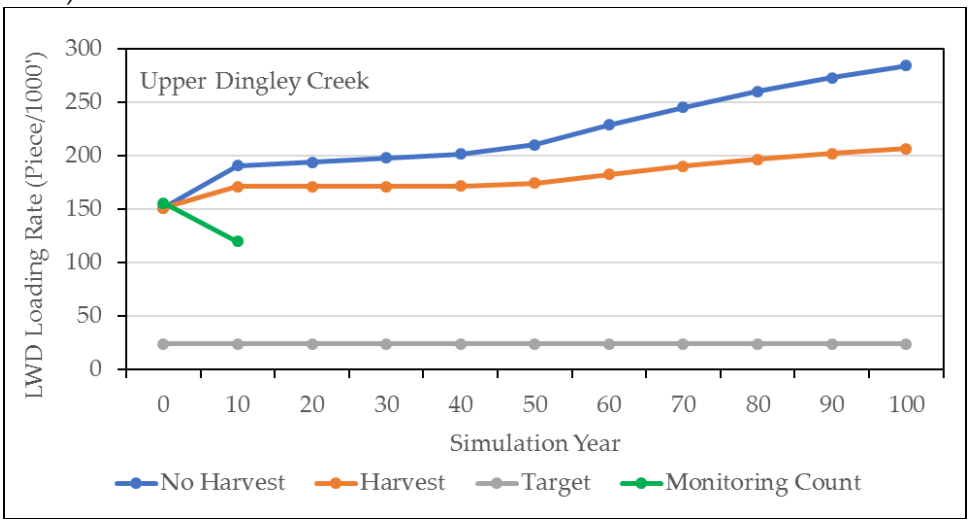


Figure 45. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Upper Dingley Creek, Central Land Office.

Timber harvest occurred along Upper Dingley Creek as a part of the Grasshopper Salvage timber sale along the south side of the stream during 2015, with a no-harvest boundary 88 feet from Lower Dingley Creek. Pre-harvest surveys conducted in 2013 found LWD loading rates of 177 pieces per 1000′ in the monitoring reach. Post-harvest LWD monitoring conducted in 2017 found a slight decrease in LWD to 170 pieces per 1000′. These results were lower than simulation results which indicated LWD loading under the harvest scenario of 218 pieces per100′ at year-10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 230 pieces per 1000′. Comparing the unharvested and harvested stand simulations indicate a decrease in LWD loading by 85 pieces per 1000′ at the as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Lower Dingley Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 24 pieces per 1000′ (Figure 46).

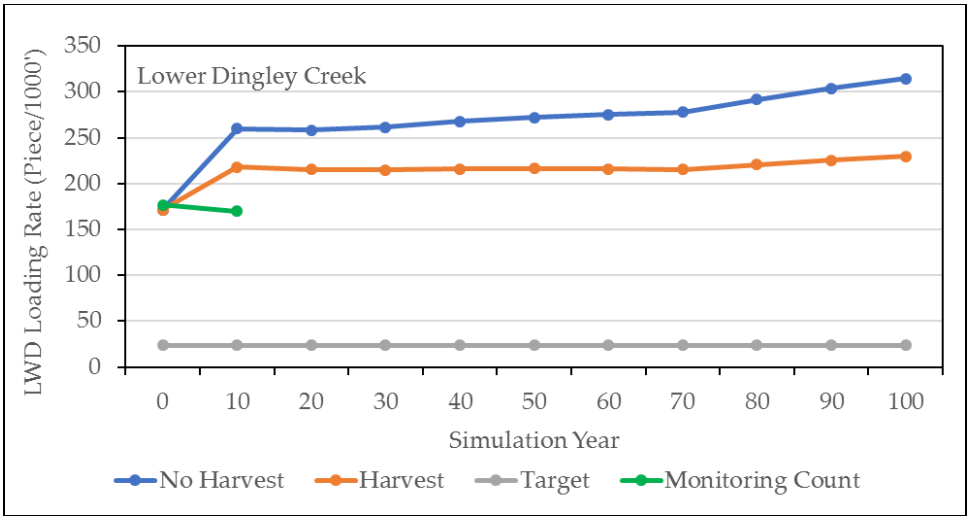


Figure 46. LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Tributary to Willow Creek, Central Land Office.

Pre-harvest stream shading measurements were collected from five sites on Upper Dingley Creek in 2004. July and August pre-harvest stream shading was 94.7 percent ± 2.6, data for June and September were not collected. Post-harvest monitoring conducted in 2017 indicated that stream shading in July and August decreased significantly to 78.75 percent ± 3.5 ($p<0.001$; Figure 47). Pre-treatment stream temperature monitoring was completed for this site between 2004 and 2006, however due to delays in the timber sale, no pre-harvest data were collected leading up to the harvest. No post-harvest stream temperature monitoring is planned at this time.

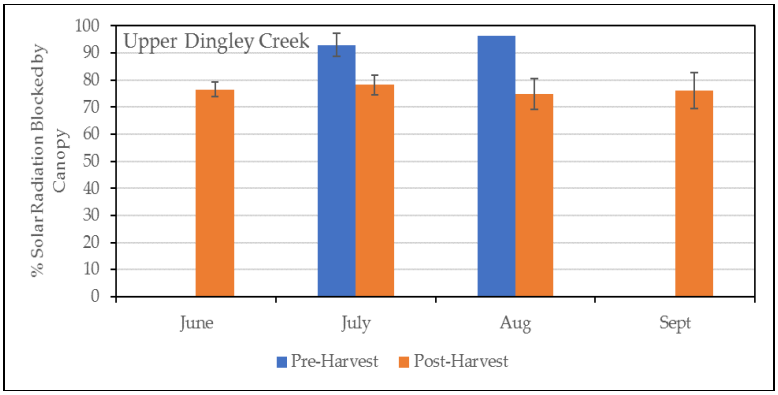


Figure 47. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Pre-harvest stream shading measurements were collected from five sites on Lower Dingley Creek in 2004. July and August pre-harvest stream shading was 87.2 percent ± 3.7, data for June and September were not collected. Post-harvest monitoring conducted in 2017 indicated that stream shading in July and August decreased significantly to 69.5 percent ± 6.5 ($p<0.001$; Figure 48).

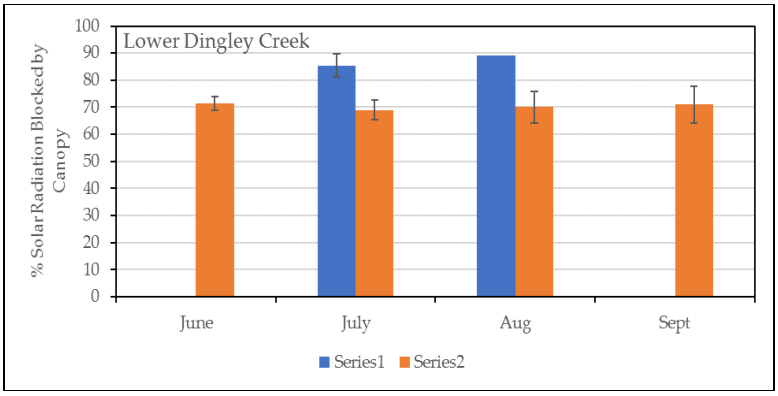


Figure 48. Stream shade measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95 percent C.I.

Based on monitoring results, timber harvest along Dingley Creek resulted in a reduction of LWD between pre-harvest and post-harvest monitoring at both the upper and lower monitoring sites. Post-harvest loading rates were considerably higher than the target levels identified in the HCP, but do not trend with LWD simulations as other RMZ monitoring sites generally have. The reduction in stream shade during July and August was significant, however post-harvest shading exceeded 75 percent which should be sufficient to maintain a thermal regime suitable for native species based on results from other RMZ monitoring sites.

DISCUSSION

Riparian management zone timber harvest monitoring conducted during the first 10 years of HCP implementation resulted in completion of 14 sites in four Aquatic Analysis Units. Pre-harvest data were collected on 15 additional sites, these sites were discontinued after RMZ timber harvest did not occur. Based on the results completed RMZ monitoring, application of riparian buffers as outlined in the HCP appears to be minimizing potential impacts to fisheries habitat which may result from riparian harvest. LWD targets established in the HCP were met in all monitoring sites, and loading rate simulations initially appear to provide an accurate assessment of anticipated loading rates for harvested stands when projected for 100 years. Continued monitoring is necessary to inform the simulation process as well as validate results obtained from simulations of stand which have been completed to date. Development of a monitoring schedule for all 14 completed sites should be established to provide data to assess trends in recruitment and depletion in both RMZ harvested stand as well as stand that did not have RMZ harvest. Based on published loading and depletion rates, a realistic timeframe for monitoring would be on a 5- to 10-year interval, allowing sufficient time for potential recruitment or depletion through decay or episodic discharge events capable of transporting LWD.

Significant reductions in stream shading were noted pre- and post-harvest shade data, the degree to which solar radiation increased varied considerably at the site level based on forest type and stand condition. Stream temperature thresholds were met in 90 percent of the monitoring sites for both acute and chronic thresholds. Evaluation of the effects of

increased solar radiation on stream temperature changes in RMZ sites yielded varied results. Of the six sites with significant reductions in shade, stream temperatures exceeded acute and chronic thresholds in one site. Additionally, chronic stream temperature thresholds were exceeded in one site where no significant increase in solar radiation was noted. These results suggest that stream temperatures are affected by a suite of variables which include stream aspect, volume, forest type, as well as riparian timber harvest. Further monitoring is needed to determine if there is a specific threshold of stream shading that is needed to be maintained to prevent coincidental increases in stream temperature. Additionally, collection of air temperature data during pre- and post-harvest monitoring should be implemented to evaluate site-specific characteristics which could be influencing changes in stream temperature independent of riparian timber harvest. Air temperature monitoring, in combination with stream shade monitoring and continued stream temperature monitoring, would provide insight into local scale climate factors that may influence some of the variability observed in the RMZ monitoring dataset.

Monitoring commitments under this conservation strategy outlined sample sizes required during the first 10 years of HCP implementation.

- LWD Recruitment
    - Monitor five or more sites during the first 10 years the HCP and permit are in effect.
    - If thresholds for recruitment are met on 80 percent of the completed monitoring sites, monitoring will be reduced to one active site through year 25 of the HCP.
- In-stream shade
    - Monitor five or more sites during the first 10 years the HCP and permit are in effect.
    - If the thresholds are met (determined through stream temperature monitoring), monitoring may be reduced to one active site through year 25 of the HCP.
- Stream temperature monitoring
    - Maintain a minimum of two ongoing stream temperature monitoring projects in combination with stream shade monitoring.
    - If acute and chronic thresholds are met monitoring will be reduced to one active site through year 25 of the HCP.
    -

Based on the initial 10-year monitoring results, DNRC is on track to meet RMZ monitoring commitments as outlined. Currently, monitoring is ongoing at two sites, with additional sites identified as projects are proposed across DNRC lands.

During the next 10-year HCP reporting period, DNRC will continue to monitor 1 to 2 RMZ timber harvest sites as outlined in the HCP. Based on results reported in this document, monitoring efforts should be focused on lower precipitation areas (<20 inches annually) in drier forest types, primarily in lodgepole pine or mixed Ponderosa pine/Douglas-fir stands. Additionally, no RMZ monitoring sites have been conducted for riparian timber harvest units where one of the major harvest allowances have been invoked, salvage of insect and disease stands, salvage following stand-replacement or severe wildfire, and promotion of shade intolerant species. While

allowances have been invoked under each of these allowances, the harvest units are typically small and do not incorporate sufficient stream length to evaluate potential harvest effects.

Appendix 1: Riparian management zone timber harvest monitoring sites initiated during the first 10 years of HCP implementation. Large wood, stream shade, and riparian stand data are presented for all sites where pre- and post-harvest data collection is complete. Data collected during pre-harvest period are presented for ongoing monitoring sites where timber harvest has not occurred to date, with post-harvest data to be collected during the next 5-year monitoring report. Pre-harvest data for discontinued monitoring sites are also presented to highlight timber stand and stream characteristics for various sites on DNRC ownership.

			Pre-harvest								Post-harvest							
			Large Woody	Stream Shade				Riparian Stand			Large Woody	Stream Shade				Riparian Stand		
Status	Aquatic Analysis Area	Stream	Debris	June	July	August	Sept	TPA	QMD	BA	Debris	June	July	August	Sept	TPA	QMD	BA
Complete	Stillwater River	Swede Creek	171	70	72	78	89	454	9	202	186	71	76	82	88	350	10.8	224
		Upper Dog Creek	114	88	87	89	93	760	6.5	176.7	126	76	79	85	89	881	6.3	192.1
		Lower Dog Creek	116	80	82	82	89	1253	6.1	255	110	74	74	80	82	755	8.3	286
		Tributary to Dog Creek, North	94	83	83	87	90	903	6.8	224.5	146	81	83	85	86	851	6.1	172.6
		Tributary to Dog Creek, South	108	83	83	87	90	903	6.8	224.5	130	82	83	86	88	876	6.4	197.6
	Rock Creek	Bear Creek	106	49	52	54	69	-	-	-	127	45	49	52	67	562	7.2	159.7
		Upper Beaver Creek	69	79	81	84	86	620	7.4	183.5	116	65	66	73	79	600	7.7	194.5
		Lower Beaver Creek	25	48	49	56	69	620	7.4	183.5	49	49	50	58	68	600	7.2	194.5
		Tributary to Willow Creek	10	69	79	76	81	245	8.3	92.5	38	45	46	48	53	226	7.8	75
	Middle Clark Fork Rive	East Fork Timber Creek	41	68	68	69	77	556	7.5	171.9	53	62	64	66	73	500	8.7	209.4
		Colonite Creek	139	81	84	89	94	467	8.5	185.5	131	82	82	83	87	667	7.4	199
	Upper Missouri River	Upper Dingley Creek	156		93	96		976	6.7	239	106	77	78	75	76	-	-	-
		Lower Dingley Creek	177	-	85	89	-	622	8.1	220.1	167	71	69	70	72	-	-	-
	Blackfoot River	Tributary to Bear Creek	48	60	66	77	86	706	6.8	175.6	61	53	56	66	86	558	7.5	172.4
Ongoing	Blackfoot	Upper Dry Cottonwood Creek	102	82	82	88	93	737	6.7	184.6	-	-	-	-	-	-	-	-
		Warm Springs Creek	35.8	73	75	76	85	-	-	-	-	-	-	-	-	-	-	-
Discontinued	Upper Missouri River	Gurnett Creek	66	57	57	62	76	-	-	-	-	-	-	-	-	-	-	-
	Swan River	South Woodward Creek	93	89	88	89	93	1833	8	633.9	-	-	-	-	-	-	-	-
		Upper Whitetail Creek	187	87	89	93	99	317	14	340.4	-	-	-	-	-	-	-	-
		Lower Whitetail Creek	135	90	91	94	96	797	9.5	391.6	-	-	-	-	-	-	-	-
		Soup Creek	108	-	63	75	-	262	8.5	104.2	-	-	-	-	-	-	-	-
		South Fork Lost Creek	111	-	69	87	-	764	9.1	346	-	-	-	-	-	-	-	-
		Middle Cilly Creek	-	-	80	88	-	-	-	-	-	-	-	-	-	-	-	-
		Lower Cilly Creek	-	-	80	80	-	650	9	284.3	-	-	-	-	-	-	-	-
	Blackfoot River	Dick Creek	69	86	89	92	98	265	9.9	142.7	-	-	-	-	-	-	-	-
		Cottonwood Creek	39	62	64	69	76	-	-	-	-	-	-	-	-	-	-	-
		Lower Dry Cottonwood Creek	91	81	79	85	88	757	5.3	115.6	-	-	-	-	-	-	-	-
	Middle Kootenai River	Upper Flower Creek	-	55	60	71	75	358	11.4	253.8	-	-	-	-	-	-	-	-
		Lower Flower Creek	-	55	60	71	75	358	11.4	253.8	-	-	-	-	-	-	-	-

Attachment AQ-6: Instream Turbidity Effects of Various Forest Management Activities in Western Montana[1]

The Montana Department of Natural Resources and Conservation, Forest Management Bureau has monitored continuous instream turbidity levels below various forest management activities for the past 12 years. The objective of these monitoring projects was to document; 1.) the magnitude and spatial extent of instream turbidity events associated with forest management projects, 2.) the effectiveness of timber sale mitigations and Best Management Practices (BMPs) to prevent sediment delivery to streams and 3.) to inform adaptive management. The forest management activities that were monitored with continuous, instream turbidity sondes are listed in Table 1; Turbidity Sampling Summary.

Concentration-duration-frequency analysis was performed to describe the magnitude of instream turbidity events directly below project activities and, at some monitoring locations, the spatial extent downstream. Monitoring results have largely validated project level environmental effects assessments that forecast impacts to water quality that result from instream construction activities, such as culvert replacement. Impacts to water quality were found for very short durations and typically returned to background levels within 24 hours of instream activities. BMP's applied to the site after the corrective action were shown to provide protection to water quality during very intense precipitation or runoff events.

The spatial extent of downstream water quality impacts was localized at the reach scale and rapidly diminish as sediment plumes translate downstream. Results also demonstrate that timber sale mitigation measures, riparian buffers and BMPs are highly effective at mitigating effects to instream turbidity during timber harvest and instream construction activities.

These findings have refined DNRC practices during instream construction activities, application of riparian buffers, and site specific BMP's and provides resource specialists in the design of timber sale mitigation measures, resulting in the reduction of water quality impacts during road-stream crossing construction and addressing sediment delivery sites. Future monitoring efforts hope to document annual and event turbidity signals, at watershed scale, that are under intense forest management practices.

[1] *Schmalenberg, J.R. 2017. Proceedings for Science, Policy and Communication: the role of science in a changing world. American Water Resources Association. Montana Section, October 2017. Helena, MT.*

Table 1. Instream Turbidity Effects of Various Forest Management Activities in Western Montana

Site/Location	Year	Sample Length	Objective	Results
Whitetail Creek (NWLO/SWN)	2009-2011	346.7	Background, short-term and long-term turbidity effects, at the watershed and reach scale, from the installation of a fish passage barrier.	Background turbidity in Whitetail Creek is very low, rarely exceeding 2.0 NTU (10% exceedance). Several significant turbidity events during installation all <1 hour. Background conditions resumed immediately after construction and BMP proved effective in subsequent years.
Upper Willow Creek (SWLO/ANA)	2010	1.1	Short-term turbidity effects, at the reach scale, of culvert removal and rock armored, improved ford installation.	Turbidity event from culvert removal and rock armor installation peaked at 1045 NTU and was less then typically culvert removals due to low fill depths. 10% exceedance for the sampling event was 28.4 NTU. Background conditions were obtained in approximately 24 hours.
Sweede Creek (NWLO/STW)	2010-2011	137.4	Background, short-term and long-term turbidity effects, at the reach and watershed scale, of culvert removal and installation of a stream simulation fish passage culvert on an open road.	Background turbidity in Sweede Creek is very low, rarely exceeding 2.0 NTU (10% exceedance). The 1% exceedance for the construction period was 27 NTU with a very quick return to background due to the steep channel grade.
Harris Creek (NWLO/LIB)	2012-2016	897.1	Background and long-term effects, at the watershed scale, from a intensive forest management project with steep slope road construction, even-age silviculture using skyline yarding systems and prescribed fire.	10% exceedance threshold prior to activities was 1.5 NTU and increased to a two year average of 19.7 NTU during and immediately after harvest operations. No clear point of sediment delivery was mapped and increased turbidity is assumed to be a response to significant spring runoff events mobilizing in-stream sediments. Significant channel adjustment was observed in the summer of 2014.
Ashby Creek (SWLO/MSO)	2012-2015	769.2	Background, short-term and long-term turbidity effects, at the watershed and reach scale, of a stream channel and road alignment project.	Background turbidity in Ashby Creek was the highest measured watershed at 19.1 NTU (10% exceedance). Stream relocation produced significant turbidity pulses as the channel adjusted but was within background 2 years post construction.
South Woodward Creek (NWLO/SWN)	2013	1.0	Short-term turbidity effects, at the reach scale and distally downstream, from culvert removal, fill removal and slope stabilization at a deep fill crossing on a large perennial, fish bearing stream.	Turbidity event 150' downstream of culvert removal peaked at 2,252 NTU for 1 minute. Downstream sites at 650' and 1,100 feet were delayed by 6 minutes and 11 minutes respectively. Downstream NTU's were reduced by 75% (558 NTU) and 91% (194 NTU) respectively.
Bear Creek (SWLO/MSO)	2014	7.1	Short-term turbidity effects both locally and at various ranges downstream of a culvert removal and bridge installation site.	Sensor 150' downstream of construction peaked at over 2,000 NTU for 2 mins. That same wave peaked at 160 NTU 650' downstream and was within water quality standards at 4.0 NTU 6,150' downstream of activity.
Fish Bowl Face (NWLO/STW)	2015	6.9	Short-term turbidity effects, at the reach scale, from the removal of a temporary Cross Laminated Timber (CLT) bridge on small, perennial stream.	No measurable change in NTU was detected during the removal if a temporary CLT bridge installation. A significant difference then if a temporary culvert was installed.
Cyclone Creek (NWLO/STW) Culvert Removal/Replacement	2016	50.0	Short and long-term turbidity effects, at the reach scale, of stream simulation, fish passage culvert replacement on an open road.	Turbidity spike of 1400 NTU for a minute and returns to background in approximately 2.4 hours. No turbidity signals observed in the following 20 days with 1.85 inches of rain when BMP's were in place.
Cyclone Creek (NWLO/STW) Culvert Removal	2016	37.0	Background and short-term turbidity effects, at the reach scale, of culvert removal and fill stabilization on a reclaimed road.	Two turbidity spikes during culvert removal and during reintroduction of stream water to new culvert. Both pulses were less than 4 mins and over 1600 NTU and 1000 NTU respectively. No turbidity signals observed when BMP's were in place post construction with intense rainfall.
Cyclone Creek (NWLO/STW) Bridge Removal	2016	50.0	Background and short-term turbidity effects, at the reach scale, of native bridge removal and fill stabilization on a restricted road.	Short term (<3 mins) turbidity pulse during removal of bridge abutments of 52 NTU. Other minor and short term spikes from equipment crossings. No turbidity signal during intense rainfall events when BMP's were in place.
South Woodward Creek (NWLO/SWN)	2017-2022 (On-going)	716.9	Background and event sampling turbidity effects, at the site scale, of Pre and Post-BMP corrective actions on a open road.	On-going
Arkansas Creek (SWLO/MSO)	2019-2021	342.9	Short-term and long-term turbidity effects, at the reach and watershed scale, of a stream simulation, fish passage culvert replacement on an restricted road.	Typical two spike turbidigraph resulting from stream diversion and reintroducing water to the culvert. Arkansas Creek background turbidity was 4.2 NTU (10% exceedance). Continued low level turbidity post-project as a result of long-term grade adjustment in the stream above the culvert.
Sweede Creek (NWLO/STW)	2021	73.8	Short-term turbidity effects, at the reach scale, of stream simulation, fish passage culvert replacement on a restricted road.	Typical two spike turbidigraph resulting from stream diversion and reintroducing water to the culvert. Turbidity spike peaked at 1010 NTU and 1500NTU respectively. No additional turbidity spikes were observed when BMP's were in place post-construction for 65 days of monitoring with 6.8 inches of rain.
Whitetail Creek (NWLO/SWN)	2021-2022	On-going	Seasonal turbidity effects, at the watershed scale, of upstream post-fire salvage logging.	On-going
Goat Creek (NWLO/SWN)	2022	On-going	Seasonal turbidity and Total Suspended Solids, at the watershed scale, of an intensely managed forested watershed in comparison to Lion Creek, a similar sized, adjacent watershed (control).	On-going

Attachment AQ-7: Redd Trampling Risk Assessment

Background

Under the Grazing Conservation Strategy AQ-GR1, DNRC identified research (Petersen et al. 2010) that indicated large increases in egg-to-fry mortality resulting from direct trampling of native salmonid redds by livestock. Based on this literature, DNRC made the decision to accept that redd trampling was likely occurring on TLMD Classified Forest grazing licenses and leases, and to focus efforts toward identifying the scope of potential impacts on HCP covered lands and development of appropriate corrective actions.

Methods

To determine the scope of potential corrective actions across the HCP planning area, DNRC utilized the existing grazing licenses or leases currently administered on Classified Forest lands. Currently, DNRC administers approximately 500 licenses allowing grazing on TLMD lands in the HCP planning area. Known fish distribution was obtained from MFWP fisheries databases and through personal communication with regional fisheries biologists. Fish population distribution data were used to select parcels with known or presumed presence of HCP covered fish species in the planning area. Known or presumed fish distribution data were utilized to select a subset of the 500 grazing licenses that had the potential to impact fisheries populations. Parcels with known grazing impacts were reviewed by DNRC resource specialists and assigned to the appropriate prioritization level. For parcels where potential grazing impacts were not known, field review of the parcel was conducted during the grazing season to evaluate site-specific impacts and assign the appropriate prioritization level. During field review, perennial streams were visually evaluated to determine if livestock had direct access to the stream, whether physical spawning habitat was present for HCP covered species, and the potential spatial extent of livestock impacts.

Results

Of the approximately 500 grazing licenses currently administered on TLMD Classified Forest land, 192 parcels were found to have at least a portion of a perennial waterbody that supported an HCP covered fish species. Review of the 192 parcels was conducted by DNRC resource specialists, including physical field assessment of potentially impacted stream segments, as well as using GIS analyses to prioritize sites where impacts were known based on previous fieldwork or grazing license mid-term or renewal field reviews. Based on this assessment, 76 parcels were found to have Priority 1 ratings, where livestock may be negatively impacting local populations (Table 1). Of the remaining 116 parcels, Priority 3 designation was applied to 41 parcels, where spawning reaches are spatially limited or of marginal quality or terrain limited access to the stream by livestock. Twenty-five sites were identified as N/A-1 priority, due to lack of fisheries populations confirmed through electrofishing, lack of available spawning habitat, or lack of perennial discharge. Seventeen sites were designated as N/A-2 due to grazing exclosures protecting spawning reaches, or terrain limiting access to spawning reaches by livestock. Thirty-three sites were classified as N/A-3 based on the adjacent waterbody being higher order nodal habitat.

Table 1: Redd risk assessment results from DNRC Classified Grazing parcels within the HCP planning area.

Land Office	Unit Office	Redd Risk Priority				
		1	3	N/A-1	N/A-2	N/A-3
Southwest	Missoula	24	5	6	4	3
	Hamilton	10	3	1		3
	Clearwater	18	6	8	3	12
	Anaconda	5	3	4	1	
Northwest	Kalispell	5	3	3	4	
	Libby	4	2	2		3
	Plains	8	17		2	12
	Stillwater	1	2			
Central	Helena			1	1	
	Dillon	1			2	
Total		76	41	25	17	33

Corrective Actions

Based on the review of the potentially impacted grazing parcels on Classified Forest parcels, corrective actions that may be applied to Priority-1 grazing licenses include the following:

- Delay start of grazing period to July 15 annually
    - Based on DNRC stream temperature data, spring emergence of Westslope cutthroat and Columbia redband trout would likely occur prior to July 15
- Rotational grazing
    - On Priority-1 parcels where the licensee holds grazing rights to multiple sections, develop rotational grazing plan in cooperation with TLMD Land Use specialists to mitigate early season grazing on spawning reaches
- Grazing exclosure
    - Modify existing exclosures where appropriate
    - Construct new permanent exclosures to protect high value spawning reaches
    - Install electric fence as a temporary mitigation to protect high value spawning reaches.